City of Richmond

Agenda

City Council

Council Chambers, City Hall
6911 No. 3 Road

Monday, March 25, 2019
7:00 p.m.

Pg. # ITEM

MINUTES

1. ***Motion to:***

CNCL-13 ***(1) adopt the minutes of the Regular Council meeting held on March 11, 2019;***

CNCL-25 ***(2) adopt the minutes of the Special Council meeting held on March 11, 2019; and***

CNCL-29 ***(3) adopt the minutes of the Regular Council meeting for Public Hearings held on March 18, 2019.***

AGENDA ADDITIONS & DELETIONS

COMMITTEE OF THE WHOLE

2. ***Motion to resolve into Committee of the Whole to hear delegations on agenda items.***

3. Delegations from the floor on Agenda items.

PLEASE NOTE THAT FOR LEGAL REASONS, DELEGATIONS ARE NOT PERMITTED ON ZONING OR OCP AMENDMENT BYLAWS WHICH ARE TO BE ADOPTED OR ON DEVELOPMENT PERMITS/DEVELOPMENT VARIANCE PERMITS – ITEM NO. 23.

4. ***Motion to rise and report.***

RATIFICATION OF COMMITTEE ACTION

CONSENT AGENDA

PLEASE NOTE THAT ITEMS APPEARING ON THE CONSENT AGENDA WHICH PRESENT A CONFLICT OF INTEREST FOR COUNCIL MEMBERS MUST BE REMOVED FROM THE CONSENT AGENDA AND CONSIDERED SEPARATELY.

CONSENT AGENDA HIGHLIGHTS

- Receipt of Committee minutes
- RCMP Monthly Activity Report- January 2019
- Conference Approval Request
- Accelerating Local Action on Climate Change: Community Energy and Emissions Plan (CEEP) Renewal
- Options for an Online Council Member Voting Record
- Richmond Heritage Commission 2018 Annual Report and 2019 Work Program
- Advisory Committee on the Environment 2018 Annual Report and 2019 Work Program
- TransLink Transit Network Review - Forthcoming Consultation
- TransLink 2019 Capital Cost-Share Program – Supplemental Applications
- Provincial Pesticide Use Permit Renewal Application
- Investing in Canada Infrastructure Program - CleanBC Communities Fund
- 2019 Clothes Washer Rebate Program
- Dike Master Plan - Phases 3 and 5 Report

- Flood Protection Management Strategy 2019 – Public and Stakeholder Engagement

5. ***Motion to adopt Items No. 6 through No. 19 by general consent.***

Consent Agenda Item

6. **COMMITTEE MINUTES**

That the minutes of:

CNCL-34 ***(1) the Community Safety Committee meeting held on March 12, 2019;***

CNCL-41 ***(2) the General Purposes Committee meeting held on March 18, 2019;***

CNCL-47 ***(3) the Planning Committee meeting held on March 19, 2019; and***

CNCL-54 ***(4) the Public Works and Transportation Committee meeting held on March 20, 2019;***

be received for information.

Consent Agenda Item

7. **RCMP MONTHLY ACTIVITY REPORT – JANUARY 2019**
(File Ref. No. 09-5000-01) (REDMS No. 6101011 v. 6)

CNCL-62 See Page **CNCL-62** for full report

COMMUNITY SAFETY COMMITTEE RECOMMENDATION

(1) That the report titled "RCMP Monthly Activity Report – January 2019", dated February 19, 2019, from the Officer in Charge, Richmond RCMP Detachment, be received for information; and

(2) That a letter be written to the RCMP National Headquarters requesting an update on the status of the Tier 3 Auxiliary program.

Consent Agenda Item

8. **CONFERENCE APPROVAL REQUEST**
(File Ref. No.)

CNCL-80 See Page **CNCL-80** for full report

GENERAL PURPOSES COMMITTEE RECOMMENDATION

(1) That Councillor Kelly Greene and Councillor Carol Day be approved to attend the Columbia Institute's Civic Governance Forum as set out in the email dated March 14, 2019 with mileage commensurate with City mileage allowances; and

(2) That staff report back with policy options on Council travel, conferences and related procedures.

Consent Agenda Item

9. **ACCELERATING LOCAL ACTION ON CLIMATE CHANGE: COMMUNITY ENERGY & EMISSIONS PLAN (CEEP) RENEWAL**
(File Ref. No. 10-6000-00) (REDMS No. 6137917; 6134827; 6136115; 6134863; 6134864; 6134866)

CNCL-94 See Page **CNCL-94** for staff memorandum

CNCL-95 See Page **CNCL-95** for full report

GENERAL PURPOSES COMMITTEE RECOMMENDATION

(1) That the public consultation program defined in the report titled "Accelerating Local Action on Climate Change: Community Energy & Emissions Plan (CEEP) Renewal" from the Director, Engineering dated February 27, 2019, to gain feedback from residents and stakeholders regarding the recommended revised greenhouse gas (GHG) reduction target and revised climate action strategies and measures consistent with and in response to the UN's Intergovernmental Panel on Climate Change report, be endorsed;

(2) That the City of Richmond declares and confirms a climate emergency; and

(3) That staff report back on:

(a) a specific statement in conjunction with the City's Community Energy and Emissions Plan;

(b) the consideration of more energy and emissions targets and more often; and

(c) strategies for enforcement relating to the City's bike lanes.

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Consent Agenda Item

10. **OPTIONS FOR AN ONLINE COUNCIL MEMBER VOTING RECORD**
(File Ref. No. 01-0105-01) (REDMS No. 6107525 v. 4, 6118822)

CNCL-122 See Page **CNCL-122** for full report

GENERAL PURPOSES COMMITTEE RECOMMENDATION

That Option 3 (voting record built as an add-on to an existing City database) with funding from the Council Contingency account as per the staff report titled "Options for an Online Council Member Voting Record," dated February 26, 2019, from the Director, City Clerk's Office, be approved.

Consent Agenda Item

11. **RICHMOND HERITAGE COMMISSION 2018 ANNUAL REPORT AND 2019 WORK PROGRAM**
(File Ref. No. 01-0100-30-HCOM1-01) (REDMS No. 6133813 v. 2)

CNCL-141 See Page **CNCL-141** for full report

PLANNING COMMITTEE RECOMMENDATION

(1) That the Richmond Heritage Commission 2018 Annual Report, as presented in this staff report, be received for information; and

(2) That the Richmond Heritage Commission 2019 Work Program, as presented in this staff report, be approved.

Consent Agenda Item

12. **ADVISORY COMMITTEE ON THE ENVIRONMENT 2018 ANNUAL REPORT AND 2019 WORK PROGRAM**
(File Ref. No. 01-0100-30-ACEN1-01) (REDMS No. 6124817 v. 1)

CNCL-146 See Page **CNCL-146** for full report

PLANNING COMMITTEE RECOMMENDATION

(1) That the Advisory Committee on the Environment 2018 Annual Report, as presented in this staff report, be received for information; and

(2) That the Advisory Committee on the Environment 2019 Work Program, as presented in this staff report, be approved.

Consent Agenda Item

13. **TRANSLINK TRANSIT NETWORK REVIEW – FORTHCOMING CONSULTATION**
(File Ref. No. 01-0154-04) (REDMS No. 6125994 v. 3)

CNCL-152

See Page **CNCL-152** for full report

PUBLIC WORKS AND TRANSPORTATION COMMITTEE RECOMMENDATION

(1) That TransLink's proposed transit network changes, as described in the attached report titled "TransLink Transit Network Review - Forthcoming Consultation" dated February 21, 2019 from the Director, Transportation, be endorsed for the purpose of public consultation; and

(2) That staff be directed to report back on the results of the public consultation and TransLink's final decisions regarding the proposed service changes.

Consent Agenda Item

14. **TRANSLINK 2019 CAPITAL COST-SHARE PROGRAM – SUPPLEMENTAL APPLICATIONS**
(File Ref. No. 01-0154-04) (REDMS No. 6125295 v. 3)

CNCL-166

See Page **CNCL-166** for full report

PUBLIC WORKS AND TRANSPORTATION COMMITTEE RECOMMENDATION

That the submission of transit-related projects for cost-sharing as part of the TransLink 2019 capital cost-share programs as described in the report titled "TransLink 2019 Capital Cost-Share Program – Supplemental Applications" dated February 12, 2019 from the Director, Transportation, be endorsed.

Consent Agenda Item

15. **PROVINCIAL PESTICIDE USE PERMIT RENEWAL APPLICATION**
(File Ref. No. 10-6160-07-01) (REDMS No. 6126419 v. 5; 6131932)

CNCL-172

See Page **CNCL-172** for full report

PUBLIC WORKS AND TRANSPORTATION COMMITTEE RECOMMENDATION

That the comments regarding a provincial Pesticide Use Permit application to manage invasive cordgrass outlined in the report titled "Provincial Pesticide Use Permit Renewal Application", dated February 12, 2019 from the Director, Engineering, be endorsed for submission to the provincial Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

Consent Agenda Item

16. **INVESTING IN CANADA INFRASTRUCTURE PROGRAM - CLEANBC COMMUNITIES FUND**
(File Ref. No. 10-6600-10-01) (REDMS No. 6123192 v. 6)

CNCL-177

See Page **CNCL-177** for full report

PUBLIC WORKS AND TRANSPORTATION COMMITTEE RECOMMENDATION

(1) That the submission to the Investing in Canada Infrastructure Program - British Columbia - Green Infrastructure - Climate Change Mitigation - CleanBC Communities Fund requesting funding of up to $6.2 million for the Oval Village DEU Sewer Heat Recovery Implementation project, as outlined in the report titled "Investing in Canada Infrastructure Program - CleanBC Communities Fund" dated February 20, 2019, from the Director, Engineering, be endorsed;

(2) That the Chief Administrative Officer and General Manager, Engineering and Public Works be authorized to enter into funding agreements with the government for the aforementioned project should it be approved for funding, as outlined in the report titled "Investing in Canada Infrastructure Program - CleanBC Communities Fund" dated February 20, 2019, from the Director, Engineering; and

(3) That, upon receipt of the funding for the aforementioned project, the City transfer the full funding amount to Lulu Island Energy Company Ltd., which is wholly owned by the City of Richmond, to deliver the aforementioned project as directed by Lulu Island Energy Company Ltd. Board of Directors; and

(4) That the submission to the Investing in Canada Infrastructure Program - British Columbia - Green Infrastructure - Climate Change Mitigation - CleanBC Communities Fund be copied to Richmond MPs and MLAs.

Consent Agenda Item

17. **2019 CLOTHES WASHER REBATE PROGRAM**
(File Ref. No. 10-6060-01) (REDMS No. 6120486 v. 4)

CNCL-183

See Page **CNCL-183** for full report

PUBLIC WORKS AND TRANSPORTATION COMMITTEE RECOMMENDATION

(1) That the City of Richmond partner with BC Hydro to the end of 2019 to offer a combined rebate of $100 for both spring and fall campaigns, equally cost shared between BC Hydro and the City, for the replacement of inefficient clothes washers with new high efficiency clothes washers; and

(2) That the Chief Administrative Officer and General Manager, Engineering and Public Works, be authorized to execute an agreement with BC Hydro to implement the Clothes Washer Rebate Program.

Consent Agenda Item

18. **DIKE MASTER PLAN – PHASES 3 AND 5 REPORT**
(File Ref. No. 10-6060-01) (REDMS No. 6121273 v. 6)

CNCL-186

See Page **CNCL-186** for full report

PUBLIC WORKS AND TRANSPORTATION COMMITTEE RECOMMENDATION

That the "Dike Master Plan - Phase 3 Final Report" and "Dike Master Plan - Phase 5 Final Report" as attached in the staff report titled "Dike Master Plan – Phases 3 and 5 Report," dated February 21, 2019 from the Director, Engineering, be endorsed for the purposes of capital project and development planning.

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Consent Agenda Item

19. **FLOOD PROTECTION MANAGEMENT STRATEGY 2019 – PUBLIC AND STAKEHOLDER ENGAGEMENT**
(File Ref. No. 10-6060-04-01) (REDMS No. 6123036 v. 9)

CNCL-443

See Page **CNCL-443** for full report

PUBLIC WORKS AND TRANSPORTATION COMMITTEE RECOMMENDATION

That the public and key stakeholders be engaged as identified in the staff report titled "Flood Protection Management Strategy 2019 – Public and Stakeholder Engagement" from the Director, Engineering, dated February 21, 2019.

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CONSIDERATION OF MATTERS REMOVED FROM THE CONSENT AGENDA

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NON-CONSENT AGENDA ITEMS

PLANNING COMMITTEE
Councillor Linda McPhail, Chair

20. **APPLICATION BY WING KUEN BECKY CHAN FOR REZONING AT 11120 GRANVILLE AVENUE FROM "AGRICULTURE (AG1)" TO A SITE SPECIFIC AGRICULTURE ZONE TO PERMIT A LARGER HOUSE SIZE**
(File Ref. No. RZ 19-850784) (REDMS No. 6141869)

CNCL-495

See Page **CNCL-495** for full report

The following recommendation was defeated by Planning Committee on a tied vote with Mayor Brodie, Cllrs. McPhail and Loo opposed.

"That the application for the rezoning of 11120 Granville Avenue from "Agriculture (AG1)" to a Site Specific Agriculture Zone, to permit a house up to 500 m^2 in floor area, be denied."

21. **APPLICATION BY CLIVE ALLADIN FOR REZONING AT 22260 RIVER ROAD FROM "AGRICULTURE (AG1)" TO A SITE SPECIFIC AGRICULTURE ZONE TO PERMIT A LARGER HOUSE SIZE**
(File Ref. No. RZ 19-851176) (REDMS No. 6120465 v. 2)

CNCL-508 See Page **CNCL-508** for staff memorandum and bylaw

CNCL-523 See Page **CNCL-523** for full report

PLANNING COMMITTEE RECOMMENDATION

Opposed: Cllrs. McNulty and Steves

That the application for the rezoning of 22260 River Road from "Agriculture (AG1)" to a Site Specific Agriculture Zone, to permit a house up to 500 m^2 in floor area, be forwarded to Council for consideration of first reading.

PLANNING AND DEVELOPMENT DIVISION

22. **GEORGE MASSEY CROSSING – PRELIMINARY PRINCIPLES, GOALS AND OBJECTIVES**
(File Ref. No. 10-6350-05-08) (REDMS No. 6150496 v. 3)

CNCL-538 See Page **CNCL-538** for full report

STAFF RECOMMENDATION

That a letter be sent to the Minister of Transportation and Infrastructure requesting that their work on the George Massey Crossing project include:

(1) the incorporation of the comments as detailed in the staff report titled "George Massey Crossing – Preliminary Principles, Goals and Objectives" dated March 19, 2019 from the Director, Transportation;

(2) request to Ministry staff to work with Richmond staff in any work to define the scope of the project and develop potential crossing options including potential interim solutions, and

(3) request to Ministry staff to work with Richmond staff in any work to define the scope of the short-term improvements at the Steveston Highway interchange.

Pg. # ITEM

PUBLIC ANNOUNCEMENTS AND EVENTS

NEW BUSINESS

BYLAWS FOR ADOPTION

CNCL-549 Credit Card Payment Service Fee Bylaw No. 9536, Amendment **Bylaw No. 9963**
Opposed at 1st/2nd/3rd Readings – None.

CNCL-550 Revenue Anticipation Borrowing (2019) **Bylaw No. 9997**
Opposed at 1st/2nd/3rd Readings – None.

CNCL-551 Richmond Zoning Bylaw No. 8500, Amendment **Bylaw No. 9948**
(13100 Smallwood Place, ZT 18-818765)
Opposed at 1st Reading – Cllr. Wolfe
Opposed at 2nd/3rd Readings – Cllr. Wolfe

DEVELOPMENT PERMIT PANEL

23. RECOMMENDATION

See DPP Plan Package (distributed separately) for full hardcopy plans

CNCL-553 ***(1) That the minutes of the Development Permit Panel meetings held on February 27, 2019 and March 13, 2019 and the Chair's report for the Development Permit Panel meetings held on February 27, 2019, be received for information; and***

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CNCL-607 *(2)* ***That the recommendations of the Panel to authorize the issuance of a Development Permit (DP 18-818762) for the property at 13100 Smallwood Place be endorsed, and the Permit so issued.***

ADJOURNMENT

City of Richmond

Minutes

Regular Council

Monday, March 11, 2019

Place:	Council Chambers Richmond City Hall
Present:	Mayor Malcolm D. Brodie Councillor Chak Au Councillor Carol Day Councillor Kelly Greene Councillor Alexa Loo Councillor Bill McNulty Councillor Linda McPhail Councillor Harold Steves Councillor Michael Wolfe Corporate Officer – David Weber
Call to Order:	Mayor Brodie called the meeting to order at 7:00 p.m.

RES NO. ITEM

MINUTES

R19/5-1 1. It was moved and seconded
That:

(1) the minutes of the Regular Council meeting held on February 25, 2019, be adopted as circulated; and

(2) the Metro Vancouver 'Board in Brief' dated February 22, 2019, 2019, be received for information.

CARRIED

Regular Council
Monday, March 11, 2019

PRESENTATIONS

(1) City of Richmond's Smart Cities Challenge 2019

With the aid of a video presentation, Grant Fengstad, Director, Information Technology and Denise Tambellini, Manager, Intergovernmental Relations and Protocol Unit, presented the City of Richmond's Smart Cities Challenge 2019 submission to the Government of Canada.

Ms. Tambellini and Mr. Fengstad then highlighted that 200 cities across Canada prepared 130 submissions and Richmond is a finalist competing for one of two $10 million prizes; winners will be announced on May 14, 2019.

(2) Government Finance Officers Association of the United States and Canada Awards

Jerry Chong, Director, Finance, and Ted Townsend, Director, Corporate Communications and Marketing, presented the Canadian Award for Financial Reporting and the Award for Outstanding Achievement in Popular Annual Financial Reporting from the Government Finance Officers Association of the United States and Canada for the City's 2017 Annual Report. Mr. Townsend highlighted that this was the 16th consecutive year that the City has received the Canadian Award for Financial Reporting and the 9th consecutive year that the City has received both awards.

COMMITTEE OF THE WHOLE

R19/5-2 2. It was moved and seconded
That Council resolve into Committee of the Whole to hear delegations on agenda items (7:18 p.m.).

CARRIED

3. Delegations from the floor on Agenda items.

Item No. 17 – Council and Committee Agenda Distribution Options

Donald Flintoff, 6071 Dover Road, commented on the proposed agenda distribution schedule for Council and Committee agendas, noting that the public should be given more time to review materials prior to their consideration at Council meetings. He then spoke to the City's practice on scheduling public delegations before Council and Committee and was of the opinion that notice of delegation on the Wednesday prior to the meeting is unreasonable.

Bylaw for Adoption – Consolidated 5 Year Financial Plan (2019-2023) Bylaw No. 9979

Mr. Flintoff spoke to the proposed Consolidated 5 Year Financial Plan (2019-2023) Bylaw No. 9979, remarking that the public consultation was inadequate. He cited concern with the use of City reserves to fund Capital projects, and was of the opinion that much of the City's spending lacks a true need.

Bylaw for Adoption – Consolidated 5 Year Financial Plan (2019-2023) Bylaw No. 9979

Ken McLennan, 6740 Dunsany Place, spoke against the proposed Consolidated 5 Year Financial Plan (2019-2023) Bylaw No. 9979, citing concern on the City's spending. Mr. McLennan commented on the Richmond Olympic Oval's Economic Impact Assessment study prepared by KPMG LLP, and provided a comparison of property tax relief for the Oval to that of other local businesses. Mr. McLennan distributed material regarding the Richmond Olympic Oval Corporation's financial performance statistics (copy on file, City Clerk's Office).

R19/5-3 4. It was moved and seconded
That Committee rise and report (7:31 p.m.).

CARRIED

CONSENT AGENDA

R19/5-4 5. It was moved and seconded
That Items No. 6 through No. 15, with the removal of Item No. 8, be adopted by general consent.

CARRIED

6. **COMMITTEE MINUTES**

That the minutes of:

(1) the Parks, Recreation and Cultural Services Committee meeting held on February 26, 2019;

(2) the General Purposes Committee meeting held on March 4, 2019;

(3) the Finance Committee meeting held on March 4, 2019;

(4) the Planning Committee meeting held on March 5, 2019;

(5) the Council/School Board Liaison Committee meeting held on January 9, 2019;

be received for information.

ADOPTED ON CONSENT

7. **RICHMOND PUBLIC ART PROGRAM 2018 ANNUAL HIGHLIGHTS AND PUBLIC ART ADVISORY COMMITTEE 2019 WORK PLAN**
(File Ref. No. 01-0100-30-RPAR1-01) (REDMS No. 6109970 v. 3, 6123939)

That the Richmond Public Art Advisory Committee 2019 Work Plan, as presented in the report titled "Richmond Public Art Program 2018 Highlights and Public Art Advisory Committee 2019 Work Plan," dated January 25, 2019, from the Director, Arts, Culture and Heritage Services, be approved.

ADOPTED ON CONSENT

8. **OPTIONS FOR USE OF PRIVATE DEVELOPER PUBLIC ART CONTRIBUTION FUNDS**
(File Ref. No. 11-7000-09-00) (REDMS No. 6102180 v. 9, 3066549)

Please see Page 7 for action on this matter.

9. **RICHMOND NEIGHBOURHOOD CELEBRATION GRANT PROGRAM ALLOCATION**
(File Ref. No. 11-7400-20-RICH1) (REDMS No. 6122169 v. 4, 6060237, 6118590)

That the Richmond Neighbourhood Celebration Grants be awarded for the recommended amounts for a total of $55,103 as outlined in the staff report titled, "Richmond Neighbourhood Celebration Grant Program Allocation," from the Director, Arts, Culture and Heritage Services, dated February 6, 2019.

ADOPTED ON CONSENT

10. **NORTH RUNWAY AT THE VANCOUVER INTERNATIONAL AIRPORT**
(File Ref. No. 01-0153-01, 01-0140-20-TCAN1-02)

(1) That a letter be written to the Minister of Transport Canada asking that the North Runway at the Vancouver International Airport be better utilized for aircraft departures to lessen the impact of aircraft noise on the people of Richmond; and

(2) That a letter be written to the City of Vancouver suggesting that noise attenuation measures in new construction be implemented to mitigate airport noise.

ADOPTED ON CONSENT

11. **INVESTMENT POLICY 3703 AMENDMENT**
(File Ref. No. 01-0095-20-3703) (REDMS No. 6006535 v. 4, 6101472)

That Council Policy 3703 (Investment Policy) be amended as proposed in the staff report titled "Investment Policy 3703 Amendment" dated February 6, 2019 from the Director, Finance.

ADOPTED ON CONSENT

12. **CREDIT CARD PAYMENT SERVICE FEE BYLAW NO. 9536, AMENDMENT BYLAW NO. 9963**
(File Ref. No. 12-8060-20-009963; 03-0900-01) (REDMS No. 6022858 v. 4, 6119619)

(1) That the staff report titled "Credit Card Payment Service Fee Bylaw No. 9536, Amendment Bylaw No. 9963" dated February 11, 2019 from the Director, Finance, be endorsed;

(2) That Credit Card Payment Service Fee Bylaw No. 9536, Amendment Bylaw No. 9963 be introduced and given first, second and third readings; and

(3) That staff examine the maximum cash amount that can be used for payments to the City.

ADOPTED ON CONSENT

13. **REVENUE ANTICIPATION BORROWING (2019) BYLAW NO. 9997**
(File Ref. No. 12-8060-20-009997) (REDMS No. 6095250, 6095252)

That Revenue Anticipation Borrowing (2019) Bylaw No. 9997 be introduced and given first, second and third readings.

ADOPTED ON CONSENT

14. **2017-2022 CHILD CARE NEEDS ASSESSMENT AND STRATEGY - 2018 UPDATE**
(File Ref. No. 07-3070-03-01) (REDMS No. 6087697 v. 8)

(1) That the staff report titled "2017-2022 Child Care Needs Assessment and Strategy - 2018 Update" dated February 12, 2019 from the Manager, Community Social Development, be received for information; and

(2) That the 2017-2022 Child Care Needs Assessment and Strategy - 2018 Update be distributed to key stakeholders and posted on the City website.

ADOPTED ON CONSENT

15. **APPLICATION BY FOUGERE ARCHITECTURE INC. FOR REZONING AT 9391, 9393, AND 9411 NO. 2 ROAD FROM "SINGLE DETACHED (RS1/E)" AND "TWO-UNIT DWELLINGS (RD1)" TO "MEDIUM DENSITY TOWNHOUSES (RTM2)**
(File Ref. No. RZ 17-785742, 12-8060-20-0010001) (REDMS No. 6122328, 6125370)

That Richmond Zoning Bylaw 8500, Amendment Bylaw 10001, for the rezoning of 9391, 9393, and 9411 No. 2 Road from "Residential Single Family (RS1/E)" and "Two-Unit Dwellings (RD1)"to "Medium Density Townhouses (RTM2)", be introduced and given first reading.

ADOPTED ON CONSENT

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CONSIDERATION OF MATTERS REMOVED FROM THE CONSENT AGENDA

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8. **OPTIONS FOR USE OF PRIVATE DEVELOPER PUBLIC ART CONTRIBUTION FUNDS**
(File Ref. No. 11-7000-09-00) (REDMS No. 6102180 v. 9, 3066549)

R19/5-5 It was moved and seconded
That the proposed option to maintain status quo funding of Community Public Art Programs with Private Developer Public Art Contributions in the report titled "Options for Use of Private Developer Public Art Contribution Funds" dated January 21, 2019 from the Director, Arts, Culture and Heritage Services, be endorsed.

The question on Resolution R19/5-5 was not called as in reply to queries from Council, Liesl Jauk, Manager, Arts Services and Biliana Velkova, Public Art Planner, advised that due to existing legal agreements with developers, funds collected from developers in the Public Art Statutory Reserve Fund may only be utilized for public art. Also, staff commented on the City's civic public art processes, noting that terms of references, calls for artists and so forth, are brought before Council for consideration. Also, staff remarked that a subsequent staff report on public art on private property is forthcoming.

The question on Resolution R19/5-5 was then called and it was **DEFEATED** with Cllrs. Au, Day, Greene, Steves, and Wolfe opposed.

Discussion then ensued on the potential to direct public art funds for alternative options that support the arts in the community. As a result, the following **referral motion** was introduced:

R19/5-6 It was moved and seconded
That staff create a policy in keeping with Option 2 of the staff report titled "Options for Use of Private Developer Public Art Contribution Funds" dated January 21, 2019 from the Director, Arts, Culture and Heritage Services and report back.

CARRIED
Opposed: Mayor Brodie
Cllrs. Loo
McPhail

NON-CONSENT AGENDA ITEMS

GENERAL PURPOSES COMMITTEE
Mayor Malcolm D. Brodie, Chair

16. **2019 FARM FEST AT GARDEN CITY LANDS UPDATE**
(File Ref. No. 11-7400-20-FFES1) (REDMS No. 6066225 v. 8, 6076849, 6143603, 6050302)

R19/5-7 It was moved and seconded
That Option 2 (Additional Farming Activations) for the 2019 Farm Fest at Garden City Lands, as outlined in the staff report titled "2019 Farm Fest at Garden City Lands Update," dated January 7, 2019, from the Director, Parks Services, be approved.

CARRIED
Opposed: Cllrs. Greene
McNulty
Steves

R19/5-8 It was moved and seconded
That 2019 Farm Fest at Garden City Lands be scheduled for August 10, 2019.

CARRIED
Opposed: Cllrs. Greene
McNulty
Steves

17. **COUNCIL AND COMMITTEE AGENDA DISTRIBUTION OPTIONS**
(File Ref. No. 01-0105-00) (REDMS No. 6056561 v. 3)

R19/5-9 It was moved and seconded

(1) That the staff report titled "Council and Committee Agenda Distribution Options" dated February 25, 2019, from the Director, City Clerk's Office be received for information;

(2) That Thursday Distribution (4 days before) be selected for Council and Public Hearing agenda distribution; and

(3) That Option 2 – Thursday Distribution (4 days before) be selected for Committee agenda distribution.

The question on Resolution R19/5-9 was not called as discussion took place and the following Council comments were noted:

- the majority of Council and Public Hearing materials are previously distributed as part of the Committee agendas and therefore, there's no need to change their distribution schedule;
- earlier agenda material distribution would be beneficial as it would provide Council members additional time to review packages and to ask questions of staff;
- earlier agenda material distribution would lend itself toward greater transparency of the Council process; and
- Metro Vancouver and TransLink distribute agendas early; this often results in multiple agenda revisions, which can cause confusion.

The question on Part (1) of Resolution R19/5-9 was then called and it was **CARRIED**.

The question on Part (2) of Resolution R19/5-9 was then called and it was **DEFEATED** with Cllrs. Au, Day, Greene, Steves and Wolfe opposed.

The question on Part (3) of Resolution R19/5-9 was then called and it was **DEFEATED** with Cllrs. Au, Day, Greene, Steves and Wolfe opposed.

R19/5-10 It was moved and seconded
That staff be directed to deliver Council and Committee agendas five business days prior to the all Council and Committee meetings to Richmond City Council members.

The question on Resolution R19/5-10 was not called as in reply to queries from Council, David Weber, Director, City Clerk's Office, and Claudia Jesson, Manager, Legislative Services, advised that the distribution of agenda materials five business days in advance of the meetings would require significant adjustments to internal deadlines. Also, it was noted that the City Clerk's Office staff and the Senior Management Team attend all Council and Committee meetings on Mondays, thereby agenda distribution five business days in advance would pose considerable logistical challenges.

The following **amendment motion** was introduced:

R19/5-11 It was moved and seconded
That the main motion be amended to replace "five business days" with "six business days."

DEFEATED
Opposed: Mayor Brodie
Cllrs. Au
Loo
McPhail
McNulty

The question on Resolution R19/5-10 was then called and it was **CARRIED** with Mayor Brodie, Cllrs. Loo, McPhail and McNulty opposed.

PLANNING COMMITTEE
Councillor Linda McPhail, Chair

18. **APPLICATION BY RAJWANT KHAIRA FOR A ZONING TEXT AMENDMENT TO THE "AGRICULTURE (AG1)" ZONE TO PERMIT A CHILD CARE FACILITY AT 7291 NO. 5 ROAD**
(File Ref. No. ZT 18-822841) (REDMS No. 6094879, 3651855, 3121576)

R19/5-12 It was moved and seconded
That the application for a Zoning Text Amendment to the "Agriculture (AG1)" Zone to allow "child care" as a site-specific secondary use, in order to permit a child care facility within a detached residential accessory building at 7291 No. 5 Road, be denied.

CARRIED
Opposed: Cllr. Loo

PUBLIC ANNOUNCEMENTS

Mayor Brodie announced that the park located at 9540, 9560, 9580, 9600, 9620 and 9700 Odlin Road has been named "Alexandra Neighbourhood Park," the park land located at 9600 Cambie Road, 9611 Odlin Road, 9560 Tomicki Avenue and 9540 Alexandra Road has been named "Alexandra Greenway," and the park located at 3233 Ketcheson Road has been named "Ketcheson Park."

Mayor Brodie then announced that Rebecca Lin and Mackenzie Biggar have been re-appointed to the Richmond Public Art Advisory Committee for a two-year term to expire on December 31, 2020.

Also, Mayor Brodie announced that "Shinde Place" has been selected for the proposed new road in Section 12 Block 3 Range 7, and "Buchanan Street" has been extended northward in Section 12 Block 3 Range 7.

Regular Council
Monday, March 11, 2019

BYLAW FOR ADOPTION

R19/5-13 It was moved and seconded
That Consolidated 5 Year Financial Plan (2019-2023) Bylaw No. 9979 be adopted.

CARRIED
Opposed: Cllrs. Au
Day
Greene
Wolfe

ADJOURNMENT

R19/5-14 It was moved and seconded
That the meeting adjourn (8:46 p.m.).

CARRIED

Certified a true and correct copy of the Minutes of the Regular meeting of the Council of the City of Richmond held on Monday, March 11, 2019.

Mayor (Malcolm D. Brodie)

Corporate Officer (David Weber)

City of Richmond

Minutes

Special Council
Monday, March 11, 2019

Place: Anderson Room
Richmond City Hall

Present: Mayor Malcolm D. Brodie
Councillor Chak Au
Councillor Carol Day
Councillor Kelly Greene
Councillor Alexa Loo
Councillor Bill McNulty
Councillor Linda McPhail
Councillor Harold Steves
Councillor Michael Wolfe (entered at 4:06 p.m.)

Corporate Officer – David Weber

Call to Order: Mayor Brodie called the meeting to order at 4:02 p.m.

RES NO. ITEM

In accordance with Section 100 of the *Community Charter*, Councillor Carol Day declared a conflict of interest as her husband owns a licenced bed and breakfast and left the meeting (4:03 p.m.).

COMMUNITY SAFETY DIVISION

1. **APPEAL OF BUSINESS LICENCE REJECTION FOR LULU BED AND BREAKFAST – 9371 BECKWITH ROAD**
(File Ref. No.: 12-8275-09) (REDMS No. 6119487)

Carli Williams, Manager, Chief Licence Inspector, provided background information regarding the bed and breakfast business licence application for 9371 Beckwith Road, noting that the Applicant's initial application was rejected due to building deficiencies, and the Applicant's subsequent application was denied as the property is owned by a corporation and not an individual person.

Councillor Wolfe entered the meeting (4:06 p.m.).

In reply to queries from Council, Ms. Williams advised that the property is now in compliance with the City's Building Regulation Bylaw No. 7320 and, in accordance with the City's Zoning Bylaw, a bed and breakfast use is permitted only where the operator is the individual registered owner of the dwelling.

Lucas Li, Applicant and owner of 9371 Beckwith Road, stated that when he first applied for a business licence for a bed and breakfast, he was advised that he had to submit a BC Company Summary as the property was registered under his company. Following an inspection by the City's Licence Inspector, he spent approximately two to three months addressing building deficiencies in an effort to comply with the City's Building Regulation Bylaw. Mr. Li then remarked that upon his second application, he was advised that a business licence cannot be issued for a bed and breakfast as the property is owned by a corporation.

Mr. Li then advised that he is now the sole shareholder of the company listed as the registered owner of 9371 Beckwith Road and provided an updated Notice of Articles for 1074193 B.C. Ltd. (copy on file, City Clerk's Office).

In reply to queries from Council, Mr. Li provided the following information:

- he resides at 9371 Beckwith Road;
- he is the sole owner and director for 1074193 B.C. Ltd.;
- he was not aware that a business licence cannot be issued for a bed and breakfast for a property that is owned by a corporation;
- it would be costly to transfer the property title to his personal name; and
- he has invested approximately $20,000 in renovations in an effort to address building deficiencies.

RES NO. ITEM

Ms. Williams then advised that a business licence is issued to an individual, and regular business licence renewal protocol often discover any changes in business ownership.

In reply to queries from Council, Anthony Capuccinello Iraci, City Solicitor, advised that, should Council wish to issue a business licence to the Applicant, a bylaw amendment would be required.

Discussion took place and Council commented on the need to have updated information with regard to the Notice of Articles for 1074193 B.C. Ltd prior to consideration of the business licence appeal. The Chair directed staff to provide an updated corporate search and to examine corporate records to determine the identity of the company's (1074193 B.C. Ltd.) shareholder(s). Also, it was noted that it would be valuable to know if other properties are owned by 1074193 B.C. Ltd. and if Council wished to consider amending the regulations with regard to property ownership for bed and breakfast businesses, what procedure would be required.

Discussion then took place on Council's intent with regard to the City's regulation that corporations may not be operators of bed and breakfast businesses. It was noted that there are beneficial financial protections with incorporating a business and Council discussed whether a company that owns a property as a sole proprietorship should be issued a business licence.

As a result of the discussion, the following **motion** was introduced:

SP19/2-1 It was moved and seconded

That the application for a business licence for Lulu Bed and Breakfast at 9371 Beckwith Road be deferred to a Special Council meeting scheduled for March 25, 2019 in the Anderson Room at City Hall and that staff provide:

(1) updated information with regard to the Notice of Articles for 1074193 B.C. Ltd;

(2) corporate records to determine the identity of 1074193 B.C. Ltd.'s shareholder(s) and whether 1074193 B.C. Ltd. owns any other property; and

RES NO. ITEM

(3) information on what procedure would be required if Council wished to consider amending the regulations with regard to property ownership for bed and breakfast businesses.

CARRIED

ADJOURNMENT

SP19/2-2 It was moved and seconded
That the meeting adjourn (4:27 p.m.).

CARRIED

Certified a true and correct copy of the Minutes of the Special meeting of the Council of the City of Richmond held on Monday, March 11, 2019.

Mayor (Malcolm D. Brodie)

Corporate Officer (David Weber)

City of Richmond

Minutes

Regular Council meeting for Public Hearings
Monday, March 18, 2019

Place: Council Chambers
Richmond City Hall

Present: Mayor Malcolm D. Brodie, Chair
Councillor Chak Au
Councillor Carol Day
Councillor Kelly Greene
Councillor Alexa Loo
Councillor Bill McNulty
Councillor Linda McPhail
Councillor Harold Steves
Councillor Michael Wolfe

Claudia Jesson, Acting Corporate Officer

Call to Order: Mayor Brodie opened the proceedings at 7:00 p.m.

1. **RICHMOND ZONING BYLAW 8500, AMENDMENT BYLAW 9891 (RZ 16-745849)**
(Location: 6031 Blundell Road; Applicant: Zget Holdings Corp.)

Applicant's Comments:

The applicant was available to respond to queries.

Written Submissions:

None.

Submissions from the floor:

None.

PH19/3-1 It was moved and seconded
That Richmond Zoning Bylaw 8500, Amendment Bylaw 9891 be given second and third readings.

CARRIED

2. **RICHMOND ZONING BYLAW 8500, AMENDMENT BYLAW 9946 (RZ 18-827880)**
(Location: 7671 Acheson Road; Applicant: Penta Builders Group)

Applicant's Comments:

The applicant was available to respond to queries.

Written Submissions:

None.

Submissions from the floor:

Yu Weng Ching, 7880 Bennett Road, commented on fencing the construction site and the Statutory Right-of-Way (SRW) registered on his property. Staff noted that the City does not require fencing during the construction phase and that a proposed six metre wide lane will use the SRW registered to the subject site and a property to the north of the subject site (7880 Bennett Road).

PH19/3-2 It was moved and seconded
That Richmond Zoning Bylaw 8500, Amendment Bylaw 9946 be given second and third readings.

The question on the motion was not called as discussion ensued with regard to the alignment of the existing lane with the proposed lane.

The question on the motion was then called and it was **CARRIED**.

3. **RICHMOND ZONING BYLAW 8500, AMENDMENT BYLAW 9969 (ZT 18-835424)**
(Location: 13171 and a portion of 13251 Smallwood Place; Applicant: Kasian Architecture Interior Design and Planning Ltd.)

Applicant's Comments:

The applicant was available to respond to queries.

Written Submissions:

None.

Submissions from the floor:

None.

PH19/3-3 It was moved and seconded
That Richmond Zoning Bylaw 8500, Amendment Bylaw 9969 be given second and third readings.

The question on the motion was not called as discussion ensued with regard to the application's proposed sustainability measures and potential risk of bird strikes on the proposed building. Staff noted that should the application proceed, measures to address the potential risk of bird strikes can be considered during the Development Permit process. Also, staff added that input from the Richmond Nature Park Society on the proposed design of the building can be submitted during the Development Permit process.

The question on the motion was then called and it was **CARRIED** with Cllrs. Greene and Wolfe opposed.

4. **RICHMOND ZONING BYLAW 8500, AMENDMENT BYLAW 9986 (RZ 18-814702)**
(Location: 8600, 8620, 8640, and 8660 Francis Road; Applicant: Eric Stine Architect, Inc.)

Applicant's Comments:

The applicant was available to respond to queries.

Written Submissions:

Jessica Wang, Richmond Resident (Schedule 1)

Submissions from the floor:

None.

PH19/3-4 It was moved and seconded
That Richmond Zoning Bylaw 8500, Amendment Bylaw 9986 be given second and third readings.

CARRIED

ADJOURNMENT

Regular Council meeting for Public Hearings
Monday, March 18, 2019

PH19/3-5 It was moved and seconded
That the meeting adjourn (7:16 p.m.).

CARRIED

Certified a true and correct copy of the Minutes of the Regular meeting for Public Hearings of the City of Richmond held on Monday, March 18, 2019.

Mayor (Malcolm D. Brodie)

Acting Corporate Officer
(Claudia Jesson)

To Public Hearing
Date: MARCH 18 2019
Item # 4
Re: BYLAW 9986

CityClerk

From: Jessica Wang <jessicawanglucky@gmail.com>
Sent: Thursday, 14 March 2019 18:57
To: CityClerk
Subject: Richmond Zoning Bylaw 8500, Amendment Bylaw 9986 (RZ 18-814702)

To whom this may concern,

I would like to thank you for hosting this public hearing.

My family is living in 8580 Francis Road, which is the closest property near construction site. We have following concerns regarding to the construction.

(1) Where is the entrance located? Please no entrance located near our property, at least 20 meters away from our property. The entrance for car and residents should be in the middle of the site, not affect the nearby neighborhood.

(2) One window in our second floor is facing to the east, which is directly facing the proposed site. For the nearest townhouse unit, please don't design the window facing to our house because of the privacy concern.
Also, we concern about the light pollution, and the height of the development, it may block out sunlight. It is ok if the neighboring unit's height is lower than our house.

(3) We are worried about the construction noise. As our family member has insomnia disorder and neurasthenia, please make the construction noise as lowest as they can, also the construction period not start too early in the morning. This is very important, please pay attention as construction noise will affect our life quality.

(4) Fence. The developer should pay and replace our fence to new one, which is closest to the proposed site.

(5) As our property is the closest property to the construction site. If there is any broken or damage to our property because of the construction, the developer must pay the damage and make the repair, or the developer requires their insurance company to pay for the damage.

All above is which we very concerns. After the above problems are solved, we will agree the rezoning.

Thanks for your consideration.

Best,

Zihong Wang

City of Richmond

Minutes

Community Safety Committee

Date:	Tuesday, March 12, 2019
Place:	Anderson Room Richmond City Hall
Present:	Councillor Bill McNulty, Chair Councillor Alexa Loo Councillor Carol Day – entered at 4:01 p.m. Councillor Kelly Greene Councillor Harold Steves
Also Present:	Councillor Linda McPhail Councillor Michael Wolfe – entered at 4:01 p.m.
Call to Order:	The Chair called the meeting to order at 4:00 p.m.

MINUTES

It was moved and seconded
That the minutes of the meeting of the Community Safety Committee held on February 12, 2019, be adopted as circulated.

CARRIED

NEXT COMMITTEE MEETING DATE

April 9, 2019, (tentative date) at 4:00 p.m. in the Anderson Room

COMMUNITY SAFETY DIVISION

1. **COMMUNITY BYLAWS MONTHLY ACTIVITY REPORT-JANUARY 2019**
(File Ref. No. 12-8060-01) (REDMS No. 6125378)

Councillor Day and Councillor Wolfe entered the meeting (4:01 p.m.).

In reply to questions from Committee, Carli Williams, Manager, Community Bylaws and Licencing advised that staff is aware there may be Richmond listings on AirBnB and any reported Richmond addresses are investigated. Ms. Williams further noted that dog licence renewal notices are sent out in November for January which accounts for the high number of licences issued for the month. She also remarked that canvassers will be following up with those who have not renewed in the next few months.

In response to a question regarding a vehicle towed from Francis Road, Susan Lloyd, Manager, Parking Enforcement, Animal Control and Administration – Community Bylaws advised that the incident involved outstanding parking tickets and noted that staff can respond to the inquiry.

It was moved and seconded
That the staff report titled "Community Bylaws Monthly Activity Report – January 2019", dated February 22, 2019, from the General Manager, Community Safety, be received for information.

CARRIED

2. **EMERGENCY PROGRAMS OVERVIEW (2018-2020)**
(File Ref. No. 09-5126-01) (REDMS No. 5883331 v. 24)

In response to queries from Committee, Norman Kotze, Manager, Emergency Programs remarked that (i) there are three more planned sessions at community centres for the Richmond Resilient Communities Program workshop up until June, (ii) staff are in initial contact with the Richmond Chamber of Commerce to assist businesses with business continuity planning, (iii) staff continue promotion efforts for the Emergency Notification System and renewing information campaigns to reach more subscribers with a focus on sign up at public events as the alert system is an opt-in notification program, (iv) staff are working with Oceans Network Canada to integrate into the early warning system for earthquakes in order to provide instant and automated notifications as part of a systems upgrade, and (v) staff are working on opportunities to possibly provide the sign up form in other languages while managing expectations as the notifications are in English and engage with volunteers with multiple languages to encourage further sign up.

It was moved and seconded
That the report titled "Emergency Programs Overview (2018-2020)", dated January 29, 2019, from the General Manager, Community Safety, be received for information.

CARRIED

3. **RICHMOND FIRE-RESCUE MONTHLY ACTIVITY REPORT- JANUARY 2019**
(File Ref. No. 09-5000-01) (REDMS No. 6120127 v. 2)

In reply to questions from Committee, Tim Wilkinson, Fire Chief spoke to specific fire incidents detailed in the report and noted that the January 18th incident at the public washroom was suspicious in nature however no further information regarding the event was garnered. Mr. Wilkinson further advised that the incident outside the caretaker's building at King George Park caused significant damage to the home and was suspicious in nature. He also noted that although Richmond Fire-Rescue coordinates with police counterparts to investigate the cause of suspicious fires, most are difficult to prove unless the person responsible is caught in the act however staff make every effort to investigate each incident.

It was moved and seconded
That the staff report titled "Richmond Fire-Rescue Monthly Activity Report – January 2019", dated February 14, 2019, from the Fire Chief, Richmond Fire-Rescue, be received for information.

CARRIED

4. **FIRE CHIEF BRIEFING**
(Verbal Report)

Items for discussion:

None.

5. **RCMP MONTHLY ACTIVITY REPORT- JANUARY 2019**
(File Ref. No. 09-5000-01) (REDMS No. 6101011 v. 6)

Will Ng, Superintendent, Officer in Charge highlighted the January statistics from the report and noted the following assault incidents in January: (i) one assault incident involved a security guard who attempted to intervene on a break and enter in progress at a storage locker, (ii) assault incidents occurred at the River Rock Casino, Richmond General Hospital, Home Depot, and Ackroyd Mall, (iii) three pepper spray assaults, (iv) one fight at McMath Secondary School, and (v) the remainder of the assaults were related to domestic violence.

Supt. Ng further outlined the following incidents of note in January: (i) five of the sexual assault incidents were related to the BC Integrated Child Exploitation (BC ICE) unit which deal with child pornography investigations, (ii) there were an increased number of indecent acts in January, and (iii) the remainder of the sexual assault incidents related to known relationships and assaults involving drugs and alcohol.

Supt. Ng also noted that Richmond RCMP have had recent success with strategies for apprehending offenders including the capture of an offender who broke into four vehicles in an underground parkade. He further commented that the auxiliaries are still altering their hours to Richmond RCMP and Richmond RCMP are waiting to hear from National Headquarters in regards to the Tier 3 training standards approval.

Discussion then took place on requesting a status update on the delivery of the training standards and uniform for the Tier 3 Auxiliary program.

As a result of the discussion, the following **motion** was introduced:

It was moved and seconded
That a letter be written to the RCMP National Headquarters requesting an update on the status of the Tier 3 Auxiliary program.

CARRIED

In reply to questions from Committee, Edward Warzel, Manager, RCMP Administration, advised that the Block Watch program is reviewed on an annual basis for active participants including captains and co-captains and updated numbers could be provided.

In response to further questions from Committee, Supt. Ng noted that (i) officers have attempted various strategies with the one person responsible for 60 of the January mental health incidents including the use of props and offering wrap around services, however they suffer from short term memory issues and continue to call despite intervention efforts, (ii) the Detachment's Youth Section expects to visit all schools in Richmond with a focus on promoting the dangers of social media and the Detachment's goal is to increase outreach capacity in the youth section, (iii) incidents of fights at schools involve different variables which may result in police being called to intervene including occurrence afterhours, (iv) the shooting incident on Mitchell Island is gang related and one male victim is currently being treated for his injuries and officers are investigating a related vehicle fire on No. 7 Road, and (vi) the recent public announcement regarding break-ins around Aberdeen Centre and Parker Place resulted in an arrest of the person responsible and since then there has been no further theft from autos in that area. He further remarked that within the last week two prolific theft from autos offenders had been arrested.

It was moved and seconded
That the report titled "RCMP Monthly Activity Report – January 2019", dated February 19, 2019, from the Officer in Charge, Richmond RCMP Detachment, be received for information.

CARRIED

6. **2018 - 2019 RICHMOND RCMP DETACHMENT ANNUAL PERFORMANCE PLAN THIRD QUARTER RESULTS (OCTOBER 1 TO DECEMBER 31, 2018)**
(File Ref. No. 09-5000-01) (REDMS No. 6107236 v. 3)

Supt. Ng noted that there has been a reduction in drug offenses as legalization of cannabis has led to a reduction in charges related to cannabis and has impacted the Richmond Detachment's ability to meet its target.

In reply to queries from Committee, Supt. Ng advised that more information related to Project 529, the online bike registry, will be promoted more on social media and one new position that was approved for this year is for includes media relations and the role will facilitate the promotion of programs like Project 529. He further remarked that the Detachment is waiting for the letter of approval from the Minister for the hiring of the additional RCMP officers.

It was moved and seconded
That the report titled "2018-2019 Richmond RCMP Detachment Annual Performance Plan Third Quarter Results (October 1 to December 31, 2018)", dated February 19, 2019, from the Officer in Charge, Richmond RCMP Detachment, be received for information.

CARRIED

7. **RCMP/OIC BRIEFING**
(Verbal Report)

Items for discussion:

RCMP Community Consultations

Supt. Ng advised that the community consultation meetings held on February 20 at Richmond General Hospital and on February 21 at West Richmond Community Centre was attended by over 80 residents. He further noted that the priorities noted by respondents at the consultations were: (1) property crime, (2) crime prevention, (3) road safety, (4) organized crime, and (5) vulnerable persons. Supt. Ng also commented that the priorities for service delivery were: (1) police call response times with 92% of respondents, (2) police visibility with 69% of respondents, and (3) community outreach with 62% of respondents. He further remarked that when respondents were asked about their perceived level of safety within the community, 86% stated they felt moderately to very safe. Supt. Ng noted that as a result of the consultation meetings, three new block watch groups were formed in high property crime areas.

8. **COMMITTEE STANDING ITEM**

E-Comm

The Chair provided an update and noted that E-Comm has opened a second site in Saanich for dispatch. The Chair further remarked that 14 fire departments have joined E-Comm within the last few months and discussions taking place regarding a possible third site in the lower Fraser Valley or South Surrey area. The Chair also advised that any new councillor is welcome to take a tour of E-Comm or BC Ambulance.

9. MANAGER'S REPORT

None.

Discussion took place regarding health and safety concerns from residents of Burkeville as a result of the YVR Templeton Redevelopment Area.

In response to questions from Committee, Ms. Achiam advised that the City has written to the Minister regarding this matter and YVR has had information sessions with residents including on February 17. She further remarked that staff could contact YVR staff regarding the matter to facilitate however the project is under federal jurisdiction.

Andrew Baxter, Burkeville resident at 1131 Wellington Crescent, noted in response to questions from Committee that (i) residents are concerned with multiple issues in relation to the development including increased noise, (ii) residents are of the opinion that the last public meeting held by YVR did not adequately address their concerns, (iii) residents have noted that the YVR Aeronautical Noise Management Committee did meet on December 6, 2018 and the Committee commented that the aircraft noise resulting from the Templeton redevelopment would not impact Burkeville residents, (iv) residents are also concerned about the change in aircraft traffic and the 24/7 operation of the logistics facility as well as its close approximation to Burkeville, and (v) residents are further concerned with a potential increase to air traffic and exhaust from planes.

As a result of the discussion, the following **referral motion** was introduced:

It was moved and seconded
That staff pursue communication with YVR representatives to encourage further discussions with the residents of Burkeville regarding their concerns on the Templeton Area Redevelopment.

CARRIED

Discussion further took place regarding noise management of the construction of the Templeton Area Redevelopment including potential communication between the YVR Aeronautical Noise Management Committee and Burkeville residents.

ADJOURNMENT

It was moved and seconded
That the meeting adjourn (4:48 p.m.).

CARRIED

Certified a true and correct copy of the Minutes of the meeting of the Community Safety Committee of the Council of the City of Richmond held on Tuesday, March 12, 2019.

Councillor Bill McNulty
Chair

Amanda Welby
Legislative Services Coordinator

City of Richmond

Minutes

General Purposes Committee

Date: Monday, March 18, 2019

Place: Anderson Room
Richmond City Hall

Present: Mayor Malcolm D. Brodie, Chair
Councillor Chak Au
Councillor Carol Day
Councillor Kelly Greene
Councillor Alexa Loo
Councillor Bill McNulty
Councillor Linda McPhail
Councillor Harold Steves
Councillor Michael Wolfe

Call to Order: The Chair called the meeting to order at 4:00 p.m.

MINUTES

It was moved and seconded
That the minutes of the meeting of the General Purposes Committee held on March 4, 2019, be adopted as circulated.

CARRIED

DELEGATION

1. Update from the Ministry of Transportation and Infrastructure, Province of BC, on the George Massey Crossing Project

With the aid of a PowerPoint presentation, Lina Halwani, George Massey Crossing Project Director, accompanied by Dawn Hinze, Regional Manager, Business Management Services, and Pam Ryan, Engagement Advisor, Ministry of Transportation and Infrastructure, provided an update on the George Massey Crossing Project and the following information was noted:

- the Ministry of Transportation and Infrastructure (MOTI) is committed to moving forward with the Crossing project and invites the City of Richmond to be involved throughout the process;
- Phase I aims to better align the Crossing project with regional plans by establishing goals and objectives, identifying and reviewing options, and preparing a business case for the selected option; Phase I is scheduled to be completed by April 2019;
- immediate improvements related to safety are scheduled to commence in the summer of 2019; interim improvements such as upgrades to the Steveston Highway – Highway 99 interchange are scheduled to be tender-ready by fall of 2020;
- Phase II will include the evaluation of shortlisted options and is scheduled to be completed by November 2019; Phase II incorporates public engagement with all audiences and includes public open houses; and
- Phase III of the Crossing project will be of a technical nature, with completion of a business case earmarked for the fall of 2020.

She then commented on draft preliminary objectives, noting that Goal #1 is to support sustainability of communities south of the Fraser River, Goal #2 is to facilitate increased share of sustainable modes of transport, Goal #3 is to enhance regional goods movement and commerce, and Goal #4 is to support a healthy environment.

Ms. Halwani spoke to the MOTI's understanding of the City's interests, noting that the MOTI would like Council's input in further developing goals and objectives for the Crossing project; also, she requested that City of Richmond staff be permitted to work with the MOTI on developing and evaluating crossing options. Ms. Halwani then remarked that Council's formal input and endorsement of the proposed preliminary goals and objectives would be appreciated by April 1, 2019.

Discussion took place and Committee members cited areas of particular concern and interest to Richmond, namely as they relate to (i) BC Hydro infrastructure, (ii) traffic congestion as a result of trucks utilizing the Crossing during peak hours, (iii) the best suitable option for a Crossing, (iv) the extension of Rice Mill Road to alleviate traffic congestion, (v) a potential interchange at Blundell Road and Highway 99, (vi) a potential parking facility south of the Crossing, (vii) the interchange at Westminster Highway and Highway 99 and its proximity to an Environmentally Sensitive Area, and (viii) rapid transit ready infrastructure.

Ms. Halwani confirmed that Council's comments will be considered as part of Phase II of the Crossing project, and then commented on immediate improvements to the Crossing, noting that a lighting upgrade is scheduled for the summer of 2019.

The Chair remarked that individual opinions of Council members' have been heard however, Richmond City Council's position will be confirmed by way of Council resolution.

As a result of the discussion, the following **referral motion** was introduced:

It was moved and seconded
That the Ministry of Transportation and Infrastructure's presentation on the George Massey Crossing project be referred to staff for comment and to report back as soon as possible in an effort to meet the Ministry's deadline for input of April 1, 2019.

CARRIED

COUNCILLOR KELLY GREENE & COUNCILLOR CAROL DAY

2. Conference approval request.

It was noted that approximately $911 is requested per Councillor to attend the Columbia Institute's Civic Governance Forum.

Discussion took place on vehicular allowances for Council members and in reply to a query from Committee, Andrew Nazareth, General Manager, Finance and Corporate Services, advised that Council members may claim half of the mileage costs for travel outside the Lower Mainland.

The following **motion** was introduced:

It was moved and seconded

(1) That Councillor Kelly Greene and Councillor Carol Day be approved to attend the Columbia Institute's Civic Governance Forum as set out in the email dated March 14, 2019 with mileage commensurate with City mileage allowances; and

(2) That staff report back with policy options on Council travel, conferences and related procedures.

The question on the motion was not called as discussion took place on a previous policy related to Council members' attendance at conferences and the rationale to rescind said policy.

The question on the motion was then called and it was **CARRIED**.

ENGINEERING AND PUBLIC WORKS DIVISION

3. **ACCELERATING LOCAL ACTION ON CLIMATE CHANGE: COMMUNITY ENERGY & EMISSIONS PLAN (CEEP) RENEWAL**
(File Ref. No. 10-6000-00) (REDMS No. 6137917; 6134827; 6136115; 6134863; 6134864; 6134866)

In reply to queries from Committee, Peter Russell, Senior Manager, Sustainability and District Energy, and Nicholas Heap, Sustainability Project Manager, advised that the City's emissions target align with those listed in the United Nation's Intergovernmental Panel on Climate Change's report of October 2018. Staff noted that the targets set out in the Richmond Community Energy and Emissions Plan (CEEP) are reviewed every five years in an effort to be current and responsive to changes in tools for energy reduction, funding for energy reduction and so forth.

Discussion took place on the City's sustainability efforts as a whole and in particular with regard to other measures the City can implement or enhance that would positively affect the City's energy and emission targets. For instance, it was noted that the City strives to encourage the use of green modes of transport such as bicycles by improving the cycling network however fails to address the need to direct delivery vehicles to the back of buildings so that they do not block bike lanes.

Discussion further ensued and Committee commented that the declaration of a climate emergency is symbolic and that public engagement should not be limited to particular stakeholders as all groups are affected by climate change. Also, Committee spoke to the United Nation's Intergovernmental Panel on Climate Change's report, emphasizing the need to endorse targets for greenhouse gas reduction.

As a result of the discussion, the following **motion** was introduced:

It was moved and seconded
That the public consultation program defined in the report titled "Accelerating Local Action on Climate Change: Community Energy & Emissions Plan (CEEP) Renewal" from the Director, Engineering dated February 27, 2019, to gain feedback from residents and stakeholders regarding the recommended revised greenhouse gas (GHG) reduction target and revised climate action strategies and measures consistent with and in response to the UN's Intergovernmental Panel on Climate Change report, be endorsed.

CARRIED

Discussion took place on declaring a climate emergency and the following **motion** was introduced:

It was moved and seconded
That the City of Richmond declares and confirms a climate emergency.

The question on the motion was not called as discussion took place on the meaning of a "climate emergency." It was noted that the term is widely used with different meanings and therefore there is a need to better define Richmond's position on a climate emergency. As a result, the following **amendment motion** was introduced:

It was moved and seconded
That the main motion be amended to include the word "global" immediately prior to "climate emergency."

DEFEATED
Opposed: Cllrs. Day
Greene
McNulty
McPhail
Steves
Wolfe

The question on the main motion was then called and it was **CARRIED**.

Discussion continued regarding the City's CEEP and the following **referral motion** was introduced:

That staff report back on:

(1) a specific statement in conjunction with the City's Community Energy and Emissions Plan;

(2) the consideration of more energy and emissions targets and more often; and

(3) strategies for enforcement relating to the City's bike lanes.

CARRIED

FINANCE AND CORPORATE SERVICES DIVISION

4. OPTIONS FOR AN ONLINE COUNCIL MEMBER VOTING RECORD

(File Ref. No. 01-0105-01) (REDMS No. 6107525 v. 4, 6118822)

David Weber, Director, City Clerk's Office, reviewed the proposed four options as described in the staff report titled "Options for an Online Council Member Voting Record," dated February 26, 2019.

In reply to queries from Committee, Mr. Weber advised that (i) both Option 3 and Option 4 can be implemented with little operational impact, (ii) should Option 4 be selected, staff anticipate a Capital submission for the 2020 budget cycle, and (iii) should Option 3 be selected, the Council Contingency account has been identified as a potential source of funding.

The following **motion** was introduced:

It was moved and seconded
That Option 3 (voting record built as an add-on to an existing City database) with funding from the Council Contingency account as per the staff report titled "Options for an Online Council Member Voting Record," dated February 26, 2019, from the Director, City Clerk's Office, be approved.

CARRIED

ADJOURNMENT

It was moved and seconded
That the meeting adjourn (5:40 p.m.).

CARRIED

Certified a true and correct copy of the Minutes of the meeting of the General Purposes Committee of the Council of the City of Richmond held on Monday, March 18, 2019.

Mayor Malcolm D. Brodie
Chair

Hanieh Berg
Legislative Services Coordinator

City of Richmond

Minutes

Planning Committee

Date:	Tuesday, March 19, 2019
Place:	Anderson Room Richmond City Hall
Present:	Councillor Linda McPhail, Chair Councillor Bill McNulty Councillor Carol Day Councillor Alexa Loo Councillor Harold Steves Mayor Malcolm Brodie
Also Present:	Councillor Michael Wolfe
Call to Order:	The Chair called the meeting to order at 4:00 p.m.

MINUTES

It was moved and seconded
That the minutes of the meeting of the Planning Committee held on March 5, 2019, be adopted as circulated.

CARRIED

NEXT COMMITTEE MEETING DATE

April 2, 2019, (tentative date) at 4:00 p.m. in the Anderson Room

PLANNING AND DEVELOPMENT DIVISION

1. **APPLICATION BY WING KUEN BECKY CHAN FOR REZONING AT 11120 GRANVILLE AVENUE FROM "AGRICULTURE (AG1)" TO A SITE SPECIFIC AGRICULTURE ZONE TO PERMIT A LARGER HOUSE SIZE**
(File Ref. No. RZ 19-850784) (REDMS No. 6141869)

Discussion ensued with regard to (i) access options to the rear of the property, (ii) the timeline of the application submission, (iii) the potential for the application to set a precedent if approved, (iv) design options to reduce the proposed house size, and (v) the number of small agricultural lots in the city.

A map of agricultural parcels under two acres was distributed (attached to and forming part of these minutes as Schedule 1).

Becky Chan, Joey Ang and Andy Deol, representing the applicants spoke on the application noting that (i) preliminary design plans were initiated on July 2017, however there were delays in the design process and the associated building permit application was submitted during the withholding period for building permit applications for sites in agricultural land in 2018, (ii) access to the backlands can be made along the side of the property, (iii) approximately $20,000 to $30,000 has been spent of preliminary design work, and (iv) the proposed house will accommodate immediate and extended family members.

It was moved and seconded
That the application for the rezoning of 11120 Granville Avenue from "Agriculture (AG1)" to a Site Specific Agriculture Zone, to permit a house up to 500 m^2 in floor area, be denied.

The question on the motion was not called as discussion ensued with regard to the timing of the building permit application submission and other building permit applications on agricultural lots submitted to the City.

The question on the motion was then called and it was **DEFEATED** on a tie vote with Mayor Brodie and Cllrs. McPhail and Loo opposed.

2. **APPLICATION BY CLIVE ALLADIN FOR REZONING AT 22260 RIVER ROAD FROM "AGRICULTURE (AG1)" TO A SITE SPECIFIC AGRICULTURE ZONE TO PERMIT A LARGER HOUSE SIZE**

(File Ref. No. RZ 19-851176) (REDMS No. 6120465 v. 2)

Staff commented on the application noting that the applicant has secured required permits to conduct site preparation and that the net buildable area for the subject site is reduced since it is generally not permitted to build on Environmentally Sensitive Areas (ESA) or Riparian Management Areas (RMA).

Discussion ensued with regard to (i) design options to reduce the proposed size of house, (ii) the timeline of the application submission, (iii) historical subdivisions of agricultural lots, (iv) the potential for the application to set a precedent if approved, and (v) wheelchair access requirements.

Clive Alladin and Naizer Kabani, representing the applicants, spoke on the application, noting that (i) the subject site was purchased in the spring of 2018 and that preliminary design work and site preparation has commenced at a cost of approximately $200,000, (ii) asbestos remediation in an existing structure on-site and removal of a septic tank in the RMA has been completed, (iii) the proposed size of the house is required in order to accommodate wheelchair access and an elevator, (iv) the applicant consulted with the City with regard to house size regulations on agricultural land at the time the lot was purchased, and (v) the associated building permit application was submitted during the withholding period for building permit applications for sites in agricultural land in 2018.

Information related to the application and agricultural properties in the city was distributed (attached to and forming part of these minutes as Schedule 2).

In reply to queries from Committee, staff noted that information regarding the following can be provided to Council: (i) agricultural lots that have been previously subdivided, (ii) space required to accommodate wheelchair access and elevators, and (iii) the number of potential applicants that have expressed interest in submitting an application to build a home on agricultural land larger than the permitted size.

It was moved and seconded

That the application for the rezoning of 22260 River Road from "Agriculture (AG1)" to a Site Specific Agriculture Zone, to permit a house up to 500 m^2 in floor area, be denied.

The question on the motion was not called as discussion ensued with regard to the timing of the application submission and the subject site's buildable area.

The question on the motion was then called and it was **DEFEATED** with Mayor Brodie and Cllrs. McPhail, Day and Loo opposed.

It was moved and seconded
That the application for the rezoning of 22260 River Road from "Agriculture (AG1)" to a Site Specific Agriculture Zone, to permit a house up to 500 m^2 in floor area, be forwarded to Council for consideration of first reading.

The question on the motion was not called as discussion ensued with regard to the space required to accommodate accessibility features.

The question on the motion was then called and it was **CARRIED** with Cllrs. McNulty and Steves opposed.

Staff were directed to prepare a bylaw related to the rezoning application of the site at 22260 River Road for the next regular Council meeting.

3. **RICHMOND HERITAGE COMMISSION 2018 ANNUAL REPORT AND 2019 WORK PROGRAM**
(File Ref. No. 01-0100-30-HCOM1-01) (REDMS No. 6133813 v. 2)

In reply to queries from Committee, Jane Fernyhough, Director, Arts, Culture and Heritage Services, noted that the public engagement process for the Heritage Inventory Update will close on March 24, 2019 and that staff will provide a report to Council on the matter.

Committee thanked the Richmond Heritage Commission for their work in the community.

It was moved and seconded
(1) ***That the Richmond Heritage Commission 2018 Annual Report, as presented in this staff report, be received for information; and***

(2) ***That the Richmond Heritage Commission 2019 Work Program, as presented in this staff report, be approved.***

CARRIED

4. **ADVISORY COMMITTEE ON THE ENVIRONMENT 2018 ANNUAL REPORT AND 2019 WORK PROGRAM**
(File Ref. No. 01-0100-30-ACEN1-01) (REDMS No. 6124817 v. 1)

Committee thanked the Advisory Committee on the Environment for their work in the community.

It was moved and seconded
(1) ***That the Advisory Committee on the Environment 2018 Annual Report, as presented in this staff report, be received for information; and***

(2) That the Advisory Committee on the Environment 2019 Work Program, as presented in this staff report, be approved.

CARRIED

5. **MANAGER'S REPORT**

(i) Lot Size Policy Public Consultation

Wayne Craig, Director, Development, briefed Committee on an upcoming public consultation to amend a Lot Size Policy for lots in the quarter section of Williams Road, Steveston Highway, No. 2 Road and Railway Avenue. He added that staff will be recommending excluding those lots along Railway Avenue from the current Lot Size Policy in order to be in line with the Official Community Plan Arterial Road Strategy.

(ii) Hamilton Area Road Works

Mr. Craig noted that as a result of development in the area, significant road works are scheduled along Westminster Highway and Gilley Road and that the developer has been requested to host a public information session on the traffic management plan. Mr. Craig added that the public information session is anticipated to take place in April 2019 and notification will be sent out to affected residents, including the Richmond School District No. 38, Hamilton Elementary School and the Hamilton Community Centre.

ADJOURNMENT

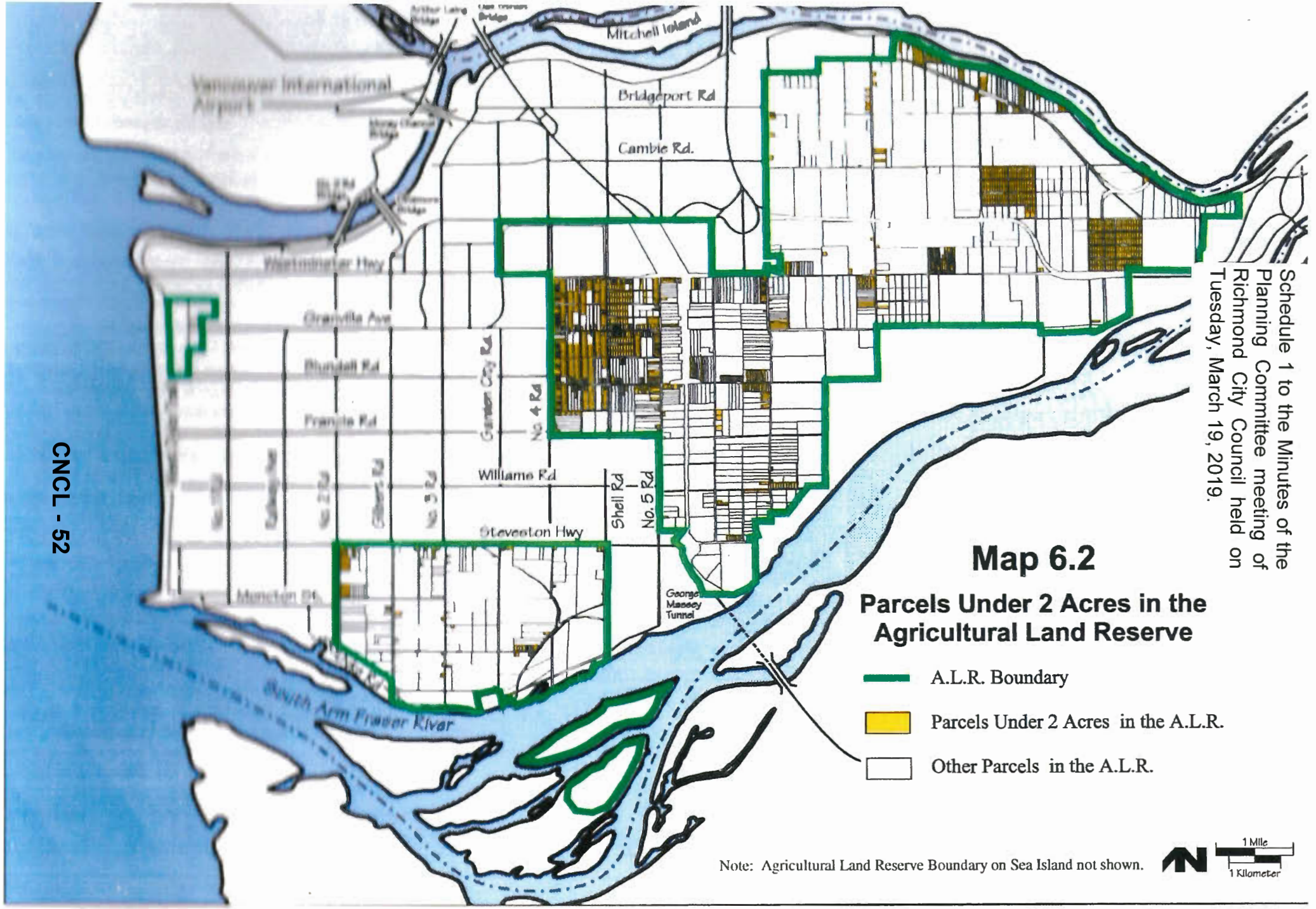
It was moved and seconded
That the meeting adjourn (5:04 p.m.).

CARRIED

Certified a true and correct copy of the Minutes of the meeting of the Planning Committee of the Council of the City of Richmond held on Tuesday, March 19, 2019.

Councillor Linda McPhail
Chair

Evangel Biason
Legislative Services Coordinator



Schedule 1 to the Minutes of the Planning Committee meeting of Richmond City Council held on Tuesday, March 19, 2019.

An A

There are over 1,000 properties in the ALR that do not have large houses. Most of them are small lots. See Map 6.2

1)The application came in after we adopted a 400 sq m or 4,300 sq ft house.

2)The application is for the provincial maximum, which we did not adopt. The total area of house at 4,600 sq ft and garage at 700 sq ft is 5,300 sq ft. The house could be redesigned to 4,300 sq ft and eliminate the garage, or reduce house size further and have a small garage.

3)The lot size is .04 ha smaller than the lots on Granville Ave. which is hardly significant. It is similar in size to lots that were previously subdivided out of larger parcels in the ALR

4)Whether the remainder of the property is ESA of farm-able is irrelevant. Both are supposed to be protected by the 4,300 sq ft house size.

5)The property may be "orphaned" compared to the larger property it was subdivided from but that is a major problem. Before the ALR was founded and a decade after it was founded farmers were permitted to build a second house on larger farms for retiring parents or young family members. They were sometimes subdivided from the main property, especially to qualify for the homeowners grant. When it became evident that the properties were being sold to non farmers the practice was discontinued by the City and the Agricultural land Commission..

Approving this application would set a precedent for the other small properties in the ALR..

Schedule 2 to the Minutes of the Planning Committee meeting of Richmond City Council held on Tuesday, March 19, 2019.

City of Richmond

Minutes

Public Works and Transportation Committee

Date: Wednesday, March 20, 2019

Place: Anderson Room
Richmond City Hall

Present: Councillor Chak Au, Chair
Councillor Linda McPhail
Councillor Kelly Greene
Councillor Alexa Loo
Councillor Michael Wolfe
Mayor Malcolm Brodie

Call to Order: The Chair called the meeting to order at 4:00 p.m.

MINUTES

It was moved and seconded
That the minutes of the meeting of the Public Works and Transportation Committee held on February 21, 2019, be adopted as circulated.

CARRIED

NEXT COMMITTEE MEETING DATE

April 17, 2019, (tentative date) at 4:00 p.m. in the Anderson Room

AGENDA ADDITION

It was moved and seconded
That Pedestrian Safety at Intersections be added to the Agenda as Item No. 1A.

CARRIED

DELEGATION

1A. Julie Halfnights, City Centre resident, spoke to her recent experience as a pedestrian crossing intersections in the City Centre and cited concern with motorists for their lack of awareness of pedestrians. Ms. Halfnights then commented on pedestrian safety practices in Hawaii whereby pedestrians utilize flags to alert drivers of their presence.

Discussion took place on densification in the City Centre and whether Richmond could benefit from different pedestrian crosswalk treatments. Also, it was noted that this matter includes a community safety component and as such, the General Manager, Community Safety should be made aware of these happenings. As a result of the discussion, the following **referral motion** was introduced:

It was moved and seconded
That staff examine pedestrian safety practices at intersections and report back.

CARRIED

COUNCILLOR KELLY GREENE

1. **WARRANT STUDY FOR THE INTERSECTION AT CONSTABLE GATE AND STEVESTON HIGHWAY**
(File Ref. No.)

Councillor Greene cited concern with vehicular and pedestrian safety at Constable Gate and Steveston Highway and remarked that improvements at this intersections would be beneficial.

In reply to queries from Committee, Lloyd Bie, Director, Transportation, advised that this intersection was studied approximately two years ago and the figures collected indicate a low priority in comparison to data gathered for other intersections in the city. Mr. Bie then stated that a second intersection study will likely not result in different findings and therefore he suggested that other solutions such as alternate access be examined in an effort to address safety concerns. Also, Mr. Bie stated that a city-wide study on intersections will be carried out in the upcoming years as part of the Traffic Signal Master Plan.

As a result of the discussion, the following **referral motion** was made:

It was moved and seconded
That staff look at options for the intersection at Constable Gate and Steveston Highway to improve traffic and pedestrian flow coming off Constable Gate.

CARRIED

PLANNING AND DEVELOPMENT DIVISION

2. **TRANSLINK TRANSIT NETWORK REVIEW – FORTHCOMING CONSULTATION**
(File Ref. No. 01-0154-04) (REDMS No. 6125994 v. 3)

In reply to queries from Committee, Donna Chan, Manager, Transportation Planning, advised that (i) staff will liaise with TransLink staff to ensure that all affected stakeholders, including Crestwood business park, are consulted, (ii) the proposed change for Route 416 would result in an additional four-minute walk for commuters, however the Route's frequency will be increased, (iii) staff will liaise with TransLink staff on proposed changes to Route 405 as they relate to service on Viking Way in an effort to ensure that employees in the area continue to be able to get to and from work.

Discussion took place on the proposed consultation and in response to Committee comments, Mr. Bie advised that staff will request that TransLink's public consultation materials be provided in multiple languages.

It was moved and seconded

(1) ***That TransLink's proposed transit network changes, as described in the attached report titled "TransLink Transit Network Review - Forthcoming Consultation" dated February 21, 2019 from the Director, Transportation, be endorsed for the purpose of public consultation; and***

(2) ***That staff be directed to report back on the results of the public consultation and TransLink's final decisions regarding the proposed service changes.***

CARRIED

3. **TRANSLINK 2019 CAPITAL COST-SHARE PROGRAM – SUPPLEMENTAL APPLICATIONS**
(File Ref. No. 01-0154-04) (REDMS No. 6125295 v. 3)

It was moved and seconded
That the submission of transit-related projects for cost-sharing as part of the TransLink 2019 capital cost-share programs as described in the report titled "TransLink 2019 Capital Cost-Share Program – Supplemental Applications" dated February 12, 2019 from the Director, Transportation, be endorsed.

The question on the motion was not called as in reply to a query from Committee, Ms. Chan advised that staff would discuss the matter of timed stops for buses with TransLink in an effort to address sightline concerns at Seaward Gate and Steveston Highway.

The question on the motion was then called and it was **CARRIED**.

4. **TRANSIT CIRCULATION AROUND RICHMOND-BRIGHOUSE STATION**
(File Ref. No. 01-0154-04) (REDMS No. 6112361 v. 4)

It was moved and seconded
That the report titled "Transit Circulation around Richmond-Brighouse Station" dated March 11, 2019 from the Director, Transportation be received for information.

CARRIED

ENGINEERING AND PUBLIC WORKS DIVISION

5. **PROVINCIAL PESTICIDE USE PERMIT RENEWAL APPLICATION**
(File Ref. No. 10-6160-07-01) (REDMS No. 6126419 v. 5; 6131932)

In reply to queries from Committee, Chad Paulin, Manager, Environment, provided the following information:

- the single cordgrass plant was removed by hand by Ducks Unlimited staff;
- if additional plants were found, an assessment would be carried out to determine the best removal option; and
- should the Ministry of Forests, Lands, Natural Resources Operations and Rural Development utilize herbicide to address invasive species, the City would be advised in advance and staff would work with the Ministry's staff.

Discussion took place and it was noted the use of aquatic pesticides is more problematic than the use of other pesticides as such pesticides drift from the application site, which results in far reaching effects of the chemicals used. As a result, it was noted that blanket pesticide applications by the Ministry be discouraged as best as possible.

It was moved and seconded
That the comments regarding a provincial Pesticide Use Permit application to manage invasive cordgrass outlined in the report titled "Provincial Pesticide Use Permit Renewal Application", dated February 12, 2019 from the Director, Engineering, be endorsed for submission to the provincial Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

CARRIED

6. **INVESTING IN CANADA INFRASTRUCTURE PROGRAM – CLEANBC COMMUNITIES FUND**
(File Ref. No. 10-6600-10-01) (REDMS No. 6123192 v. 6)

In reply to queries from Committee, Alen Postolka, Manager, District Energy, advised that (i) the CleanBC Communities Fund is in partnership with the Government of Canada and the Province of BC, (ii) the Oval Village District Energy Utility sewer heat recovery implementation was selected for submission as staff believe this project will be able to meet the timeline for deliverables, (iii) should the City's grant application be unsuccessful, there would be no financial impact as this project is existing and financially planned for, and (iv) the City currently does not generate electric utility, however other utility technologies are regularly reviewed.

Discussion took place on advising local Members of Parliament and Members of the Legislative assembly on the proposed submission. As a result, the following **motion** was introduced:

It was moved and seconded
(1) ***That the submission to the Investing in Canada Infrastructure Program - British Columbia - Green Infrastructure - Climate Change Mitigation - CleanBC Communities Fund requesting funding of up to $6.2 million for the Oval Village DEU Sewer Heat Recovery Implementation project, as outlined in the report titled "Investing in Canada Infrastructure Program - CleanBC Communities Fund" dated February 20, 2019, from the Director, Engineering, be endorsed;***

(2) That the Chief Administrative Officer and General Manager, Engineering and Public Works be authorized to enter into funding agreements with the government for the aforementioned project should it be approved for funding, as outlined in the report titled "Investing in Canada Infrastructure Program - CleanBC Communities Fund" dated February 20, 2019, from the Director, Engineering;

(3) That, upon receipt of the funding for the aforementioned project, the City transfer the full funding amount to Lulu Island Energy Company Ltd., which is wholly owned by the City of Richmond, to deliver the aforementioned project as directed by Lulu Island Energy Company Ltd. Board of Directors; and

(4) That the submission to the Investing in Canada Infrastructure Program - British Columbia - Green Infrastructure - Climate Change Mitigation - CleanBC Communities Fund be copied to Richmond MPs and MLAs.

CARRIED

7. **2019 CLOTHES WASHER REBATE PROGRAM**
(File Ref. No. 10-6060-01) (REDMS No. 6120486 v. 4)

In reply to queries from Committee, John Irving, Director, Engineering, commented on other conservation measures funded through the Toilet and Clothes Washer Rebate program budget, noting that any unspent funds are returned annually.

It was moved and seconded

(1) That the City of Richmond partner with BC Hydro to the end of 2019 to offer a combined rebate of $100 for both spring and fall campaigns, equally cost shared between BC Hydro and the City, for the replacement of inefficient clothes washers with new high efficiency clothes washers; and

(2) That the Chief Administrative Officer and General Manager, Engineering and Public Works, be authorized to execute an agreement with BC Hydro to implement the Clothes Washer Rebate Program.

CARRIED

8. **DIKE MASTER PLAN – PHASES 3 AND 5 REPORT**
(File Ref. No. 10-6060-01) (REDMS No. 6121273 v. 6)

In response to questions from Committee, Eric Sparolin, Senior Project Engineer, and Mr. Irving provided the following information:

- the proposed dike design includes 0.6 freeboard to account for other factors like storms;
- the probability of a high water event with an earthquake is very low;
- managed retreat areas in the Hamilton area will be examined as part of future Capital works in the area;
- properties not within the City's diking system have flood covenants;
- although the City's perimeter dike was identified as a priority in 2008, staff continue to examine a mid-island dike on an opportunistic basis; and
- staff work closely with the City of New Westminster's staff on diking infrastructure that interface between the two cities.

Discussion took place on the technical nature of the Dike Master Plan – Phases 3 and 5 report and staff was requested to provide a user-friendly summary of the City's extensive diking efforts.

In reply to further queries from Committee, Mr. Paulin advised that Environmental Sustainability staff are working on a habitat banking program whereby a habitat compensation component would be included as part of Capital works; he remarked that a report on habitat banking is anticipated to be brought forward for Council consideration in late 2019.

Discussion ensued on work along the dike at the south end of Gilbert Road and Mr. Irving advised that staff would provide information regarding tree replacement and other environmental credits by way of memorandum. Also, staff was requested to provide public notification by way of advertisement in the local newspaper regarding the works being carried out along the dike at the south end of Gilbert Road.

It was moved and seconded
That the "Dike Master Plan - Phase 3 Final Report" and "Dike Master Plan - Phase 5 Final Report" as attached in the staff report titled "Dike Master Plan – Phases 3 and 5 Report," dated February 21, 2019 from the Director, Engineering, be endorsed for the purposes of capital project and development planning.

CARRIED

9. **FLOOD PROTECTION MANAGEMENT STRATEGY 2019 – PUBLIC AND STAKEHOLDER ENGAGEMENT**
(File Ref. No. 10-6060-04-01) (REDMS No. 6123036 v. 9)

It was moved and seconded
That the public and key stakeholders be engaged as identified in the staff report titled "Flood Protection Management Strategy 2019 – Public and Stakeholder Engagement" from the Director, Engineering, dated February 21, 2019.

CARRIED

10. **MANAGER'S REPORT**

(i) South end of West Dike

Larry Ford, Manager, Roads and Construction Services, spoke of upcoming works on the south end of the West Dike, noting that multiple beaver burrows have been found and as a result, staff will be investigating to determine the extent of the damage. Mr. Ford then remarked that the West Dike will remain open during staff's examination of the dike.

(ii) REaDY Summit

Mr. Paulin highlighted that the 2019 REaDY Summit will be held on April 8, 2019 from 8:45 am to 12:30 pm at Steveston-London Secondary School and that this year's theme is Youth Empowerment for a Sustainable Earth.

ADJOURNMENT

It was moved and seconded
That the meeting adjourn (5:06 p.m.).

CARRIED

Certified a true and correct copy of the Minutes of the meeting of the Public Works and Transportation Committee of the Council of the City of Richmond held on Wednesday, March 20, 2019.

Councillor Chak Au
Chair

Hanieh Berg
Legislative Services Coordinator

City of Richmond

Report to Committee

To:	Community Safety Committee	**Date:**	February 19, 2019
From:	Will Ng, Superintendent Officer in Charge, Richmond RCMP Detachment	**File:**	09-5000-01/2019-Vol 01
Re:	**RCMP Monthly Activity Report – January 2019**		

Staff Recommendation

That the report titled "RCMP Monthly Activity Report – January 2019", dated February 19, 2019, from the Officer in Charge, Richmond RCMP Detachment, be received for information.

Will Ng
Superintendent, Officer in Charge
(604-278-1212)

Att. 3

REPORT CONCURRENCE	
CONCURRENCE OF GENERAL MANAGER	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: CJ
APPROVED BY CAO FOR	

6101011

Staff Report

Origin

At the request of the Community Safety Committee, the Officer in Charge will keep Council informed on matters pertaining to policing in the Richmond community. This monthly activity report for the RCMP provides information on each of the following areas:

1. Activities and Noteworthy files
2. Analysis of Police Statistics
3. Crime Trends Across Jurisdictions
4. Auxiliary Program
5. Block Watch
6. Community Police Station Programs
7. Crime Prevention Unit
8. Road Safety Unit
9. Victim Services
10. Youth Section

Analysis

Activities and Noteworthy Files

Injured Pedestrian

On January 8, 2019, Richmond RCMP officers responded to the area of St. Alban's Road and General Currie Road for reports of an injured pedestrian. A 31-year-old woman was transported to hospital suffering life threatening injuries after being struck by a vehicle. The driver of the vehicle remained on scene and was cooperative with police. The Richmond Criminal Crash Investigation Team is investigating the collision.

Suspicious Occurrence

On January 20, 2019, Richmond RCMP Detachment (the Detachment) issued a media release warning the public of individuals going door to door posing as security firm employees. The warning came, after Richmond RCMP was notified of social media posts indicating multiple residents in the Hamilton area had a similar experience. According to the posts, these individuals were asking homeowners questions about their security systems and, in some cases, even attempted to gain access to the residences.

Vehicle Collision

On January 21, 2019, Richmond RCMP officers responded to the area of No. 6 Road and Blundell Road after reports of a single-vehicle collision with a hydro pole. Two occupants were removed from the vehicle and transported to hospital. The driver sustained critical injuries and the passenger had serious, but non-life-threatening injuries. The accident caused power outages throughout the area. The Richmond RCMP Road Safety Unit and Integrated Collision Analysis and Reconstruction Service are investigating.

Robbery

On January 21, 2019, Richmond RCMP officers responded to a residence in the 5000 block of Walton Road for reports of a robbery of a vehicle. The victim was approached by a suspect, who produced a weapon and smashed the vehicle window. The victim sustained non-life threatening injuries and was transported to hospital. The vehicle was located later that morning by the Vancouver Police Department that resulted in the arrest of two suspects. The Richmond RCMP is investigating.

Weapons

On January 23, 2019, Richmond RCMP officers responded to a residence in the 8000 block of No. 2 Road for a domestic disturbance with a weapon. A 29-year-old male suspect surrendered to police after a one hour standoff. An infant that was located in the residence was unharmed. RCMP officers from the Lower Mainland Integrated Police Dog Services secured the area and a neighbouring school was placed on a hold as a precautionary safety measure. The Richmond RCMP is investigating.

Analysis of Police Statistics

In January 2019, important changes were implemented regarding the collection of Uniform Crime Reporting Survey data.[1] As a result of significant media attention in February 2017 regarding sexual assault reporting, the Canadian Centre for Justice Statistics (CCJS) and the Police Information and Statistics Committee of the Canadian Association of Chiefs of Police worked to develop recommendations for changes to police records methodology, with particular attention on classifying founded and unfounded cases. These changes will impact police statistics across Canada will affect all crime types, not only sexual offences. The new standards will provide more stringent criteria to classify a case as unfounded. As a result, there will likely be an increase in many crime statistics and clearance rates will conversely decline. This change creates numerous challenges when conducting comparisons with previous years' data. The information presented in this section must be evaluated within the context of this limitation. Further analysis will be provided throughout the year.

Arson

In January 2019, there were three incidents of arson, which is down one incident from the previous month and up one incident from January 2018. The number of arsons this month is within the five-year statistical average range.

Assault Serious (Assault with a Weapon)

There were 14 assault serious events in January 2019, which is double the number from the previous month. The number of reported serious assaults this month is outside the five-year average range and represents a 56 per cent increase from January 2018. Six of these files were domestic-related. The elevated number of files this month is primarily explained by the new

[1] Statistics Canada, https://www150.statcan.gc.ca/n1/pub/85-002-x/2018001/article/54973-eng.htm

standards for CCJS reporting and/or non-operational reasons. No patterns, trends or files of note have been identified.

Auto Theft

There were 33 auto theft incidents this month, which is an 11 per cent decrease from December 2018 and a 106 per cent increase from January 2018. For the second consecutive month, the number of auto thefts is outside of the five-year average range.

Auto theft numbers were high in the second half of 2018. A number of these thefts continue to be linked with Residential Break and Enters, which has been an active crime type for the last few months.

Drugs

In January 2019 there were 45 drug incidents, which represent a 55 per cent increase from the previous month and a two per cent increase from January 2018. After numerous months of below average numbers of drug offences, correlated to the legalization of cannabis on October 17, 2018, and decline in cannabis-related offences, the number of drug offences this month is within the five-year average range.

Mental Health

There were 190 mental health incidents in January 2019, which represents a 31 per cent increase from December 2018 and a 71 per cent increase from January 2018. The number of mental health incidents is significantly above the five-year average range and the number recorded this month is the highest number since 2012.[2]

It should be noted that 60 of these incidents (approximately 32 per cent) can be attributed to one individual, who has been identified as a high volume client for a number of years. These calls did not require police resources and are linked to the individual's health condition. Further analysis indicates that the number of police apprehensions has remained steady; indicating that the overall police workload for mental health related incidents has not changed even though the number of files has increased. The elevated number of files this month is primarily explained by non-operational reasons. No patterns or trends have been identified.

Residential Break and Enter

There were 104 break and enters to residences in January 2019, which is a three per cent increase from the previous month and a 39 per cent increase from January 2018. The number of residential break and enters this month is above the five-year average range

Richmond RCMP Detachment has deployed additional resources to target property crime. Persons/groups of interest have been identified through criminal analysis, which has resulted in targeted enforcement. This month, the Detachment issued a media release advising that a lengthy

[2] With updated file scoring implemented in 2012

police investigation, including four search warrants, led to 15 property crime charges against a Richmond resident. Over one thousand items were seized including numerous luxury goods.

Commercial Break and Enter

In January 2019, there were 44 break and enters to businesses, which represents a four per cent decrease from December 2018. This number represents a 37 per cent decrease from January 2018, during which a statistically high number of commercial break and enters were reported. Commercial break and enters remain within the expected range.

Robbery

There were 10 robbery incidents in January 2019, which is up three incidents from the previous month and double the number of incidents from January 2018. However, this number remains within the five-year average range.

Sexual Offences

There were 26 sexual offence files in January 2019, which represents a 117 per cent increase from the previous month. The number of sexual offences this month marks an eight per cent increase from January 2018, during which a statistically high number of offences were reported. This month's total is significantly outside the five-year average range.

The elevated number of files this month is linked to the CCJS scoring changes. In addition, this month the Detachment's Serous Crimes section forwarded five files related to the BC Integrated Child Exploitation Unit. The elevated number of files this month is primarily explained by the new standards for CCJS reporting and/or non-operational reasons. No patterns, trends, or files of note have been identified.

Shoplifting

There were 78 shoplifting thefts in January 2019, which is a 70 per cent increase from the previous month and a 26 per cent increase from January 2018. This month, reported shoplifting thefts are outside the five-year expected range.

The increase in reported shoplifting thefts this month can be largely attributed to a two-day project with local Loss Prevention Officers (LPO). Approximately 20 LPOs participated with 17 Richmond RCMP Officers in this annual project, which resulted in 30 arrests this year.[3]

Theft from Auto

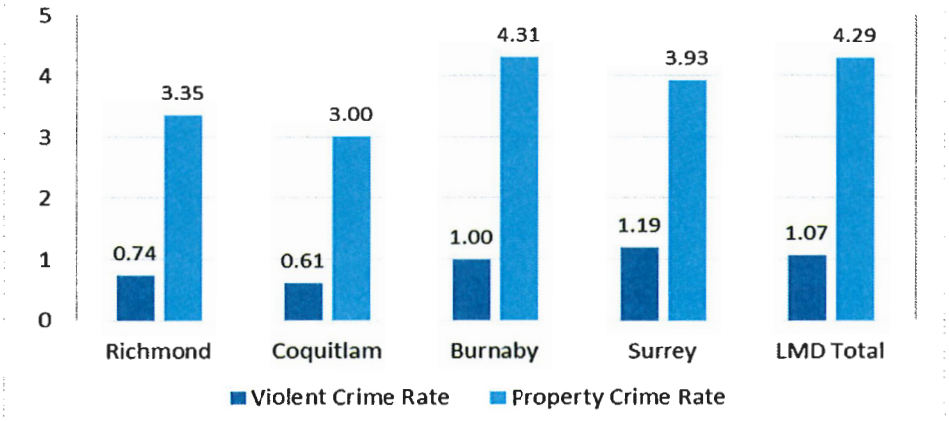
There were 183 theft from auto incidents in January 2019, which represents a five per cent decrease from the previous month. This number marks a 16 per cent decrease from January 2018 and is below the five-year average range.

[3] Participation included RCMP members from the Prolific Offender Suppression Team, Property Crime Unit and General Duty.

Crime Trends Across Jurisdictions

Data on crime rates is presented below (Figure 1).[4] Out of the four largest municipalities policed by the RCMP in the Lower Mainland District (LMD), Richmond has the second lowest violent crime rate. Richmond has also maintained the second lowest property crime rate. These low numbers can be attributed to the quick identification of targets and resulting enforcement, in addition to successful collaboration with partner agencies for multi-jurisdictional offenders.

Figure 1: January 2019 Crime Rates



Auxiliary Program

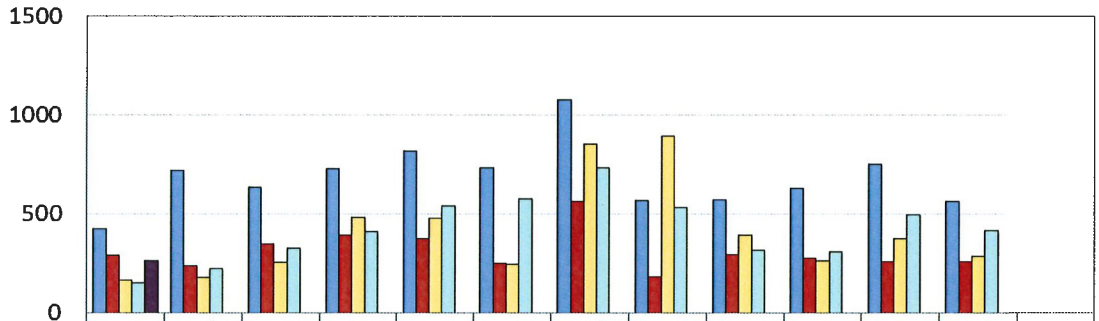
In January 2019, Richmond Detachment had a complement of 37 Auxiliaries.[5] Auxiliaries provided a total of 262 volunteer hours during the month of January.

In the coming months, the Province of BC and RCMP "E" Division are expected to announce the training standards for the Tier 3 Auxiliary program.[6] Once these details are known, the Detachment will commence recruitment of a new troop of Auxiliaries. The RCMP recently announced that for the immediate future there will be no changes to the current Auxiliary uniform.

[4] Crime rate is calculated per 1,000 people (using 2019 population projections)
[5] Previously referred to as Auxiliary Constables.
[6] http://www.rcmp-grc.gc.ca/en/auxiliary-program-tiers

Figure 2 compares the monthly hours of service provided by month from 2014 to 2018.

Figure 2: Auxiliary Constable Volunteer Hours



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2015	426	719	635	727	819	730	1074	565	570	630	750	562	8207
2016	290	238	348	392	374	248	565	184	297	276	259	259	3730
2017	167	180	255	483	477	248	854	892	395	262	376	284	4870
2018	150	223	324	411	539	578	733	529	317	310	494	417	5025
2019	262												262

Auxiliary Program Activities

Auxiliaries attend events in the community to promote a positive police presence, support RCMP members and provide traffic and crowd control. During the month of January, Auxiliaries participated in:

- Bait Car Deployments
- Break and Enter Outreach
- Crime Watch
- Home Security Checks
- Positive Ticket Program
- School Sports Events

Block Watch

At the end of January 2019, the Block Watch program had 456 groups totaling 10,202 participants. Currently, the program includes 553 captains and co-captains.[7]

Community Police Station Programs

Community police stations continue to enhance the Detachment's policing services by providing an array of crime prevention resources and community safety initiatives. City staff and volunteers pursue safety initiatives to enhance crime prevention program awareness, community engagement and police accessibility. These initiatives help to reduce anxiety and fear related to crime. The program activities vary from month to month reflective of weather conditions, seasonal initiatives, events and the availability of volunteers.

[7] The variance from previous months' data is due to an ongoing database upgrade. Revised numbers will continue to reflect more accurate participation data.

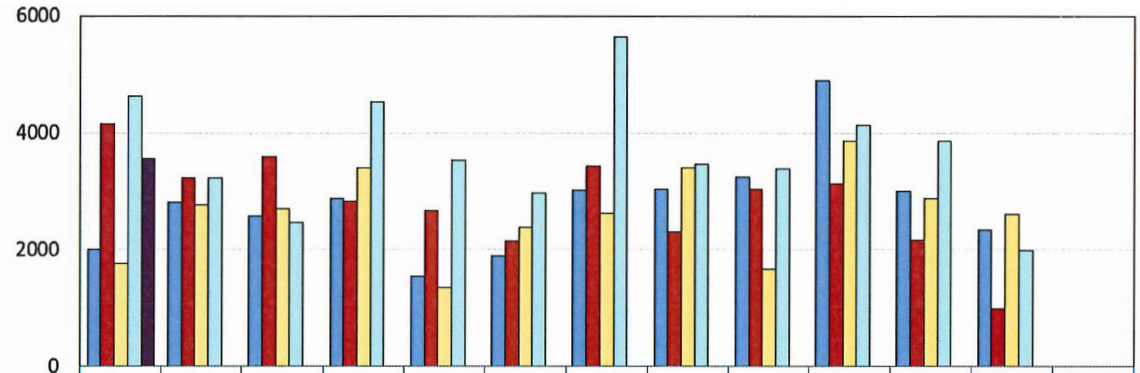
During the month of January volunteer highlights included:

- The deployment of 33 foot/van patrols totalling 226 hours.
- 41 Fail to Stop deployments took place, which resulted in 1,783 warning letters.
- Speed Watch was conducted on 2,954 vehicles at various locations.
- January 7 – Four volunteers participated in community outreach in residential break and enter hot spot areas. Accompanied by an RCMP member, the volunteers visited 75 homes in a strategically identified area.
- January 17 – Six volunteers participated in community outreach in residential break and enter hot spot areas. Accompanied by an RCMP member, the volunteers interacted with 25 residents and distributed a number of crime prevention brochures.
- January 19 – While conducting a Crime Watch Deployment, volunteers recovered a stolen vehicle.
- January 19 – While conducting a Crime Watch Deployment, volunteers observed a suspected impaired driver and reported it to police.
- January 21 – Six volunteers participated in community outreach in residential break and enter hot spot areas. Accompanied by an RCMP member, the volunteers 74 residences in a strategically identified area.
- January 25 – Two volunteers located a stolen vehicle while conducting van patrol using the Stolen Auto Recovery program.
- January 31 – Eight volunteers participated in a School Sports event at James Whiteside Elementary School.

Lock-Out Auto Crime

Figure 3 provides a comparison by year of the number of vehicle notices issued.

Figure 3: Lock Out Auto Crime Vehicles Issued a Notice

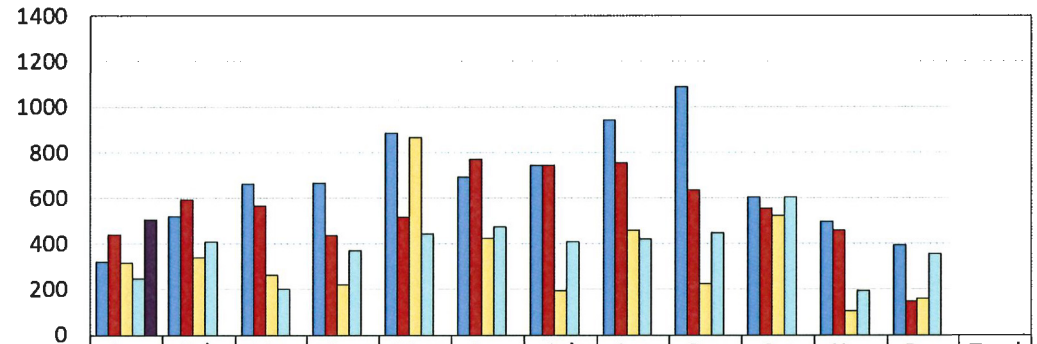


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2015	2007	2814	2571	2881	1537	1893	3029	3045	3249	4900	3007	2337	33270
2016	4156	3236	3594	2838	2677	2153	3440	2314	3035	3128	2168	996	33735
2017	1771	2771	2705	3407	1351	2382	2631	3397	1679	3872	2881	2613	31460
2018	4625	3228	2466	4538	3538	2978	5654	3466	3393	4133	3870	1991	43880
2019	3569												3569

Speed Watch

Figure 4 provides a yearly comparison of the number of letters sent to registered vehicle owners.

Figure 4: Speed Watch Letters Sent



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2015	319	519	663	666	882	693	741	942	1086	603	497	392	8003
2016	438	591	565	435	515	770	742	753	636	554	457	149	6605
2017	315	341	262	220	866	424	193	459	225	523	107	161	4096
2018	249	409	200	370	444	473	409	420	446	604	193	354	4571
2019	506												506

Crime Prevention Unit

The Crime Prevention Unit reduces crime and enhances community engagement through public awareness and dialogue initiatives. During the month of January, the Crime Prevention Unit participated in the following events/activities:

- Break and Enter Outreach
- Broadmoor Patrols
- Crime Prevention through Environmental Design
- Hot Spot Patrols
- School Sports Events
- Vulnerable Institution Patrols

Road Safety Unit

The Road Safety Unit makes Richmond's roads safer through evidence-based traffic enforcement, investigation of serious vehicle collisions and public education programs. The following statistics compare January 2019 data to both November 2018 and December 2018.

Violation Tickets were issued for the following infractions:

Table 1: Violation Tickets Issued

Infraction	November 2018	December 2018	January 2019
Distracted Driving	53	38	116
Driver License	205	234	232
Impaired	38	38	23
Intersection offences	116	98	98
Moving Violations[8]	151	222	245
Speeding	264	235	379
Seatbelts	8	17	9
Vehicle Related[9]	57	89	63
Other[10]	9	22	12
Total	**901**	**993**	**1,177**

Victim Services

In January 2019, Richmond RCMP Victim Services attended to 66 new clients and attended nine crime/trauma scenes after hours. The unit currently maintains an active caseload of 151 ongoing files. Victim Services responded to a number of cases involving property crime, motor vehicle accidents, suicide deaths and family conflict.

Youth Section

The Detachment's Youth Section focuses on strategies that contribute to safe and healthy behaviours essential to the development of productive and civic-minded adults. During the month of January, Youth Section highlights include:

- This month, members from the Youth Section participated in a lockdown drill at McRoberts Secondary School.
- RCMP members from the Youth Section presented an Internet Safety Talk at Palmer Secondary School. They discussed the benefits and dangers associated to various electronic devices and social media platforms, cyber bullying and criminal offences related to the internet. Presenters cautioned students regarding posting too much personal information online and demonstrated how to use the platforms and devices safely.

Financial Impact

None.

[8] Moving violations refers to unsafe lane change and unsafe passing.
[9] Vehicle related refers to vehicle defects, for example no lights and no insurance.
[10] Other refers to miscellaneous charges including fail to remain at the scene of an accident and failing to stop for police.

Conclusion

The Officer in Charge, Richmond RCMP Detachment continues to ensure Richmond remains a safe and desirable community.

Edward Warzel
Manager, RCMP Administration
(604-207-4767)

Att. 1: Community Policing Programs
2: Crime Statistics
3: Crime Maps

Auxiliary Constables

- The primary mandate of Richmond's Auxiliary Constables is to support community policing activities related to public safety and crime prevention.
- For more information, visit www.richmond.ca/safety/police/prevention/auxiliary.htm

Block Watch

- Community-based crime prevention program aimed at helping neighbors organize themselves to prevent crime.
- Residents can receive email alerts of neighbourhood residential break and enters by registering their email addresses at: blockwatch@richmond.ca
- For more information, visit www.richmond.ca/safety/police/prevention/blockwatch.htm

Difference Maker Project

- The Difference Maker Project is an off-shoot of the School Sports Programs. Elementary school students are mentored by teachers, police officers and community ambassadors. This activity aims to encourage social and civic responsibility amongst elementary and secondary school aged youth through community projects.

Distracted Driving Program

- Trained volunteers monitor intersections and observe distracted drivers.
- A letter is sent to the registered owner of the offending vehicle with information on the safety risks associated to the observed behaviour and applicable fine amounts.
- For more information, visit www.richmond.ca/safety/police/prevention/programs.htm

Fail to Stop

- Trained volunteers monitor areas that have been referred to the program by local businesses or residents where drivers are not making a full stop at the stop sign, or running a red light.
- An information letter is sent to the registered owner of the vehicle advising them the date, time and location and applicable fine amounts if the driver received a violation ticket.

Lock Out Auto Crime

- Co-sponsored by the Insurance Corporation of BC (ICBC), volunteers patrol city streets and parking lots looking for automobile security vulnerabilities.
- Notices supplied by ICBC are issued to every vehicle inspected indicating to the owner what issues need to be addressed in order to keep the vehicle and contents secure.
- For more information, visit
- www.richmond.ca/safety/police/personal/vehicle.htm

Project 529

- This program allows riders to easily and securely register their bikes. This up-to-date database of bikes alerts its registrants if a fellow 529 bike is stolen.
- Project 529 is a unique, multi-national registry that holds a database of all registered and stolen bikes.

Speed Watch

- Co-sponsored by ICBC, promotes safe driving habits by alerting drivers of their speed.
- Trained volunteers are equipped with radar and a speed watch reader board that gives drivers instant feedback regarding their speed.
- Volunteers record the license plate number and the speed, and a letter is sent to the registered owner of the offending vehicle. The letter includes the date, time and location and applicable fine amounts if the driver received a violation ticket.

Stolen Auto Recovery

- Co-sponsored by ICBC, trained volunteers equipped with portable computers identify stolen vehicles.
- These volunteers recover hundreds of stolen vehicles each year throughout the Lower Mainland.

Volunteer Bike and Foot Patrol Program

- Trained volunteers patrol Richmond neighbourhoods reporting suspicious activities and providing a visible deterrent to crime and public order issues.

JANUARY 2019 STATISTICS
RICHMOND RCMP

This chart identifies the monthly totals for founded Criminal Code incidents, excluding traffic-related Criminal Code incidents. Based on Uniform Crime Reporting (UCR) scoring, there are three categories: (1) Violent Crime, (2) Property Crime, and (3) Other Criminal Code. Within each category, particular offence types are highlighted in this chart. In addition, monthly totals for Controlled Drugs and Substances Act (CDSA) incidents and MHA-related calls for service are included. Individual UCR codes are indicated below the specific crime type.

For 2019, CCJS scoring standards have been modified. Previously, unsubstantiated files were not captured in this data, but effective 2019-01-01, this CCJS category has been collapsed. 2019 files of this variety are now considered as founded. For more information, contact Richmond Crime Analysts.

The Average Range data is based on activity in a single month over the past 5 years. If the current monthly total for an offence is above the expected average range (using a standard deviation), it will be noted in red, while below expected numbers will be noted in blue.
Year-to-Date percentage increases of more than 10% are marked in red, while decreases of more than 10% are blue.

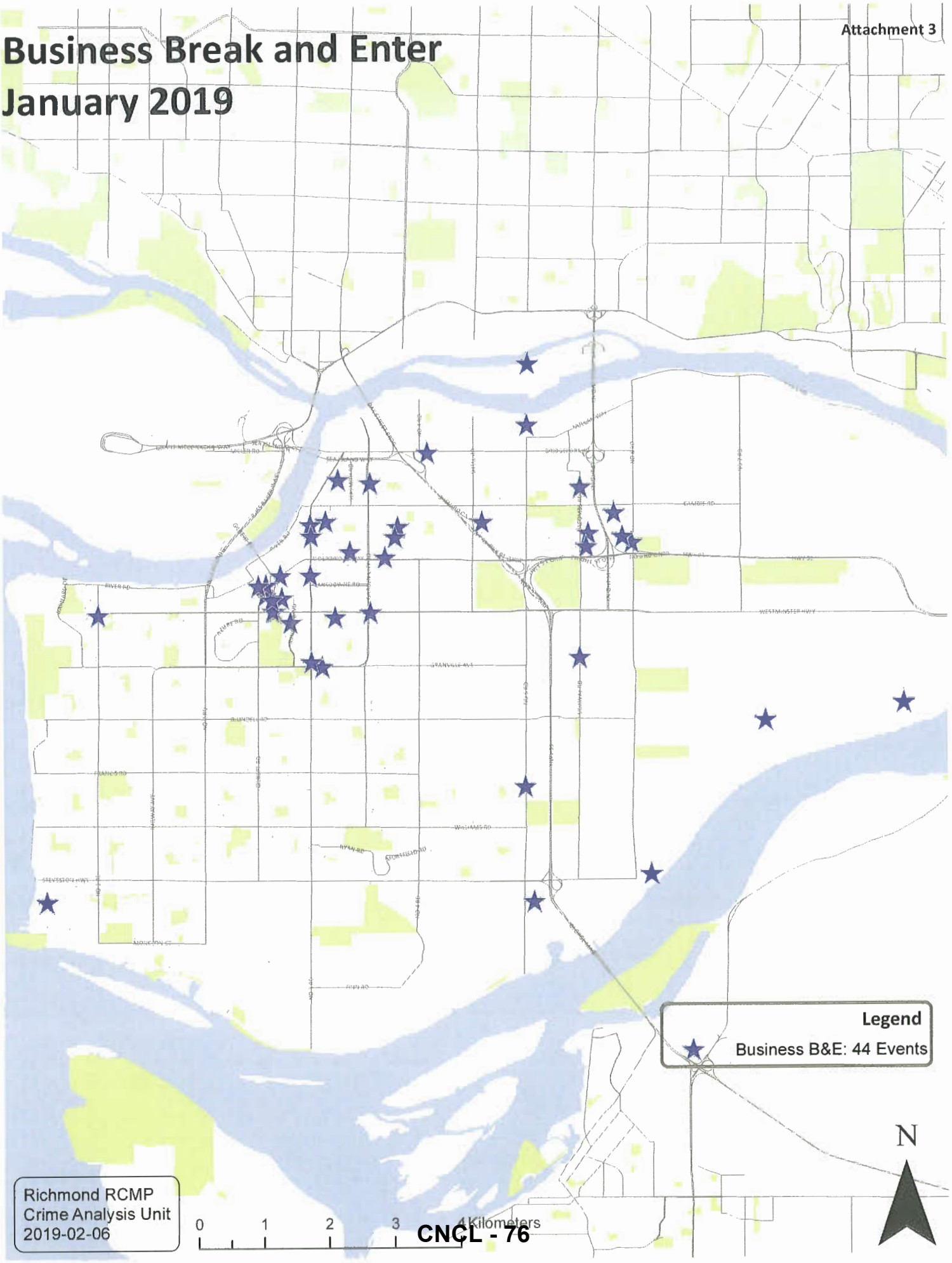
	Month	5-Yr Avg	5-Yr Range	Year to Date Totals			
	Jan-19	*January*		*2018*	*2019*	*% Change*	*# Change*
VIOLENT CRIME (UCR 1000-Series Offences)	**160**	**102.0**	**92-112**	**107**	**160**	**50%**	**53**
Robbery UCR 1610 (1-3)	10	8.2	5-11	5	10	100%	5
Assault Common UCR 1430	**50**	40.0	35-45	42	50	19%	8
Assault Serious UCR 1410, 1420	**14**	10.0	9-11	9	14	56%	5
Sexual Offences UCR 1150, 1160, 1310	**26**	9.4	2-17	24	26	8%	2
PROPERTY CRIME (UCR 2000-Series Offences)	**757**	**707.8**	**677-739**	**676**	**757**	**12%**	**81**
Business B&E UCR 2120-1	44	42.6	28-57	70	44	-37%	-26
Residential B&E UCR 2120-2	**104**	83.6	69-98	75	104	39%	29
Auto Theft UCR 2135 (1-10), 2178	**33**	23.8	18-30	16	33	106%	17
Theft from Auto UCR 2132, 2142	183	220.4	183-258	217	183	-16%	-34
Theft UCR 2130, 2140	115	113.6	91-136	99	115	16%	16
Shoplifting UCR 2133, 2143	**78**	57.0	49-65	62	78	26%	16
Fraud UCR 2160 (1-10), 2170, 2180	76	67.6	54-82	62	76	23%	14
OTHER CRIMINAL CODE (UCR 3000-Series Offences)	**160**	**173.6**	**168-179**	**171**	**160**	**-6%**	**-11**
Arson UCR 1620, 2110	3	2.8	2-4	2	3	50%	1
SUBTOTAL CC OFFENCES (UCR 1000 to 3000 Series)	**1077**	**983.4**	**950-1017**	**954**	**1077**	**13%**	**123**
DRUGS (UCR 4000-Series Offences)	**45**	**47.6**	**39-56**	**44**	**45**	**2%**	**1**
MHA RELATED CALLS (MHA files or Mental Health flag)	**190**	**108.8**	**99-119**	**111**	**190**	**71%**	**79**

Prepared by Richmond RCMP Crime Analysts. Data collected from PRIME on 2019-02-06. Published 2019-02-06.

These data are operational and subject to change. This document is not to be copied, reproduced, used in whole or part or disseminated to any other person or agency without the consent of the originator(s).

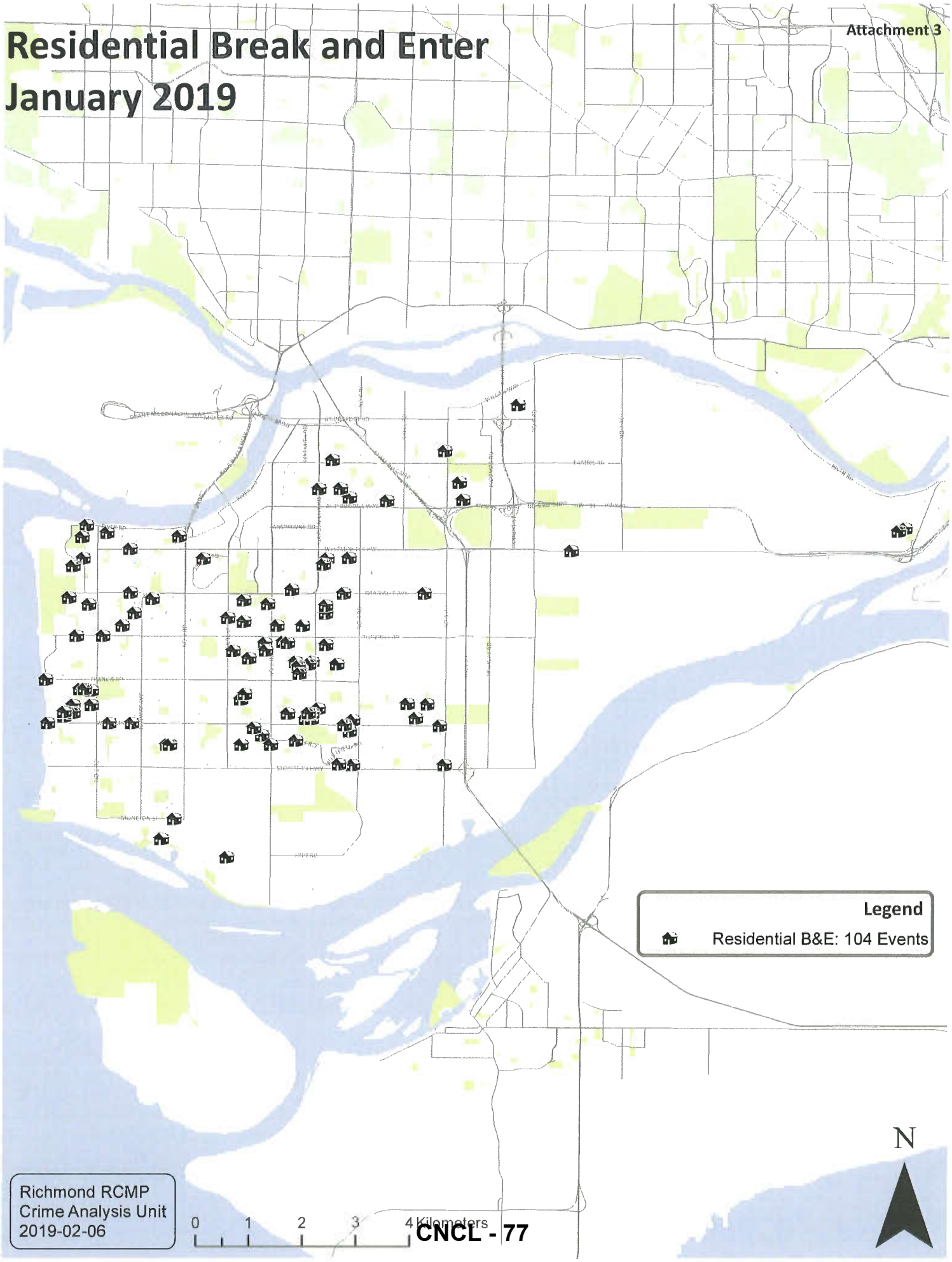
Attachment 3

Business Break and Enter
January 2019

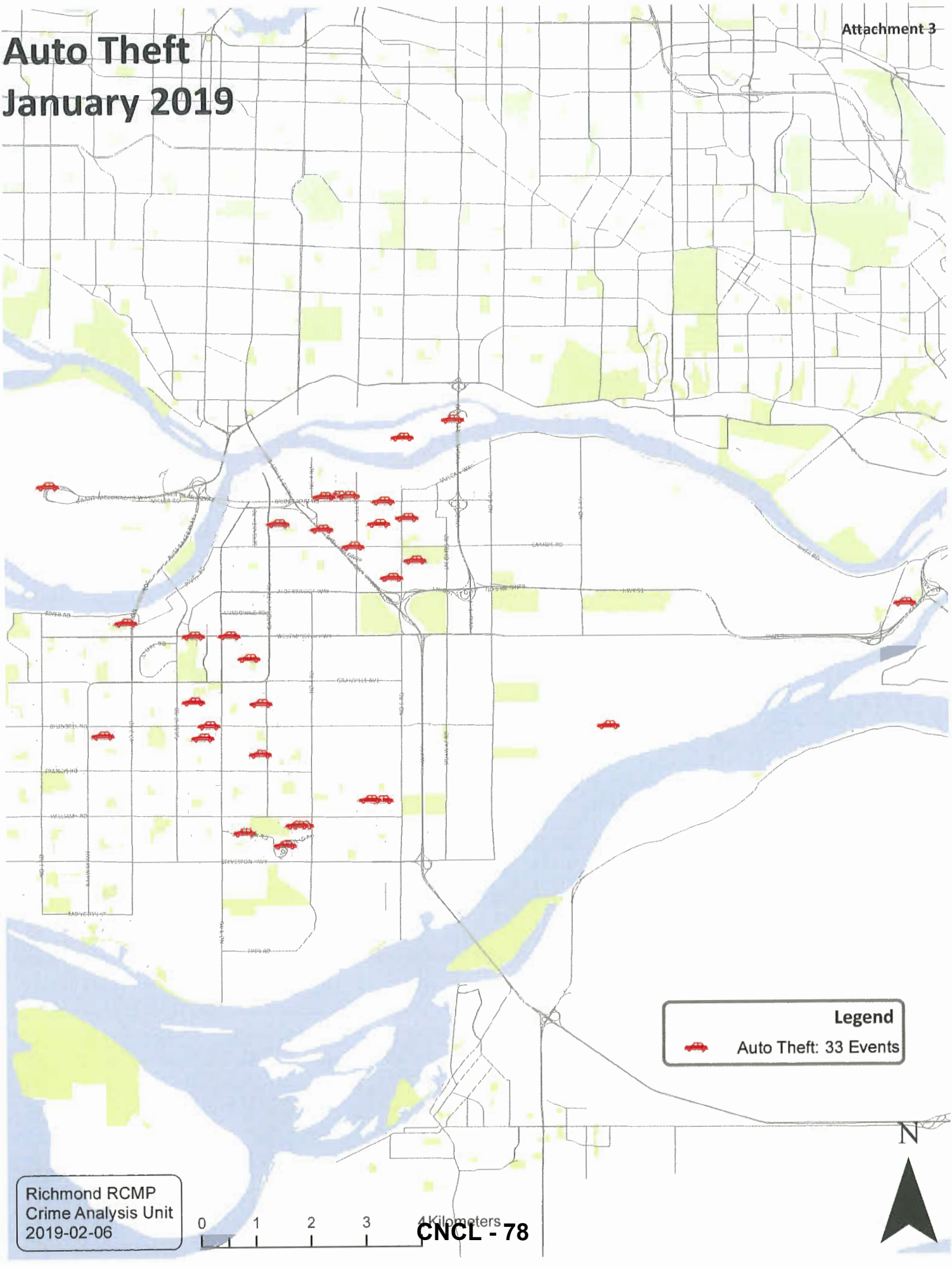


Residential Break and Enter
January 2019

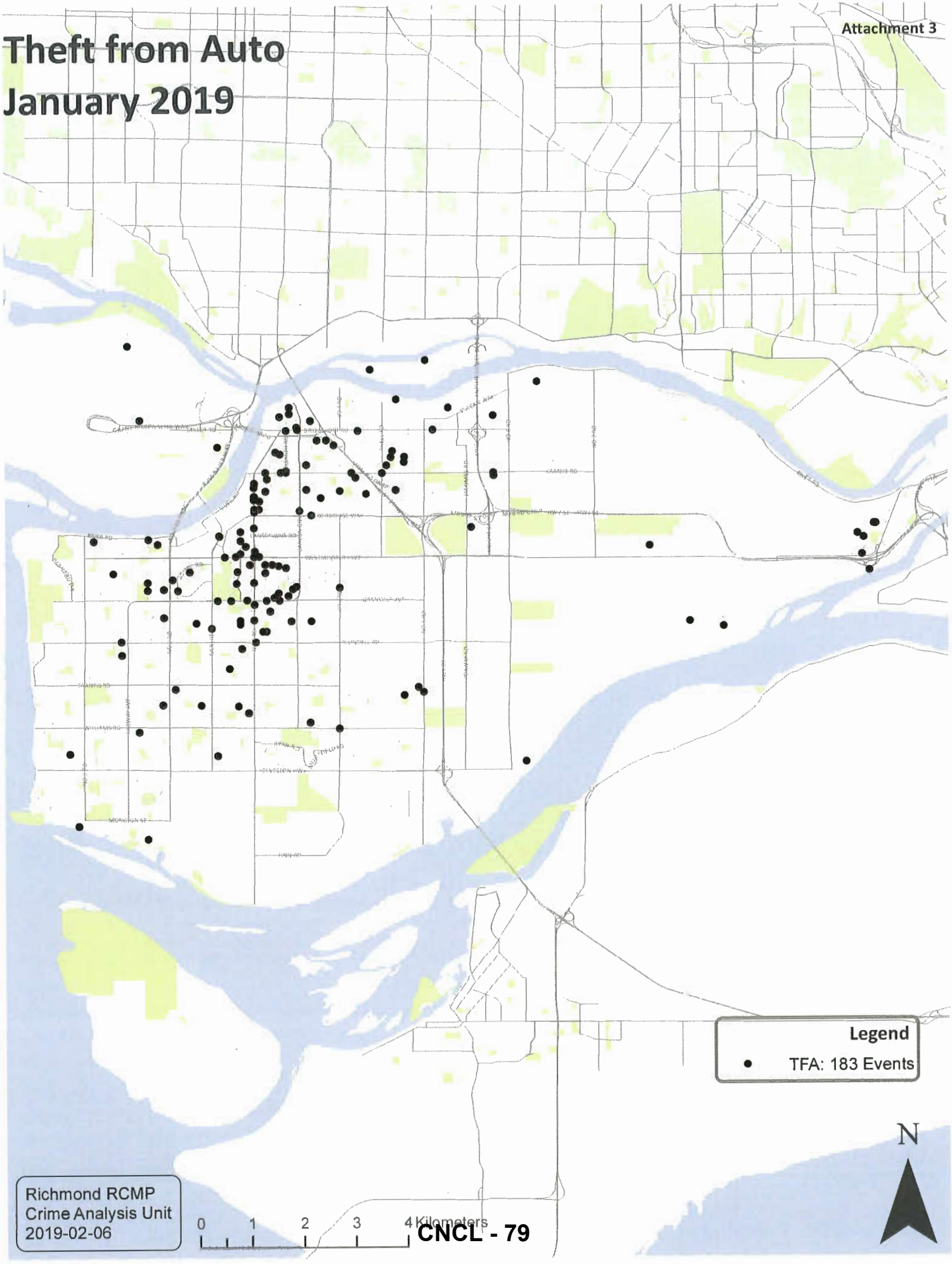
Attachment 3



Auto Theft
January 2019



Theft from Auto
January 2019



From: Greene,Kelly
Sent: Thursday, 14 March 2019 12:02 PM
To: Weber,David
Subject: Text for agenda item

Columbia Institute Civic Governance Forum Higher Ground: Rising to the Challenge March 29-30 at Harrison Hot Springs Resort
$475 plus $10 pre-forum Women in Leadership dialogue Accommodation approximately $210 Meals are included except lunch on Friday March 29 Lunch per diem is $19.85
280 km round trip $162.40
Incidentals per diem (2 days)(17.30/day) = $34.60 Total forum cost: $911.85 Speakers List:
https://www.civicgovernance.ca/wordpress/wp-content/uploads/2019/03/
Speaker-spotlight_working-doc_3-11-2019.pdf
Program: https://www.civicgovernance.ca/wordpress/wp-content/uploads/2019/03/2019-At-a- Glance-03-11-195943.pdf
Registration: https://events.eply.com/2019HighGroundRisingtotheChallenge2754606

Kelly Greene
Richmond City Councillor

(604) 276-4134
6911 No. 3 Road
Richmond, BC
V6Y 2C1

HIGH GROUND 2019: PROGRAM AT A GLANCE

Friday, March 29				
10:00– 11:30 am	Pre-Conference Workshop: Women in Leadership Dialogue (Please pre-register)			
1:00 – 1:40 pm	Welcome Stratcom's BC public opinion poll results			
1:40 – 3:00 pm	Homes for BC; A Year in Review Opening with Selina Robinson, Minister of Municipal Affairs and Housing			
3:15 – 4:30 pm	**Breakout Workshops I**			
	Reducing Poverty and Income Inequality in BC	Child Care: Next Steps in BC	BC's natural disasters and climate change adaptation	Changing landscape of digital communications: how to use research and technology to increase citizen engagement
4:45 – 6:00 pm	**Breakout Workshops II**			
	Moving our Communities with Public Transport	Today's Classroom: Equity in Action	Katowice talks and how municipalities are ramping up climate action	So You're Elected, Now What? Building Roots in the Community
6:30 pm	Reception			
7:15 pm	Dinner begins with Katrina Chen, Minister of State for Child Care			
8:10 pm	Dinner continues with Pecha Kucha			
Saturday, March 30				
7:00 am	Breakfast buffet opens			
8:30 – 9:10 am	Mobilizing Popular Support for Public Education: The People for Education Story			
9:15 – 10:30 am	**Breakout Workshops III**			
	The Opioid Crisis: What You Need to Know	Popular Priorities for K-12 Renewal: Insights from Ontario	Jobs for Tomorrow and Net Zero Emissions	Communicating with Staff as a Newly Elected
10:55 am – 12:00 pm	Plenary: Emerging Issues			
12:00 – 1:00 pm	Lunch with Minister Shane Simpson, Minister of Social Development and Poverty Reduction			
1:15 – 2:30 pm	**Breakout Workshops IV**			
	Reconciliation: Making It Tangible	Indigenous Education	Food Security	Budgeting 101
2:45 – 3:30 pm	Closing Plenary with Lana Popham, Minister of Agriculture			

Subject to Change: As of March 11, 2019

FEATURED SPEAKERS



SELINA ROBINSON was elected as the MLA for Coquitlam-Maillardville in 2013 and re-elected in 2017. She is the Minister of Municipal Affairs and Housing. Selina served as the Official Opposition spokesperson for mental health and addictions, seniors, local government and sports. As a former city councillor, Selina advocated for the rights of taxpayers, fought to protect the health of children and families by introducing a local ban on cosmetic pesticides, and worked to improve access for people with disabilities as chair of the Coquitlam Universal Access-Ability Advisory Committee.



SHANE SIMPSON was first elected MLA for Vancouver Hastings in May 2005. He is the Minister of Social Development and Poverty Reduction. Shane has worked as the Director of Policy and Communications for Smart Growth BC, chair of the Vancouver City Planning Commission, an instructor in the Community Economic Development program at Simon Fraser University, Executive Director of the Worker Ownership Resource Center, Legislative Coordinator for the Canadian Union of Public Employees, coordinator and fundraiser for the Ray Cam Cooperative Center, Executive Assistant to former Vancouver East MP Margaret Mitchell, and as a self-employed consultant on business and economic development for labour, co-operative and non-profit groups.



LANA POPHAM was elected MLA for Saanich South in 2009. She is the Minister of Agriculture. She served as the Official Opposition spokesperson for Small Business and Agriculture & Food, and as the Official Opposition spokesperson for Tourism and for Arts & Culture. Lana was raised on Quadra Island in a do-it-yourself community, where growing food, raising animals and harvesting from the sea was a way of life. Lana entered politics to improve the quality of life in Saanich, promote sustainable agriculture and strengthen the provincial response to climate change.



KATRINA CHEN was elected as the MLA for Burnaby-Lougheed in May 2017. She is the Minister of State for Child Care. She has served as a Trustee on the Burnaby Board of Education, and worked in both provincial and federal government constituency offices for over 10 years. Katrina has a Bachelor of Arts Degree with a political science major and a history minor from Simon Fraser University, and also earned a certificate in Immigration Laws, Policies and Procedures from the University of British Columbia. She has also worked as a community organizer with ACORN, emceed for major cultural festivals, and volunteered as an executive member for several local non-profit organizations for many years.



ANNIE KIDDER is the Executive Director and a founder of People for Education. She regularly provides advice to policy-makers and government, and her writing on education has been published in a range of media. She is the recipient of numerous awards, including the Ontario Principals' Council 2004 *Outstanding Contribution to Education Award*, the Canadian Teachers' Federation 2005 *Public Education Advocacy Award*, and in 2018, an honourary doctorate from York University. She has spoken at conferences in Canada, the United States, Europe, Africa and South America. @PeopleforEd

SPEAKERS



CATHERINE ABREU is the Executive Director of Climate Action Network - Réseau action climat (CAN-Rac) Canada. CAN-Rac is a coalition of 115 organizations operating from coast to coast to coast. For 30 years, it has been Canada's only national network dedicated to climate change and energy issues. Catherine is one of Canada's foremost climate campaigners, with over 15 years of experience campaigning on environmental issues including 7 years in the heart of the Canadian climate movement. @cat_abreu



CAROLA ALDER is an urban planner and marketing guru. At 14 she transformed the mobile juice business in Victoria with Juice on the Goose. In her early 20's she was designing jewelry for Lady Gaga and other A-list celebs under her own brand, Bun. Now a partner in CityState Consulting Group, Carola helps clients through complex rezoning processes and presenting their projects to Councils throughout the lower mainland. As a member of the Tri-Cities Chamber of Commerce Economic Development Committee, she is committed to building better communities; a vision only possible when we rise to the challenge!



ANITA ANSARI is a working mother, a professional engineer, and the newly-elected Vice-Chair for School District 40, in New Westminster. She also serves as the co-chair of New Westminster's oldest non-profit day care society, and as an administrator for the over 3,000-member strong New West Mom's Group on Facebook. She is passionate about increasing equity and access in all her roles, and believes that empowering diverse perspectives produces innovative solutions and progress in our communities. @newwestanita



THOM ARMSTRONG has more than 30 years of experience in the co-operative housing movement, holding leadership positions in Saskatchewan, Ontario and BC. He is currently the executive director of the Co-operative Housing Federation of BC (CHF BC), COHO Management Services Society, and the Community Land Trust Foundation, all headquartered in Vancouver, BC. He also chairs the board of Encasa Financial Inc., a Canadian social purpose mutual fund company owned by the community housing sector. CHF BC is the voice of the co-operative housing sector in BC, with the vision to play a leadership role in growing a community of permanently affordable co-operative housing in British Columbia.



RHIANNON BENNETT is a much-sought-after speaker and is well known for asking tough questions in a manner that encourages engagement and dialogue. In 2014, she was the first Indigenous person elected to the Delta Board of Education. While not successfully re-elected, she was inspired to find other ways to continue to do the important work. Hummingbirds Rising vision is to work towards creating a society that understands the violence of colonization and its other impacts and are actively reconciling and working towards decolonization. @salishRhiannon @hummingbirdsRA



GEORGE BENSON is the Green Building Market Acceleration Consultant for the Vancouver Economic Commission, the economic development agency of the City of Vancouver. He works to support BC manufacturers of green building products to meet future local demand and assist them with global trade opportunities. George has sat on the provincial planning association's Climate Action Task Force, the Canadian and American planning associations' national executives, and is Co-Founder of a youth-led nonprofit, the Climate Migrants and Refugees Project. @georgeprbenson



DR SCOTT BENWELL has more than twenty years of experience in educational leadership ranging from Vice-Principal to Superintendent of Schools/CEO. He has served students, families, and communities in British Columbia, Yukon, and Alberta. Currently he is both Superintendent of Schools/CEO for SD64 (Gulf Islands) and Field Liaison with the B.C. Ministry of Education. Scott earned a PhD in Educational Leadership from the University of Calgary in 2005 and continues to have research interests in school effectiveness and improvement, responsive learning environments and leadership that makes a difference and creates equity of opportunity for each learner. @sbenwell1



ELVEZIO DEL BIANCO (ELVY), Vancity Credit Union's Cooperative Portfolio Manager, works internally on disseminating knowledge of the cooperative business model to increase Vancity's capacity to support co-ops, and externally on building partnerships and developing projects with cooperatives and others to help realize a stronger cooperative economy. This work is largely informed by the activities of the Italy's Emilia-Romagna region, the world's most significant cooperative economy and the focus of Vancity's Cooperative Study Tour, which Elvy has organized since 2008. Elvy is the founder and organizer of Cooperate Now, a co-op business model education program and a board director of the Foodlands Cooperative of British Columbia.



RICHARD BOASE has worked in environmental geoscience and urban watersheds for over 25 years delivering programs ranging from bylaw enforcement to pollution prevention. He currently supervises the administration of the District's Natural Hazards Management and Risk Tolerance program involving new development and is assisting with the implementation of the Climate Change Adaptation Plan. Currently Vice President of the Partnership for Water Sustainability in BC, a non-profit society working on innovative tools and the promotion of leadership towards BC's water sustainability action plan.



CHRISTINE BOYLE is a newly elected Councillor with OneCity Vancouver. She is a community organizer, a climate justice activist, and an ordained United Church Minister. She previously did national climate justice organizing among diverse faith communities, including at COP21 and at the Vatican. She also led Strategic Communications at the Columbia Institute. She has a teenager and a preschooler. @christineeboyle



KALEB CHILD, Musgamdzi is a member of the Kwakiutl (Kwagiulth) First Nation and is currently the Provincial Director of Indigenous Education at the Ministry of Education. His education and professional experience has been connected closely to First Nations communities throughout his career as a teacher, director and educational leader. In his role across communities he works to enhance and support leadership development committed to equitable learning environments, an Indigenous vision for pedagogy, authentic Aboriginal learning connections for all learners, language and culture revitalization, and strengthening meaningful relationships across communities. @kalebchild



TERESA DOWNS is the Superintendent of Schools for the Gold Trail School District. Teresa completed her practicum in Gold Trail and has stayed in the district since that time. She has been a classroom teacher, Learner Support Teacher, Principal, Director of Instruction and now Superintendent. She is dedicated to the students and families of Gold Trail and to improving the quality of the educational experience for each student with a focus on Indigenous learners for whom the system has disadvantaged.



SHARMARKE DUBOW only recently gained Canadian citizenship in July, 2017. He arrived in Canada in 2012 after fleeing civil war in Somalia at the age of 8. He was a refugee for 20 years until he got resettled to Canada. Sharmarke cast his first vote in October 20, 2018, and at the same time was elected as a Victoria City Councillor. Sharmarke's passion and commitment to diversity, inclusion, equity and his work for immigrants and refugees at the local and national level has earned him a reputation as a respected community leader and voice for human rights. @deardubow



MEGAN DYKEMAN is the Managing Director of Strategics Canada, a firm which specializes in board governance and strategic planning; project management; marketing; and public relations. She is also Chair of the Langley Board of Education and founder of a specialty poultry farm in Langley. She is a Farm Business Management graduate from U. Sask and holds a BPA in Governance Law and Management and a Masters of International Relations focused on the effects of International Trade Agreements on Food Security. @megandykeman



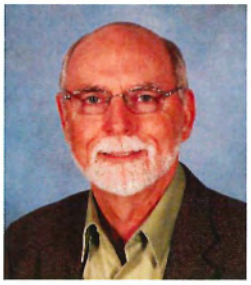
PAUL FINCH was elected Executive Vice President of the BCGEU in 2011 and Treasurer in 2014. The BCGEU is the most diverse labour union in BC, representing over 78,000 members at 550 different employers and government ministries. As Treasurer, Paul works closely with the President of the BCGEU and serves as the Union's Chief Financial and Administrative Officer. In his role he has closely overseen the move to ethical investing, technological innovation, communications modernization, constitutional and structural changes and policy development. Paul has written on land economics since 2014, and in 2017 co-authored the Affordable BC plan with members of CUPE 1767 and BCGEU staff.



SHARON GREGSON is the provincial spokesperson for the successful $10aDay Child Care campaign in British Columbia, building a public system of quality affordable child care. She works with the Coalition of Child Care Advocates of BC and travels extensively speaking with local governments, school boards, community, labour and business about current child care chaos and the solution - the $10aDay Plan.She was twice elected as a Trustee to the Vancouver Board of Education and is well-known to be a feminist and relentless advocate, skilled in campaign strategy and campaigning, government and stakeholder relations.



LYN HALL has been an active member of the Prince George community for over 30 years. He first entered local politics in 2001 when he won a seat as a School Trustee on the Prince George School Board. He spent 10 years on the board holding various positions including vice-chair and chair. In 2011, he ran and successfully won a seat on Prince George City Council. As a Councillor, he was a member of several committees and community groups. In 2014 and 2018 he ran successful campaigns for Mayor of Prince George. @ Lynhallpg



DOUG HILLIAN is a four-time Courtenay councillor and Regional District Director. A community volunteer and activist throughout his life, Doug recently retired from human services management after a long career on the front lines of social work and the justice system. He finds balance playing soccer, singing in a community choir and hiking in the mountains. Doug's presentation considers the challenges municipalities face grappling with homeless campsites, an ongoing manifestation of the housing crisis that continues to afflict our communities.



IGLIKA IVANOVA is a feminist economist who researches and writes on key social and economic challenges facing BC and Canada, including poverty, economic insecurity and labour market shifts toward more precarious work. Iglika also investigates issues of government finance, tax policy and privatization and how they relate to the accessibility and quality of public services. She is particularly interested in the potential for public policy to build a more just, inclusive and sustainable economy. @IglikaIvanova



KHELSILEM is serving his first four-year term as an elected Councillor & Spokesperson for the Squamish Nation Council based in North Vancouver, BC. He serves on numerous committees but has spent his first year in office focusing on housing, capital projects, language and culture, and economic development. He believes in progressive policy and ending the climate emergency. @khelsilem



LISA LANGEVIN is an electrician and a passionate advocate for making trades more accessible to women. She was a founding member of both the IBEW 213 and BC IBEW Women's Committees, as well as the national and the provincial chapters of Build Together – Women of the Building Trades. She helped form, and is currently the president of, the BC Tradeswomen Society. She currently works as an Assistant Business Manager for Local 213 of the International Brotherhood of Electrical Workers (IBEW), based in Port Coquitlam, British Columbia. In addition to serving on the Governance Committee for the BC Centre for Women in The Trades she is also a board member of the ITA (Industry Training Authority) in British Columbia. @ElectricLisaL



JANETTE LOVEYS is the Chief Administrative Officer with the Sunshine Coast Regional District, a beautiful coastal community since 2015. Janette has been a public sector employee since 1989 where she started her career with the Province of Ontario. She went on to work for the City of Guelph where she provided the leadership for the first policy in Canada to allocate tax funds by citizens – participatory budgeting. Janette has the opportunity to work in senior roles at the Capital Regional District and in the Niagara Region, Ontario. In 2013, Janette received the Queen Elizabeth Diamond Jubilee award for her work with Federation of Canadian Municipalities.



AMY LUBIK is a first term City Councillor in Port Moody. Amy is a health policy analyst and researcher, currently working for Fraser Health Authority. She works on the social determinants of health: broadly how issues such as poverty and unequal access to housing, transit, and services impact health outcomes. She also has experience researching how the built environment can influence health, focusing on the mental health impacts of social isolation, as well as municipal resilience to climate change. She is also member for the Canadian Association of Physicians for the Environment, and the Public Health Association of BC.



STEPHANIE LYNN joined Stratcom in June 2016 on her return to Canada from Asia, bringing her commitment to excellence in innovation to Stratcom's clients in British Columbia and Alberta. She comes with three decades of experience working with heads of state, legislatures, political parties and community activists in over twenty countries. Stephanie is renowned for her achievements in leveraging research on public and political leaders' opinions and policy advocacy to advance representative, responsive governance. She brings her expertise to bear in message development and communications training, particularly in support of women leaders.



ADRIENNE MONTANI is the Provincial Coordinator for BC Child and Youth Advocacy Coalition. She has lived, worked and been a social justice activist in Vancouver since 1976. She joined First Call in 2000 and became the provincial coordinator in 2005. Prior to working with First Call, she served as the child and youth advocate for the City of Vancouver, and as the chairperson of the Vancouver School Board for three of her six years as an elected school trustee. Some of her earlier leadership positions included serving as the executive director of Surrey Delta Immigrant Services Society and of Big Sisters of BC Lower Mainland. @FirstCallBC



LEE MOSSMAN is the Local Government Liaison for CUPE BC. Lee has worked in the Public Sector for nearly 35 years in Public Works. He served three terms as President for the Municipal Workers of the Central Okanagan and was also a member on the CUPE BC Executive Board. More recently, Lee was elected as a School Board Trustee for District 23 in the Central Okanagan, serving from 2014 – 2018.



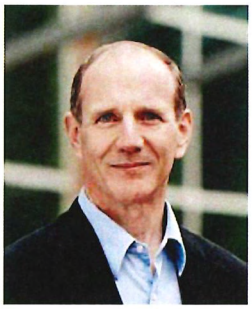
LORI PRATT was elected as Sunshine Coast Regional District director for Area B - Halfmoon Bay in 2018. The board elected her as chair at their inaugural meeting. Prior to moving into this role at the SCRD, Lori spent 10 years as an elected trustee to the Board of Education of School District No. 46 (Sunshine Coast). Lori has a strong drive to create space for women's voices that is inspired by her own experiences and by wanting to create a better world for her three daughters. @LoriAnnPratt



CHUCK PUCHMAYR is a City Councillor for the city of New Westminster and Retired Member of the Legislative Assembly of BC. He is the founder and volunteer for A Beef With Hunger Society, chairperson of the Lookout Housing and Health Foundation and an avid volunteer for BC Transplant. Chuck was first elected to city council in 1996 and went on to serve in the provincial legislature from 2005, retiring in 2009. Chuck re-entered civic politics in 2011. @chuckPuchmayr



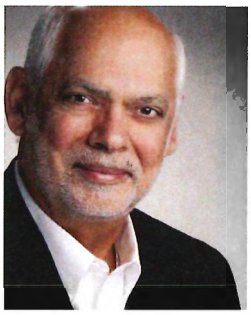
JENNIFER REDDY is working towards an inclusive community where people are engaged as valuable and deserving individuals, who can use their agency to lead the changes they wish to see. I hold a Masters in Social Policy and Development from the London School of Economics, a Bachelors in Development Studies from the University of Calgary, and a Certificate in Curriculum Development and Instructional Design from Mount Royal University. From SFU, EdMeCo and the VSB to Kuru Kuru Training Centre in Guyana, I have been inspired by global leadership in education and social change. I look forward to the opportunity to learn from and contribute to the efforts of individuals and communities that drive educational leadership in our city. @reddyforchange



GAETAN ROYER is the CEO of CityState Consulting. His love of everything urban brought him to hundreds of cities in 30 countries. An urban planner originally from Québec City, he received a Governor General's Medal for his humanitarian work in Sarajevo. During his time as City Manager in Port Moody, the city received numerous awards including the International Livable Communities Award. The author of "Time for Cities," a book about getting a better deal for cities, he is also an Associate with the Columbia Institute who contributed to several reports.



HALENA SEIFERLING is the Campaign Organizer for the Living Wage for Families Campaign, hosted in Vancouver on unceded Coast Salish territory. Halena is originally from Regina (Treaty 4) and moved west in 2014 to obtain a Masters in Public Policy from SFU. Her thesis focused on measures to encourage more women to run for office at the local level. Halena has also worked on issues including electoral reform, gender equity, and climate justice and adaptation within a municipal context. @lwforfamilies



PAUL SHAKER is a career educator who has served as teacher, teacher educator, and dean in five of the United States, in the Mideast, and in Canada at Simon Fraser University where he is professor emeritus and former dean. Shaker created Friends of Simon, an outreach to immigrant children that provides university students as tutors. He also hosts Your Education Matters a community engagement project supporting British Columbia education. Shaker is the co-author of Reclaiming Education for Democracy and numerous articles. For more, see paulshaker.com and youreducationmatters.ca. @profpaulshaker



DARNELDA SIEGERS has served the District of Sechelt as a Councillor since 2011 and was elected Mayor in 2018. She currently also sits as Vice-Chair of the Sunshine Coast Regional District. She and her husband, Adrian, moved to Sechelt from Alberta in 2009. With a passion for life-long learning, Darnelda has a diploma in Business Administration, a Bachelor of Education Degree and recently completed an Executive Certificate in Local Government. She is committed to supporting women as they pursue leadership roles. @dsiegers.



SUSSANNE SKIDMORE was elected BCFED Secretary-Treasurer in November 2018. A well-known human rights, social justice and queer rights activist, Sussanne has served as executive vice-president of BCGEU since 2014. She has also served as co-chair of the BCFED's Human Rights Committee, and is active in the Women's Rights Committee.



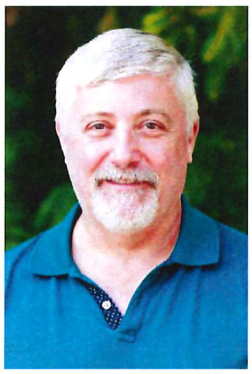
ADRIENNE SMITH is a human rights activist and drug policy lawyer. Adrienne worked to ensure access to prescription heroin in British Columbia. They recently settled a BC Supreme Court case which guaranteed access to opiate replacement therapy for prisoners in BC jails. Adrienne appeared at the BC Court of Appeal and the Supreme Court of Canada where they argued about the deleterious effects of mandatory minimum sentences for women, indigenous people, and people who come before the court as a result of their addiction. They live and work in the Downtown Eastside where 5 people die every day of preventable opiate overdose. @Vanalias



MATT SMITH is the President of Stratcom since May 2017 and oversees the company's day-to-day operations in fundraising, research and engagement to serve Canada's progressive governments, charities, unions and political parties. Matt was Senior Director of Research & Engagement for six years and continues to play a lead role in all government-facing and election-related work. With fifteen years of research and campaign experience, Matt's expertise includes strategic planning, designing multi-modal research projects, audience analysis and targeting and campaign planning and execution.



CHA'AN DTUT (Rena Soutar) is of Haida descent and works as Reconciliation Planner for the Vancouver Park Board. Her portfolio includes the ambitious goal of decolonizing the Vancouver Park Board. Among other initiatives, she works with local First Nations on a long-term comprehensive plan for Stanley Park. Author of Songhees, a cultural biography of the Songhees Nation in Victoria, she makes her home in Greater Vancouver with her husband and six year old daughter. Rena draws strength from her family and is reminded that helping build a world beyond colonialism means building a better future for all young ones. @unsettling_us



RON STIPP is a Regional Representative for the Canadian Labour Congress in British Columbia. His responsibilities include political action, media and communications for the CLC in the Pacific Region. He regularly instructs workshops and seminars on campaign management, candidate training, working with the media and media training. Additionally, he chairs the CLC Regional Federal Working Group and Municipal Working Group. Ron is a member of the Living Wage Advisory Committee, and the coordinator of the Sustainable Communities Initiative.



BRAD WEST is a life-long resident of Port Coquitlam and was first elected to Council in 2008. He was re-elected in 2011 and 2014, receiving the most votes of all candidates both times. In 2018, Brad was elected as the 16th Mayor of the City of Port Coquitlam. He is a graduate of the University of Victoria, St. Francis Xavier University and most recently completed a program in Leadership at Harvard University. @BradWestPOCO



ALLAN WONG is currently serving his eighth term as a trustee of the Vancouver School Board, being first elected in 1999. Allan is an alumnus of UBC graduating with a Diploma in Multicultural Teachers Program and a Bachelor of Arts in Asian Area Relations. His public service experience includes terms with several boards and committees, including the Vancouver Public Library Board and numerous Diversity related Advisory Committees. He is a lifetime advocate for Public Education.



MARY CLARE ZAK is the Managing Director of the Social Policy & Projects Division with the City of Vancouver. She has decades of public sector experience at all three levels of government and the not-for-profit sector. Her role at the City of Vancouver is to provide advice to the Mayor and Council on social issues, and to work across government and various sectors to address these issues.

STAY TUNED FOR MORE SPEAKERS

City of Richmond

Memorandum

Engineering and Public Works
Sustainability

To:	Mayor and Councillors	**Date:**	March 19, 2019
From:	Nicholas Heap Sustainability Project Manager	**File:**	10-6125-07-02/2019-Vol 01
Re:	**Calculation Errors in the "Accelerating Local Action on Climate Change: Community Energy & Emissions Plan (CEEP) Renewal" Report**		

At the General Purposes Committee Meeting held on March 18, 2019, the Committee adopted the following recommendation:

1. *That the public consultation program defined in the report titled "Accelerating Local Action on Climate Change: Community Energy & Emissions Plan (CEEP) Renewal" from the Director, Engineering dated February 27, 2019, to gain feedback from residents and stakeholders regarding the recommended revised greenhouse gas (GHG) reduction target and revised climate action strategies and measures consistent with and in response to the UN's Intergovernmental Panel on Climate Change report, be endorsed.*

Consistent with the findings of the IPCC *Special Report on Global Warming of 1.5°C*, staff proposed GHG reduction targets in the staff report that were adapted to Richmond's context. Staff have identified a calculation error in the proposed 2030 emission reduction target on page GP-50 of the staff report, which was incorrectly stated to be "40% below 2007 levels by 2030." This should be corrected to "50% below 2007 levels by 2030."

This correction does not affect the wording of the resolution adopted by the General Purposes Committee.

For the purposes of the recommended community engagement program, the target that the IPCC considers necessary at the global scale to limit warming to 1.5°C will be used to engage and inform the public and stakeholders. When the renewed CEEP is presented to Council following community engagement, staff will bring forward recommended targets that are consistent with Council direction for consideration.

Nicholas Heap
Sustainability Project Manager
(604-276-4267)

pc: SMT

City of Richmond

Report to Committee

To:	General Purposes Committee	**Date:**	February 27, 2019
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6000-00/Vol 01
Re:	**Accelerating Local Action on Climate Change: Community Energy & Emissions Plan (CEEP) Renewal**		

Staff Recommendation

That the public consultation program defined in the report entitled "Accelerating Local Action on Climate Change: Community Energy & Emissions Plan (CEEP) Renewal" from the Director, Engineering dated February 27, 2019, to gain feedback from residents and stakeholders regarding the recommended revised greenhouse gas (GHG) reduction target and revised climate action strategies and measures, be endorsed.

John Irving, P.Eng. MPA
Director, Engineering
(604-276-4140)

Att. 7

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Building Approvals	☑	
Development Applications	☑	
Emergency Programs	☑	
Parks Services	☑	
Policy Planning	☑	
Transportation	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

This report responds to a referral from the September 11, 2018 General Purposes Committee Meeting, which requested:

> *"That staff evaluate the City's medium-term GHG reduction targets in light of the new provincial targets, and bring back options for consideration."*

This report responds to a referral from the January 29, 2019 Parks, Recreation & Cultural Services Committee, which requested:

> *"That staff report back by fall of 2019 with a State of the Environment report, encompassing all the City's environmental sustainability initiatives including a review on the City's objectives, targets, timelines, and actions."*

This report responds to a referral from the February 11, 2019 Council Meeting, which requested:

> *"That the matter be referred back to staff to report back on: (1) the definition of a climate emergency; (2) what constitutes a climate emergency; (3) whether Richmond is experiencing a climate emergency; and (4)the ramifications of declaring a climate emergency."*

Background

Sustainability Reports to Council

Over the past 20 years, staff have prepared a series of reports to Council regarding environmental sustainability issues and the implementation status of actions taken in these areas. The following list is a summary of the reports and plans developed by staff and presented to Council:

- City Staff produced a series of *State of Environment* reports in 1998, 2001 and 2005.
- Council approved the Richmond Sustainability Framework in 2010.
- Staff presented the *Sustainability Progress Report* to Council in 2014.
- Council adopted the *Community Energy & Emissions Plan* (CEEP) in 2014, and there have been update reports to Council regarding CEEP implementation in 2015 and 2017. The next CEEP update report is scheduled for the end of 2019.
- Council adopted the *Ecological Network Management Strategy* (ENMS) in 2015, and Council received the *ENMS Update* report in January 2018.
- Council also receives annual solid waste and drinking water quality reports.

The combined effect of the reporting between 2014 and 2018 has been to update Council and the community with more detailed and timely information on the City's progress in implementing the wide range of community sustainability initiatives now underway. A diagram of the City's environmental, energy efficiency and climate action strategies, plans and implemented measures is included as Attachment 1 to this report.

City of Richmond Climate Action Leadership – Reducing GHG Emissions

In January 2014, Council adopted the *Community Energy and Emissions Plan* (CEEP). The City has since implemented a wide range of greenhouse gas (GHG) emission reduction initiatives targeting both corporate activities and city-wide (community) sources. Examples of City's initiatives that have reduced corporate and community GHG emissions include the following:

- **Land Use Planning:** The CEEP is informed by the 2009 City Centre Area Plan (2009), enabling high-density development to be effectively supported by low-carbon rapid transit. The CEEP is also congruent with city-wide OCP priorities for the redevelopment of neighbourhood centres and Arterial Road Development (i.e. along TransLink's frequent transit network), reinforcing the land use – transportation link.

- **District Energy**: Since 2011, buildings in City Centre are required to be "District Energy-Ready" (i.e. using a hot water-based heating system, or connected to the City's Lulu Island Energy Company (LIEC) infrastructure for space heating[1] and hot water services). The City's DEU systems already provide more than 3.6 million ft^2 of residential and commercial floor space with energy-efficient and cost-effective energy services. LIEC's Alexandra District Energy System uses a renewable geo-exchange system to provide heating and cooling for new buildings in the area, including the first Walmart in North America to be connected to a civic thermal energy utility, and Richmond Fire Hall #3. LIEC's plan is to access the sewer heat resource of the Gilbert Road sanitary forcemain to generate energy for the Oval Village District Energy Utility.

- **Energy Efficient New Development**: The City Centre Area Plan established a policy, in effect from 2009 to 2018, that new developments greater than $2000m^2$ achieve a LEED Silver-equivalent level of performance as a consideration of rezoning. In September 2014, Council adopted the City's Townhouse Energy Efficiency and Renewable Energy policy, in effect until 2018, which required that all new townhouse units resulting from rezoning applications be designed and built to achieve an "EnerGuide 82" energy efficiency performance rating or better, and comply with the BC Solar Hot Water ready regulation, or alternatively, connect to a renewable energy system. In 2018, both policies were superseded by more stringent Energy Step Code requirements for new development (see below). New detached homes are also required to meet the requirements of the BC Solar Hot Water Ready regulation.

- **Electric Vehicles:** As of February 2019, the City has installed 10 public L2 EV charging ports at five different locations in Richmond, with the installation of 6 additional ports (including 2 L3 ports and a sixth location) planned. A new Richmond requirement that

[1]Cooling is also provided in some cases.

100% of new residential parking spaces be supplied with EV charging infrastructure is a North American first and an increasingly influential precedent for other local governments.

- **Energy Efficient Existing Buildings:** EnergySave Richmond (www.energy.richmond.ca) has offered a suite of programs for residents, businesses and developers:
  - Building Energy Challenge: A friendly competition between building owners to promote energy performance and reporting of energy use (2015-2017);
  - ClimateSmart: Energy efficiency and GHG reduction coaching for local businesses (2016-2018);
  - Richmond Carbon Market: Program for purchasing carbon credits from Richmond-based GHG reduction projects (since 2015); and
  - Targeted incentives for Energy Star clothes washers (since 2010), replacement restaurant hot water spray-valves (2016), and "smart" thermostats (2016-2017).
  - The website also hosts on-line registration forms for the City of Richmond Airtightness Training Program that supports local builders and construction trades workers in building successfully to the City's Energy Step Code requirements.

- **Active Transportation and Walkability:** Since 2010, the City has issued Building Permits for 4,773 new City Centre building units within a 5-minute walk of Canada Line stations (including 2,292 units near the planned station at Capstan Way), with many more to come. New transit shelters, crosswalks, bike lanes and other cycling facilities have been installed throughout Richmond to encourage low-carbon active transportation. Between 2006 and 2016, the transit mode share for journey to work trips increased from 11.8% to 19.1%, and vehicle trips declined from 82.2% to 74.2%. The City has also supported the introduction and expansion of car-share services and is currently piloting a public bike-share system.

- **Civic Buildings**: New civic buildings have been built to LEED Gold levels of environmental performance, including the City Centre Community Centre, Fire Hall No.1 and the new Minoru Centre for Active Living, while Fire Hall #3 and the attached ambulance station are connected to the Alexandra DEU. The City reduced GHGs from City buildings by 25% between 2007 and 2017 by implementing energy efficiency and fuel-switching initiatives. Council has approved a target of reducing corporate GHG emissions to 65% below 2007 levels by 2020.

- **City Fleet:** Through implementation of the City's *Green Fleet Action Plan*, Richmond was the first local government to achieve an E3 Fleet[2] "Platinum" rating.

- **Parks Services:** Staff are assessing the carbon storage capacity of the North East Bog Forest to advance the City's carbon neutrality efforts as well as the Ecological Network; if the assessment shows promising results, staff intend to assess the carbon stored within the Garden City Lands.

[2] E3 Fleet: "Energy, Environment, Excellence": https://www.e3fleet.com/

- **Waste Diversion**: Richmond achieved 78% diversion of organic wastes from single family homes in 2016, greatly reducing GHG emissions from anaerobic decomposition. Also in 2016, Council adopted the *Demolition Waste and Recyclable Materials Bylaw*. The City is aiming for 80% waste diversion by 2020.

- **Carbon Neutral Operations:** Building on GHG emission reductions achieved through the City's waste diversion, parks, civic building and city fleet initiatives (see above), the City has additionally purchased locally-generated GHG offsets through its innovative Richmond Carbon Marketplace program to achieve carbon neutral corporate operations every year since 2013, and plans to maintain this success going forward.

- **Solar energy**: Staff developed the Solar Friendly Richmond framework in 2016, proposing corporate and community-focused policies and programs. City facilities with solar energy generation installed include:
  - South Arm Community Centre and Hamilton Fire Hall (solar air pre-heating)
  - Steveston Fire Hall No 2, South Arm Outdoor Pool, and the old Minoru Aquatic Centre (solar hot water).
  - Planned solar PV installations at the new Fire Hall No 1.

  Staff are currently assessing a solar policy for new development per the referral from the December 18, 2018, Planning Committee meeting, and intend to bring a report to Council in spring 2019.

- **BC Energy Step Code:** From 2016 through to the present, the City has played a key role in both developing and implementing the Province's new Energy Step Code (ESC), a new set of "better-than-code" energy efficiency standards available for voluntary adoption by local governments in British Columbia. Richmond became the first municipality in BC to announce its intent to begin stakeholder consultations on local adoption of the ESC. Richmond's approach to ESC targets sets out differentiated Step Code targets that incent the use of "low-carbon energy systems" including District Energy. See Attachment 2 for a table of current and proposed ESC requirements for new construction in Richmond, consistent with achieving net-zero energy ready construction for new developments as soon as 2025.

- **Civic Leadership and Advocacy:** The City regularly calls on senior levels of government to take greater action on sustainability and climate change issues. Within recent years, Council has provided input to the development of the 2015 BC *Climate Leadership Plan* and the recent *CleanBC* plan (see below), and has successfully championed resolutions on building energy benchmarking and the right to a clean environment through the Union of BC Municipalities (UBCM). Richmond has also consistently taken a leadership position among local governments, pioneering new EV charging requirements for residential development, and leading research on incentives for heat pump technology. Richmond's leadership in adopting the Energy Step Code has already inspired many other local governments in BC to follow suit, and the City's Energy Step Code targets, regulatory procedures and well-regarded stakeholder consultation process are all being widely cited as best practice by both industry and government.

City of Richmond Climate Action Leadership – Climate Change Adaptation

Over the last decade, Richmond has implemented a series of strategies and plans that in combination respond to many of the impacts of climate change projected for Richmond over the coming century. The following initiatives have reduced risks and vulnerabilities for Richmond's residents, businesses and the local environment:

- Establishing the Drainage and Diking Utility reserve fund in 2003;
- Adopting the *2008-2031 Richmond Flood Protection Strategy*, and the *Flood Plain Designation and Protection Bylaw* in 2008;
- Working with waterfront developers to construct wide "superdikes";
- Developing and implementing the *Dike Master Plan*; and
- Ongoing improvements to the City's flood protection system;
- Adopting the *Invasive Species Action Plan*;
- Development of an urban forest management strategy; and
- Implementing clean air cooling stations as a rapid response to the summer 2018 heat wave and smog event.

More information on these climate adaptation measures is included as Attachment 3.

Declaring a "State of Local Emergency"

The concept of a "climate emergency" was discussed at the February 11, 2019 Council Meeting. Staff were asked to inform Council on the implications of declaring an "emergency" related to the impacts of climate change.

Local governments have a mandate to declare a "State of Local Emergency," which enables local authorities the power to exercise emergency powers as listed in the *Emergency Program Act*. In the context of the declaration, the term "Emergency" is defined as a present or imminent event or circumstance that a) is caused by accident, fire, explosion, technical failure or the forces of nature, and b) requires prompt coordination of action or special regulation of persons or property to protect the health, safety or welfare of a person or to limit damage to property. A "climate emergency" does not appear to meet the requirements of this definition.

When a State of Local Emergency is enacted (by order of the head of the local authority, by resolution or by bylaw, and by the submission of a Declaration Order form to the Province), the jurisdiction gains a legal mandate to:

a) Acquire or use any land or personal property considered necessary to prevent, respond to or alleviate the effects of an emergency or disaster;

b) Authorize or require any person to render assistance of a type that the person is qualified to provide or that otherwise is or may be required to prevent, respond to or alleviate the effects of an emergency or disaster;

c) Control or prohibit travel to or from any area of British Columbia;

d) Provide for the restoration of essential facilities and the distribution of essential supplies and provide, maintain and coordinate emergency medical, welfare and other essential services in any part of British Columbia;

e) Cause the evacuation of persons and the removal of livestock, animals and personal property from any area of British Columbia that is or may be affected by an emergency or a disaster and make arrangements for the adequate care and protection of those persons, livestock, animals and personal property;

f) Authorize the entry into any building or on any land, without warrant, by any person in the course of implementing an emergency plan or program or if otherwise considered by the minister to be necessary to prevent, respond to or alleviate the effects of an emergency or disaster;

g) Cause the demolition or removal of any trees, structures or crops if the demolition or removal is considered by the minister to be necessary or appropriate in order to prevent, respond to or alleviate the effects of an emergency or disaster;

h) Construct works considered by the minister to be necessary or appropriate to prevent, respond to or alleviate the effects of an emergency or disaster;

i) Procure, fix prices for or ration food, clothing, fuel, equipment, medical supplies or other essential supplies and the use of any property, services, resources or equipment within any part of British Columbia for the duration of the state of emergency.

According to the Province's *Declaring a State of Local Emergency In British Columbia* guidelines, "these powers infringe on civil liberties of citizens and should only be drawn upon by local authorities when no other reasonably achievable options are available to protect the community." The guidelines also note that a declaration of a State of Local Emergency is not required "to implement part or all of a local emergency response plan, as long as access to emergency powers are not required."

Local government "Climate Emergency" declarations

In response to the IPCC *Special Report on Global Warming of 1.5°C*, a number of local initiatives are now underway seeking local government declarations of a "Climate Emergency". As of February 16, 2019, the following local government jurisdictions are listed as having adopted "Climate Emergency" declarations[3]:

- United Kingdom: 29 councils (including London, Bristol and Oxford) representing 14 million people.
- United States: 9 councils representing almost 6 million people
- Australia: 8 councils representing 650,000 people

[3] https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/

Within Canada, as of the writing of this report, 288 councils representing over 7 million people have adopted a climate emergency declaration. Aside from Halifax, Vancouver and the Capital Regional District, all of these councils are from Quebec[4], where local governments have adopted the *Déclaration citoyenne universelle d'urgence climatique (DUC)*.[5]
While there is no standard text for these Climate Emergency declarations (aside from the DUC document cited in Quebec, noted above), many appear to have the following common elements:

1. A public statement that a disparity between the potential impacts of climate change, and current efforts to prevent or adapt to these impacts;
2. A call for the development of, or adoption of, more stringent GHG reduction targets in line with those set out by the IPCC report;
3. A call for the implementation of, or the development of, action plans containing measures sufficient to achieve the new GHG reduction targets adopted;
4. A call for other local governments and for senior levels of government to do likewise; and
5. A call for senior levels of government to provide Council with expanded mandates and resources to facilitate climate action at the local level.

New Provincial GHG reduction targets and *CleanBC* plan

In May 2018, the Province updated their greenhouse gas (GHG) emissions reduction targets. In line with the recommendations of the Climate Leadership Team, the Province repealed the 2020 emission reduction target, and added the following new targets for 2030 and 2040:

- By 2030 and for each subsequent calendar year, BC greenhouse gas emissions will be at least 40% less than the level of those emissions in 2007; and
- By 2040 and for each subsequent calendar year, BC greenhouse gas emissions will be at least 60% less than the level of those emissions in 2007.

In December 2018, the Province released *CleanBC*, which is intended to serve both as a climate action strategy and an economic development plan. The key strategies articulated in the plan are to seek emission reductions from industry, the transportation sector, and from buildings and urban form. Several of the measures outlined in the plan will provide new incentives that are supportive of the City's existing climate action priorities. New measures proposed in the plan include:

- Implementing a zero-emission vehicle mandate starting in 2025 (10% of new cars) that ramps up to 100% by 2040;
- Supporting investments in public EV charging;
- Gradually increasing minimum energy efficiency requirements in the BC Building Code, in line with Energy Step Code targets, so that all construction is net-zero energy ready by 2032;
- Adopting energy efficiency requirements for existing buildings by 2024;
- Providing incentives for high-efficiency low-carbon heat pumps in existing buildings;
- Requiring building energy labelling and reporting; and
- Achieving 95% diversion of organic wastes.

[4] https://montrealgazette.com/opinion/columnists/allison-hanes-heat-is-on-to-make-climate-a-priority-in-quebec
[5] http://www.cssante.com/sites/www.cssante.com/files/duc_couleur.pdf

Additional measures address the waste sector, the need for skills training and for reporting measures. Additional information on the *CleanBC* plan can be found in Attachment 4.

IPCC Special Report on Global Warming of 1.5°C

In October 2018, the Intergovernmental Panel in Climate Change (IPCC) approved the *Special Report on Global Warming of 1.5°C*. This report follows from Article 2 of the Paris Agreement, which states that:

> *This Agreement ... aims to strengthen the global response to the threat of climate change ... by ... holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change...*

Global average warming is predicted to be 4°C above pre-industrial levels by 2100 if current trends continue. This report projects global climate change impacts assuming that the international community is successful in achieving the overall goal of limiting global climate change to 2°C or to 1.5°C of global warming (i.e. the lowest magnitude of human-caused climate change considered achievable at this time). The report finds that the projected impacts of climate change are significantly greater with 2°C rather than 1.5°C of global average warming, especially during the latter half of the current century. Under the 1.5°C scenario many projected climate change impacts actually peak and begin to decrease slightly after 2050, while under the 2°C scenario most projected impacts continue to increase until 2100.

The IPCC report also states that while limiting global average warming to 1.5°C is still possible, GHG emissions need to be rapidly reduced to net zero.[6] This in turn calls for GHG emission reduction targets that are considerably more aggressive than have been have yet been adopted by most jurisdictions. The summary of the IPCC report is included as Attachment 5 to this report.

Based on projections of local climate impacts resulting from 1.5°C and 2°C of global average warming, and the capacity of Richmond's current infrastructure plans, staff are confident that the City will remain resilient to 1.5°C or 2°C of global climate change out to 2100. More information on the projected local impacts of 1.5°C and 2°C climate change is included as Attachment 6. Information on the climate adaptation measures the City is already implementing in response to these projected impacts is included as Attachment 3.

Analysis

Richmond Community Energy & Emissions Plan (CEEP)

In 2010, Council adopted targets included in Richmond's Official Community Plan to reduce community greenhouse gas (GHG) emissions 33% below 2007 levels by 2020, and 80% below

[6] The report states that "All pathways that limit global warming to 1.5°C with limited or no overshoot project the use of carbon dioxide removal," in which annual carbon sequestration totals would exceed GHG emissions into the atmosphere. p.19

2007 levels by 2050. These targets were aligned with the Province's own GHG emission reduction targets, adopted in 2007.

The City's initial CEEP, adopted in 2014, included a list of measures that, in combination with policies already adopted by the Province and the federal government, were projected to reduce community-wide GHG emissions to 6% below 2007 emission levels by 2020, and 25% below 2007 levels by 2050, even with continued population and economic growth over this time. The 2014 CEEP recognized that deep emission reductions could not be achievable by City action alone; rather, these would require supportive utility, provincial and federal regulations and funding, market innovation, and increased carbon pricing. Beyond this, the CEEP also recognized that the City's community emissions reduction targets would only be achieved if "big breakthroughs" (relative to the situation in 2012-2013) were made in the following areas:

- That by 2041, there would be near complete conversion of the passenger vehicle fleet to electric cars;
- That by 2025 all new buildings would "net zero" carbon emitters[7]; and
- That by 2050 all existing buildings would have had a major renovation that dramatically reduces their external energy needs and carbon emissions.

When the CEEP was adopted in 2014, none of these measures were considered to be implementable given the policy tools and product availability available at that time. Five years later, staff consider that it would now be practical to plan the implementation of any or all these measures.

GHG Emissions Trend in Richmond: 2007 to 2015

Actual community-wide reductions in GHG emissions to 2016 were significantly better than projected in the 2014 CEEP. Implementation of all emission reduction measures in the CEEP were projected to result in an absolute reduction in 2015 of 1% below 2007 levels, and a decrease of 10% from a "business as usual," scenario in which no GHG reduction actions were implemented. A recent analysis of available data indicates that total community-wide emissions (including large industry) within the City of Richmond actually totalled an estimated 977,972 tonnes (in CO_2 equivalent emissions, or CO_2e) in 2015, having declined 12% from 1,116,832 tonnes CO_2e in 2007.[8] Available data further indicates that community wide emissions declined by 8% between 2007 and 2010, and that a further 4% decline took place between 2010 and 2015. See Attachment 7 for a graph of this data.

Staff expect emission reductions to continue as adopted policies (e.g. Energy Step Code requirements) become more fully implemented and low-carbon technologies are adopted by increasing numbers of Richmond residents and businesses.

Between 2007 and 2015, GHG emissions in Richmond's residential sector[9] declined by an estimated 16%. Total residential and commercial consumption of electricity declined by 0.5%,

[7] Now referred to as "net zero energy ready": a building so energy efficient that on-site zero-carbon energy generation (e.g. solar PV) would be sufficient to offset the building's energy consumption.
[8] As indicated on the graph, community-wide GHG emission reductions between 2007 and 2015 were minimally affected by including large industrial emissions within the scope of the emission inventory.
[9] i.e., GHG emissions from light-duty vehicles, and residential electricity and natural gas accounts.

and residential natural gas consumption declined by a remarkable 17%, despite ongoing economic expansion and an estimated 12% increase in population during this time.[10]

The provincial government reports that BC's GHG emissions declined by only an estimated 2.1% during 2007 – 2015, while the federal government assesses that Canada's overall GHG emissions declined by 2.2% between 2005 and 2015.[11]

Emission reductions achieved at the local level are a product of local municipal actions as well as policies enacted by senior governments and utilities. The Province implemented a carbon tax and low carbon vehicle fuel standards in 2008. Vehicle fuel economy standards and the provision of increased public transit service (notably including the opening of the Canada Line in 2009), have led to reductions. Ongoing implementation of the City's urban densification, energy efficiency, GHG reduction, district energy and transportation initiatives have also had a cumulative impact on local emission trends, and should increasingly drive emissions reductions relative to "business as usual" as the City continues to grow.

Community GHG Emission Reduction Target

As noted above, the findings of the IPCC 1.5°C report make it clear that the City's existing GHG emission reduction targets are not consistent with the global emission reductions that must be achieved to limit global average warming to 1.5°C. In as much as the City's existing targets do not require local GHG emissions to be reduced to net zero at any date in the future, they are also inconsistent with limiting global average warming to 2°C. The province's GHG reduction targets, although recently revised, were adopted based on the recommendations of the Climate Leadership Team in 2015, and are not reflective of the new findings in the IPCC report.

The City's climate adaptation actions now underway will provide effective protection against climate change impacts currently projected for 1.5°C of global average warming. While additional local adaptation measures would be necessary if "positive feedback" processes (e.g. collapse of the Greenland ice cap) were to occur, the chances of this occurring would be minimized by achieving emissions reductions consistent with the 1.5°C target.

Staff recommend that for the purposes of consultation, that staff seek feedback on revising the City's GHG reduction target to align with emissions reduction trajectory consistent with "no or limited overshoot of 1.5°C" as set out by the IPCC in the 1.5°C report,[12] as stated below:

- Reduce Richmond's community-wide[13] GHG emissions by:

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[10] *Richmond's population was 185,818 in 2007 and 208,229 in 2015.* https://www.richmond.ca/__shared/assets/Population_Hot_Facts6248.pdf

[11] GHG emission estimates for the City of Richmond are constrained by a lack of comprehensive transportation sector emissions data disaggregated to the local government level. These totals include emissions from natural gas consumption by industrial facilities within City boundaries. In 2007 and 2010 (years for which disaggregated data is available) industrial natural gas emissions were 104,806 and 78,462 tonnes respectively, or 9.4% and 7.6% of total emissions). Metro Vancouver as a whole appears to have achieved an equivalent 12% emissions reduction between *2007 and 2015.*

[12] https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_High_Res.pdf p.14

- At least 40% below 2007 levels by 2030[14]; and
- Achieve net zero GHG emissions by 2050.

This is more stringent than the Province's targets of reducing GHG emissions 30% by 2030 and 80% by 2050.

While there are clear benefits – both at the global and local scale - to limiting global average warming to 1.5°C, achieving the emission reductions targets that needed to achieve these benefits will require a considerable increase in the scope and intensity of the City's emission reduction efforts. There is considerable value in raising public awareness both about the challenges that climate change poses for our community, and the practical options now available for reducing local emissions.

Community Energy & Emissions Plan (CEEP) Renewal

The 2014 CEEP acknowledged that while significant actions by all levels of government and the community are required, the identified actions could achieve significant reductions in energy use and GHG emissions" while continuing to accommodate population growth and economic development. The plan also stated that "it is anticipated that other actions may be identified in the future based on opportunities that present themselves during implementation," and "could be identified through a plan review 5 to 7 years following adoption."

Some of the most promising GHG reduction initiatives that the City has begun to implement within the last five years have been achieved in these "big breakthrough" areas that were not considered feasible at the time the CEEP was originally developed. These measures include:

- Development and adoption of an aggressive "beyond-code" energy efficiency building standard applicable to most types of new development (Energy Step Code);
- Incenting low-carbon building energy systems within new developments outside of DEU service areas by means of innovative policy tools enabled through the Energy Step Code and the Lulu Island Energy Company (LIEC); and
- Development and adoption of a electric vehicle charging infrastructure requirement for all new residential parking stalls, at a time when electric vehicles have reached 15% of all new passenger car sales in BC - and climbing.[15]

Staff now have a better understanding of how the City can achieve deep GHG emissions reductions over the next 15 to 30 years through implementation of practical measures. With a

[13] Consistent with the City's previous GHG reduction targets, these targets exclude "large final emitters" (i.e. large industrial operations) situated within Richmond because of the Council's limited mandate to secure emission reductions from these sources.

[14] Based on the City's GHG emission inventory above, this is consistent with the IPCC's recommended target of a 45% reduction below 2010 levels by 2030. Given that Richmond's GHG emissions in 2007 were 109% of 2010 levels, the 2030 target equals 1.09 x 0.55 = 0.6 of 2007 emissions. As previously, this target excludes "large final emitters" (i.e. large industrial operations) because of the City's limited mandate to secure emission reductions from these sources.

[15] *EVs (plug-in hybrids and battery electric vehicles) were 15.5% of new passenger car sales in BC in Q3 2018.* https://www.fleetcarma.com/electric-vehicles-sales-update-q3-2018-canada/ Accessed 180124.

strategic land use plan in place, and new technologies and new policy tools now available, achieving deep GHG reductions within the next generation now appears to be technically feasible:

- **Neighbourhoods and Buildings:** Residential buildings accounted for 17.9% of total community-wide GHG emissions within Richmond during 2015.
    - Continued development of a liveable, compact City Centre, and the intensification of development of the city's neighbourhood centres – in line with policy directions set out in the existing OCP - can deliver large-scale GHG reductions through low-carbon district energy systems, by allowing for high-amenity public transit services, and enabling residents to access a greater proportion of their travel destinations via low-carbon public transit or zero-carbon active transportation modes like walking and cycling.
    - Continued expansion of "low-carbon energy systems" for new development.
    - Greenhouse gas intensity targets could be added to the province's existing energy efficiency targets under the Energy Step Code.
    - Benchmarking and reporting requirements for building energy performance would be a powerful means of incenting voluntary and cost-effective energy efficiency upgrades of existing buildings.[16]
    - The energy and emissions performance of Richmond's existing building stock could be improved by upgrading insulation and windows, installing more energy-efficient mechanical systems, and by successfully incenting a switch to low-carbon heat pumps.
    - Facilitating the installation of EV charging infrastructure in or adjacent to existing residential buildings would further reduce barriers to EV ownership for Richmond residents.
    - Advancing green roofs within the City Centre area and urban forest management throughout Richmond would address urban heat island effects, improve stormwater management, create liveability and increase carbon sequestration.

- **Mobility and Access**: Light duty vehicle gasoline use contributed 42.6% of total GHG emissions.
    - Continue to support TransLink's ongoing implementation of expanded transit service across the city. Provision of transit and active transportation amenities may be accelerated, depending on opportunities arising through redevelopment, any new Federal or Provincial funding, or potential reallocation of funds through the capital planning process.
    - Richmond's public EV charging stations could be accelerated and/or expanded, as described within the City's recent Smart Cities Challenge funding proposal.
    - Community GHG emissions could be reduced by accelerating the transition to EVs by local residents, and by encouraging the use of new low-carbon ride-sharing technologies.

[16] Implementing both energy efficiency and fuel switching (from natural gas to low-carbon electricity) measures in existing buildings are key to achieving deep GHG reductions.

- **Resilient Economy**: Commercial and industrial buildings accounted for 29.8%, with heavy duty vehicle gas and diesel use adding a further 7.2% to total community GHG emissions.
    - The range of buildings covered by the Energy Step Code could be expanded to cover additional types of commercial and industrial buildings[17], with staff working with builders and the Province to ensure the full realization of these energy efficiency requirements.
    - The City could encourage early adoption of electric trucks and other service vehicles as these become available, in part by encouraging the installation of EV charging infrastructure at commercial and industrial developments.

- **Sustainable Infrastructure and Resources:** GHG emissions from the decomposition of organic wastes totalled 2.5%. Existing City plans and programs to divert compostable waste could be broadened and accelerated by using a "circular economy"[18] approach.

As with responses to other, more acute types of "emergency," a local government response commensurate to the challenge posed by climate change will require a significant investment of resources. Projects will often need to be implemented over a compressed time period relative to "business as usual," and shall likely affect all Richmond residents to a greater or lesser degree. The proposed consultation program will help the community understand the scale of the response required.

To fully achieve any of these targets, policy changes will be required at senior levels of government, and the City will need to implement additional measures.

Community and Stakeholder Engagement

Staff recommend that Council endorse an engagement program to develop options for new GHG emission reduction measures reflective of the scale of the GHG emissions reductions needed under a new City's target commensurate with limiting global average warming to 1.5°C.

Engagement events would highlight the essential challenges and opportunities for Richmond posed by climate change, and gain feedback on actions that the City could take on GHG emissions reduction and adaptation to the impacts of climate change. The engagement program will ultimately assess community and stakeholder support for the types of policies and programs outlined above.

Staff propose community and stakeholder engagement with the following groups using the following methods:

1. Leveraging the City's social media tools such as the Let's Talk Richmond platform and Richmond Energy Save website;

[17] As the Province adopts new sets of Energy Step Code targets, (e.g. for hotels).
[18] i.e. an economic system aimed at making the most use of resources, minimising waste, and regenerating products and materials at the end of their service life.

2. Holding community workshops and focus group events targeting local stakeholders, e.g.:
    - Non-governmental organizations;
    - Local Business Improvement Areas / Chamber of Commerce;
    - Urban Development Institute (UDI);
    - Richmond Home Builders Group;
    - North American Chinese Construction Contractors Association – BC Chapter (NACCCA);
    - Architectural Institute of British Columbia (AIBC);
    - Engineers and Geoscientists BC (EGBC);
    - Richmond School Board and students;
    - Richmond Advisory Committee on the Environment;
    - Richmond Advisory Design Panel;
    - Richmond Economic Advisory Committee; and
    - Richmond Community Services Advisory Committee.

3. Hosting open houses with presentations by thought leaders to engage the public.

Staff will notify Council via memorandum when dates and venues are booked for public events.

Following this consultation process, staff would provide recommendations regarding the scope and ambition, and general content of a renewed CEEP in the fall of 2019.

Financial Impact

None.

Conclusion

For over a decade, the City of Richmond has been a leader in actively implementing climate change mitigation and adaption measures. Climate adaptation measures now being implemented will protect Richmond from current projections of climate change impacts out to 2100.

Richmond has been successful in reducing community-wide GHG emissions by an estimated 12% between 2007 and 2015, and energy efficiency and GHG reduction measures now being implemented at scale by the City should drive additional GHG emission reductions going forward. The strong support provided by Council for local climate action has resulted in Richmond becoming a leader in implementing climate action: best practices pioneered here have increasingly been cited and adopted by other local governments, magnifying the effectiveness of the City's climate actions.

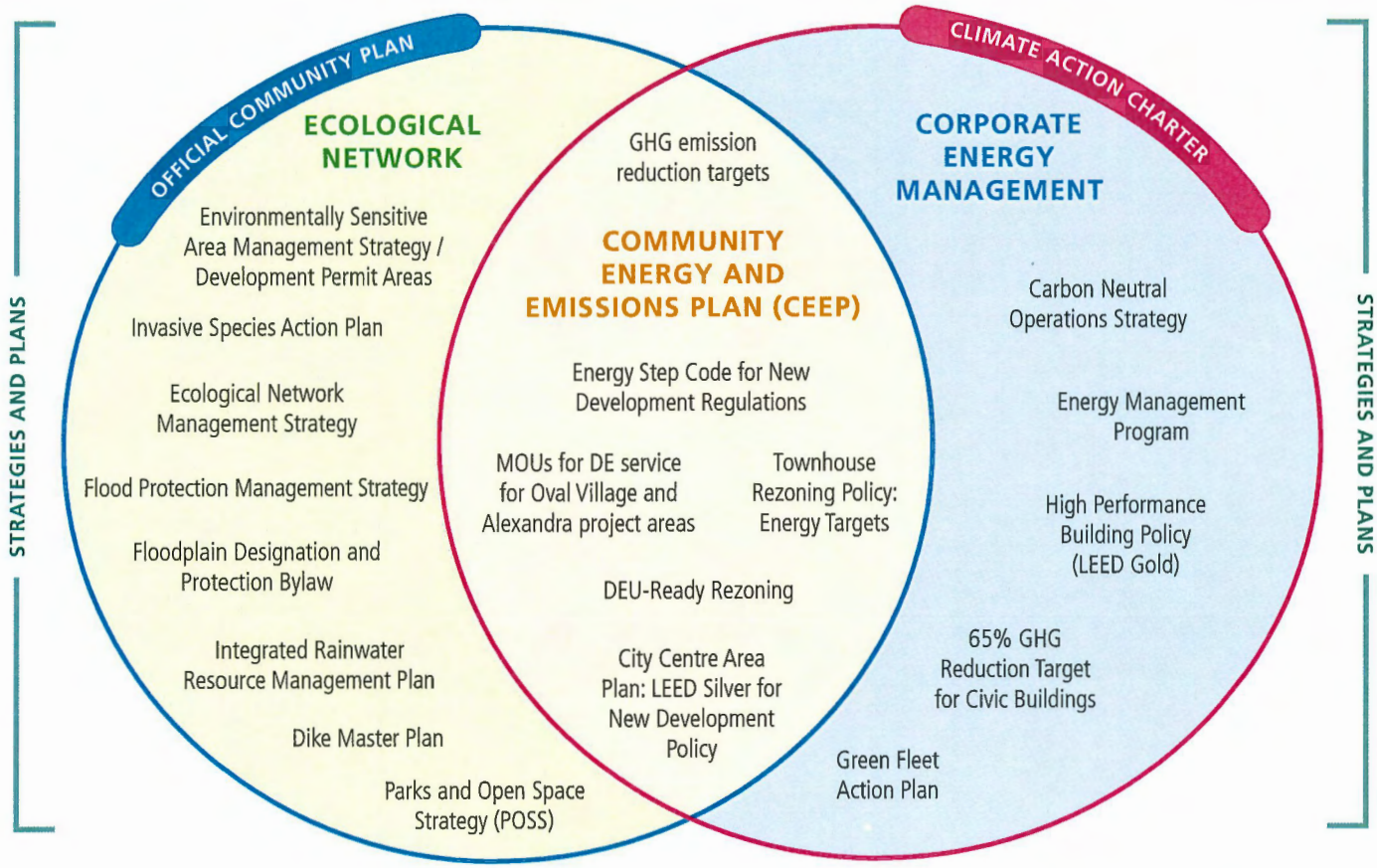
Despite this, the new IPCC findings indicate that Richmond's GHG reduction targets are not consistent with limiting global average warming to 1.5°C. Noting that new policy tools and new technologies are creating new opportunities for deep GHG emission reductions, staff recommend that the City seek input on the adoption of an new GHG target consistent with the IPCC's findings, and that staff commence a consultation process regarding the scope, and content of a revised CEEP outlining actions capable of meeting the City's GHG emission reduction targets.

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Att. 1: State of the Environment: Sustainability Framework diagram
Att. 2: Existing and proposed BC Energy Step Code requirements for the City of Richmond
Att. 3: City of Richmond action on climate change adaptation
Att. 4: *CleanBC* plan
Att. 5: IPCC *Special Report on Global Warming of 1.5 °C*
Att. 6: Global and local projected impacts of climate change
Att. 7: Estimated Richmond community GHG emissions: 2007 – 2016

SUSTAINABILITY FRAMEWORK
STATE OF THE ENVIRONMENT



FEATURE PROJECTS

- Pollinator Pastures
- Riparian Management Area (RMA) network
- Bath Slough Revitalization
- North East Bog Forest
- Capital Funding for Knotweed Treatment
- Terra Nova Rural Park
- Railway Greenway
- Garden City Lands Park

LULU ISLAND ENERGY CO.

Alexandra District Energy Utility (ADEU)

Oval Village District Energy Utility (OVDEU)

City Centre District Energy Utility (CCDEU)

FEATURE PROJECTS

- Building Energy Challenge
- Residential Smart Thermostat Pilot
- Active Transportation (walk/cycle)
- Business Water and Energy Efficiency Initiatives
- Airtightness Training Program
- Public EV Charging Stations
- Promote BC Hydro, FortisBC, and Metro Vancouver Efficiency Incentives

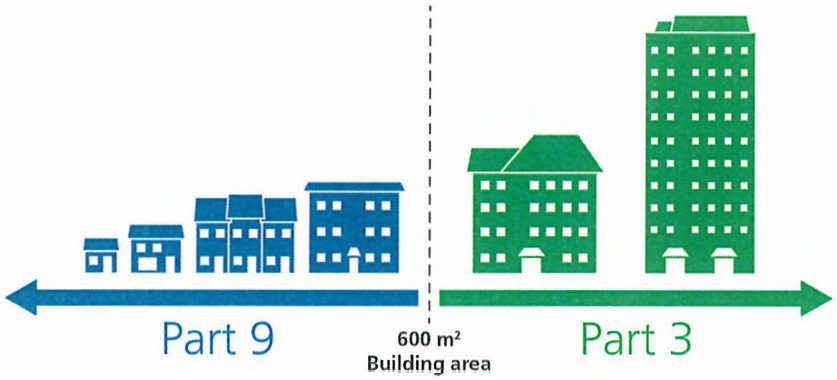
FEATURE PROJECTS

- Minoru Centre for Active Living
- Richmond Fire Halls
- Energy Retrofits to Existing Civic Buildings
- Recommissioning / optimization of existing building energy systems
- Zero Waste programs
- Expanding EV Fleet
- LED Streetlight Program
- Resilient Pump Station Pilot
- Gateway Theatre Sewer Heat Recovery

COMMUNITY FOCUS ← → CORPORATE FOCUS

Attachment 2: Richmond's existing and proposed BC Energy Step Code requirements

Part 9 and Part 3 Buildings



Current Energy Step Code requirements and proposed timetable for higher Steps

Building Permit Application

	Required	*Timetable for Future Consideration as identified in the Official Community Plan*		
	Sept 1 2018[1]	**Jan 2020**	**Jan 2022**	**Jan 2025**
Smaller Part 9 Residential				
Townhomes and apartments	Step 3	*Same as 2018*	Step 4	Step 4 or Step 5
Single family, duplex and other residential	Step 1	Step 3	Step 3 or Step 4	Step 4 or Step 5
Larger Part 3 Developments				
Residential Concrete	Step 3 or Step 2 & LCES*	*Same as 2018*	Step 3	Step 4
Residential Woodframe Low/Mid Rise	Step 3	*Same as 2018*	Step 4	Step 4
Office & Retail Buildings	Step 2	*Same as 2018*	Step 3	Step 3

**LCES: Low-carbon energy systems*

[1] Projects with "in-stream" DP applications will have until December 31, 2019, to submit an acceptable Building Permit under previous requirements.

Attachment 3: City of Richmond action on climate change adaptation

Over the last decade, Richmond has implemented a series of strategies and plans that in combination respond to many of the impacts of climate change projected for Richmond over the coming century. Staff continue to actively monitor projections of climate change impacts are as new analyses become available to ensure that potential vulnerabilities are appropriately addressed in a timely manner. The following initiatives have reduced risks and vulnerabilities for Richmond's residents, businesses and the local environment:

Richmond action on sea level rise and river freshet impacts

- The City's drainage and flood protection system is currently valued at an estimated $1.5 billion, comprising 581 km of drainage pipes, 61 km of culverts, 165 km of watercourses, 39 pump stations and 49 km of dikes. Staff are continuously upgrading and improving the City's flood protection system to accommodate the impacts of infrastructure age, growth and climate change.
- In 2003, Council established a Drainage and Diking Utility reserve fund to ensure sustainable funding for dike improvements by the City. Since then the Drainage and Diking Utility has annually increased from $0.6 million to its current level of $11.9 million. The total capacity of the City's drainage pump stations over the last 10 years has increased by 22%. Since Council endorsement of the reserve fund, the City has rebuilt eleven of its thirty nine drainage pump stations and has performed significant upgrades on a further four.
- In 2008, Council adopted the *2008-2031 Richmond Flood Protection Strategy*, which provided the City with "a framework for developing appropriate adaptation responses." The *Strategy* identified the need to "begin to address climate change implications specific to Richmond" relating to flood protection," and called on the City to "prepare and implement a comprehensive dike improvement program." This resulted in the development of the *Dike Master Plan* (see below).
- The City is actively pursuing opportunities to construct superdikes, where land supporting development behind the dike is filled to the same elevation as the dike crest. This eliminates visual impacts of a raised dike structure on waterfront views while providing an enhanced flood protection structure for the City. Construction of a section of superdike east of the Richmond Olympic Oval was recently completed, and a section of superdike will be constructed through development by 2021 between Capstan Way and Sea Island Way.

Dike Master Plan

- The *Dike Master Plan* sets a goal of increasing the height of Richmond's dike system to 4.7 m. This 4.7m dike elevation is derived from:
    - The 200-year flood elevation (at Steveston) of 2.9m. This is the projected height of a freshet flood equalling flows during the Fraser River's 1894 flood of record, taking the river's current hydrography into account.[1]

[1] Fraser Basin Council, *Lower Fraser Hydraulic Model-Summary of Results*. November 14, 2006.

- Provincial requirements for a freeboard of 0.6m above the 200-year flood elevation standard.
- An allowance for up to 1m of sea level rise as well as 0.2m of geologic subsidence through the year 2100, in line with the Province's 2011 guidance regarding sea dikes.[2]
-

The Dike Master Plan further requires that the structural design of these upgraded dikes be able to facilitate a further raising to 5.5 m to accommodate possible additional sea level rise in future years.

- In April 2018, Council directed staff to consult with the public and stakeholders with regard to the *Dike Master Plan – Phase 2 Report*, which sets out dike infrastructure improvements resilient to the projected climate change impacts to 2100 from West Dike at Williams Road to North Dike at No. 6 Road.
- Currently funded dike improvement projects include over 2.5 km and $11 million in upgrades.

Other climate adaptation initiatives

- In January 2016, Council adopted the Invasive Species Action Plan in order to "reduce the economic and environmental risks of invasive species in Richmond, which are caused, in part, by climate change and associated ecological shifts that influence the proliferation of invasive species.
- City staff are developing an urban forest management strategy to maximize the multiple benefits that trees provide for Richmond, including local shading and cooling effects that counter urban heat island effects.
- During the August 2018 heat wave and smog event resulting from wildfires in the BC Interior, the City encouraged the use of Richmond community centres, community centres, pools, water parks, libraries and arenas, as clean air cooling stations for residents vulnerable to heat stress and/or respiratory conditions.

[2] BC Ministry of Environment. *Climate Change Adaption Guidelines for Sea Dikes and Coastal Flood Hazard Land Use Sea Dike Guidelines* 27 January 2011.

Attachment 4: *CleanBC* plan

Summary list of *CleanBC* plan initiatives

CleanBC initiatives by sector

INITIATIVE	DESCRIPTION	GHG Mt in 2030
CLEANER TRANSPORTATION		
Bring down the price of clean vehicles	**Just over 20 years from now, every new car will be a zero-emission vehicle** • Mandate 100% of new cars to be zero-emission vehicles (ZEVs) by 2040; 30% ZEV by 2030 and 10% ZEV by 2025.	1.3
	Help people to afford cleaner cars and save money on gas bills with zero-emission vehicle (ZEV) incentives • Continue to provide rebates for light-duty vehicles • Expand incentives for clean buses and heavy-duty vehicles	0.3
	Make it easier to charge an electric car or fuel a hydrogen car • Expand the charging network with home, work and public fast-charging stations and additional hydrogen fueling stations • Enable private investment in charging and hydrogen fueling infrastructure to get more stations faster	
Speed up the switch to cleaner fuels	**Phase in more renewable fuels for the gas we use** • Make our fuel cleaner by increasing the low carbon fuel standard to 20% by 2030 • Increase the supply of cleaner fuels by ramping up new production in B.C. of 650 million litres of renewable gasoline and diesel by 2030	4.0
	• Make vehicles run cleaner by increasing tailpipe emissions standards for vehicles sold after 2025	0.4
Get to work on getting rid of gridlock	• Help people get around with a long-term strategy to increase active transportation and look at better commuting solutions.	
	subtotal	**6.0**
IMPROVE WHERE WE LIVE AND WORK		
Better Buildings	**Make every building more efficient** • Improve the BC Building Code in phases leading up to "net-zero energy ready" by 2032 • Adopt the model National Energy Code for existing buildings by 2024 • Increase efficiency standards for heating equipment and windows • Encourage the development of innovative and cost-effective low-carbon building solutions	
Support for Better Buildings	**Focused investments in public housing to use less energy at home** • $1.1 B for Capital Renewal fund for public housing to improve living conditions, energy efficiency, and reduce emissions • Incentives to make heat pumps affordable and make homes more comfortable through building envelope upgrades • Retrofits for public buildings so they use less energy • Improve building energy information available to buyers and renters	0.5
	• Make residential natural gas consumption cleaner by putting in place a minimum requirement of 15% to come from renewable gas	1.5
Support for Communities	• Help remote communities reduce their dependence on diesel • Support public infrastructure efficiency upgrades and fuel switching to biofuels with the CleanBC Communities Fund	
	subtotal	**2.0**

INITIATIVE	DESCRIPTION	GHG Mt in 2030
CLEANER INDUSTRY		
Ramp up the clean growth program for industry	• Direct a portion of B.C.'s carbon tax paid by industry into incentives for cleaner operations	2.5
Improve air quality by cutting air pollution	• Clean up air pollution in the lower mainland with a pilot project to test options to switch 1,700 freight trucks to natural gas and low or zero-carbon fuel by 2030 • Make heavy-duty vehicles more efficient with fuel efficiency improvements, education on best driving practices	
Reduce emissions from methane	• Reduce methane emissions from upstream oil and gas operations by 45%	0.9
Industrial electrification	• Provide clean electricity to planned natural gas production in the Peace region	2.2
	• Increase access to clean electricity for large operations with new transmission lines and interconnectivity to existing lines	1.3
Carbon capture and storage	• Ensure a regulatory framework for safe and effective underground CO_2 storage and direct air capture	0.6
Cleaner fuels for industry	• Make industrial natural gas consumption cleaner by putting in place a minimum requirement of 15% to come from renewable gas	0.9
	subtotal	8.4
REDUCE WASTE		
Reduce waste and turn it into a clean resource	• Help communities to achieve 95% organic waste diversion for agricultural, industrial, and municipal waste – including systems in place to capture 75% of landfill gas • Waste less and make better use of it across all sectors of our economy, like forestry, agriculture, and residential areas, including renewing the B.C. Bioenergy Strategy and building out the bioenergy and biofuels cluster	0.7
	subtotal	0.7
HELPING PEOPLE GET THE SKILLS THEY NEED		
Make sure British Columbians can lead the clean transition	• Develop programs like Energy Step Code training and certification, and Certified Retrofit Professional accreditation • Expand job training for electric and other zero-emission vehicles	
MEASURING OUR PROGRESS		
Establish credible targets and a strategy to meet them	• Roll-out associated programs and enabling legislation for CleanBC	
Stay accountable	• Coordinate implementation and reporting for CleanBC	
Carbon pricing	• Grow the carbon tax $5.00 per year 2018 to 2021 to encourage lower emission alternatives, with rebates for low and middle income British Columbians and support for clean investments	1.8
	subtotal	1.8
	2018 CleanBC TOTAL REDUCTIONS *The legislated target for 2030 is a reduction of 25.4 Mt GHG from a 2007 baseline*	18.9

** Policy line items represent individual reduction potential estimates. Subtotals and totals are derived from combined modeling and may be lower than the sum of policies because of policy interactions (two policies contribute to the same reduction)*

Download the *CleanBC Summary Report* (16 pages) **here:**

https://cleanbc.gov.bc.ca/app/uploads/sites/436/2018/12/CleanBC_Highlights_Report.pdf

Attachment 5: *IPCC Special Report on Global Warming of 1.5 °C*

Abstract

Ninety-one authors and review editors from 40 countries prepared the IPCC *Special Report on Global Warming of 1.5°C* in response to an invitation from the United Nations Framework Convention on Climate Change (UNFCCC) when it adopted the Paris Agreement in 2015. This report highlights a number of climate change impacts that could be avoided by limiting global average warming to 1.5°C rather than 2°C or more. The report also states the global emission reduction targets necessary to limit average global warming to 1.5°C above pre-industrial levels.

The IPCC report states that the world has already warmed by 1°C since pre-industrial times due to human activity. Global average warming is likely to increase past the 1.5°C mark between 2030 and 2052, even if decisive action is taken on limiting GHG emissions. Continental land masses are warming faster than the oceans and the Arctic is warming at 2-3 times the global average rate.

The IPCC report states that the world is already committed to further warming and sea level rise because of the significant lag between the emission of greenhouse gas emissions and their effect on the climate. The IPCC also notes that total GHG emissions *to date* are unlikely to tip temperatures over the 1.5°C threshold, and that there is a small remaining GHG emission "reserve" that can still be expended even if the global community is to achieve a 1.5°C target, but global GHG emissions will need to reach net zero by 2050 and remain at (or below) net zero levels if we are to stabilise temperatures at the 1.5°C target. The amount of warming is ultimately determined by how long it takes to get to net zero. Given the limited time and remaining GHG "reserve" now available, reducing net GHG emissions to zero will likely involve removing carbon dioxide from the air and sequestering it.

The IPCC has produced global GHG emissions scenarios, differentiated by the level of additional human-caused GHGs emitted. The IPCC's "RCP2.6" scenario results in approximately 1.5°C of warming by mid-century, with most global climate change impacts either stabilizing or declining slightly after this time. The "RCP4.5" scenario results in approximately 2.0°C of global average warming with temperatures stabilizing by 2100, although the magnitude of climate change impacts continues to increase to the end of the century. The impact of possible positive feedback effects such methane releases from melting permafrost, increased forest and/or peatland wildfire, and ice shelf and/or ice cap collapse are not captured in these scenarios.

Download the IPCC *Special Report on Global Warming of 1.5 °C – Summary for Policymakers* (26 pages) **here:** https://cleanbc.gov.bc.ca/app/uploads/sites/436/2018/12/CleanBC_Highlights_Report.pdf

Attachment 6: Global and regional projected impacts of climate change

The IPCC *Special Report on Global Warming of 1.5 °C* includes descriptions of climate change impacts projected to result from 1.5°C and 2°C of global average warming. These projections are inherently generalized, whereas the specific impacts of climate change impacts in a given location will be influenced by local geography.

In 2016 the Pacific Climate Impacts Consortium (PCIC) at the University of Victoria completed the *Climate Projections for Metro Vancouver* report for the Metro Vancouver Regional District. This PCIC report documents the results produced by "downscaled" climate models that translate the outputs from the IPCC's low-resolution global-scale climate models into high-resolution projections at the local scale, providing insight into possible local impacts of the global warming scenarios referenced by the IPCC report. The PCIC report provides regional projections of climate change impacts derived from the IPCC's 1.5 °C, 2 °C and 4 °C scenarios of global average warming, for both the 2050s and the 2080s. All results are compared against actual 1970-2000 averages for the Metro Vancouver region. The impacts of possible positive feedback effects are not included in these findings.

Heat waves

Projected global impacts: The IPCC report projects that globally there will be worse heat waves at 2°C compared to 1.5°C.

Projected regional impacts: Within Metro Vancouver, PCIC projects the following:

- During 1971-2000, an average of 22 summer days had daytime maximum temperatures above 25°C. In the 1.5 °C global average warming scenario, this increases to an average of 40 days during the 2050s, as compared with 53 days (i.e. seven and half weeks) above 25°C during the 2050s under the 2 °C scenario.
- Under the 1.5 °C scenario, the 1-in-20-year hottest day is projected to increase by 2.1 °C to 36.1 °C, and by 2.5 °C to 36.6 °C in 2050s and 2080s respectively. Under the 2 °C scenario, the net gain increases by about 50%, so that 37.3°C and 38.1°C are projected for the 2050s and 2080s respectively.
- "Tropical nights," in which nighttime low temperatures remain above 20 °C (and opening windows at nighttime becomes ineffective as a means of cooling off), are also projected for the region. On average, Metro Vancouver experienced less than one regional average nighttime low above 20°C during 1970-2000. However, the region is projected to have 20 tropical nights on average by the 2050s even under the 1.5°C scenario, although this frequency declines somewhat by the 2080s as the climate re-stabilizes. Under the 2°C scenario, 28 tropical nights are expected in our region by the 2050s, climbing to 34 nights (i.e. more than a month's worth) in the 2080s.

Drought

Projected global impacts: The IPCC report projects that globally there will be worse drought at 2 °C compared to 1.5 °C.

Projected regional impacts: Within Metro Vancouver, PCIC projects the following:

- The regional climate projections indicate a modest increase in total annual precipitation under both 1.5°C and 2.0°C scenarios. Both scenarios show a shift towards wetter fall-spring periods, which is partially offset by dryer summers. Precipitation increases mostly during the fall for both the 1.5 °C and 2.0 °C scenarios. The biggest declines in summertime precipitation are forecast for the 2 °C scenario.
- The projected average duration of summertime dry spells will increase from the 1971-2000 average of 21 days. Under the 1.5 °C global average warming scenario, the average summertime dry spell lengthens modestly to 25 days in 2050s and 24 days in 2080s. Under the 2°C warming scenario, the average length of dry spells increases dramatically to 37 days in the 2050s and 42 days in 2080s. In combination with projections of reduced snowpack in the mountains (not modelled by PCIC for these scenarios), these precipitation trends suggest that Metro Vancouver drinking water supplies will face increased pressures during the summer months for all climate scenarios. The most severe drought impacts are projected for the 2 °C global average warming scenario.

Precipitation

Projected global impacts: The IPCC report projects that around the globe, there will be increased flooding with 2 °C of global average warming compared to 1.5 °C.

Projected regional impacts: Within Metro Vancouver, PCIC projects that there is likely to be a shift towards an increased intensity, duration and frequency of precipitation events. Depending on topography, these shifts can result in increased flooding risk. Within the drinking water supply areas of Metro Vancouver, increased rainfall intensity can exacerbate landslides and turbidity events in the reservoirs.

Richmond's drainage system is designed to accommodate a 1-in-10-year storm event. While there have been some minor instances of surface ponding in low-lying properties caused by flooding during heavy rainstorms that exceeded 1-in-10-year storm events, the flat topography of Richmond has helped to protect the City during these extreme precipitation events, as there is no rapid concentration of above-ground stormwater flow into "flash floods". Extreme precipitation events observed to date have been highly localized, affecting only a portion of the City's stormwater collection system. New drainage pump stations are designed such that there is adequate stormwater pumping capacity on a city-wide basis to respond to these events. With continued capital improvements supported through the City's diking and drainage utility, capacity within Richmond's stormwater system (and particularly in Richmond's open watercourses) will continue to protect local residents from flooding impacts for the coming century under either the 1.5 °C or 2.0 °C climate future.

Sea Level Rise and Freshet Flooding

Projected global impacts: The IPCC report projects a global average rise in sea level of 0.26 to 0.77 m by 2100 (relative to average sea levels in 1986-2005) with 1.5°C of global warming. This is 10cm less that would be experienced with 2 °C of global average warming. The report also states that "sea level rise will continue beyond 2100 even if global warming is limited to 1.5°C in the 21st century (high confidence)." Text in the full IPCC report suggests that if destabilization of polar ice sheets is avoided, global average sea levels could regain equilibrium after a rise of "0.5–1.2 m and 0.6–1.7 m in 1.5°C and 2°C warmer worlds, respectively."[1] However, "marine ice sheet instability in Antarctica and/or irreversible loss of the Greenland ice sheet could result in multi-metre rise in sea level over hundreds to thousands of years," and that "these instabilities could be triggered at around 1.5°C to 2°C of global warming (medium confidence)."[2]

Projected regional impacts: The *Climate Projections for Metro Vancouver* report does not include a downscaled projection of sea level rise for Metro Vancouver, but in 2018 the Washington Coastal Hazards Resilience Network produced sea level rise projections to 2150 for more than 100 locations on the coast of Washington State, for both the 2°C global average warming and 4°C global average warming scenarios.[3] The projections for Point Roberts (the closest modelled location to Richmond) show mid-range sea level rise estimates of 1.3 ft. (40 cm) and 1.8 ft. (55 cm) by 2100 under the 2°C and 4°C scenarios respectively, with 3% and 9% respective probabilities of sea level rise exceeding 0.91 m (3ft).[4]

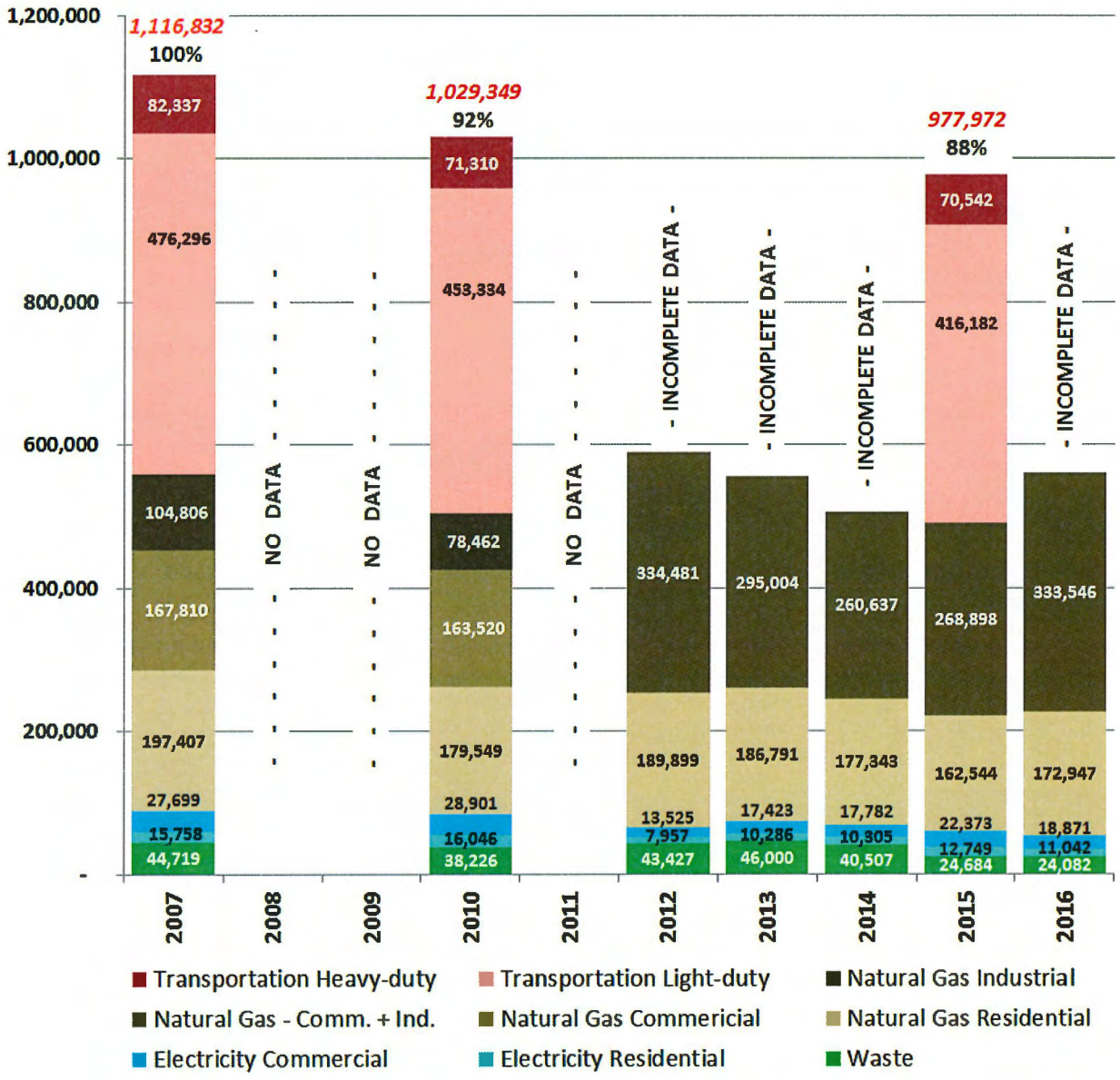
As noted in Attachment 4 below, the City is implementing the *Dike Master Plan*, which provides full protection against 1 metre of sea level rise, and can accommodate up to 1.7 metres of sea level rise. As such, work already underway is sufficient to protect Richmond against projected local sea level rise out to 2100. If climate change is successfully limited to 1.5 °C of global average warming, no further adaption to sea level rise should ever be needed beyond ongoing maintenance of the adaptation already underway.

Climate change is also projected to result in a more rapid snowmelt period earlier in the year, producing an increased risk of flooding during freshet of the Fraser River. This potential impact is also explicitly addressed through the Richmond's *Flood Protection Strategy* and *Dike Master Plan.*

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[1] IPCC, *Impacts of 1.5°C of Global Warming on Natural and Human Systems*. Chapter 3, p.271
[2] IPCC, *Global warming of 1.5°C. Summary for Policymakers*. B2.2, p.9
[3] i.e. downscaled projections of the IPCC's RCP4.5 and RCP8.5 scenarios respectively. This work did not include projections based on the RCP2.5 scenario that results in 1.5 oC of global average warming.
[4] Under the 2°C scenario, the same study estimates the 1% and 0.1% risk of sea level rise as 1.43m and 2.44m respectively, implying that sea level rise in 2100 at the 0.5% or 1-in-200 risk level would be (somewhat less than) 1.93m, likely exceeding the maximum 1.8m increase in dike levels currently allowed for. However, if this magnitude of sea level rise was experienced by 2100, sea level rise would almost certainly continue at a similar pace after 2100, making any additional raising of dike levels useful only for a limited period of time.

Attachment 7: Estimated Richmond community GHG emissions: 2007 – 2016



City of Richmond

Report to Committee

To:	General Purposes Committee	**Date:**	February 26, 2019
From:	David Weber Director, City Clerk's Office	**File:**	01-0105-01/2019-Vol 01
Re:	**Options for an Online Council Member Voting Record**		

Staff Recommendation

That the staff report titled "Options for an Online Council Member Voting Record," dated February 26, 2019, from the Director, City Clerk's Office, be received for information.

David Weber
Director, City Clerk's Office
(604-276-4098)

Att. 7

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Information Technology	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** CJ	**APPROVED BY CAO**

Staff Report

Origin

At the General Purposes Committee of December 3, 2018, the following referral motion was adopted:

> *That staff be directed to examine options and the feasibility for a public registry of City Council member voting records and report back.*

This report responds to this referral and outlines options for Council's consideration.

Analysis

It is commonplace even for very small local governments to publish agendas and minutes online. The City of Richmond was an early adopter of this practice and has been publishing Council and Committee agendas and minutes since January 2000. The minutes comply with all requirements of the *Local Government Act* and the *Council Procedures Bylaw* by recording all motions and final decisions of Council, direction to staff, Council members' attendance or absence, declarations of conflict of interest, pertinent discussion and votes cast on all motions including specifying those voting in opposition. Outside of the Council and Committee minutes, there is currently no other stand-alone City summary of individual Council member votes.

Staff conducted a scan of 80 local government websites in BC and across the country in order to determine if and how municipalities post summary voting data online (Attachment 1). A total of 40 BC and lower mainland local government websites were surveyed. Of those surveyed, every local government publishes agendas and minutes online, and 2 of those local governments, namely Vancouver and Prince George, also create and publish a separate Council member voting record online. Additionally, out of a total of 40 of the largest cities and provincial capitals that were surveyed across Canada, a further 3 cities, namely Toronto, Brampton, and Halifax, were found to publish a separate voting record or summary on their websites in addition to publishing agendas and minutes.

The municipalities that regularly provide a voting summary separate from meeting minutes take varying approaches to compiling and presenting the voting data and offer different features as part of their end product. These differing approaches generally reflect varying levels of resources devoted to the process. A brief description of each city's approach is provided in Attachments 2-6 along with samples of the published voting records. Below is a summary of some of the key differences in approaches and features observed:

- How voting data is captured: Some of the municipalities simply work from the official minutes to glean the voting data for the voting record or summary after the fact. Other municipalities, such as Vancouver, Toronto and Halifax, instead use their meeting audio/visual control systems to capture and collect live voting data at the time of voting. By pressing buttons during the meeting on a control panel, individual Council members can cast their vote on a motion which is then captured and populated into a system that is used to create and display a voting record. This approach requires the appropriate hardware and software to be in place in the meeting room.

- Static documents versus database-driven systems: Some municipalities create a separate static document for the voting summary which simply lists the agenda items along with the individual Council member votes. Other municipalities capture the voting information in a database system which is then used to create or display a dynamic online report. Database-driven systems are typically more flexible in terms of how the information can be accessed and displayed over time, they provide more search and filter options, and can more easily link to related minutes and reports.

- Resources: Depending on the nature of the voting record or summary, a municipality's investment towards providing this service may be modest or significant. Prince George's model, for example, would be fairly modest to implement as it would only require the production of a single document once every two weeks. At the other end of the spectrum, Toronto's investment has been significant in that their online voting record is part of a larger meeting management database system that was developed in-house approximately ten years ago. This system manages all manner of information related to the legislative process including agenda creation, minutes, referral and action tracking, voting records, searching and web publication. The system is used by numerous legislative services staff and the public and is supported by four full-time technical staff to manage the system.

City of Richmond Council Decisions Database

Since approximately 2005, the City Clerk's Office has maintained a database which documents all open Council meeting decisions as presented in official minutes. Information in the Council Decisions Database dates from the year 2000 onwards and is regularly kept up-to-date. Using a web-based interface, users can search the database by multiple fields such as subject, keyword and date. Once a search result is obtained, users can link directly from the database search results list to the relevant minutes and reports on the City website. Over the years, the database has grown in scope and has become a significant tool for staff for records management and research.

Initially, the database was used only by staff in the City Clerk's Office to assist with research requests. However, a few years ago, after the addition of a more user-friendly search screen, the database was made available to all City staff as a self-serve research tool through the City intranet. Over the last year, staff have been working towards making the database available to the public on the City website, with a potential public launch of the system by mid-2019.

The database significantly enhances access to the vast store of information found in minutes and reports on the City website that document the Council decision-making process over the last 19 years. Once launched, the Council Decisions Database will provide an enhanced level of service to the public and will support transparency of government and improve access to information. This enhanced level of service will support and make all of the options outlined below more robust.

Option 1 – Enhanced status quo

Voting information is a required element and is already included in official municipal minutes. Every recorded motion indicates whether it is carried or defeated and includes the names of individual Council members who may have voted in opposition. Minutes of Council and

Committee meetings have been readily available online and in the public domain since January 2000 and provide a comprehensive voting record for all motions and resolutions.

While it may currently be challenging to search for a specific item out of 19 years of minutes and reports, the soon to be launched Council Decisions Database (available mid-2019) will significantly enhance the public's ability to research Council decisions, reports to Council and voting information as recorded in minutes.

There is no additional financial impact to implementing Option 1.

Option 2 – Voting Record created as a static document

A separate voting record could be produced after each meeting in the form of a simple word-processed, excel or pdf document, similar to the Prince George voting record. As a static stand-alone document, there would be little to no ability to search or filter results, and there would be no ability to dynamically display the information. Over time, static stand-alone voting record documents would become very lengthy and numerous and challenging to navigate.

Staff recommend that if voting information were provided separately under this option, that it only be made available on a "go-forward" basis (starting with the beginning of the current Council term) and that the scope of the available records would cover decisions made at Council meetings and Public Hearings.

There would be no additional start-up cost to creating and publishing static stand-alone voting record documents following each meeting. There would be some ongoing staffing impact since the creation of the voting record documents would require some effort on the part of staff following each meeting, however, it is anticipated that this task could be reasonably incorporated into current workloads. Implementation could proceed forthwith.

Option 3 – Voting Record built as an add-on to an existing City database

It would also be feasible to create a separate voting record or voting summary by building new functionality into the Council Decisions Database. The vendor of the Council Decisions Database software has indicated that this functionality could be reasonably added to the current system and would work in conjunction with the existing body of work in the database, thus avoiding duplication of effort if a separate stand-alone record were to be implemented. A voting record provided in this manner would function similarly to that seen in the Vancouver model and would provide various search, filtering and display features. Links to the minutes and reports would also be possible.

Staff recommend that if voting information were provided separately under this option, that it only be made available on a "go-forward" basis (starting with the beginning of the current Council term) and that the scope of the available records would cover decisions made at Council meetings and Public Hearings.

A voting record provided as an add-on to Richmond's existing Council Decisions Database would have an estimated start-up cost under $10,000. There would be some ongoing staffing impact since entering the voting data into the database following each meeting would require some effort on the part of staff, however, it is anticipated that this task could be reasonably incorporated into current workloads. Implementation would occur by mid-2019 with the launch of the Council Decisions Database.

Option 4 – Voting Record built on live voting data

Several of the municipalities that provide a separate voting record, including Vancouver, Toronto and Halifax, capture the voting data using a live voting feature that is built into their respective meeting room control systems. To illustrate, during a meeting when the question is called on a motion, Council members are asked to press voting buttons on a control panel, the results of which are displayed on a screen and are automatically captured into a database system. This data is later used as the source to display an online voting record. Online voting records created using this type of system typically include search and filter capabilities and flexible online reporting.

The City of Richmond does not have a voting component as part of the current Council Chambers audio/visual meeting control system, although the original system was capable of displaying voting information on the Council Chamber screens. In order to display and capture live voting data in the same manner as Vancouver, Toronto and Halifax, and then to provide an online voting record, software modifications would be required to the current Council Chambers system at a one-time estimated cost of $44,000.

This option would require a significant change to the existing meeting procedures in that voting would no longer be conducted by a show of hands, but instead, voting would be conducted using technology to tabulate, display and record voting results.

Although staff recommend that voting records be provided only for Council decisions made at Council meetings and Public Hearings on a "go-forward" basis, if Council directed that the same functionality also be provided for Committee meetings, then the Anderson Room would have to be equipped with the appropriate hardware and software (similar to the Council Chambers system) at a further estimated cost of $32,000 or, alternately, the Committee meetings would have to be held in the Council Chambers.

If Council's preference were Option 4, the next steps would be to better define the scope of work for the necessary system upgrades, including any potential OBI (ongoing budget impact) and to submit a capital request as part of the 2020 budget cycle.

Table 1: Summary of Options and Features

	Option 1 (Enhanced status quo)	Option 2 (Voting Record created as a static document)	Option 3 (Voting Record as add-on to City database)	Option 4 (Voting Record built on live voting data)
Minutes and Reports Available Online (minutes include voting information)(already existing)	✓	✓	✓	✓
Enhanced search capability using new Council Decisions Database (starting mid-2019)	✓	✓	✓	✓
Separate Voting Record in addition to official minutes		✓	✓	✓
Ability to search and filter voting data			✓	✓
Additional cost – one-time (with possible OBI for Option 4)			✓ (Under $10,000)	✓ ($44,000 - $76,000)
Changes to meeting procedures required				✓

Financial Analysis

There is no direct financial impact for Option 1 or Option 2.

The financial impact of implementing Option 3 would be under $10,000 and could be funded from Council Contingency.

The financial impact of Option 4, which would require significant software and hardware upgrades in the Council Chambers (and potentially in the Anderson Room) would be estimated to cost from $44,000 to $76,000. If Option 4 is the preferred option, a capital project request, including any potential OBI (operating budget impact), would be submitted for consideration as part of the next budget process. However, if Council wished to proceed with Option 4 prior to the next budget process, staff could suggest alternate funding sources such as Council Contingency.

Financial Impact

None.

Conclusion

There are a number of options available should Council decide to implement a separate Council member voting record. Option 1 (Enhanced Status Quo) will leverage the mid-2019 launch of the Richmond Council Decisions Database. This Database will offer a new and robust search tool that will assist the public in navigating through the official minutes and reports considered by Council over the last 19 years. The database supports transparency of the Council decision-making process and provides enhanced access to information found in the minutes. The official minutes provide a complete record and full wording of every resolution along with the voting information for each motion as required by law.

The Council Decisions Database will also support and provide an enhanced level of service in conjunction with all of the options outlined in this report. Options 2, 3 and 4 outline levels of service whereby a further additional voting record is made available that summarizes how individual Council members vote on resolutions. The difference between Options 2, 3 and 4 is the cost, the flexibility and strength of the search and display features, and the way in which the voting data is captured.

In Option 2 (the static document model), the voting data is taken from the minutes, the cost is negligible, but the search and display features are limited. In Option 3 (building a voting record by adding new functionality to the Council Decisions Database), the voting data is also taken from the minutes, the start-up cost is under $10,000, and the search and display features would be flexible and similar to Vancouver's online voting record. In Option 4, the voting data would be captured live using a new push-button voting display system, the cost of which is estimated at $44,000 to upgrade the Council Chambers or $76,000 to upgrade the Chambers and the

Anderson Room meeting control systems. Option 4 would also have flexible search and display features and would have the ability to provide an online voting record with similar features to Vancouver's and similar to that described in Option 3.

David Weber
Director, City Clerk's Office
(604-276-4098)

Att. 1: Online Voting Record – Scan of 80 Local Government Websites
2: City of Vancouver - Council Voting Record
3: City of Prince George - Council Voting Summary
4: City of Brampton - Recorded Vote Summary
5: City of Halifax - Council Voting Report
6: City of Toronto – Council Voting Record Data Set
7: City of Richmond - Council Decisions Database

Online Voting Record – Scan of 80 Local Government Websites

BC and Lower Mainland Local Governments
Larger Canadian and Other Select Local Governments

A scan of other local government websites was undertaken to determine:

- Which local governments publish **agendas** online
- Which local governments publish **minutes** online
- Which local governments publish an additional **voting record** online

Findings:

- All local governments surveyed publish minutes and/or agendas online.
- **5 out of 80** local governments surveyed publish an additional voting record online.

BC and Lower Mainland Local Governments	Publish Agendas?	Publish Minutes?	Publish additional or separate Voting Records?
1. Abbotsford	Yes	Yes	No
2. Anmore	Yes	Yes	No
3. Belcarra	Yes	Yes	No
4. Bowen Island	Yes	Yes	No
5. Burnaby	Yes	Yes	No
6. Chilliwack	Yes	Yes	No
7. Coquitlam	Yes	Yes	No
8. Delta	Yes	Yes	No
9. Harrison Hot Springs	Yes	Yes	No
10. Hope	Yes	Yes	No
11. Kamloops	Yes	Yes	No
12. Kelowna	Yes	Yes	No
13. Kent	Yes	Yes	No
14. Langley (City)	Yes	Yes	No
15. Langley (Township)	Yes	Yes	No
16. Lions Bay	Yes	Yes	No
17. Maple Ridge	Yes	Yes	No
18. Metro Vancouver	Yes	Yes	No
19. Mission	Yes	Yes	No
20. Nanaimo	Yes	Yes	No
21. Nanaimo Reg. District	Yes	Yes	No
22. New Westminster	Yes	Yes	No
23. North Vancouver (City)	Yes	Yes	No
24. North Vancouver (Dist)	Yes	Yes	No
25. Pemberton	Yes	Yes	No

BC and Lower Mainland Local Governments	Publish Agendas?	Publish Minutes?	Publish additional or separate Voting Records?
26. Pitt Meadows	Yes	Yes	No
27. Port Coquitlam	Yes	Yes	No
28. Port Moody	Yes	Yes	No
29. Prince George	Yes	Yes	Yes
30. Quesnel	Yes	Yes	No
31. Richmond	Yes	Yes	No
32. Squamish	Yes	Yes	No
33. Surrey	Yes	Yes	No
34. Vancouver	Yes	Yes	Yes
35. Vernon	Yes	Yes	No
36. Victoria	Yes	Yes	No
37. West Kelowna	Yes	Yes	No
38. West Vancouver	Yes	Yes	No
39. Whistler	Yes	Yes	No
40. White Rock	Yes	Yes	No

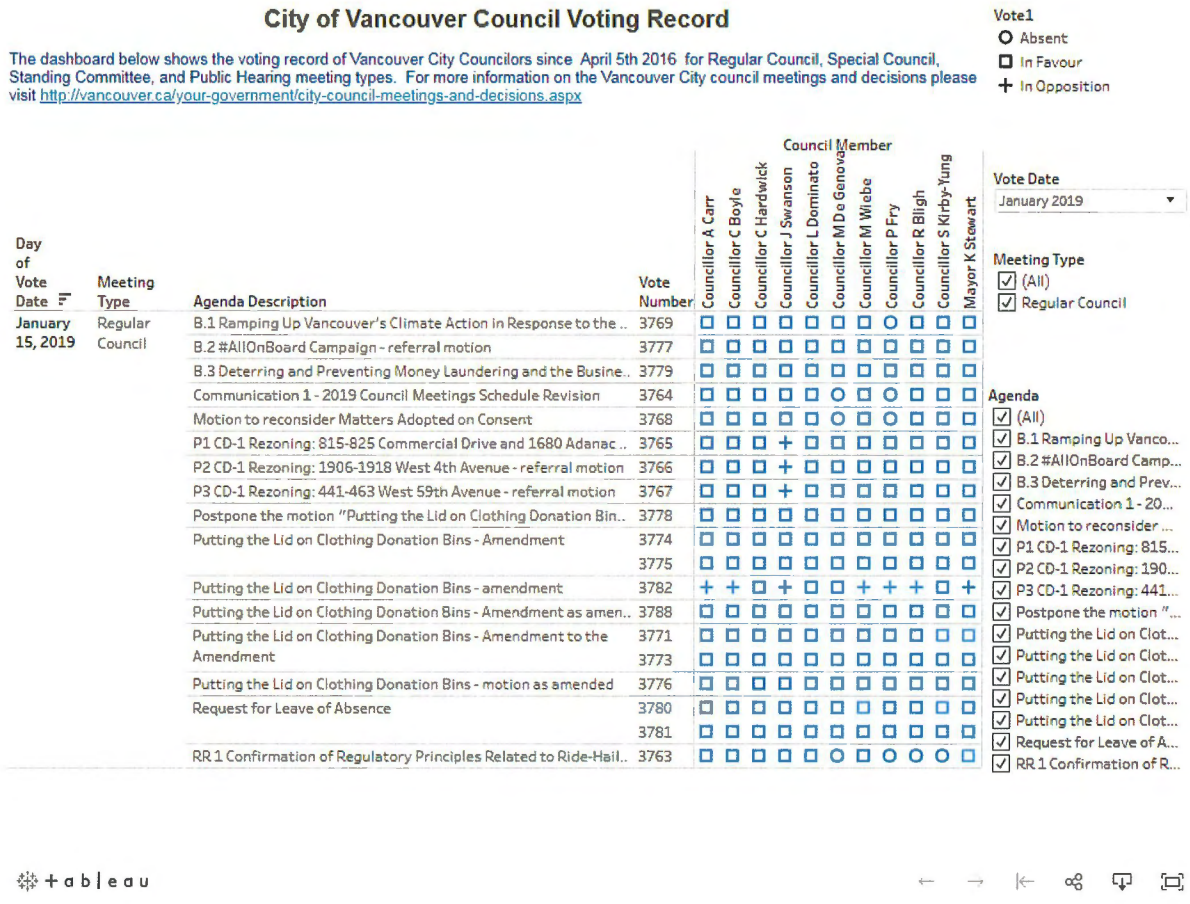
Larger Canadian / Other Select Local Governments	Publish Agendas?	Publish Minutes?	Publish additional or separate Voting Records?
41. Barrie, Ontario	Yes	Yes	No
42. Brampton, Ontario	Yes	Yes	Yes
43. Burlington, Ontario	Yes	Yes	No
44. Calgary, Alberta	Yes	Yes	No
45. Cambridge, Ontario	Yes	Yes	No
46. Charlottetown, PEI	Yes	Yes	No
47. Edmonton, Alberta	Yes	Yes	No
48. Gatineau, Quebec	Yes	Yes	No
49. Greater Sudbury, Ontario	Yes	Yes	No
50. Guelph, Ontario	Yes	Yes	No
51. Halifax, Nova Scotia	Yes	Yes	Yes
52. Hamilton, Ontario	Yes	Yes	No
53. Kitchener, Ontario	Yes	Yes	No
54. Levis, Quebec	Yes	Yes	No
55. London, Ontario	Yes	Yes	No
56. Longueuil, Quebec	Yes	Yes	No
57. Markham, Ontario	Yes	Yes	No
58. Mississauga, Ontario	Yes	Yes	No
59. Montreal, Quebec	Yes	Yes	No

Larger Canadian / Other Select Local Governments (cont.)	Publish Agendas?	Publish Minutes?	Publish additional or separate Voting Records?
60. Oakville, Ontario	Yes	Yes	No
61. Oshawa, Ontario	Yes	Yes	No
62. Ottawa, Ontario	Yes	Yes	No
63. Pointe Claire, Quebec	Yes	Yes	No
64. Portland, Oregon	Yes	Yes	No
65. Quebec City, Quebec	Yes	Yes	No
66. Regina, Saskatchewan	Yes	Yes	No
67. Saint John, New Brunswick	Yes	Yes	No
68. Saskatoon, Saskatchewan	Yes	Yes	No
69. Seattle, Washington	Yes	Yes	No
70. Sherbrooke Quebec	Yes	Yes	No
71. St. Catharines, Ontario	Yes	Yes	No
72. St. John's, Newfoundland	Yes	Yes	No
73. Toronto, Ontario	Yes	Yes	Yes
74. Trois-Rivières, Quebec	Yes	Yes	No
75. Vaughan, Ontario	Yes	Yes	No
76. Whitby, Ontario	Yes	Yes	No
77. Whitehorse, Yukon	Yes	Yes	No
78. Windsor, Ontario	Yes	Yes	No
79. Winnipeg, Manitoba	Yes	Yes	No
80. Yellowknife, NWT	Yes	Yes	No

City of Vancouver

Council Voting Record

- The City of Vancouver began publishing a searchable online voting record in 2016 as part of a broader City-wide open data initiative.
- The voting data is captured and recorded live at the time of voting when Council members press voting buttons that are linked to the Council Chambers a/v meeting control system.
- Council member votes are captured and made available for Regular and Special Council meetings, Standing Committee meetings, and Public Hearings, which are all held in the Council Chambers where the hardware / software for data capture is located.
- The Vancouver Council Voting Record system allows users to download voting data, to filter and display voting data by month, meeting type, agenda items and by Council member.
- Agendas and minutes are available in a separate area on the City of Vancouver's website and are not directly linked to the Voting Record items.



Website: https://vancouver.ca/your-government/council-voting-dashboard.aspx

City of Prince George

Council Voting Summary

- The City of Prince George produces a Voting Summary document following each Council meeting which is published on its website alongside the meeting minutes.
- The summary provides a listing of agenda items and report titles along with the voting data which is taken from the minutes.
- The summary is a stand-alone document and published as a pdf document.
- The individual Voting Record summaries are not linked to one another, they have no search or filtering capabilities and are not directly linked to the meeting minutes.

Regular Council Meeting - March 5, 2018 Council Voting Summary — Page 1

Agenda Item	Description	Mayor Hall	Councillor Everitt	Councillor Frizzell	Councillor Koehler	Councillor Krause	Councillor McConnachie	Councillor Merrick	Councillor Scott	Councillor Skakun	Decision	For/Against Count
A.	ADOPTION OF AGENDA	Yes	Yes	Absent	Yes	Yes	Yes	Yes	Yes	Yes	CARRIED	8 - 0
B.	ADOPTION OF MINUTES											
B.1	Minutes of Regular Council Meeting held February 19, 2018	Yes	Yes	Absent	Yes	Yes	Yes	Yes	Yes	Yes	CARRIED	8 - 0
C.	DELEGATIONS											
C.1	Volunteer Prince George											
C.2	Prince George BMX Supertrak	Yes	Yes	Absent	Yes	Yes	Yes	Yes	Yes	Yes	CARRIED	8 - 0
D.	CONSENT AGENDA											
D.1	Report: Dave Dyer, General Manager of Engineering and Public Works: BMX Track Lighting at Carrie Jane Gray Park	Yes	Yes	Absent	Yes	Yes	Yes	Yes	Yes	Yes	CARRIED	8 - 0
E.	INFORMAL HEARINGS											
E.1	Report: Ian Wells, General Manager of Planning and Development: Development Variance Permit Application No. VP100491 5202 Chief Lake Road (To Approve)	Yes	Yes	Absent	Yes	Yes	Yes	No	Yes	Yes	CARRIED	7 - 1
E.2	Report: Ian Wells, General Manager of Planning and Development: Development Variance Permit Application No. VP100490 3620 Fisher Road (To Approve)	Yes	Yes	Absent	Yes	Yes	Absent	Yes	Yes	Yes	CARRIED	7 - 0
F.	FORMAL PUBLIC HEARING											

Document No. 451190

Sample page from March 5, 2018 City of Prince George Council meeting https://www.princegeorge.ca/City%20Hall/Minutes/2018/March/2018-03-05_Voting_Summary_2018.pdf

City of Brampton

Council Recorded Votes Summary

- The City of Brampton publishes a voting record summary of "*recorded votes*" only.
- Recorded votes are those that, by request of a Council member, are recorded indicating those in favour and those opposed to a motion. Unless a recorded vote is otherwise requested, the minutes would only indicate whether a motion is carried or lost.
- The summary is provided on the website in a pdf format and in a large tabular form online (shown below) which allows for filtering and sorting of results.
- Links to meeting minutes are also provided.

2014-2018 Term of Council Recorded Votes

Last Updated for the Council Meeting held on September 12, 2018.

This page lists recorded votes for City Council and its Standing Committees for the 2014-2018 term. For the official meeting record or questi

This glossary of terms is listed for convenience to help users understand the terminology that has been used in the list of recorded votes.

Council / Committee	Meeting Date	Agenda Item #	Agenda Item Subject
City Council	2014/12/10	N.1	Mayor's compensation
City Council - Special	2014/12/17	D.2	Interim Auditor General
City Council - Special	2014/12/17	D.2	Interim Auditor General
City Council - Special	2014/12/17	D.2	Interim Auditor General
Corporate Services Committee	2015/01/21	H.9	Lobbyist Registry under Sec.223.9
Corporate Services Committee	2015/01/21	H.10	Gift Registry
Community and Public Services Committee	2015/02/04	E.2	Staff Recommended Disapproval of Proposed Fence Encroachment
Corporate Services Committee	2015/02/04	E.1	Prayer at Council Meetings
Corporate Services Committee	2015/02/04	E.1	Prayer at Council Meetings
City Council	2015/02/11	F.3	Lord's Prayer
City Council - Special	2015/04/08	E.1	2015 Operating and Capital Budget

Cont. →

Resolution #	Minute Link	Motion Type	Recorded Vote	Result	Vote Type	Motion Description
-2014	Minute	Adopt item	11-0-0	Carried	Majority	Establish remuneration for Mayor
-2014	Minute	Adopt item	11-0-0	Carried	Majority	Clause 20 - Appointment of Jim McCart
-2014	Minute	Adopt item	11-0-0	Carried	Majority	Clause 21 - Budget for Auditor General
C326-2014	Minute	Adopt item	11-0-0	Carried	Majority	Clause 22 - Terms of reference for Auditor General
CS011-2015	Minute	Adopt item	11-0-0	Carried	Majority	Develop a framework/mechanism to administer Lo
CS012-2015	Minute	Adopt item	11-0-0	Carried	Majority	Develop Gift Registry
CPS013-2015	Minute	Adopt item	4-6-0	Lost	Majority	Instalment of a fence on City-owned land
CS021-2015	Minute	Adopt item	2-9-0	Lost	Majority	Reinstate Lord's Prayer at council meeting on interi
CS022-2015	Minute	Adopt item	9-2-0	Carried	Majority	Call Special Council Meeting to consider prayer at C
C028-2015	Minute	Adopt item	10-0-1	Carried	Majority	Moment of reflection be observed at meetings
C111-2015	Minute	Amend item	10-1-0	Carried	Majority	2015 budget be reduced by $1 million - staffing, wa

Cont. →

Cont. →

Bowman	Dhillon	Fortini	Gibson	Jeffrey	Medeiros	Miles	Moore	Palleschi	Sprovieri	Whillans
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	Yes	No	No	N/A	No	No	Yes	No	Yes	Yes
No	No	No	No	No	No	No	No	Yes	Yes	No
Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Absent	Yes
Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

City of Halifax

Council Voting Report

- Halifax publishes a vote summary for its Council meetings the data for which is captured using a meeting room control system similar to Vancouver's. However, the summary that is produced (sample shown below) is a static document and has no search or filter capabilities.
- The Voting Report summary is published online as a background document along with the meeting video and meeting minutes.

Voting Report

14.6.1 Case 20594 - Amendments to the Municipal Planning Strategy and Land Use By-law for lands at Opportunity Site B, Fall River

Voting Details

Meeting:	Regional Council January 29, 2019
Agenda name:	14.6.1 Case 20594 - Amendments to the Municipal Planning Strategy and Land Use By-law for lands at Opportunity Site B, Fall River
Vote name:	14.6.1 Case 20594 - Amendments to the Municipal Planning Strategy and
Vote subject:	Land Use By-law for lands at Opportunity Site B, Fall River
Vote start:	29/01/2019 15:23:11
Vote stop:	29/01/2019 15:23:55

Total Voting Results

Participants:		
	Present	17
Votes:		
	Yes	15
	No	2

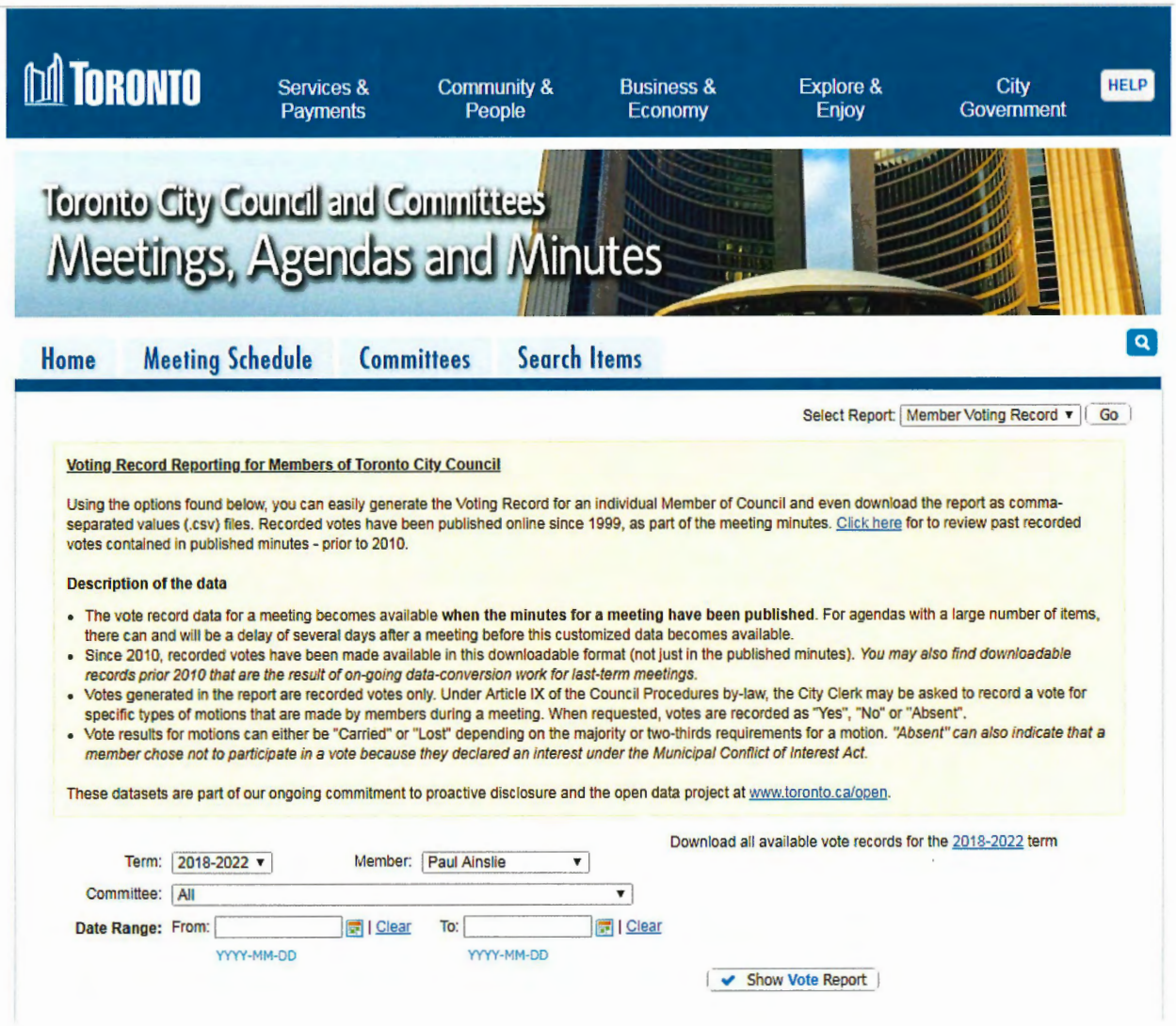
Individual Voting Results

Yes	
Steve Streatch	District 1
David Hendsbee	District 2
Bill Karsten	District 3
Lorelei Nicoll	District 4
Sam Austin	District 5
Waye Mason	District 7
Lindell Smith	District 8
Russell Walker	District 10
Stephen Adams	District 11
Richard Zurawski	District 12
Matt Whitman	District 13
Lisa Blackburn	District 14
Steve Craig	District 15
Tim Outhit	District 16
Mike Savage	Mayor
No	
Shawn Cleary	District 9
Deputy Mayor Mancini	District 6

City of Toronto

Council Voting Record Data Set

- The City of Toronto provides web-based access to their Council member voting records dating back to 2010.
- Accessible through Toronto's open data system, the voting record includes the ability to search by Council term and Council member name. Further filtering by Committee or date range is also possible from the main search screen. Once a result is presented, the system allows the user to sort various information columns.
- Users may also download into Microsoft Excel the voting records for the entire cumulative 2018-2022 term.
- The Voting Record data is a component of a broader more comprehensive legislative services information management system that was developed in-house.
- Links to further information in agendas and minutes are provided



Sample Toronto Voting Record

Download all available vote records for the 2018-2022 term

Term: 2018-2022 ▼ Member: Paul Ainslie ▼

Committee: All ▼

Date Range: From: | Clear To: | Clear

YYYY-MM-DD YYYY-MM-DD

Show Vote Report

Guide to the Data | Download as CSV

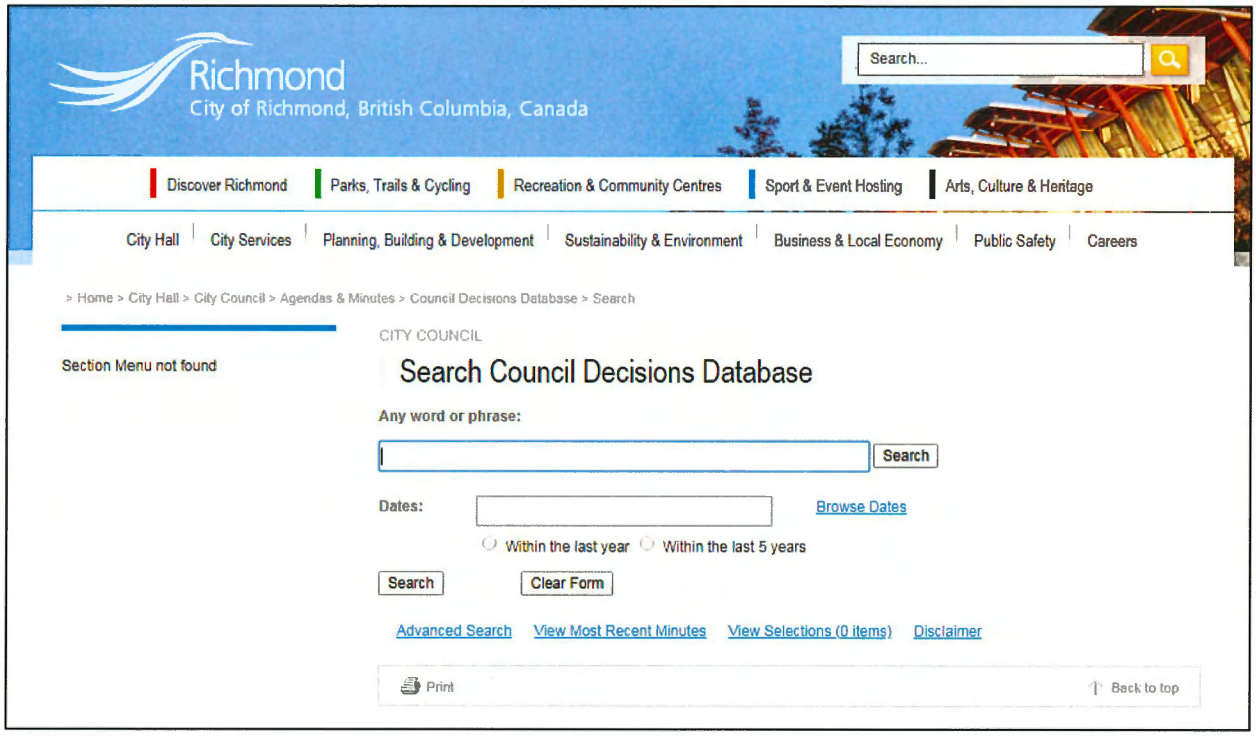
Committee	Date/Time	Agenda Item #	Agenda Item Title	Motion Type	Vote	Result	Vote Description
City Council	2018-12-13 06:37 PM	2019.CC1.4	Provincially-Licensed Cannabis Retail Stores in Toronto	Amend Item (Additional)	No	Lost 10-14	Majority Required - CC1.4 - Cressy- motion 3
City Council	2018-12-13 06:38 PM	2019.CC1.4	Provincially-Licensed Cannabis Retail Stores in Toronto	Amend Item (Additional)	No	Lost (tie) 12-12	Majority Required - CC1.4 - Lai - motion 4
City Council	2018-12-13 06:39 PM	2019.CC1.4	Provincially-Licensed Cannabis Retail Stores in Toronto	Amend Item (Additional)	No	Carried 22-2	Majority Required - CC1.4 - Colle - motion 5a
City Council	2018-12-13 06:41 PM	2019.CC1.4	Provincially-Licensed Cannabis Retail Stores in Toronto	Amend Item (Additional)	No	Lost 11-13	Majority Required - CC1.4 - Matlow - motion 6
City Council	2018-12-13 06:41 PM	2019.CC1.4	Provincially-Licensed Cannabis Retail Stores in Toronto	Amend Item (Additional)	Yes	Carried 23-1	Majority Required - CC1.4 - Fletcher - motion 7
City Council	2018-12-13 06:42 PM	2019.CC1.4	Provincially-Licensed Cannabis Retail Stores in Toronto	Adopt Item as Amended	Yes	Carried 20-4	Majority Required - CC1.4 - Adopt the item as amended
City Council	2018-12-13 07:09 PM	2019.CC1.25	5, 7 and 9 Dale Avenue - Official Plan and Zoning By-law Amendment Applications and Demolition of Three Heritage Properties in	Adopt Item	Yes	Carried 18-4	Majority Required - CC1.25 - Adopt

City of Richmond

Council Decisions Database

- The Council Decisions Database was developed as an internal research tool. Staff have been working over the last year to make the database available to the public on the City of Richmond website. It is anticipated that the database will be ready to launch by mid-2019.
- With close to 12,000 entries in the database covering 19 years of Council minutes and reports the database provides enhanced search capabilities and enables browsing by multiple fields.
- Database users have the ability to save, email, or print out search results for future reference and use.
- The database searches the full text of the minutes and returns results showing resolutions, discussion and Council member voting information.
- Links are provided directly to minutes and reports.

Council Decisions Database Search Screen:



Search Results

Search results initially present an abbreviated list with the option to select "More Details" "View Minutes" and/or "View Report".

CITY COUNCIL

Council Decisions Search Results

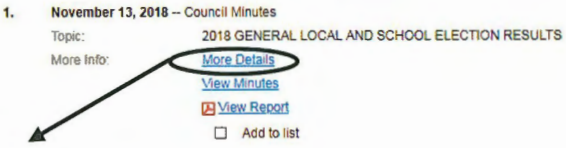
Your search for *election* AND >=@DATE-365* found **11** result(s). Sort: Date Relevance View Selections (0 items)

« First 20 ‹ Previous 20 Next 20 › Last 20 » Revise Search New Search ☐ Select All

1. **November 13, 2018** – Council Minutes
Topic: 2018 GENERAL LOCAL AND SCHOOL ELECTION RESULTS
More Info: More Details
View Minutes
View Report
☐ Add to list

Selecting "More Details"

Selecting "More Details" will provide the complete entry from the official minutes including discussion, the text of the resolution, the result of the vote and the names of those opposed (if any):



CITY COUNCIL

Council Decisions Search Results

Record 1 of 11 View Selections (0 items)

« First ‹ Previous Next › Last » Revise Search New Search Back to search results

November 13, 2018 – Council Minutes

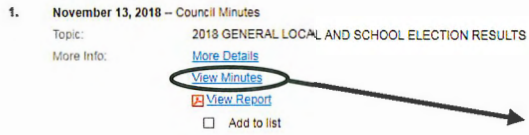
Agenda Item Number:	17
Item Topic:	2018 GENERAL LOCAL AND SCHOOL ELECTION RESULTS
Resolution Number:	R18/19-14
Full Text:	n/a
Resolution:	It was moved and seconded That the Declaration of Official Results for the 2018 General Local and School **Election**, attached to the staff report dated November 1, 2018 from the Chief **Election** Officer, be received for information by Richmond City Council in accordance with the requirement of Section 158 of the Local Government Act.
Outcome:	CARRIED
Related Items by Name:	RICHMOND SCHOOL DISTRICT BOARD
Related Items by Subject:	ELECTIONS - LOCAL | SCHOOL DISTRICTS | COUNCIL

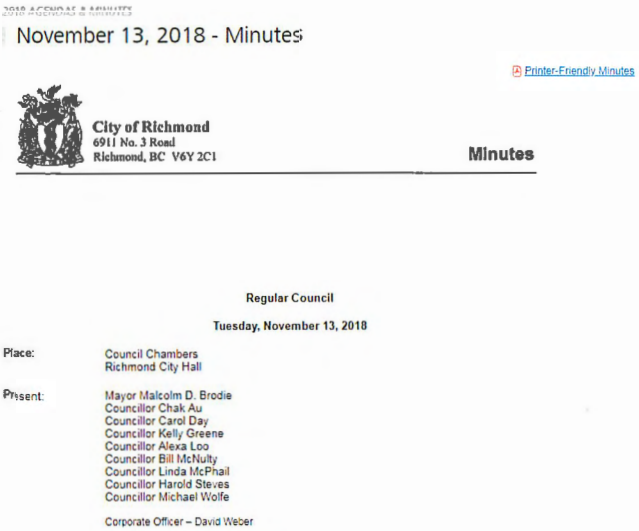
View Minutes
View Report
☐ Add to list
Permalink

« First ‹ Previous Next › Last » Revise Search New Search Back to search results

Selecting "View Minutes"

Selecting "View Minutes" links the user to the minutes web page relevant to that item.




November 13, 2018 - Minutes

Printer-Friendly Minutes

City of Richmond
6911 No. 3 Road
Richmond, BC V6Y 2C1

Minutes

Regular Council

Tuesday, November 13, 2018

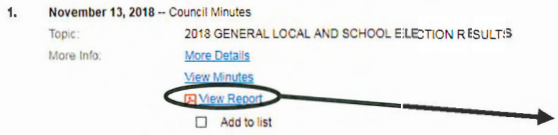
Place: Council Chambers
Richmond City Hall

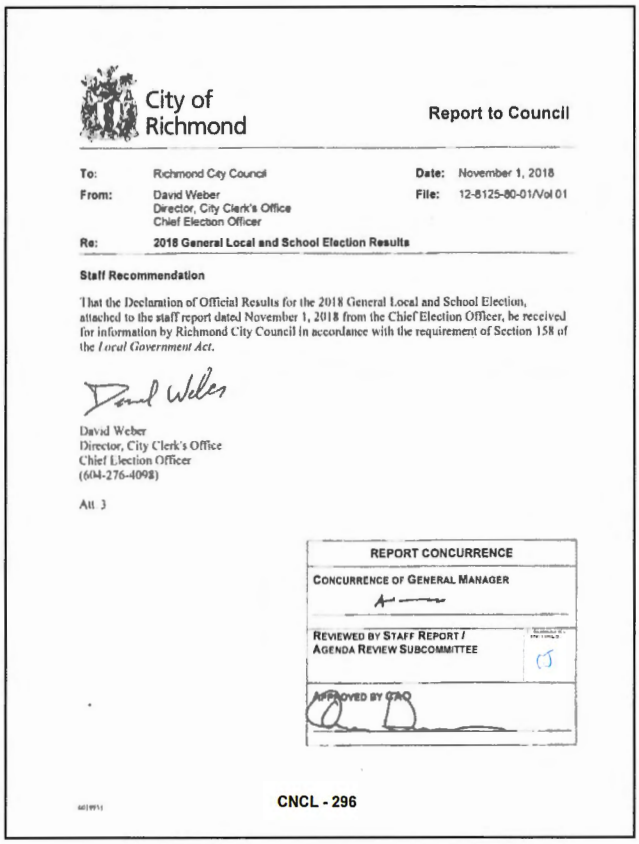
Present: Mayor Malcolm D. Brodie
Councillor Chak Au
Councillor Carol Day
Councillor Kelly Greene
Councillor Alexa Loo
Councillor Bill McNulty
Councillor Linda McPhail
Councillor Harold Steves
Councillor Michael Wolfe

Corporate Officer – David Weber

Selecting "View Report"

Selecting "View Report" links the user directly to the PDF of the report(s) to Council which may then be downloaded as a pdf or printed.




City of Richmond

Report to Council

To: Richmond City Council — Date: November 1, 2018

From: David Weber, Director, City Clerk's Office, Chief Election Officer — File: 12-8125-80-01/Vol 01

Re: **2018 General Local and School Election Results**

Staff Recommendation

That the Declaration of Official Results for the 2018 General Local and School Election, attached to the staff report dated November 1, 2018 from the Chief Election Officer, be received for information by Richmond City Council in accordance with the requirement of Section 158 of the *Local Government Act*.

David Weber
Director, City Clerk's Office
Chief Election Officer
(604-276-4098)

Att. 3

REPORT CONCURRENCE

CONCURRENCE OF GENERAL MANAGER

REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE

APPROVED BY CAO

CNCL - 296

City of Richmond

Report to Committee

To:	Planning Committee	**Date:**	February 22, 2019
From:	Barry Konkin Manager, Policy Planning	**File:**	01-0100-30-HCOM1-01/2019-Vol 01
Re:	**Richmond Heritage Commission 2018 Annual Report and 2019 Work Program**		

Staff Recommendation

1. That the Richmond Heritage Commission 2018 Annual Report, as presented in this staff report, be received for information; and

2. That the Richmond Heritage Commission 2019 Work Program, as presented in this staff report, be approved.

Barry Konkin,
Manager, Policy Planning

Att. 2

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Arts, Culture & Heritage	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** CJ	**APPROVED BY CAO**

Staff Report

Origin

The Richmond Heritage Commission (RHC) was established on May 9, 2005 upon Council approval of Richmond Heritage Commission Bylaw No.7906. The RHC consists of nine members of the public, appointed by Council. Three new members were appointed to the RHC in 2018 for a two-year term to expire on December 31, 2020.

A primary role of the RHC is to provide advice from a heritage perspective to Council, City staff and other stakeholders on issues and projects that impact the heritage value and special character of historic places in Richmond.

In accordance with Richmond Heritage Commission Bylaw No. 7906, this report summarizes the activities of the Commission in 2018 and recommends a 2019 Work Program for consideration and approval by Council.

Summary of 2018 Annual Report

The detailed 2018 Annual Report of the RHC is contained in Attachment 1. Highlights are as follows:

- Reviewed and provided comments on four (4) development proposals affecting or related to the heritage value and special character of Steveston Village and a heritage-designated property.
- Reviewed and provided comments on the Steveston Village Heritage Conservation Area Grant Program.
- Received information and regular updates on various City policies and initiatives.
- Received seven (7) nominations for the annual Richmond Heritage Awards and selected three (3) recipients.
- Provided sponsorship to Doors Open Richmond, Richmond Heritage Fair and the Oral Histories project.
- Continued to work on marketing and communication materials to promote heritage conservation.

Summary of Proposed 2019 Work Program

The detailed 2019 Work Program is contained in Attachment 2. The following is a summary of highlights anticipated for 2019.

- Continue to review and provide recommendations on planning and other proposals related to heritage and heritage conservation, as forwarded to the RHC from staff and Council.
- Participate as a stakeholder in both the Heritage Inventory Update and the Museum Models Evaluation Study.
- Refine the nomination form and evaluation and selection criteria for the 2019 Richmond Heritage Awards, with guidance from staff; Receive nominations and select and honour the winners.

- Continue to provide sponsorship to Doors Open Richmond and Richmond Heritage Fair, as well as the Richmond Museum Society's multi-year Oral Histories Project.
- Continue to participate in staff-led or other workshops to expand and enhance members' knowledge and expertise related to heritage, and pursue other educational opportunities as they arise.

Financial Impact

None.

Conclusion

The RHC's mandates are to advise Council on heritage conservation and promotion matters and to undertake and provide support for activities that benefit and advance heritage in Richmond.

The 2018 Annual Report for the RHC is submitted for information and the 2019 Work Program is recommended for Council approval.

Minhee Park
Planner 2
(604) 276-4188

MP:cas

Attachment 1: Richmond Heritage Commission 2018 Annual Report
Attachment 2: Richmond Heritage Commission 2019 Work Program

2018 ANNUAL REPORT
RICHMOND HERITAGE COMMISSION

Richmond Heritage Commission 2018 Accomplishments		
Projects	**Achieved Outcomes**	**Accomplishments and Comments**
Development Proposals	Provided heritage perspective and advice to Council	• Reviewed and provided comments on a total of four (4) development applications forwarded by staff
Heritage Policy	Provided heritage perspective and advice to Council	• Reviewed and provided comments on the Steveston Village Heritage Conservation Grant Program Update
Richmond Heritage Awards	Received nominations and selected recipients	• Received a total of seven (7) nominations and selected three (3) winners
Richmond Heritage Services and Sites	Received information and helped support and promote the City's services and sites	• Received information from staff on programs, initiatives and projects related to City-owned historic places and museums • Contributed to the Annual Heritage Update publication prepared by the City's Museum and Heritage Services staff
Community Projects	Sponsored and supported community initiatives	• Provided $1,000 in sponsorship to Doors Open Richmond and participated in this event • Provided $2,000 in sponsorship to Richmond Heritage Fair • Provided $350 in sponsorship to the Oral Histories project

List of Applications Reviewed in 2018		
Application No.	**Address of property**	**Application Purpose**
HA 18-804880	12111 3rd Avenue (Steveston Hotel)	To remove the decorative shutters and replace the windows on the upper level
HA 18-818536	3711 and 3731 Chatham Street (Steveston Methodist Church)	To construct a new foundation
HA 18-818781	12111 3rd Avenue (Steveston Hotel)	To add a new storefront door and windows in the front elevation
RZ 17-775892	12011 3rd Avenue (Steveston Courthouse)	To relocate the Steveston Courthouse (identified heritage resource in the Steveston Conservation Area) to the northeast corner of the property and construct a new 3-storey, mixed-use building.

2019 DRAFT WORK PROGRAM
RICHMOND HERITAGE COMMISSION

Richmond Heritage Commission 2019 Draft Work Program		
Projects	**Results Expected**	**Accomplishments and Comments**
Development Proposals	Heritage perspective and advice to Council	• Continue to review and provide recommendations on planning, and other proposals (e.g., public art) in Steveston Village Development Permit Area and Heritage Conservation Area and other heritage properties
Heritage Policy	Heritage perspective and advice to Council	• Participate as a stakeholder in the Heritage Inventory Update
Richmond Heritage Awards	Receive nominations and select recipients	• Continue to review and finalize a nomination form and evaluation and selection criteria under the guidance of staff • Receive award nominations, and select and honour the winners
Richmond Heritage Services and Sites	Receive information and help support and promote the City's services and sites	• Participate in the Museum Models Evaluation Study • Receive information from staff on programs, initiatives and projects related to City-owned historic places and museums
Community Heritage Partners and Projects	Sponsor and support community initiatives	• Provide sponsorship to the Oral Histories Project of Richmond Historical Society, Doors Open Richmond and Richmond Heritage Fair

City of Richmond

Report to Committee

To:	Planning Committee	**Date:**	February 20, 2019
From:	Barry Konkin Manager, Policy Planning	**File:**	01-0100-30-ACEN1-01/2019-Vol 01
Re:	**Advisory Committee on the Environment 2018 Annual Report and 2019 Work Program**		

Staff Recommendation

1. That the Advisory Committee on the Environment 2018 Annual Report, as presented in this staff report, be received for information; and

2. That the Advisory Committee on the Environment 2019 Work Program, as presented in this staff report, be approved.

Barry Konkin
Manager, Policy Planning

Att. 2

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Sustainability	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** CJ	**APPROVED BY CAO**

Staff Report

Origin

The Advisory Committee of the Environment (ACE) was originally formed by Council in 1993. The role of ACE is to provide advice to Council on environmental issues of concern to the community, and to promote effective means to achieve a sustainable environment. This report summarizes the activities of the Committee in 2018 and recommends a 2019 Work Program for consideration and approval by Council. ACE reviewed and endorsed the proposed work program at its meeting held on January 9, 2019.

Summary of 2018 Annual Report

The detailed 2018 Annual Report is contained in Attachment 1. Highlights are as follows:

- Received updates on and supported the Ecological Network Management Strategy and incorporation of Riparian Management Area regulations into the City's Zoning Bylaw.
- Organized and participated in a sustainability best practices tour involving the Alexandra District Energy Utility facility and the City Parks Barn Owl Box Program to increase education and awareness amongst members.
- Received updates from Parks staff on construction and planting activities on the Garden City Lands project.
- Provided City staff with the Committee's ideas on the management of trees in the city.
- In response to ACE member requests, received general information from staff on various initiatives and plans in the city with an environmental component or potential impact.

Summary of the Proposed ACE 2019 Work Program

The detailed 2019 Work Program is contained in Attachment 2. Highlights are as follows:

- Sustainability initiatives, plans and strategies – receive information and provide feedback on the City's Community Energy Emissions Plan (CEEP) and engaging and involving community stakeholders, exploration of wildlife sensitive design guidelines and integrated pest management practices in the City.
- Specific projects of interest to ACE include Garden City Lands construction and program updates, examine the environmental impacts of light pollution and liaise with staff in response to ACE recommendations on the management of trees in the City.
- Education and awareness – Organize a sustainability best practices activity/tour for ACE members to provide opportunities for learning and awareness.
- Information sharing – Provide regular updates and information sharing to both Council and staff liaisons and Committee members.

Financial Impact

None.

Conclusion

The Advisory Committee on the Environment serves an important role in providing advice and guidance to Council on achieving a sustainable environment and promoting awareness on a wide range of environmental issues. The 2018 Annual Report is submitted for information and the 2019 Work Program is recommended for Council approval.

Kevin Eng
Planner 2

KE:cas

Att. 1: Advisory Committee on the Environment 2018Annual Report
2: Draft Advisory Committee on the Environment 2019 Work Program

2018 ANNUAL REPORT
ADVISORY COMMITTEE ON THE ENVIRONMENT

Advisory Committee on the Environment 2018 Accomplishments		
Projects/Initiatives	**Achieved Outcomes**	**Accomplishments and Comments**
Ecological Network Management Strategy	Received information on the strategy and passed a motion to support the strategy	• Environmental Sustainability staff presentation on the Ecological Network Management Strategy to highlight recent accomplishments and outline future initiatives specific to: o green infrastructure and development; o vegetation, habitat and wildlife; o parks and public spaces; and o stewardship and collaboration.
Riparian Management Area Updates	Received information on the Riparian Management Area updates and passed a motion to support the overall approach	• Environmental Sustainability staff presentation on the incorporation of Riparian Management Area regulations (i.e., setbacks) into the City's Zoning and Development Bylaw. • ACE provided feedback to staff reiterating the importance of implementing protection measures for riparian areas to manage development activities around watercourses.
Sustainability Best Practices Activity/Tour	June 20, 2018 – ACE participated in a sustainability best practices tour	• ACE members toured the Alexandra District Energy Utility Facility and viewed the Barn Owl Boxes installed at this location. • ACE members also received a presentation from Parks staff on the City's Barn Owl Box Program. • The tour and event was organized and supported by City staff with the intent of providing ACE members the opportunity to increase their awareness about green infrastructure and/or environmental initiatives in the city. • This committee activity was well received by members.
Trees in the City	ACE endorsement of a memo on the management and regulation of trees across the City.	• ACE members refinement of comments and presentation to a City staff stakeholder group. • Continued dialogue with City staff to follow-up on ideas presented by ACE around the management of trees in the city.
General Information Received	Submission of information to ACE on a variety of sustainability focussed topics and initiatives	• Information received on Public Electric Vehicle (EV) Charging Infrastructure plans within the City of Richmond. • Updates provided specific to the Harvest Power facility (odour issues). • Information was received by ACE members about CN Rail's Pesticide Management Plan in BC, which was forwarded to Environmental Sustainability staff for review. o Resulting accomplishment was Council requesting staff to reach out to engage CN to incorporate integrated pest management approaches and best practices into their plan.
Garden City Lands Project	ACE received construction and programming	• Construction and activity updates presented by Parks staff in relation to the completion of the perimeter trail and landscape plantings that had occurred across the

Advisory Committee on the Environment 2018 Accomplishments		
Projects/Initiatives	**Achieved Outcomes**	**Accomplishments and Comments**
	updates on the project	site. • Programming updates were also provided to specific to the partnership with Kwantlen Polytechnic University in support of their intensive agriculture curriculum.
Information Sharing	Received updates and information from the Council and staff liaisons and other members of the Committee	• Regular updates provided by the Council Liaison and Staff Liaison to ACE.

ATTACHMENT 2

DRAFT 2019 WORK PROGRAM
ADVISORY COMMITTEE ON THE ENVIRONMENT

Advisory Committee on the Environment Draft 2019 Work Program	
Projects/Initiatives	**Objectives and Deliverables**
Parks Department – Projects and Plans	• Garden City Lands project construction and programming updates to be provided by Parks staff. • Provide comments and feedback on the development of general Parks related projects, initiatives and programs when requested.
Community Energy and Emissions Plan and Climate Change	• Receive up-to-date information on the City's Community Energy Emissions Plan (CEEP) from Environmental Sustainability. • Provide ideas around education, public awareness and opportunities to engage and involve community stakeholders.
Exploration of Wildlife Sensitive Design Guidelines	• Committee members and Environmental Sustainability staff to develop a project scope. • With the support of City staff – Present information on wildlife sensitive design examples to understand cases of best practices in Metro Vancouver.
Pesticide Restrictions and Integrated Pest Management Practices	• Receive information and updates from Environmental Sustainability staff on current City initiatives to manage and restrict the application of pesticides and the City's Invasive Species Action Plan (ACE to provide feedback on initiatives and projects). • Integrated Pest Management Practices in the City – Provide feedback on initiatives.
Examine the Impact to the Environment from Light Pollution	• Examination of the issue of light pollution, including developing a project scope by ACE, with support from City staff. • Potential areas to explore include examining excessive artificial light and negative impacts to natural habitat areas and to people.
Trees in the City	• In response to ACE's ideas on the management of trees in the city. o Through the staff liaison, coordinate follow-up with other City staff. o Provide feedback and comments on proposed initiatives.
Sustainability Best Practices Activity/Tour	• Organizing an activity and/or tour intended for ACE members with a focus on sustainable best practices in action. o Provides an opportunity for learning and awareness. • The staff liaison will be a resource to help organize the activity in consultation with ACE.

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	February 21, 2019
From:	Lloyd Bie, P.Eng. Director, Transportation	**File:**	01-0154-04/2019-Vol 01
Re:	**TransLink Transit Network Review - Forthcoming Consultation**		

Staff Recommendation

1. That TransLink's proposed transit network changes, as described in the attached report titled "TransLink Transit Network Review - Forthcoming Consultation" dated February 21, 2019 from the Director, Transportation, be endorsed for the purpose of public consultation.

2. That staff be directed to report back on the results of the public consultation and TransLink's final decisions regarding the proposed service changes.

Lloyd Bie, P.Eng.
Director, Transportation
(604-276-4131)

Att. 4

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Economic Development Policy Planning	☑ ☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

TransLink regularly undertakes a Transit Network Review to identify proposed changes to bus routes throughout the region. Proposals emerge through:

- TransLink's ongoing monitoring of the network,
- Phase Two Investment Plan projects that require more refined analysis and planning, and
- recommendation of the Southwest Area Transport Plan (SWATP). The SWATP was approved in April 2018 and is a blueprint for how TransLink can best allocate its resources over the next decade to improve transportation in the southwest area (Richmond, south Delta and Tsawwassen First Nation) in response to local needs and consistent with regional objectives.

This report outlines the proposed transit network changes for Richmond bus routes that will be the focus of regional and Richmond-specific public consultation to be undertaken by TransLink in April 2019.

Analysis

Transit Network Review

The Transit Network Review process identifies projects region-wide that deliver on existing plans and address emerging areas of transit demand. As shown in Figure 1, the current proposed projects are planned for implementation beginning in late 2019 through 2021 pending the outcome of public feedback.



Figure 1: Timeline for Transit Network Review

The proposals fall into two broad categories:

- *Phase Two Bus Expansion*: The refinement of projects from TransLink's Phase Two Investment Plan as well as services to new areas that require more detailed planning; and

- *Network Adjustments*: Cost-neutral changes encompassing proposals from previous Area Transport Plans that require further consultation, and changes to routes to address emerging issues or to make the network more efficient.

Region-wide, up to 21 proposals in total are being considered for Vancouver, Richmond, Surrey/White Rock, the North Shore, Burnaby/New Westminster, and Port Coquitlam.

Proposals for Richmond Bus Routes

The proposed route changes in Richmond are bundled into four projects as described below.

407 Bridgeport-Gilbert

The 407 currently travels between Steveston and Richmond-Brighouse Station, via Steveston Highway and Gilbert Road, and then carries on to Knight Street-Marine Drive via Garden City Road and Bridgeport Road. As recommended in the SWATP, the proposal would split the route at Bridgeport Station and introduce routing changes to the resulting western and eastern services (Attachment 1).

The western route would continue on Gilbert Road to Lansdowne Road and Garden City Road to Bridgeport Station, thus stopping at Lansdowne Station instead of Richmond-Brighouse Station. The eastern route would still operate between Bridgeport Station and Knight Street-Marine Drive but would now travel on Vulcan Way and No. 6 Road to provide all day service to this area that currently has peak period service only. Table 1 provides a summary of the benefits and trade-offs of the proposal vis-à-vis the current service.

Table 1: Benefits and Trade-offs of 407 Proposal

Category	Benefits	Trade-offs
Splitting the Route	• Improves reliability, as the length of the current route is relatively long • Allows service to better match demand in each section	• Passengers travelling between south Richmond and beyond Bridgeport Station must transfer • Impacts daily average of 25 northbound and 28 southbound passengers (1% of daily average boardings)
Western Route	• New service along Lansdowne Road in response to requests • Improved transit access to Oval area (new bus stop is 500 m closer) • New direct service between Steveston and Kwantlen Polytechnic University • Reduced bus circulation around Richmond-Brighouse Station	• No direct connection to Richmond-Brighouse Station and Richmond Centre o Alternative Options: – Transfer at Lansdowne Station – Use 401/402/406 from Steveston
Eastern Route	• Improved service frequency from peak period to all day for industrial employment area on Vulcan Way and No. 6 Road	• None

The proposed route realignment would bring transit coverage to new areas of the city in response to customer requests for service and increased service frequency to existing areas of growing demand. Although some passengers may need to transfer depending on their origin-destination, the numbers of impacted passengers are either very low or alternative direct routes are available.

404 Brighouse Stn-Four Road / 405 Cambie-Five Road / 416 East Cambie-Brighouse Stn

The 404 currently operates between Richmond-Brighouse Station and Riverport via No. 4 Road. The 405 currently travels between Riverside Industrial Park and Richmond-Brighouse Station, via No. 5 Road and Westminster Highway, and then carries on to Knight Street-Marine Drive via Cambie Road, Viking Way and Bridgeport Road. The 416 currently operates during weekday

peak periods only between Richmond-Brighouse Station and the Crestwood business park on No. 6 Road.

As recommended in the SWATP, the following changes are proposed for the three routes (Attachment 2):

- 404: Realigned to provide increased service to Riverside Industrial Park in response to growing demand. The 404 would also terminate at Riverside Industrial Park instead of Riverport, which is already served by the 403, 408 and 413.
- 405: Realigned to contribute to an overall simpler and more efficient grid network as well as to serve new neighbourhoods in the east Cambie and Bridgeport areas in response to requests. The service would terminate at Bridgeport Station, rather than Richmond-Brighouse Station, and the connection to Knight Street-Marine Drive would be eliminated as current utilization is only 12% of capacity (per TransLink data) and the service would be redundant with the 407.
- 416: Realigned so that transit service is still provided on some roadway sections that previously were served by the 405. The connection to the Crestwood business park would be eliminated as the location is already served by the 410 along No. 6 Road.

Table 2 provides a summary of the benefits and trade-offs of the proposal vis-à-vis the current services.

Table 2: Benefits and Trade-offs of 404 / 405 / 416 Proposal

Route	Benefits	Trade-offs
404	• Increased service frequency to Riverside Industrial Park	• Passengers destined for Riverport must transfer o Alternative Options: – Take 403 or 408 from City Centre – Transfer at Ironwood
405	• New service coverage for residential areas on No. 5 Road north of Westminster Hwy • New service coverage for residential areas in north Bridgeport area • Increased service frequency to Riverside Industrial Park • More direct route connection between Canada Line and Ironwood	• Removes northbound service from two bus stops on Kwantlen St for Kwantlen Polytechnic University o Alternative Options: – 430 from Richmond-Brighouse – 407 from Bridgeport • No direct connection to Richmond-Brighouse Stn o Alternative Options: – 404 or 408 from Ironwood area – Transfer to 410 or 416 at Cambie Road from along No. 5 Road • Removes service from 4 bus stops on Westminster Hwy between No. 4 Road and No. 5 Road (average of 11 daily boardings/alightings or less than 1% of total daily average boardings) • Removes service from 5 bus stops on Viking Way (average of 104 daily boardings or 9% of total daily average boardings) o 50-400 m (1-6 min walk) to nearest alternate bus stops

Route	Benefits	Trade-offs
416	• New service coverage on No. 4 Road north of Westminster Hwy	• Removes service from 2 bus stops within Crestwood business park (average of 200 daily boardings or 60% of total daily boardings) o 250 m (4 min walk) to nearest alternate bus stop with all day service at higher frequency

Overall, the proposed route realignments would bring transit coverage to new areas of the city and increased service frequency to existing areas of growing demand. Although some passengers would need to transfer and/or walk further depending on their destination, the numbers of impacted passengers are either relatively low or alternative routes would be within walking distance that offer increased service frequency.

NightBus: N10 Brighouse Station-Downtown / N15 Cambie-Downtown

The N10 currently operates between Richmond-Brighouse Station and downtown Vancouver via YVR between 1:00 am and 3:00 am. As a result, there is a gap in service to YVR between 3:00 am and the first Canada Line train at 5:00 am. The N15 currently operates within Vancouver between Marine Drive Station and downtown Vancouver.

As part of the Phase Two bus expansion and as recommended in the SWATP, the N15 would be extended from Marine Drive Station to YVR and its operating hours extended to close the gap in service (Attachment 3). The N10 would continue to operate between Richmond-Brighouse Station and downtown Vancouver but would no longer serve YVR. Table 3 provides a summary of the benefits and trade-offs of the proposal vis-à-vis the current services.

Table 3: Benefits and Trade-offs of N10 / N15 Proposal

Route	Benefits	Trade-offs
N10	• Faster and more direct service between Richmond-Brighouse Station and downtown Vancouver	• Passengers destined for YVR from Richmond must transfer at Bridgeport Station (daily average of 2 passengers)
N15	• Extended operating hours to YVR to provide complete coverage when Canada Line not operational • More consistent and legible grid service	• None

Staff have asked TransLink to ensure that the schedules of the N10 and N15 include a timed transfer point at Bridgeport Station so that passengers switching between the two services have a minimal waiting period.

408 Ironwood/Riverport-Brighouse Station

The 408 currently operates between Richmond-Brighouse Station and Riverside Industrial Park via Garden City Road, Williams Road and No. 5 Road. Evening and weekend trips extend to Riverport. Part of the route includes a one-way deviation via King Road and Seacote Road for westbound trips only.

To improve route consistency and legibility with a grid network, the 408 is proposed to remain on Williams Road in both directions and would no longer travel along King Road-Seacote Road for westbound trips (Attachment 4). Table 4 provides a summary of the benefits and trade-offs of the proposal vis-à-vis the current service.

Table 4: Benefits and Trade-offs of 408 Proposal

Benefits	Trade-offs
• More direct and easily understood service • Faster travel time for passengers moving through this section of the route	• Removes service from 3 bus stops • Impacts daily average of 198 passengers boarding and 32 passengers alighting (2% of total daily average boardings) • Alternative Options: o 350-600 m (5-9 min walk) to 408 bus stops o 70-350 m (1-5 min walk) to 405 bus stops

The proposal would retain the service on an arterial road rather than a local road through a neighbourhood. While a small proportion of passengers would be required to walk to alternative bus stops, all of the stops are within a 10 minute walk along existing sidewalks or pathways.

Public Engagement

TransLink intends to undertake public consultation in April 2019 to both inform and gather feedback from customers and stakeholders who are directly and indirectly affected by the proposed changes to the transit network. The process will seek to gather public feedback regarding:

- connections to community activity centres,
- bus stop locations,
- impacts on existing customers and residents, and
- service design considerations including service span and minor adjustments to the schedules and/or routes.

Identified stakeholder groups in Richmond include Kwantlen Polytechnic University students, Riverside Industrial Park and Vulcan Way businesses, residents of No. 5 Road, River Drive and in the Oval Village area, Richmond School District, and YVR employees.

TransLink will consider the feedback and, where appropriate, utilize it to refine the changes. A variety of techniques will be used to reach and engage the public:

- Delivery of postcards to homes and emailed to community groups and businesses in the areas with proposed changes;
- Advertisement of the engagement online and in print to encourage broad participation;
- An online survey for the duration of the engagement period to gather detailed feedback;
- Provision of paper surveys and drop boxes at key community locations, for those without access to the internet, or who prefer to complete the survey in hard copy;
- Hosting in-person public engagement sessions and transit operator sessions during the engagement period; and
- Consultation with municipal staff and elected officials on the proposed service changes throughout the process.

TransLink will attend the March 20, 2019 meeting of the Public Works and Transportation Committee to answer any questions of the Committee. Additional activities to be held in Richmond during the primary consultation period of April 2-18, 2019 include:

- Richmond-Brighouse Station Pop-up Event: TransLink's street team to distribute postcards directing recipients to the online survey. Date is to be determined but likely April 13th.
- Richmond City Centre Pop-up Information Session: location and date to be determined. Potential locations include Richmond Olympic Oval or Kwantlen Polytechnic University.
- City Capital Projects Open House: TransLink will provide material for the City's annual capital projects open house to be held April 17, 2019 at City Hall that will direct attendees to the online survey.

The City will support TransLink's public engagement process with promotion of the online survey and the open house event in Richmond via the City's social media channels. Staff have suggested to TransLink that the mail delivery of postcards target the following groups: residents along King Road and Seacote Road (regarding the 408 proposal) and institutions along No. 5 Road (regarding the 405 proposal).

Next Steps

Staff would report back on the outcome of the public consultation and how TransLink considered the feedback, along with other technical information, regarding its final decisions to implement, modify, or defer the service changes.

Financial Impact

None.

Conclusion

TransLink will be undertaking public consultation in April 2019 on a number of proposed transit network changes for Richmond that would expand bus service to new areas, realign routes to address emerging issues or make the network more efficient. The proposed changes are consistent with TransLink's Southwest Area Transport Plan approved by Council in March 2018. Staff would report back outcome of the consultation with further details of the finalized service changes.

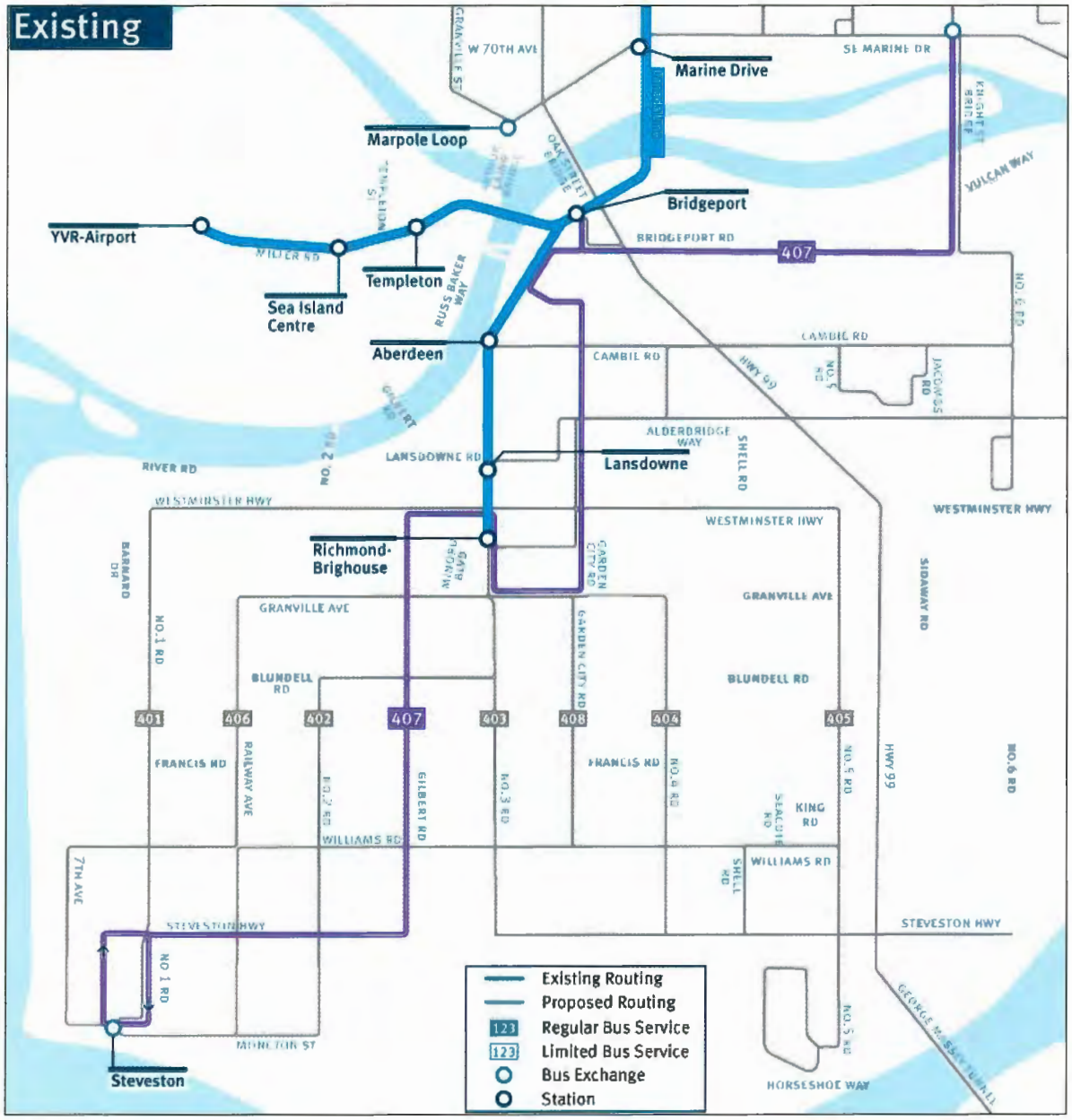
J Caravan

Joan Caravan
Transportation Planner
(604-276-4035)

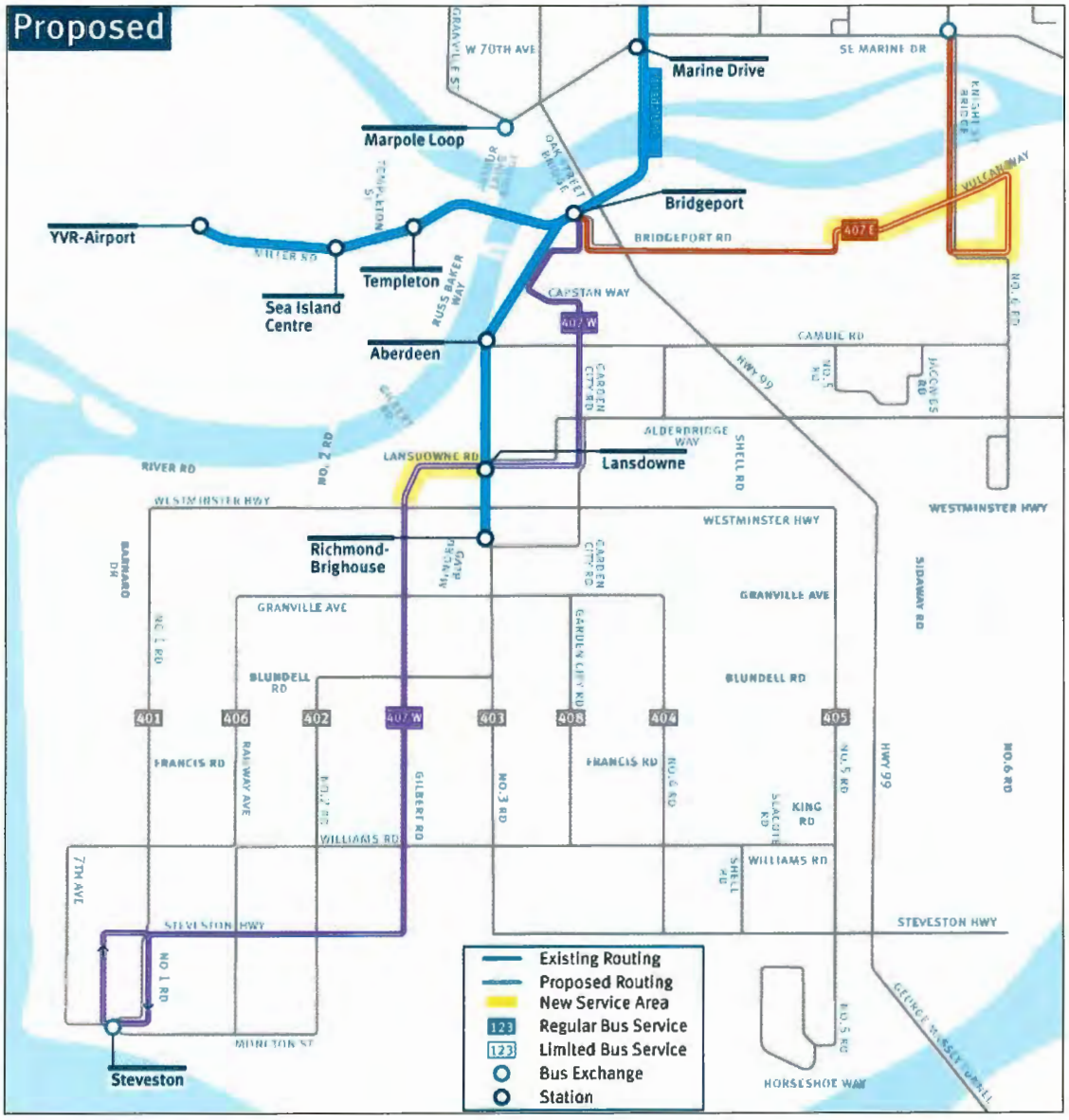
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Att. 1: 407 Bridgeport-Gilbert Proposal
Att. 2: 404 Brighouse Station-Four Road / 405 Cambie-Five Road / 416 East Cambie-Brighouse Station Proposal
Att. 3: N10 Brighouse Station-Downtown / N15 Cambie-Downtown Proposal
Att. 4: 408 Ironwood/Riverport-Brighouse Station Proposal

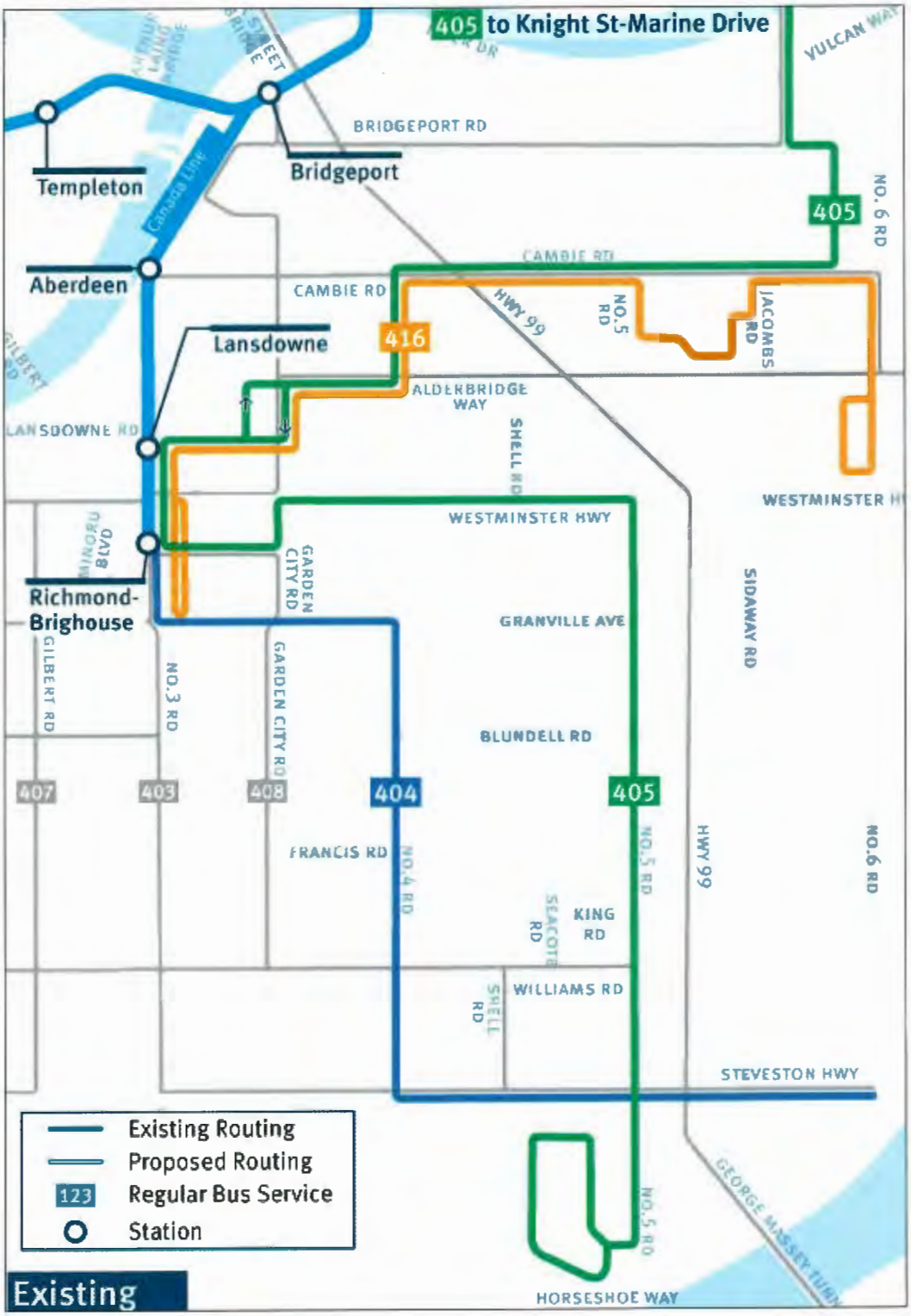
407 Bridgeport-Gilbert Proposal



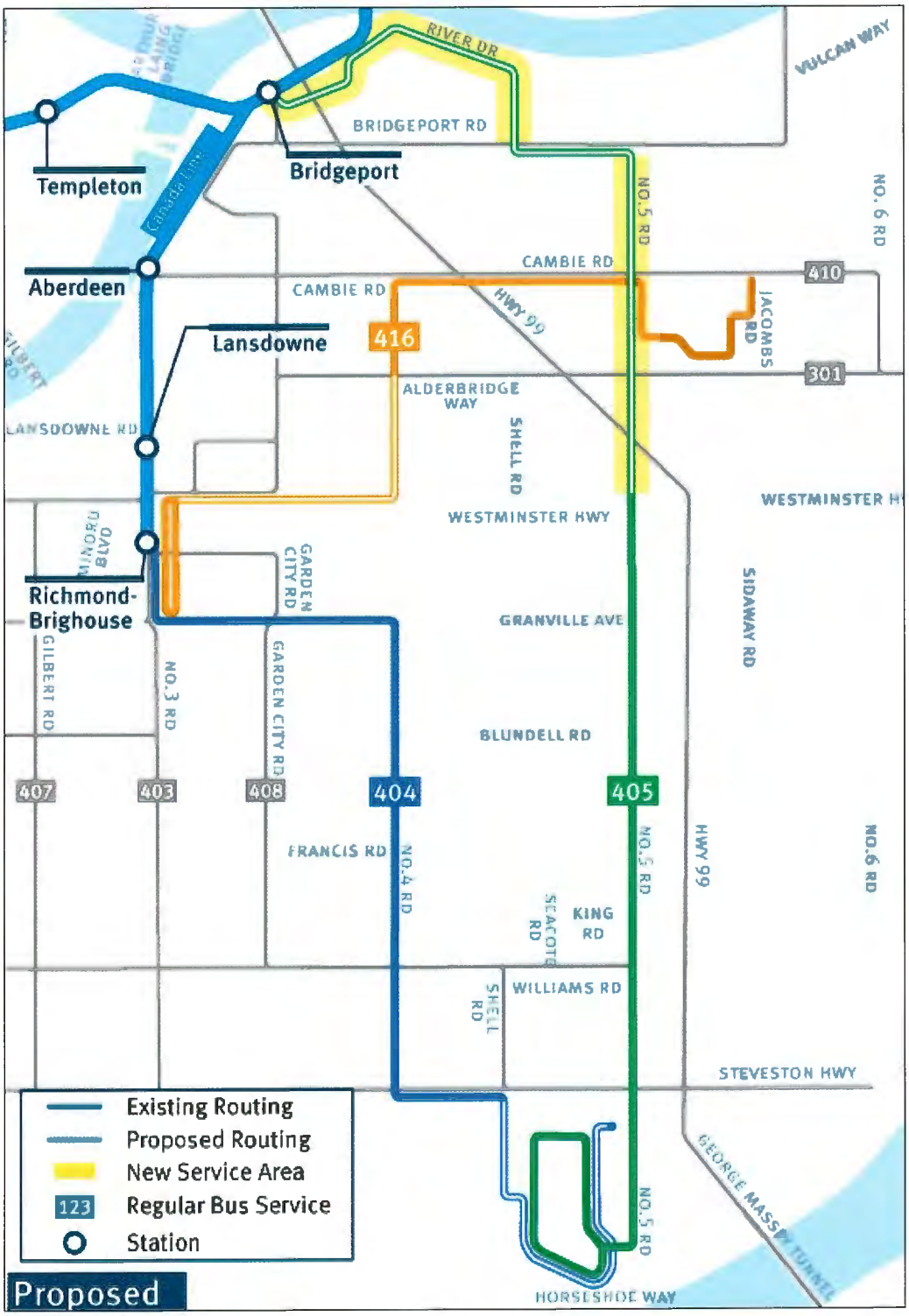
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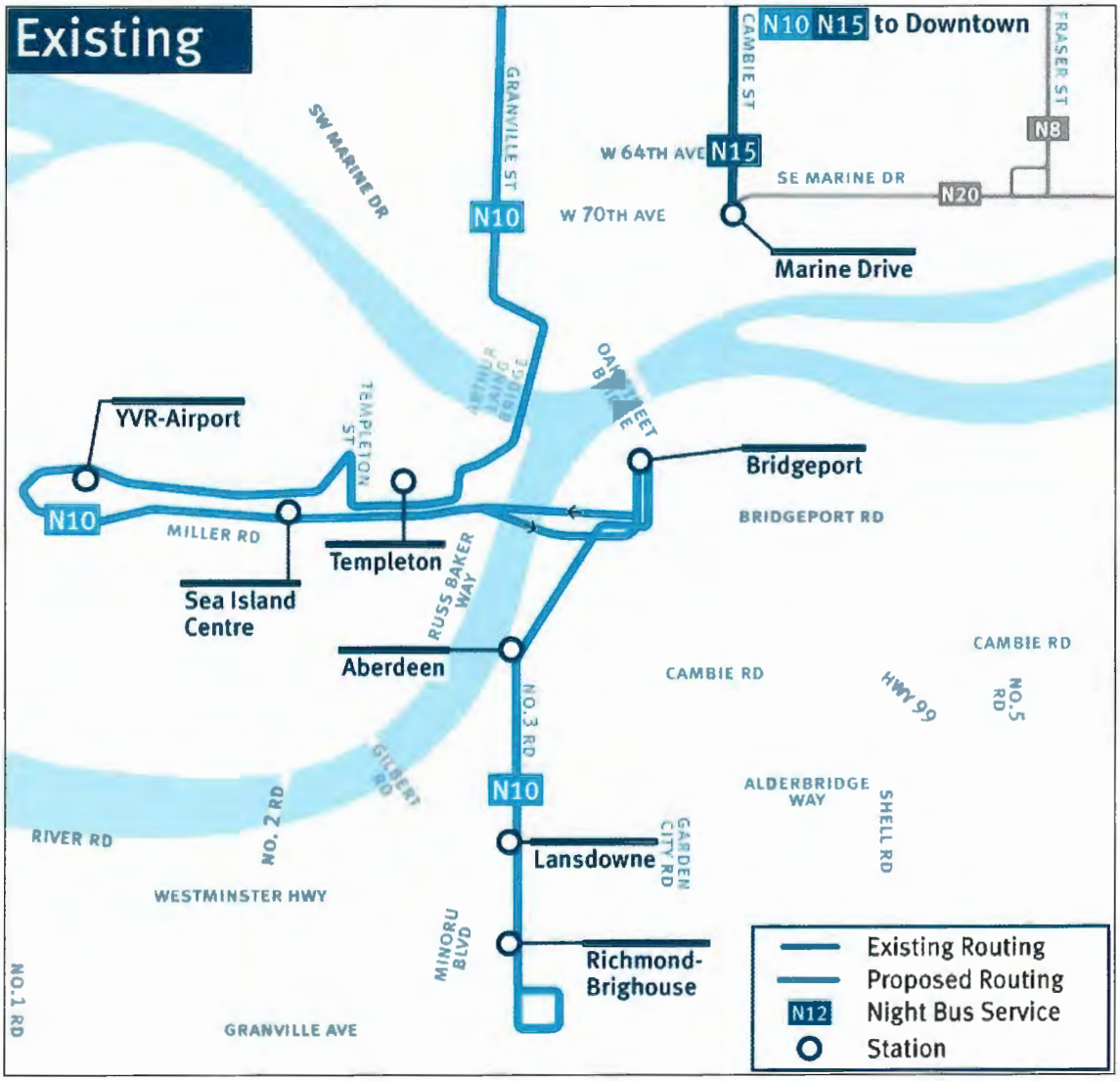
404 Brighouse Stn-Four Road / 405 Cambie-Five Road / 416 East Cambie-Brighouse Stn Proposal



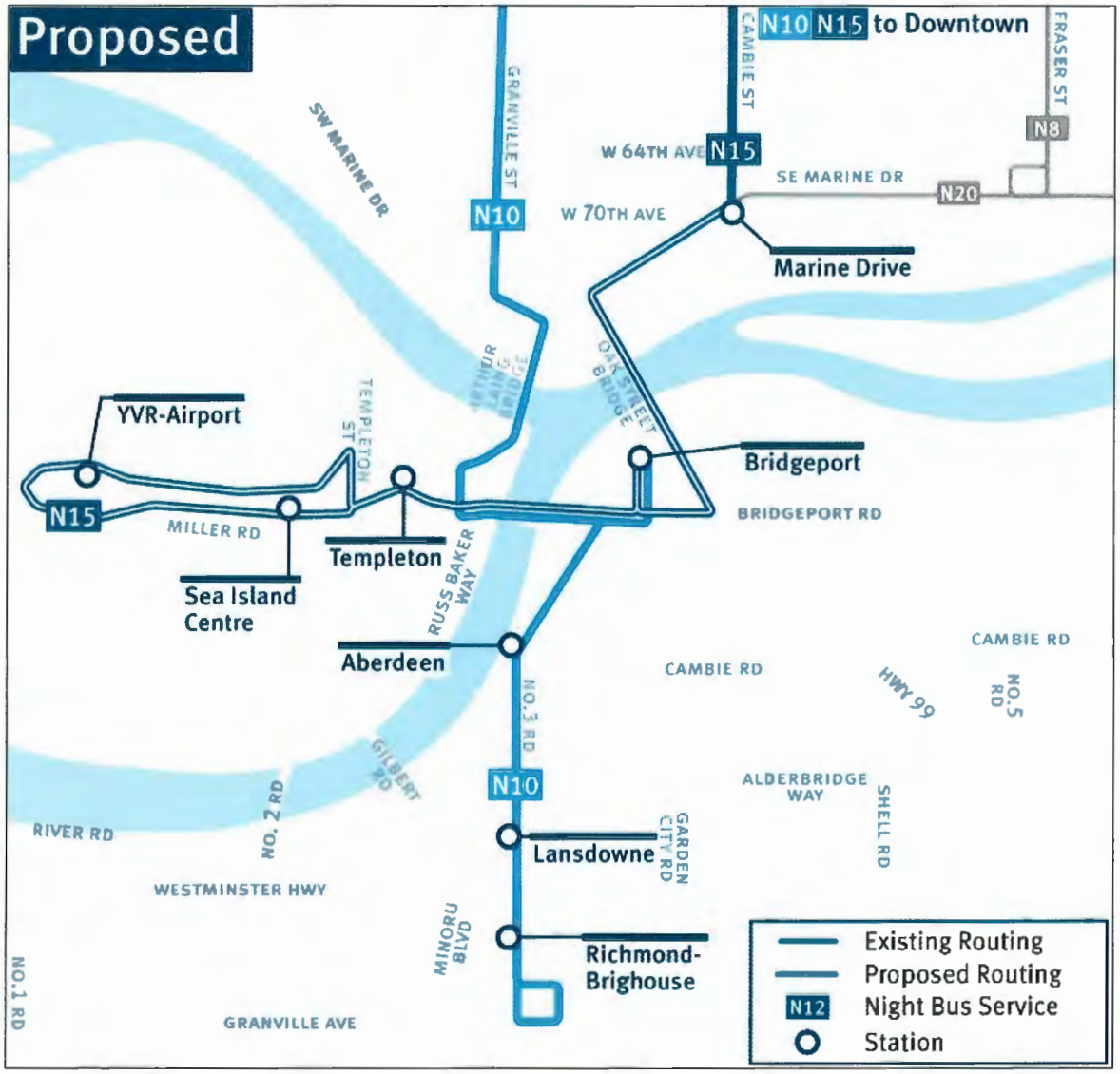
404 Brighouse Stn-Four Road / 405 Cambie-Five Road / 416 East Cambie-Brighouse Stn Proposal



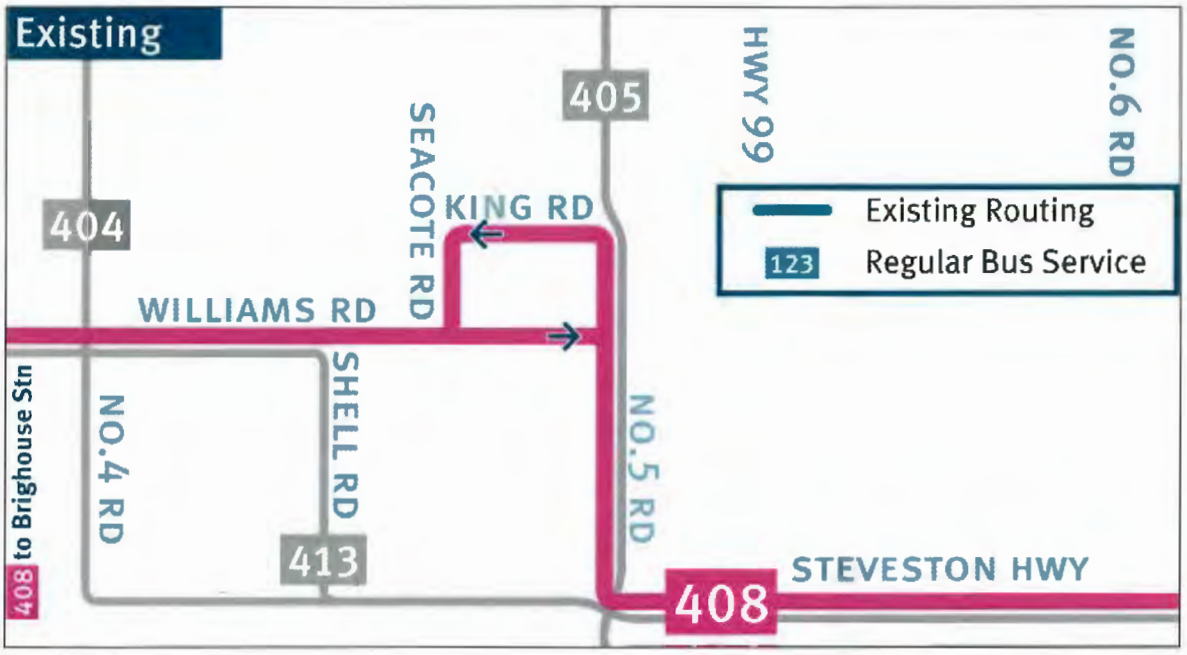
N10 Brighouse Station-Downtown / N15 Cambie-Downtown Proposal

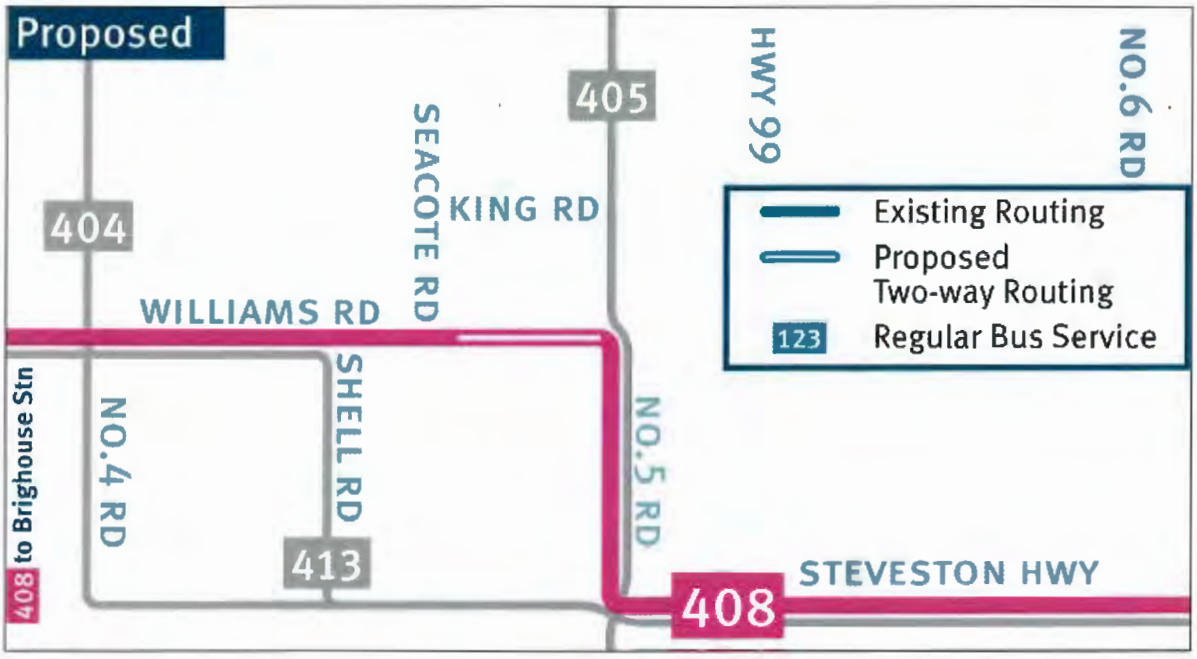


N10 Brighouse Station-Downtown / N15 Cambie-Downtown Proposal



408 Ironwood/Riverport-Brighouse Station Proposal





City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	February 12, 2019
From:	Lloyd Bie, P. Eng. Director, Transportation	**File:**	01-0154-04/2019-Vol 01
Re:	**TransLink 2019 Capital Cost-Share Program – Supplemental Applications**		

Staff Recommendation

That the submission of transit-related projects for cost-sharing as part of the TransLink 2019 capital cost-share programs as described in the report titled "TransLink 2019 Capital Cost-Share Program – Supplemental Applications" dated February 12, 2019 from the Director, Transportation, be endorsed.

Lloyd Bie, P. Eng.
Director, Transportation
(604-276-4131)

Att. 1

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Finance Law Engineering	☑ ☑ ☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

In September 2018, Council endorsed the submission of several road, bicycle and transit-related improvement projects for funding consideration from TransLink's 2019 capital cost-share funding programs. This report presents proposed supplemental applications from the City to TransLink's new Bus Speed and Reliability Program for 2019.

Analysis

TransLink Bus Speed and Reliability Program

Declining bus operating speeds has required TransLink to invest regionally $2.5-$4 million of operating funds each year to maintain existing levels of service (Figure 1). Since 2012, 250,000 annual service hours have been added at a total cost of approximately $144 million. By 2019, the additional annual service hours are expected to exceed 300,000.

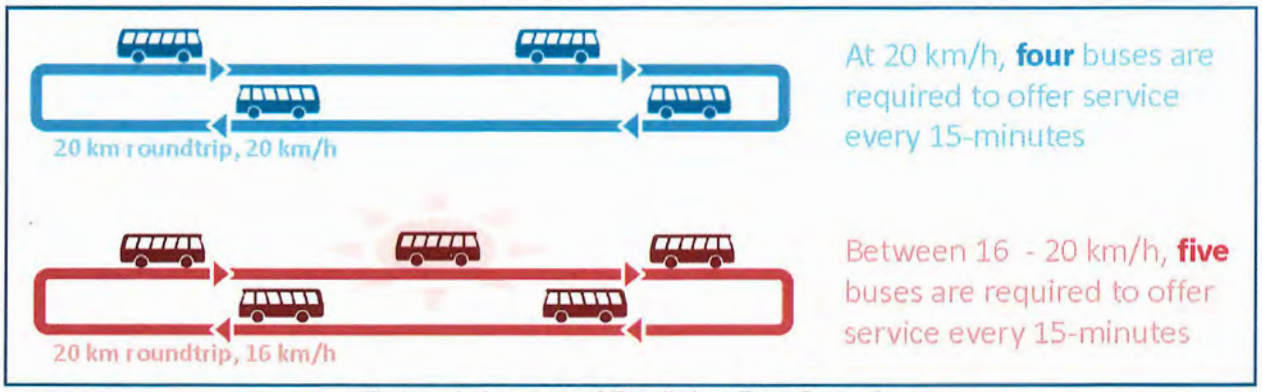


Figure 1: Impact of Declining Bus Speeds

The Mayors' Council 10-Year Vision identified the need for TransLink to work with municipalities to implement measures that enable a faster, more efficient, more reliable, and more cost-effective transit service. TransLink's Bus Speed and Reliability Program is a new program starting in 2019 that provides cost-share funding on a competitive basis for feasibility studies and capital projects that support improved bus speed and reliability. TransLink has allocated approximately $16 million in total for the Program for 2019-2022 through the Phase One ($4 million) and Phase Two ($12 million) Investment Plans of the 10-Year Vision.

Projects must be located on the Frequent Transit Network (FTN), at major transit nodes, or other locations identified by TransLink as a high priority. Four categories of projects are eligible for funding:

- *Municipal Capacity Building*: Training to enhance municipal capacity to identify, develop, and deliver transit projects;
- *Project Development*: Limited-term technical support to develop conceptual designs;
- *Pilot Project*: Capital and operating funds to design, deliver and evaluate short-term pilot projects to inform decisions about permanent design of facilities to improve bus speed and reliability; and

- *Capital Project*: Technical support and capital funds to design, deliver, and evaluate permanent capital projects to improve bus speed and reliability.

TransLink may provide up to 100% cost-share funding for projects deemed to be high priority.

Projects Proposed for Submission to 2019 TransLink Bus Speed and Reliability Program

For 2019, the Program has a total of $2.175 million available. The City proposes to submit three Project Development applications for consideration to be included in the 2019 Program as described below.

Project Development

All of the following locations (see Attachment 1) are identified by TransLink as key areas in Richmond where bus speed and reliability are negatively impacted. Each of the proposed projects would fund retaining a consultant to analyze the issues and identify potential solutions. If supported by the City and TransLink, the potential solutions may then be the subject of future cost-share applications to support implementation, particularly for any infrastructure changes.

- *Bridgeport Station Access/Egress*: Bus operators for regional routes to/from south of the Fraser River experience delays when transiting between Highway 99 and the Bridgeport Exchange. Due to traffic volumes, the movement from southbound Great Canadian Way to eastbound Sea Island Way can be particularly problematic. The study would seek to optimize traffic signal timing in this corridor and identify potential infrastructure changes (e.g., road geometry modifications).

- *Garden City Road-Westminster Highway*: Bus operators can experience delays for the eastbound Westminster Highway to northbound Garden City Road movement. The study would seek to optimize traffic signal timing at this intersection.

- *Steveston Highway (No. 5 Road-Highway 99)*: Bus operators can experience delays in this corridor, particularly when travelling westbound on Steveston Highway. The study would seek to optimize traffic signal timing in this corridor and identify potential infrastructure changes. Any proposed infrastructure changes would need to recognize any future changes in the area associated with potential improvements associated with the Steveston Highway-Highway 99 Interchange and the Massey Tunnel crossing.

Requested Funding and Estimated Project Costs

The total requested funding for the Project Development applications to TransLink's 2019 Bus Speed and Reliability program is $75,000 as summarized in Table 1. Staff are seeking 100% cost-share funding for these applications and would provide in-kind support via management of the consultant.

Table 1: Projects to be Submitted to 2019 TransLink Bus Speed and Reliability Program

Project	Category	Requested TransLink Funding[1]	Proposed City Portion & Funding Source[2]	Est. Total Project Cost
Bridgeport Station Access/Egress	Project Development	$30,000	$0	$30,000
Garden City Road-Westminster Hwy	Project Development	$15,000	$0	$15,000
Steveston Highway (No. 5 Road-Hwy 99)	Project Development	$30,000	$0	$30,000
Total		**$75,000**	**$0**	**$75,000**

(1) The amounts shown represent the maximum funding contribution to be requested from TransLink based on the City's cost estimate for the project. The actual amount invoiced to TransLink follows project completion and is based on incurred costs.

(2) The City's portions of the costs of the projects have been previously approved by Council.

Should the submissions be successful, the City would enter into funding agreements with TransLink. The agreements are standard form agreements provided by TransLink and include an indemnity and release in favour of TransLink. Staff recommend that the Chief Administrative Officer and General Manager, Planning and Development be authorized to execute the agreements.

Financial Impact

None.

Conclusion

Several projects are proposed for submission to TransLink's 2019 Bus Speed and Reliability program that would support advancing the goals of the *Official Community Plan* to achieve a higher transit mode share. The proposed projects capitalize on the expanded external cost-share funding available from TransLink as part of the implementation of Phases One and Two of the 10-Year Investment Plan.

J Caravan

Joan Caravan
Transportation Planner
(604-276-4035)

JC:lce

Att.1: Locations of Proposed 2019 Bus Speed and Reliability Program Projects

Proposed 2019 Bus Speed and Reliability Program Projects: Locations

1. Bridgeport Station Access/Egress





Proposed 2019 Bus Speed and Reliability Program Projects: Locations

2. Garden City Road-Westminster Highway



3. Steveston Highway (No. 5 Road-Highway 99)



City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	February 12, 2019
From:	John Irving, P.Eng., MPA Director, Engineering	**File:**	10-6160-07-01/2019-Vol 01
Re:	**Provincial Pesticide Use Permit Renewal Application**		

Staff Recommendation

That the comments regarding a provincial Pesticide Use Permit application to manage invasive cordgrass outlined in the report titled "Provincial Pesticide Use Permit Renewal Application", dated February 12, 2019 from the Director, Engineering, be endorsed for submission to the provincial Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

John Irving, P.Eng., MPA
Director, Engineering
(604-276-4140)

REPORT CONCURRENCE	
CONCURRENCE OF GENERAL MANAGER	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS:
APPROVED BY CAO	

Staff Report

Origin

The provincial Ministry of Forests, Lands, Natural Resource Operations and Rural Development ('the Ministry') has applied to renew a regional Pesticide Use Permit ('the permit') to continue management of a highly invasive species of cordgrass in coastal foreshore areas across the Lower Mainland. The provincial pesticide use permit process requires consultation with regional stakeholders including the City of Richmond.

Background

The Province of BC manages the *Weed Control Act* and the *Integrated Pest Management Act*. The *Weed Control Act* is administered by the Ministry and requires all landowners including municipalities to control the spread of listed noxious weeds. The *Integrated Pest Management Act* is administered by the Ministry of Environment and Climate Change Strategy and regulates the use of pesticides to control provincial and/or regional invasive species including noxious weeds listed in the *Weed Control Act*. BC's *Community Charter* enables municipalities to restrict the use of certain pesticides in the community.

Council adopted the Enhanced Pesticide Management Program and the subsequent *Pesticide Use Control Bylaw No. 8514* in 2009. The City's Invasive Species Action Plan was adopted in 2016 and prescribes a strategic, risk-based approach to prioritize the management of invasive species pursuant to the provincial *Integrated Pest Management Act* and the provincial Early Detection and Rapid Response program. The Invasive Species Action Plan lists the City's top eight (8) priority invasive species based on immediate threats to Richmond's natural ecosystems and infrastructure. The City is dedicated to an integrated pest management approach to manage priority species that supports the judicious use of pesticides when necessary. Staff implement a rigorous notification procedure that exceeds the notification requirements under the provincial *Integrated Pest Management Act* when pesticides are used for noxious weed treatment.

The Province is also dedicated to an integrated pest management approach and implements its Early Detection Rapid Response program in partnership with municipalities and federal agencies. The Ministry has been working with Ducks Unlimited Canada to monitor and eradicate an extremely aggressive species of intertidal cordgrass since 2003. Cordgrass is an aquatic grass that establishes on intertidal mudflats and has the ability to reduce open habitat for shorebirds, outcompete native vegetation and alter the natural functions of estuaries. There are currently three species of cordgrass posing an immediate threat to BC's coastline that are believed to have been imported to the region via shipping vessels in the 1800s. Cordgrass has since spread aggressively through California, Oregon, Washington, Puget Sound and Boundary Bay.

BC has committed to the containment, reduction, and eradication of cordgrass and has entered into a cross-border partnership agreement with California, Oregon, and Washington to prioritize the management of cordgrass and promote ocean health. The Ministry has requested the City's comments relating to their regional permit application that currently authorizes the use of herbicide to manage cordgrass regionally.

Analysis

Provincial Cordgrass Management Program

Three species of invasive cordgrass (*Spartina anglica, densiflora, patens*) have migrated north from California since the 1980's and the first infestations were detected in BC in 2003. The Ministry, in partnership with Ducks Unlimited, have been actively monitoring, mapping, and managing invasive cordgrass infestations in the Lower Mainland since detection. Early integrated management approaches employed by the Ministry have included costly manual excavation, mechanical excavation, and light-shading techniques that have had poor results.

The Ministry secured its first permit from the Ministry of Environment and Climate Change Strategy to manage cordgrass regionally in 2013 for a three year term. It was the first permit in the province issued for intertidal areas and authorized the Ministry to manually apply herbicide to manage cordgrass within the approved limits (Attachment 1). The permit was later renewed for an additional three years in 2016 and remains the only regional permit relating a noxious weed. The Ministry's current permit will expire on May 31, 2019. The Ministry's integrated pesticide management approach has been successful in limiting the spread of cordgrass in Boundary Bay, Robert's Bank, and Burrard Inlet by reports of declining populations since herbicide was introduced.

A single cordgrass plant was identified on Sturgeon Bank by Ducks Unlimited Canada in 2013. The plant and its roots were carefully removed by hand at that time and no additional plants have since been recorded at or near Richmond's foreshores areas.

Proposed Pesticide Use Permit Renewal

The Ministry has submitted an application to extend its current permit for an additional three years (2019 – 2022) in an effort to eventually eradicate the species. The proposed boundaries remain consistent with previous permits and will authorize the treatment of up to 26 hectares of intertidal area annually to control cordgrass infestations. Herbicide will be manually applied directly to individual cordgrass plants during the growing season (typically July to September of each year). Herbicide application will only be conducted by certified pesticide applicators that must following the strict treatment and monitoring conditions of the permit that protect sensitive intertidal conditions. No treatment is currently scheduled in Richmond including Sturgeon Bank.

Staff Feedback

The Ministry's monitoring program is regionally-significant and has reduced the regional spread of cordgrass by incorporating herbicide in its integrated management approach. Staff have reviewed the Ministry's permit application and recommends that Council support the application due to the significant risk that it poses to local ecosystems subject to the following comments:

- The City has not historically received summaries of the Ministry's cordgrass management program consistently. The City requests that a summary of the program's

annual data for each growing season be forwarded to staff when available for review and record keeping;

- The City requests to be notified immediately of any future records of cordgrass within or near Richmond's municipal boundaries;
- That staff receive a copy of the permit and its conditions if issued by the Ministry of Environment and Climate Change Strategy;
- That staff are notified in advance of the Ministry's intent to apply herbicide near the community pursuant to the notification requirements outlined within the permit if issued by the Ministry of Environment and Climate Change Strategy; and
- That staff work with the Ministry and its partners to explore opportunities to improve cordgrass education and identification in the local community.

Financial Impact

None.

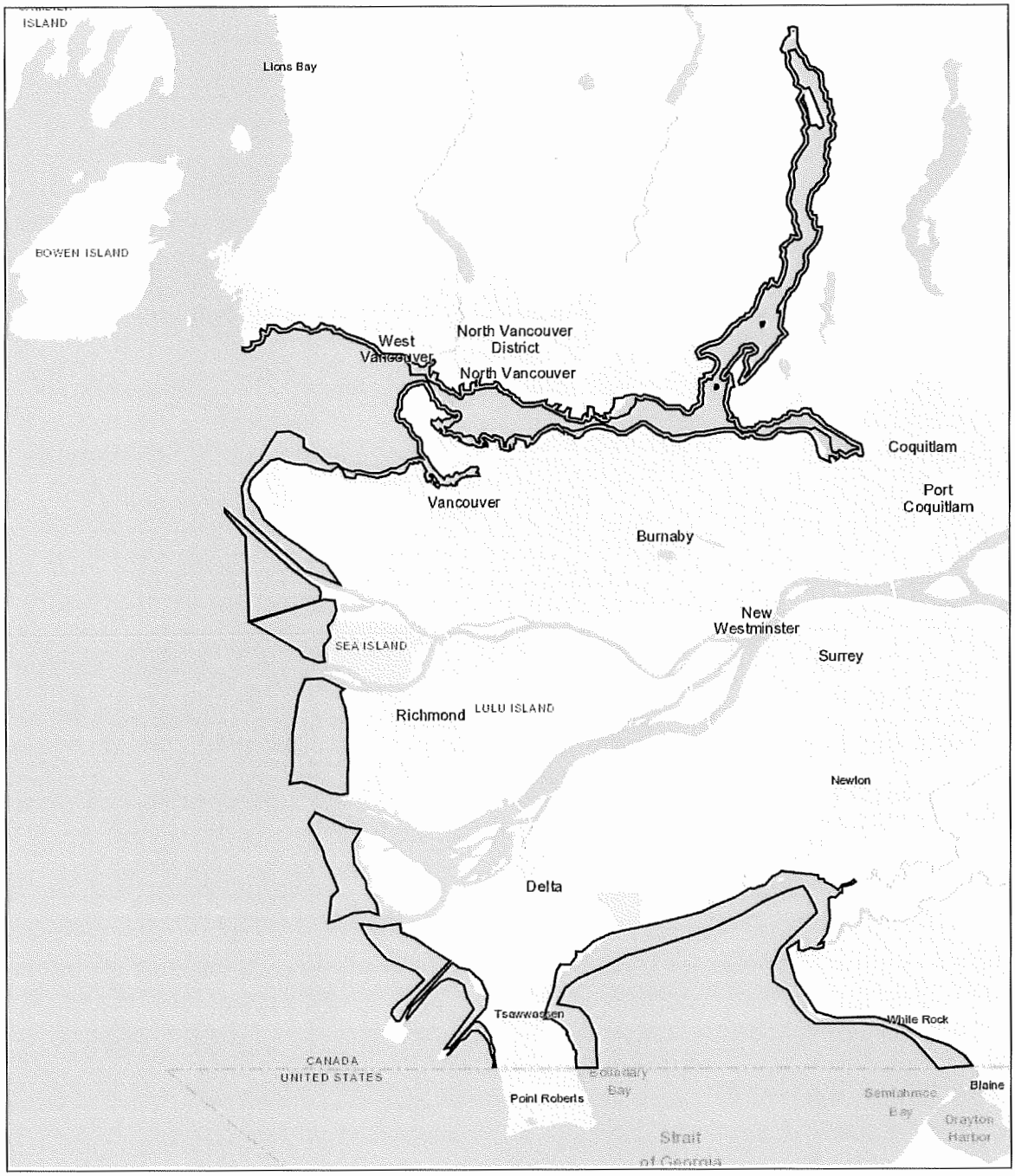
Conclusion

The provincial Ministry of Forests, Lands, Natural Resource Operations and Rural Development is currently managing an invasive species of cordgrass in regional intertidal areas. The Province has employed an integrated pest management approach to control the spread of cordgrass that includes the use of herbicide pursuant to an active Pesticide Use Permit that will expire in May 2019. The Ministry's monitoring data implies that management efforts have significantly reduced the spread of the cordgrass since the inclusion of herbicide and a new permit is required to continue the program. Staff have reviewed the application and provided feedback that will be forwarded to the Ministry if endorsed by Council.

Chad Paulin M.Sc., P.Ag.
Manager, Environment
(604-247-4672)

Att. 1: Proposed Boundaries for the Regional Pesticide Use Permit (2019 – 2022)

Attachment 1. Proposed Boundaries for the Regional Pesticide Use Permit (2019 – 2022)



City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	February 20, 2019
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6600-10-01/2019-Vol 01
Re:	**Investing in Canada Infrastructure Program – CleanBC Communities Fund**		

Staff Recommendation

1. That the submission to the Investing in Canada Infrastructure Program - British Columbia - Green Infrastructure - Climate Change Mitigation - CleanBC Communities Fund requesting funding of up to $6.2 million for the Oval Village DEU Sewer Heat Recovery Implementation project, as outlined in the report titled "Investing in Canada Infrastructure Program - CleanBC Communities Fund" dated February 20, 2019, from the Director, Engineering, be endorsed;

2. That the Chief Administrative Officer and General Manager, Engineering and Public Works be authorized to enter into funding agreements with the government for the aforementioned project should it be approved for funding, as outlined in the report titled "Investing in Canada Infrastructure Program - CleanBC Communities Fund" dated February 20, 2019, from the Director, Engineering; and

3. That, upon receipt of the funding for the aforementioned project, the City transfer the full funding amount to Lulu Island Energy Company Ltd., which is wholly owned by the City of Richmond, to deliver the aforementioned project as directed by Lulu Island Energy Company Ltd. Board of Directors.

John Irving, P.Eng. MPA
Director, Engineering
(604-276-4140)

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Intergovernmental Relations & Protocol Unit	☑	
Finance Department	☑	
Parks Services	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** CJ	**APPROVED BY CAO**

Staff Report

Origin

In December 2018, the Province of British Columbia and Government of Canada announced cost-shared funding in locally owned green infrastructure projects that help communities use clean energy and become more energy efficient. Funding will be provided through the new CleanBC Communities Fund (CCF), part of the Investing in Canada infrastructure plan's Green Infrastructure Stream (Climate Change Mitigation sub-stream). The initial funding available is $62.94 million, with applications due by March 27, 2019.

The purpose of this report is to seek Council's endorsement for the application to the CCF for grant funding of up to $6.2 million for the Oval Village DEU Sewer Heat Recovery implementation project, which will be delivered by Lulu Island Energy Company (LIEC), wholly-owned City corporation, in partnership with Oval Village DEU (OVDEU) concessionaire Corix Utilities (Corix).

Analysis

Funding Requirements

The CCF provides funding for infrastructure projects that support the management of renewable energy, access to clean energy transportation, improved energy efficiency of buildings and the generation of clean energy. Eligible applicants are Local Governments, Indigenous Ultimate Recipients (both on and off-reserve), Not-for-Profit organizations and For-Profit organizations (when partnered with a local government or Indigenous government). Projects must meet related federal outcomes to be eligible. Eligible projects will support public infrastructure, defined as tangible capital assets primarily for public use and benefit.

The objectives of the CCF are to:

- Support local governments' and Indigenous Peoples' capital investments in energy efficiency and clean energy projects;
- Support the province's energy, economic, environmental and greenhouse gas reduction priorities and advance British Columbia's clean energy sector;
- Encourage investments in community-owned energy generation from clean or renewable resources such as biomass, biogas, geothermal heat, hydro, solar, ocean, integrated resource recovery or wind; and
- Promote community-owned projects and partnerships with industry that advance this growing sector of the provincial economy.

A project must meet at least one of the following outcomes to be eligible:

- Increased capacity to manage renewable energy;
- Increased access to clean energy transportation;
- Increased energy efficiency of buildings; and
- Increased generation of clean energy.

It is anticipated that there will be more projects that qualify for funding than there are program funds available. Eligible projects will be subject to technical evaluation and ranked according to the extent to which they meet the program's objectives and the eligibility criteria. Reductions in greenhouse gas emissions (as compared to a baseline scenario) will be a consideration in evaluating projects for funding.

Only one project per municipality may be submitted, the project must start within 2 years from the date of the application, and the project must be completed within five to six years of the approval, or by March 31, 2026.

Total funding available for the initial phase of the CCF is $62.94 million. Funding guidelines indicate that there is no cap on the maximum allowable funding amount per project; however, consideration will be given to a fair distribution of funding. Guidelines further recommend that applicants should consider whether phasing is an option where project funding would represent more than 10% ($6.294 million) of the total funding available for the intake.

A resolution endorsing the project must be approved by the appropriate authorized governing body such as a council or board. The resolution must also show commitment from the proponent to contribute its share of the eligible and ineligible costs and overages related to the project. In this project case, a resolution is needed from Council and LIEC Board of Directors.

Recommended Project - Oval Village DEU Sewer Heat Recovery Implementation

In 2014, Council approved the material terms of a Concession Agreement ("Agreement") endorsing LIEC and Corix to enter into the Agreement whereby LIEC would own the OVDEU and its infrastructure, and Corix would design, build, finance and operate the OVDEU, subject to the City setting rates for customers. There are currently eight residential buildings connected to the OVDEU system with energy supplied from two interim energy centres which use centralized natural gas boilers instead of individual boilers in order to achieve efficiencies, and therefore reduction in emissions, from the centralized approach. The plan is that when enough buildings are connected to the system, a permanent energy centre will be built which will produce low carbon energy harnessed from the Gilbert Trunk force main sewer. In 2013, Council endorsed the location for the OVDEU permanent energy centre at the western edge of the future Middle Arm Park (Attachment 1).

Grant funding from CCF would enable implementation of the low carbon energy source over the next couple of years to replace the use of the natural gas, and it would also ensure that early implementation of the low carbon energy source has no impact on the rates to customers.

During the teleconference with the administrators of CCF (Ministry of Environment and Climate Change Strategy's Climate Action Secretariat and the Ministry of Municipal Affairs and Housing), staff have heard that this funding targets projects which:

1. Include capital infrastructure for public use and benefits;
2. Reduce GHG emissions greatly; and
3. Have well-defined implementation strategy and proven project delivery.

Considering the above, staff recommends the OVDEU sewer heat recovery implementation project for the following reasons:

1. OVDEU SHR is a capital infrastructure project providing City of Richmond residents with reliable and cost competitive energy for space heating and domestic hot water. It provides financial and environmental resiliency to Richmond residents by using local and low carbon energy sources which mitigate the potential for volatility in thermal energy prices.
2. Staff have estimated that the implementation of the sewer heat recovery at the OVDEU will reduce ~5500 tonnes of GHG emissions annually immediately after the project commissioning (2023) and increase this reduction to ~9000 tonnes annually at the full build-out. Staff have estimated that over the life of the project (assumed 30 years) this would reduce ~200,000 tonnes of GHG emissions.
3. OVDEU implementation and delivery has been seamless from the start of the project. It incorporates a distinctive partnership between a experienced private utility and a municipally owned corporation for transparency and cost oversights. By means of a concession agreement executed by parties, the OVDEU project has a clearly defined financial and delivery model which is being reviewed and updated on an annual basis.

The total value of the OVDEU SHR implementation project is estimated to be $20M. If the project is successful in receiving the funding, the remainder of the funding will be secured by LIEC through the concession agreement between LIEC and Corix. LIEC may also fund a portion of the project from its provision account.

Financial Impact

There is no financial impact to the City.

The City of Richmond will be requesting up to $6.2 million towards the OVDEU sewer heat recovery implementation project under the Investing in Canada Infrastructure Program – CleanBC Communities Fund.

Should the City be successful with the grant application, the full funding amount will be transferred to LIEC to deliver the project on behalf of the City and as directed by LIEC Board of Directors. The remainder of the capital funding for the project will be secured through the concession agreement between LIEC and Corix. LIEC may also fund a portion of the project from its provision account.

Conclusion

Staff are requesting Council to endorse the submission to the Investing in Canada Infrastructure Program - British Columbia - Green Infrastructure - Climate Change Mitigation - CleanBC Communities Fund requesting funding of up to $6.2 million for the Oval Village DEU Sewer Heat Recovery Implementation project. Completion of this project will move the City closer to their objectives of provision of low carbon energy for the OVDEU customers and in turn immediate avoidance of GHG emissions from a number of developments in Richmond's City Centre area.

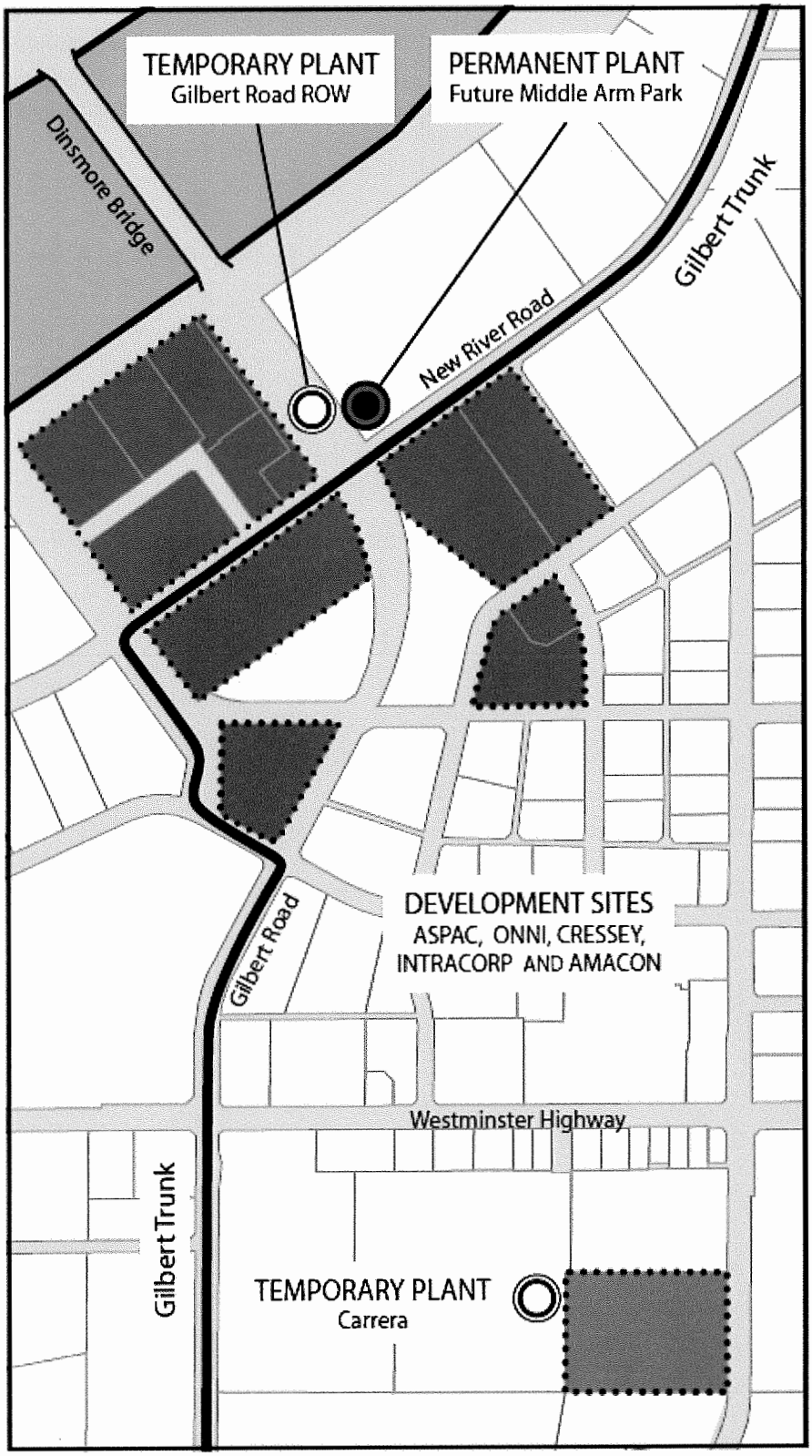


Peter Russell
Senior Manager, Sustainability and District Energy
(604-276-4130)

PR:ap

Att.1: Council endorsed location for the OVDEU permanent energy centre

Attachment 1 – Council endorsed location for the OVDEU permanent energy centre



City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	February 21, 2019
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6060-01/2019-Vol 01
Re:	**2019 Clothes Washer Rebate Program**		

Staff Recommendation

1. That the City of Richmond partner with BC Hydro to the end of 2019 to offer a combined rebate of $100 for both spring and fall campaigns, equally cost shared between BC Hydro and the City, for the replacement of inefficient clothes washers with new high efficiency clothes washers; and

2. That the Chief Administrative Officer and General Manager, Engineering and Public Works, be authorized to execute an agreement with BC Hydro to implement the Clothes Washer Rebate Program.

John Irving, P.Eng. MPA
Director, Engineering
(604-276-4140)

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Finance Department Water Services	☑ ☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** CJ	**APPROVED BY CAO**

Staff Report

Origin

BC Hydro and local governments have an interest in encouraging the conservation of water and energy. Through PowerSmart, BC Hydro offers a variety of incentive programs that encourage uptake of energy-efficient technologies, including energy-efficient appliances.

Since 2014, the City has partnered with BC Hydro to implement the Clothes Washer Rebate Program. In 2018, the program offered a rebate of up to $100, which was equally cost-shared between BC Hydro and the City.

BC Hydro is offering the Clothes Washer Rebate Program again in 2019 and is requesting that the City continue its participation.

This program supports the 2041 Official Community Plan (OCP), the Corporate Sustainability Framework, as well as the Community Energy and Emissions Plan, which includes "promoting building efficiency through outreach and education and providing incentives for building retrofit action."

Analysis

Clothes Washer Rebate Program

The 2018 Clothes Washer Rebate Program issued 149 rebates at a cost of $7,450 to the City. Over 900 rebates have been issued to date at a total cost of $66,300 to the City, resulting in annual savings in water and energy of 3,442,000 liters per year and 88,110 kilowatt hours per year, respectively. Eleven municipalities, including the City of Abbotsford and the City of Vancouver, participated in the partnership program with BC Hydro in 2018.

2019 Clothes Washer Rebate Program

The proposed 2019 Clothes Washer Rebate Program offered by BC Hydro will run during the spring and fall of this year. It is anticipated that all eleven municipalities that partook last year will participate in this year's partnership program with BC Hydro.

In addition to recommended City participation, BC Hydro will also seek industry partners to match their rebate, increasing the total rebate amount for eligible clothes washers.

This year's program details are as follows:

- The City partners with BC Hydro to offer a combined Clothes Washer Rebate Program. BC Hydro will offer a single tier rebate of $50 and the City will match this rebate to provide a combined rebate of $100, for the replacement of an inefficient clothes washer with a new high efficiency clothes washer in the 2019 campaigns.

- The proposed spring and fall campaigns will run from April 5 to May 31, 2019 and October 1 to November 29, 2019, subject to coordination with BC Hydro.

Staff recommend that the City partner with BC Hydro to match rebate offers on high efficiency washing machines for the proposed dates and any future extensions that may be requested.

Roles and Responsibilities

The City and BC Hydro roles and responsibilities are outlined in Table 1. BC Hydro will be responsible for carrying out program administration and associated activities, and the City will be responsible for providing matching funding to supplement the BC Hydro rebate and advertising the rebate program within Richmond.

Table 1: City and BC Hydro Roles and Responsibilities

City of Richmond	BC Hydro
• **Provide funding to supplement the BC Hydro rebate**	• **Answer email and phone inquiries about the program**
• **Advertise the rebate offer locally**	• **Receive and process online applications**
	• **Provide rebate directly to applicants, and invoice the City for its portion**
	• **Provide post campaign reporting to the City**

Financial Impact

Staff recommend that the rebates be funded from the approved Toilet and Clothes Washer Rebate Program. The Toilet and Clothes Washer Rebate Program has an annual budget of $100,000. The uptake on toilet and washing machine rebates has a high degree of variability. Staff will monitor participation and report back to Council if there is higher than anticipated participation. BC Hydro will be responsible for all costs associated with program administration.

Conclusion

The City has an opportunity to continue partnering with BC Hydro to provide rebate incentives to residents for purchasing efficient clothes washers through the Clothes Washer Rebate Program. Staff recommend that the City continue to participate in this rebate program which provides a combined rebate of $100 for both spring and fall campaigns, equally shared between BC Hydro and the City, and that rebates be funded from the Toilet and Clothes Washer Rebate Program.

Eric Sparolin, P.Eng.
Acting Manager, Engineering Planning
(4915)

Arnold Lau
Engineering Technician
(4178)

ES:al

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	February 21, 2019
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6060-01/2019-Vol 01
Re:	**Dike Master Plan - Phases 3 and 5 Report**		

Staff Recommendation

That the "Dike Master Plan - Phase 3 Final Report" and "Dike Master Plan - Phase 5 Final Report" as attached in the staff report titled "Dike Master Plan – Phases 3 and 5 Report," dated February 21, 2019 from the Director, Engineering, be endorsed for the purposes of capital project and development planning.

John Irving, P.Eng. MPA
Director, Engineering
(604-276-4140)

Att. 2

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Real Estate Services	☑	
Parks Services	☑	
Roads & Construction	☑	
Sewerage & Drainage	☑	
Development Applications	☑	
Policy Planning	☑	
Transportation	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** CJ	**APPROVED BY CAO**

Staff Report

Origin

By the year 2100, climate change scientists estimate that sea levels will rise approximately 1.0 metres and the City will subside by 0.2 metres. To maintain Richmond's high level of flood protection, the City will need to increase the height of the perimeter dikes by 1.2 metres over the next 25 to 75 years.

The City of Richmond's 2008-2031 Flood Protection Management Strategy identifies the need to "prepare and implement a comprehensive dike improvement program."

On October 24, 2016, Council endorsed the City's submission to the National Disaster Mitigation Program requesting funding for Dike Master Plan Phase 3. The project was approved and is 100% funded through the grant to a maximum of $250,000.

On December 11, 2017, Council approved $200,000 through the 2018 Capital Budget to prepare Dike Master Plan Phase 5. Subsequently, it was approved to be 100% funded by the Province of British Columbia through the 2017 Flood Risk Assessment, Flood Mapping & Flood Mitigation Planning Program.

The Dike Master Plan Phases 3 and 5 Draft Report was presented at the regular Council meeting on December 19, 2018, where Council resolved:

> *"That the public and key external stakeholders be consulted as identified in the staff report titled "Dike Master Plan – Phase 3 and 5" from the Director, Engineering, dated November 30, 2018."*

Staff completed public and key stakeholder consultation for Dike Master Plan Phases 3 and 5 and the results of that consultation are the focus of this report.

Dike Master Plan Phase 4 is undergoing further analysis on environmental compensation requirements and is scheduled to be brought forward later in the year.

Analysis

The City of Richmond is approximately 1.0 metres above mean sea level and protected by 49 kilometres of dike on Lulu Island, 1.1 kilometres of dike on Sea Island and 3.5 kilometres of flood protection structural works on Mitchell Island. The 2008-2031 Flood Protection Management Strategy identifies the perimeter dike as the primary system to protect the City from flooding due to climate change induced sea level rise.

Climate change scientists estimate that sea levels will rise approximately 1.0 metres by the year 2100 and 0.2 metres of land subsidence is forecasted during the same time period. With a combined 1.2 metres of relative sea level rise, the target dike elevation by year 2100 is 4.7 metres geodetic for the majority of the City. To address sea level rise beyond 2100, all new dikes will be designed to have a further height increase of 0.8 metres.

Current forecasts indicate that dike raising will need to be completed in the next 25 to 75 years. Dike improvements are ongoing through the Council approved Capital Program and development partnerships.

The Dike Master Plans are intended to be a comprehensive guide to:

- Upgrade the City of Richmond's perimeter dike;
- Protect Richmond from both storm surges and Fraser River freshet events;
- Adapt to sea level rise and land subsidence;
- Be seismically resilient;
- Integrate the Ecological Network Management Strategy vision and goals;
- Follow the five strategic directions of the City's 2009 Waterfront Strategy (Working Together, Amenities and Legacy, Thriving Eco-Systems and Community, Economic Vitality, Responding to Climate Change and Natural Hazards); and
- Prioritize dike improvement phasing to efficiently use resources.

The current phases of the Dike Master Plan are shown in Figure 1. Dike Master Plan Phases 1 and 2 have been adopted by Council while preparation of Dike Master Plan Phase 4 is underway. Stakeholder consultation for Dike Master Plan Phases 3 and 5 is complete and is the focus of this report.

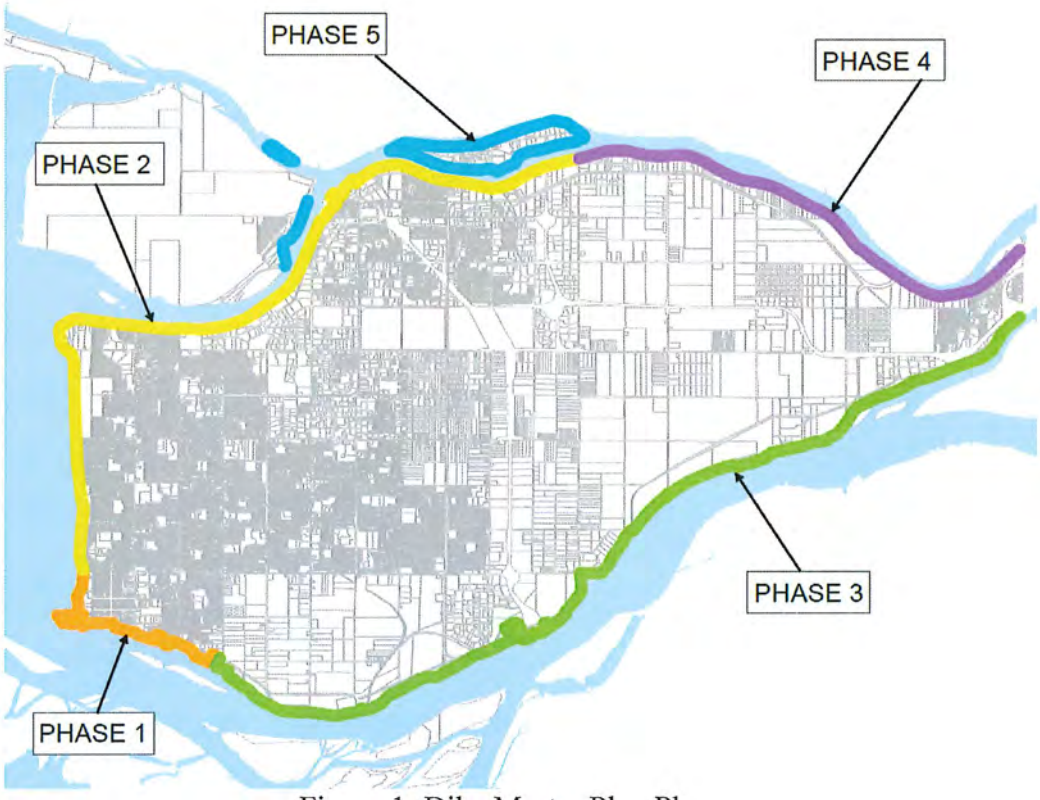


Figure 1: Dike Master Plan Phases

The study area for Dike Master Plan Phase 3 includes the south dike of Lulu Island between No. 2 Road and Boundary Road while the study area of Dike Master Plan Phase 5 includes Sea Island from the Sea Island Connector Bridge to the south end of 3800 Cessna Drive, Mitchell Island, and Richmond Island.

Dike Master Plan Phases 3 and 5 are appended as Attachments 1 and 2.

In order to meet grant funding conditions, the final report for Dike Master Plan Phase 3 is due to the Province of British Columbia and Public Safety Canada no later than March 31, 2019. Similarly, the final report for Dike Master Plan Phase 5 is due to the Province of British Columbia through the Union of BC Municipalities (UBCM) on March 31, 2019 to meet grant funding conditions.

Public Feedback

In January 2019, Dike Master Plan Phases 3 and 5 were presented to the public through two open houses, the Smart Cities Ideas Fair, and the City's "LetsTalkRichmond.ca" public engagement site. The public sessions attracted around 75 attendees while 518 people visited the "LetsTalkRichmond.ca" web page.

Based on feedback, the public indicated:

- support for the proactive approach to dike master planning and dike raising;
- support for the actions being taken with regards to community safety;
- support for ongoing sea level monitoring;
- support for environmental considerations in the Dike Master Plan;
- support for coordination with development to create superdikes;
- support for policy guiding flood construction levels and building standards for flood protection;
- concern regarding the removal of shrubs, trees, logs, and habitat along the dike;
- concern regarding the uncertainty in sea level rise forecasting and support for building dikes higher and in a shorter timeframe that anticipates accelerated sea level rise;
- that they appreciated the thoroughness of the report, the phasing methodology, and the clear concepts within the Plan;
- that the dike trail network is an important amenity with suggestions relating to paved walkways, distance markers, additional lighting, benches, and establishing a continuous perimeter trail; and

- that they would like more information regarding the amount of capital assigned to dike improvements and the timing of dike upgrades.

During the public open houses, staff received questions relating to costs of the proposed works and the public was advised that the City has three funding sources to implement the Dike Master Plan: the Drainage and Diking Utility, senior government grant funding, and development partnerships.

A detailed summary of the open house and website feedback is provided in the attached reports.

Key External Stakeholder Feedback

Key external stakeholders engaged included:

- BC Ferries
- Canadian Fishing Company
- City of New Westminster
- Crown Packaging
- Fisheries and Oceans Canada
- Environment Canada
- Lafarge Canada Inc.
- Ministry of Forests, Lands and Natural Resource Operations and Rural Development
- Ministry of Transportation and Infrastructure
- Mitchell Island Businesses
- Port of Vancouver
- Provincial Inspector of Dikes
- Sea Island Commercial Interests
- Sea Island Community Association
- TransLink
- Urban Development Institute
- Vancouver Airport Authority

Stakeholders that returned comments were generally supportive of the findings in Dike Master Plan Phases 3 and 5.

BC Ferries provided presentations and details on their current development works at the Deas Dock site. The proposed dike design aligns with the Dike Master Plan as an interim option; the ultimate goal being to raise the entire site to create a superdike as redevelopment occurs.

The Ministry of Forests, Lands and Natural Resource Operations and Rural Development continues to refer to the 2014 Seismic Design Guidelines for Dikes – 2nd Edition as the primary resource for seismic design. The Inspector of Dikes is open to flexibility for dike design in specific scenarios but is looking for consistency in seismic standards. Studies are currently being performed for the Province which may affect seismic designs when completed.

The Port of Vancouver indicated general support for the City's goal to have continuous, high-quality flood protection for the entire Lulu Island. The Port of Vancouver is currently in the early

stages of developing their long-term plans for land use and development of their sites. They are interested in working collaboratively with the City during design of dike upgrades to ensure that flood protection is coordinated with their operations.

TransLink does not require further engagement at this time unless the proposed dike improvements impact trucking operations, changes the Major Road Network, or affects bus stops. TransLink should be contacted during the planning phase of projects if these impacts are expected to occur.

Urban Development Institute have no comments on the Plans at this time. They have requested a general presentation on the Dike Master Plans when they have been endorsed by Council.

Vancouver Airport Authority and the City of Richmond agreed to continue discussions to establish a formal agreement of dike ownership on Sea Island. The Airport Authority is currently upgrading their perimeter dike to 4.7 metres and intends to complete a Dike Master Plan to inform their flood protection work.

In addition to the key external stakeholders already consulted, Staff will be planning Dike Master Plan Phases 3 and 5 presentations to the Advisory Committee on the Environment and the Agricultural Advisory Committee.

Recommendations

Following public and key stakeholder consultation, comments received have been reviewed and are incorporated in the finalized report. Recommendations of Dike Master Plan Phases 3 and 5 are summarized as follows:

Lulu Island - south dike between No. 2 Road and Boundary Road

- Raise the dike crest to allow for 1.0 metres of sea level rise and 0.2 metres of subsidence by the year 2100. For the dike area from No. 2 Road to west of Nelson Road, the raised dike elevation would be 4.7 metres geodetic. For the dike east of Nelson Road to Boundary Road, the raised dike elevation would increase from 4.7 metres at Nelson Road to 5.0 metres at Boundary Road.
- Reconfigure and reconstruct Dyke Road to be inland rather than on top of the dike to facilitate short-term and long-term dike upgrading. This will allow for City utilities to be relocated inland of the dike.
- Pursue superdikes and individual site strategies dependant on existing rights and agreements, the urgency of works, and the opportunities for redevelopment of each site.
- Construct the south section of a secondary dike near Boundary Road.
- Construct a separate multi-use path along the dike to improve pedestrian and cyclist safety. This would be consistent with the 2010 Richmond Trail Strategy that guides the City in trail development and aligns with the vision for a perimeter trail system.

Mitchell Island

- Raise roadways to a 4.7 metre dike elevation to provide an emergency egress.
- Acquire rights-of-way along river bank properties for a future dike and for further bank protection works.

- Establish redevelopment policies on Mitchell Island that require superdike formation to a 4.7 metre dike elevation.
- Engage low elevation properties to mitigate flood.

Sea Island - from the Sea Island Connector Bridge to 3800 Cessna Drive

- Raise the dike crest to 4.7 metres to allow for 1.0 metres of sea level rise and 0.2 metres of subsidence.
- Establish redevelopment policies on Sea Island that require superdike formation to a 4.7 metre dike elevation.
- As an interim measure prior to redevelopment, raise the dike to 4.7 metres using individual site strategies where low sections of dike occur.

Richmond Island

- Flood protection responsibility will remain with the property owner.
- Inform the property owner on Richmond Island of the scour risk that has been identified in the North Arm of the Fraser River adjacent to Richmond Island.

Next Steps

Dike Master Plan Phases 3 and 5 identifies a medium to long term program for dike improvements on the south dike of Lulu Island, the City of Richmond's section of perimeter dike on Sea Island, Mitchell Island, and Richmond Island over the next 25 to 75 years to stay ahead of climate change induced sea level rise and land subsidence.

As sea level rise is realized, the rate of dike improvement will be adjusted accordingly. Staff will present annual utility funding levels for dike improvement for Council's consideration through the bi-annual Ageing Infrastructure Report. Upgrades will also occur in conjunction with the City's growth, allowing synergies between the City and the development community.

In the short and medium term, there is a significant amount of work that can be carried out in preparation for these upgrades. Should Council endorse this work plan, staff will:

- Encourage the construction of superdikes through development;
- Re-evaluate current and future flood construction levels and development bylaws to reduce flood risk;
- Strategically acquire properties in support of future dike upgrading;
- Monitor sea level rise using water level sensors; and
- Investigate the creation of a habitat banking program to support dike improvement projects based on environmental assessment.

Financial Impact

Capital projects will be brought forward for Council consideration as part of the Council budget process.

Conclusion

Consistent with the City's 2008-2031 Richmond Flood Protection Management Strategy, Dike Master Plan Phases 3 and 5 identifies the City's preferred medium to long term dike improvements for the south dike of Lulu Island from No. 2 Road to Boundary Road, Sea Island from the Sea Island Connector Bridge to the south end of 3800 Cessna Drive, Mitchell Island, and Richmond Island to address climate change induced sea level rise and land subsidence.

Dike Master Plan Phases 3 and 5 generally recommends that the City raise the dike to a minimum 4.7 metre dike elevation while allowing for a further height increase to 5.5 metres in the future, integrate the proposed dike concepts within the study areas, pursue superdikes through development, and engage private property owners to raise the dike within their property.

Public and key stakeholder feedback on Dike Master Plan Phases 3 and 5 will be incorporated into capital dike improvement projects as identified in this plan.

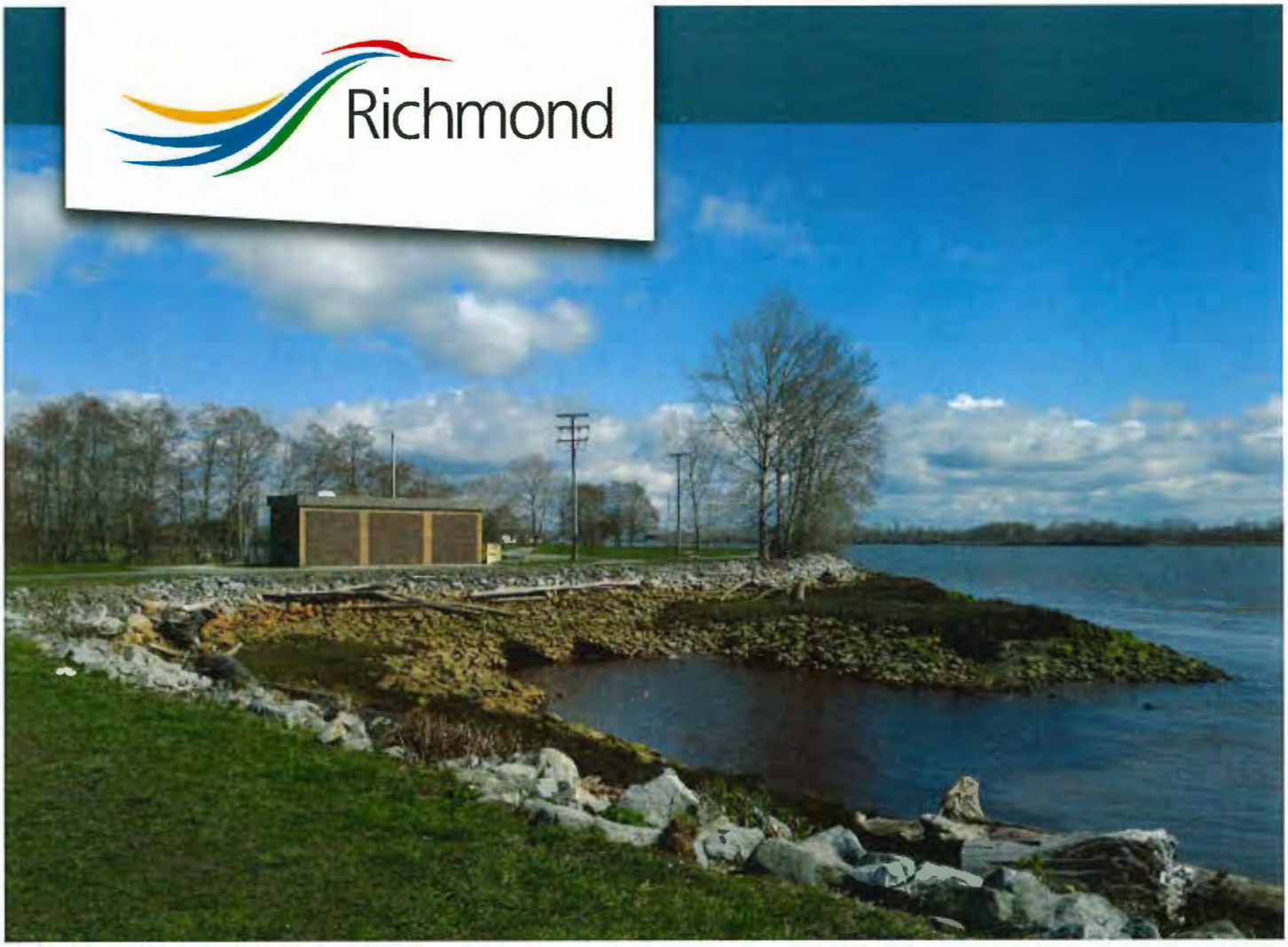
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ES: am

Att. 1: Dike Master Plan Phase 3 Final Report 2019
2: Dike Master Plan Phase 5 Final Report 2019

Richmond









Final Report

Richmond Dike Master Plan - Phase 3

February 2019
KWL File No. 0651.110-300

Submitted by:

KERR WOOD LEIDAL
consulting engineers

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Executive Summary

The City of Richmond uses a Dike Master Planning program to guide future dike upgrading projects, and to ensure that land development adjacent to the dike is compatible with flood protection objectives. The program includes 4 phases for the 49 km of the Lulu Island perimeter dike within Richmond, plus a 5th phase for Sea Island, Mitchell Island and Richmond Island. The goal is to raise the dikes to 4.7 m CGVD28 to allow for 1 m of sea level rise plus 0.2 m of land subsidence, while allowing for further future upgrading. The long-term vision is to provide the City with a world-class level of flood protection to keep pace with the rapidly growing community within the dikes.

This Phase 3 Dike Master Plan covers approximately 20 km of the Lulu Island perimeter dike along the Fraser River, on the south side of the island between Gilbert Road and Boundary Road. The dike within Phase 3 crosses through a variety of land uses, including roads, parks, and industrial land. Challenges along the dike alignment include conflicts with roads, drainage channels, utilities, and industrial development. There are also challenges with residential and commercial development outside the dike, and liquefiable soils beneath the dike. There are opportunities to construct at least some dike works through redevelopment, and to create linked trail networks for a full trail loop around Lulu Island.

This report describes existing conditions, develops an ideal vision for dike upgrading, presents design criteria, identifies options for dike upgrading, and presents recommended dike upgrading options that appropriately address the challenges. This work can be used as a basis for design of dike upgrading projects, recognizing that site-specific refinement of recommended options will be required in some areas. This work can also be used to assist with land use planning activities along the dike corridor. The main features of the recommended options to dike upgrading in Phase 3 are described below.

- West of Nelson Road, the raised dike crest would be 4.7 m (CGVD28). East of Nelson Road, the raised dike crest would increase to 5.0 m at Boundary Road. The plan also allows for longer term upgrading to accommodate a further 1 m of sea level rise (i.e. 2 m of sea level rise).
- Widen the dike on the land side rather than into the Fraser River.
- Move Dyke Road inside the dike to facilitate dike upgrading. This will require the road to be reconfigured and reconstructed, with some additional land tenure. Moving the road will allow removal of utilities within the dike.
- Raise the relocated Dyke Road to the dike crest elevation. This will facilitate driveway access over the dike to riverside properties. It will also be compatible with the desire to raise land inside the dike.
- Pursue individual industrial site strategies depending on the existing rights and agreements, the urgency of the works, and opportunities for redevelopment for each site.
- Replace the drainage channels immediately inside the dike with storm sewers and swales. This will improve dike stability, and will provide some of the land needed to relocate Dyke Road.
- Improve pedestrian and cyclist safety by constructing a separate multi-use path along the dike. This would be consistent with the City Parks vision for a perimeter trail system.
- Construct the south section of a secondary dike near Boundary Road.

It is also recommended that the City prepare a comprehensive implementation plan for dike upgrading that incorporates the elements of the Phase 3 Dike Master Plan, and the elements of the other Dike Master Plans. To address habitat compensation issues associated with dike upgrading, it is further recommended that the City consider development of a habitat banking program that could provide effective large-scale compensation.

For all Dike Master Plan phases, the City should continue to investigate alternative ways to achieve seismic performance objectives, including soil densification research, custom design criteria, and filling a wide swath of land inside the dike.

1. Introduction

Flood protection in Richmond is guided by the City's 2008-2031 Flood Protection Management Strategy which includes a comprehensive suite of measures including structural measures (e.g., dikes and pump stations), non-structural measures (e.g., flood construction levels), and flood response and recovery plans.

Dike Master Plans are critical components of the City's 2008-2031 Flood Protection Management Strategy, and are used to guide the implementation of long-term dike upgrades.

The City of Richmond (City) has retained Kerr Wood Leidal (KWL) to prepare the Richmond Dike Master Plan Phase 3.

Phase 3 covers the south-eastern portion of the Lulu Island perimeter dike from No. 2 Road to Boundary Road (City of New Westminster). Figure 1-1 presents the extent of the City's Dike Master Plan phases. Figure 1-2 shows the reaches of the Phase 3 Dike Master Plan.

1.1 Background

Richmond has a population of about 220,000 and is situated entirely on islands within the overlapping Fraser River and coastal floodplains (Lulu Island, Sea Island, Mitchell Island, Richmond Island, etc.). The City's continued success is due in part to its flat, arable land and its strategic location at the mouth of the Fraser River and on the seashore. The low elevation of the land and its proximity to the water comes with flood risks.

Lulu Island is the most heavily developed part of Richmond. Lulu Island is bounded by the Fraser River and the Strait of Georgia, and is subject to flood risks from the Fraser River and the sea. Lulu Island is also subject to other flood-related hazards, including dike breach, seismic effects, extreme rainfall wave action, and river instability. The typical natural ground elevation is in the range of 1 m to 2 m as shown on Figure 1-1.

The cornerstone of the Lulu Island flood defenses is a 49 km long perimeter dike. Internal drainage is provided by an integrated system of channels and storm sewers that drain to 39 pump stations / floodboxes. Richmond occupies over 90% of Lulu Island. The balance of Lulu Island (the upstream end) is occupied by the Queensborough neighbourhood of the City of New Westminster.

As Richmond is fully situated within the river/coastal floodplain, there is no option to locate development out of the floodplain. The continued success of the City depends on providing a high level of structural and non-structural flood protection measures. Without continued improvements, the flood risk within the City would progressively rise as a result of rising flood levels (due to sea level and climate change), subsiding land, and increasing development.

The 2008-2031 Flood Protection Management Strategy guides the City's flood risk reduction activities across the City's organizational structure and across the spectrum of structural and non-structural flood protection measures.

The Lulu Island perimeter dike is the most critical structural flood protection measure, and improvement of this asset is identified as the priority action in the Flood Protection Management Strategy.

1.2 Purpose and Objectives

The purpose of the Dike Master Plan is to guide the implementation of dike upgrades and provide a starting point for the City to work with proposed developments adjacent to the dike. The master plan defines the City's preferred and minimum acceptable dike upgrading concepts.

The Dike Master Plan facilitates the City's annual dike upgrading program by providing critical information for the design of dike upgrades, including:

- general design concept;
- alignment;
- typical cross-section (conceptual design);
- footprint and land acquisition and tenure needs;
- design and performance criteria;
- infrastructure changes required for dike upgrading;
- operation and maintenance considerations;
- environmental features and potential impacts;
- social and public amenity considerations;
- guidance for future development adjacent to the dike; and
- guidance on interaction with other structural flood protection measures (e.g. secondary dikes).

The Dike Master Plan is intended to guide dike upgrading over the next 20 to 30 years.

Other flood protection measures, including non-structural measures, are identified in the City's 2008-2031 Flood Protection Management Strategy. The City is currently working on an updated strategy.

1.3 Approach and Methodology

The Dike Master Plan has been developed using a 5-step approach presented and described below.



Define: Confirm Dike Master Plan objectives and design/performance criteria.

Understand: Collect and compile relevant information, including spatial data and background reports from the City and several other parties (City of New Westminster, provincial regulators, the port, etc.).

Assess: Develop dike upgrading options and identification of constraints and potential impacts. Desktop and field review of options with City staff to identify preferred options.

Consult: Present to and gather feedback from council and stakeholders on preferred options.

Refine: Develop the master plan informed by consultation and review by the City.

The scope for the Dike Master Plan includes the following main tasks:

- goals and objectives development;
- background data collection and review;
- design criteria development and identification of constraints;
- options development and review;
- site visits;
- drainage impacts assessment;

- desktop habitat mapping and impacts review;
- geotechnical assessment;
- public amenity review;
- stakeholder consultation; and
- report preparation.

1.4 Report Format

This report is organized as follows:

- The executive summary provides a high-level overview of the master plan and key features;
- Section 1 introduces the master plan context and process;
- Section 2 documents the existing conditions;
- Section 3 documents the options development and assessment, and presents the recommended options;
- Section 4 is a compilation of 2-page summary sheets highlighting existing conditions and key features of the preferred option for each reach; and
- Section 5 provides implementation strategy, including costs, phasing, and coordination; and
- Section 6 provides general and reach specific recommendations for next steps and implementation.

Appendix A provides figures showing conditions along the existing dike alignment, and the preliminary design footprint for of the recommended upgrading options discussed in Section 3.

1.5 Project Team

The KWL project team includes the following key individuals:

- Colin Kristiansen, P.Eng., MBA – Project Manager;
- Mike Currie, M.Eng., P.Eng., FEC – Senior Engineer and Technical Reviewer;
- Sarah Lawrie, M.A.Sc., P.Eng. – Project Engineer;
- Laurel Morgan, M.Sc., P.Eng., P.E. – Drainage Engineer;
- Daniel Brown, B.Sc., B.Tech., BIT – Project Biologist;
- Patrick Lilley, M.Sc., R.P.Bio., BC-CESCL – Senior Biologist; and
- Jack Lau - GIS/CAD Analyst.

This report was primarily written by Sarah Lawrie. The report was reviewed by Mike Currie and Colin Kristiansen.

Thurber Engineering Ltd. (Steven Coulter, M.Sc., P.Eng.) provided geotechnical engineering services and Hapa Collaborative (Joseph Fry, BCSLA) provided landscape architecture services.

The project was guided on behalf of the City by:

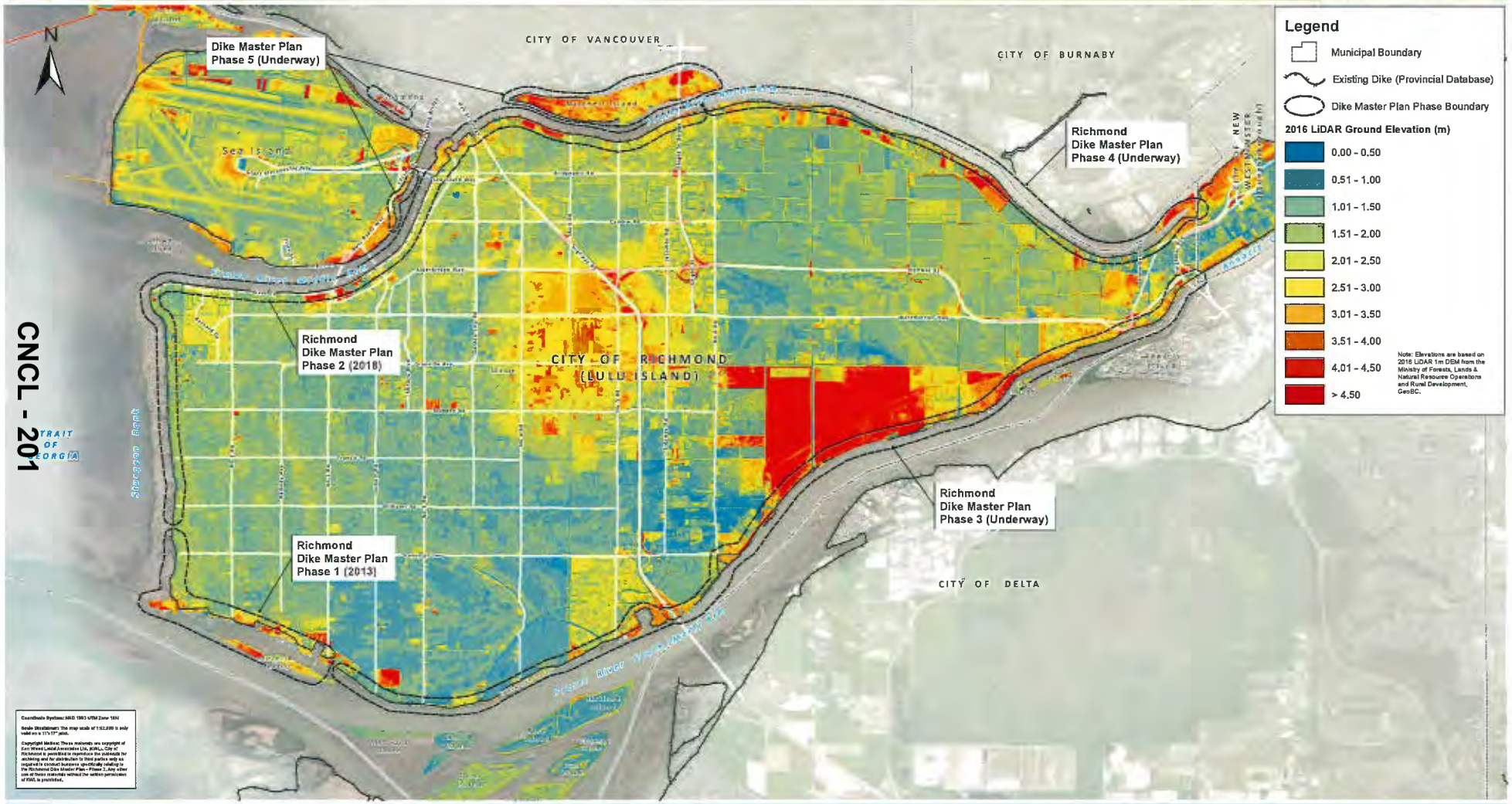
- Lloyd Bie, P.Eng. – Manager, Engineering Planning;
- Corrine Haer, P.Eng. – Project Engineer, Engineering Planning;
- Pratima Milaire, P.Eng., PMP - Project Engineer, Engineering Planning; and
- Chris Chan, B.A.Sc., E.I.T. – Project Engineer, Engineering Planning.

Many additional City staff contributed to the project during workshops, site visits, and in reviewing draft report materials.

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers



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Dike Master Plan Phases

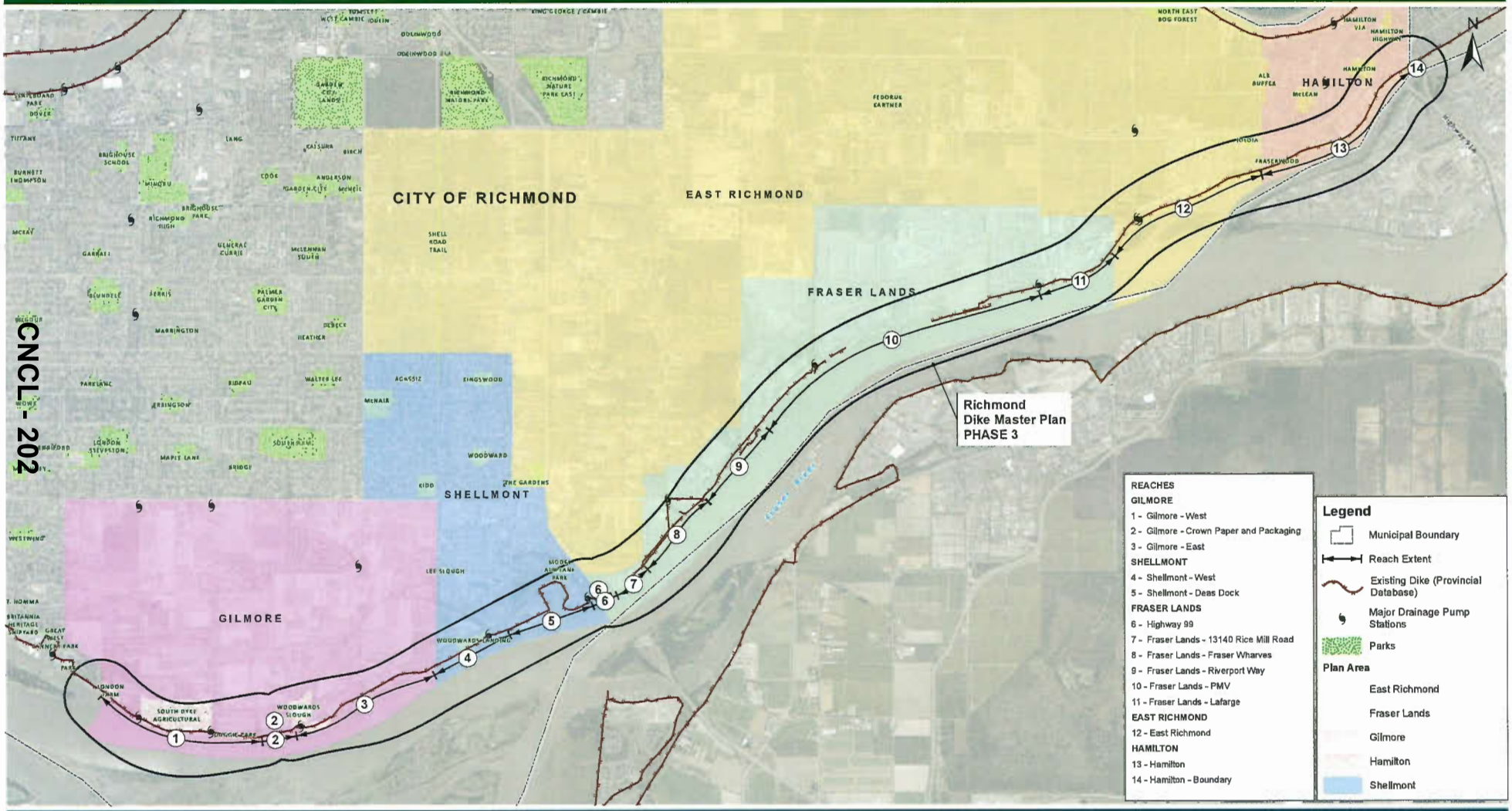
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City of Richmond

Richmond Dike Master Plan - Phase 3

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Dike Master Plan Phase 3 Reaches

Figure 1-2

2. Existing Conditions

This section summarizes the options development process undertaken, including the following components:

- review of existing conditions;
- design considerations;
- upgrading strategies; and
- preferred options and concepts.

2.1 Reaches and Major Features

The dike in Phase 3 is characterized as a dike in the road alignment (predominantly in Dyke Road), a dike through park space and a dike through industrial lands. A variety of land uses, structures and infrastructure are located on either side of the road/dike.

Space is limited in the road corridor presenting unique challenges for the master plan. City staff has identified road safety, including pedestrian and cyclist safety, as an important consideration for the Dike Master Plan.

In the active works yards and port facilities, space can be limited and industrial activities, such as the need for river access and site grading constraints due to specialized machinery, present unique challenges for the master plan. City staff has identified access for dike maintenance and inspection as an important consideration for the Dike Master Plan.

Land uses adjacent to the dike in Phase 3 comprise industrial, agricultural, and single and multi-family residential. The setback between the river bank and the dike varies from more than 15 m to none where the edge of the dike/road is the river bank and riprap bank protection is in place.

There are marine-based industries in Phase 3, including shipbuilding and repair, barge on/off-loading, port facilities, tour operations, and marinas. These operations typically require access to the river over the dike, or they are set outside of the dike and are unprotected.

There are residential settlements on the river-side of the dike. Finn Slough heritage community is a residential community situated on the river, outside of the protection of the dike (Reach 3). Similarly, a recent townhome development (23740 and 23580 Dyke Road, Reach 13) is on the river, outside of the protection of the dike.

Phase 3 has been subdivided into 14 reaches with relatively uniform conditions. Reach extents are presented on Figure 1-2.

Table 2-1 describes the existing conditions and features of each reach. It is anticipated that these defined reaches can be subsequently used for dike upgrading implementation phasing.

Table 2-1: Phase 3 Reaches and Features

Reach # & Name	Extent / Length	Existing Dike Alignment	Major Features
1 – Gilmore West	No. 2 Road to Crown Packaging (2.7 km)	Dyke Road Dyke Trail Dog Park (trail)	• Dike in road with utilities • Habitat, trail, and park amenities on water side • Farms, residences, and channels on land side • London Heritage Farm, a historical site featuring a 19th-century farmhouse and barn, is located on the landside of the dike at approximate chainage 68+500. Dike upgrades need to protect this area without impacting the existing structures • South Dyke Trail runs along the crest of the dike from No. 2 Road to No. 5 Road • No. 3 Road Pier, a public amenity on the water side of the dike, at chainage 67+400 • Lulu Island Waste Water Treatment Plant is located approximately 200 m inland of the dike at chainage 68+100 • Dike upgrade project between Gilbert Road and No. 3 Road under construction 2019 (approximate chainage 68+100 to 67+300) • Fish habitat compensation site at the base of Gilbert Road • Drainage channel along the landside toe of the road/dike • Gilbert Road South pump station • No. 3 Road South pump station
2 – Crown Packaging (13911 Garden City Road)	66+500 to 66+150 (350m)	Adjacent to the River Riverside of Crown Packaging	• Active industrial site and barge facility with restricted maintenance access • Rail and road access issues limit options to go around the site • Property is leased to Crown Packaging with 18 years left on the lease • Restricted City maintenance access • Dike crest elevation is approximately 2.75 m to 3.5 m • Crown Packaging operates a large cardboard production plant on the site (60 to 65 m from top of bank) • Rail line is located on the property (below the dike crest elevation) with rail access from the east • Sub-leased shore area to a shipping/receiving company that uses sea-cans, large forklifts, semi-trucks and rail cars as part of their operations

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Reach # & Name	Extent / Length	Existing Dike Alignment	Major Features
3 – Gilmore East	Crown Packaging to Shell Road (1.75 km)	Dyke Road	• Dike in road with utilities • Habitat and Finn Slough on water side • Farms and residences on land side • Woodwards Slough pump station • South Dyke Trail runs along the crest of the dike from No. 2 Road to No. 5 Road • Drainage channel on the land side adjacent to the existing road/dike • Large, newly built homes and farm structures (barns etc.) near the toe of the existing dike/road
4 – Shellmont West	Shell Road to No. 5 Road (1 km)	Dyke Road	• Dike in road with utilities • Industrial/commercial buildings and parks on land side • South Dyke Trail runs along the crest of the dike from No. 2 Road to No. 5 Road and provides connection to the Horseshoe Slough Trail • Woodward's Landing park space • Horseshoe Slough pump station • Existing drainage channel along the landside toe of the road/dike • Habitat, trail, and park amenities on water side
5 – Shellmont Deas Dock BC Ferries Fleet Maintenance Unit (12800 Rice Mill Road)	No. 5 Road to Rice Mill Road (1 km) (1.6 km of dike)	Adjacent to the River	• Port facilities under redevelopment • Active marine work yard and shipyard facilities with restricted maintenance access • Rail and road access issues limit options to go around the site • Active redevelopment activities • Mainland Sand and Gravel have an agreement with the City to maintain a given elevation of the material to provide flood protection (not a defined dike structure on the site) • Fish habitat compensation site (plantings along Deas Dock area) • BC Ferries, Deas Pacific Marine, have a flood response plan for high water events
6 – Highway 99	Rice Mill Road (250 m)	Adjacent to the River	• Dike in road • Peace Arch (Hwy 99) pump station • Flood protection needs to integrate with the George Massey Tunnel • Unique risks associated with having a tunnel under the dike

Reach # & Name	Extent / Length	Existing Dike Alignment	Major Features
7 – Fraser Lands – Canadian Fishing Company (13140 Rice Mill Road)	Rice Mill Road to Fraser Wharves (500 m)	Adjacent to the River	• Active industrial site, dock and barge facility with restricted maintenance access • Rail and road access issues limit options to go around the site • Fish habitat compensation site (plantings on the river-side of the property) • Dike crest elevation ranges from less than 3 m to up to 3.5 m
8 – Fraser Lands Fraser Wharves	Fraser Wharves to Steveston Hwy (1 km)	Adjacent to the River	• Active ship to land car unloading facilities • Habitat on water side with limited or no community access • Near-term potential redevelopment • Active redevelopment activities • No. 6 Road South pump station
9 – Fraser Lands Riverport Way	Steveston Hwy to Williams Road (1 km)	Adjacent to the River	• Dike in road with utilities and dike trail • Residential and commercial development • Some recently constructed improvements challenging to raise • Redevelopment offers opportunity to raise site (superdikes) and provide community amenities • Fish habitat compensation site in front of the Riverport Way development
10 – Fraser Lands Port of Vancouver	Williams Road to Nelson Road (3.5 km)	Adjacent to the River	• PMV development, barge facilities, dredged material and construction material stockpiles on extensive high ground due to historic landfill • Stability concerns due to proximity to narrow section of river with deep dredging • Development offers opportunities for creating superdike improvements and raising the land behind the dike • Opportunities for dike material stockpile areas, and increased public amenities • Three (3) Fish habitat compensation sites: front face of the loading area in the Port, and two (2) intertidal areas near No. 8 Road • City-owned property along the waterfront provides recreational opportunities • No. 7 Road South pump station • Nelson Road South pump station

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Reach # & Name	Extent / Length	Existing Dike Alignment	Major Features
11 – Fraser Lands Lafarge (7611 No 9 Road)	Nelson Road to Dyke Road (1.5 km)	Adjacent to the River	• Active industrial site and barge facility with restricted maintenance access • Rail and road access issues limit options to go around the site • Dike upgrade project under construction 2018
12 – East Richmond	Dyke Road to Fraserwood Way (1.8 km)	Dyke Road	• Dike in the road with utilities • Commercial development on land side • Existing drainage channel along the landside toe of the road/dike • Marinas with access over dike on water side • Shelter Island Marina and Boatyard needs low gradient access across the dike for the Travelifts to haul out or launch boats • East Richmond Trail and Fraserwood Trail run along the dike crest, or adjacent to the road from No. 9 Road to Boundary Road • Ewen Road Irrigation pump station
13/14 – Hamilton/Boundary	Fraserwood Way to Boundary Road (1.7 km)	Fraserwood Way Dyke Road	• Dike in the road with utilities • Commercial development on land side • Existing drainage channel along the landside toe of the road/dike • Marinas and float homes with river access over the dike on both the land side and river side • East Richmond Trail and Fraserwood Trail run along the dike crest, or adjacent to the road from No. 9 Road to Boundary Road • Final 500 m of dike is set back on the land side of Fraserwood Way (Fraserwood Trail) and road and buildings are on the river side of the dike • Townhome complex at 23740 and 23580 Dyke Road outside of the dike • Fish habitat compensation site on either side of the Queensburough Connector • Highway 91 and City of New Westminster dike interface

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2.2 Land Tenure

The majority of the existing dike footprint is located within the City's road dedication, on a right-of-way, or on City-owned land parcels. However, there are several areas where the existing dike footprint encroaches onto private property or where space is very limited such that any upgrading would encroach onto private property.

The existing land tenure in Phase 3 is presented on Figure 2-1 and in more detail in Appendix A.

2.3 Infrastructure

There are considerable infrastructure and utilities associated with the existing dike corridor in Phase 3. In addition to the road that runs along the top of the dike for much of the reach, there are also watermains, sanitary mains and forcemains, drainage channels, and storm mains that run parallel to the dike, predominantly at the landside toe. This infrastructure will need to be moved to accommodate any increases to the dike footprint.

There are nine (9) pump stations that cross through the dike in Phase 3. The pump stations and the associated reach are summarized in Table 2-2. The condition of the pump stations was not assessed as part of preparing the master plan.

***Table 2-2: Phase 3 Pump Stations and Reach* Locations**

Pump Station	Reach
Gilbert Road South	1
No. 3 Road South	1
Woodwards Slough	3
Horseshoe Slough	4
Peace Arch (Hwy 99)	6
No. 6 Road South	8
No. 7 Road South	10
Nelson Road South	10
Ewen Road Irrigation	12

There are a number of parks and public spaces associated with the existing dike (Table 2-3). The dike crest provides recreation opportunities and connection for the public to the waterfront. The South Dyke Trail runs along the crest of the dike from No. 2 Road to No. 5 Road (Reaches 1 through 4), with a short detour around Crown Packaging (Reach 2). The South Dyke Trail provides connection to inland trails, including the Horseshoe Slough Trail.

The East Richmond Trail and Fraserwood Trail run along the dike crest, or adjacent to Fraserwood Way and Dyke Road, from No. 9 Road to Boundary Road (Reaches 12 and 13).

In addition to the official City parks and trails, there are portions of the dike which is City-owned land and is used by the public as an unofficial trail and recreational area (Reach 10).

Table 2-3: Phase 3 Parks and Reach Locations

Park Name	Reach
No. 2 Road Pier/London's Landing	1
Gilbert Beach	1
London Heritage Farm	1
Dyke Trail Dog Park	1
No. 3 Road Waterfront Park / No. 3 Road Fishing Pier	1
Woodward's Landing	4

2.4 Habitat

Methodology

A desktop review was conducted to the ecological setting along and adjacent to the length of proposed dike upgrades. The Phase 3 study area includes the existing dike and adjacent land or intertidal area on the south side of Lulu Island between Princess Lane and Boundary Road and is split into 14 reaches. Spatial data were used to identify overlap of known environmental values with the Phase 3 study area, which will inform development of the detailed design for dike improvements.

Spatial data reviewed in the desktop study includes:

- Fraser River Estuary Management Program mapping (FREMP 2012, 2007) mapping used to identify riparian and intertidal habitat types and quality;
- iMapBC web application (iMapBC 2017);
- Richmond Interactive Map web application (City of Richmond 2018) and
- City of Richmond aerial photographs (Richmond Interactive Map 2017).

The location and extent of high quality Fraser River riparian and intertidal habitat was identified to inform development of dike upgrade options and their potential impacts. FREMP habitat polygons were assigned the following categories: high quality riparian, high quality intertidal, or other. Deciduous tree woodland polygons were categorized as high quality riparian habitat because these communities provide cover and nutrients to fish using nearshore habitat. Mud, sand, and marsh polygons were categorized as high quality intertidal habitat because of the foraging and nesting habitat they provide for bird species and the foraging, egg deposition and rearing habitat they provide for fish species. Aquatic and riparian habitat on the land side of the existing dike was identified and mapped using the Riparian Area Regulation buffer layers from the Richmond Interactive Map (City of Richmond 2018) and interpretation of recent aerial photography (City of Richmond 2017).

Fish and Aquatic Habitat

High quality intertidal and riparian habitat is present in 12 of 13 Phase 3 reaches on the Fraser River side of the dike. This important habitat provides forage and cover habitat as well as a staging area for anadromous salmonids transitioning from saltwater to freshwater. Conversely, armoured sections of shoreline on the Fraser River side of the existing dike are also present in Reaches 1, 2, 3, 7, 8, 9, 11, and 12. These sections provide limited habitat value and construction here would have less of a negative impact on fish.

On the land-side of the dike, drainage channels are present in 7 of 13 reaches (Reaches 1, 3, 4, 5, 10, 12, 13). These channels provide low to moderate quality aquatic and riparian habitat for fish and amphibians.

Seven existing fish habitat compensation projects are present in the Phase 3 study area. Completed between 1979 and 2004, these projects included the creation of intertidal marsh habitat to compensate for damage to habitat elsewhere. The reaches where these habitat compensation projects are located are listed in Table 2-4.

Wildlife and Terrestrial Habitat

Terrestrial habitat types in Phase 3 include deciduous tree woodland, tall shrub woodland, low shrub woodland, and vascular plant meadow, as well as uncategorized sections (e.g. paved lots; FREMP 2007). These habitat types have potential to provide nesting habitat to migratory birds in all reaches of Phase 3. Orthoimagery review identified potential raptor nesting trees in all reaches of the Phase 3 study area.

The internal drainage channels that are mentioned above and are present in six of the 13 reaches of Phase 3 (Reaches 1, 3, 4, 10, 12, and 13) are likely used by native amphibian species as breeding habitat as well as by fish species. It is possible that additional amphibian habitat is present in small ponds or channels along the dike that were not identified in the desktop review.

Species and Ecological Communities at Risk

No known occurrences of terrestrial wildlife species at risk are present in the Phase 3 study area but several occurrences exist nearby, on islands in the Fraser River or on the river banks across from Richmond. It is possible that individuals of these species also occur on the Richmond side of the Fraser River. The Lower Fraser River population of White Sturgeon (*Acipenser transmontanus* pop. 4) is known to occur in the Fraser River next to the dike. Mapped critical habitat for at-risk species is not present within 500 m of the study area.

FREMP mapping (2007) shows the presence of intertidal marsh communities in eight of thirteen reaches of the Phase 3 study area (Reaches 1, 2, 3, 8, 9, 10, 12, and 13). Many of these communities in British Columbia are considered at-risk (i.e. Blue-Listed; meaning they are considered of special concern, or Red-Listed; meaning they are threatened, or endangered). No ecological communities at-risk are shown in either the study area on BC iMap (2017), but it is likely that some are present in the Phase 3 study area.

Table 2-4 presents the findings of the desktop review on a reach-by-reach basis and separates Fraser River side results from land-side results.

Table 2-4: Environmental Values

Reach #	Location	Environmental setting (organized by inland side and shoreline side of existing dike)	Construction Constraints	Construction Opportunities	FREMP Habitat Types	Richmond ESA types present	Known Species at Risk Occurrence Near Dyke Alignment	Potential Raptor Nesting Trees	Potential Migratory Bird Nesting Habitat	Existing Habitat Compensation Sites Present
1 Gilmore - West	Land Side	• Most of reach bordered by low-quality fish-bearing, and amphibian habitat drainage channel • Moderate quality deciduous woodland, tall shrub woodland, and meadow present on inland bank of drainage channel	Drainage channel full length of reach	East end of reach, dike is set back from watercourse	Deciduous tree woodland Tall shrub woodland Meadow	Shoreline	Henderson's Checker-mallow (*Sidalcea hendersonii*) Joe-pye Weed (*Eutrochium maculatum var. bruneri*) Vancouver Island beggarticks (*Bidens amplissima*) White Sturgeon (Lower Fraser River population) (*Acipenser transmontanus* pop. 4)	Y	Y	Project: Lulu Island Sewage Treatment Plant Outfall Replacement Year Created:1993
	Fraser River Side	• Western third of reach is bordered by high quality marsh and mudflat habitat • Middle third of reach is low quality habitat armoured bank • Eastern third of reach has narrow strip of marsh habitat	High quality habitat at west end	Existing dike is set back from the shoreline in portions of this reach	Marsh Meadow Mudflat	Intertidal Shoreline				
2 Gilmore - Crown Packaging (13911 Garden City Road)	Land Side	• Paved parking lot	Private property	n/a	Unvegetated	Shoreline	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	N
	Fraser River Side	• Armoured bank with small area of high quality riparian deciduous treed woodland habitat	Small area of high quality habitat	n/a	Marsh Meadow	Intertidal Shoreline				
3 Gilmore - East	Land Side	• Drainage channel bordering agricultural fields along entire length of reach (Potential amphibian breeding habitat • Fish species presence not recorded)	Drainage channel bordering dike	n/a	Meadow Low shrub woodland Deciduous tree woodland	Freshwater wetland Shoreline	Flowering Quillwort (*Lilaea scilloides*) White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	N
	Fraser River Side	• Habitat in West quarter of reach is low quality (landscaped grasses and walking trails, set back from armoured slope) • Middle section adjacent to Gilmour Slough, (records of threespine stickleback and carp) • Habitat on banks of Gilmour slough is high quality marsh • Riparian habitat on south side of Gilmour slough is high quality (tall shrubby woodland)	Gilmour slough (high quality habitat) bordering dike	Dike is set back from shoreline at west end	Meadow Marsh Deciduous tree woodland Mud flat	Intertidal Freshwater wetland Shoreline				
4 Shellmont - West	Land Side	• Low quality habitat, walking path and maintained lawn at east and west end of reach • Drainage channel adjacent to middle of reach (Threespine stickleback, amphibian habitat)	Drainage channel in middle of reach	Absence of watercourses in east and west ends	Deciduous tree woodland Meadow	Shoreline Freshwater wetland	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	N
	Fraser River Side	• Very West end of reach is set back from Fraser River • High quality marsh habitat in Fraser River in east half of Reach	High quality riparian habitat at west end. Marsh at east half	Low quality riparian habitat in middle third	Deciduous tree woodland Sand Meadow	Intertidal Shoreline Freshwater wetland				
5 Shellmont - Deas Dock BC Ferries Fleet Maintenance Unit (12800 Rice Mill Road)	Land Side	• Mostly paved, some low quality herbaceous habitat present	n/a	Low quality habitat and absence of watercourses along full length	Meadow Unvegetated	Shoreline	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	Project: Richmond Plywood Year Created: 1989
	Fraser River Side	• Dike is set back approx. 100 m from High Quality marsh habitat in west half of reach • High quality mudflats and marsh bordering dike in east third of reach	High quality habitat at east end	absence of riparian habitat on east side of bay dike is set back from riparian habitat on west end	Sand Meadow Mud flat	Intertidal Shoreline				
6 Highway 99	Land Side	• Low quality gravel parking lots	n/a	Low quality habitat along full length	Deciduous tree woodland	Shoreline	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	N
	Fraser River Side	• High quality deciduous tree riparian woodland, mostly at west end	High quality riparian habitat	n/a	Deciduous tree woodland	Intertidal Shoreline				

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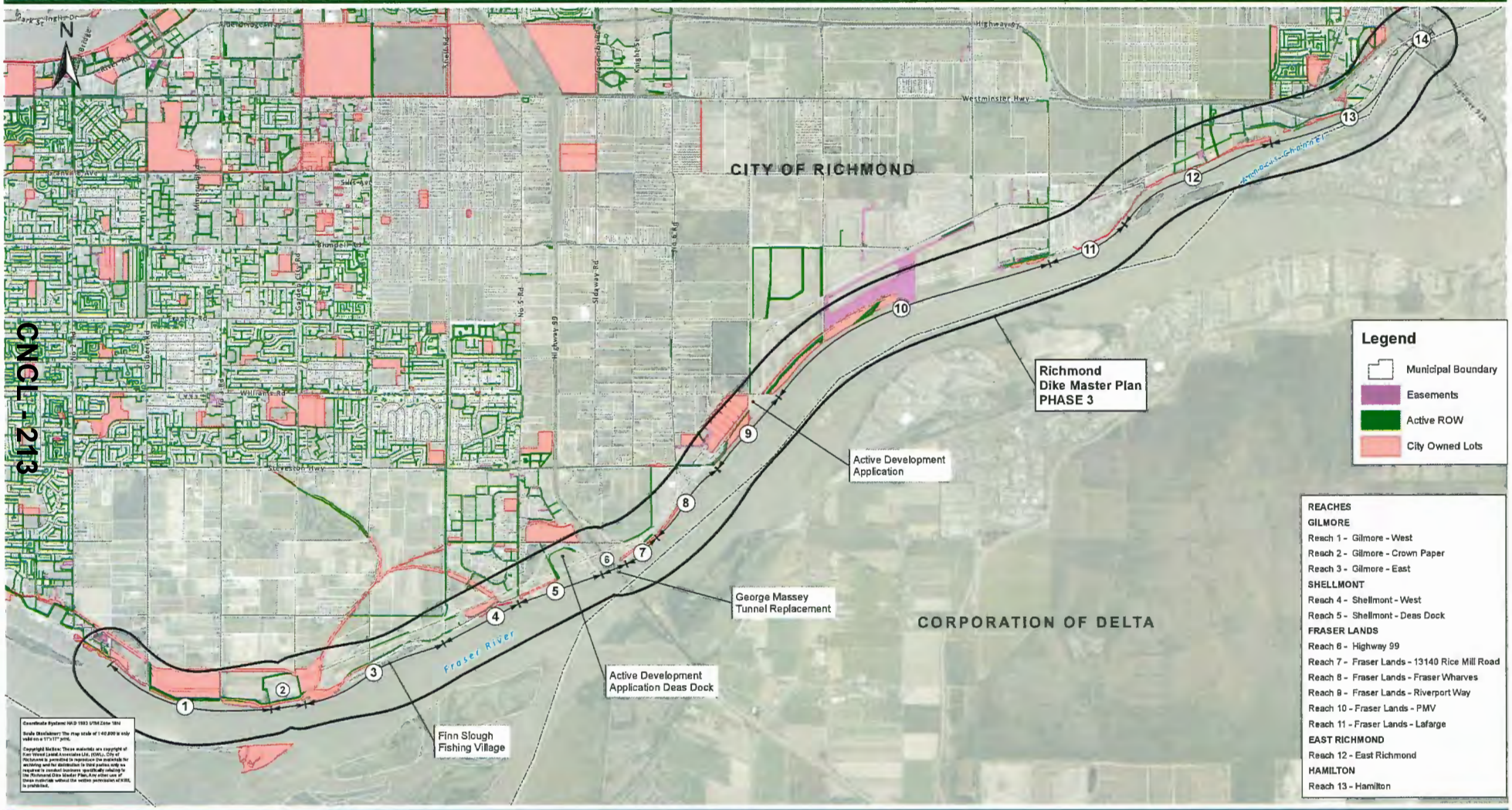
Reach #	Location	Environmental setting (organized by inland side and shoreline side of existing dike)	Construction Constraints	Construction Opportunities	FREMP Habitat Types	Richmond ESA types present	Known Species at Risk Occurrence Near Dyke Alignment	Potential Raptor Nesting Trees	Potential Migratory Bird Nesting Habitat	Existing Habitat Compensation Sites Present
7 Fraser Lands – Canadian Fishing Company (13140 Rice Mill Road)	Land Side	• Some deciduous trees, but mostly paved of buildings	Private property, buildings Some trees at east end	Mostly low quality paved	Meadow Unvegetated	Shoreline	Pointed Rush (*Juncus oxymeris*) White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	Project: Ocean Fisheries Limited Year Created: 1987
	Fraser River Side	• Low quality habitat armoured slope or pier	Pier	Low quality riparian habitat	Meadow Unvegetated	Intertidal Shoreline				
8 Fraser lands - Fraser Wharves	Land Side	• Paved Parking Lot, some low quality shrub habitat between dike and pavement	n/a	Low quality habitat along full length	Meadow Unvegetated	Shoreline	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	N
	Fraser River Side	• High quality deciduous treed riparian habitat in east half and small patch in west half-armoured slope and pier in middle of reach	Dike is mostly set back from high quality riparian habitat	Low quality habitat in middle of reach and at far east end	Meadow Deciduous tree woodland Marsh	Intertidal Shoreline				
9 Fraser Lands - Riverport Way	Land Side	• Maintained lawn or gravel lot, low quality habitat	Private property	Low quality habitat along full length	Meadow Unvegetated	Shoreline	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	Project: Legacy Park Lands Year Created: 2003
	Fraser River Side	• High quality deciduous forest riparian habitat in middle of reach • Low quality habitat armoured bank at east and west ends	High quality riparian habitat in middle of reach	Low quality riparian habitat at east and west ends of reach	Meadow, deciduous tree Woodland marsh Unvegetated	Intertidal Shoreline				
10 Fraser Lands – Port of Vancouver	Land Side	• Drainage channel at east end (Stickleback, amphibian habitat) • Paved lots at east and west ends • Large, seasonally flooded area in middle of reach (Potential for overwintering habitat creation)	Drainage channel at east end flooded area in middle of reach	Sections of low quality habitat at west and east ends	Meadow Tall shrub woodland	Shoreline Upland forest	Three-flowered (*Waterwort Elatine rubella*) White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	Project: Barge Facility Year Created: 2003 Project: Fraser Richmond Landfill Compensation Sites (2) Year Created: 1979
	Fraser River Side	• Large areas of high quality riparian forest, intertidal marsh along full length of reach	Large areas of high quality riparian habitat intertidal marsh along full length of reach	n/a	Deciduous tree woodland Marsh Sand bar Meadow	Intertidal Shoreline				
11 Fraser Lands – Lafarge Canada Inc. (7611 No 9 Road)	Land Side	• Low quality habitat paved lots and buildings	Private property	Low quality habitat, absence of watercourses	None (Paved)	Shoreline	Three-flowered (*Waterwort Elatine rubella*) White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	N
	Fraser River Side	• Some high quality forested riparian habitat at east end • Low quality habitat armoured bank at west end	High quality habitat at east end of reach	Low quality armoured bank at west end of reach	Meadow Deciduous tree woodland Sand	Intertidal Shoreline				
12 East Richmond	Land Side	• Drainage channels adjacent to dike at east and west ends of reach (amphibian habitat) • Low quality habitat paved or maintained lawn in middle of reach	Drainage channel at east and west ends	Paved or maintained lawn in middle of reach	Meadow Low shrub woodland Deciduous tree woodland Unvegetated	Shoreline Upland forest	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	N
	Fraser River Side	• High quality habitat mud flats at middle and east end of reach • Deciduous treed woodland high quality habitat at west end of reach	High quality habitat along almost full length of reach	Small section of low quality armoured bank in western portion of reach	Deciduous tree woodland Meadow Mud flat Marsh	Intertidal Shoreline				
13/14 Hamilton/Boundary	Land Side	• Drainage channels at very west end and in middle of reach (amphibian habitat) • Low quality paved or landscaping shrubs at west end of reach habitat • High quality shrubland habitat at east end of reach	Drainage channel at very west end and in middle of reach	Low quality habitat in west end of reach	Meadow	Upland Forest	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	Project: Former Queensborough Shipyard Restoration Year Created: 2004
	Fraser River Side	• High quality mud flats and marsh at west end of reach • Patches of high quality marsh and riparian deciduous woodland along east end of reach • Small patches of unvegetated low quality habitat along reach	High quality habitat at west end of reach	Small patches of low quality habitat	Deciduous tree woodland Marsh Mudflat Meadow Sandbar	Intertidal Upland Forest				

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL
consulting engineers



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Project No. 651-110
Date February 2019
Scale 1:40,000

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Existing Land Tenure

Figure 2-1

3. Options Assessment

This section summarizes the options assessment process, including the following components:

- design considerations and design criteria;
- upgrading strategies;
- upgrading options and concepts;
- summary of external stakeholder consultation; and
- recommended options for implementation.

3.1 Design Considerations

This section summarizes the main themes and issues that have informed the development of upgrading strategies and options for Phase 3.

Dike Performance, Maintenance, and Upgrading

Dike performance, maintenance, and upgrading are the most important design considerations for the Dike Master Plan.

The following themes define the ideal vision for dike upgrading:

1. **Level of Protection:** The City's 2008-2031 Flood Protection Management Strategy sets a target level of protection for structural measures. The City is presently developing an updated flood protection management strategy that will have an even more ambitious flood protection level target. The level of protection translates to a hazard-based design flood scenario to be incorporated into the Dike Master Plan. At this time, the proposed design flood scenario for the Lulu Island perimeter dike is the 500-year return period flood event (0.2 % annual exceedance probability, AEP) with climate change allowances including 1 m of sea level rise. For the river dikes, including those in Phase 3, this is determined as the site-specific maximum of spring freshet flood and a coastal winter flood (combination of tide/storm surge with Fraser River winter flow). However, the Dike Master Plan should be flexible to accommodate a future change in the design flood scenario.
2. **Form and Performance:** The preferred form of the dike is a continuous, compacted dike fill embankment with standard or better geometry. Walls and other non-standard forms are less reliable and are not preferred. The level of performance of the dike should be in line with the significant population and assets that the dike protects. The dike should meet all relevant design guidelines of the day and in some cases, exceed guidelines to provide a higher level of performance. Dike performance can be expressed in terms of freeboard above the design flood scenario water level and factors of safety against various failure processes, including flood conditions and internal erosion (piping). The dike design should consider the need for regular and emergency maintenance.
3. **Passive Operation:** Minimal human or mechanical intervention or operation should be required to achieve full dike performance. To achieve this, the dike should not have any gaps, gates, or stop log structures.
4. **Enhance Performance** (slow failure): The likelihood of a catastrophic dike failure causing significant flood damages can be reduced by design features that aim to slow down failure processes, provide redundancy, and provide time to implement emergency repairs. In general, failure can be slowed or controlled with additional setback, crest width, and armouring of the river side slope, crest, and land-

side slope. Such measures can slow the impacts of river erosion, overtopping erosion, and stability failures. Increased monitoring approaches and technology may also be helpful.

5. **Post-earthquake Protection:** The dike should provide adequate protection following a major earthquake until permanent repairs can be implemented. In general, this means avoiding dike conditions where a major earthquake would result in a sudden and full failure of the dike cross-section into the river, referred to as a 'flow-slide failure'. Other conditions where the dike crest settles, but still provides sufficient freeboard and factors of safety until repairs can be conducted may be tolerable. In general, increased crest width, crest elevation, and setback from the river may be undertaken to help achieve adequate post-earthquake protection. In some cases, improved seismic performance will also require ground improvement and densification works. The specifics of post-earthquake protection requirements are dependent on the seismic performance criteria currently under review as part of the Richmond Flood Protection Management Strategy update.
6. **Future Upgrading:** Uncertainty in climate change, particularly sea level rise timing, may require the City to further upgrade the dike sooner or higher than anticipated by current guidelines and policies. Sufficient space should be reserved under secured land tenure for future upgrading based on standard geometry. Conceptual design is provided for design flood levels which incorporate 1 m of sea level rise, and proof-of-concept design is provided for design flood levels which incorporate another 1 m water level increase for further climate change impacts (i.e. 2 m of sea level rise).

Some specific design considerations related to the above principles are presented in Table 3-1.

Table 3-1: Ideal Dike Design Principles and Considerations

Design Principle	Ideal Design Principles and Considerations
Level of Protection	• Currently proposed: 500-year return period (0.2% AEP) with climate change allowances as per provincial studies
Form and Performance	• Continuous, compacted dike fill with standard or better geometry • Crest elevation and adequate freeboard • Factors of safety for stability • Minimal infrastructure within the dike corridor • Adequate bank protection or setback
Passive operation	• No gaps, gates, or stop logs • Passive monitoring (e.g. SCADA water levels)
Enhance Performance (slow failure)	• Wide dike crest • Armoured river-bank slope to resist erosion • Paved/armoured crest and/or land-side slope to resist overtopping • Wide setback from the river
Post-earthquake Protection	• No loss of full dike geometry into the river ("flowslide failure") up to a return period to be determined • Adequate post-earthquake freeboard and stability until repairs • Wide dike crest and/or wide setback from the river
Future upgrading	• Space and tenure for upgrading (standard or better geometry) • Avoid need for future infrastructure relocation or land acquisition

Road Safety and Access

The safety of drivers, cyclists, and pedestrians using Dyke Road, Fraserwood Way and the dike trail system in south Richmond is a significant consideration in Phase 3. City transportation engineering staff were consulted during the master plan development to provide input on dike upgrading concepts that will also improve road safety. The City's preferred concept for Dyke Road is to provide wider vehicle travel lanes and separated multi-use paths, which may be located on the dike crest. Preferred travel lane and multi-use path widths are documented in the design criteria in Section 3.2.

Vehicle access to the properties located on both sides of Dyke Road is also a significant consideration. Dike raising alignments will impact driveway access for both residential and commercial landowners. Land use on these properties includes industrial / port-related uses, residential, and agricultural. As such, a variety of vehicles, including semi-trailer trucks, need safe access from Dyke Road to these properties. Currently, these properties are generally at grade with or slightly below the road and access is provided via asphalt or gravel driveways.

Driveway access was considered in options development by identifying several access upgrading concepts including upgrading driveways, land filling to raise sites to the dike / road level, and providing vehicle parking at the dike / road level.

Land Raising and Acquisition

Land acquisition is an important consideration for the development and evaluation of dike upgrading options. In many areas, the existing dike corridor is confined on both sides by private property with no room for expansion of the dike footprint.

The figures in Appendix A present the overlap between the proposed dike footprint and private property for select upgrading options discussed in Section 3. This overlap can be used to produce a land acquisition plan.

In some locations, an alternative to land acquisition may be land use planning and development control tools to raise private properties to the dike elevation to create a wider raised platform (similar to recent developments along the Middle Arm (e.g. Olympic Oval). The active redevelopment activities through the Fraser Lands (Reaches 7 – 11) offer opportunities for land raising to create so-called "superdikes".

Industrial Operations and River Access

South Richmond (Phase 3) is an important industrial area in the City. Existing industrial operations and river access for marine operations is an important consideration for developing and evaluating the dike upgrading options. In particular, landowners and leaseholders at Crown Packaging (Reach 2), Mainland Sand and Gravel (Reach 5), BC Ferries Richmond (Reach 5), Canadian Fishing Company (Reach 7), Fraser Wharves ship-to-land car unloading facilities (Reach 8), Port Metro Vancouver (Reach 10), Lafarge (Reach 11), Shelter Island Marina and Boatyard (Reach 12), and various small marine operations (Reach 12 and Reach 13).

In these locations, alternative dike geometries may be considered in the interim until redevelopment allows for land acquisition or land raising activities.

Internal Drainage System

As with any diked area, drainage for the interior protected area must be integrated with the flood protection measures such that the protected area does not experience flooding due to conflicting functions between the drainage of water from the interior area and prevention of flooding from water exterior to the dike system.

There are several smaller drainage channels and drainage pipes located at the landside toe of the existing dike providing local surface drainage for the area. As part of any upgrades, the existing drainage channel along the landside toe will need to be moved out of the proposed dike section or replaced with a pipe and inlets for local drainage. Additionally, the existing drainage pipes located within the proposed dike section may need to be relocated or upgraded to accommodate the proposed dike section.

The existing intakes and outfalls for the pump stations may need to be modified or extended and the pump station piping should be reviewed to consider structural impacts of the preferred dike section.

Tie-in with City of New Westminster Dike

The Phase 3 dike needs to tie into the City of New Westminster portion of the Lulu Island perimeter dike.

Approximately 500 m of the current dike in the boundary area is set back from Dyke Road so that the road and riverside townhomes (23740 and 23580 Dyke Road) are outside of the protection of the dike. The dike then ties back into the road at the Boundary Road and continues as part of South Dyke Road in the City of New Westminster.

Coordination between the City and the City of New Westminster is needed to confirm the dike tie-in design at the boundary.

Potential Future Secondary Dikes

The City's 2008-2031 Flood Protection Management Strategy identifies potential secondary dike concepts which are important considerations for Phase 3, including the proposed mid-island dike and the proposed Richmond-New Westminster boundary dike. The purpose of these secondary dikes is to limit flood damages by creating flood cells on Lulu Island which would contain flooding to smaller areas and prevent complete flooding of the island if dike breaches were to occur.

The Phase 3 Dike Master Plan has been developed to allow tie-ins with the possible mid-island dike and the proposed Richmond-New Westminster boundary dike. The possible mid-island dike is not addressed because it is linked to changes to the George Massey Tunnel and the tunnel's potential replacement. It is understood the City is also considering the implementation of both of these proposed dikes through gradual land raising through development as opposed to a dedicated dike corridor. The City's 2008-2031 Flood Protection Management Strategy provides additional information regarding potential future secondary dikes.

Environmental Considerations

The City's Official Community Plan (OCP) bylaw (2012) includes an Ecological Network Management Strategy (ENMS) that identifies ecologically important areas in the City's Ecological Network (EN). These areas include Environmentally Sensitive Areas (ESAs), Riparian Management Areas (RMAs), and EN components (hubs, sites, and corridors, shoreline, city parks).

ESAs are designated as Development Permit Areas (DPAs) with specific restrictions and guidelines for development controlled through a review and permitting process (City of Richmond 2012). There are five ESA types, based on habitat, each with specific management objectives. These are summarized in Table 3-2 and more detailed guidelines can be found in HB Lanarc-Golder and Raincoast Applied Ecology (2012). According to Richmond's OCP dike maintenance is exempt from development permits in ESAs. However, the guidelines provide useful direction that can be used to minimize impacts to these areas and provincial and federal legislation (see below) still applies to these areas.

RMAs are setbacks that were implemented in accordance with the provincial *Riparian Areas Regulation* of the *Riparian Areas Protection Act* (formerly the *Fish Protection Act*) and act as pre-determined Streamside and Protection Areas (SPEAs) under the Act. They extend 5 m or 15 m back from the top of bank of the City's channelized watercourses and are to remain free from development unless authorized by the City (City of Richmond, 2017). RMAs are present in 10 of 13 Phase 3 reaches (Reaches 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13).

Hubs, sites, and corridors are components of the City of Richmond's EN, which are not specifically afforded protection, but often overlap ESAs and RMAs, which are protected. These components are present in 11 of 13 reaches of Phase 3 (Reaches 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, and 13).

Dike upgrade options will consider the potential impacts to these areas.

Table 3-2: City of Richmond ESA Type Management Objectives

ESA Type	Reaches Where Present	Management Objectives
Intertidal	All	• Prevent infilling or direct disturbance to vegetation and soil in the intertidal zones • Maintain ecosystem processes such as drainage or sediment that sustain intertidal zones
Shoreline	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12	• Preserve existing shoreline vegetation and soils, and increase natural vegetation in developed areas during development or retrofitting
Upland Forest	1, 10, 12, 13	• Maintain stands or patches of healthy upland forests by preventing or limiting tree removal or damage, and maintaining ecological processes that sustain forests over the long term
Old Fields and Shrublands	None	• Maintain the extent and condition of old fields and shrublands, while recognizing the dynamic nature of these ecosystems • Preservation should recognize the balance between habitat loss and creation with the overall objective of preventing permanent loss of old fields and shrublands
Freshwater Wetland	3, 4	• Maintain the areal extent and condition of freshwater wetland ESAs by preserving vegetation and soils, and maintaining predevelopment hydrology, drainage patterns, and water quality

Source: (City of Richmond 2012))

Fish Habitat and Offsetting

Fish and aquatic habitat is protected by the federal *Fisheries Act*. Under the Act, *serious harm to fish* must be authorized by the Minister of Fisheries and Oceans and impacts that cannot be avoided or mitigated must be balanced through offsetting. Offsetting plans are negotiated on a case-by-case basis and may require consultation with Aboriginal groups and the Province. Offsetting options include habitat restoration, enhancement, habitat creation (or a combination of the three) and must be proportional to the loss caused by the project. The area of offsetting may need to be increased to account for uncertainty with the effectiveness and time lag between impacts and offsetting. Often, the offset area is equal to an area greater than that of the impacted area.

Where possible, impacts to existing habitat compensation sites should be avoided. Where impacts to these sites are not avoidable, habitat offsetting will likely be required, and requirements will be determined through discussions with Fisheries and Oceans Canada (DFO).

Wildlife Considerations

Migratory birds, their eggs, and active nests are protected by the *Migratory Birds Convention Act* and appropriate measures must be taken to avoid incidental take. The most effective and efficient of these measures includes scheduling vegetation clearing outside of the migratory bird nesting season. If this is not possible, bird nest surveys can be completed immediately prior to vegetation clearing to identify active nests and delay vegetation clearing until the nest is no longer active.

The nests of Bald Eagles, herons and other raptors (both active and inactive) are protected under the provincial *Wildlife Act*. It is also prohibited under the *Wildlife Act* to harm an active bird nest, birds, and their eggs. The detailed design stage for dike upgrading should attempt to avoid the removal of trees where bald eagle nests are located.

Native amphibian species are likely use the drainage channels at the toes of the land side of the dike. These species are protected by the provincial *Wildlife Act* and detailed design should consider potential impacts to these species.

Public Realm and Ecological Enhancement

The dike is a major existing public realm feature providing a variety of recreation opportunities. The Dike Master Plan provides an opportunity to significantly enhance the public amenity of the dike system. Additionally, the dike upgrading provides an opportunity to enhance ecological value through the landscaping treatments that will define the dike surface and edges.

Appendix B presents a suite of landscape concepts prepared by landscape architects at Hapa to supplement the Dike Master Plan. These include landscape design principles, an overall network connectivity concept for the Lulu Island perimeter dike trail, and design toolkits for ecological enhancement and public realm features. Additionally, the Appendix B presents a suite of landscape concepts to supplement the upgrading options presented in Section 3.6.

3.2 Design Criteria

This section describes the main design criteria used in the Phase 3 Dike Master Plan. These criteria were developed and reviewed in collaboration with City staff.

Table 3-3 presents a summary of the criteria and is followed by additional discussion. The criteria are presented in terms of both what is the minimum acceptable level and the preferred level.

Table 3-3: Design Criteria Summary

Item	Value and Description	
	Minimum Acceptable	Preferred
Proposed Dike Crest Elevation	4.7 m CGVD28 downstream of Nelson Road 4.7 m CGVD28 to 5.0 m CGVD28 between Nelson Road and Boundary Road	
Future Dike Crest Elevation (for proof-of-concept design)	5.5 m CGVD28 downstream of Nelson Road 5.5 m CGVD28 to 6.0 m CGVD28 between Nelson Road and Boundary Road	
Geometry and Stability	4 m wide crest with dike fill core 3H:1V land-side slope 3H:1V river-side slope (or 2H:1V with riprap revetment) Retaining walls minimized Sheetpile walls acceptable only with minimum 4 m wide dike fill core behind wall No standalone flood walls Meet minimum geotechnical factors of safety	Meets or exceed provincial dike standard and City dike standard
Land Tenure	Registered standard right-of-way	Dike located on City-owned land
Infrastructure in Dike	Crossings designed with seepage control Locate parallel infrastructure to land-side away from dike core	No infrastructure in dike
Vegetation on the Dike Slopes and Crest	Minimize shrubs and trees on the dike crest and slopes Operation and maintenance procedures need to deal with excessive vegetation	With overwide dike, it may be appropriate to allow for some relaxation of vegetation guidelines
Land Adjacent to Dike	Land is raised as much as is practical	Land is raised to meet or exceed dike crest elevation

Item	Value and Description	
	Minimum Acceptable	Preferred
Seismic Performance	Seismic performance criteria currently under review as part of the pending Richmond Flood Protection Management Strategy update and further consultation with the Province	
River-side Slope, Setback and Vegetation	2H:1V bank slope with riprap revetment Vegetation in/near the dike should adhere to provincial guidelines	>10 m setback between river top of bank and dike river-side slope toe 3H:1V river-side bank slope with acceptable vegetation
Crest Surfacing and Land-side Slope Treatment	Crest surfacing: 150 mm thick road mulch Land-side slope treatment: hydraulically seeded grass	Meet or exceed provincial dike standard and City dike standard Consider paved crest and land-side slope vegetation/armouring to add robustness against overtopping
Road Design Width[a]	From river-side to land-side: 0.5 m allowance for barrier 0.6 m min horizontal clearance Two 3.7 m travel lanes 0.6 m min horizontal clearance 0.5 m allowance for barrier Total width: 9.6 m	From river-side to land-side: 4.0 m multi-use path 0.5 m min horizontal clearance 0.5 m allowance for barrier 0.6 m min horizontal clearance Two 3.7 m travel lanes 0.6 m min horizontal clearance 0.5 m allowance for barrier 2.0 m pedestrian walkway Total width: 16.1 m

a. *Based on City of Richmond Engineering Design Specifications for* Roadworks (2008) and City staff input. https://www.richmond.ca/__shared/assets/Roadworks20127.pdf

Dike Crest Elevation

At this time, the Province has not established an official Fraser River flood profile and dike design profile that considers sea level rise and climate change. It is understood that the Fraser Basin Council's Lower Mainland Flood Management Strategy project may produce a recommended future flood profile. The most recent available flood profile information is provided in the Province's 2014 study of climate change and sea level rise effects on the Fraser River flood hazard (MFLNRO, 2014).

The designated flood profile for developing the master plan is proposed as the site-specific maximum of the following flood scenarios:

- 500-year return period coastal water level with 1 m of sea level rise (no wind/wave effects) with winter Fraser River flood flow; and
- 500-year return period freshet with moderate climate change impacts and 1 m of sea level rise.

Figure 3-1 shows the estimated flood profile water levels (in CGVD28 vertical datum, excluding wind/wave effects and freeboard) along the river in the study area. As shown on the figure, the coastal flood scenario governs from the ocean upstream to approximately Nelson Road.

Dike crest elevations are derived by adding freeboard and an allowance for land subsidence to the flood level. Adequate information on wind/wave effects is not available at this time and is a consideration in the pending Richmond Flood Protection Management Strategy update. However, it is generally assumed that the dike reaches within Phase 3 are not significantly impacted by wind/wave effects. This assumption should be confirmed during detailed design. Table 3-4 presents the components that sum to the proposed dike crest elevation.

Table 3-4: Flood Levels and Dike Crest Elevations

Item	Downstream of Nelson Road (flat profile)	Upstream of Nelson Road (sloped profile)		
		Nelson Road	Boundary Road (Border with City of New Westminster)	Eastern Tip of Lulu Island
Governing Flood Hazard	tide + storm surge (with historic winter Fraser River flow)	Fraser River freshet		
Level of Performance	500-year return period (0.2% annual exceedance probability)			
Climate Change Allowance	1 m sea level rise	1 m sea level rise and 20% freshet flow increase		
Design Flood Level (m, CGD28)[a]	3.8		4.2	4.6
Wind/Wave Effects Allowance	None			
Freeboard (m)	0.6			
Land Subsidence Allowance (m)	0.2			
Minimum Dike Crest Elevation (m, CGVD28)[b]	4.7[c]		5.0	5.4

Notes:

a) From (BC MFLNRO, 2014).

b) The City's adopted downstream design crest elevation (4.7 m) exceeds the minimum required elevation (4.6 m). This is a result of updated coastal water level analysis methods (joint probability analysis) that result in a discrepancy when compared to previous methods (additive method).

c) Dikes may need to be overbuilt to achieve target crest elevation following post-construction settlement. This should be addressed by an additional site-specific crest elevation allowance to be determined during detailed design.

The master plan also allows for further upgrading by providing proof of concept for dike raising to between 5.5 m downstream of Nelson Road and 6.0 m at the boundary with the City of New Westminster.

Seismic Performance

The current provincial seismic performance criteria for dikes are generally difficult to meet without costly and impractical ground improvement works. Additionally, the guidelines are considered very conservative in some situations because they require performance under extremely rare scenarios. For example, the guidelines require dikes to maintain 0.3 m freeboard in the event of a 10-year return period flood occurring following a 2,475-year return period earthquake which has a probability of 0.004% in a 1-year period. This is significantly rarer than the design event for the dike crest elevation (500-year return period event has a 0.2% annual exceedance probability).

It is understood that the Province is conducting a review of the current criteria and associated guidelines. In January 2019[1], the Province released a status update for the two components of the review and clarifications on the existing guidelines:

- Dike Consequence Classification (anticipated to be completed in 2019); and
- Seismic Assessment and Geotechnical Investigation of Lower Mainland Dikes (anticipated to be completed in 2021).

The seismic performance criteria for dikes in Richmond are currently under review as part of the pending update to the Richmond Flood Protection Management Strategy, with consideration of potential alternative performance approaches. As a result, City-specific seismic performance criteria have not been established as a part of Dike Master Plan Phase 3, with the expectation that this will be further developed and discussed as part of the Flood Protection Management Strategy and in discussion with the Province.

Vegetation

Vegetation on and adjacent to the dike should adhere to provincial guidelines[2]. These guidelines limit vegetation on the dike crest, side slopes, and landside toe predominantly to trimmed grass, with specific situations where other vegetation may be allowed (overwide dikes, natural levees, setback dikes). The guidelines include consideration for variations that may be considered for sensitive habitat:

> "Where environmental agencies have significant concerns for areas of sensitive habitat (such as historically overgrown works and/or FREMP red-coded areas), variations from these guidelines may be considered to increase protection of habitat where practical and economic, provided public safety is not compromised."

Richmond could consider developing more prescriptive city-wide dike vegetation management guidelines, which would require acceptance by the Province. A City-specific vegetation management plan could investigate opportunities to increase the robustness of dikes while accommodating vegetation beyond trimmed grass (e.g. exploring methods to armour dikes against overtopping erosion while accommodating shrubs and small trees).

3.3 Alternative Upgrading Strategies

Several high-level dike upgrading strategies, summarized in Table 3-5, were considered to inform the development of specific options for the Dike Master Plan.

[1] https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/iod_letter_re_seismic_2019.pdf
[2] Environmental Guidelines for Vegetation Management on Flood Protection Works to Protect Public Safety and the Environment. http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/env_gd_veg_man.pdf

Table 3-5: High-level Dike Upgrading Strategies

Strategy	Advantages	Disadvantages
Road Dike *Raise road to dike crest elevation*	• Smaller footprint • Wider crest (more robust) • Smaller impacts to habitat	• Operation and maintenance challenges • Infrastructure within dike • High cost to raise dike in the future • Possible conflicts with recreational cyclists/pedestrians and vehicles – recreational users may need to be rerouted along inland routes
Separated Dike and Road *Conventional dike adjacent to road*	• Operation and maintenance separated from road • No infrastructure within dike	• Larger footprint and impact to infrastructure and habitat
Raise River-side Dike *Conventional dike along riverbank*	• Minimize footprint	• Limited space • Impacts to Fraser River riparian and intertidal habitat and drainage channel side riparian and aquatic habitat • Reduced seismic performance • Erosion hazard
Fill River-side Dike *Build into river to achieve conventional dike*	• Less impacts to existing development and on-shore infrastructure	• Impacts to Fraser River riparian and intertidal habitat • Reduced seismic performance • Erosion hazard
Setback Dike *Realign significantly away from river*	• Increased seismic performance • Reduced erosion hazard • Increased opportunities for riparian and intertidal habitat enhancement	• Increase in unprotected development • High infrastructure impacts • High cost to construct new dike alignment • Would result in 2 dikes (existing and setback) to maintain
Land Raising ("superdike") *Raise development and roads adjacent to dike*	• Wider crest (more robust) • Reduced grading issues (after implementation) • Less impacts to raise a dike in the future	• Timing and phasing depends on development • High cost to raise large lots with low density land use • Grading and access issues for water-oriented developments • Impacts to Fraser River riparian and intertidal habitat and drainage channel side riparian and aquatic habitat

3.4 Options and Concepts

Through a series of meetings and site visits with City staff, the high-level upgrading strategies have been narrowed down to a set of options and concepts for each reach.

The main options developed for Phase 3 Dike Master Plan include:

- Option 1: Separated dike and road (Figure 3-2): raise dike and road, extend land-side;
- Option 2: Riverbank dike (Figure 3-3): raise dike only and extend land-side; and
- Option 3: Superdike (Figure 3-4): raise land behind the dike.

In addition to the above long-term options, additional interim options are being considered for areas where there is not enough space to build a standard dike and/or current operations at the site preclude the landowner from constructing a standard dike. These options are intended to function as temporary measures until the land behind the dike can be raised to an appropriate level, or leaseholders and landowners change, and the site can be redeveloped. These interim options are:

- Option 4: Road dike (Figure 3-5): keep the dike within the road footprint and raise the road and associated dike, extend land-side;
- Option 5: Setback sheetpile wall (Figure 3-6): raise the dike with sheetpile retaining wall behind existing development to minimize footprint and allow for access to the water;
- Option 6: Riverside sheetpile wall (Figure 3-7); raise the dike with sheetpile retaining wall along the riverside to minimize footprint

Table 3-6 presents a summary of the options for each reach. Appendix B includes landscape concepts prepared by Hapa associated with the cross-section options.

Table 3-6: Dike Upgrading Options

Reach # and Name	Options
1 – Gilmore West	• Option 1: Separated dike and road • Option 2: Riverbank dike • Option 3: Superdike *Site-specific interim options:* • Option 4: Road Dike
2 – Crown Packaging (13911 Garden City Road)	• Option 2: Riverbank dike • Option 3: Superdike *Site-specific interim options:* • Option 6: Riverside sheetpile wall • Combined with site grading and Option 2
3 – Gilmore East	• Option 1: Separated dike and road • Option 2: Riverbank dike • Option 3: Superdike *Site-specific interim options:* • Option 4: Road Dike
4 – Shellmont West	• Option 1: Separated dike and road

Reach # and Name	Options
5 – Shellmont Deas Dock BC Ferries Fleet Maintenance Unit (12800 Rice Mill Road)	• Option 1: Riverbank dike • Option 3: Superdike *Site-specific interim options:* • Option 5: Setback sheetpile wall • Combined with site grading and Option 1 • Combined with site-specific flood response
6 – Highway 99	• Option 1: Separated dike and road • Option 3: Superdike • Note: the link to the potential mid-island secondary dike is not shown or addressed because it is dependent on changes to the George Massey Tunnel
7 – Fraser Lands – Canadian Fishing Company (13140 Rice Mill Road)	• Option 2: Riverbank dike • Option 3: Superdike *Site-specific interim options:* • Option 5: Setback sheetpile wall • Combined with site grading and Option 1
8 – Fraser Lands Fraser Wharves	• Option 2: Riverbank dike • Option 3: Superdike
9 – Fraser Lands Riverport Way	• Option 2: Riverbank dike • Option 3: Superdike
10 – Fraser Lands Port of Vancouver	• Option 2: Riverbank dike • Option 3: Superdike
11 – Fraser Lands Lafarge Canada Inc. (7611 No 9 Road)	• Option 2: Riverbank dike • Option 3: Superdike
12 – East Richmond	• Option 1: Separated dike and road • Option 2: Riverbank dike • Option 3: Superdike *Site-specific interim options:* • Option 4: Road Dike
13– Hamilton	• Option 1: Separated dike and road • Option 2: Riverbank dike • Option 3: Superdike *Site-specific interim options:* • Option 4: Road Dike • Option 6: Riverside sheetpile wall around townhomes outside of the current dike
14 – Boundary	• Option 1: Separated dike and road • Option 3: Superdike • Site-specific option to include a secondary dike to tie into the higher elevations of the Hwy 91 interchange *Site-specific interim options:* • Option 4: Road Dike (tie into New Westminster's dike system at South Dyke Road)

The plan view and typical sections on a reach-by-reach basis are shown in Appendix A.

Option 1: Separated Dike and Road: Separate Dike and Road, Raise Dike and Road, and Extend Land-side

The primary option developed for Phase 3 involves separating the dike and Dyke Road, raising both to the dike crest elevation, and extending the footprint of the fill towards the land-side. Figure 3-2 presents a typical cross-section for this option.

This option addresses several of the main design considerations including providing a substantially wide dike and improving road safety by separating vehicles and cyclists/pedestrians.

In some reaches, extending the footprint towards the land-side requires filling in the existing channel and replacing or relocating the drainage conveyance and storage. The preferred approach is to replace the channels with pipes. This will result in a loss of aquatic and riparian habitat and will require habitat creation, restoration, or enhancement (or a combination of the three) to be completed elsewhere to offset the loss.

Extending the footprint towards the land-side will require land acquisition where the existing corridor width is insufficient. In general, this would affect a narrow strip of land on the frontage of large lots and should be feasible to implement.

However, there are also areas on both the land-side and the river-side where the upgrade will result in access issues. The areas with the most severe space limitations and potential options to address the access issues are presented in Table 3-8.

Table 3-7: Space Limitations and Access Issues

Reach / Location / Description	Photo	Options to Address Footprint and Access
Reach 1 London Farm		• Work with Museum and Heritage Services to site the upgrades to preserve character-defining elements of the site
Reach 3 Finn Slough		• Steeper driveway access • Provide parking on land-side • Steeper or longer road ramps up to the new road elevation

Reach / Location / Description	Photo	Options to Address Footprint and Access
Reach 11 Shelter Island Marina and Boatyard		• Steeper driveway access • Steeper or longer road ramps up to the new road elevation • Coordinate with industry to raise the site or to raise the ship crane and associated river access infrastructure • Raise land at time of redevelopment
Reach 13 Intersection with Fraserwood Way		• Steeper or longer road ramps up to the new road elevation • Raise land at time of redevelopment
Reach 13 - Hamilton		• Steeper driveway access • Provide parking on land-side (instead of driveway down to lot) • Raise land at time of redevelopment • Steeper or longer road ramps up to the new road elevation • Managed retreat (buy-out, relocate, or do not allow redevelopment)
Reach 13 – Hamilton 23700 blk of Dyke Road		• Steeper driveway access • Provide parking on land-side (instead of driveway down to lot) • Leave existing road as a low "local road" and provide access to the new road at an intersection near Boundary Road • Managed retreat (buy-out, relocate, or do not allow redevelopment)
Note: Images from Google Street View		

Option 2: Riverbank Dike: Raise Dike, and Extend Land-Side

The primary option developed for Phase 3 where there is no road associated with the dike, is to raise the dike crest elevation and extend the footprint of fill towards the land-side. Figure 3-3 presents a typical cross-section for this option.

Extending the footprint towards the land-side will require land acquisition where the existing corridor width is insufficient. In general, this would affect a narrow strip of land on the frontage of large lots and should be feasible to implement. Extending the dike footprint to the land-side decreases the amount of Fraser River riparian and river habitat that is impacted, but may result in the loss aquatic and riparian habitat from drainage channels on the land side of the dike.

Option 3: Superdikes: Land Raising

Another option that is being considered for Phase 3 is the raising of lands behind the dike to the dike crest elevation. This creates a more robust flood protection structure and has the potential to improve site grading issues and river access constraints. The option to raise the land behind the dike is most appropriate for areas that are contemplated for short-term redevelopment.

This option will result in a loss of aquatic and riparian habitat and will require habitat creation or enhancement to be completed elsewhere to offset the loss.

Option 4: Road Dike: Raise Dike and Road, and Extend Land-side (Interim Solution)

An interim option is being considered where the existing development encroaches on the dike/road corridor such that separating the dike from the road and raising both structures is not immediately feasible. This option is to continue to have the dike in the road, while raising the road to the design dike crest elevation and extending the footprint of fill towards the land-side.

This option addresses several of the main design considerations; however, it does not allow for complete separation of pedestrians and bikes from the roadway and does not address concerns of complexities of future dike raising if the road infrastructure is integrated into the dike structure.

This option will result in a loss of aquatic and riparian habitat and will require habitat creation or enhancement to be completed elsewhere to offset the loss.

Option 5 & 6: Sheetpile Walls (Interim Solution)

Site-specific interim solutions are considered where a site is not scheduled for short-term redevelopment and site constraints such as rail lines, barge access and site grading for specialized equipment do not allow for constructing a standard dike as per the options discussed previously. Two sheetpile wall configurations (Figure 3-6 and Figure 3-7) are considered to address short-term flood protection at three sites:

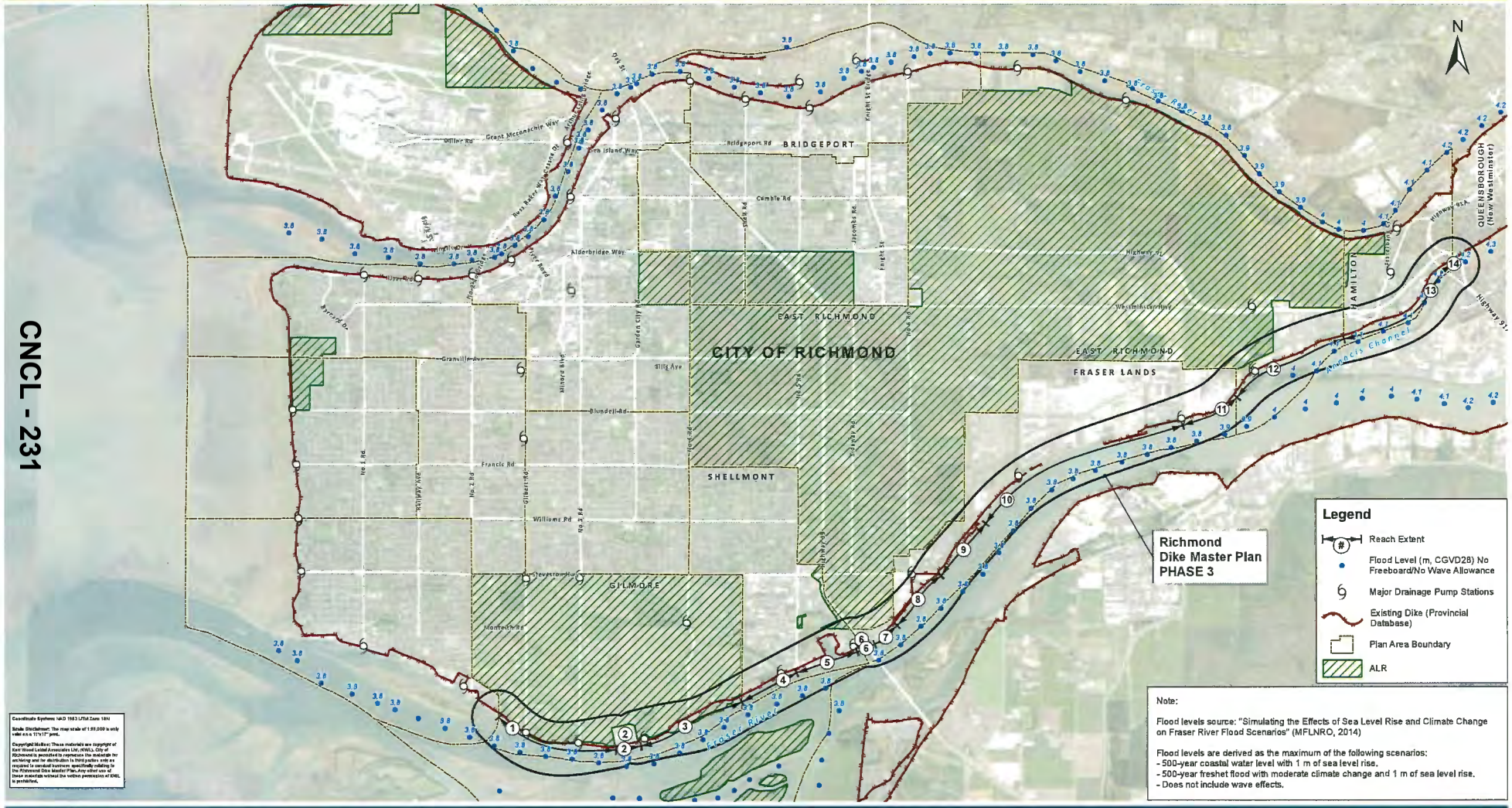
- Crown Packaging, 13911 Garden City Road (Reach 2);
- Deas Dock, BC Ferries Fleet Maintenance Unit, 12800 Rice Mill Road (Reach 5); and
- Canadian Fishing Company, 13140 Rice Mill Road, (Reach 7).

For all three of these sites, the sheetpile wall would bring the dike crest to the design elevation. The dike width would be narrower than the preferred options but could allow for raising the dike to an acceptable level where there is minimal room on the site for additional dike footprint. For those locations where a setback dike is constructed, the landowner would need to develop and implement a flood response plan and reasonable floodproofing measures would be required. Retaining walls should consider the need for handrails for safety, in accordance with applicable regulations. Loss of aquatic and riparian habitat may be reduced with this option.

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City of Richmond
Richmond Dike Master Plan - Phase 3

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Date February 2019
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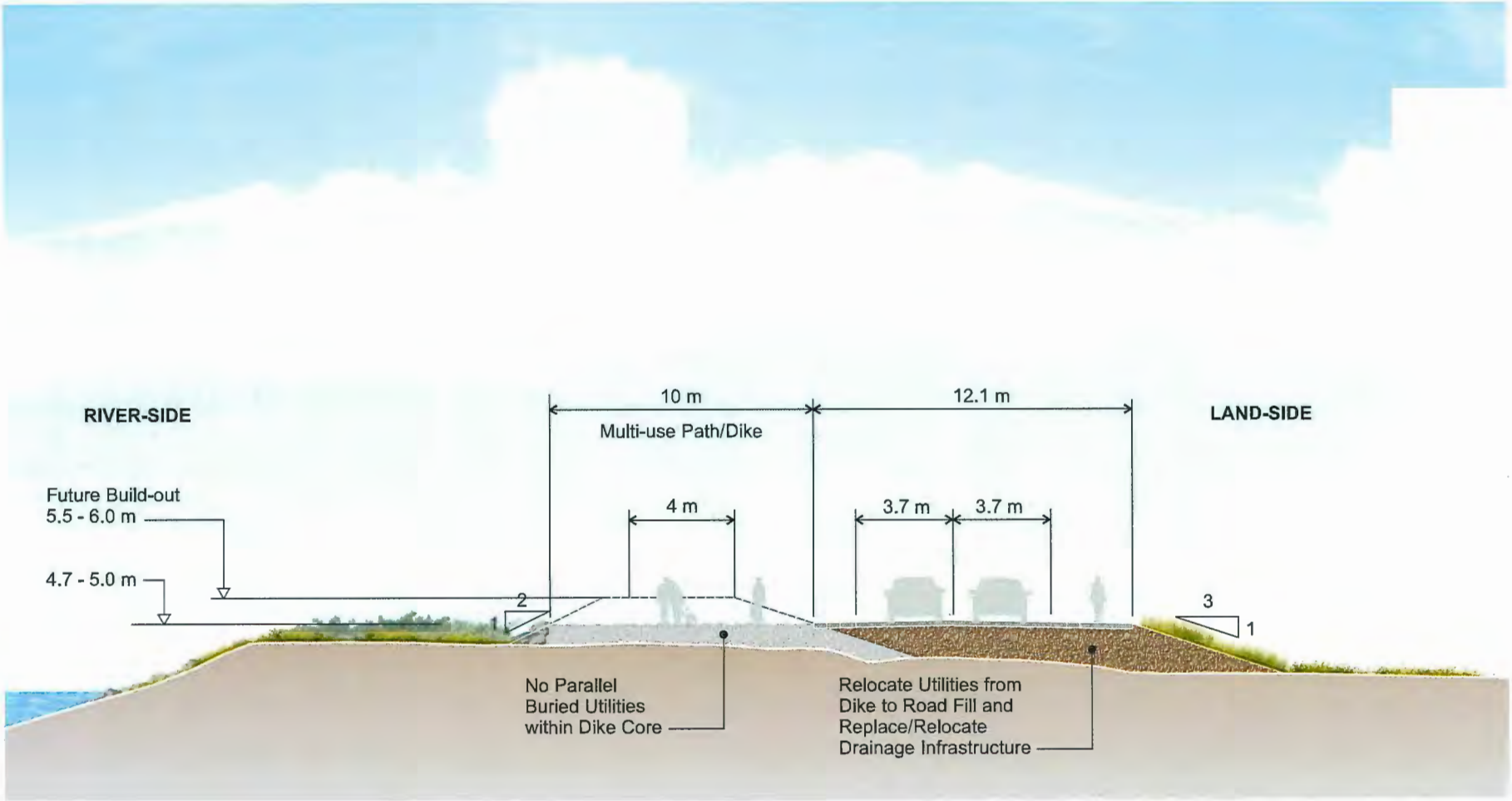
Fraser River Flood Elevations

Figure 3-1

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Richmond Dike Master Plan - Phase 3

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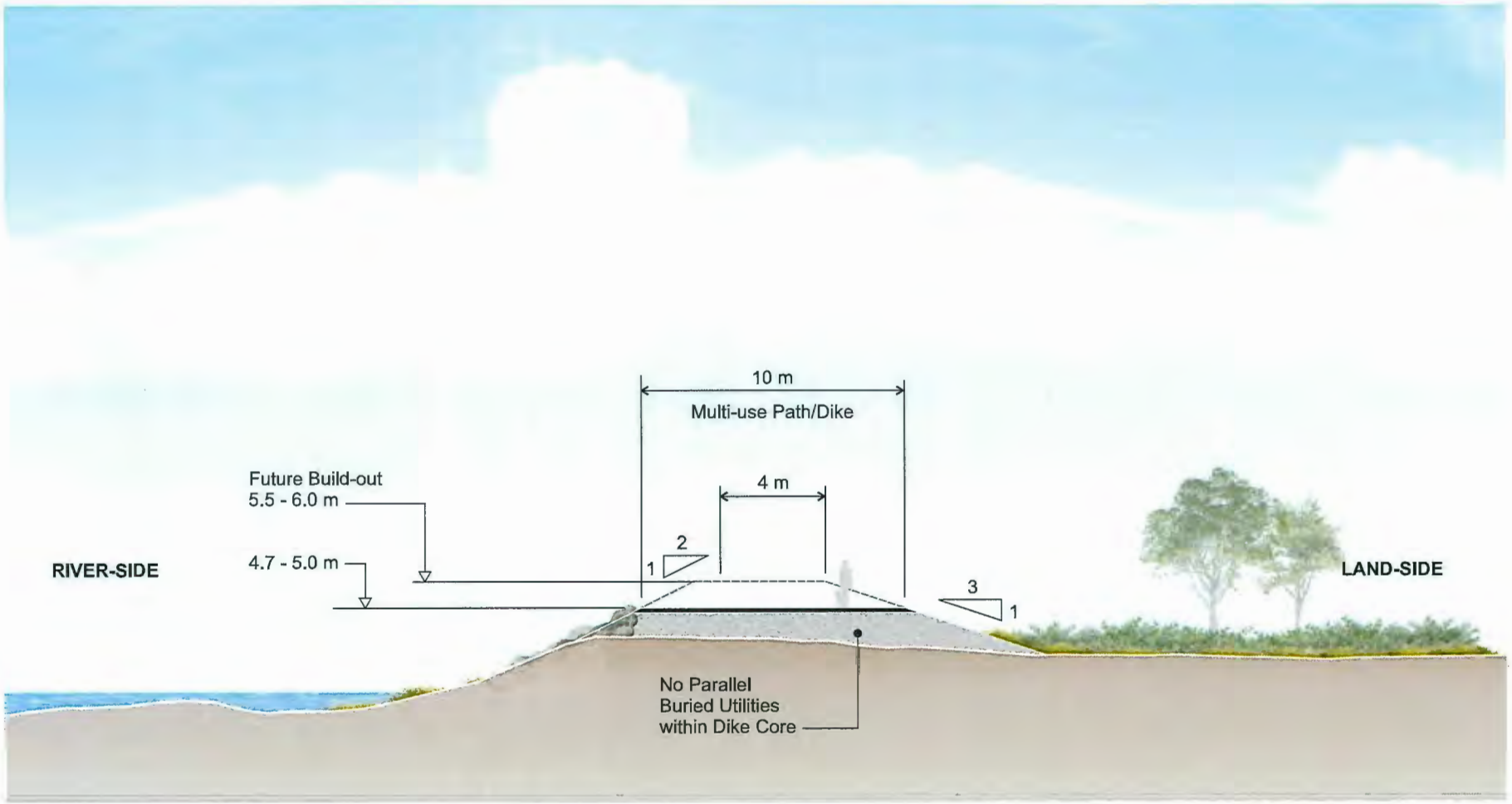
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Option 1: Separated Dike and Road
Raise Dike and Road, Extend Land-side

Figure 3-2

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Richmond Dike Master Plan - Phase 3

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Project No.	651.110
Date	February 2019
Scale	Not to Scale

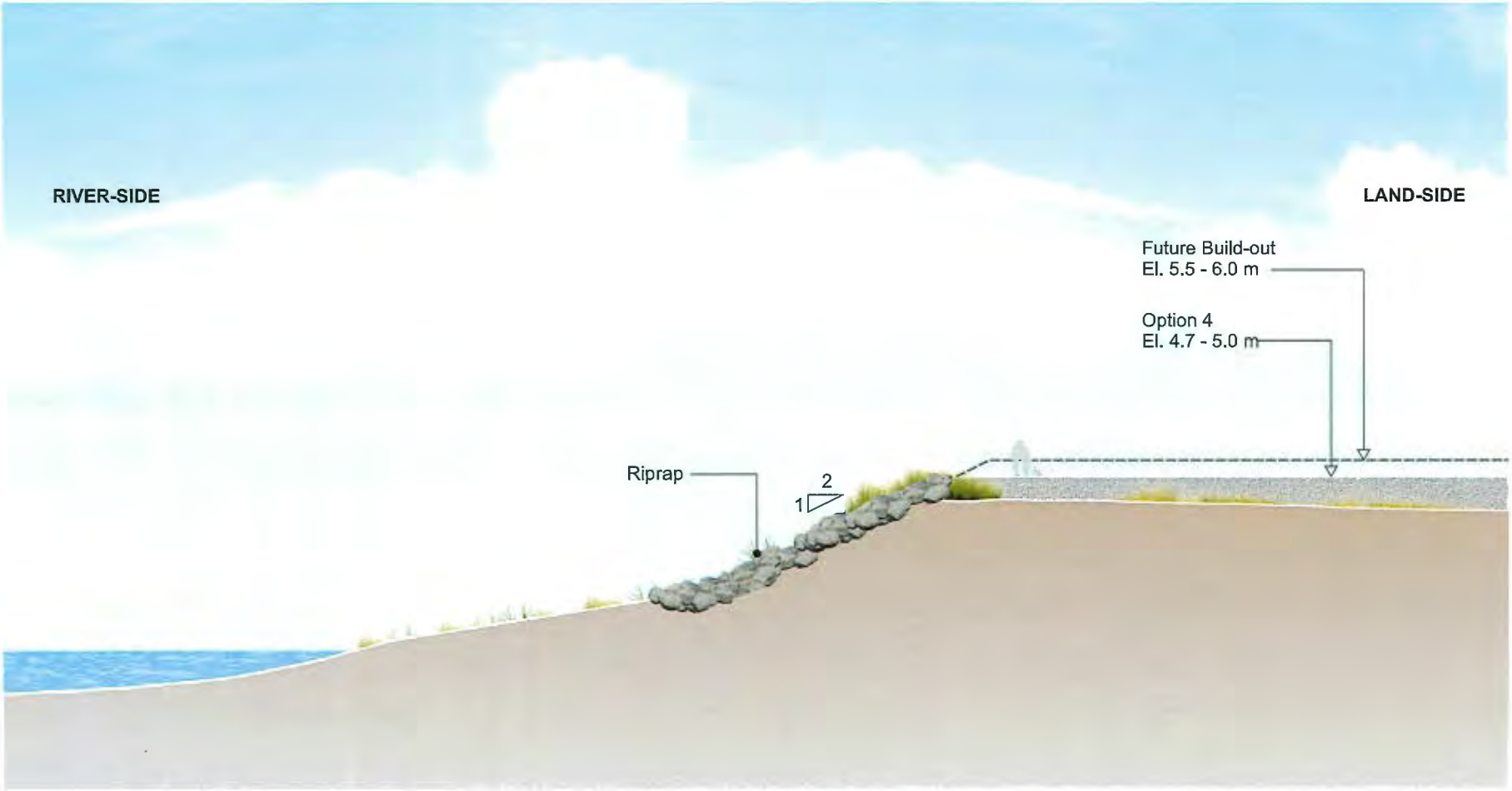
Option 2: Riverbank Dike
Raise Dike Only and Extend Land-side

Figure 3-3

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Date	February 2019
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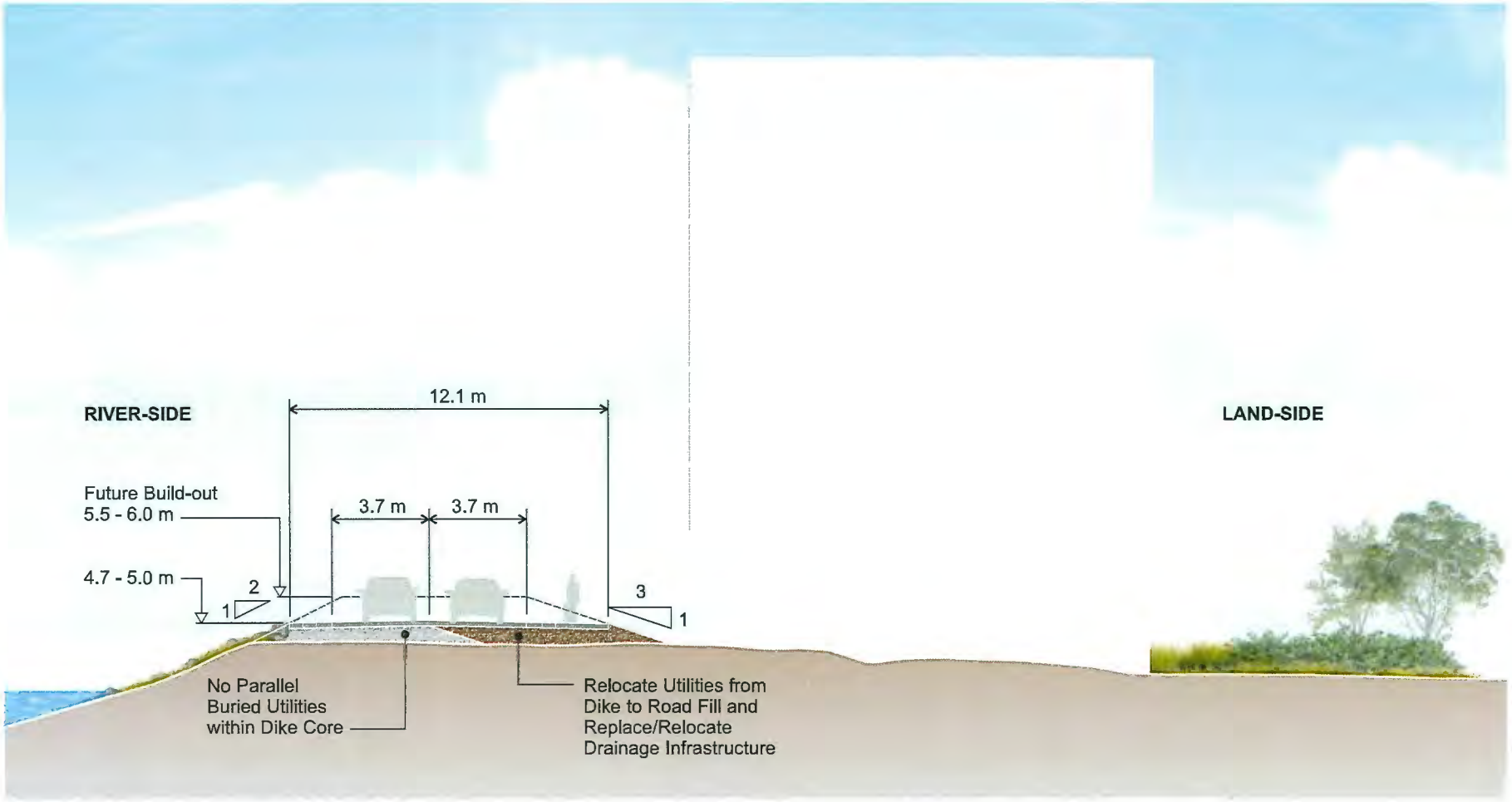
Option 3: Superdike
Raise Land Behind Dike

Figure 3-4

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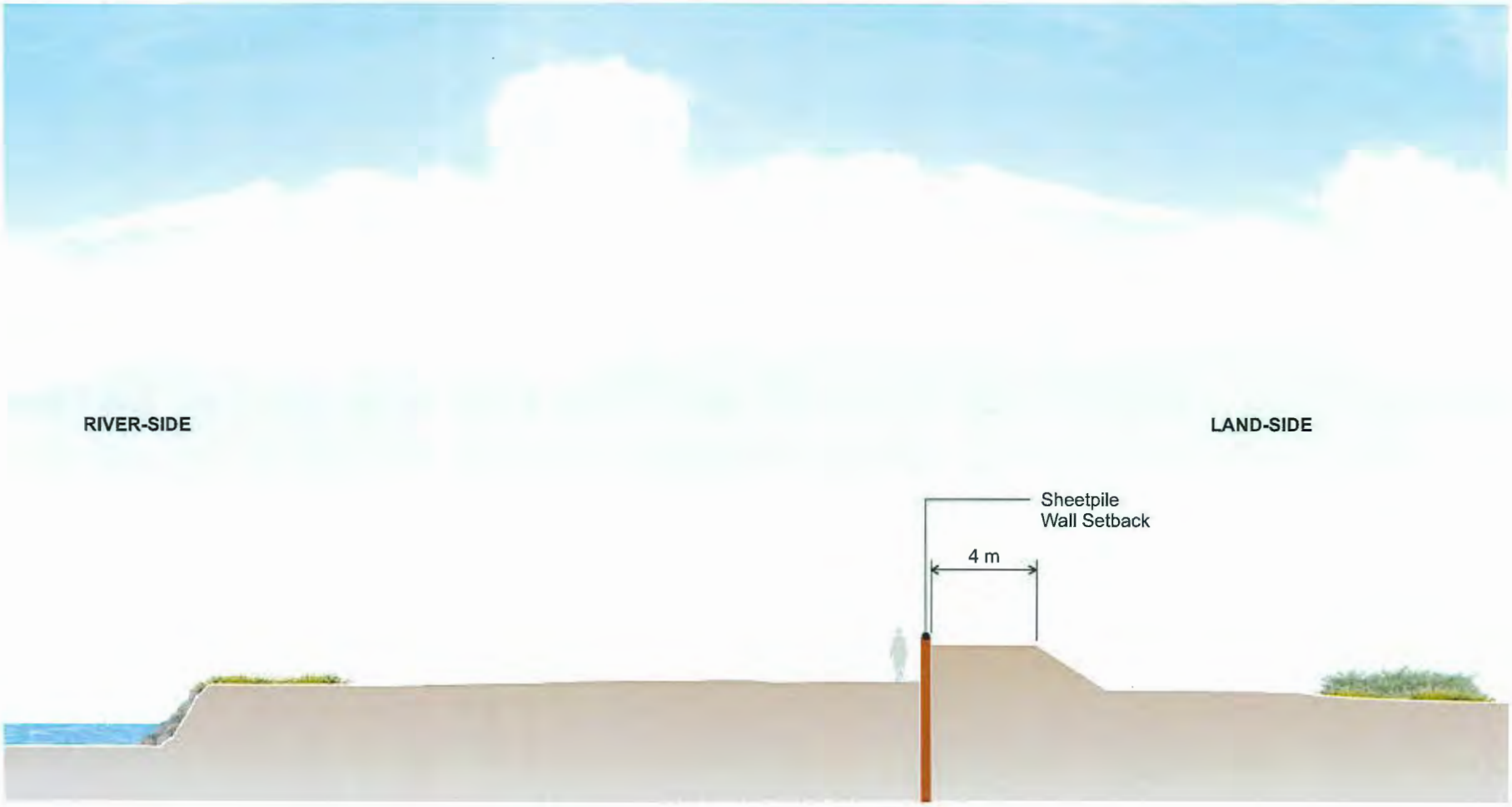
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Date	February 2019
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Option 4: Road Dike
Raise the Existing Dike within the Road (Interim Option)

Figure 3-5

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Richmond Dike Master Plan - Phase 3

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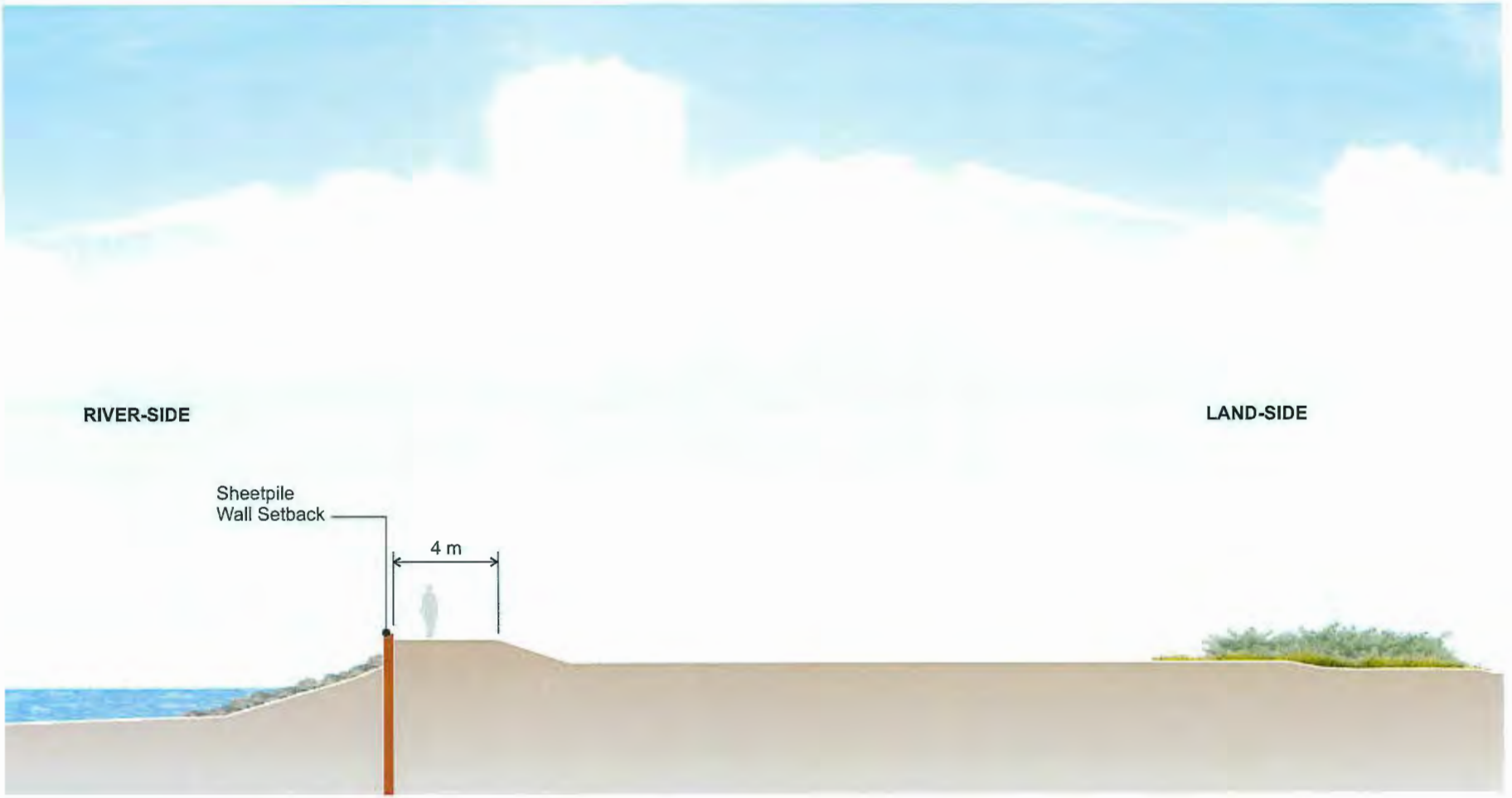
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Date	February 2019
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Option 5: Setback Sheetpile Wall (Interim Option)

Figure 3-6

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Date	February 2019
Scale	Not to Scale

Option 6: Riverside Sheetpile Wall (Interim Option)

Figure 3-7

3.5 Stakeholder Engagement

Stakeholder engagement for Phases 3, and 5 of the Dike Master Plan has being completed jointly in two stages. Prior to initial City Council review, initial stakeholder engagement was completed that included meetings with internal City departments and some government agencies (also including Phase 4). This initial stakeholder engagement allowed for input from City groups on options developed, additional background, and future coordination, with the goal of informing the recommended upgrade options. Following Council review, additional stakeholder engagement was completed, which included reaching out for meetings with specific stakeholder groups and several public consultation events. The second stage of stakeholder engagement was intended to inform the public on the draft preferred options and seek any feedback the City may wish to consider in finalizing the Dike Master Plan and moving towards implementation.

For Phase 3, the City engaged the following parties:

- City of Richmond Internal Stakeholders:
    - Transportation,
    - Development Applications,
    - Policy Planning,
    - Engineering & Public Works,
    - Real Estate,
    - Parks Planning, Design & Construction,
    - Parks Operations;
- City of New Westminster;
- Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (MFLNRORD), including Inspector of Dikes, Flood Safety, and Water Authorizations staff;
- Lafarge Canada Inc. (7611 No 9 Road);
- Crown Packaging (13911 Garden City Road);
- Deas Dock BC Ferries Feet Maintenance Unity (12800 Rice Mill Road);
- Canadian Fishing Company (13140 Rice Mill Road);
- Port of Vancouver;
- Fisheries and Oceans Canada (DFO); and
- general public.

The City and KWL met with internal stakeholders, Port of Vancouver, and MFLNRO and hosted public open houses. All other parties contacted requested engagement closer to project planning in areas that may affect their operations. Additional collaboration and discussions should be held during detailed design of dike upgrades. DFO declined to meet with the City, stating that input would be provided during later stages in the established review and approvals process. Additionally, Richmond is within the traditional territory of the Coast Salish people and the City works with Nations on various projects where appropriate. Feedback from external stakeholders is summarized in Table 3-8.

Table 3-8: External Stakeholder Feedback

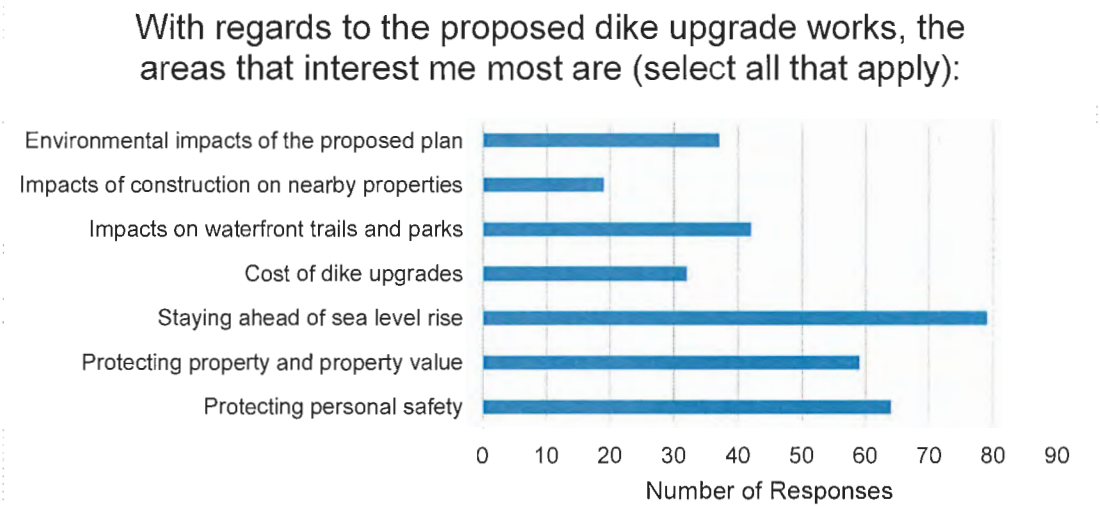
Stakeholder	Summary of Comments
Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Inspector of Dikes	**Inspector Of Dikes (IOD):** Currently there are two projects that may impact the application of the Guidelines for Seismic Design of Dikes: The Dike Consequence Classification (lead by the Province), and the Seismic Assessment and Geotechnical Investigation of Lower Mainland Dikes (lead by the Fraser Basin Council). Until this work is completed, all applicants for Dike Maintenance Act approvals are to continue to follow the 2014 Seismic Design Guidelines for Dikes – 2nd Edition, where the dike is considered a high consequence dike. IOD is generally open to flexibility in specific scenarios but is looking for consistency with seismic standards. It is unlikely that an expedited application process would be considered.
Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Water Authorizations	Noted that the Province provides emergency bulletin to property owners to remove harmful substances in the floodplain in high water/flood scenarios, in order to reduce risk of environmental contamination from flooding. Generally interested in larger scale compensation for impacts of large-scale dike upgrades in Richmond to achieve more meaningful compensation. There is still a need to compensate locally. This could potentially include approval of overall compensation program and plan, but it would still require project by project approvals (approval in principle of the plan already). This method hasn't been developed before and would need to be developed with Richmond.
Port of Vancouver	Generally supports the City's goal to have continuous, high-quality flood protection for the entire Lulu Island. Much of the Port land is high near the area called Richmond Lands. This is not a high-priority for dike raising; however, the Port understands that as areas redevelop, this is the best time to improve the dike and create opportunities for superdikes. The Port is in the early stages of developing their long-term plan for operations and response to sea level rise and climate change. The Port is interested in working collaboratively with the City during design of dike upgrades to ensure that the flood protection works with current and planned operations.
BC Ferries (Deas Dock, Fleet Maintenance Unit)	The BC Ferries Corp. provided a copy of the TetraTech presentation for their proposed dike design. The proposed dike design aligns with the Dike Master Plan optional alignment for a setback sheetpile wall (interim option). The proposed dike design provided is for a dike with portions that have over-steepened side slopes and a 4 m wide crest. This should be considered an interim option, with the ultimate goal the raising of the entire site to create a superdike as redevelopment occurs.

Two public open houses were held for Phase 3 and 5 jointly, including one event at the City Centre Community Centre on January 15, and another event at City Hall on January 23. In addition, City staff participated at a Smart Cities event with the public consultation materials on January 17. A total of 75 people attended the open houses. Draft reports and information poster boards were also available online at LetsTalkRichmond.ca with 518 visits to the site during the consultation window (January 14 to February 2). A survey to seek feedback was provided at open houses and online, and a total of 92 responses were received. Feedback from public consultation is summarized in Table 3-9 and Infographic 3-1.

Table 3-9: Summary of Public Consultation Feedback

Topic	Summary of Comments
Proactive Planning / Flood Protection	Many comments appreciating the proactive approach for dike planning, the robust concepts, and the long-reaching strategies. Several comments relating to expediting the dike raising process in anticipation of accelerated sea level rise. A couple questions received on earthquake effects, the application of a secondary inland diking system, and the role of internal drainage related to flood protection. Over 80% of participants rank perimeter dike upgrading as being either very important or extremely important.
Dike Aesthetics / Recreational Use	Many comments received noting the importance of maintaining pedestrian-friendly, multi-use trails. Suggestions relating to recreational use include paved pathways, distance markers, additional lighting, benches, and establishing a continuous perimeter trail. Two commenters like the opportunity to upgrade infrastructure and trails in the Hamilton area. One comment about improving trails around Crown Packaging.
Development / Property Value	Several commenters like the Plans with respect to protection of properties and future developments. A commenter suggested research into riverside expansion of the dike. One commenter suggested residential construction standards. One commenter does not support superdikes (development on the dike).
Thoroughness/Consultation	Several comments appreciating the thoroughness of the report; the phasing methodology and clear concepts made the Plan easy to understand. One suggestion to further consult utility stakeholders who may cross the dike.
Priority Areas / Safety	Many commenters like that the City is taking action with regards to community safety. Single commenters noted priority areas which include: Phase 3, Steveston, Terra Nova. A single comment on the west dike as a priority location and for barrier islands to be built. A single comment questioning how Britannia will be protected and concern for houses along Dyke Road.
Environment / Habitat	A few comments and questions on the importance of maintaining habitat and the environment. One comment on using free fill material for the dike rather than other forms of disposal. One commenter is concerned about removal of shrubs, trees, logs, and habitat along the dike.
Climate Change / Sea Level Rise	Several questions were received relating to level of protection, climate change, and sea level rise science. A couple of comments suggested that raising the dikes are premature and that sea level rise may not happen.

Topic	Summary of Comments
Cost	Several questions on cost to taxpayers and Provincial/Federal involvement in paying for flood protection upgrades. One question relating to evaluating the cost of managed retreats from certain areas.
General	One comment on providing more information on social media. One question about elevation of areas adjacent to dikes. One commenter requesting additional signage in project areas.



Infographic 3-1: Summary of Pubic Responses

It is expected that there will be opportunity for more engagement with stakeholders during detailed design of dike upgrades.

3.6 Options Evaluation and Selection

General Recommendations

The options described in Section 3.4 have been assessed considering the feedback from the stakeholder meetings and the following:

- dike design criteria;
- impacts to habitat;
- cost implications;
- robustness of flood protection;
- impacts to existing properties and operations; and
- ability to accommodate further long-term upgrading.

The recommended options are based on a vision of Richmond progressively improving its level of flood protection ahead of the pace of development and rising sea level. Recommended dike design features include the following for Phase 3.

High and Wide Earth Fill – Favour earth fill dike construction where possible since it is more robust, flexible, and expandable than other types of structures. Build to 4.7 m crest elevation (higher upstream), expandable to 5.5 m to accommodate additional sea level rise. Build the 4.7 m crest elevation with a crest width of 10 m to make it expandable to 5.5 m crest elevation without the need for further road reconstruction or land acquisition.

Separate Roads and Utilities – Utilities pose an unnecessary risk to the dikes. Along with roads, they also increase the complexity and cost of dike maintenance and expansion. The City should seek to separate roads with utilities away from the dike structure, preferably on the land-side the dike, and put the road elevation at dike crest height to be compatible with raised land use behind the dike and road.

Raised Development – Raise the land on the land-side of the dike to facilitate existing and future raised land use. This supports a vision of a waterfront community that has adjacent development above and looking down over the dike instead of behind it. It also reduces the amount of land acquisition required to support dike raising by eliminating the land-side slope.

Land Acquisition for Full Future Needs - Acquire enough land or rights-of-way at first reasonable opportunity to facilitate full width of the future 5.5 m crest height. Land acquisition and rights-of-way may be a condition of redevelopment, or land could be purchased specifically for planned dike construction. For industrial sites, access for inspection, maintenance and future raising is required. For other sites, public use of the dike is also needed. Where land acquisition opportunities can not keep pace with dike requirements, interim narrower dike options may be considered.

Habitat Balance – Dike widening is typically recommended to be on the land-side of the existing dike, as opposed to extending the dike footprint further toward, or into, the river. This is due to a preference to preserve or enhance river riparian habitat. However, there are some cases where inland channel habitat may be impacted or where moving the dike towards the river may be the best option to reduce large impacts to roads. Where habitat and drainage channels would be impacted by dike upgrading, it is recommended that their hydraulic function and habitat value be compensated by other means. This may include storm sewers, channels relocated inland, and separate habitat offsetting projects.

Recommended Options

The various high-level dike upgrading strategies and potential dike upgrading options have been distilled to two main recommended options for long-term dike planning, as described below.

- **Separated dike and road** (Option 1):
    - Use in locations where there is a road associated with the dike.
    - Separate the dike and roadway such that there is an over-wide dike and separate travel areas for vehicles and cyclists/pedestrians.
    - Raise the dike crest and road surface to the design dike crest elevation and extend the footprint of fill towards the land-side.
    - Install bank protection works on the river side to match existing.

- **Riverbank dike** (Option 2):
    - Use in locations where there is no road associated with the dike.
    - Raise the dike crest to the design elevation and extend the footprint of fill towards the land-side.
    - Install bank protection works on the river side to match existing.

In general, the two above options are recommended because they are the most robust of the options considered. They produce a wide dike crest at a stable geometry that is set back from the river. The dike portion of the overall crest would be 10 m wide to accommodate future dike raising without having to modify the road. The "separated dike and road" option is recommended in areas where there is currently a road associated with the dike because it is the most robust of the options considered as it produces an earth fill embankment (dike and road) that is approximately 22 m wide at the crest. This is a significant increase above the standard dike crest width of 4 m and is expected to reduce the likelihood of failure across a variety of processes.

Additionally, separating the dike and road provides several community benefits including improved pedestrian, cyclist, and vehicle safety, and the opportunity for a linear park / multi-use path. Other interim options are recommended in areas which are constrained and do not allow for the separated dike and road option.

In addition to the two options listed above, another recommendation for flood protection in all areas of Phase 3 is to target land raising of the areas behind the dike. This is shown as Option 3: Superdike. It should be considered for all reaches.

Interim Options

The two recommended options will require land acquisition and phased implementation as existing development and current land use limit the existing dike corridor and some existing industries need access to the river for operations. To address this phased implementation, additional interim options are recommended, as described below.

- **Road Dike** (Option 4):
    - Use at sites not scheduled for short-term redevelopment.
    - Continue to have the dike in the road where existing development encroaches on the corridor.
    - Raise the road surface to the design dike crest elevation and extend the footprint of fill towards the land-side.
    - Install bank protection works on the river side to match existing.
- **Setback Sheetpile Wall** (Option 5):
    - Use at sites not scheduled for short-term redevelopment where site constraints such as rail lines, barge access and site grading for specialized equipment do not allow for construction of a standard dike.
    - Raise the dike to the design dike crest elevation using sheetpile walls to minimize the encroachment of fill on the property.
    - Use site specific flood response plans to address flood hazards on the site.

- **Riverside Sheetpile Wall** (Option 6):
  - Use at sites not scheduled for short-term redevelopment where site constraints such as rail lines, barge access and site grading for specialized equipment do not allow for construction of a standard dike.
  - Raise the dike to the design dike crest elevation using sheetpile walls to minimize the encroachment of fill on the property.

Summary of Recommended Options by Reach

Table 3-9 presents a summary of the recommended options for each reach as well as the recommended interim options to address site specific concerns. For all reaches, Option 3: Superdike, raising the land for approximately 200 m inland of the dike, is recommended for related flood protection and seismic stability reasons. Because Option 3 is a global recommendation for Phase 3 Dike Master Plan, it has not been included in Table 3-9. The recommended options are shown in Appendix A.

Table 3-10: Recommended Dike Upgrading Options (Phase 3)

Reach # and Name	Recommended Options
1 – Gilmore West	• Option 1: Separated dike and road Option 2: Riverbank dike (park area) *Site specific interim options:* • Option 4: Road dike (London Farm)
2 – Crown Packaging (13911 Garden City Road)	• Option 2: Riverbank dike *Site specific interim options:* • Option 6: Riverside sheetpile wall • Combined with site grading and Option 2
3 – Gilmore East	• Option 1: Separated dike and road • Option 2: Riverbank dike (park area) *Site specific interim options:* • Option 4: Road dike (Finn Slough)
4 – Shellmont West	• Option 1: Separated dike and road
5 – Shellmont Deas Dock, BC Ferries Fleet Maintenance Unit (12800 Rice Mill Road)	• Option 2: Riverbank dike *Site specific interim options:* • Option 5: Setback sheetpile wall • Combined with site grading and Option 2 • Combined with site specific flood response
6 – Highway 99	• Option 2: Riverbank dike Note: the link to the potential mid-island secondary dike is not shown or addressed because it is dependent on changes to the George Massey Tunnel
7 – Fraser Lands – Canadian Fishing Company (13140 Rice Mill Road)	• Option 2: Riverbank dike *Site specific interim options:* • Option 5: Setback sheetpile wall • Combined with site grading and Option 2

Reach # and Name	Recommended Options
8 – Fraser Lands Fraser Wharves	• Option 2: Riverbank dike
9 – Fraser Lands Riverport Way	• Option 2: Riverbank dike
10 – Fraser Lands Port of Vancouver	• Option 2: Riverbank dike
11 – Fraser Lands Lafarge Canada Inc. (7611 No 9 Road)	• Option 2: Riverbank dike
12 – East Richmond	• Option 1: Separated dike and road • Option 2: Riverbank dike *Site specific interim options:* • Option 4: Road dike
13– Hamilton	• Option 1: Separated dike and road *Site specific interim options:* • Option 4: Road dike
14 – Boundary	• Option 1: Separated dike and road • Site specific option to include a secondary dike to tie into the higher elevations of the Hwy 91 interchange *Site specific interim options:* • Option 4: Road dike (tie into New Westminster's dike system at South Dyke Road)

Drainage Impact Assessment

The internal drainage system of Lulu Island provides irrigation service as well as drainage service. The system of channels allows water from intakes on the Fraser River to flow into Lulu Island and distribute through the drainage conveyance system to provide irrigation water to the farmlands. This use of the drainage conveyance system relies on the storage capacity within the channels to provide adequate water to the farmlands.

There are two large, agricultural drainage channels adjacent to Dyke Road that would potentially be impacted by the proposed increase in road and dike footprint. These include the area adjacent to Finn Slough and the area near London Heritage Farm. The option expected to be both the simplest to implement and the least cost is to replace the existing channels that would be impacted by the dike and road upgrades along Dyke Road with pipes. The replacement pipes would be located within the cross-section of the road and outside of the dike cross-section. In the case of the drainage channel south of London Farm, the change to the dike footprint would be discussed with the Museum and Heritage Services during detailed design to preserve character-defining elements of the site.

The approach of filling the existing drainage channel and replacing it with a pipe is limited by the size of the pipe that can fit within the road cross-section and the invert elevations of the existing internal agricultural drainage infrastructure (culverts, drainage channels and drain tiles). Multiple connections and or inlets to the pipe may be required to replace existing drainage and irrigation functions for the adjacent agricultural fields. The new pipes would drain to the existing north-south channels that convey runoff to the pump stations.

No detailed drainage assessment has been completed for this study and further work would be needed to assess if replacing the existing drainage channels with pipes is feasible and to size and design the pipes. If feasible, drainage from both Dyke Road and the interior lots adjacent to the road would be directly connected to the new drainage pipes. If the required capacity or depth cannot be provided in a pipe, then replacement open channels would have to be located adjacent to the toe of the upgraded road section.

Habitat Impact Assessment

In total, the estimated impact for the selected Phase 3 options is 19,300 m^2 of high-quality Fraser River intertidal habitat, 27,500 m^2 high quality Fraser River riparian habitat, 14,200 m^2 of drainage channel aquatic habitat, and 48,500 m^2 of drainage channel riparian habitat.

These areas reflect an estimate of impact area based on FREMP habitat mapping from 2007, and orthoimagery interpretation. Not all Fraser River riparian and intertidal habitat was quantified. The desktop review only quantified high-quality riparian and intertidal habitat types on the Fraser River side of the existing dike. The remaining habitat area, while not calculated here, would also be required in calculations for determining offsetting requirements. A detailed aquatic effects assessment is required to calculate the actual area of impact to fish habitat and to determine potential offsetting requirements.

The estimated area of overlap of proposed dike improvements with the City's ESA's is 2,000 m^2 of Freshwater Wetland ESA, 44,200 m^2 of intertidal ESA, 300 m^2 of Old Field and Shrublands ESA, 188,700 m^2 of Shoreline ESA and 5,700 m^2 of Upland Forest ESA. ESAs often overlap with high quality habitat (i.e. high quality Fraser River intertidal, high quality Fraser River riparian) but they can also include modified habitat (i.e. dikes), low quality habitat (e.g. areas infested with invasive plant species) and developed areas (e.g. buildings and roads) which do not provide habitat value. If ESAs are to be disturbed due to dike upgrades, mitigation and compensation may be required. In order to properly assess the environment values that may be disturbed by dike improvements in ESAs and thus the amount of compensation that is required, detailed site-specific assessments are recommended.

The impact area presented above represents a significant area of impact that will require major offsetting effort. Estimated reach-by-reach impact areas are presented below.

Table 3-11: Reach-by-Reach Summary of Potential Habitat Impacts and ESA Overlap

Reach # and Name	High-Quality Fraser River Intertidal (m^2)	High Quality Fraser River Riparian (m^2)	Drainage Channel Aquatic (m^2)	Drainage Channel Riparian (m^2)	Overlap with ESA Types (m)
1 – Gilmore West	9,900	-	4,400	21,100	Intertidal:7,500 Shoreline: 7,800
2 – Crown Packaging (13911 Garden City Road)	600	-	-	-	Intertidal: 700 Shoreline: 6,300

Reach # and Name	High-Quality Fraser River Intertidal (m^2)	High Quality Fraser River Riparian (m^2)	Drainage Channel Aquatic (m^2)	Drainage Channel Riparian (m^2)	Overlap with ESA Types (m)
3 – Gilmore East	6,700	2,400	3,100	14,200	Freshwater Wetland: 300 Intertidal: 8,100 Shoreline: 21,000
4 – Shellmont West	-	200	1,200	4,400	Freshwater Wetland: 1,700 Intertidal: 700 Old Fields and Shrublands: 300 Shoreline: 19,300
5 – Shellmont Deas Dock, BC Ferries Fleet Maintenance Unit (12800 Rice Mill Road0	1,100	-	< 100	< 100	Intertidal: 11,200 Shoreline: 18,200
6 – Highway 99	-	200	-	-	Intertidal: 1,500 Shoreline: 6,900
7 – Fraser Lands – Canadian Fishing Company (13140 Rice Mill Road)	-	-	-	-	Intertidal: 1,700 Shoreline:7,900
8 – Fraser Lands Fraser Wharves	200	100	-	-	Intertidal: 300 Shoreline: 10,600
9 – Fraser Lands Riverport Way	100	100	-	-	Intertidal: 1;200 Shoreline: 7,500
10 – Fraser Lands Port of Vancouver	700	17,000	1,300	900	Intertidal: 5,300 Shoreline: 45,100 Upland Forest: 5,500
11 – Fraser Lands Lafarge Canada Inc. (7611 No 9 Road)	-	900	-	-	Intertidal: 300 Shoreline: 11,500
12 – East Richmond	-	2,500	3,200	5,500	Intertidal: 4,800 Shoreline: 25,300 Upland Forest: <100
13/14– Hamilton/Boundary	100	4,200	1,100	2,400	Intertidal: 900 Shoreline: 200 Upland Forest: 100

Geotechnical Considerations for Recommended Options

The proposed dike improvements were assessed with consideration for the BC Seismic Design Guidelines for Dikes.

Thurber Engineering Ltd. (Thurber) assessed three sample cross-sections to estimate the potential deformation resulting from seismic events. The cross-sections were based on the recommended cross-section at what was judged to be the most susceptible areas for deformation. Soil conditions were determined by cone penetration tests. Seismic performance was assessed on the basis of existing foundation conditions, (i.e. no additional ground improvement/densification) to determine the need for ground improvement or alternative approaches. The analysis included seismic events representing 100, 475 and 2,475-year return period events. Seismic performance was assessed using two methods: 1-D (i.e. flat ground) liquefaction assessment to estimate reconsolidation settlements, and 2-D numerical deformation assessment to estimate dynamic deformations. The methods are complimentary, and the results are interpreted together.

The preliminary geotechnical report is attached in Appendix C.

The key results of the geotechnical analysis are summarized below.

- Proposed dike cross-sections will not meet the performance requirements of the BC Seismic Design Guidelines for Dikes based on numerical deformation analysis, without ground improvement or alternative approaches.
- The liquefaction hazard is considered insignificant for earthquakes up to the 100-year return period event.
- The liquefaction hazard is considered moderate and high for the 475 and 2,475-year return period events respectively. The resulting deformations would be large.
- Liquefaction may result in a flowslide into the river for dike alignments along the river-bank due to lateral spreading, whereas it would result only in vertical deformation for dike alignments significantly set back from the river bank.
- The deformation analysis indicates that dikes may meet the performance requirements of the seismic design guidelines if they are typically set back 50 m to 100 m from the river-bank and have flat slopes or some localized ground improvement.

Options to address seismically induced deformations are provided below.

- **Densification** – The typical approach to densification is to install stone columns. To be effective against the liquefaction expected to follow the 2,475-year return period event, densification would have to extend the depth of the liquefaction zone, and for a similar width. In a typical scenario, this can be considered as a 30 m (width) by 30 m (depth) densification located at the river-side toe of the dike. Densification can be very costly (e.g. $9,000 to $18,000 per lineal metre of dike). Alternate experimental techniques are being tested by the City that may offer a more economic solution.
- **Higher Crest** – For the 100-year return period event, additional crest elevation may compensate for deformations caused by settlement. For events that cause liquefaction, added height results in added deformation, so it would be less effective. This is not an effective strategy by itself for return periods above 100-year due to lateral spreading and large vertical deformations.

- **Setback and Slope** – Flatter side slopes on the dike improves seismic stability. However, to prevent large deformations in the 2,475-year return period event, the maximum acceptable slope between the river channel invert and the dike crest would need to be approximately 2%, which would require a significant setback between the dike and river.
- **Wide Crest** ("superdikes") – A very wide dike (e.g. several hundred metres) could be used to extend the dike beyond the limit of significant lateral spreading due to liquefaction. A portion of the wide crest could be considered sacrificial in the even to major lateral spreading. The minimum distance for each fill area should be based on a geotechnical evaluation of the setback required for the superdike to retain its hydraulic integrity under seismic design performance criteria (seismic stability and flowslide). Raising the land inland of the dike is desirable for related flood protection reasons and may be desired by the City for other reasons such as land use planning. It has already been done as part of multiple family, commercial, and industrial development projects in some waterfront areas. Buildings in this zone should be built above the dike crest elevation and have densified foundations capable of withstanding liquefaction.
- **Dike Relocation / Secondary Dikes** – Place the dike inland of the liquefaction lateral spreading zone (similar to set back approach) or place a secondary dike inland of the liquefaction lateral spreading zone. The wider option above would essentially include a secondary dike. Relocating the primary dike inland would be a form of retreat and would leave existing property and buildings exposed outside of the dike.
- **Post-earthquake Dike Repair** – Dike reach specific plans could be developed for post-earthquake dike repairs. These would need to consider the feasibility of dike repair construction following a major earthquake. In general, it is likely not feasible to quickly repair a dike that has failed due to a flowslide induced by liquefaction lateral spreading, especially if the breach results flooding from regular high tides. However, it may be feasible to prepare dike repair plans for dikes where a flowslide is not anticipated.

Additionally, the City may wish to use alternative seismic performance criteria, as is considered in the pending update to the Flood Protection Management Strategy.

Considerations to manage the seismic risk are provided below.

- Consider alternative seismic performance criteria as considered in the pending Flood Protection Management Strategy. Review the criteria if/when the Province issues updated guidelines for seismic performance of dikes.
- Fill a wide swath of land (several hundred metres) inland of the dike to the design dike crest elevation. Buildings in this zone should be built above the dike crest elevation and have densified foundations capable of withstanding liquefaction. The required distance requires some additional evaluation and may be addressed in the pending update to the Flood Protection Management Strategy.
- Continue to investigate practical densification options, and consider earthquake induced dike deformations in emergency response and recovery planning.

3.7 Cost Opinions

Cost opinions for the recommended option in each reach are provided to help the City consider the financial implications for planning and comparing options. A breakdown is provided to help understand the proportional cost for recommendations such as separating and raising the road.

Costs are based on unit rate cost estimates and tender results for similar works. The most relevant rates are from the City's Gilbert Road dike project. The City provided a summary of the cost estimate prepared by WSP for this project.

Rates from recent tenders for diking on the Lower Fraser River and other locations within the Lower Mainland were used to check the reasonableness of the rates and estimate other features such as sheet piles or large diameter drain pipes.

The costs were broken down by reach so that unit rates could be applied to similar typical cross-sections. They were also broken down into the main features that coincide with options that the City may wish to consider further. The cost estimate for the recommended option includes construction from existing condition to recommended option, without considering any potential interim works. Cost estimates for interim works are provided, and it is expected that there would be some cost saving associated with upgrading the interim dike to the long-term option, which are not accounted for. These features are described below.

- **Dike Raising** – this is the core element required to provide flood protection. It includes a 10 m crest width at 4.7 m elevation that can be raised while still achieving a 4 m crest width for future raising to 5.5 m. This includes site preparation, fill, and erosion protection.
- **Road Structure and Utilities** – this includes stripping, subgrade preparation, pavement structure, drainage and utilities. Where the existing road is atop the dike, most of this cost would be incurred regardless of where it gets relocated.
- **Road Raising to Dike Crest** – this includes the additional fill required to raise the road to the dike crest elevation.
- **Other** – features such as landscaping, habitat improvements, multi-use paths, driveway ramps and other amenities typically have a combined impact of less that 10%, so are lumped together for conciseness.
- **Contingency** – A 40% contingency is provided because the costs are based on concept plans only.
- **Interim Measures** – some industrial sites may not redevelop within the time frame that dike improvements are planned for. The City can either proceed with the improvements with accompanying disruptions to the existing land use, or proceed with interim measures that provide a reasonable level of protection until the recommended high level of protection can be achieved during redevelopment. These costs are listed separately because they may or may not be needed depending on the timing of redevelopment.

Table 3-11 presents a summary of all reaches with cost breakdowns for the items described above. Costs for each reach are also provided in the Reach Summary Sheets in Section 5. Table 3-13 presents a summary of the potential interim measures. Some cost savings may be expected in situations where the interim option is constructed initially and the recommended option is constructed at a later date, as an upgrade to the interim option. The cost opinion does not account for these savings. The cost opinion for the recommended option includes construction from existing condition to recommended option, without considering any potential interim works.

Table 3-12: Summary of Construction Costs ($ in Millions)

Item	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12	Reach 13/14	Total
Dike Raising	$12.5 Million	$1.6 Million	$7.9 Million	$4.5 Million	$7.2 Million	$1.1 Million	$2.3 Million	$4.5 Million	$4.5 Million	$15.8 Million	$6.8 Million	$8.1 Million	$7.7 Million	$84.3 Million
Road Structure & Utilities	$9.0 Million		$4.9 Million	$3.9 Million		$0.7 Million						$3.9 Million	$6.6 Million	$28.9 Million
Raise Road to Dike Height	$12.2 Million		$6.6 Million	$5.3 Million								$5.3 Million	$9.0 Million	$38.4 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.4 Million		$0.3 Million	$0.4 Million	$0.3 Million	$0.1 Million		$0.8 Million	$0.1 Million	$0.2 Million	$0.4 Million	$0.4 Million	$1.2 Million	$4.5 Million
Other*	$3.8 Million	$1.0 Million	$2.9 Million	$1.2 Million	$6.8 Million	$0.1 Million	$1.5 Million	$2.9 Million	$2.9 Million	$10.2 Million	$4.4 Million	$3.5 Million	$0.5 Million	$41.5 Million
Contingency (40%)	**$15.1 Million**	**$1.0 Million**	**$9.0 Million**	**$6.1 Million**	**$5.7 Million**	**$0.8 Million**	**$1.5 Million**	**$3.3 Million**	**$3.0 Million**	**$10.5 Million**	**$4.6 Million**	**$8.5 Million**	**$10.0 Million**	**$79.0 Million**
Total	**$53.0 Million**	**$3.6 Million**	**$31.5 Million**	**$21.3 Million**	**$20.0 Million**	**$2.7 Million**	**$5.2 Million**	**$11.5 Million**	**$10.5 Million**	**$36.6 Million**	**$16.1 Million**	**$29.7 Million**	**$35.0 Million**	**$276.6 Million**

Table 3-13: Summary of Costs for Interim Measures ($ in Millions)

Item	Reach 2	Reach 3	Reach 5	Reach 7	Reach 12	Reach 13/14	Total
Dike Raising	$1.6 Million	$9.5 Million	$2.9 Million	$0.9 Million	$9.7 Million	$9.2 Million	$33.7 Million
Road Structure & Utilities		$6.8 Million			$7.0 Million	$6.6 Million	$20.5 Million
Raise Road to Dike Height							
Driveways, Ramps or Road Intersection Reconstruction		$0.3 Million	$0.3 Million		$0.4 Million	$1.2 Million	$2.1 Million
Other*	$1.5 Million	$0.5 Million	$6.8 Million	$2.1 Million	$0.5 Million	$0.5 Million	$12.0 Million
Contingency (40%)	**$1.2 Million**	**$6.8 Million**	**$4.0 Million**	**$1.2 Million**	**$7.1 Million**	**$7.0 Million**	**$27.3 Million**
Total	**$4.3 Million**	**$23.9 Million**	**$13.9 Million**	**$4.2 Million**	**$24.8 Million**	**$24.5 Million**	**$95.6 Million**

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Costs that are not included are noted below.

- Land acquisition is not included. Ideally, land will be acquired during redevelopment. Similarly, there may be opportunities to have dike improvements tied to adjacent development.
- Seismic performance measures are not included. Raising land inside the dike is likely a preferred strategy to deal with liquefaction. If the road and land behind the dike is not raised, then densification may be appropriate. Current techniques such as stone columns would cost approximately $9,000 to $18,000 per metre of dike.
- Habitat enhancement and off-site habitat projects (that may be needed beyond the habitat enhancement provided along the dike corridor) are not included. Such cost could be roughly 5% of the construction cost. It is understood that a separate Dike Master Plan may be prepared to address habitat compensation by identifying and developing medium to large habitat compensation concepts.
- Raising the land behind the dike is not included. This is proposed to be a condition of development behind the dike, with the cost and benefit attributed to the property owner.
- Professional fees (engineering, surveying, environmental, archeological, etc.) are not included. Such costs could be in the range of 10% to 15% of the construction cost.

4. Implementation Strategy

The implementation strategy has three parts:

- Pre-design measures;
- Construction sequencing for a typical reach; and
- Prioritization of reaches for construction.

4.1 Pre-design Measures

Before construction can be implemented, the following steps are recommended.

- Use the Dike Master Plan as a planning tool with City land use planning to acquire land during redevelopment, and to rezone land with conditions for land raising inland of the dike.
- Acquire land prior to construction.
- Seek habitat compensation projects to bank credits in preparation for drainage channel and associated riparian area impacts. A separate master plan for habitat compensation could be prepared to identify and develop medium to large habitat enhancement concepts to serve as compensation for multiple reaches.
- Assess required drainage system modifications (e.g. filling drainage channels and constructing a piped drainage system) in additional detail.
- Design with consideration for construction sequencing noted below.
- Advance public space and multi-use path design concepts further.
- Consider the need for an appropriate building setback from the land-side toe of any future flood protection works in view of the current BC setback guideline of 7.5 m. This should consider the planned dike upgrade to 4.7 m CGVD28, as well as future buildout to 5.5 m CGVD28. This may require consultation with the Inspector of Dikes.

4.2 Construction Sequence

The construction sequence for a typical reach is provided below. A typical reach currently has a road atop the dike, and utilities within the dike.

1. Secure land.
2. Coordinate third party utility relocations. This is mainly hydro on poles, Fortis gas infrastructure, and CN and local rail lines.
3. Install storm sewer (diameter to be confirmed at detailed design) in proximity to existing channel.
4. Fill over storm sewer to underside of road structure. The fill placement may be followed by a settlement period depending on geotechnical recommendations. If so, this fill may include a preload depth in excess of the road fill.
5. Install new utilities (typically water and hydro, with some sewer).
6. Construct new road with parking where access outside the dike will be impacted.
7. Divert traffic to new road.
8. Remove existing road and utilities. Do not abandon utilities within dike.

9. Fill dike to crest elevation. Excavation of sub-grade may be required to remove unsuitable materials.
10. Complete armouring, trail, and landscaping.

Larger projects will result in less temporary road diversion works. As an alternate, the entire road could be reconstructed first, in phases, before the dike is built later. This would work with the new road being raised to dike crest elevation.

4.3 Prioritization

Priority for construction will depend on which section is the lowest and therefore most urgent to raise, opportunities such as site development or road improvement plans, level of preparedness for issues such as land acquisition and habitat offsets, and adjacent residents' receptiveness to a higher dike. A preliminary priority list is provided below. Opportunities may shift the order, and the reaches may be broken down into smaller or larger projects.

Table 4-1: Priority by Reach

Priority	Reach # and Name	Extent / Length	Major Features
1	1 – Gilmore West	No. 2 Road to Crown Packaging (2.7 km)	• Designed and tendered.
2	2 – Crown Packaging (13911 Garden City Road)	66+500 to 66+150 (350m)	• Low section. Interim measures planned.
3	7 – Fraser Lands – Canadian Fishing Company (13140 Rice Mill Road)	Rice Mill Road to Fraser Wharves (500 m)	• Low section. Interim measures likely.
4	3 – Gilmore East	Crown Packaging to Shell Road (1.75 km)	• Relatively straightforward
5	6 – Highway 99	Rice Mill Road (250 m)	• Await MOTI opportunity.
6	8 – Fraser Lands Fraser Wharves	Fraser Wharves to Steveston Hwy (1 km)	• Seek redevelopment opportunities with Port Metro Vancouver (PMV)
7	4 – Shellmont West	Shell Road to No. 5 Road (1 km)	• Seek redevelopment opportunities for land acquisition and to resolve access issues.
8	5 – Shellmont Deas Dock, BC Ferries Fleet Maintenance Unit (12800 Rice Mill Road)	No. 5 Road to Rice Mill Road (1 km) (1.6 km of dike)	• Seek redevelopment opportunities with BC Ferries.
9	11 – Fraser Lands Lafarge Canada Inc. (7611 No 9 Road)	Nelson Road to Dyke Road (1.5 km)	• Seek redevelopment opportunities with Lafarge, else install interim measures.
10	12 – East Richmond	Dyke Road to Fraserwood Way (1.8 km)	• Seek redevelopment opportunities for land acquisition and to resolve access issues.
11	13/14 – Hamilton/Boundary	Fraserwood Way to Boundary Road (1.7 km)	• Seek redevelopment opportunities for land acquisition and to resolve access issues.

Priority	Reach # and Name	Extent / Length	Major Features
12	10 – Fraser Lands Port of Vancouver	Williams Road to Nelson Road (3.5 km)	• Most Land is high. Coordinate with PMV
13	9 – Fraser Lands Riverport Way	Steveston Hwy to Williams Road (1 km)	• This is newer and higher section.
14	Boundary Secondary Dike	Dike Road to Hwy 91	• This is a back up to New Westminster dikes

5. Reach Summary Sheets

The following section contains 2-page, reach-by-reach summary sheets that summarize the existing conditions, design considerations and potential constraints for each reach of Phase 3. The second sheet will summarize the features of the master plan through each reach including typical cross-sections, plan features, costs and priority for upgrade. The second sheet will be completed after stakeholder consultation and option selection.

Reach 1: Gilmore West





Existing Conditions

This reach of the dike is characterized as a dike in the roadway (Dyke Road). There is riparian habitat on the water side of the dike along with a public trail and park amenities. The land side of the dike is predominantly farmland with a drainage channel adjacent to the road. There are utilities (a watermain) within the land side toe of the road between chainage 69+000 to No 3 Road at chainage 67+100.

The final approximately 550 m of dike is along the river through the Dyke Trail Dog Park. This section of dike does not include a road, it is a multi-use trail.

The master plan must balance road, habitat interests, trail and park amenities, while still providing room to expand and minimizing utility risks.

Unique Features

- London Heritage Farm, a historical site featuring a 19th-century farmhouse and barn, is located on the landside of the dike at approximate chainage 68+400. Dike upgrades need to protect this area without impacting the existing structures
- No 3 Road Waterfront Park and Fishing Pier, a public amenity on the water side of the dike, at chainage 67+150
- South Dyke Trail on the dike crest from No. 2 Road to Crown Packaging (then detours inland)
- Lulu Island Waste Water Treatment Plant is located approximately 200 m inland of the dike at chainage 67+950
- Dike upgrade project between Gilbert Road and No 3 Road scheduled for construction in 2019 (approximate chainage 68+000 to 67+000)
- FREMP habitat compensation site at the base of Gilbert Road
- Gilbert Road South pump station
- No. 3 Road South pump station

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Infrastructure in the dike

Dyke Road

Dike cross-section at the pump station will have to be expanded and modified.

Future pump station upgrades need to consider the planned dike upgrades to allow enough room for pumping infrastructure

Social

No. 2 Road Pier / London's Landing
Gilbert Beach
London Heritage Farm historical site
Dyke Trail Dog Park
South Dyke Trail
No. 3 Road Waterfront Park/Pier
Wayfinding and public information signs
Traffic and road safety

Environmental

Intertidal and Shoreline ESAs present in the reach

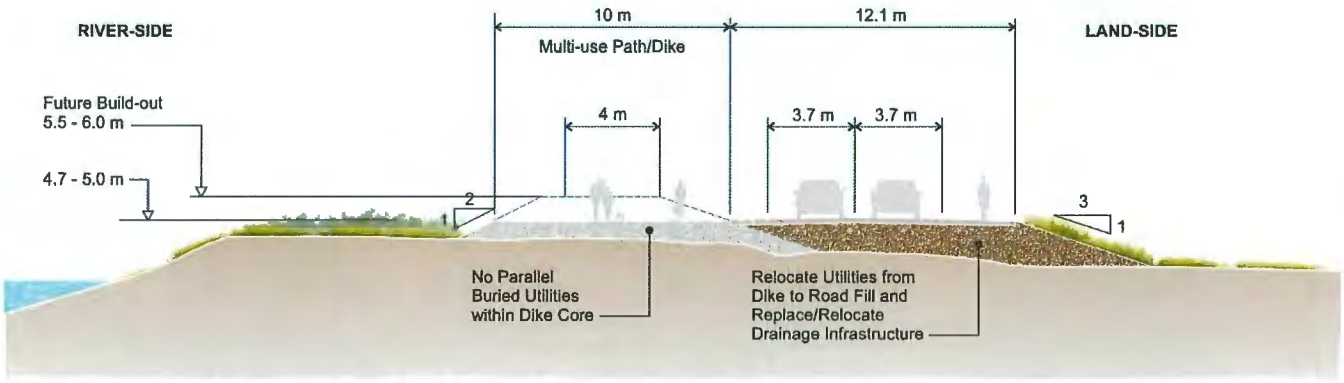
Land side is bordered by a drainage channel that is fish bearing with amphibian habitat.

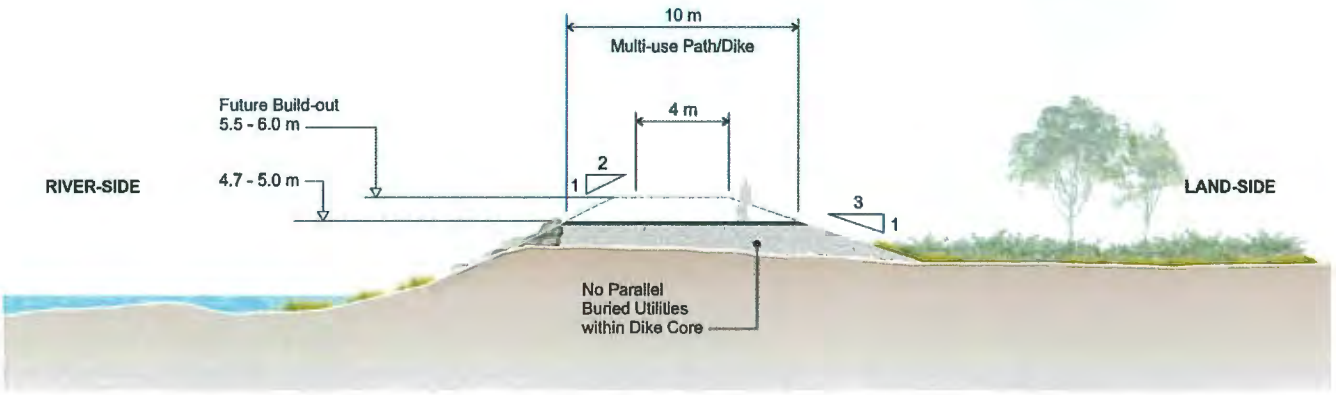
Moderate quality deciduous woodland, tall shrub woodland, and meadow present on inland bank of the drainage channel.

Fraser River side habitat includes:

- high quality marsh and mudflat habitat,
- low quality habitat armoured bank, and
- a narrow strip of marsh habitat.

Reach 1: Gilmore West - Recommended Improvements





Reach 1: Gilmore West - Recommended Improvements

Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Dike side slopes: 2H:1V on waterside (with erosion protection) and 3H:1V on landside

Structure will be over-wide with the adjacent Dyke Road, and to accommodate future dike raising to 5.5 m

Industrial and Infrastructure

Long term

Relocate parallel infrastructure in the dike corridor to landside, outside of the dike footprint

Infrastructure crossing the dike will be designed with seepage control

Separate the dike from the road

Dyke Road to be relocated to the land side of the dike, and the dike crest will be a dedicated dike/multi-use path

Relocate and reduce the landside drainage channel, while maintaining internal drainage

Social

Align with 2009 Waterfront Strategy

Traffic and road safety – separate Dyke Road from the multi-use path and include allowances for barricades and road shoulders

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

Environmental

Building the dike to the landside, where possible, to minimize impact to Fraser River aquatic and riparian habitat

The proposed footprint would impact an estimated 9,900 m² of high-quality Fraser River intertidal habitat, 4,400 m² of drainage channel aquatic habitat, and 21,100 m² drainage channel riparian habitat*

Relocating the drainage channel further inland and including appropriate plantings to the land side

Mitigation and compensation for disturbance to ESAs may be required

*NOTE: This is an estimate based on 2007 FREMP mapping and 2017 orthoimagery interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Priority

This section is first priority due to relative preparedness to proceed. The works are already designed and tendered. The road is planned to remain atop the dike, but utilities are being removed. Road relocation can be reconsidered at a future date as a low priority.

Construction Cost

Costs below are for 2700 m of dike similar to cross-sections above.

Item	Cost
Dike Raising	$12.5 Million
Road Structure and Utilities	$9.0 Million
Raise Road to Dike Height	$12.2 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.4 Million
Other*	$3.8 Million
Contingency (40%)	**$15.1 Million**
Total	**$53 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 2: Gilmore Crown Packaging (13911 Garden City Road)





Existing Conditions

This reach of the dike is characterized as a dike through an active works yard with barge facilities. The land side of the dike consists of paved areas with offices, warehouses and loading facilities. A warehouse structure sits at the landside toe of the dike and there is a barge loading/unloading facility on the river side of the dike.

Site grading needs to accommodate specialized vehicle traffic on the site (*i.e.,* forklifts, semi-trucks, rail cars).

The master plan must balance existing operations and access to barge facilities with improved City maintenance access, while still providing room to expand and minimizing utility risks.

Unique Features

- Active works yard and barge facility
- Restricted City maintenance access with dike crest elevation below 3.5 m
- Rail and road access issues limit options to go around the site
- Property is leased to Crown Packaging with 18 years left on the lease
- Crown Packaging operates a large cardboard production plant on the site (60 to 65 m from top of bank)
- Rail line is located on the property (below the dike crest elevation) with rail access from the east
- Sub-leased shore area to a shipping/receiving company that uses sea-cans, large forklifts, semi-trucks and rail cars as part of their operations

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Marine operations and access to the Fraser River

Forklift, rail and semi-truck access to warehouses

Site grading constraints for vehicle traffic

Social

Environmental

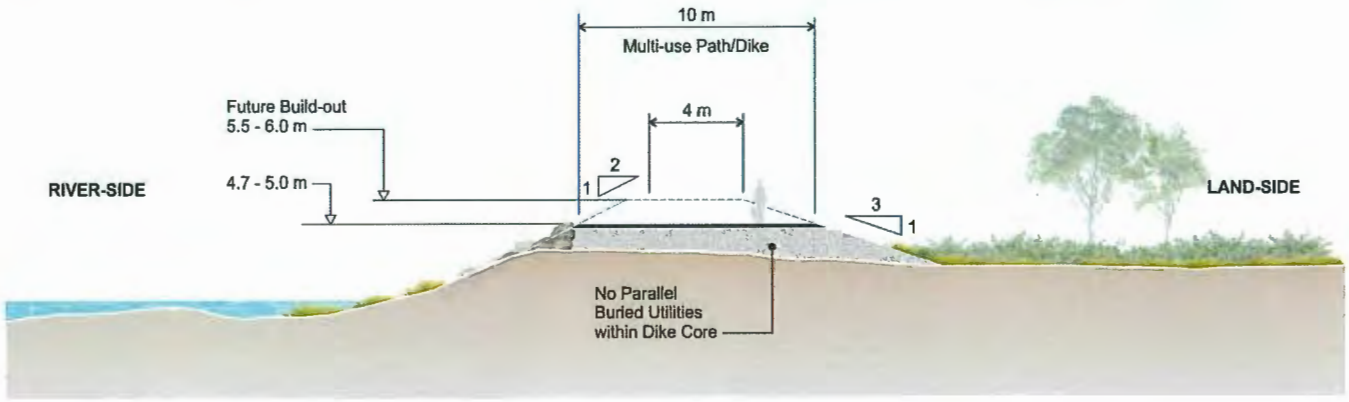
Intertidal and Shoreline ESAs present in the reach

Land-side is a paved parking lot.

Fraser River-side habitat includes:

- low quality habitat armoured bank, and
- small area of high quality riparian deciduous treed woodland habitat

Reach 2: Gilmore Crown Packaging (13911 Garden City Road) - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Dike side slopes: 2H:1V on waterside (with erosion protection) and 3H:1V on landside

Structure will be over-wide to accommodate future dike raising to 5.5 m

This site will include a phased plan to increase flood protection to a minimum of 3.9 m in the near-term with long-term flood mitigation to include construction of a standard dike to 4.7 m design elevation at the end of the current lease (2036)

Industrial and Infrastructure

Short term phasing (to 2036):

- construct a standard dike (where possible) on the west side of the property
- construct a steel sheetpile wall to 3.9 m elevation to accommodate the narrow area
- construct a narrow (approx. 2 m wide), paved access ramp with 12% grade to allow for barge access by forklifts

Long term (2036)

- Raise dike and full site to 4.7 m with redevelopment

Social

Align with 2009 Waterfront Strategy

Maintain and improve multi-use path around the site

Environmental

Building the dike to the landside, where possible, to minimize impact to Fraser River aquatic and riparian habitat

The proposed footprint would impact an estimated 600 m² of high-quality Fraser River intertidal habitat *

Mitigation and compensation for disturbance to ESAs may be required

*NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Reach 2: Gilmore Crown Packaging (13911 Garden City Road) - Recommended Improvements

Priority

Interim improvements to 3.9 m are high priority due to low elevation of this section of dike.

Full raising to 4.7 m is planned for 2036.

Construction Cost

Costs below are for 350 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$1.6 Million
Other*	$1.0 Million
Contingency (40%)	**$1.0 Million**
Total	**$3.6 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

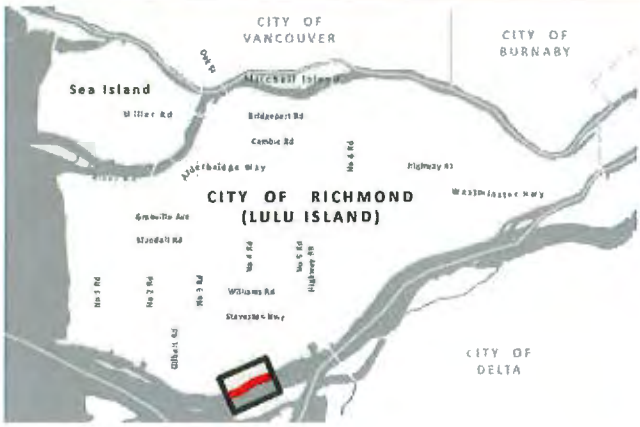
Interim

Item	Cost
Dike Raising	$1.6 Million
Other*	$1.5 Million
Contingency (40%)	**$1.2 Million**
Total	**$4.3 Million**

*Other – Pathways, Utilities, Sheetpile walls

Cost opinions are in 2018 Canadian Dollars.

Reach 3: Gilmore East





Existing Conditions

The first approximately 500 m of this reach is characterized as a dike only section through a City park from Crown Packaging by Woodwards Slough pump station to Dyke Road.

The second portion of this reach of the dike is characterized as a dike in the roadway (Dyke Road). There is riparian habitat on the water side of the dike along with the Finn Slough residences. The land side of the dike is predominantly farmland with a drainage channel adjacent to the road.

There are utilities (a watermain) within the land side toe of the road from No. 4 Road (approximate chainage 65+300) onwards.

The master plan must balance drainage and community needs, road, habitat interests, and trail and park amenities, while still providing room to expand and minimizing utility risks.

Unique Features

- Woodwards Slough pump station
- South Dyke Trail runs along the dike crest to No. 5 Road
- Finn Slough residences sits on the river side of the dike. The homes consists of houses on piles, floating homes, boats, docks and storage sheds with access by a pedestrian-only, wooden draw-bridge
- Drainage channel adjacent to the existing road/dike
- Homes and farm structures (barns etc.) on the land side near the toe of the existing dike/road

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Infrastructure in the dike

Dyke Road

Dike cross-section at the pump station will have to be expanded and modified

Future pump station upgrades need to consider the planned dike upgrades to allow enough room for pumping infrastructure

Social

South Dyke Trail
Traffic and road safety
Finn Slough residences

Environmental

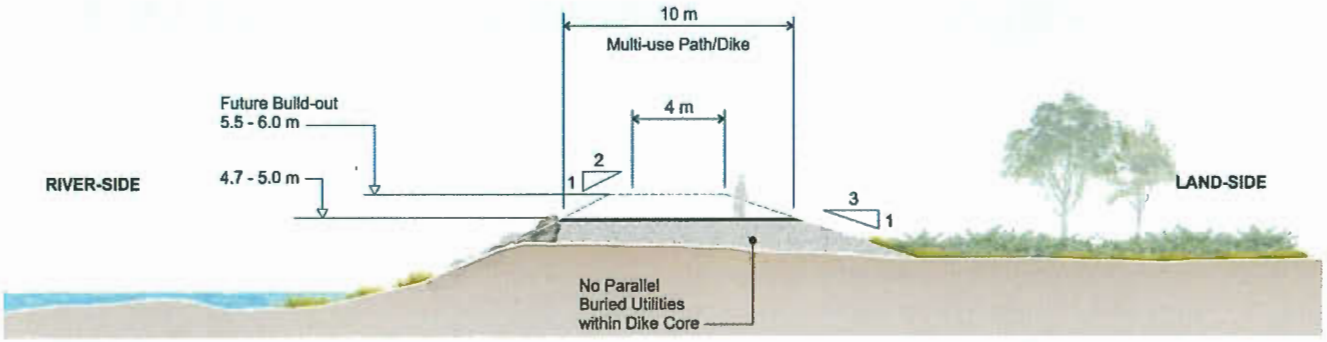
Freshwater Wetland, Intertidal and Shoreline ESAs present in the reach

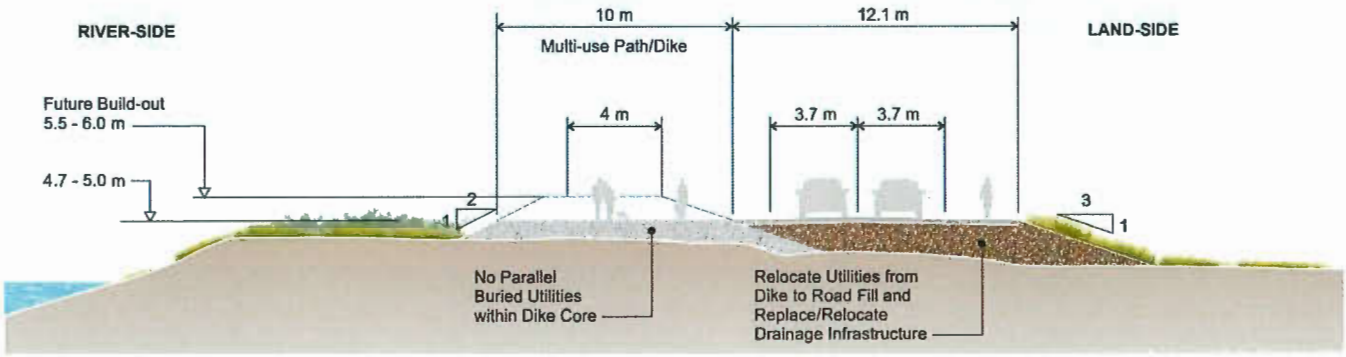
Land-side is bordered by a drainage channel that is potential amphibian breeding habitat. Fish species presence not recorded.

Fraser River-side habitat includes:

- low quality landscaped grasses and walking trails setback from armoured slopes
- high quality marsh habitat on the banks of Finn Slough, and
- high quality riparian habitat on the south side of Finn Slough (tall shrubby woodland)

Reach 3: Gilmore East - Recommended Improvements





Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Dike side slopes: 2H:1V on waterside (with erosion protection) and 3H:1V on landside

Structure will be over-wide to accommodate future dike raising to 5.5m

Industrial and Infrastructure

Short term phasing:

Combine Dyke Road with the dike to minimize the footprint of the proposed master plan

Long term

Separate the dike from the road

Dyke Road to be relocated to the land side of the dike, and the dike crest will be a dedicated dike/multi-use path

Relocate parallel infrastructure in the dike corridor to landside, outside of the dike footprint

Infrastructure crossing the dike will be designed with seepage control

Relocate and reduce the landside drainage channel, while maintaining internal drainage

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

Finn Slough habitat features preserved

Environmental

Building the dike to the landside, where possible, to minimize impact to Fraser River aquatic and riparian habitat

The proposed footprint would impact and estimated 2,400 m² of high-quality Fraser River riparian habitat, 6,700 m² of high-quality Fraser River intertidal habitat, 3,100 m² of drainage channel aquatic habitat, and 14,200 m² drainage channel riparian habitat*

Relocating the drainage channel further inland and including appropriate plantings to the land side

Mitigation and compensation for disturbance to ESAs may be required

*NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Reach 3: Gilmore East - Recommended Improvements

Priority

High priority due to relative preparedness to proceed. There are driveway coordination details, and there would be some benefit to waiting for adjacent redevelopment. However, redevelopment is likely too far off and the dike and road can be raised without impacting structures. The Finn Slough and housing can remain, although access will change.

Construction Cost

Costs below are for 1750 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$7.9 Million
Road Structure and Utilities	$4.9Million
Raise Road to Dike Height	$6.6 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.3 Million
Other*	$2.9 Million
Contingency (40%)	**$9.0 Million**
Total	**$31.5 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Interim

Item	Cost
Dike Raising	$9.5 Million
Road Structure and Utilities	$6.8 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.3 Million
Other*	$0.5 Million
Contingency (40%)	**$6.8 Million**
Total	**$23.9 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 4: Shellmont West





Existing Conditions

This reach of the dike is characterized as a dike in the roadway (Dyke Road). The land side of the dike is predominantly light industrial for the first and last approximately 300 m of the reach. These sites do not have river access as part of their operations; however, they do require semi-trailer access to the sites from Dyke Road.

The middle portion of the reach on the landside of the dike is characterized as a park or greenspace called: Woodward's Landing Campground.

There are utilities (a watermain and a stormdrain) within the land side toe of the road. There is also a small surface drainage channel along the Woodward's Landing Campground property.

The master plan must balance road, trail and park amenities, and habitat interests, while still providing room to expand and minimizing utility risks.

Unique Features

- Horseshoe Slough pump station
- South Dyke Trail runs along the dike crest to No. 5 Road and provides connection to Horseshoe Slough Trail
- Log boom mooring dolphins in the Fraser River from Shell Road to No 5 Road
- First and last 300 m (approx.) of the reach is light industrial with no river operations, but building access required for semi-trailers
- Middle 300 m (approx.) of the reach is Woodward's Landing Campground on the landside of Dyke Road

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Infrastructure in the dike

Dyke Road

Dike cross-section at the pump station will have to be expanded and modified

Future pump station upgrades need to consider the planned dike upgrades to allow enough room for pumping infrastructure

Social

South Dyke Trail (provides connection to inland trail system)
Woodward's Landing Park
Wayfinding and public information signs
Traffic and road safety

Environmental

Freshwater Wetland, Intertidal, Old Field and Shrubland and Shoreline ESAs present in the reach

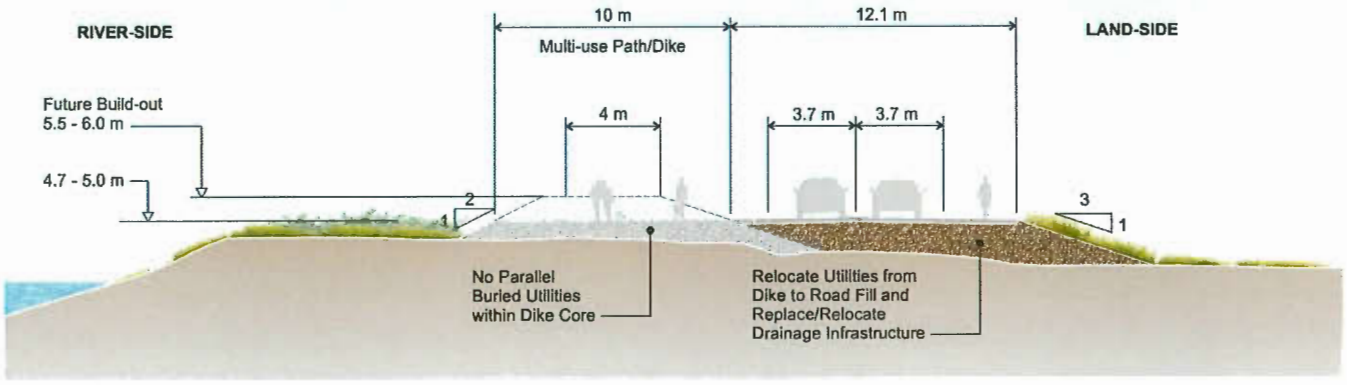
Land-side habitat includes:

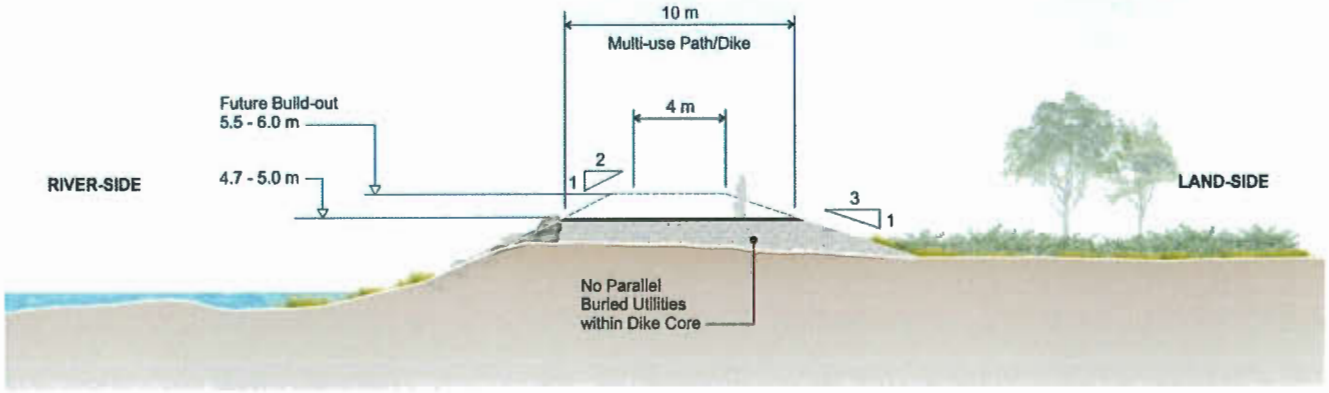
- low quality habitat (walking path and lawn) at east and west end of reach
- drainage channel adjacent to middle of reach (Threespine stickleback, amphibian habitat)

Fraser River-side habitat includes:

- low quality paved or gravel surfaces setback from armoured slopes
- very west end of reach is set back from Fraser River
- high quality marsh habitat in Fraser River in east half of reach

Reach 4: Shellmont West - Recommended Improvements





Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Dike side slopes: 2H:1V on waterside (with erosion protection) and 3H:1V on landside

Structure will be over-wide with the adjacent Dyke Road and to accommodate future dike raising to 5.5m

Industrial and Infrastructure

Long term

Relocate parallel infrastructure in the dike corridor to landside, outside of the dike footprint

Infrastructure crossing the dike will be designed with seepage control

Relocate and reduce the landside drainage channel, while maintaining internal drainage

Dike cross-section at the pump station will have to be expanded and modified

Future pump station upgrades need to consider the planned dike upgrades to allow enough room for pumping infrastructure

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

Environmental

Building the dike to the landside, where possible, to minimize impact to aquatic and riparian habitat

The proposed footprint would impact an estimated 200 m² of high-quality Fraser River riparian habitat, 1,200 m² of drainage channel aquatic habitat, and 4,400 m² drainage channel riparian habitat*

Relocating the drainage channel further inland and including appropriate plantings to the land side

Mitigation and compensation for disturbance to ESAs may be required

* NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Reach 4: Shellmont West - Recommended Improvements

Priority

High priority due to relative preparedness to proceed. There are driveway coordination details, and there would be some benefit to waiting for adjacent redevelopment. However, redevelopment is likely too far off and the dike and road can be raised without impacting structures.

Construction Cost

Costs below are for 1000 m of dike similar to cross-sections above.

Item	Cost
Dike Raising	$4.5 Million
Road Structure and Utilities	$3.9 Million
Raise Road to Dike Height	$5.3 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.4 Million
Other*	$1.2 Million
Contingency (40%)	**$6.1 Million**
Total	**$21.3 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 5: Shellmont Deas Dock, BC Ferries Fleet Maintenance Unit (12800 Rice Mill Road)





Existing Conditions

This reach of the dike is characterized as a dike through an active port facility. The land side of the dike consists of paved areas with offices, warehouses and loading facilities.

Current stakeholders include: Mainland Sand and Gravel (No. 5 Rd Depot) and BC Ferries Richmond (Deas Pacific Marine).

The master plan must balance existing operations and access to the river with improved City maintenance access, while still providing room to expand and minimizing utility risks.

Redevelopment offers the opportunity to raise the site (super-dikes) and improve access.

Unique Features

- Port facilities under redevelopment
- Active marine work yard and shipyard facilities with restricted maintenance access
- Rail and road access issues limit options to go around the site
- Active redevelopment activities
- FREMP habitat compensation site (plantings) in the Deas Dock area

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Marine operations and access to the Fraser River

Forklift, rail and semi-truck access to warehouses

Site grading constraints for vehicle traffic

No defined dike structure in Mainland Sand and Gravel depot with the active movement of material and loading of barges

Social

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

Environmental

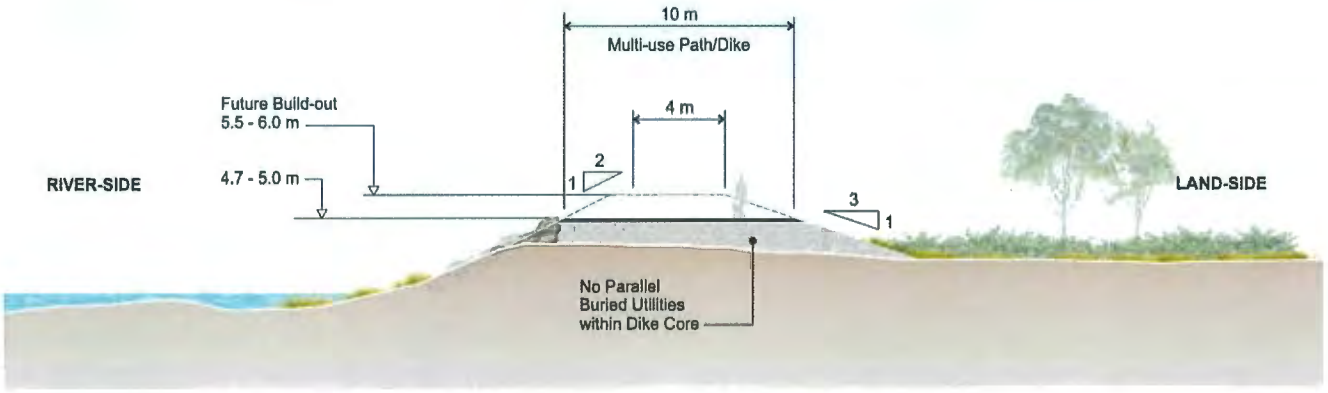
Intertidal and Shoreline ESAs present in the reach

Land-side is mostly paved with some low-quality herbaceous habitat present

Fraser River-side habitat includes:

- high quality marsh habitat where the dike is setback approx. 100 m in west half of reach
- high quality mudflats and marsh habitat bordering dike in the east third of reach

Reach 5: Shellmont Deas Dock, BC Ferries Fleet Maintenance Unity (12800 Rice Mill Road) - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

This site will include an interim measure for non-standard cross-section (setback sheetpile wall) to accommodate space constraints and operations until site can be raised to final elevation

Industrial and Infrastructure

Short term phasing:

- construct a standard dike (where possible); and
- construct a steel sheetpile wall to 4.7 m elevation to accommodate the narrow area
- potential for building a structure around the site and allow the stakeholder to address the flood hazards with site-specific response plans

Long term

- create a superdike and raise the property during redevelopment

Social

Align with 2009 Waterfront Strategy

Maintain and improve multi-use path around the site

This path will divert around the Deas Dock

Environmental

The proposed footprint would impact an estimated 1,000 m² of high-quality Fraser River intertidal habitat, less than 100 m² of drainage channel aquatic habitat, and less than 100 m² drainage channel riparian habitat*

Mitigation and compensation for disturbance to ESAs may be required

* NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Reach 5: Shellmont Deas Dock, BC Ferries Fleet Maintenance Unit (12800 Rice Mill Road) - Recommended Improvements

Priority

Medium priority. Timing will depend on coordination with BC Ferries and the potential raising of the dike and site along with redevelopment of Deas Dock. If improvements don't proceed in a reasonable timeframe, interim measures such as raising the road around the site, may need to proceed before site redevelopment.

Construction Cost

Costs below are for 1600 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$7.2 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.3 Million
Other*	$6.8 Million
Contingency (40%)	**$5.7 Million**
Total	**$20.0 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

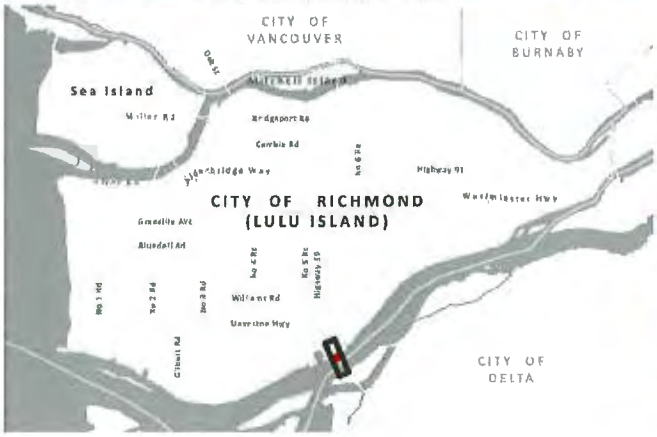
Interim

Item	Cost
Dike Raising	$2.9 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.3 Million
Other*	$6.8 Million
Contingency (40%)	**$4.0 Million**
Total	**$13.9 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 6: Highway 99





Existing Conditions

This reach of the dike is characterized as a dike and a dike in a road (Rice Mill Road). The land side of the dike consists of gravel parking lots and infrastructure for the George Massey Tunnel.

The master plan must balance the unique risks of having a tunnel through the dike with habitat interests, trail and park amenities, while still providing room to expand.

Unique Features

- Flood protection needs to integrate with the George Massey Tunnel
- Unique risks associated with having a tunnel under the dike
- Peace Arch (Highway 99) pump station

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Dike cross-section at the pump station will have to be expanded and modified

Future pump station upgrades need to consider the planned dike upgrades to allow enough room for pumping infrastructure

Social

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

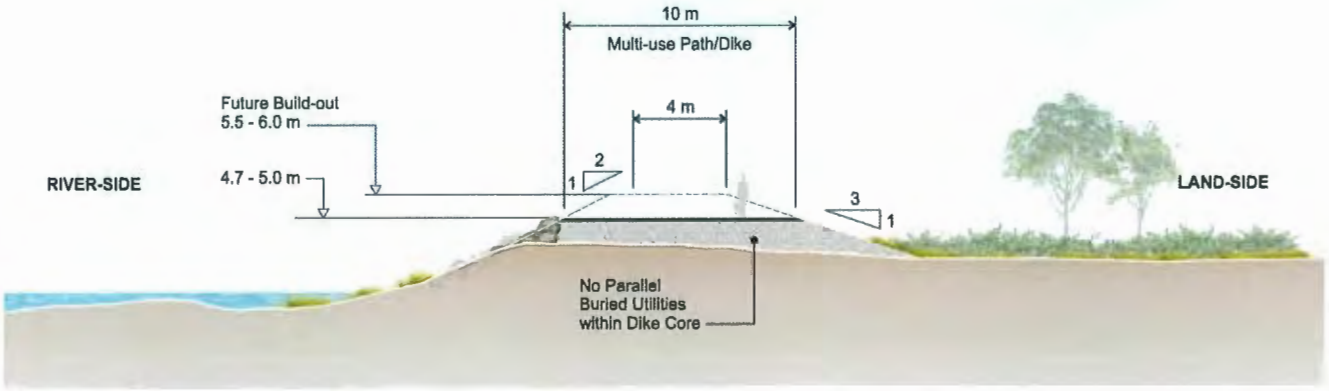
Environmental

Intertidal and Shoreline ESAs present in the reach

Land-side is mostly low-quality gravel parking lots

Fraser River-side habitat includes high quality deciduous tree riparian woodland (at the west end)

Reach 6: Highway 99 - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Design to respond to Massey tunnel replacement. Previous plans included sealing off the tunnel and constructing a bridge

Industrial and Infrastructure

Long term

Relocate parallel infrastructure in the dike corridor to landside, outside of the dike footprint

Infrastructure crossing the dike will be designed with seepage control

Relocate and reduce the landside drainage channel, while maintaining internal drainage

Dike cross-section at the pump station will have to be expanded and modified

Future pump station upgrades need to consider the planned dike upgrades to allow enough room for pumping infrastructure

If a bridge is selected to replace the tunnel, seal off the tunnel

If a tunnel is selected, the approach should rise to 4.7m with berms leading up to it as a barrier to tunnel collapse and flooding

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

Environmental

The proposed footprint would impact an estimated 200 m² of high-quality Fraser River riparian habitat*

Mitigation and compensation for disturbance to ESAs may be required

* NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Reach 6: Highway 99 - Recommended Improvements

Priority

Medium priority. Timing will depend on coordination with BC Ministry of Transportation and Infrastructure.

If improvements don't proceed in a reasonable timeframe, interim measures such as sheetpile walls, may need to proceed before the tunnel replacement.

Construction Cost

Costs below are for 250 m of dike similar to cross-section above.

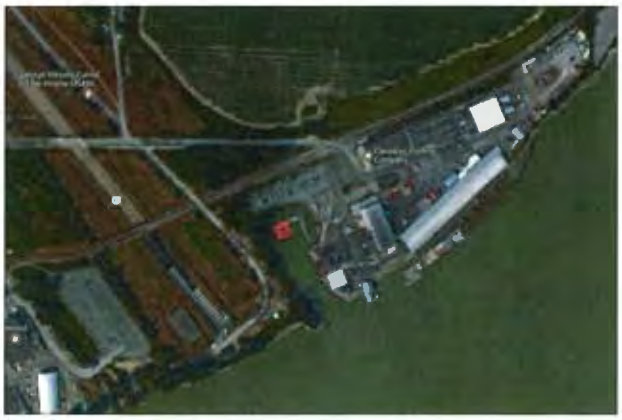
Item	Cost per metre	Cost
Dike Raising	$4,500	$1.1 Million
Road Structure and Utilities	$2,600	$0.7 Million
Driveways, Ramps or Road Intersection Reconstruction		$0.1 Million
Other*	$300	$0.1 Million
Contingency (40%)		**$0.8 Million**
Total		**$2.7 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 7: Fraser Lands Canadian Fishing Company (13140 Rice Mill Road)





Existing Conditions

This reach of the dike is characterized as a dike through an active works yard with barge facilities (Canadian Fishing Company). The land side of the dike consists of paved areas with offices, warehouses and loading facilities. Current buildings are located on the dike, with no access for City maintenance crews to inspect or maintain the area.

Rail lines are located north of the property and limit the options for routing a standard dike around the property.

Site grading needs to accommodate specialized vehicle traffic on the site (*i.e.*, forklifts and semi-trucks).

The master plan must balance existing operations and access to barge facilities with improved City maintenance access, while still providing room to expand and minimizing utility risks.

Unique Features

- Active works yard and barge facility
- Restricted City maintenance access with dike crest elevation below 3.5 m
- Rail and road access issues limit options to go around the site
- FREMP habitat compensation site in the area

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Marine operations and access to the Fraser River
Forklift, rail and semi-truck access to warehouses
Site grading constraints for vehicle traffic

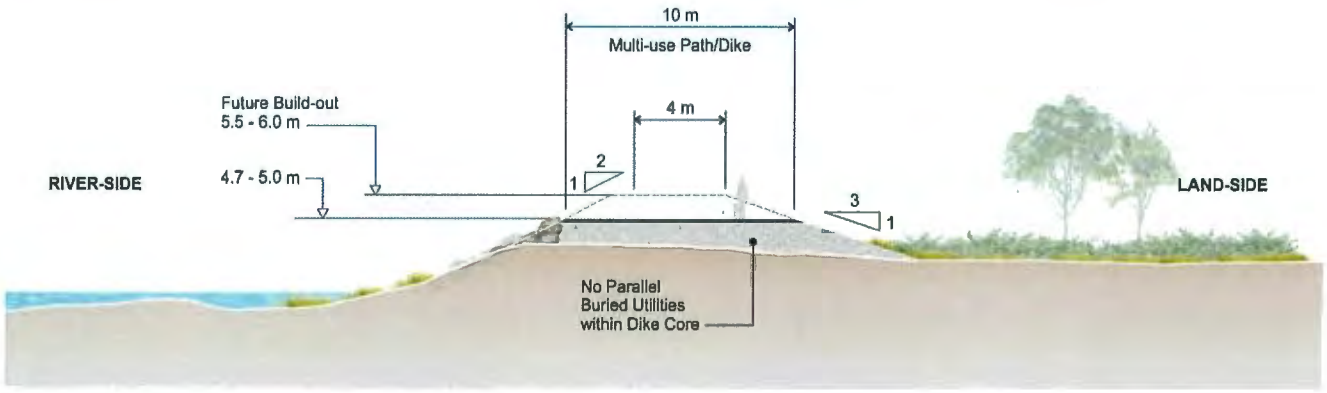
Social

Connect to existing and planned trails and public amenities
Wayfinding and public information signs
Traffic and road safety

Environmental

Intertidal and Shoreline ESAs present in the reach
Land-side has some deciduous trees, but most of the area is paved or has buildings
Fraser River-side habitat is low quality habitat with armoured slope or pier

Reach 7: Fraser Lands Canadian Fishing Company (13140 Rice Mill Road) - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Dike side slopes: 2H:1V on waterside (with erosion protection) and 3H:1V on landside

Structure will be over-wide to accommodate future dike raising to 5.5 m

This site will include a phased plan to increase flood protection to a minimum of 3.9 m in the near-term with long-term flood mitigation to include construction of a standard dike to 4.7 m design elevation at the end of the current lease

Industrial and Infrastructure

Short term phasing:

- construct a standard dike (where possible); and

Interim

- construct a steel sheetpile wall to 3.9 m elevation to accommodate the narrow area north of the site, between it and the rail ROW
- potential for building a structure around the site and allow the stakeholder to address the flood hazards with site-specific response plans
- Relocate site access to the west in order to install dike across current entrance

Long term

- create a superdike and raise the property during redevelopment

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

This path will divert north around this site

Environmental

Building the dike to the landside, where possible, to minimize impact to Fraser River aquatic and riparian habitat

The proposed footprint would not impact fish or aquatic habitat

Mitigation and compensation for disturbance to ESAs may be required

Reach 7: Fraser Lands Canadian Fishing Company (13140 Rice Mill Road) - Recommended Improvements

Priority

High priority due to low elevations. This may be limited to interim measures until the full standard dike can be coordinated with future site redevelopment.

Construction Cost

Costs below are for 500 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$2.3 Million
Other*	$1.5 Million
Contingency (40%)	**$1.5 Million**
Total	**$5.2 Million**

*Other – Pathways, Utilties, Furnishings & Bollards

Interim

Item	Cost
Dike Raising	$0.9 Million
Other*	$2.1 Million
Contingency (40%)	**$1.2 Million**
Total	**$4.2 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 8: Fraser Lands Fraser Wharves





Existing Conditions

This reach of the dike is characterized as a dike through an active port facility. The land side of the dike consists of paved areas with offices, warehouses and loading facilities.

The master plan must address existing operations and access to unloading facilities, and balance existing operations and access to the river with improved City maintenance access, while still providing room to expand and minimizing utility risks.

Redevelopment offers the opportunity to raise the site (super-dikes) and improve access, habitat and community amenities.

Unique Features

- Active ship-to-land car unloading facilities
- Active redevelopment activities
- No. 6 Road South pump station

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Marine operations and access to the Fraser River

Site grading constraints for vehicle traffic

No defined dike structure in Mainland Sand and Gravel depot with the active movement of material and loading of barges

Dike cross-section at the pump station will have to be expanded and modified

Future pump station upgrades need to consider the planned dike upgrades to allow enough room for pumping infrastructure

Social

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

Environmental

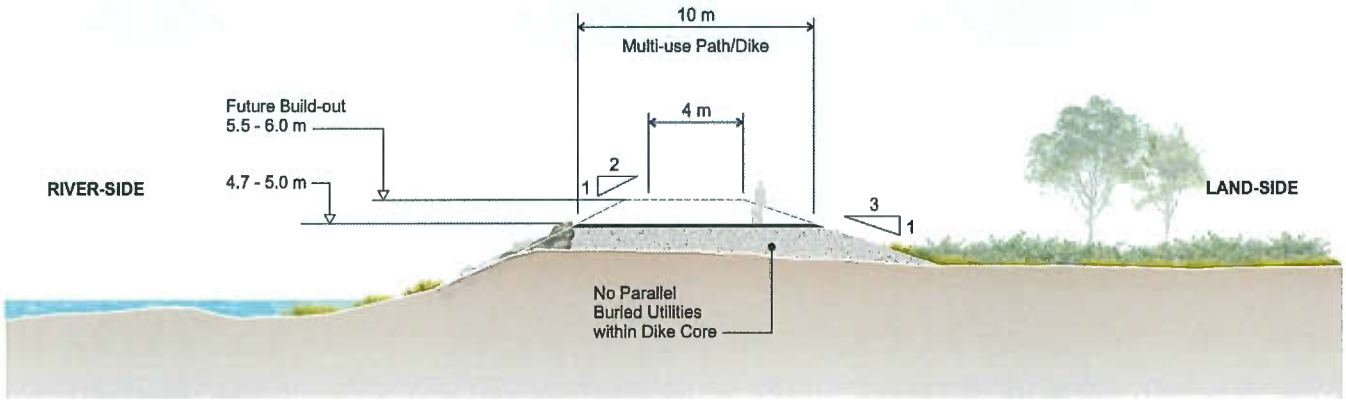
Intertidal and Shoreline ESAs present in the reach

Land-side is mostly paved with some low-quality shrub habitat between dike and pavement.

Fraser River-side habitat includes:

- high quality deciduous treed riparian habitat in east half and small patch in west half
- armoured slope and pier in middle of reach

Reach 8: Fraser Lands Fraser Wharves - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Industrial and Infrastructure

Long term

Coordinate improvements with Port Metro Vancouver

Dike runs through active port operations, so is expected to be gated

Raise the property during redevelopment to create a "superdike"

Construct a riverside dike that function with current and planned operations

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

This path will divert north around this site

Environmental

The proposed footprint would impact an estimated less than 100 m² of high-quality Fraser River riparian habitat, and 200 m² of high-quality Fraser River intertidal habitat*

Mitigation and compensation for disturbance to ESAs may be required

*NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Priority

Medium priority due to need to coordinate with PMV. Improvements may be achieved through site redevelopment.

Construction Cost

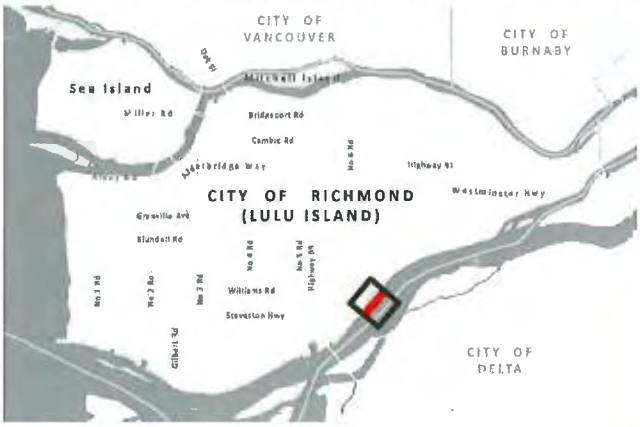
Costs below are for 1000 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$4.5 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.8 Million
Other*	$2.9 Million
Contingency (40%)	**$3.3 Million**
Total	**$11.5 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 9: Fraser Lands Riverport Way





Existing Conditions

This reach of the dike is characterized as a dike with a pedestrian walkway and path. There is riparian habitat on the water side of the dike along with a public trail and park amenities.

The master plan must balance recent development, habitat interests, trail and park amenities, while still providing room to expand.

Unique Features

- FREMP habitat compensation site in front of the Riverport Way development
- Recent Riverport Way development includes some recently constructed improvements (paved pedestrian pathway) that are challenging to raise
- Redevelopment activities along the eastern portion of the reach

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Pedestrian pathway in front of Riverport Way development is paved and buildings open directly onto the dike

Social

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

Environmental

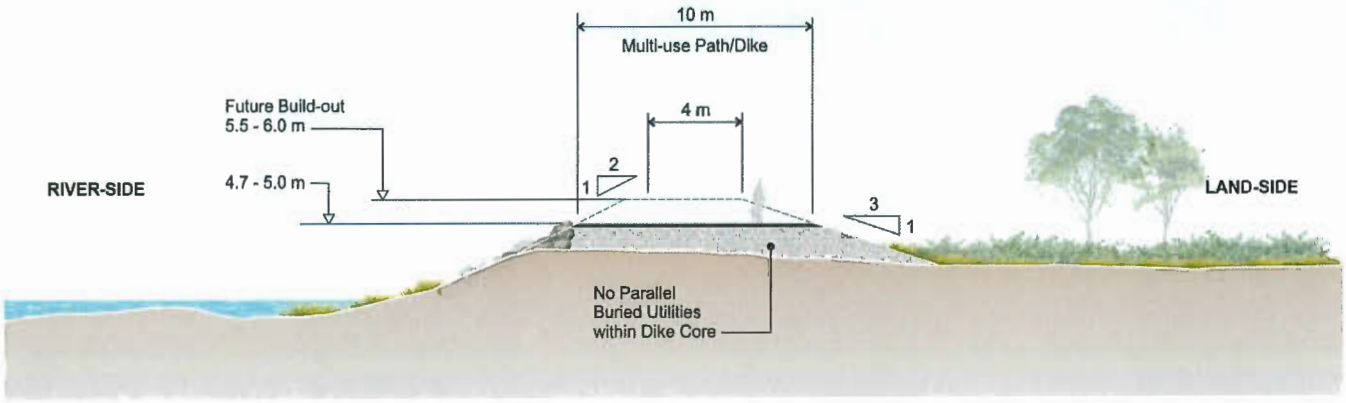
Intertidal and Shoreline ESAs present in the reach

Land-side is characterized by lawn or gravel lot with low quality habitat.

Fraser River-side habitat includes:

- high quality deciduous forest riparian habitat in middle of reach
- low quality habitat armoured bank at east and west ends a narrow strip of marsh habitat

Reach 9: Fraser Lands Riverport Way - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Dike side slopes: 2H:1V on waterside (with erosion protection) and 3H:1V on landside

Structure will be over-wide to accommodate future dike raising to 5.5m.

Industrial and Infrastructure

Long term

No existing infrastructure within the dike

Construct a riverside dike

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

Environmental

Building the dike to the landside, where possible, to minimize impact to aquatic and riparian habitat

The proposed footprint would impact an estimated 100 m² of high-quality Fraser River riparian habitat, and 100 m² of high quality Fraser River intertidal habitat *

Mitigation and compensation for disturbance to ESAs may be required

* NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Priority

Low priority. This portion of dike is newer and relatively high. Improvements can be deferred until the higher priority sections are addressed.

Construction Cost

Costs below are for 1000 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$4.5 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.1 Million
Other*	$2.9 Million
Contingency (40%)	**$3.0 Million**
Total	**$10.5 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 10: Fraser Lands Port of Vancouver





Existing Conditions

Much of this reach of the dike is characterized as a dike through an active port facility. Some locations within the reach have the dike in the road (Dyke Road) and in some locations, the dike is a trail through area.

The master plan must balance existing operations and access to the river with improved City maintenance access, while still providing room to expand and minimizing utility risks.

Redevelopment offers the opportunity to raise the site (super-dikes) and improve access. Continued development offers opportunities for dike material stockpile areas and some public amenities.

Unique Features

- Port facilities under redevelopment
- Active marine work yard and shipyard facilities with restricted maintenance access
- Active redevelopment activities
- City-owned waterfront between Williams Road and Coast 2000 terminals
- Three (3) FREMP habitat compensation sites: front face of the loading area in the Port, and two (2) intertidal areas near No. 8 Rd
- No. 7 Road South pump station
- Nelson Road South pump station

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Marine operations and access to the Fraser River

Forklift, rail and semi-truck access to warehouses

Site grading constraints for vehicle traffic

No defined dike structure or rights of way in some areas

Social

City owns portion of the waterfront that is used as an unofficial recreation area

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

Environmental

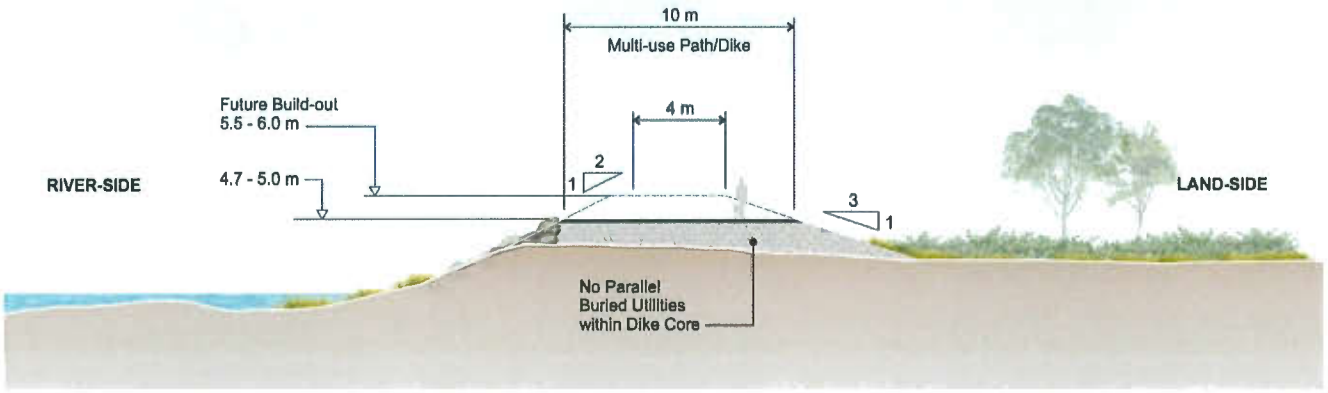
Intertidal, Shoreline, and Upland Forest ESAs present in the reach

Land side has:

- drainage channel at east end (Stickleback, amphibian habitat),
- paved lots at east and west ends, and
- large, seasonally flooded area in middle of reach (Potential for overwintering habitat creation).

Fraser River side habitat includes large areas of high-quality riparian forest, intertidal marsh along full length of reach

Reach 10: Fraser Lands Port of Vancouver - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Industrial and Infrastructure

Long term

Most of the Port of Vancouver lands are high and above the proposed dike crest height

Fill remaining low areas above dike elevations during redevelopment

Seek rights of way or agreement for inspection, maintenance, and construction of dikes or erosion protection along section that isn't within the City's jurisdiction

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

This path will divert north up the east bank of the No. 7 Rd. drainage channel and north around the PMV lands

Environmental

The proposed footprint would impact an estimated 17,000 m² of high-quality Fraser River riparian habitat, 700 m² of high quality Fraser River intertidal habitat, 1,300 m² of drainage channel aquatic habitat, and 900 m² drainage channel riparian habitat*

Opportunities for habitat improvements or creation of overwintering habitat in the middle of the reach

Mitigation and compensation for disturbance to ESAs may be required

*NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Priority

Low priority because most of the land and dikes are high. Coordinated planning with PMV should proceed earlier to develop and plan to deal with future site development, land raising, and responsibility or rights of way over federal portion of waterfront.

Construction Cost

Costs below are for 3500 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$15.8 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.2 Million
Other*	$10.2 Million
Contingency (40%)	**$10.5 Million**
Total	**$36.6 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 11: Fraser Lands Lafarge Canada Inc. (7611 No 9 Road)



Existing Conditions

Much of this reach of the dike is characterized as a dike through an active port facility.

The master plan must balance existing operations and access to the river with improved City maintenance access, while still providing room to expand and minimizing utility risks.

Unique Features

- Active works yard and barge facilities with restricted maintenance access.
- Restricted access for City maintenance
- Rail and road access issues limit options to go around the site
- Dike upgrades designed 2018

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Marine operations and access to the Fraser River

Forklift, rail and semi-truck access to warehouses

Site grading constraints for vehicle traffic

No defined dike structure in some areas

Social

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

Environmental

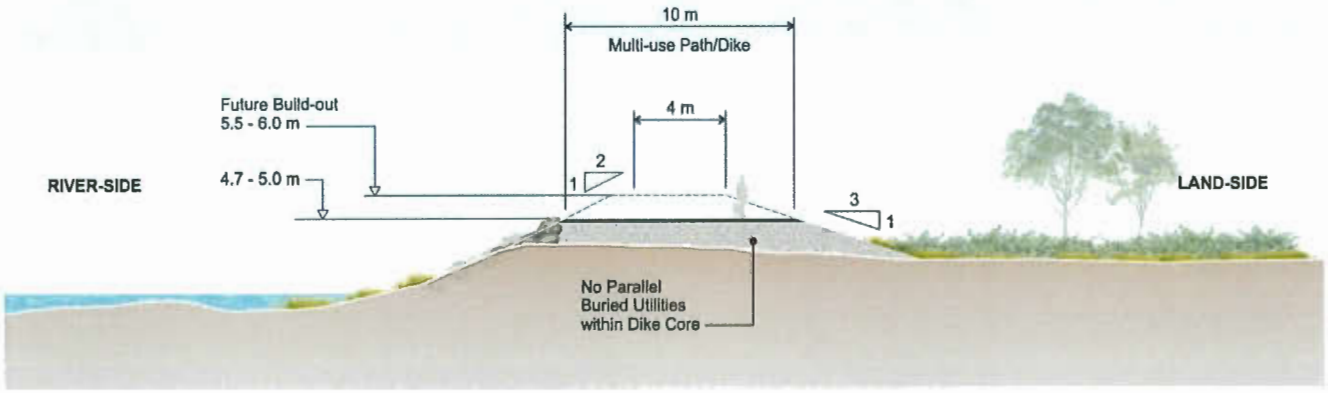
Intertidal and Shoreline ESAs present in the reach

Land-side has low quality habitat with paved lots and buildings.

Fraser River-side habitat includes some:

- high quality forested riparian habitat at the east end, and
- low quality habitat armoured bank at the west end

Reach 11: Fraser Lands Lafarge Canada Inc. (7611 No 9 Road) - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment through site, or negotiate a change in alignment that is favourable to the City and adjacent land owner

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Industrial and Infrastructure

Long term

Raising the dike in its current location will be very disruptive to Lafarge

Relocation to the water's edge would provide better control over erosion inspection and maintenance

Alternatively, relocation along the north perimeter of their site would limit the conflict of land use to access ramps

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road. Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B). This path will run along the north side of the Lafarge lands

Environmental

The proposed footprint would impact an estimated 900 m² of high-quality Fraser River riparian habitat *

Opportunities for habitat improvements or creation of overwintering habitat in the middle of the reach

Mitigation and compensation for disturbance to ESAs may be required

* NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Priority

Medium to low priority because the land is relatively high. However, raising the land and dike will be challenging with the current operations, so negotiated changes may take time. Seek redevelopment opportunities. Consider interim measures if opportunities not forthcoming.

Construction Cost

Costs below are for 1500 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$6.8 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.4 Million
Other*	$4.4 Million
Contingency (40%)	**$4.6 Million**
Total	**$16.1 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 12: East Richmond





Existing Conditions

This reach of the dike is characterized as a dike in the roadway (Dyke Road).

There are utilities (a watermain and storm main) within the land side toe of the road as well as local drainage provided by surface channels at the toe of the slope.

The master plan must balance drainage and community needs, road, habitat interests, and trail and park amenities, while still providing room to expand and minimizing utility risks.

Unique Features

- Ewen Road Irrigation pump station
- Commercial development on the land side
- East Richmond Trail runs along the dike crest adjacent to Dyke Road from No. 9 Road
- Very little room for dike works
- Multiple marinas with access over the dike on the water side
- Shelter Island Marina and Boatyard needs low gradient access across the dike for the Travelifts to haul out or launch boats

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Infrastructure in the dike

Dyke Road

Dike cross-section at the pump station will have to be expanded and modified

Future pump station upgrades need to consider the planned dike upgrades to allow enough room for pumping infrastructure

Social

East Richmond Trail

Connect to existing and planned trails and public amenities

Wayfinding and public information signs

Traffic and road safety

Environmental

Intertidal, Shoreline, and Upland Forest ESAs present in the reach

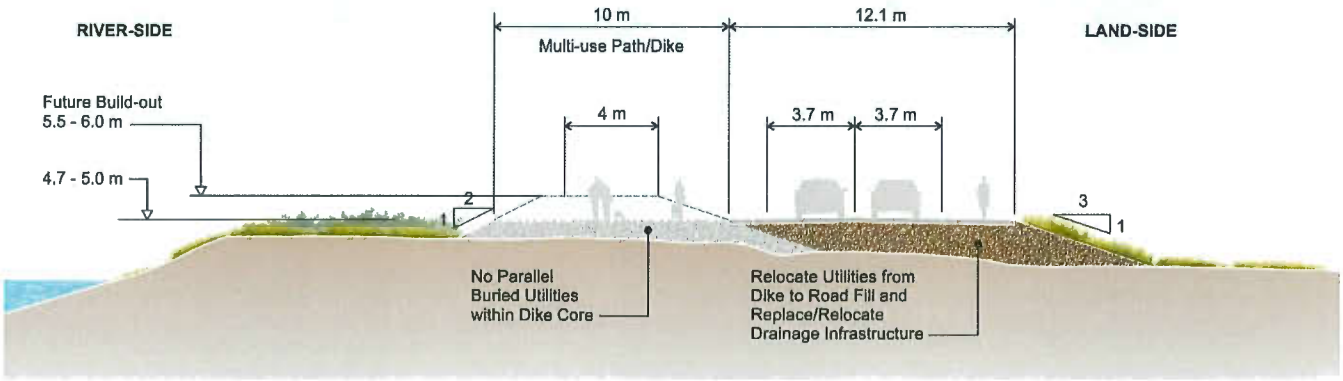
Land-side includes:

- drainage channel adjacent to dike at east and west ends of reach (amphibian habitat)
- low quality habitat paved or maintained lawn in middle of reach

Fraser River-side habitat includes:

- high quality habitat mud flats at middle and east end of reach
- deciduous treed woodland high quality habitat at west end of reach

Reach 12: East Richmond - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Dike side slopes: 2H:1V on waterside (with erosion protection) and 3H:1V on landside

Structure will be over-wide to accommodate future dike raising to 5.5m

Industrial and Infrastructure

Short term phasing:

Combine Dyke Road with the dike to minimize the footprint of the proposed master plan

Long term

Relocate parallel infrastructure in the dike corridor to landside, outside of the dike footprint

Infrastructure crossing the dike will be designed with seepage control

Relocate and reduce the landside drainage channel, while maintaining internal drainage

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

Environmental

Building the dike to the landside, where possible, to minimize impact to aquatic and riparian habitat

The proposed footprint would impact an estimated 2,500 m² of high-quality Fraser River riparian habitat, 3,200 m² of drainage channel aquatic habitat, and 5,500 m² drainage channel riparian habitat*

Relocating the drainage channel further inland and including appropriate plantings to the land side

Mitigation and compensation for disturbance to ESAs may be required

* NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Reach 12: East Richmond - Recommended Improvements

Priority

Medium to low priority due to the many property access conflicts to be resolved. Raise and acquire land over time along with redevelopment to prepare for dike raising and road relocation and raising.

Construction Cost

Costs below are for 1800 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$8.1 Million
Road Structure & Utilities	$3.9 Million
Raise Road to Dike Height	$5.3 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.4 Million
Other*	$3.5 Million
Contingency (40%)	**$8.5 Million**
Total	**$29.7 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

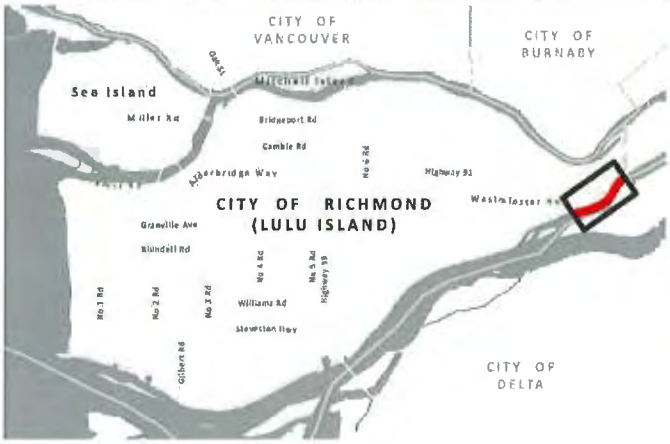
Interim

Item	Cost
Dike Raising	$9.7 Million
Road Structure & Utilities	$7.0 Million
Driveways, Ramps or Road Intersection Reconstruction	$0.4 Million
Other*	$0.5 Million
Contingency (40%)	**$7.1 Million**
Total	**$24.8 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

Reach 13/14: Hamilton/Boundary



Existing Conditions

This reach of the dike is characterized as a dike in the roadway (Fraserwood Way and Dyke Road) with utilities. The land side of the dike is predominantly commercial developments with marinas, businesses and houses with river access over the dike.

There are utilities (a watermain and storm main) within the land side toe of the road as well as local drainage provided by surface channels at the toe of the slope.

The master plan must balance drainage and community needs, road, marina, habitat interests, and trail and park amenities, while still providing room to expand and minimizing utility risks.

Unique Features

- Dike is set back for the final 500 m before the connection with New Westminster
- Newly developed townhouses on the river, outside of the dike (23740 and 23580 Dyke Road)
- FREMP habitat compensation site plantings in front of Townhome complex at 23740 and 23580 Dyke Road
- Commercial development on land side
- Marinas and float homes with river access over the dike on both the land side and river side
- East Richmond Trail and Fraserwood Trail run along the dike crest on or adjacent to the roadway to Boundary Road
- Highway 91 and City of New Westminster dike interface

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial and Infrastructure

Infrastructure in the dike
Fraserwood Way

Social

East Richmond Trail
Fraserwood Trail
Connect to existing and planned trails and public amenities
Wayfinding and public information signs
Traffic and road safety
Finn Slough heritage values

Environmental

Intertidal, Shoreline, and Upland Forest ESAs present in the reach

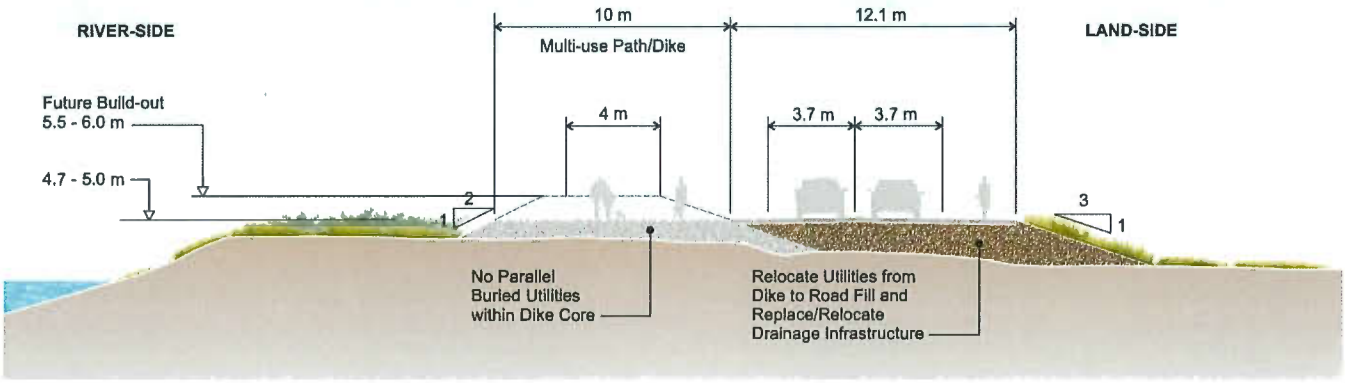
Land-side includes:

- drainage channels at very west end and in middle of reach (amphibian habitat)
- low quality paved or landscaping shrubs at west end of reach habitat
- high quality shrubland habitat at east end of reach

Fraser River-side habitat includes:

- high quality mud flats and marsh at west end of reach
- patches of high quality marsh and riparian deciduous woodland along east end of reach
- small patches of unvegetated low quality habitat along reach

Reach 13/14: Hamilton/Boundary - Recommended Improvements



Master Plan Features

Flood Protection

Maintain existing alignment

Dike crest elevation: 4.7 m, with future buildout to 5.5 m

Dike crest width: 10 m, future buildout to 4 m

Dike side slopes: 2H:1V on waterside (with erosion protection) and 3H:1V on landside

Structure will be over-wide to accommodate future dike raising to 5.5m

Industrial and Infrastructure

Short term phasing:

Combine Fraserwood Way and Dyke Road with the dike to minimize the footprint of the proposed master plan

Long term

Separate the dike from the road

Road to be relocated to the land side of the dike, and the dike crest will be a dedicated dike/multi-use path

Relocate parallel infrastructure in the dike corridor to landside, outside of the dike footprint

Infrastructure crossing the dike will be designed with seepage control

Relocate and reduce the landside drainage channel, while maintaining internal drainage

Social

Align with 2009 Waterfront Strategy

Construct multi-use path separate from road

Link to parks, trails, public amenities, and wayfinding, per perimeter trail concept (Appendix B)

Environmental

Building the dike to the landside, where possible, to minimize impact to aquatic and riparian habitat

The proposed footprint would impact an estimated 4,200 m² of high quality Fraser River riparian habitat, 100 m² of high quality Fraser River intertidal habitat, 1,100 m² of drainage channel aquatic habitat , and 2,400 m² drainage channel riparian habitat*.

Relocating the drainage channel further inland and including appropriate plantings to the land side

Mitigation and compensation for disturbance to ESAs may be required

* NOTE: This is an estimate based on air photo interpretation. Exact numbers will require an aquatic habitat survey and aquatic effects assessment

Reach 13/14: Hamilton/Boundary - Recommended Improvements

Priority

Low priority due to the many property access conflicts to be resolved inside and outside the dike. Raise and acquire land over time along with redevelopment to prepare for dike raising and road relocation and raising.

The proposed secondary dike near Boundary road is a low priority because it provides back-up to the primary defenses. However, it is relatively simple to construct, but requires coordination and agreement with MoTI.

Cost

Costs below are for 1700 m of dike similar to cross-section above.

Item	Cost
Dike Raising	$7.7 Million
Road Structure & Utilities	$6.6 Million
Raise Road to Dike Height	$9.0 Million
Driveways, Ramps or Road Intersection Reconstruction	$1.2 Million
Other*	$0.5 Million
Contingency (40%)	**$10.0 Million**
Total	**$35.0 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Interim

Item	Cost
Dike Raising	$9.2 Million
Road Structure & Utilities	$6.6 Million
Driveways, Ramps or Road Intersection Reconstruction	$1.2 Million
Other*	$0.5 Million
Contingency (40%)	**$7.0 Million**
Total	**$24.5 Million**

*Other – Pathways, Utilities, Furnishings & Bollards

Cost opinions are in 2018 Canadian Dollars.

6. Recommendations

It is recommended that the City adopt the Phase 3 Dike Master Plan as documented in this report, including the main features described below.

- Raise the dike crest to allow for 1 m of sea level rise. West of Nelson Road, the raised dike crest would be 4.7 m (CGVD28). East of Nelson Road, the raised dike crest would increase to 5.0 m at Boundary Road. The plan also allows for longer term upgrading to accommodate a further 1 m of sea level rise (i.e. 2 m of sea level rise).
- Widen the dike on the land side rather than into the Fraser River.
- Move Dyke Road inside the dike to facilitate short-term and long-term dike upgrading. This will require the road to be reconfigured and reconstructed, with some additional need for land tenure. Moving the road will allow removal of utilities within the dike.
- Raise the relocated Dyke Road to the dike crest elevation. This will facilitate driveway access over the dike to riverside properties. It will also be compatible with the desire to raise land inside the dike.Pursue individual industrial site strategies depending on the existing rights and agreements, the urgency of the works, and opportunities for redevelopment for each site. These include:
    - Crown Packaging, 13911 Garden City Road – construct interim improvements to 3.5 m to correct low spot. Raise dike and full site to 4.7m during redevelopment expected in 18 years.
    - Deas Dock, BC Ferries Fleet Maintenance Unit, 12800 Rice Mill Road – seek improvement opportunities with BC Ferries. Raise full site, else raise road behind the site.
    - Canadian Fishing Company, 13140 Rice Mill Road – determine redevelopment opportunities with owner. Plan for interim improvements within limited space including new access from west and sheet pile wall between site and rail ROW.
    - Port of Vancouver Lands – Where rights exist, coordinate improvements with adjacent Port operations. There no rights exist, collaborate with Port to either acquire rights or develop agreement on responsibility to inspect, maintain, and improve dikes and shoreline protection.
    - Lafarge Canada Inc., 7611 No 9 Road – Either raise the dike within the current City property that bisects their site, or negotiate land swap to place and build dike improvements at the riverside. Raise entire site with future redevelopment.
- Replace the drainage channel immediately inside the dike with storm sewers and swales. This will improve dike stability, and will provide some of the land needed to relocate Dyke Road.
- Raise land and roads immediately inside the dike (during redevelopment) to improve seismic resilience. This will also improve liveability by allowing residents to looking down over the water, rather than at the backside of a dike.
- Assess and modify drainage system infrastructure to maintain drainage services for lots before and after land raising.

- Improve pedestrian and cyclist safety by constructing a separate multi-use path along the dike. This would be consistent with the City Parks vision for a perimeter trail system (similar to the perimeter trail network envisioned in Appendix B).
- Construct the south section of a secondary dike near Boundary Road.

It is also recommended that the City prepare a comprehensive implementation plan for dike upgrading that incorporates the elements of the Phase 3 Dike Master Plan, and the elements of the other Dike Master Plans.

To address habitat compensation issues associated with the Dike Master Plans, it is further recommended that the City consider development of a habitat banking program that could provide effective large-scale compensation for the environmental impacts of dike upgrading.

For all phases of the Dike Master Plan, the City should continue to research alternative densification strategies for seismic stability, consider alternative seismic performance criteria, and consider a plan to fill a wide swath of land (several hundred metres) inside the dike. The latter two points (seismic criteria and fill inside the dike) are considerations in the pending update to the Flood Protection Management Strategy.

Report Submission

Prepared by:

KERR WOOD LEIDAL ASSOCIATES LTD.

Feb. 21, 2019
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35409

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Revision History

Revision #	Date	Status	Revision	Author
0	February 21, 2019	FINAL	Issued to client as final	SJL

IQQM CERTIFIED

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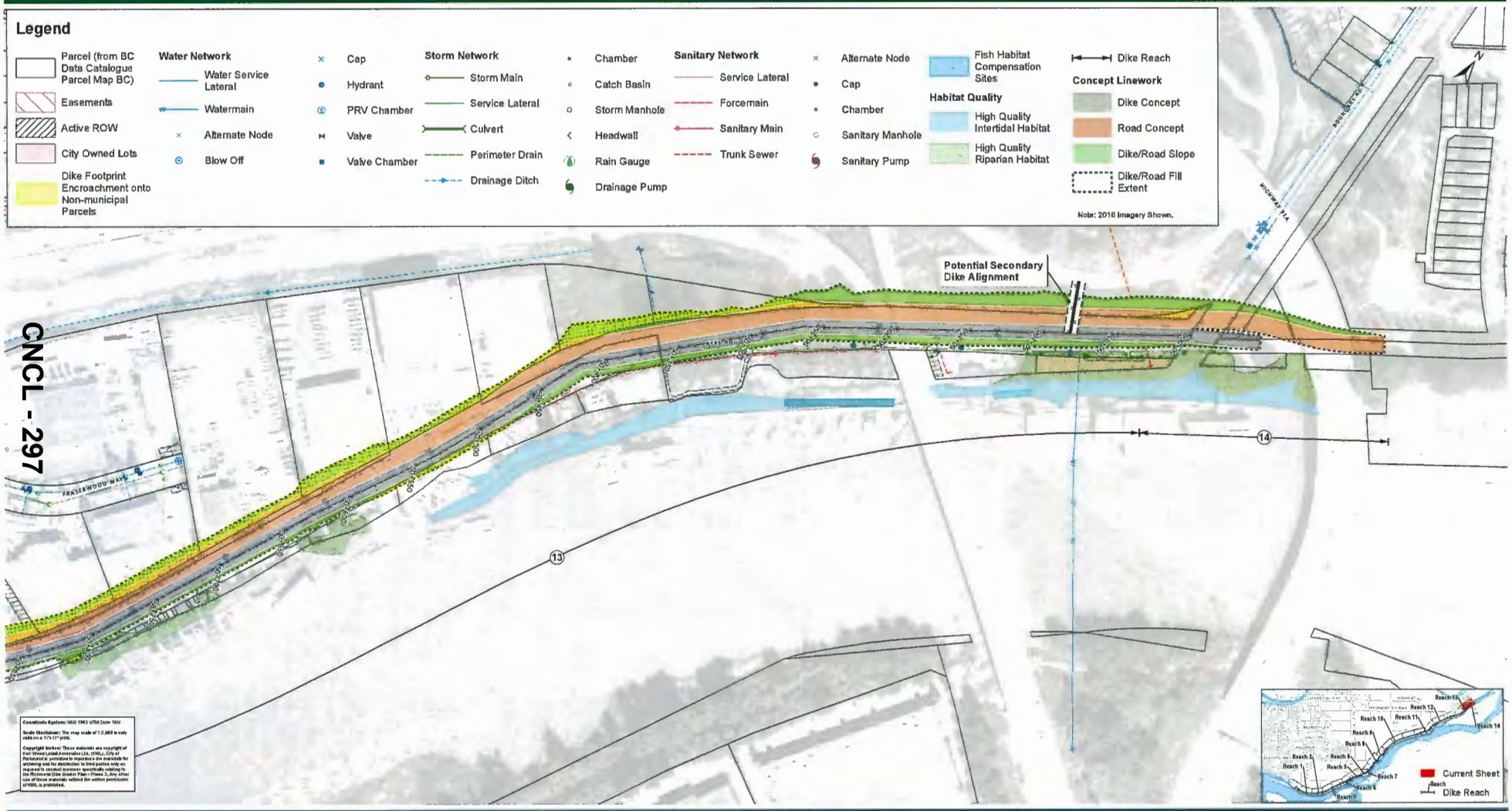
Appendix A

Plans and Sections for Richmond Dike Master Plan – Phase 3

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers



CNCL - 297

Project No. 651.122
Date February 2019
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Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 13 and 14

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City of Richmond
Richmond Dike Master Plan - Phase 3

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Legend

- Parcel (from BC Data Catalogue Parcel Map BC)
- Easements
- Active ROW
- City Owned Lots
- Dike Footprint Encroachment onto Non-municipal Parcels

Water Network
- Water Service Lateral
- Watermain
- Alternate Node
- Blow Off
- Cap
- Hydrant
- PRV Chamber
- Valve
- Valve Chamber

Storm Network
- Storm Main
- Service Lateral
- Culvert
- Perimeter Drain
- Drainage Ditch
- Chamber
- Catch Basin
- Storm Manhole
- Headwall
- Rain Gauge
- Drainage Pump

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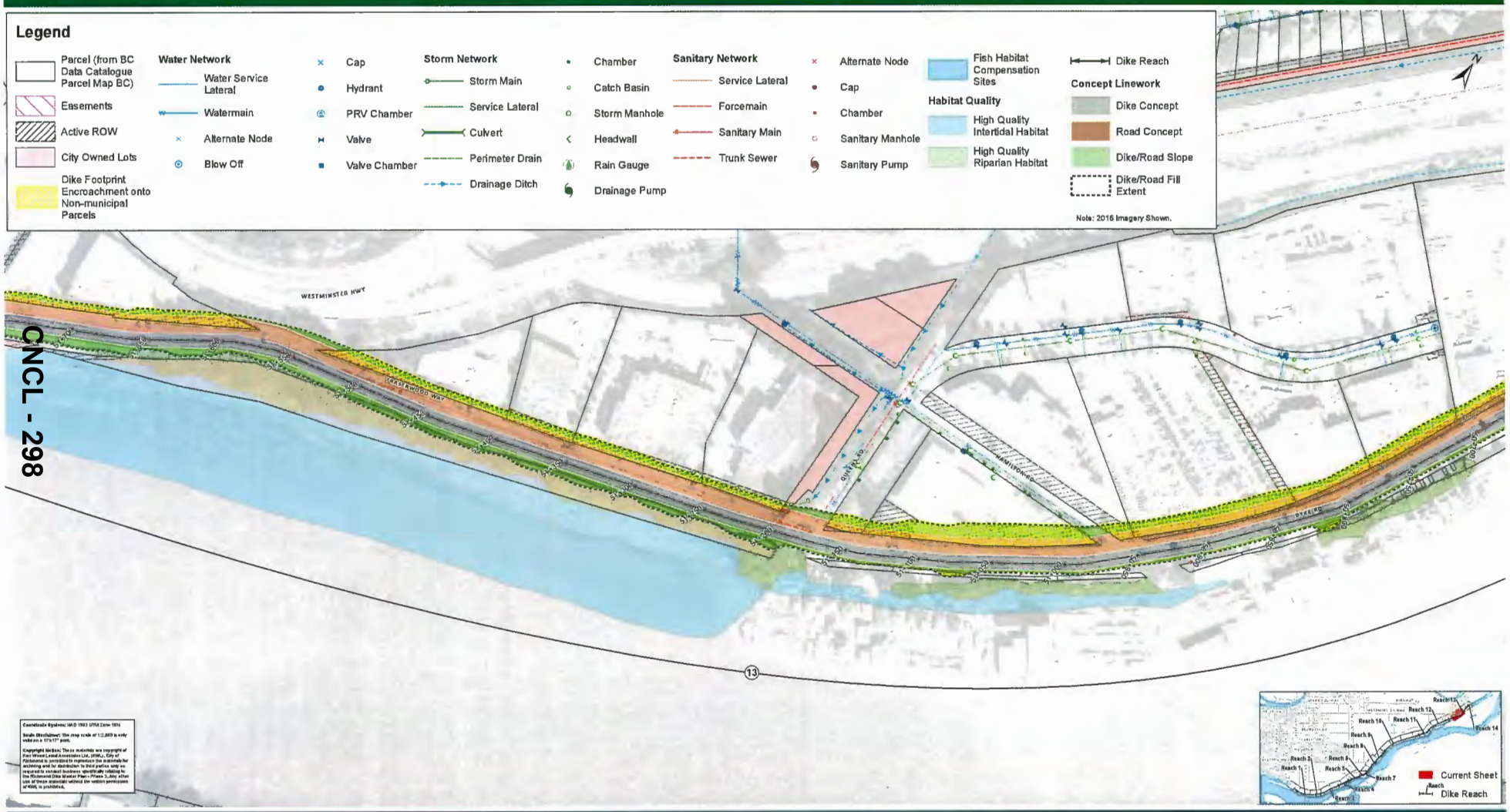
- Fish Habitat Compensation Sites

Habitat Quality
- High Quality Intertidal Habitat
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2016 Imagery Shown.



Coordinate System: NAD 1983 UTM Zone 10N

Scale Disclaimer: The map scale of 1:2,500 is only valid on a 17"x11" print.

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Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 13

City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

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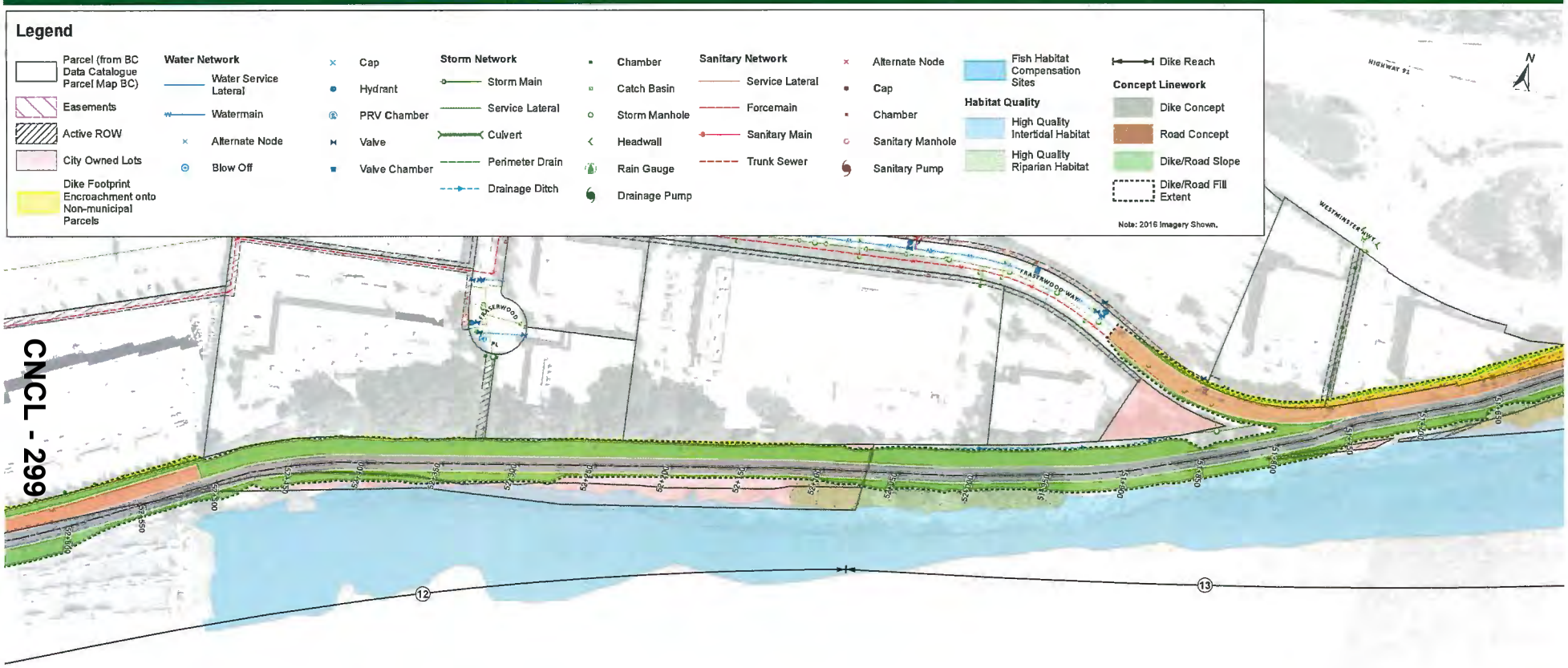
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CNCL - 299

Coordinate System: NAD 1983 UTM Zone 10N
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Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 12 and13

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City of Richmond
Richmond Dike Master Plan - Phase 3

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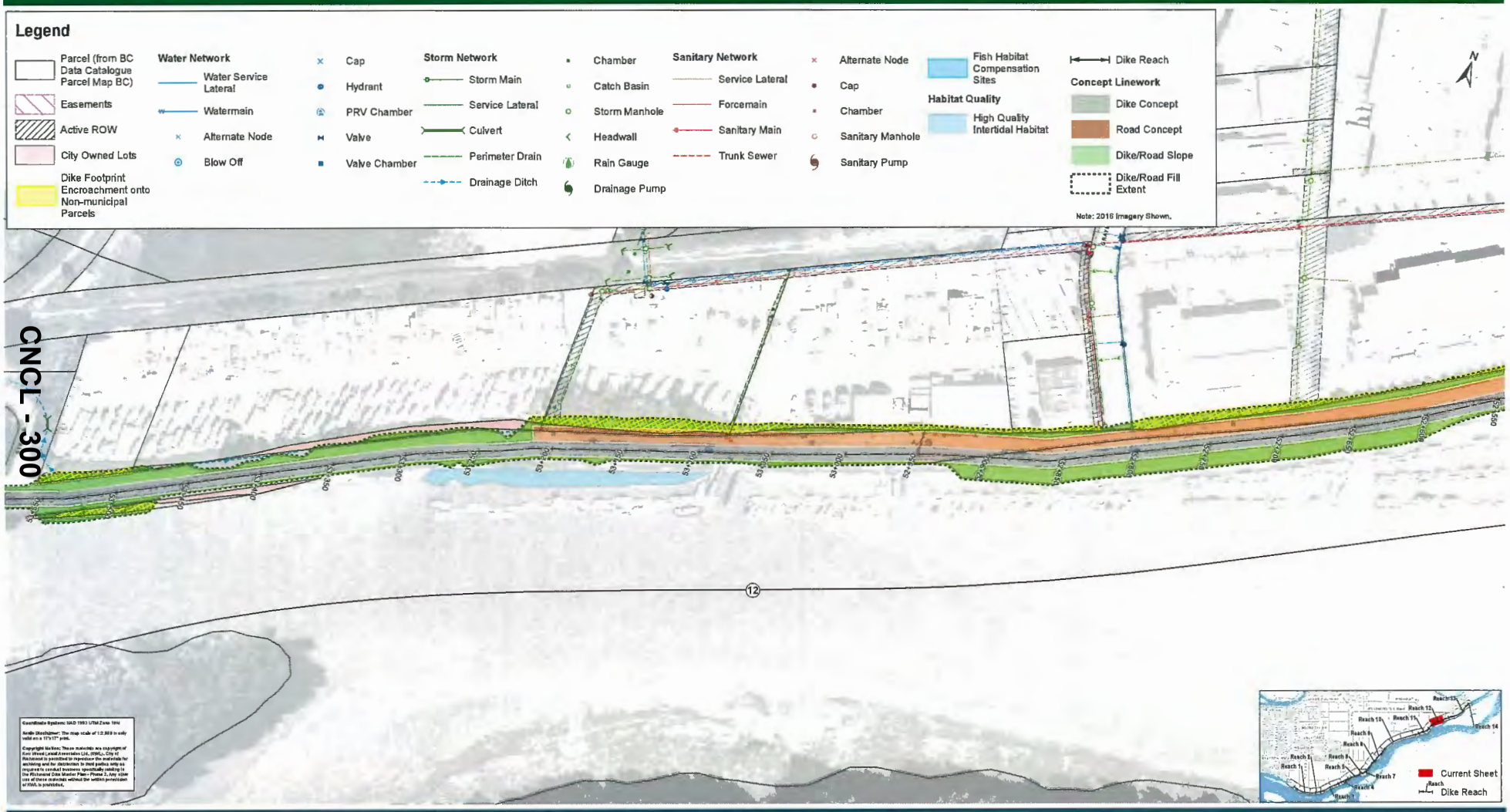
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Note: 2016 Imagery Shown.

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Project No. 651.122
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Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 12

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City of Richmond
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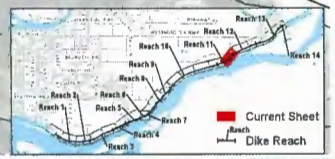
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Note: 2016 Imagery Shown.

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Project No. 651.122
Date February 2019
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Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 11 and 12

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City of Richmond
Richmond Dike Master Plan - Phase 3

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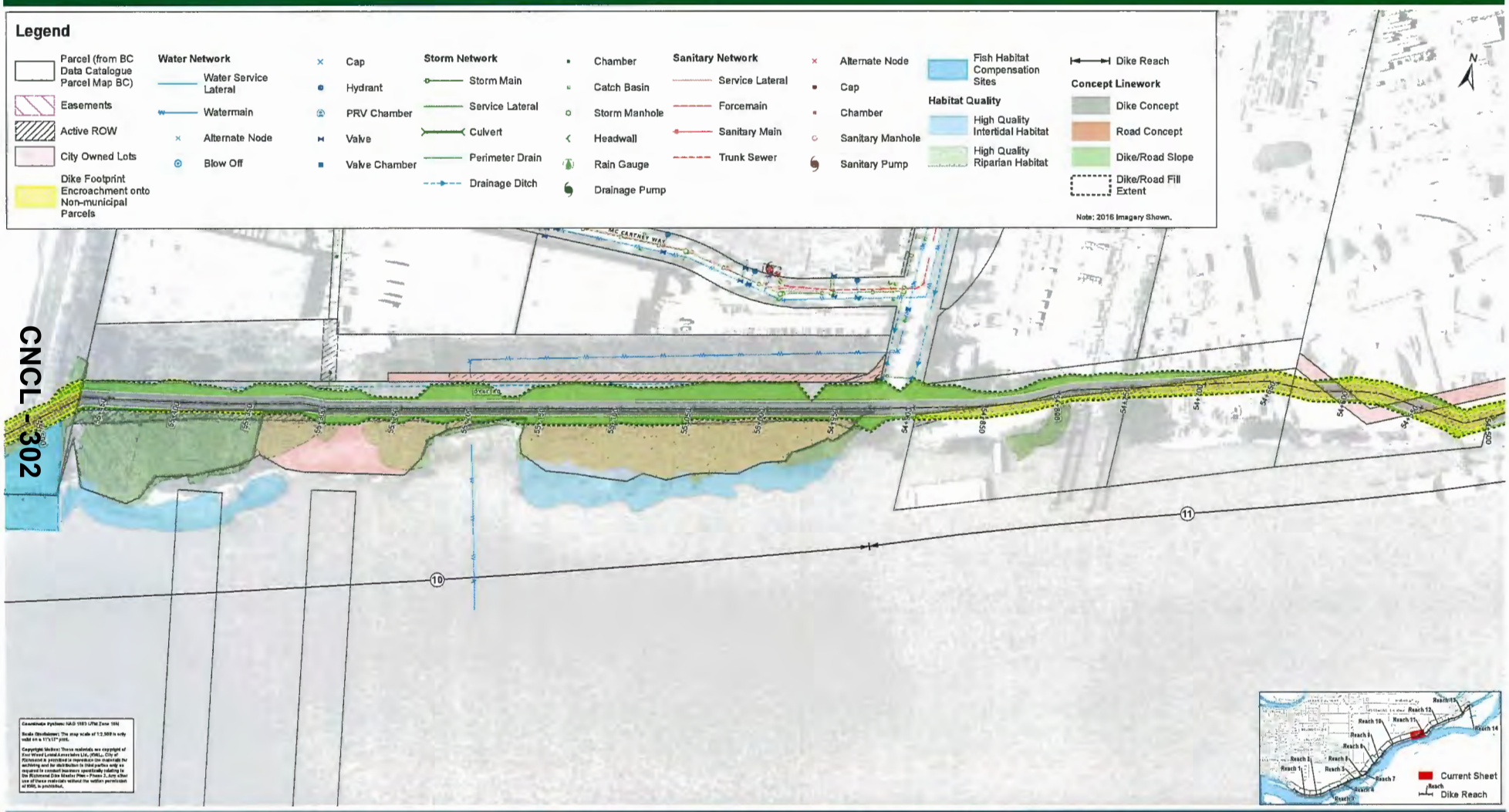
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- Dike/Road Fill Extent

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Project No. 651.122
Date February 2019
Scale 1:2,500

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Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 10 and 11

CNCL - 302

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

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- PRV Chamber
- Valve
- Valve Chamber

Storm Network
- Storm Main
- Service Lateral
- Culvert
- Perimeter Drain
- Drainage Ditch
- Chamber
- Catch Basin
- Storm Manhole
- Headwall
- Rain Gauge
- Drainage Pump

Sanitary Network
- Service Lateral
- Forcemain
- Sanitary Main
- Trunk Sewer
- Alternate Node
- Cap
- Chamber
- Sanitary Manhole
- Sanitary Pump

- Fish Habitat Compensation Sites

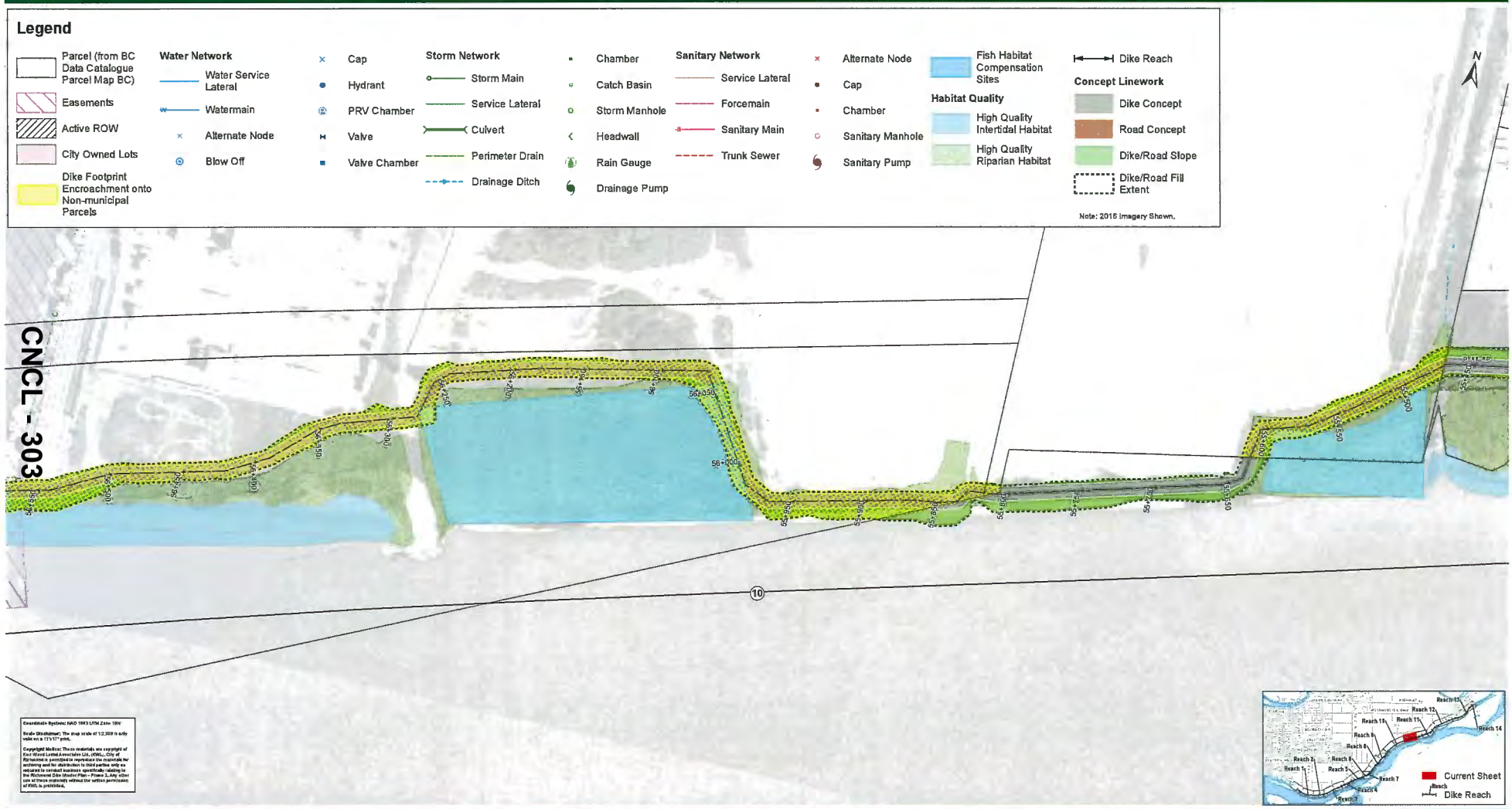
Habitat Quality
- High Quality Intertidal Habitat
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2015 Imagery Shown.

CNCL - 303



Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 10

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

- Parcel (from BC Data Catalogue Parcel Map BC)
- Easements
- Active ROW
- City Owned Lots
- Dike Footprint Encroachment onto Non-municipal Parcels

Water Network
- Water Service Lateral
- Watermain
- Alternate Node
- Blow Off
- Cap
- Hydrant
- PRV Chamber
- Valve
- Valve Chamber

Storm Network
- Storm Main
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- Chamber
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- Sanitary Pump

- Fish Habitat Compensation Sites

Habitat Quality
- High Quality Intertidal Habitat
- High Quality Riparian Habitat

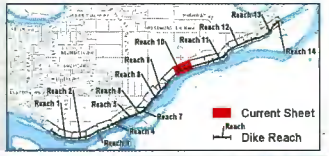
- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2016 Imagery Shown.

CNCL - 304

Coordinate System: NAD 1983 UTM Zone 10N
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Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 10

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

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Sanitary Network
- Service Lateral
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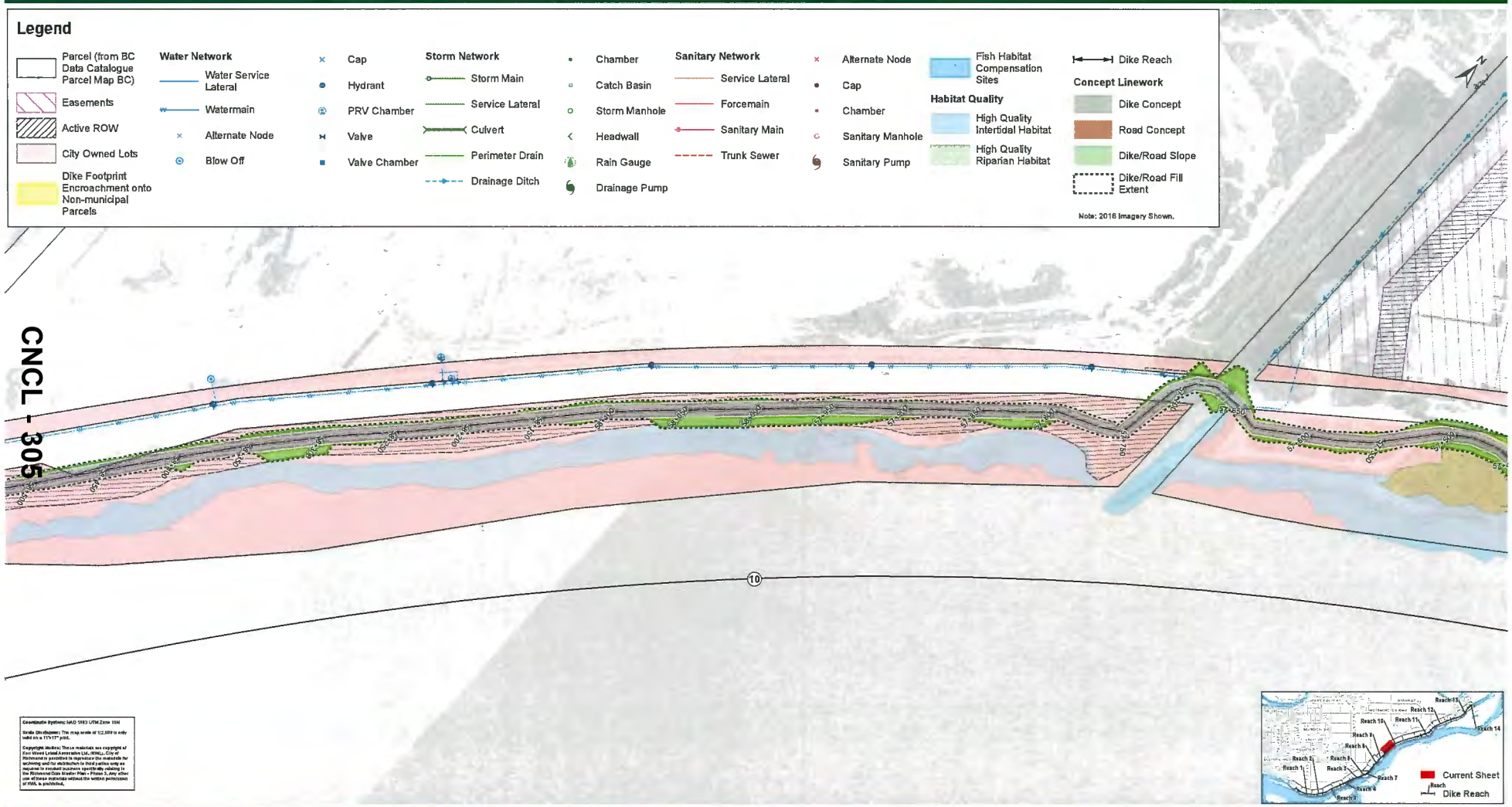
- Fish Habitat Compensation Sites

Habitat Quality
- High Quality Intertidal Habitat
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2016 Imagery Shown.



Coordinate System: NAD 1983 UTM Zone 10N

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Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 10

CNCL - 305

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KERR WOOD LEIDAL consulting engineers

Legend

- Parcel (from BC Data Catalogue Parcel Map BC)
- Easements
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Water Network
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Sanitary Network
- Service Lateral
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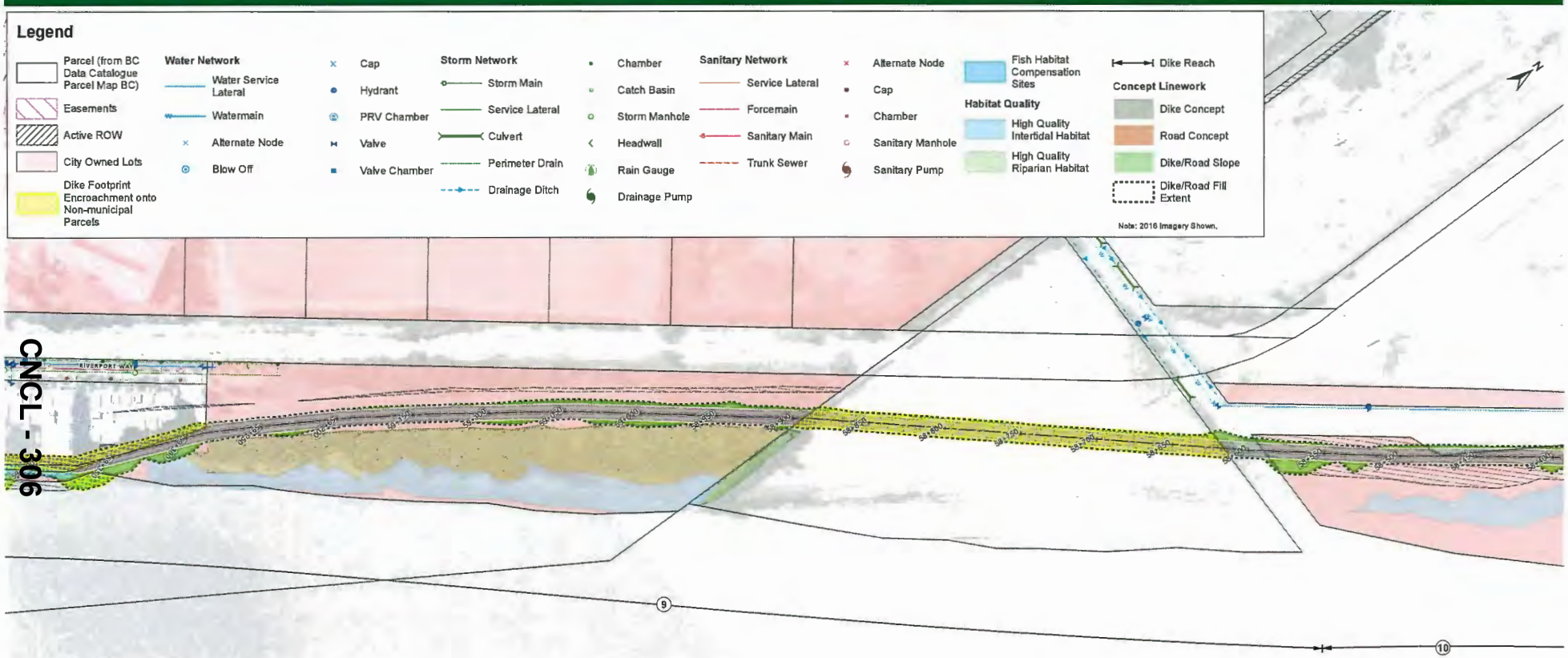
- Fish Habitat Compensation Sites

Habitat Quality
- High Quality Intertidal Habitat
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2016 Imagery Shown.





Coordinate System: NAD 1983 UTM Zone 10N

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Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

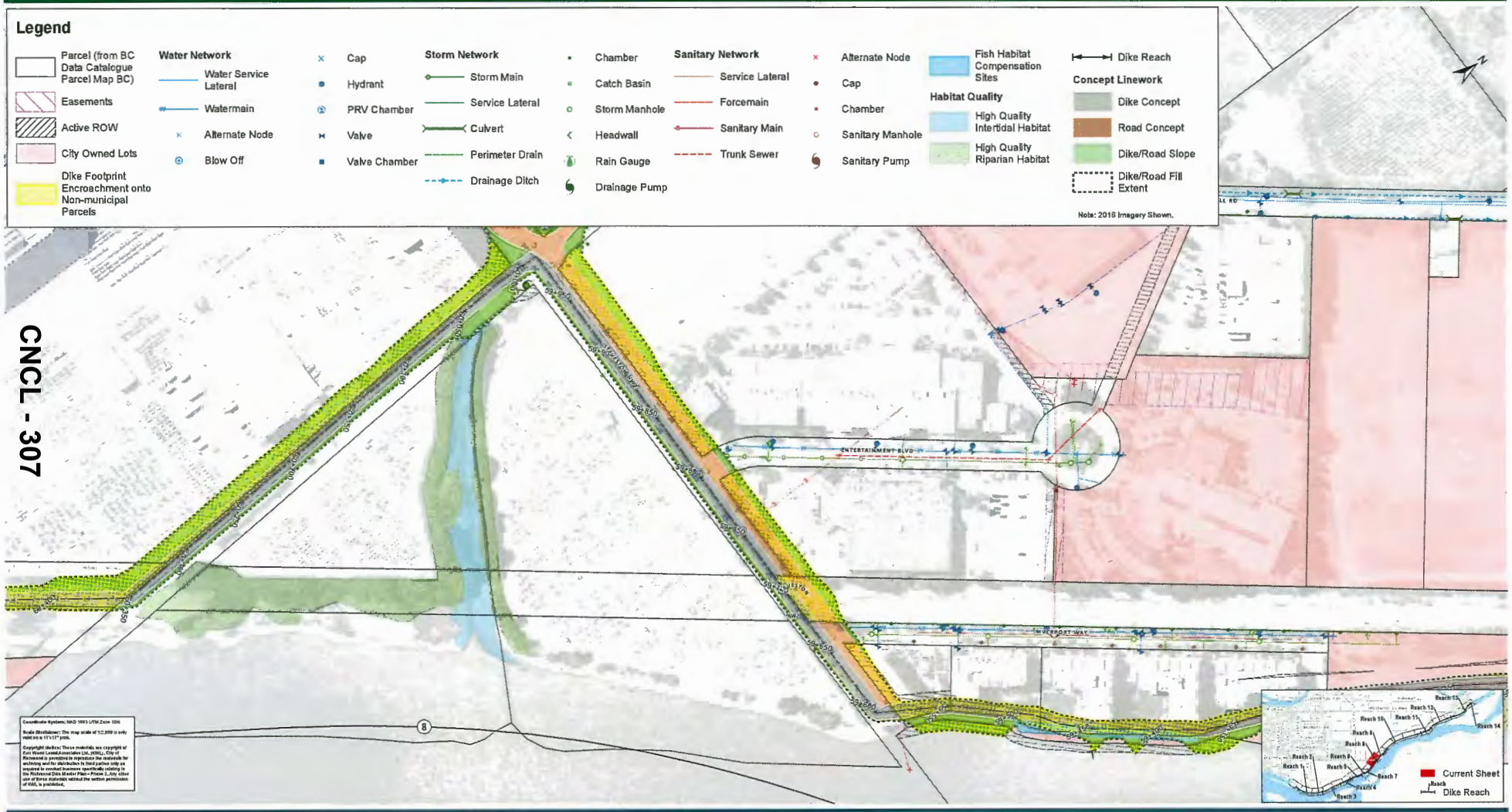
Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 9

CNCL - 306

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers



CNCL - 307

Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 8

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

- Parcel (from BC Data Catalogue Parcel Map BC)
- Easements
- Active ROW
- City Owned Lots
- Dike Footprint Encroachment onto Non-municipal Parcels

Water Network
- Water Service Lateral
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Sanitary Network
- Service Lateral
- Forcemain
- Sanitary Main
- Trunk Sewer
- Alternate Node
- Cap
- Chamber
- Sanitary Manhole
- Sanitary Pump

- Fish Habitat Compensation Sites

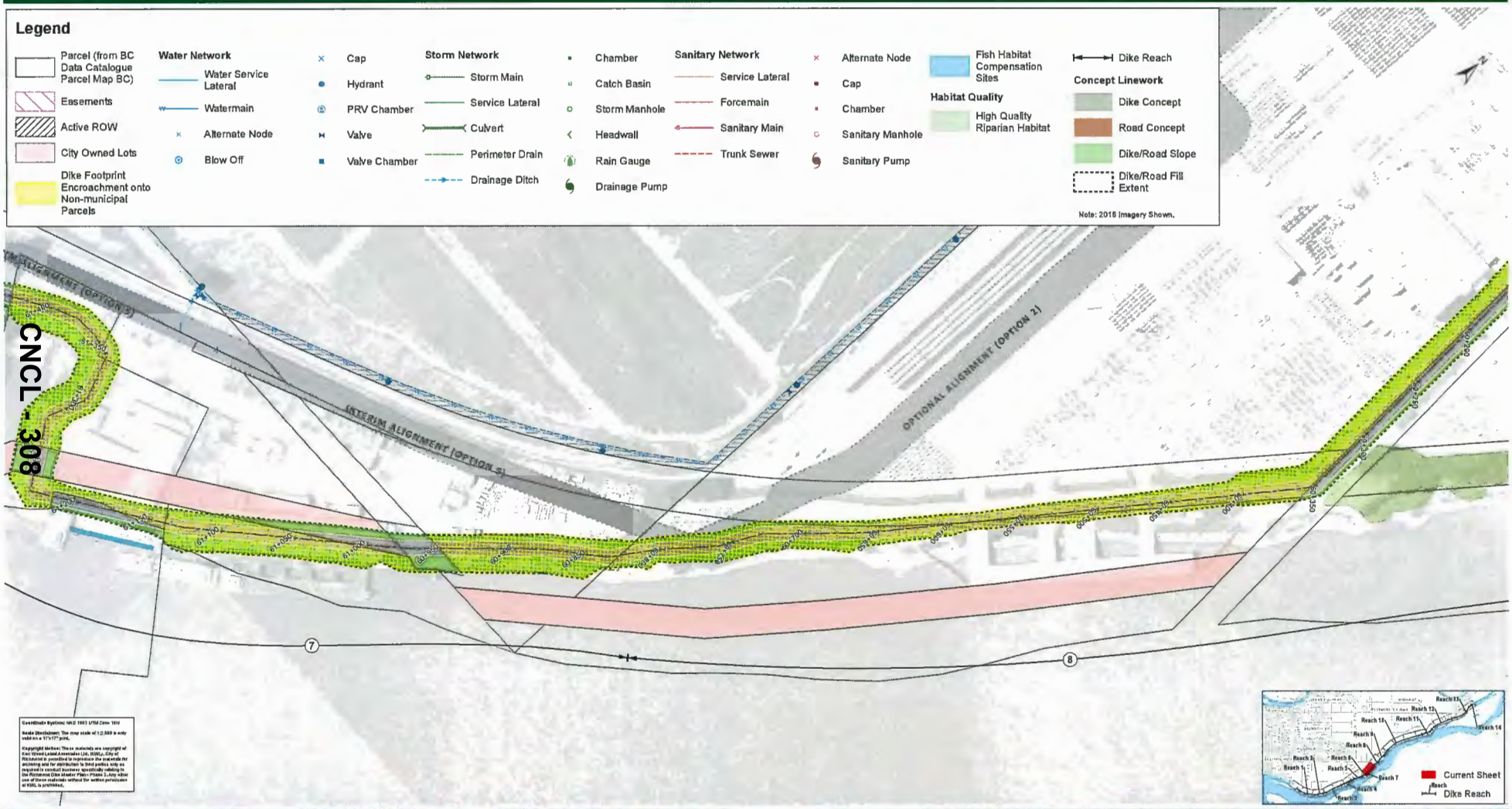
Habitat Quality
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2015 Imagery Shown.

CNCL - 308



Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 7 and 8

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

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- Forcemain
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- Sanitary Pump

- Fish Habitat Compensation Sites

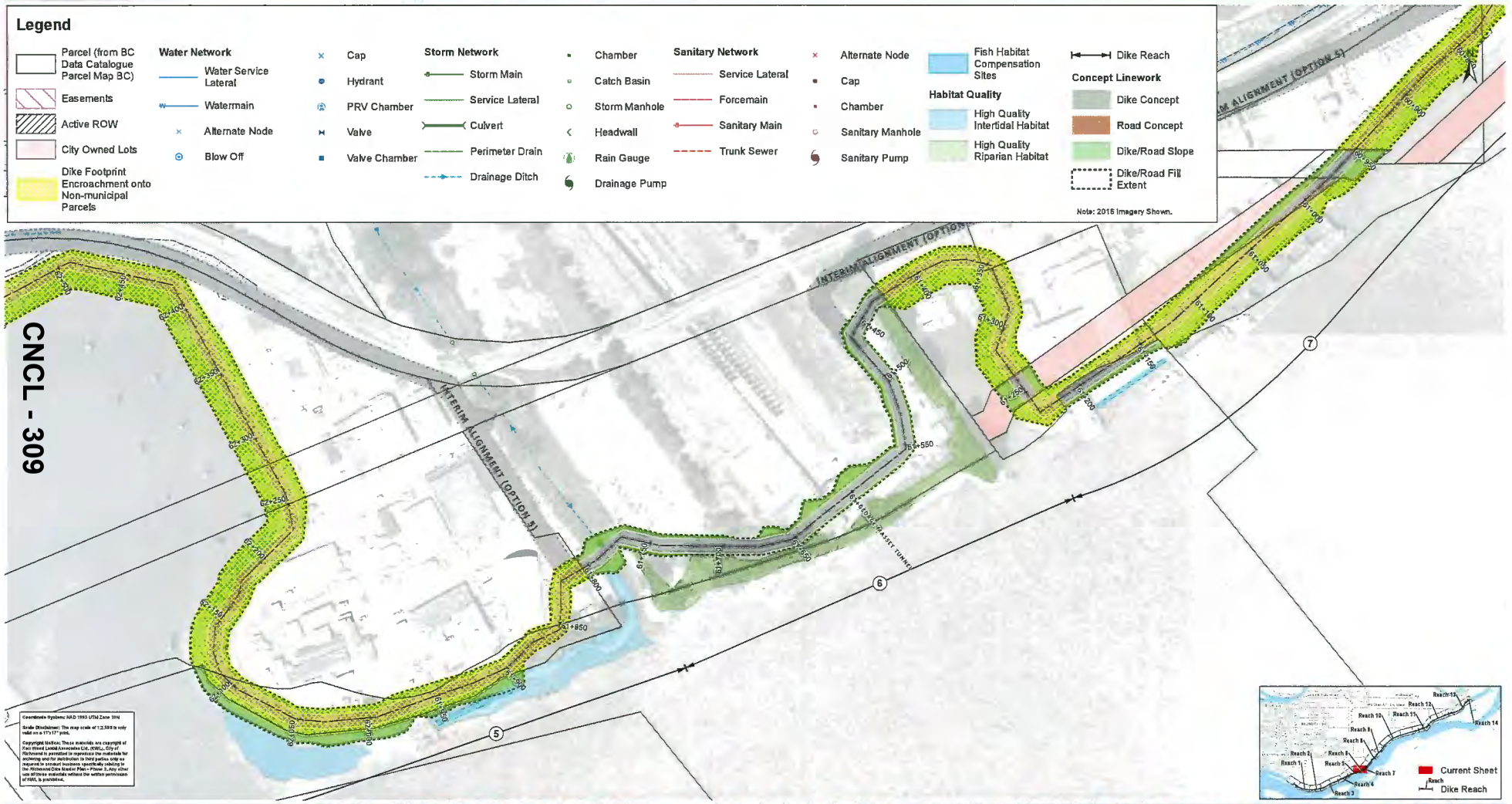
Habitat Quality
- High Quality Intertidal Habitat
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2016 Imagery Shown.

CNCL - 309



Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 5, 6 and 7

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

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Sanitary Network
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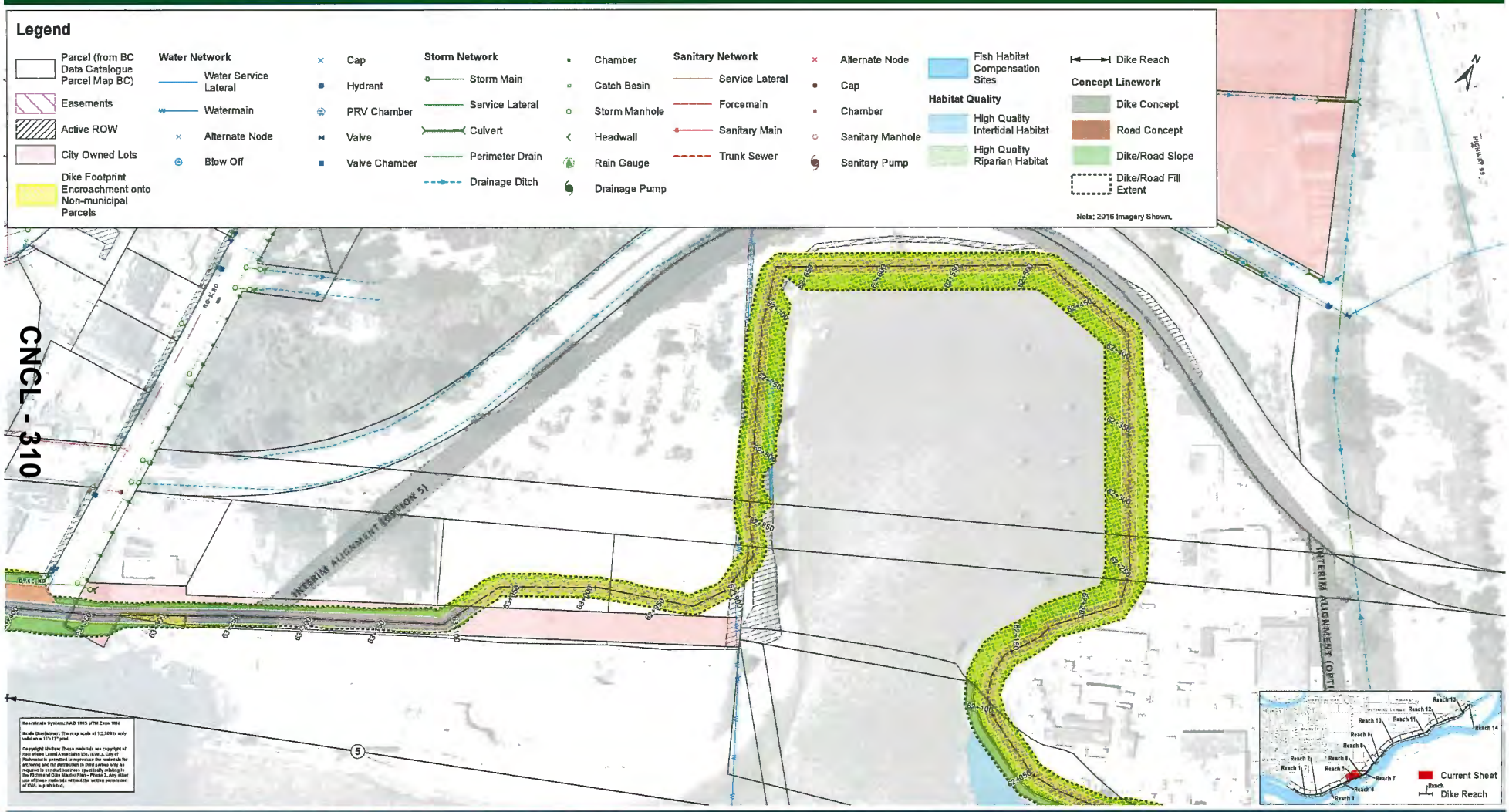
- Fish Habitat Compensation Sites

Habitat Quality
- High Quality Intertidal Habitat
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2016 Imagery Shown.



CNCL - 310

Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 5

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

- Parcel (from BC Data Catalogue Parcel Map BC)
- Easements
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Water Network
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Sanitary Network
- Service Lateral
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- Alternate Node
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- Chamber
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- Sanitary Pump

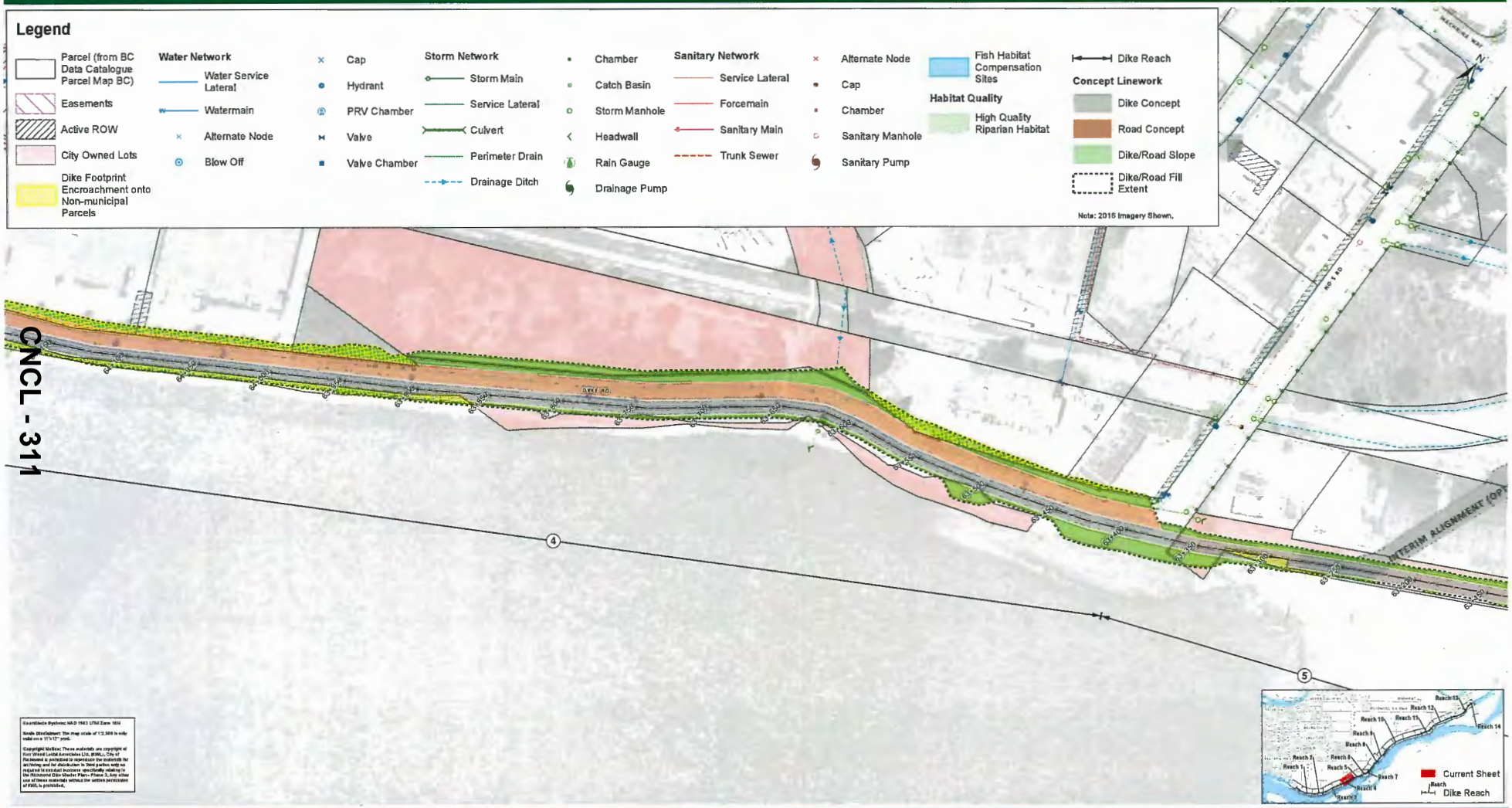
- Fish Habitat Compensation Sites

Habitat Quality
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2015 Imagery Shown.



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Project No. 651.122
Date February 2019
Scale 1:2,500

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Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 4 and 5

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

- Parcel (from BC Data Catalogue Parcel Map BC)
- Easements
- Active ROW
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Sanitary Network
- Service Lateral
- Forcemain
- Sanitary Main
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- Alternate Node
- Cap
- Chamber
- Sanitary Manhole
- Sanitary Pump

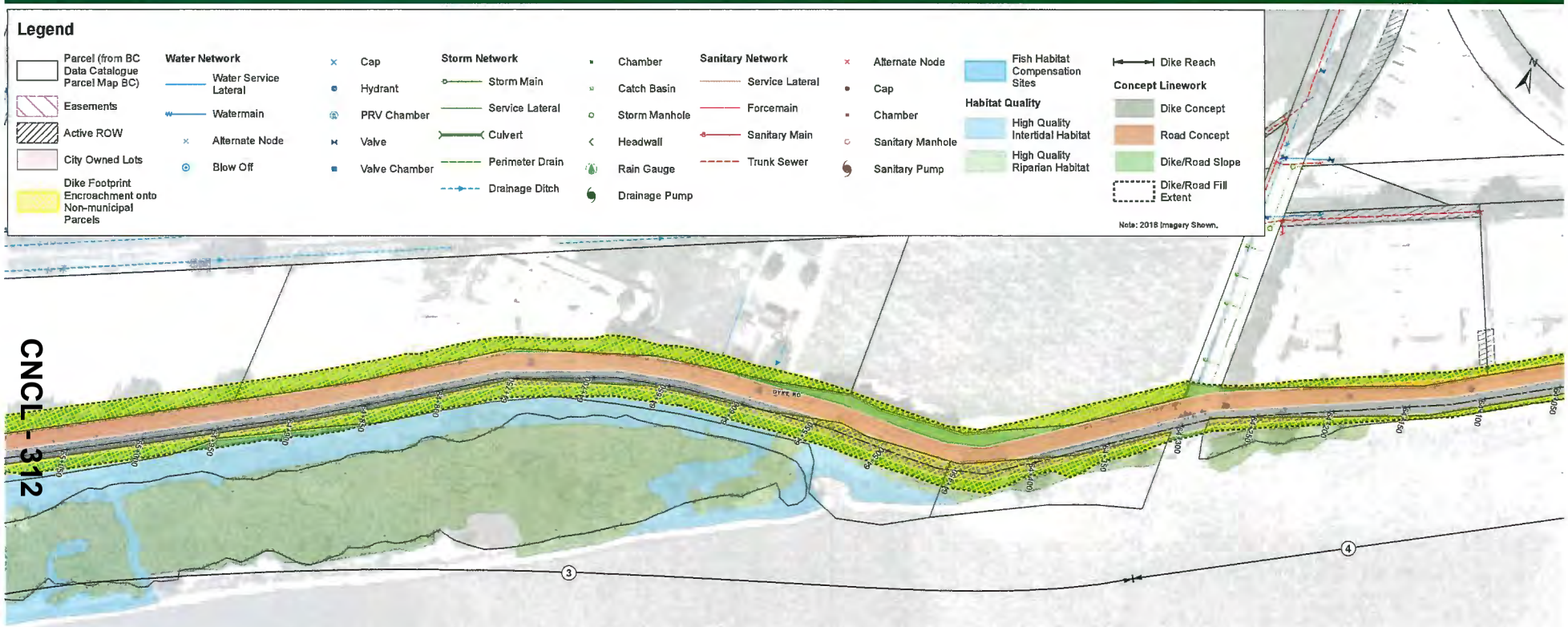
- Fish Habitat Compensation Sites

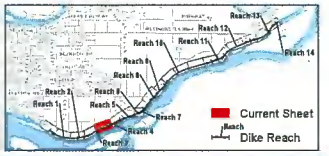
Habitat Quality
- High Quality Intertidal Habitat
- High Quality Riparian Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2018 Imagery Shown.





Coordinate System: NAD 1983 UTM Zone 10N
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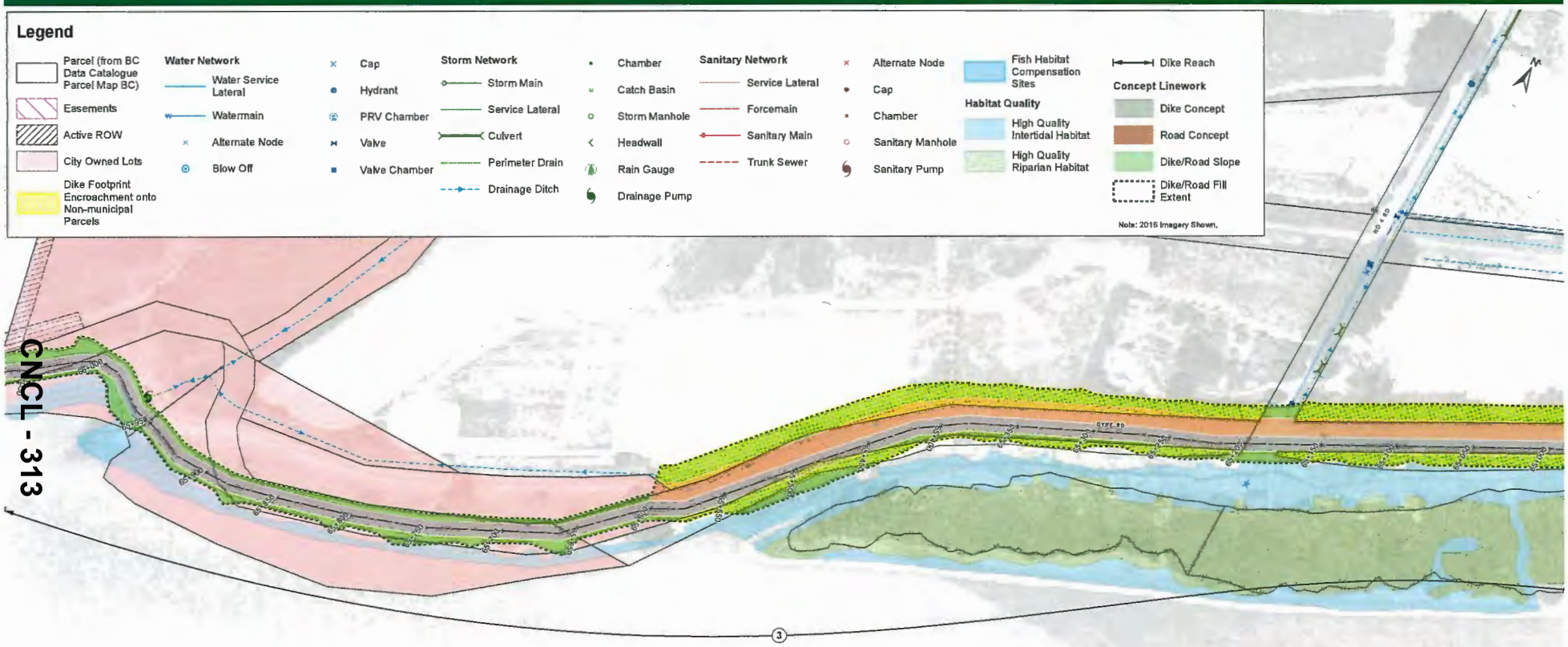
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Project No. 651.122
Date February 2019
Scale 1:2,500

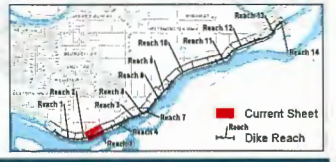
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Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 3 and 4

CNCL - 312



CNCL - 313



Coordinate System: NAD 1983 UTM Zone 10N
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Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 3

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

- Parcel (from BC Data Catalogue Parcel Map BC)
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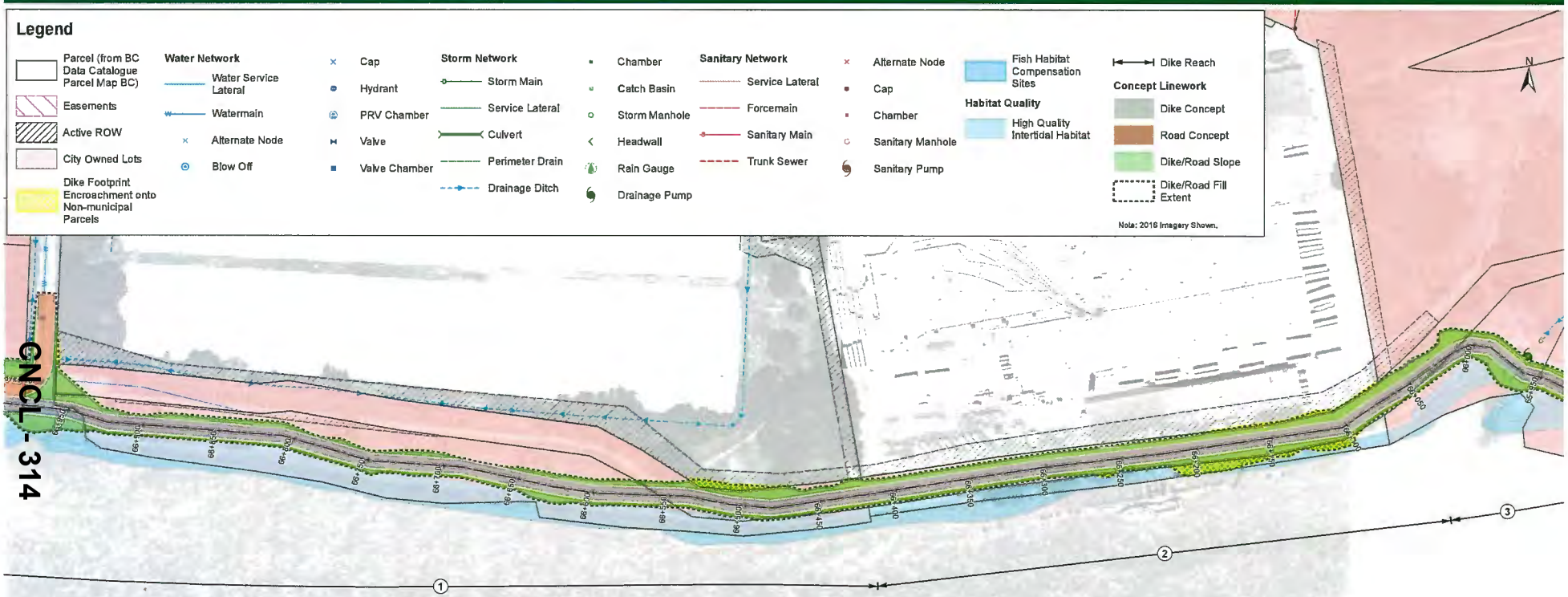
- Fish Habitat Compensation Sites

Habitat Quality
- High Quality Intertidal Habitat

- Dike Reach

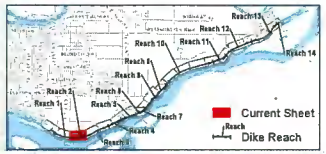
Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2016 Imagery Shown.



CNCL - 314

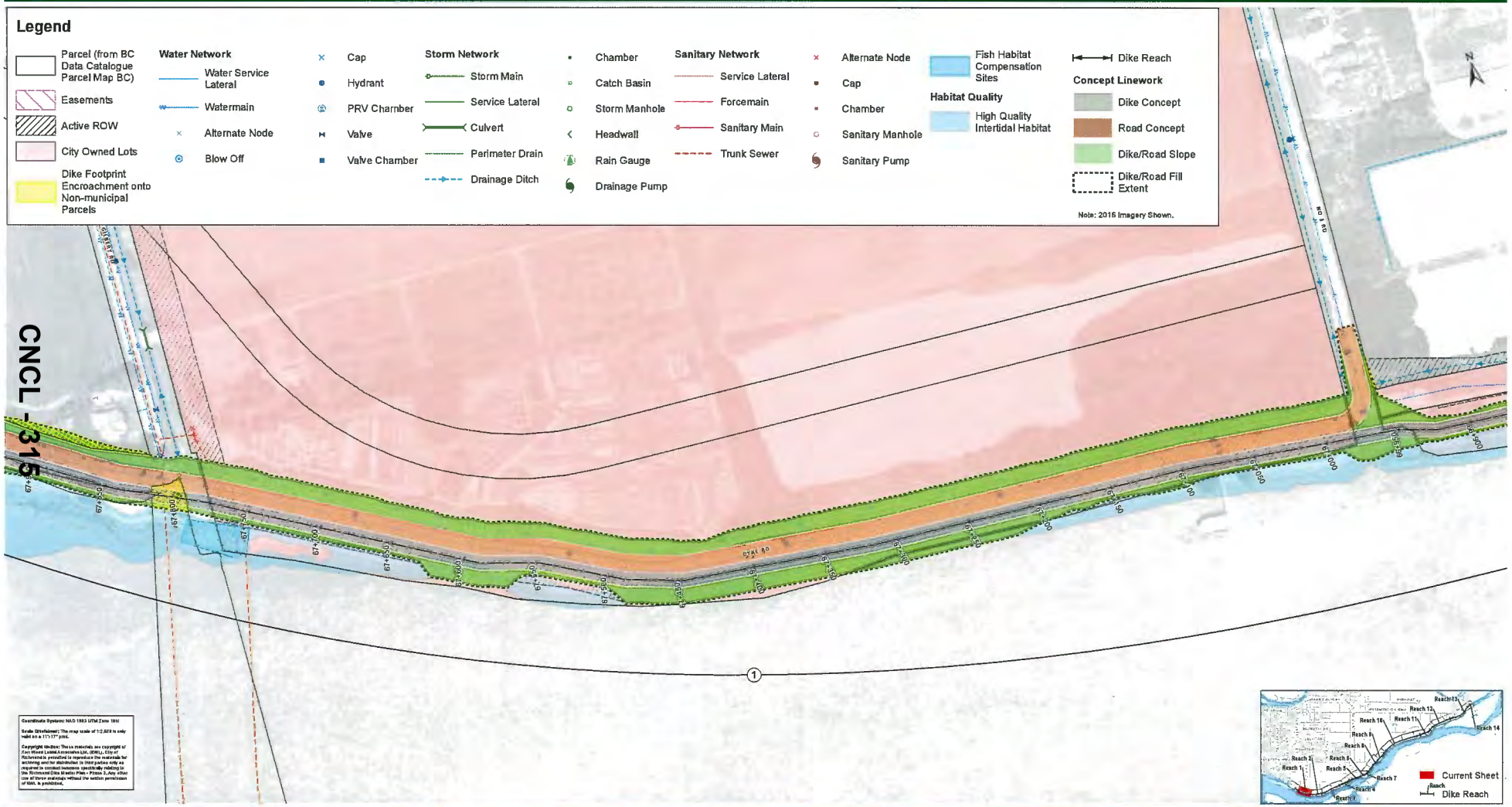
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Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 1 and 2



CNCL - 315

Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 1

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City of Richmond
Richmond Dike Master Plan - Phase 3

KERR WOOD LEIDAL consulting engineers

Legend

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- Trunk Sewer
- Alternate Node
- Cap
- Chamber
- Sanitary Manhole
- Sanitary Pump

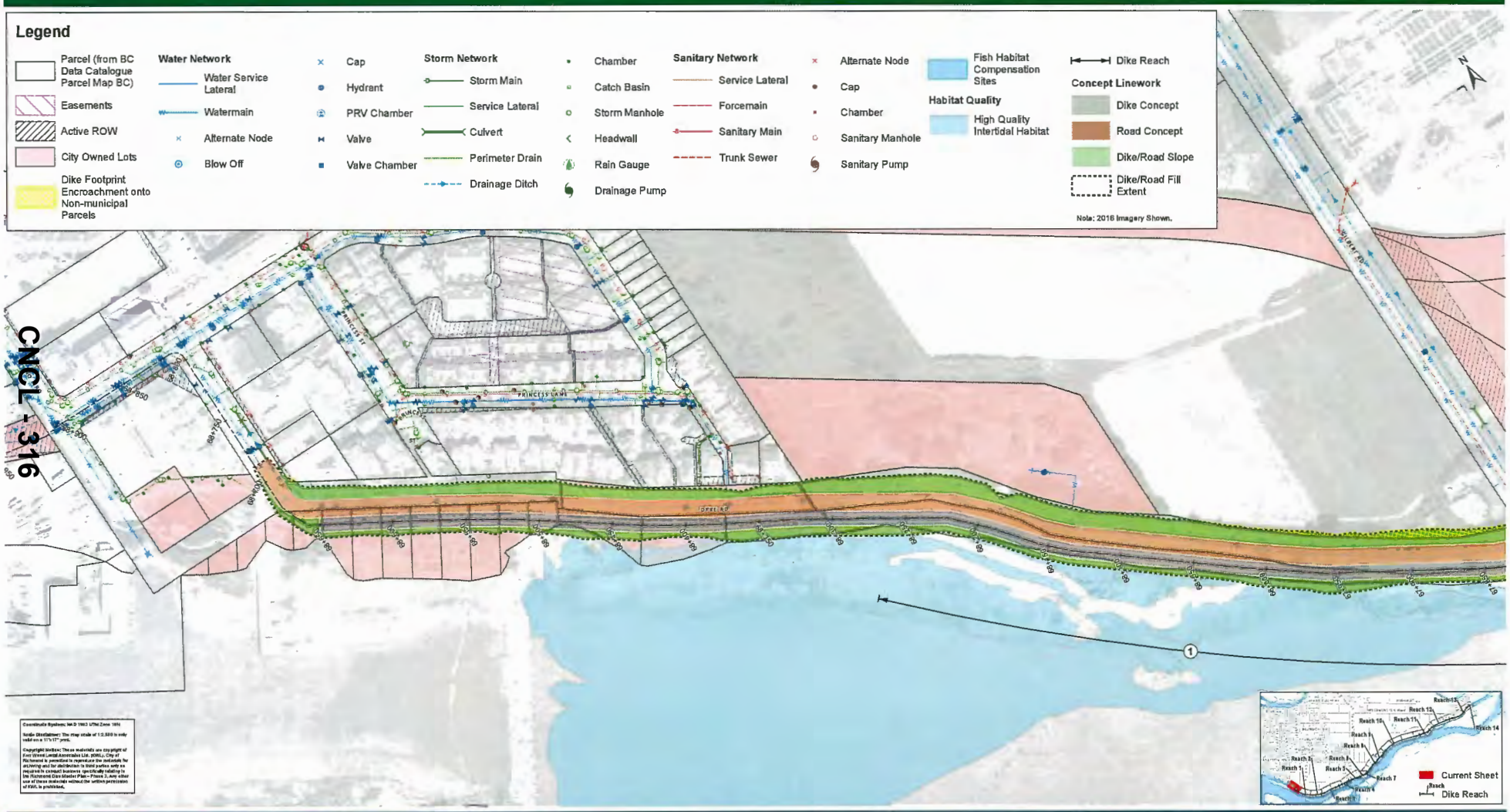
- Fish Habitat Compensation Sites

Habitat Quality
- High Quality Intertidal Habitat

- Dike Reach

Concept Linework
- Dike Concept
- Road Concept
- Dike/Road Slope
- Dike/Road Fill Extent

Note: 2016 Imagery Shown.



Project No. 651.122
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 3 Initial Road/Dike Alignment
Reach 1

20

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Appendix B

Richmond Dike Master Plan - Concept Plan

RICHMOND DIKE MASTER PLAN
CONCEPT PLAN



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Appendix C

Geotechnical Engineering Analysis Report (Thurber)

THURBER ENGINEERING LTD.

October 16, 2018 File: 17991

Kerr Wood Leidal Associates Ltd.
200 4185A Still Creek Drive
Burnaby, BC V5C 6G9

Attention: Colin Kristiansen, P.Eng.

LULU ISLAND DIKE MASTER PLAN - PHASES 3, 4 AND 5
GEOTECHNICAL SEISMIC ASSESSMENT OF FLOOD CONTROL DIKES
PRELIMINARY REPORT

Dear Colin:

As requested, Thurber Engineering Ltd. (Thurber) has carried out numerical seismic deformation analyses for the above project using the software program Plaxis. This report presents the results of the deformation analysis and a preliminary assessment of the performance of flood control measures in the context of provincial design requirements for high-consequence dikes. It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

1. INTRODUCTION

The City of Richmond (the City) requires input to identify dike upgrade options for Phases 3, 4 and 5 of the Lulu Island Dike Master Plan. The purpose of the Dike Master Plan is to address the short, medium and long-term needs of the Lulu Island diking system. Phase 1 of the plan was carried out in 2012 and included input on the Steveston Dike and south section of the West Dike. Phase 2 of the plan included the north section of the West Dike and the North Dike.

Phase 3 comprises about 20 km of the South Dike on the south arm of the Fraser River. Phase 4 includes the North Dike, extending from No. 6 Road to Boundary Rd. Phase 5 includes Mitchell Island, Richmond Island, and the Richmond part of Sea Island (from the southern end of the BCIT campus North to the Moray Rd. Bridge).

These high-consequence dikes are required to consider seismic performance as described in the Ministry of Forests Lands and Natural Resource Operations' (MFLNRO's) 2014 Seismic Design Guidelines for Dikes. (2014 Seismic Guidelines). Additionally, the dikes are anticipated to be raised in the future to address sea level rise.

Accordingly, this report presents the preliminary results of our numerical seismic deformation analyses for eight dike sections: three in each of the Phase 3 and Phase 4 study areas, and two in the Phase 5 study area. The analyses presented below follow the analytical methods described in the 2014 Seismic Guidelines.

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2. SEISMIC ASSESSMENT BASIS

Seismic assessments were carried out for the eight dike sections at the locations in the table below. The assessments for the Phase 3 dike sections were carried out using cone penetration test (CPT) data provided by the City. Geotechnical investigations were carried out specifically for this project at the five sections in the Phase 4 and 5 study areas. The locations of the dike sections were selected by KWL. Profile drawings showing the section analysed at each location were prepared by KWL and are included in Appendix A. Our analyses followed the analytical methods described in the 2014 Seismic Guidelines.

Section	Phase	Test Hole
53+900	3	Tetra Tech CPT17-02
61+900	3	GeoPacific CPT06-03, CPT 06-06
67+600	3	MEG CPT17-03
11+700	4	CPT 18-03
16+400	4	CPT 18-04
18+750	4	CPT 18-05
1+000	5	CPT 18-01
5+700	5	CPT 18-02

The 2014 Seismic Guidelines recommend designing high-consequence dikes and appurtenant structures to control seismic deformations within prescribed limits. The seismic deformation limits vary depending on the seismic hazard return period as shown in the table below.

Seismic hazard return period (year)	Maximum allowable displacement (mm)	
	Horizontal	Vertical
1 in 100	<30	<30
1 in 475	300	150
1 in 2,475	900	500

The analyses used earthquake time-histories that were developed for the George Massey Tunnel replacement project. The earthquake time-histories were scaled for each dike section location using Natural Resources Canada's on-line seismic hazard calculator. The analyses were carried out for the crustal, inslab, and interface (i.e. Cascadia subduction event) scenario earthquakes. Three earthquake time histories for each scenario earthquake were developed for each of the 1 in 100, 475 and 2,475-year return period seismic hazards.

We carried out 1-dimensional site-specific response analyses (SSRAs) using each of the time histories. The SSRAs were carried out using the software program DEEPSOIL published by the University of Illinois. The SSRAs were completed using three crustal, three in-slab and three interface earthquake time-histories for each of the 1 in 100, 475 and 2,475-year return period

seismic hazards, for a total of 27 SSRAs per dike section. The results of the SSRAs were used in both the liquefaction assessment and numerical deformation analysis. The SSRAs used the shear wave velocity data from the CPTs to estimate the site-specific seismic accelerations and seismically induced shear stresses and strains.

The numerical deformation modelling analyses were completed using one crustal, one inslab and one interface earthquake for each of the slope sections analysed. The time history for each scenario earthquake type (i.e. crustal, inslab and interface/subduction) used in the numerical analyses was selected by choosing the earthquake that had the median maximum shear stress profile obtained from the SSRAs. The soil stiffness and damping parameters used in the numerical deformation analyses were calibrated based on the maximum shear strain profile and ground response obtained from the SSRAs.

The seismic assessment included liquefaction analyses and numerical deformation analyses using the results from the SSRAs and the data from the CPTs. The numerical deformation analyses were based on the dike sections provided by KWL.

3. GEOTECHNICAL INVESTIGATION

3.1 Program of work

The field investigation was carried out July 5 and 6, 2018 and comprised a combination of auger drilling and CPT profiling. The CPTs included two seismic CPTs (i.e. SCPTs), which are CPTs with the addition of shear wave velocity profiling. The CPT profiles, test hole logs and a test hole location plans (Drawings 17991-1 to 17991-5) are attached in Appendix B.

The CPTs were advanced to depths of 30 m. Two CPTs (CPT 18-02 to 18-05) were supplemented with shear wave velocity measurements. The CPT provides a continuous trace of cone tip resistance, sleeve friction and pore pressure. This data was used to interpret the soil stratigraphy and estimate soil properties (e.g. strength and density). The SCPT includes shear wave velocity measurements that were used to estimate the small-strain shear modulus of the soil. The small-strain shear modulus has been used in the SSRAs and numerical deformation analyses. The CPTs were drilled out to depths of nominally 7.5 m with a solid stem auger to confirm the soil profile and obtain disturbed samples.

The soil and groundwater conditions in the test holes were logged in the field by an experienced geotechnical engineer and representative disturbed samples were collected for routine moisture content testing and visual classification in our laboratory. Fines content analyses (% passing 75 µm sieve) and Atterberg limit testing were carried out on select representative samples.

All test holes located on the dike and within the dike right-of-way were grouted in general accordance with B.C. groundwater protection regulations and MFLNRO requirements.

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3.2 Results

The results of the investigation and laboratory testing are summarized on the attached test hole and CPT logs. The logs provide a complete, detailed description of the conditions encountered and should be used in preference to the generalized descriptions given below. The soil descriptions provided on the CPT logs are Gregg Drilling and Testing Canada's interpretations of the CPT data using generally accepted correlations and should be considered approximate.

At TH/CPTs 18-04 and 18-05, which are at the east end of Lulu Island, the conditions encountered comprised a thick silt layer at the surface underlain by Fraser River sand. The silt layer was about 17 m to 20 m thick and comprised clayey organic silt to sandy silt. The underlying Fraser River Sand was encountered to the maximum depth investigated (30 m).

At TH/CPTs 18-01, 18-02 and 18-03 the subsurface conditions comprised a silt crust that varied from about 4 m to 7 m thick. Below the crust, Fraser River sand was encountered to depths of about 23 m to 24 m. Silt was encountered below this to the maximum depth investigated.

The interpretation of the CPT data provided by the City for the three Phase 3 dike sections indicates the subsurface conditions at these locations are similar to the conditions encountered at TH/CPTs 18-01, 18-02 and 18-03. We expect that conditions in this phase typically comprise a 2 m to 7 m thick clay first overlaying Fraser River sand to depths of about 20 m to 25 m.

The results of the investigation were consistent with the British Columbia Geological Survey's Map 2010-2 "Quaternary Geology of Richmond, British Columbia", which is attached for reference. This map indicates that surficial geology of most of Lulu Island comprises a silt crust at the surface that is typically 2 m to 7 m thick, underlain by Fraser River sand extending to depths of about 25 m. The map shows that the surficial geology on the east end of Lulu Island comprises organic silts and peat up to 12 m thick underlain by Fraser River Sand.

Groundwater levels are anticipated to generally follow water levels in the Fraser River and can be expected to vary with rainfall, drainage and infiltration.

4. SEISMIC PERFORMANCE

4.1 Liquefaction Assessment

Liquefaction assessments using empirical methods were carried out to assess the degree of liquefaction under each of the seismic hazard return periods for each earthquake scenario type and to provide estimates of reconsolidation settlement. These liquefaction assessments were also used to compare the liquefaction predicted using empirical methods against the liquefaction predicted from the 1D numerical models.

Liquefaction assessments were carried out for flat ground (i.e. 1D) conditions for each of the three design earthquake levels using the software program CLiq published by Geologismiki.

These assessments followed the methods described by Idriss and Boulanger (2008 and 2014) to evaluate the resistance to liquefaction (i.e. the cyclic resistance ratio (CRR)). The shear stress triggering liquefaction (i.e. the cyclic stress ratio (CSR)) was calculated by averaging the maximum stress ratio profiles for each scenario earthquake (e.g. the CSR for the 1 in 100-year crustal earthquake was calculated using the average of the maximum stress ratio profiles from the three crustal time-histories).

The results of the liquefaction triggering analyses are presented on the plots generated by CLiq in Appendix C. These plots show layers where liquefaction is anticipated (i.e. where the CSR is greater than the CRR, or the factor of safety is less than one against liquefaction) and also provide estimates of post-liquefaction reconsolidation settlement.

The liquefaction triggering assessment shows that liquefaction is anticipated to be insignificant under all of the scenario earthquakes for the 1 in 100-year return period seismic hazard. This corresponds to "No liquefaction (L0)" per the 2014 Seismic Guidelines. The assessment also indicates that the sand encountered is generally liquefiable under all of the scenario earthquakes for the 1 in 475 and 2,475-year return period seismic hazards. We have inferred that the extent of liquefaction of the sand layers under the 1 in 475-year return period earthquakes is "Mild liquefaction (L1)" to "Moderate liquefaction (L2). The extent of liquefaction under the 1 in 2,475-year return period seismic hazards is inferred be "High liquefaction (L3)".

The reconsolidation settlements under the 1 in 475 and 2475-year return period seismic hazards are anticipated to be typically between about 400 mm to 1000 mm. The exception to this is at the sections at the east end of Lulu Island where a thick layer of surficial silt was encountered. At these locations, reconsolidation settlements are anticipated to be about 50 to 400 mm under the 1 in 475 and 2475-year return period seismic hazards. For the 1 in 100-year return period seismic hazard, reconsolidation settlements are anticipated to be less than 100 mm at all of the dike sections analysed for all earthquake scenario types. The reconsolidation settlements typically nominally meet or exceed the performance requirements of the 2014 Seismic Guidelines.

For reference we have attached the British Columbia Geological Survey's Map 2010-3 "Liquefaction Hazard Map of Richmond, British Columbia" which shows a qualitative assessment of the liquefaction risk. The results of our liquefaction assessment are consistent with the information shown on the map.

4.2 Numerical Deformation Analysis

We carried out seismic numerical deformation analyses using the software program Plaxis 2D. Plaxis 2D is an advanced finite element modelling program that allows for complex modelling of cyclic soil behaviour, similar to the software program FLAC, but with a user-friendly interface that allows for more rapid model construction and a faster computation routine. The deformation analyses incorporated complex cyclic soil behaviour using the UBCSand soil model, which is the same model used in FLAC for similar numerical deformation analysis.

The numerical deformation analysis used the site-specific earthquake acceleration time histories output from the SSRAs. The numerical deformation analyses were carried out for the 1 in 100, 475 and 2,475-year return period seismic hazards for each of the earthquake scenario types.

One time-history was run for each of the scenario earthquakes for each return period seismic hazard. The time histories were selected by taking the scenario earthquake time-histories that had the median CSRs for each scenario earthquake type.

In keeping with the intent of the concept that the dikes must perform under a uniform hazard framework consistent with the NRC's probabilistic seismic hazard assessment, we have taken the performance under each earthquake return period as the largest displacements of the scenario earthquakes. The largest displacements for all of the sections analysed was the crustal scenario earthquake for the 1 in 100-year return period seismic hazards. For the 1 in 475 and 2,475-year return period seismic hazards, the subduction scenario earthquake resulted in the largest displacements for all of the dike sections.

The output from the Plaxis analyses provided in Appendix D presents the results from the earthquake scenario type that had the largest seismic displacements. The output includes plots of vertical and horizontal displacements for comparison with the performance requirements of the 2014 Seismic Guidelines. We have also included plots showing total displacement as this provides a clearer interpretation of the pattern of displacements.

The numerical deformation analyses indicate that the dikes will not meet the performance requirements of the 2014 Seismic Guidelines for any of the return period seismic hazards. The analyses indicate that typically the required dike setback will be about 50 m to 100 m. The actual setback will depend on the dike height and configuration and site-specific conditions.

5. DISCUSSION

We understand that the intent of the 2014 Seismic Guidelines is for construction of conventional dikes using alignments or reasonable design features to meet the required seismic performance criteria. However, extensive ground improvement is not necessarily required if the seismic performance criteria are not met. The 2014 Seismic Guidelines acknowledge that ground improvement methods are "costly and may only be practical for short sections or at appurtenant structures", such as pump stations or flood gates. Accordingly, if cost-prohibitive ground improvement is the only way to conform to the guidelines, alternatives should be considered.

The 2014 Seismic Guidelines suggest alternatives such as: 1) realigning dikes to less seismically vulnerable areas, 2) overbuilding dikes to accommodate seismic displacements, 3) building very wide "superdikes", and 4) developing comprehensive flood risk and flood protection strategies, including post-earthquake dike repair plans.

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The analysis indicates that ground improvement or other remedial measures will be required to meet the performance requirements of the 2014 Seismic Guidelines for dikes near riverbanks.. The critical location for ground improvement is under the waterside toes/slopes of the dikes, where the shear stress bias is the highest. In some situations, such as where the dikes are high, ground improvement may also be required under the landside toes/slopes of the dikes. Sufficient deformation control could probably be achieved using ground improvement with an aspect ratio of between 0.75H:1V and 1H:1V extending to the bottom of the deepest liquefiable layer (i.e. in profile view, the width of the ground improvement should be 75% to 100% of the depth of liquefaction).

It is our opinion that ground improvement using stone columns is probably the most suitable ground improvement method for the contemplated dike upgrade. Stone columns typically cost about $\$15/m^3$ on a treated volume basis. Compaction piles, soil mixing and jet grouting are other alternatives to increase the strength of the sand to limit liquefaction. These alternatives typically cost more and could be more difficult to adapt to changing or unexpected subsurface conditions than stone columns.

Compaction piles would also probably need to be straight (i.e. without taper) displacement piles. Although timber piles are commonly used as compaction piles, because they are tapered they may not be able to densify the soil at depth. Accordingly, they are not recommended. Compaction piles comprising precast concrete or steel pipe piles are expected to cost about 20 times stone columns on a volume basis.

Soil mixing methods include deep soil mixing (DSM) and cutter soil mixing (CSM). These methods are typically about five times the cost of stone columns per treated soil volume. Jet grouting also costs more, at about seven times the cost of stone columns.

As a potential alternative to ground improvement, the dikes could be set back from the river bank. Based on the results of the Plaxis deformation analyses, the required distance could be in the order of 50 m to 100 m. Setback dikes could either require flat slopes or some ground improvement to mitigate seismic deformations (i.e. lateral spreading of the dike embankment).

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6. CLOSURE

We trust that this letter provides sufficient information for your needs at this time. Should you require clarification of any item or additional information, please do not hesitate to contact us.

Yours truly,

Thurber Engineering Ltd.
David Regehr, P.Eng.
Review Principal



Steven Coulter, P.Eng.
Project Engineer

Attachments

- Statement of Limitations and Conditions (1 page)
- Appendix A – KWL Dike Sections (9 pages)
- Appendix B – Geotechnical Investigation (15 pages)
- Appendix C – Liquefaction assessment CLiq output (72 pages)
- Appendix D – Numerical deformation analyses Plaxis output (72 pages)
- British Columbia Geological Survey Map 2010-2 "Quaternary Geology of Richmond, British Columbia"
- British Columbia Geological Survey Map 2010-3 "Liquefaction Hazard Map of Richmond, British Columbia"

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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.

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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.

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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.

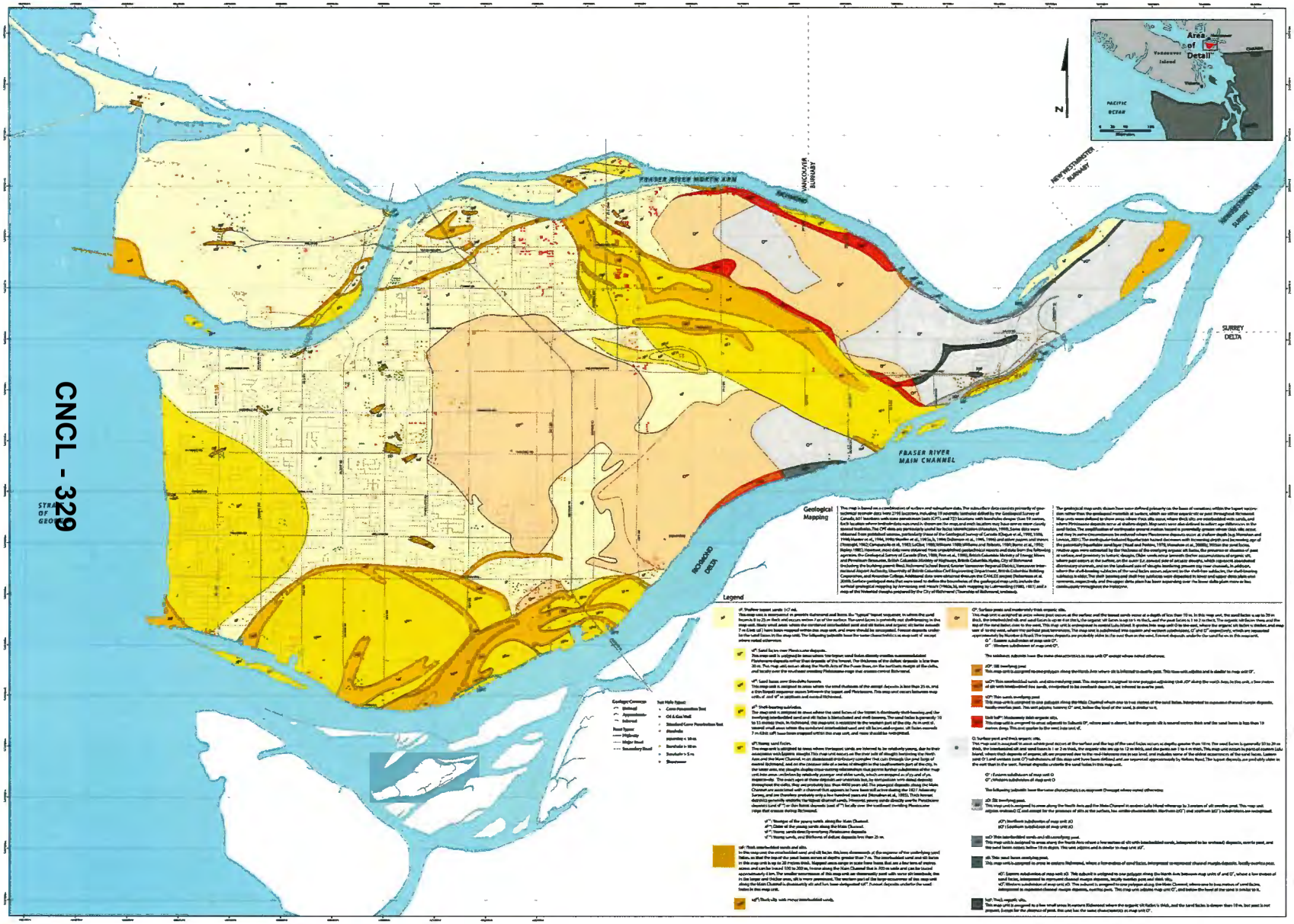
d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted 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.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



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Ministry of Energy, Mines and Petroleum Resources

British Columbia Geological Survey

Geoscience Map 2010-2

QUATERNARY GEOLOGY OF RICHMOND, BRITISH COLUMBIA

parts of NTS 092G/01 and 092G/02

Patrick A. Monahan, Victor M. Levson and Sue Kerr

This map shows geological variation in the Quaternary deposits underlying the City of Richmond, British Columbia, and has been prepared as part of an earthquake hazard mapping project in the city. Richmond is located in one of the most seismically active regions in Canada (Rogers, 1998), and the deltaic sediments on which the city is built can amplify ground motions and are susceptible to earthquake induced liquefaction (e.g. Byrne, 1978; Finn et al., 1989; Byrne and Anderson, 1991; Clague et al., 1992, 1997, 1998a; Watts et al., 1992; Rogers et al., 1998; Harris et al., 1995, 1998; Cassidy et al., 1997; Cassidy and Rogers, 1999; Levson and Monahan, 2004). Because the variation in earthquake hazards is most affected by geological conditions in the upper 20 to 30 metres, this map primarily reflects geological variation in the upper 20 to 30 metres of the Quaternary sequence.

Quaternary Geology Framework

Richmond is located entirely within the Fraser River delta, which is the largest delta in western Canada. The deltaic deposits consistently thicken to the west and overlie Late Pleistocene glaciomarine sediments (Clague et al., 1982, 1991, 1998a; Luternauer et al., 1989). The thickness of the deltaic deposits underlying Richmond varies from less than 20 metres locally along the North Arm of the Fraser River to a maximum known thickness of 255 m at Richmond City Hall (Luternauer et al., 1989). Deltaic deposits are generally more than 50 m at Queensborough (more than 1 km from the delta margin), and the northern Delta is located immediately north of the Fraser River in the southernmost parts of Vancouver and Burnaby. However, a buried ridge of Pleistocene sediments, above which deltaic deposits are locally less than 20 metres thick, extends southward across the city from the western edge of Mitchell Island, only 4 km inland on the North Arm of the River.

Monahan et al. (1997, 2000a), Clague et al. (1998a), and Monahan (1999) provide descriptions of the stratigraphy of the delta. The deltaic section can be subdivided into topset, foreset, and bottomset units. Topset deposits were deposited on the delta plain in near-channel, tidal flat and floodplain environments, and consist of sand, silt and locally peat. The topset forms the uppermost 20 to 25 metres of the deltaic sequence, so that this map primarily reflects geological conditions in this topset which are discussed in more detail below. Foreset deposits underlie the topset sequence and were deposited on the delta slope beyond the river mouth. They are up to 165 metres thick, consist of sands, and silt interbedded on a variety of scales, and are characterized by steeply dipping beds that are commonly 10 over the top of the foreset. The bottom equivalents of the foreset are commonly being deposited on the delta slope offshore of Sand Heads. Bottomset deposits were deposited beyond the delta slope and consist of mainly clayey silt. They occur only in deeper deltaic sections, where they are up to 120 metres thick. Foreset and bottomset deposits underlying the delta generally consist of silts and other sediments that have been overridden by glaciers and are overconsolidated. However, in the deeper deltaic sections, a few metres of normally overconsolidated Late Pleistocene glaciomarine clay and silt occur between the deltaic sediments and underlying Pleistocene deposits.

Fraser Delta Topset Deposits

In Richmond, the topset deposits rise from 20 metres in eastern Lulu Island, near the apex of the delta, to 20 metres or less at the old Sydney Hotel, western Lulu Island (Clague et al., 1982, 1998a; Williams and Roberts, 1989; Monahan et al., 1997; Monahan, 1999). The westerly thinning of the topset is the result of a relative sea level rise of 11 metres during the Holocene, most of which occurred between 8000 and 4000 years B.P (Clague et al., 1982; Williams and Roberts, 1989, 1992). The topset forms an overall fining-upward sequence that grades up from a lower sand facies, through an interbedded sand and silt facies, to an upper organic silt facies. The latter is locally overlain by peat.

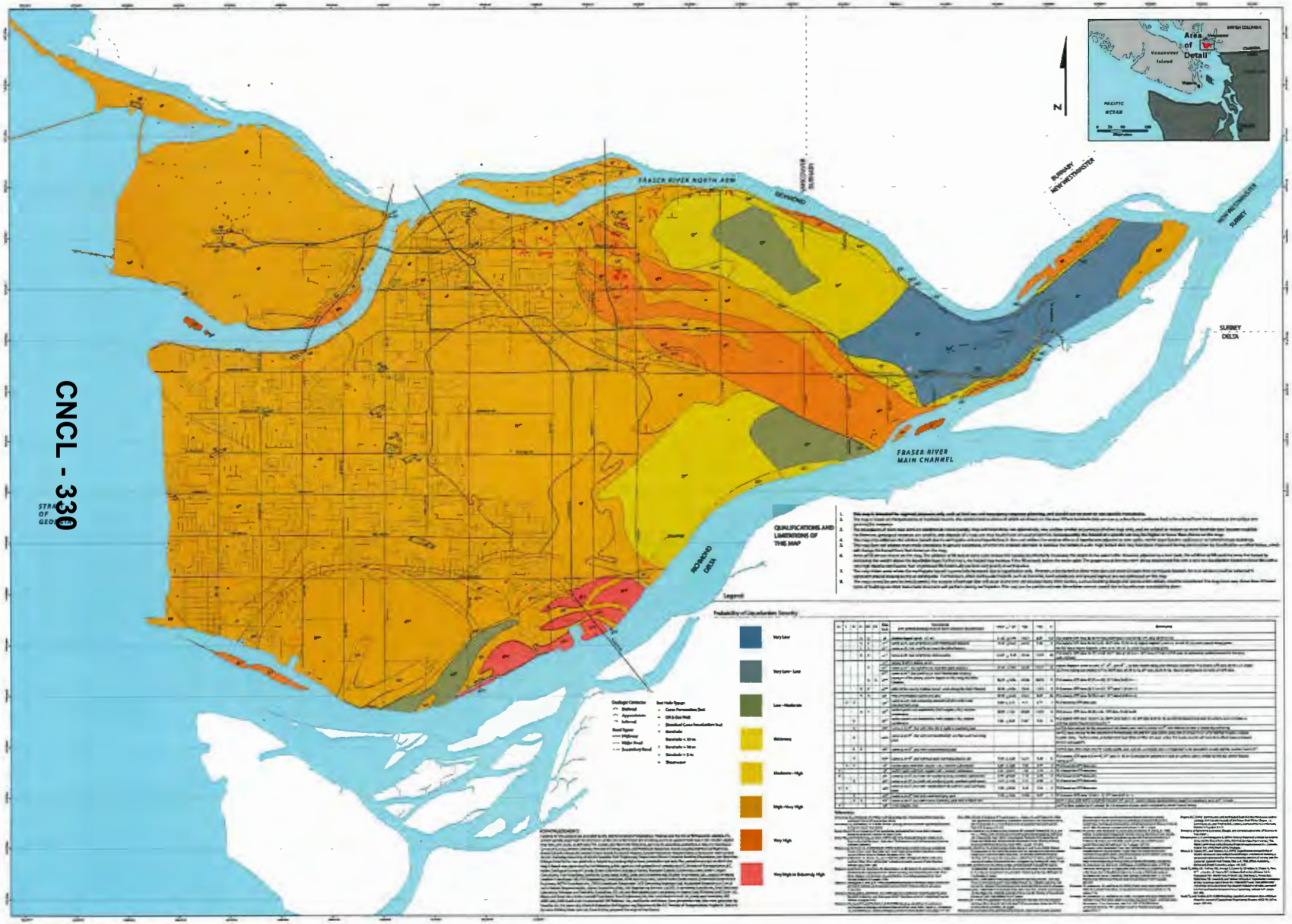
The topset is dominated by the lower sand facies, where it is generally 8 to 10 metres thick. It has an erosional base with several metres of local relief, and is commonly organized into one or more coarsening-upward sequences. It has been interpreted to represent a complex of distributary channel deposits (Monahan et al., 1993, 1998, 1997; Hunter et al., 1998; Monahan, 1999).

The sediments of the sand facies exist in Richmond and with the overlying interbedded sand and silt facies form two distinct facies successions in the topset (Monahan et al., 1993, 1995, 1997; Clague et al., 1998a; Monahan, 1999). In the first facies succession the sand facies exhibits shell debris, particularly near the base. The interbedded sand and silt facies is up to 2 m thick, extremely bioturbated, also shell bearing, and contains an intertidal to intertidal/subtidal fauna (Williams, 1989). This facies succession is interpreted to represent strata deposited in migrating distributary channels in a tidal flat environment and capped by tidal flat deposits (see Clague et al., 1982). The shell debris was incorporated into the distributary channel sands as channels migrated and eroded earlier tidal flat deposits. In the second facies succession, the sand facies does not contain shell debris and includes beds that are slightly coarser than in the first succession. The overlying interbedded sand and silt facies is generally only a few metres thick, well-bedded and consists of finely interbedded fine to medium sand and laminated silt. This facies succession is interpreted to represent strata deposited in distributary channels in a more floodplain environment, capped by silts and sands deposited in active tidal and slough environments during channel abandonment.

Locally, the interbedded peat and silt facies thickens at the expense of the underlying sand facies to form narrow channel bodies that are up to 20 metres thick. These deposits represent strata deposited in and associated with tidal channels on the delta plain (Terminus of Richmond, undated) and are interpreted to document the fill of partially abandoned channels. The channels are more than one and a half metres deep across the city and can be mapped 100 to 200 metres, to one along the Main Channel that is 700 metres wide and can be traced approximately 4 kilometres.

The interbedded peat and silt facies is overlain by stratigraphic facies consisting of horizontal and massive clayey silt deposited in the tidal marsh and floodplain environments. Due to the relatively low rise in sea level, the organic silts are up to 12 metres thick in eastern Lulu Island, near the head of the delta, and thin westward to less than 1 metre at the sites on western Lulu Island. The organic silts are in turn overlain by peat in parts of central and western Lulu Island (Clague et al., 1982; Williams and Roberts, 1989).

References



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British Columbia Geological Survey
Geoscience Map 2010-3

LIQUEFACTION HAZARD MAP OF RICHMOND, BRITISH COLUMBIA

Patrick A. Monahan, Victor M. Levson and Ben Kerr

The City of Richmond, British Columbia, is located in one of the most seismically active regions in Canada (Rogers, 1998). The effects of earthquakes are not only dependent upon the magnitude of the earthquake and the distance from the source, but can vary considerably due to local geological conditions. These conditions can be mapped using existing geological and geotechnical data. This map shows the variation in the earthquake-induced liquefaction hazard in City of Richmond, British Columbia. The city is located entirely within the modern Fraser River delta, and the deltaic sediments on which the city is built are particularly susceptible to earthquake induced liquefaction (e.g. Byrne, 1978; Finn et al., 1989; Byrne and Andersorn, 1991; Clague et al., 1992, 1997, 1998a; Watts et al., 1992). This map has been prepared as part of an earthquake hazard mapping project in the city. An accompanying map shows the Quaternary geology of the Richmond area.

This map is intended for regional purposes only, such as land use and emergency response planning, and should not be used for site-specific evaluations. This map can be used with other criteria to help planners select potential areas for development, avoid geologically vulnerable areas, and prioritize seismic upgrading programs. However, this *map does not replace the need for site-specific geotechnical evaluations prior to new construction or upgrading of buildings and other facilities.* The qualifications and limitations of this map are discussed in more detail below.

Liquefaction Hazard Mapping

Liquefaction is the transformation that occurs when earthquake shaking (or other disturbance) causes a saturated granular soil (e.g. sand) to lose its strength and behave like a liquid. Liquefaction can be one of the main causes of damage during an earthquake. The susceptibility of a site to liquefaction is dependent upon the depth to the water table and the density, grain size and age of the underlying deposits (e.g. Youd and Perkins, 1978).

The initial step in the regional assessment of the liquefaction hazard of Richmond was the preparation of a geological map that reflects subsurface variations in the Quaternary stratigraphy and past the surficial geological materials, which are areas of organic silt or peat (Fraserview) Richmond). Because the variation in earthquake hazards is most affected by geological conditions in the upper 30 to 50 metres, the geological map primarily reflects the variations within the Fraser delta layers, which forms the upper 20 to 25 metres of the deltaic succession. The layers forms an overall fining upward sequence that grades up from a dense sand facies, through an interbedded sand and silt facies, to an upper organic silt facies, which is locally overlain by peat (Clague et al., 1982; Hebda Williams and Sellers, 1983; Monahan et al., 1993; Monahan, 1993). The sand facies is interpreted to be the Fraser River Sand (Hebda and Williams, 1983; Monahan et al., 1993; Monahan, 1993). This unit was divided into three types, which reflect only broad variations in sand content, where Massive fine deposits occur at shallow depth, and to reflect age differences in the sand facies. The map units were defined on the basis of the geological materials at surface only where data provide information about the subsurface layers. The stratification of surficial ground cannot hinted to potentially greater where thick silty areas, and may in some circumstances be reduced where Fraserview deposits occur at shallow depth (e.g. Monahan and Levson, 2001). The liquefaction hazard decreases with increasing depth and increasing age of the potentially liquefiable sand layer (Youd and Perkins, 1978; Monahan et al., 2010a). Within the sand facies, relative ages were estimated by the thickness of the overlying organic silt facies, the presence or absence of peat at surface, and proximity to historic sloughs. Older sands occur beneath thicker accumulations of organic silt, where peat occurs at the surface, on the outer (i.e. convex) side of present sloughs, which represent abandoned distributary channels, and on the landward side of sloughs bordering present day river channels. In addition, where the shell-bearing portions of the sand facies occurs adjacent to the shell-free subfacies, the shell-bearing subfacies is older.

The geological map is based on a consolidation of surficial and subsurface data. The subsurface data consists primarily of geotechnical borehole data from 2743 locations, including 19 scientific testholes drilled by the Geological Survey of Canada, 687 locations with cone penetration tests (CPT), and 723 locations with testholes deeper than 10 metres. Each location where testhole data was used is shown on the map, and each location may have one or more closely spaced testholes. Surficial geological data was used to define the boundaries of the geological map units include the surficial geological mapping by Armstrong and Hicock (1980), VL-units mapping by Luternauding (1990, 1991) and a map of the historical sloughs prepared by the City of Richmond (Geomatics of Richmond, undated).

The liquefaction hazard map was processed by assigning a hazard rating or range of hazard ratings to each geological map unit based on quantitative analysis of geotechnical testhole data. Quantitative analyses were conducted on 279 locations, comprising 222 cone penetration tests (CPT), 21 standard penetration tests (SPT), and 36 borehole shear vane tests (BPT). Because of the greater reproducibility of CPT data, these were used preferentially, and analyses were conducted using the other forms of data where CPT data were not available.

The CPT, BSPT, and SPT data were analyzed according the processing recommended by Youd et al. (2001). This method assesses the cyclic resistance ratio (CRR), which is a measure of the soil resistance to liquefaction, to the cyclic stress ratio (CSR), which is a measure of the strength of the earthquake shaking. Where the CSR is greater than the CRR, liquefaction can be triggered.

The liquefaction susceptibility at the various sites has been quantified here by calculation of the Probability of Liquefaction Severity (PLS; Levson et al., 1994a, 1999; Monahan et al., 1994, 2010a). PLS is defined by:

$$PLS = \frac{\int_0^{20} P(z)\,dz}{\int_0^{20} dz}$$

where P is the probability of liquefaction at depth z (calculated from 0 to 20 metres), which is calculated from CSR and the probabilistic, National Building Code of Canada seismic, model (J. Cassidy, Geological Survey of Canada, 2002 [external communication]), z is the layer thickness, and $\int P, \int z$ is depth sampling function (if all decisions linearly here 0.1 m the surface to 0 at 20 metres.

Calculation of PLS provides not only a relative index of liquefaction susceptibility within an area, but also permits comparison of the liquefaction hazard between areas of different seismic hazard because it takes into account both seismicity and in situ liquefaction susceptibility. Hazard ratings have been assigned to specific PLS ranges (Table 1).

Table 1. Liquefaction hazard ratings associated with PLS (Levson et al., 1994a, Monahan et al., 1994, 2010a)

PLS (in %) equal	Hazard Rating
>30%	extremely high
20-30%	very high
10-20%	high
5-10%	moderate
2-5%	low
0-2%	very low

The objective of this map is to show the relative hazard between areas, not to predict the amount of earthquake damage that will occur in a given area. Although PLS is strongly influenced by earthquake magnitude and the depth to the water table, the effects of these factors are constant, that is, with the PLS in each grid, and using the observed water table, according to the procedures recommended by Youd et al. (2001). The PLS was then calculated from the normalized data, using data from the observed natural ground level. Furthermore, the PLS was calculated assuming a water table that is one metre below the lowest surface, based on the assumption that the strike surface is at approximately the same elevation throughout Richmond. This assumption was used in order to minimize the effects of seasonal water table, and to be able to compare the relative hazard at each site.

Calculation of the PLS was made for assuming a Magnitude 7 earthquake, rather than a range of earthquake magnitudes, based on the assumption that most of the earthquake hazard is derived from a Magnitude 7 earthquake. A consideration magnitude scaling factor (MSF) was applied to the CSR (Youd et al., 2001), although this changes does not improve the real effects of variability of earthquake magnitude, it dampens the parameter of a large value of data. Because all data were analyzed in the same way, the relative differences in liquefaction hazard are valid.

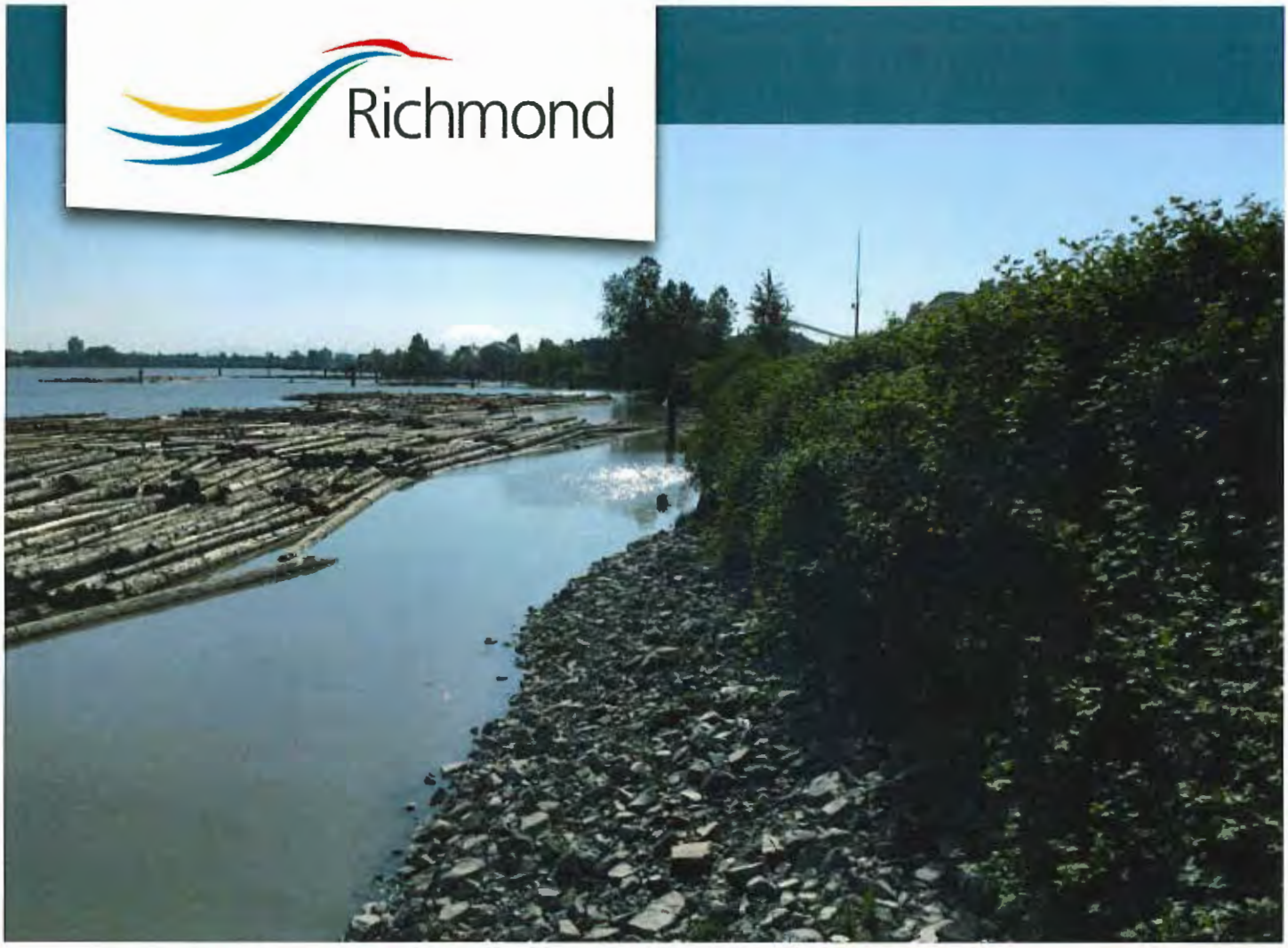
A uniform amplification of accelerations resulting from the thickness of deltaic sediments was used in the PLS calculation and was based on the ratio of the design acceleration on firm ground to the acceleration recommended by Byrne and Anderson (1991) for sites in the Fraser River delta. This amplification is over-conservative because amplification varies with the thickness of the deltaic section (e.g. Monahan and Hancock, 2004). However, the thickness of the deltaic sediment is not consistent beyond the northeastern margin of the study in northern Richmond, so that the effect of the variation in deltaic thickness could not be consistently applied.

In the calculation of the CPR using CPT data, points with $I_c > 2.6$ were considered too clay-rich to liquefy, as suggested by Youd et al. (2001). Finn et al. (1994) have to be the sediments in Richmond, this cutoff provide approximate the limits of potentially liquefiable soils as determined by the Chinese criteria, with some specific exceptions. In map unit sP, in which the sand facies is silt-bearing, interbedded sand and silt facies is frequently encountered so that the sediments are more mixed than elsewhere. Consequently, most silt beds have less than 15% clay and so are potentially liquefiable, in contrast to non-liquefiable silts in this facies. However, in south-central and silt facies, to an upper organic silt facies, which is locally overlain by peat (Clague et al., 1982; Hebda Williams and Sellers, 1983; Monahan et al., 1993; Monahan, 1993). This unit was divided into three types, which reflect only broad variations in sand content, where Massive fine deposits occur at shallow depth, and to reflect age differences in the sand facies. The map units were defined on the basis of the geological materials at surface only where data provide information about the subsurface layers. The stratification of surficial ground cannot hinted to potentially greater where thick silty areas, and may in some circumstances be reduced where Fraserview deposits occur at shallow depth (e.g. Monahan and Levson, 2001). The liquefaction hazard decreases with increasing depth and increasing age of the potentially liquefiable sand layer (Youd and Perkins, 1978; Monahan et al., 2010a). Within the sand facies, relative ages were estimated by the thickness of the overlying organic silt facies, the presence or absence of peat at surface, and proximity to historic sloughs. Older sands occur beneath thicker accumulations of organic silt, where peat occurs at the surface, on the outer (i.e. convex) side of present sloughs, which represent abandoned distributary channels, and on the landward side of sloughs bordering present day river channels. In addition, where the shell-bearing portions of the sand facies occurs adjacent to the shell-free subfacies, the shell-bearing subfacies is older.

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Richmond









Final Report

Dike Master Plan - Phase 5

February 2019
KWL File No. 0651.129-300
Richmond File No. 631343

Submitted by:

KERR WOOD LEIDAL
consulting engineers

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Executive Summary

The City of Richmond uses a Dike Master Planning program to guide future dike upgrading projects, and to ensure that land development adjacent to the dike is compatible with flood protection objectives. The program includes 4 phases for the 49 km of the Lulu Island perimeter dike in Richmond, and an additional 5th phase for Sea Island, Mitchell Island, and Richmond Island. The goal is to raise the dikes to 4.7 m CGVD28 to allow for 1 m of sea level rise and 0.2 m of land subsidence, while allowing for further upgrading in the future. The long-term vision is to provide the City with a world-class level of flood protection to keep pace with the rapidly growing population and assets within the dikes.

This Phase 5 Dike Master Plan covers Mitchell Island, Sea Island and Richmond Island. The Sea Island 15 km perimeter dike is shared with Vancouver Airport Authority (YVR), with the City managing a 1.1 km section south of the Moray Channel Bridge plus three road rights-of-way through the YVR sections of the dike. Mitchell Island is not currently protected by a dike, although most of the island is above 2.5 m CGVD28. Richmond Island is a single property that is above the design flood level with flood protection responsibility remaining with the property owner.

This report describes existing conditions, develops an ideal vision for dike upgrading, presents design criteria, identifies options for dike upgrading, and presents recommended dike upgrading options that appropriately address the challenges. This work can be used as a basis for design of dike upgrading projects, recognizing that site-specific refinement of recommended options will be required in some areas. This work can also be used to assist with land use planning activities along the dike corridor. The main features of the recommended options to dike upgrading in Phase 5 are described below.

Mitchell Island

- Raise roads to the design dike crest elevation to provide emergency egress.
- During redevelopment, require properties to be raised to the design dike crest elevation and acquire rights-of-way along the river bank. Such rights-of-way will allow for a future dike and/or bank protection works.

Sea Island

- Widen the dike on the land side rather than into the Fraser River Middle Arm. Consider retaining walls or extending the dike towards the riparian area in site-specific constrained areas. Coordinate dike improvements with YVR and establish agreed upon dike jurisdictions.
- Coordinate upgrades to the dike with upgrades to Miller Road Pump Station and the Moray Channel Bridge.
- As an interim measure along the Pacific Gateway Hotel (until the site redevelops), raise the dike to 4.7 m CGVD 28 with a sheetpile wall embedded along the river bank and a land-side retaining wall.

Richmond Island

- No changes by the City are proposed as the island is almost entirely above the future dike elevation (5.5 m CGVD28). It is recommended that flood protection responsibility remain with the property owner.

It is also recommended that the City prepare a comprehensive implementation plan for dike upgrading that incorporates the elements of the Phase 5 Dike Master Plan, and the elements of the other Dike Master Plans. To address habitat compensation issues associated with dike upgrading, it is further recommended that the City consider development of a habitat banking program that could provide effective large-scale compensation.

For all Dike Master Plan phases, the City should continue to investigate alternative ways to achieve seismic performance objectives, including soil densification research, custom design criteria, and filling a wide swath of land inside the dike.

1. Introduction

Flood protection in Richmond is guided by the City's 2008-2031 Flood Protection Strategy which includes a comprehensive suite of measures including structural measures (e.g. dikes and pump stations), non-structural measures (e.g. flood construction levels), and flood response and recovery plans.

Dike Master Plans are critical components of the City's 2008-2031 Flood Protection Strategy and are used to guide the implementation of long-term dike upgrades.

The City of Richmond (City) has retained Kerr Wood Leidal (KWL) to prepare the Richmond Dike Master Plan Phase 5.

Phase 5 encompasses the islands on the north side of Lulu Island within the City of Richmond, along the Fraser River North Arm. This includes Richmond Island, Mitchell Island, and Sea Island (primarily under Vancouver Airport Authority (YVR) jurisdiction). These are three distinct islands that require consideration of separate constraints and opportunities, independent of each other, but within the overall context of the Dike Master Plan. Figure 1-1 presents the extent of the City's Dike Master Plan phases and existing ground elevation, based on Emergency Management BC (EMBC) 2016 LiDAR. Figure 1-2 shows the reaches of the Phase 5 Dike Master Plan.

1.1 Background

Richmond has a population of about 220,000 and is situated entirely on islands within the overlapping Fraser River and coastal floodplains (Lulu Island, Sea Island, Mitchell Island, Richmond Island). The City's continued success is due in part to its flat, arable land and its strategic location at the mouth of the Fraser River and on the seashore. The low elevation of the land and its proximity to the water comes with flood risks.

As Richmond is fully situated within the river/coastal floodplain, there is no option to locate development out of the floodplain. The continued success of the City depends on providing a high level of structural and non-structural flood protection measures. Without continued improvements, the flood risk within the City would progressively rise as a result of rising flood levels (due to climate change), subsiding land, and increasing development.

The 2008-2031 Flood Protection Strategy guides the City's flood risk reduction activities across the City's organizational structure and across the spectrum of structural and non-structural flood protection measures. The Flood Protection Strategy is currently in the process of being updated.

While Lulu Island is the most populous and developed Richmond island, Mitchell Island and Sea Island are also very important to the success of Richmond and the region. Mitchell Island and Sea Island are economic and employment hubs with light to medium industrial uses on Mitchell Island and the Vancouver International Airport and associated industries located on Sea Island. There is also a residential community (Burkeville) located on Sea Island. Richmond Island is currently occupied by a single business operating a marina and a pub.

1.2 Purpose and Objectives

The purpose of the Dike Master Plan is to guide the implementation of dike upgrades and provide a starting point for the City to work with proposed developments adjacent to dikes. Unlike the previous Dike Master Plan phases, which focus on the Lulu Island perimeter dike, Phase 5 focuses on areas outside of Lulu Island, including both diked and undiked islands. In diked areas (Sea Island), the Phase 5 Dike Master Plan will focus on upgrading of the City's portion of the existing perimeter dike. In undiked areas (Mitchell Island and Richmond Island), alternative flood protection strategies may be warranted, such as land raising or relying only on non-structural measures (Flood Construction Levels (FCLs), covenants, flood insurance).

The master plan defines the City's preferred and minimum acceptable structural flood protection works upgrading concepts (dikes, land raising, erosion protection). The Dike Master Plan facilitates the City's annual dike upgrading program by providing critical information for the design of dike upgrades, including:

- general design concept;
- alignment;
- typical cross-section (conceptual design);
- footprint and land acquisition and tenure needs;
- design and performance criteria;
- infrastructure changes required for dike upgrading/construction;
- operation and maintenance considerations;
- environmental features and potential impacts;
- social and public amenity considerations;
- guidance for future development adjacent to the dike; and
- guidance on interaction with other structural flood protection measures (e.g. secondary dikes).

The Dike Master Plan is intended to guide dike upgrading over the next 20 to 30 years.

Other flood protection measures, including non-structural measures, are addressed in the City's 2008-2031 Flood Protection Strategy. The City is currently working on an updated strategy.

1.3 Approach and Methodology

The Dike Master Plan has been developed using a 5-step approach presented and described below.



Define: Confirm Dike Master Plan objectives and design/performance criteria.

Understand: Collect and compile relevant information, including spatial data and background reports from the City and several other parties (Vancouver Airport Authority, provincial regulators, the port, etc.).

Assess: Develop dike upgrading options and identification of constraints and potential impacts. Desktop and field review of options with City staff to identify preferred options.

Consult: Present to and gather feedback from council and stakeholders on preferred options.

Refine: Develop the master plan informed by consultation and review by the City.

The scope for the Dike Master Plan includes the following main tasks:

- goals and objectives development;
- background data collection and review;
- design criteria development and identification of constraints;
- options development and review;
- site visits;
- drainage impacts assessment;
- desktop habitat mapping and impacts review;
- geotechnical assessment;
- public amenity review;
- stakeholder consultation; and
- report preparation.

1.4 Report Format

This report is organized as follows:

- The executive summary provides a high-level overview of the master plan and key features;
- Section 1 introduces the master plan context and process;
- Section 2 documents the existing conditions;
- Section 3 documents the options development and assessment, and presents the recommended options;
- Section 4 provides implementation strategy, including costs, phasing, and coordination;
- Section 5 is a compilation of 2-page summary sheets highlighting existing conditions and key features of the preferred option for each reach; and
- Section 6 provides general and reach specific recommendations for next steps and implementation.

Appendix A provides figures showing conditions along the existing dike alignment, and the preliminary design footprint of the recommended upgrading options discussed in Section 3.

1.5 Project Team

The KWL project team includes the following key individuals:

- Colin Kristiansen, P.Eng., MBA – Project Manager;
- Mike Currie, M.Eng., P.Eng., FEC – Senior Engineer and Technical Reviewer;
- Amir Taleghani, M.Eng., P.Eng. – Water Resources Engineer;
- Allison Matfin, EIT – Project Engineer
- Laurel Morgan, M.Sc., P.Eng., P.E. – Drainage Engineer;
- Daniel Brown, B.Sc., B.Tech., BIT – Project Biologist;
- Patrick Lilley, M.Sc., R.P.Bio., BC-CESCL - Senior Biologist and
- Jack Lau - GIS/CAD Analyst.

This report was primarily written by Allison Matfin with direction from Amir Taleghani. The report was reviewed by Mike Currie and Colin Kristiansen.

Thurber Engineering Ltd. (Steven Coulter, M.Sc., P.Eng.) provided geotechnical engineering services.

The project was guided on behalf of the City by:

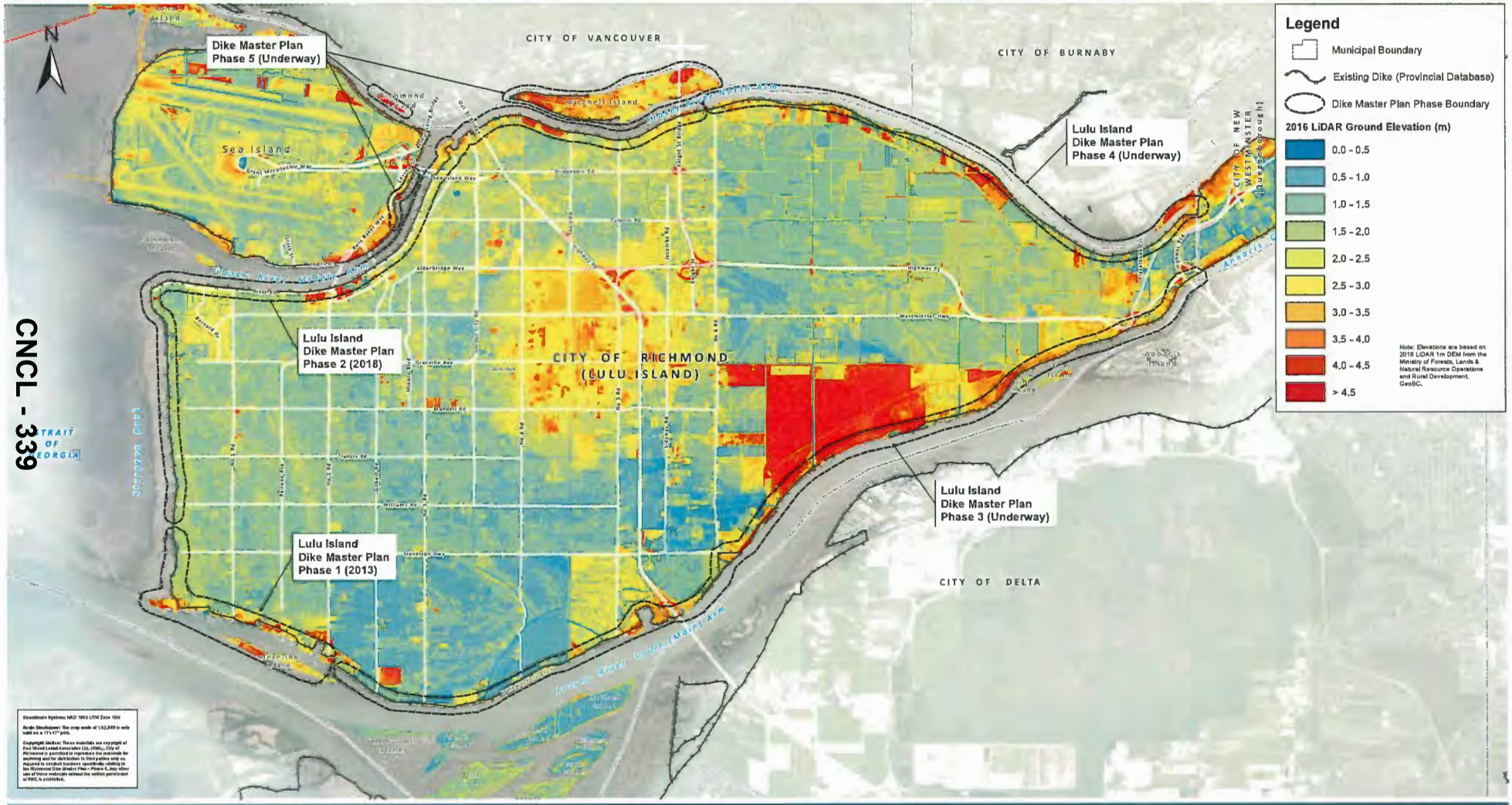
- Lloyd Bie, P.Eng. – Manager, Engineering Planning;
- Corrine Haer, P.Eng. - Project Engineer, Engineering Planning; and
- Chris Chan, B.A.Sc. EIT – Project Engineer, Engineering Planning.

Many additional City staff contributed to the project during workshops, site visits, and in reviewing draft report materials.

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City of Richmond
Richmond Dike Master Plan - Phase 5

KERR WOOD LEIDAL
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Date February 2019
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Dike Master Plan Phases

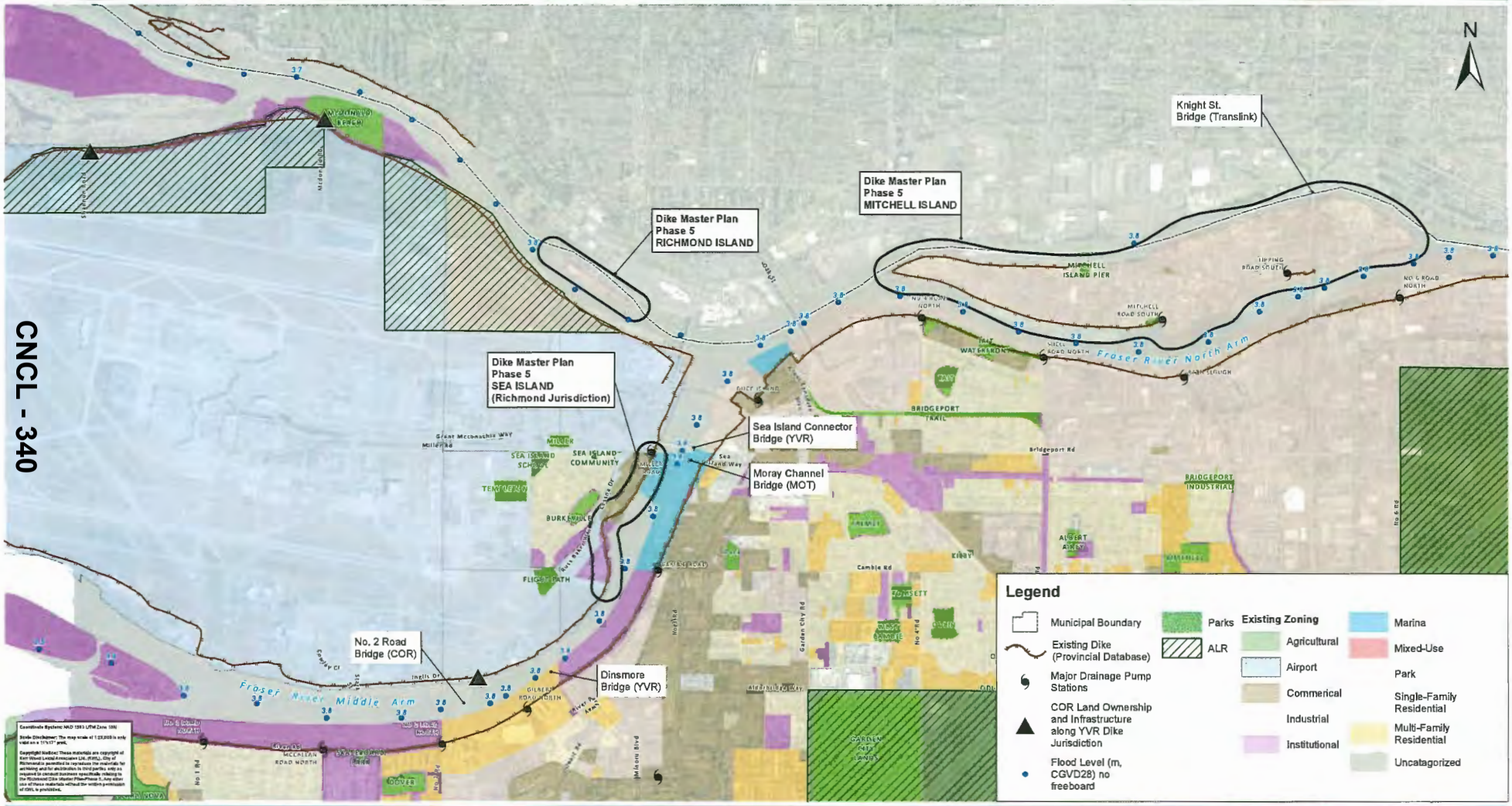
Figure 1-1

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City of Richmond
Richmond Dike Master Plan - Phase 5

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Date February 2019
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Phase 5 Dike Master Plan Study Area

Figure 1-2

2. Existing Conditions

This section summarizes the options development process undertaken, including the following components:

- review of existing conditions;
- design considerations;
- upgrading strategies; and
- preferred options and concepts.

2.1 Reaches and Major Features

Mitchell Island, Sea Island, and Richmond Island are unique areas with varying types and degrees of flood protection. Mitchell Island has an old and unmaintained private dike along the western extent, with areas of private erosion protection and small sections of sheetpile elsewhere on the island. Conversely, Richmond Island has no flood protection works, though private bank protection works are in place. Sea Island is protected by an approximately 15 km long perimeter dike, though diking responsibility largely rests with the Vancouver Airport Authority (YVR) with one eastern reach under the City's responsibility. As a result, these three distinct islands require consideration of separate constraints and opportunities, independent of each other, but within the overall context of the Dike Master Plan.

Phase 5 is divided by Island as each Island has relatively uniform conditions with several locations with unique constraints. Islands/reaches are presented on Figure 1-2.

The sections below and Table 2-1 describe the existing conditions and features of each island. Mitchell Island may need to be further subdivided for future dike upgrading implementation phasing.

Appendix A provides a set of figures showing the existing dike alignment, proposed upgrading, adjacent land tenure, municipal infrastructure, and existing habitat.

Reach 1 - Mitchell Island

Mitchell Island was created by filling in the river between three separate islands (Twigg, Eburne, and Mitchell Islands).

Mitchell Island is densely developed with industrial and commercial businesses, and some residences that are not in compliance with current zoning. The City's Official Community Plan (OCP) indicates that Mitchell Island will be maintained as industrial and commercial zoning, to preserve space in the City for these types of economic activities. A private dike was constructed on the western end of Mitchell Island many decades ago and was passed to the City by the Province of British Columbia (the Province); however, the dike has not been maintained nor inspected and is no longer apparent on the island. The elevation of the island ranges from 2.5 to 4.5 m CGVD28 generally, and private bank protection works and sheetpile walls are in place in many locations.

Implementing structural flood protection works on Mitchell Island would have a significant impact on the existing conditions, as no access or rights-of-way currently exists for the City to complete these works. However, flood protection for Mitchell Island is beneficial as not implementing flood protection would result in economic loss for the region, risk public life at current residences, and could result in contamination from flooding of industrial sites.

Reach 2 - Sea Island

Sea Island has an existing perimeter dike that is largely under the responsibility of YVR. Only one eastern reach is under the City's responsibility, from the south side of the Moray Channel Bridge to the southern property boundary of BCIT (approximately 1.1 km). Dike crest elevation in this reach ranges from 4.7 m to as low as 2.7 m CGVD28 and is set back from the river in a few locations. Little to no bank protection is in place, and ongoing invasive vegetation (knotweed) treatment is resulting in damage to the river bank near the setback dike. The current dike alignment ties into the Moray Channel Bridge, owned by the City of Richmond. Based on 2016 EMBC LiDAR data, the bridge deck on Sea Island is below 4.7 m CGVD28 and would not be sufficient for dike upgrades. The dike borders four large commercial lots with major transportation corridors and the community of Burkeville located behind the commercial areas.

The City also owns the land the dike traverses at McDonald Beach Park road, the No. 2 Road Bridge, and Shannon Road, though YVR is responsible for the dike in these locations. In addition to these noted locations of Richmond ownership with YVR dike responsibility, there may be additional locations where Richmond owns the land the dike crosses (such as Grauer Road or Ferguson Road). This mixed ownership and uncertainty is the result of historic proposed and completed land exchanges with the federal government on Sea Island, as part of the development of the airport. The Phase 5 Dike Master Plan does not resolve long-standing land ownership uncertainties on Sea Island; however, consultation has contributed to the process of resolving dike land ownership, with these efforts continuing beyond the Dike Master Plan.

Reach 3 - Richmond Island

No existing dike is in place on Richmond Island. The only flood protection works is riprap bank protection works along the southern bank. The total perimeter of Richmond Island is approximately 1.2 km. The land elevation of Richmond Island ranges from 6.4 m CGVD28 at the north end to 3.4 m CGVD28 at the south end, where the Island is connected to the City of Vancouver. The entire island is one lot currently leased by Milltown Marina & Boatyard Ltd. which includes a restaurant, marina, and private utilities. Richmond Island is not included in the current OCP.

A restrictive covenant[1] attached to the land title was created in November 27, 2012 with North Fraser Terminals Inc., the Milltown Marina & Boatyard Ltd., and the City of Richmond that:

- acknowledges the risk of flooding and erosion on Richmond Island;
- notes that the City has no plans to protect the island from flood and erosion; and
- releases the City from any damage or losses caused by flooding or erosion.

As a result of the terms of this covenant, the City may consider implementing no flood protection measures for Richmond Island.

[1] CA2885848 RCVD: 2012-11-27

Table 2-1: Phase 5 Reaches and Features

Reach ID and Name	Extent / Length	Existing Dike Alignment	Major Features
1- Mitchell Island	Entire Island (7.8 km perimeter)	None	• Condition and elevation of existing dike and bank protection on western half of Mitchell Island is unknown (no available background information, no inspections or maintenance) • Dense industrial development on the entire island • Mitchell Road South Drainage Pump Station • Tipping Road South Drainage Pump Station • Large number of industries and businesses as stakeholders • Active water lots used by industry • Two City watermains to Mitchell Island from Lulu Island • Metro Vancouver Twigg Island Forcemain underneath existing dike on north side • Land elevation generally between 2.5 m and 4.5 m CGVD28 but as low as 1.5 m CGVD28 • Intermittent bank protection works in some locations • Two City parks along the river bank, no other public access to the river bank • Bathymetry suggests potential scour on the foreshore and scour holes on the north side
2 - Sea Island	South end of BCIT to south side of Airport Connector Bridge (1.1 km)	Walking and cycling trail	• Dike is a pedestrian path • Miller Road Drainage Pump Station • Commercial development directly abuts existing dike in several locations • Marina and restaurant access on the river-side • Tie in and jurisdiction boundaries with YVR adjacent to the Moray Channel Bridge and South of BCIT • Lowest area of dike north of Lysander Lane (<3.5 m CGVD28 elevation) • Low area directly adjacent to Cessna Drive with no established dike right-of-way • One section of dike already upgraded to 4.7 m CGVD28 elevation at 3600 Lysander Lane • Drainage outfall with flap gate at North end of BCIT campus not identified in City drainage utilities

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Reach ID and Name	Extent / Length	Existing Dike Alignment	Major Features
			• Sanitary forcemain crossing near BCIT • Little to no bank protection • High value marsh habitat from BCIT to hotel • North of BCIT, there is an old water connection to the foreshore where industrial activity used to take place on the river • The Moray Channel Bridge that the dike currently connects to is below 4.7 m CGVD28 (based on 2016 EMBC LiDAR).
3 - Richmond Island	Entire Island (0.55 km length)	None	• No existing dike • Connected to City of Vancouver via a short causeway, which provides utilities from Vancouver • Majority of the land is higher than the current dike elevation of 4.7 m CGVD28 and future elevation of 5.5 m CGVD28. The only exception is the causeway to Vancouver. • Existing private bank protection works visible on the south side • The north arm of the Fraser River along Richmond Island is a location of channel scour, with elevations as low as -11 m CGVD28. • All of the land on Richmond Island is one lot and is owned by Milltown Marina Moorage Co Ltd. • Restrictive covenant in place as of 2012 (CA2885848): ○ *"the City currently does not have any plans to install a Dike system on or near the Lands or to otherwise protect the lands from flooding and/or erosion."*

2.2 Land Tenure

Land tenure on each island in Phase 5 includes a mixture of rights-of-way, private property, and City-owned land. Flood and erosion covenants have been established in the past for various properties in Phase 5, which are summarized in Table 2-2. Land tenure along the river bank or existing dike is described below for each island and shown on Figure 2-1.

Mitchell Island

Though a private dike was constructed in the past, no land tenure is established on Mitchell Island for a dike. The majority of the river bank is located on either private property or on aquatic Crown land (designated as Fraser River foreshore) where the City has no existing right-of-way. The City owns land along the river bank at two-small parks and at the Knight Street Bridge off-ramps, and there is a short right-of-way immediately west of the Knight Street Bridge on the south side of the island.

Sea Island

Sea Island is protected by an approximately 15 km long perimeter dike, but diking responsibility largely rests with the Vancouver Airport Authority (YVR). Only one eastern reach is under the City's responsibility, from the Moray Channel Bridge to the southern property boundary of BCIT (approximately 1.1 km). An active right-of-way is in place from BCIT to Lysander Lane, with one gap north of BCIT, but there is no right-of-way north of Lysander Lane.

The City also owns the land the dike traverses at McDonald Beach Park road, the No. 2 Road Bridge, and Shannon Road, though YVR is responsible for the dike in these areas. In addition to these noted locations of Richmond ownership with YVR dike responsibility, there may be additional locations where Richmond owns the land the dike crosses (such as Grauer Road or Ferguson Road). This mixed ownership and uncertainty is the result of historic proposed and completed land exchanges with the federal government on Sea Island, as part of the development of the airport.

The transition points for dike responsibility are not clearly defined, and the City and YVR have discussed this matter during consultation (see Section 3.6 for further discussion).

Richmond Island

Richmond Island has no existing land tenure in favour of the City (ownership or right-of-way). Richmond Island is one lot owned by North Fraser Terminals Inc., which is leased by Milltown Marina & Boatyard Ltd. The development is connected to the City of Vancouver and its utility network.

A restrictive covenant[2] attached to the land title was created in November 27, 2012 with North Fraser Terminals Inc., the Milltown Marina & Boatyard Ltd., and the City of Richmond that:

- acknowledges the risk of flooding and erosion on Richmond Island;
- notes that the City has no plans to protect the island from flood and erosion; and
- releases the City from any damage or losses caused by flooding or erosion.

[2] CA2885848 RCVD: 2012-11-27

Flood and Erosion Covenants

The City provided a title and covenant information for properties along the Phase 5 dike sections under their authority. This information was provided to the City by Dye and Durham, a legal process serving company. The following table summarizes the covenants that pertain to flood and erosion protection, for future awareness and consideration while developing flood protection works.

Table 2-2: Existing Flood and/or Erosion Covenants

Covenant ID	Date Established	PIDs	Address
Mitchell Island			
BB2020219	2012/08/22	None	11060 & 11200 Twigg Place
BK187446	1996/06/17	003-684-539 003-684-547 003-684-652 003-684-687	Group 1 New Westminster District Lots: 528, 5587, 1014, 459, 5091, 5782
BP304365	2000/12/19	008-591-857	Group 1 New Westminster District Lots 459, 1014
BX10111	2005/09/06	003-679-837	Group 1 New Westminster District Lot 459
Sea Island			
BB843923	2006/03/25	017-560-616	3800 Cessna Drive
CA3630774	2014/03/13	None	3600 Lysander Lane
CA3630776	2014/03/13	026-601-621	3600 Lysander Lane
Richmond Island			
CA2885848	2012/11/27	025-409-018 003-335-232	Richmond Island and Group 1 New Westminster District Lots 3869 and 3871

2.3 Infrastructure

There is limited municipal infrastructure along the existing dike corridor / island perimeters. This includes pump stations summarized in the table below.

Table 2-3: Phase 5 Pump Stations and Locations

Pump Station	Location
Miller Road	Sea Island - North end of City reach
Tipping Road South	Mitchell Island – South end of Tipping Road
Mitchell Road South	Mitchell Island – South end of Mitchell Road

On Mitchell Island, there may be private infrastructure associated with industrial uses, particularly water-oriented industries, which may conflict with potential diking options. This will be explored through stakeholder consultation.

2.4 Habitat

Desktop Review

A desktop review was conducted of the ecological setting along and adjacent to the existing dikes in Phase 5. The study area includes the existing dike alignment and adjacent land or intertidal area. Spatial data were used to identify overlap of known environmental values with the study area.

Spatial data reviewed in the desktop study includes:

- Fraser River Estuary Management Program mapping (FREMP 2012, 2007) mapping used to identify riparian and intertidal habitat types and quality,
- iMapBC web application (iMapBC 2017), and
- City of Richmond aerial photographs and Riparian Area Regulation 5 m and 15 m buffer layers (Richmond Interactive Map 2017).

For the purposes of the desktop review, and to allow for a concise description of the different habitat types in the locations within the Phase 5 study area, seven discrete focal areas were defined. Results of the desktop review are presented below and listed by focal area in Table 2-3.

The location and extent of high-quality Fraser River riparian and intertidal habitat were identified to inform the development of dike upgrade options and their potential impacts. FREMP habitat polygons were assigned the following categories: high quality riparian, high quality intertidal, or other. Deciduous tree woodland polygons were categorized as high-quality riparian habitat because these communities provide cover and nutrients to fish using nearshore habitat. Mud, sand, and marsh polygons were categorized as high-quality intertidal habitat because of the foraging and nesting habitat they provide for bird species and the foraging, egg deposition and rearing habitat they provide for fish species. Aquatic and riparian habitat on the land side of the existing dike was identified and mapped using the Riparian Area Regulation buffer layers and interpretation of recent aerial photography (City of Richmond 2017).

Aquatic and Riparian Habitat

High quality intertidal and riparian habitat is present in all three Phase 5 reaches on the Fraser River side of the dike. This important habitat provides forage and cover habitat as well as a staging area for anadromous salmonids transitioning from saltwater to freshwater. Conversely, armoured sections of shoreline on the Fraser River side of the existing dike are present in all three Phase 5 reaches. These sections provide limited habitat value and construction here would have less of a negative impact on fish.

Eight existing fish habitat compensation projects have been completed between 1988 and 2007 in the Phase 5 study area. These included the creation of intertidal marsh and mudflat habitat and riparian habitat to compensate for damage to habitat elsewhere. More information on these compensation projects is provided in Table 2-4.

Wildlife and Terrestrial Habitat

Terrestrial habitat types in Phase 5 include deciduous tree woodland, tall shrub woodland, low shrub woodland, and vascular plant meadow, as well as uncategorized sections (e.g. paved lots; FREMP 2007). These habitat types have potential to provide nesting habitat to migratory birds in all six reaches of Phase 5. Orthoimagery review identified potential raptor nesting trees in all three reaches of the Phase 5 study area.

Drainage channels that may serve as amphibian breeding habitat were not identified in orthoimagery used for the desktop review. It is possible that amphibian habitat is present in small ponds or ditches along the dike that were not identified in the desktop review.

Species and Ecological Communities at Risk

No known occurrences of terrestrial wildlife species at risk are present in the Phase 5 study area, but several occurrences exist on nearby islands in the Fraser River or on the river banks across from Richmond. It is possible that individuals of these species also occur on the Richmond side of the Fraser River. The Lower Fraser River population of White Sturgeon (*Acipenser transmontanus* pop. 4) is known to occur in the Fraser River next to the dike. Mapped critical habitat for at-risk species is not present within 500 m of the Phase 5 study area.

FREMP mapping (2007) indicates the presence of intertidal marsh communities in Reaches 2 and 3. Many of these communities in British Columbia are considered at-risk (i.e. Blue-Listed, meaning they are considered of special concern, or Red-Listed, meaning they are threatened, or endangered). No ecological communities at-risk are shown in either the study area on BC iMap (2017), but it is likely that some are present.

Table 2-4 presents the findings of the desktop review on a reach-by-reach basis and separates Fraser River side results from land-side results.

Table 2-4: Environmental Values

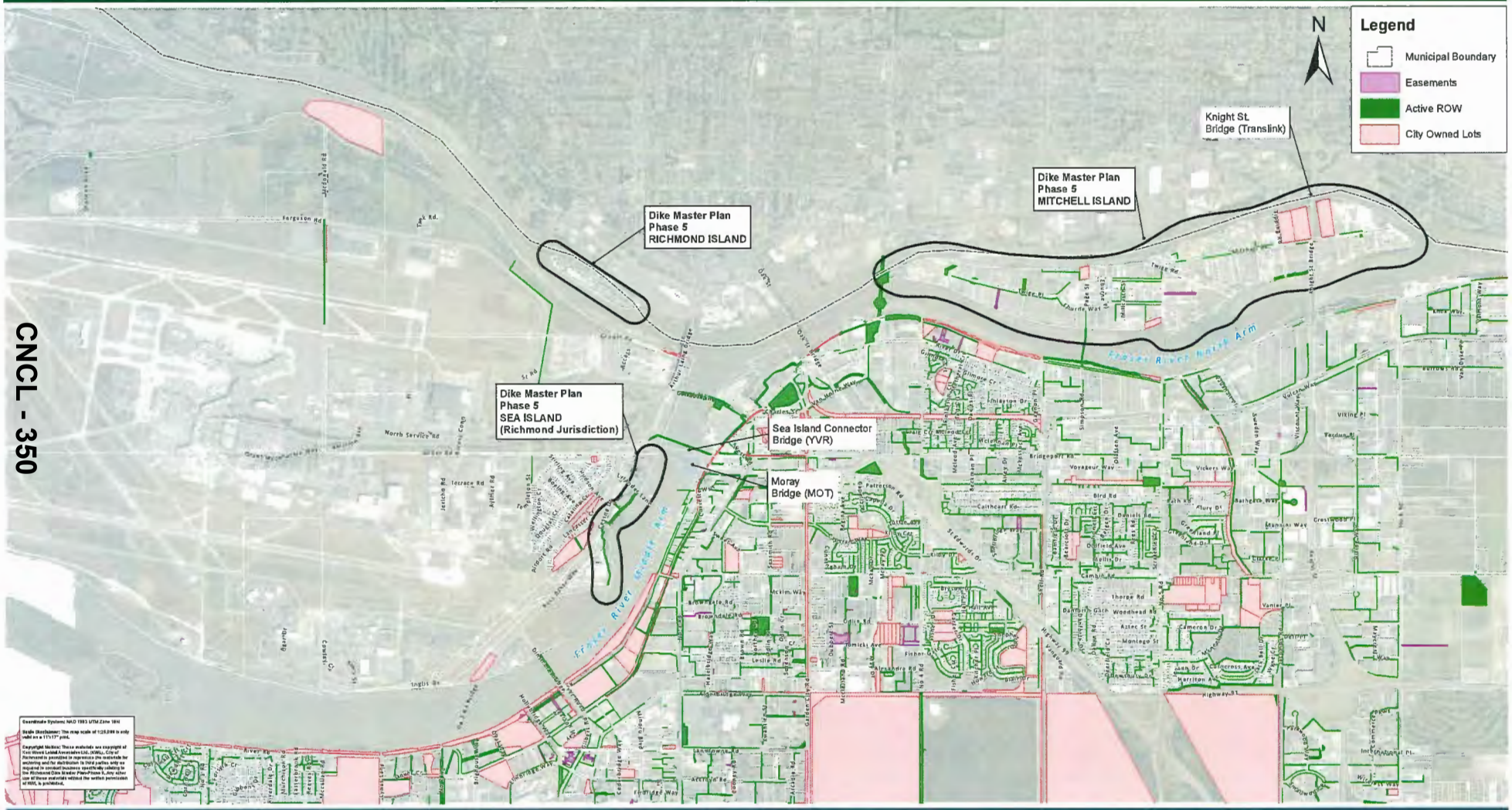
Reach ID and Name	Location	Environmental Setting (organized by inland side and shoreline side of existing dike)	Construction Constraints	Construction Opportunities	FREMP Habitat Types	Richmond ESA Types Present	Known Species at Risk Occurrence Near Dyke Alignment	Potential Raptor Nesting Trees	Potential Migratory Bird Nesting Habitat	Existing Habitat Compensation Sites Present
1 - Mitchell Island	Inland Side	• Low-quality herbaceous habitat at the west end of the island • Small patch of deciduous treed woodland near centre of south side • Sections with no existing dike • Low quality disturbed habitat or paved (no habitat value) along rest of reach	Existing infrastructure Existing habitat compensation site	n/a	Paved Vascular meadow Deciduous tree woodland	Shoreline	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	Project: Canada Line Year Created: 2005 Industrial development Year Created: 2007 McQueen's Boat Works Year Created: 1989 Project: Miller Road Pump Station Year Created: 1991 Bridgeport Market Year Created: 1988 Project: Arrow Transportation Soil Remediation Year Created: 2007
	Fraser River Side	• High quality deciduous tree riparian habitat in patches along length north side of Island • Moderate quality low shrub riparian habitat for most of length north side of island • Sections of moderate quality riparian habitat along south-east side of island (low shrub woodland, deciduous tree woodland) • Sections of high quality mudflat and sandflat intertidal habitat along north and south sides of island • High quality intertidal marsh, on southwest side of island • Low quality armored bank along south west side of island	Moderate-quality riparian along most of length of shoreline on north side of island High-quality intertidal habitat along majority of length of shoreline	n/a	Paved Mud Sand Marsh Gramonoids and forbs Vascula meadow Low shrub woodland Tall shrub woodland Deciduous tree woodland	Shoreline Intertidal				
2 -Sea Island	Inland Side	• Sections of low quality lawn • Sections of paved parking lots with no habitat value	Existing infrastructure	n/a	Mowed grass Mostly parking lot	Shoreline	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	
	Fraser River Side	• Sections high quality marsh and mudflat intertidal habitat concentrated around centre of reach • High quality deciduous woodland riparian habitat at south half of reach	High-quality riparian and intertidal habitat in centre of reach Existing habitat compensation site at north end of reach	n/a	Mud Marsh Deciduous tree woodland Shoreline in front of Marina not included in FREMP mapping	Shoreline Intertidal				
3 - Richmond Island	Inland Side	• No existing dike	No existing dike	n/a	Not included in FREMP mapping	Shoreline	White Sturgeon (Lower Fraser River population) (Acipenser transmontanus pop. 4)	Y	Y	Project: Canfor Year Created: 1988
	Fraser River Side	• High quality mudflat intertidal habitat along full length on north side • Moderate quality low shrub woodland riparian habitat above armoured bank on south side low quality armoured bank along full length of south side	High-quality intertidal habitat along full length north side Moderate-quality riparian habitat along south side Existing habitat compensation site	n/a	Mud Low shrub woodland Sand	Shoreline Intertidal				

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Project No. 651-129
Date February 2019
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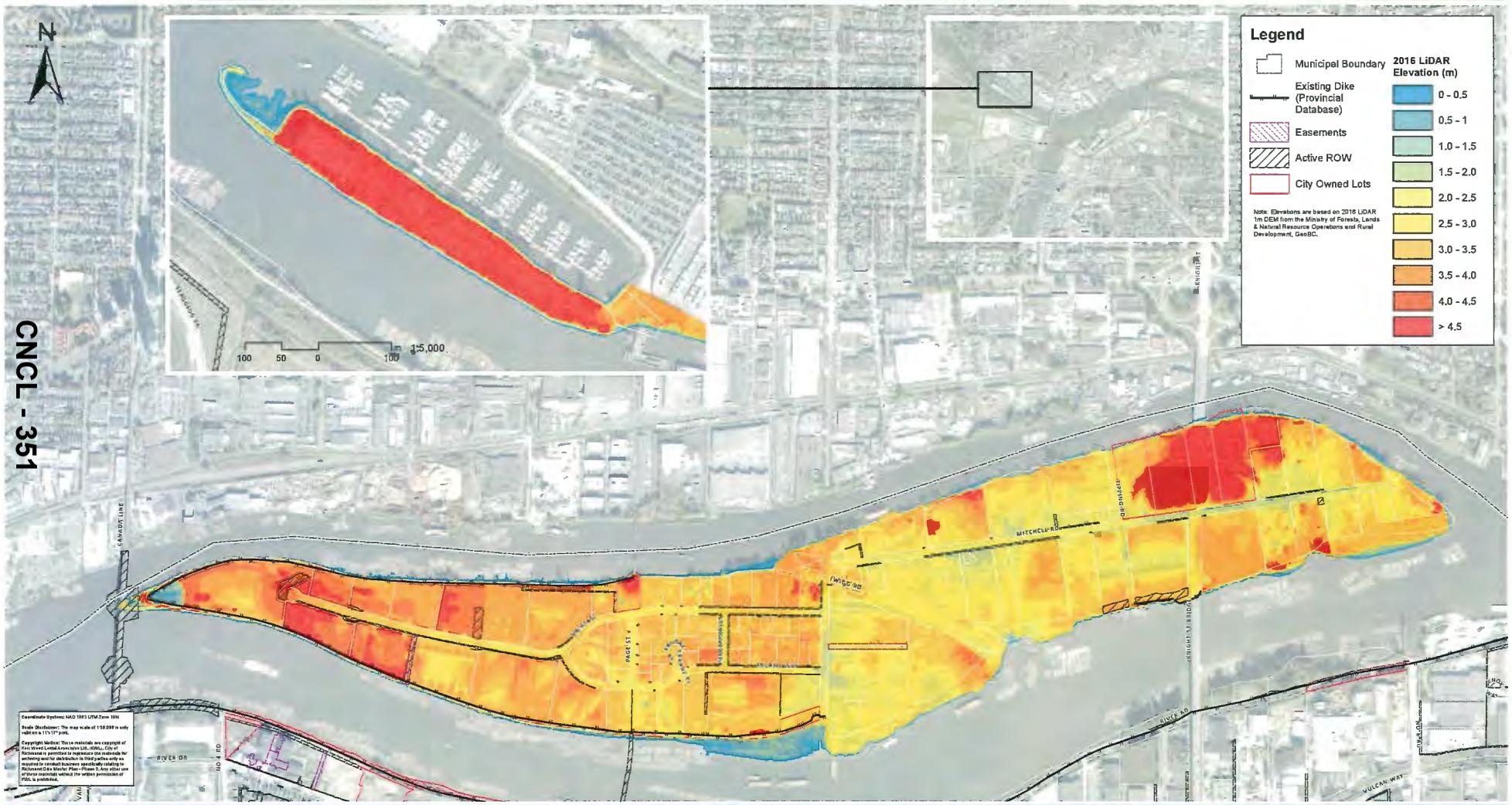
Existing Land Tenure

Figure 2-1

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Project No. 651.129
Date February 2019
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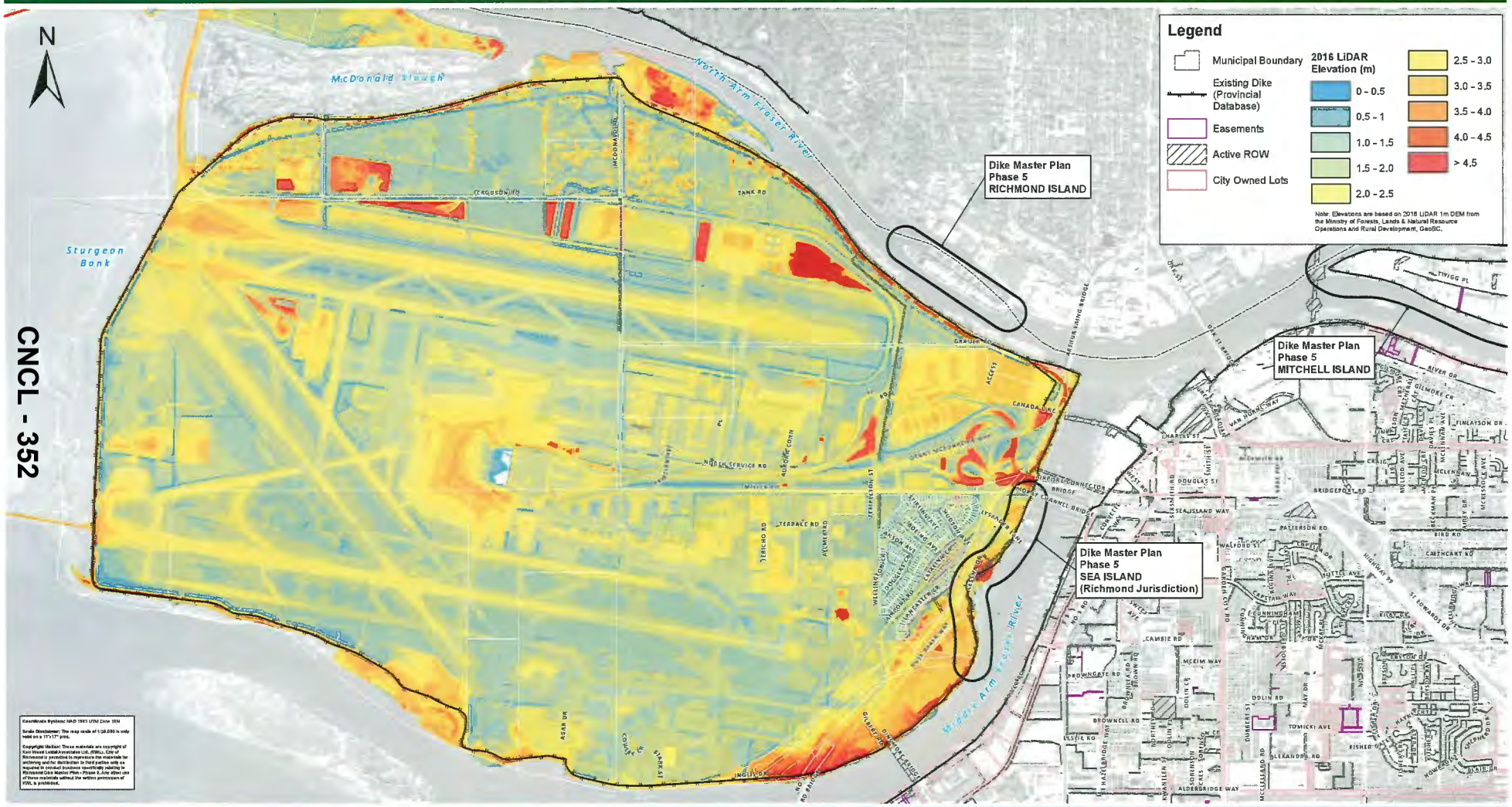
Mitchell Island and Richmond Island Existing Ground Elevations

Figure 2-2

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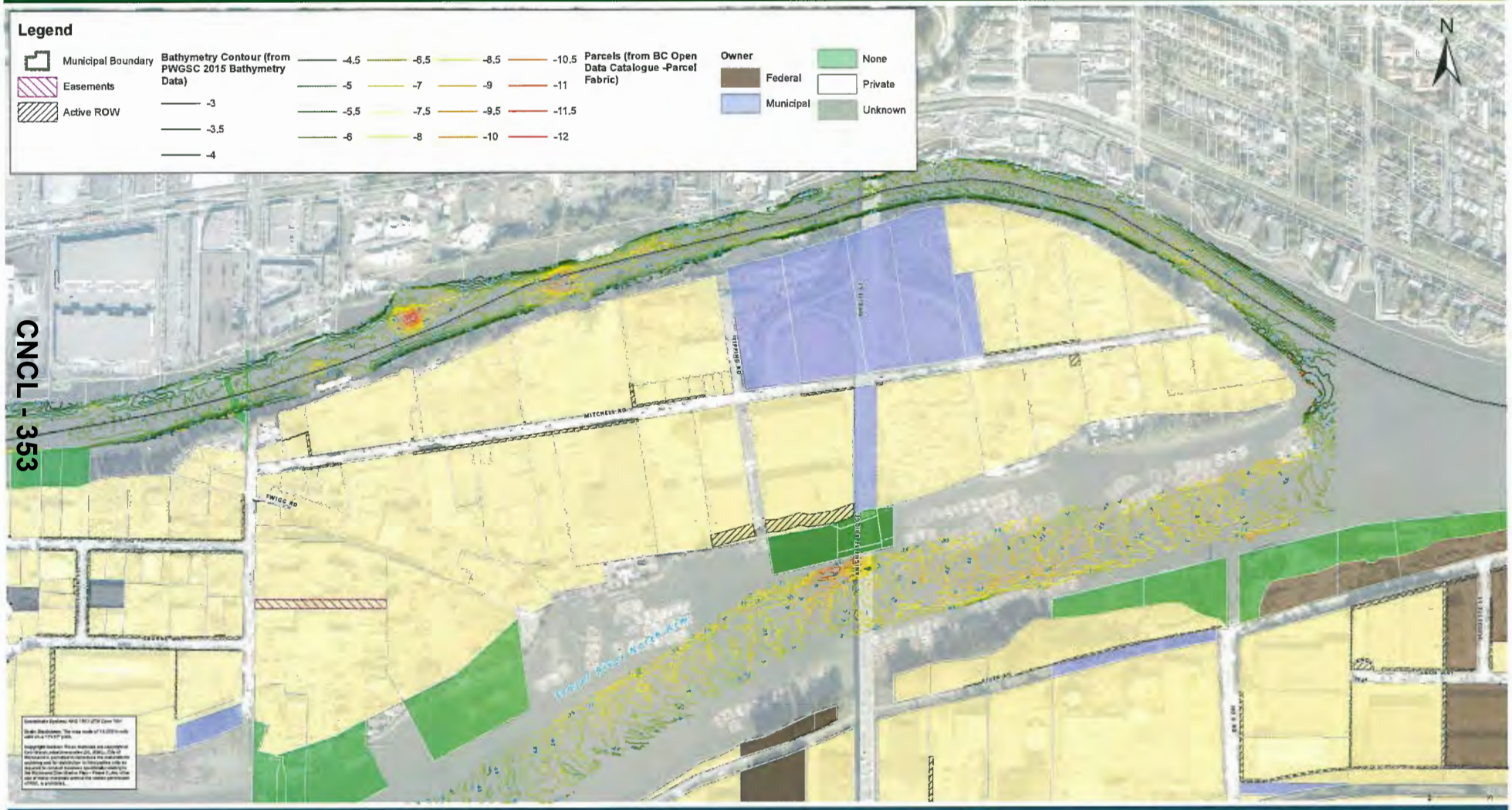
Sea Island Existing Ground Elevations

Figure 2-3

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Bathymetry Contours - Mitchell Island

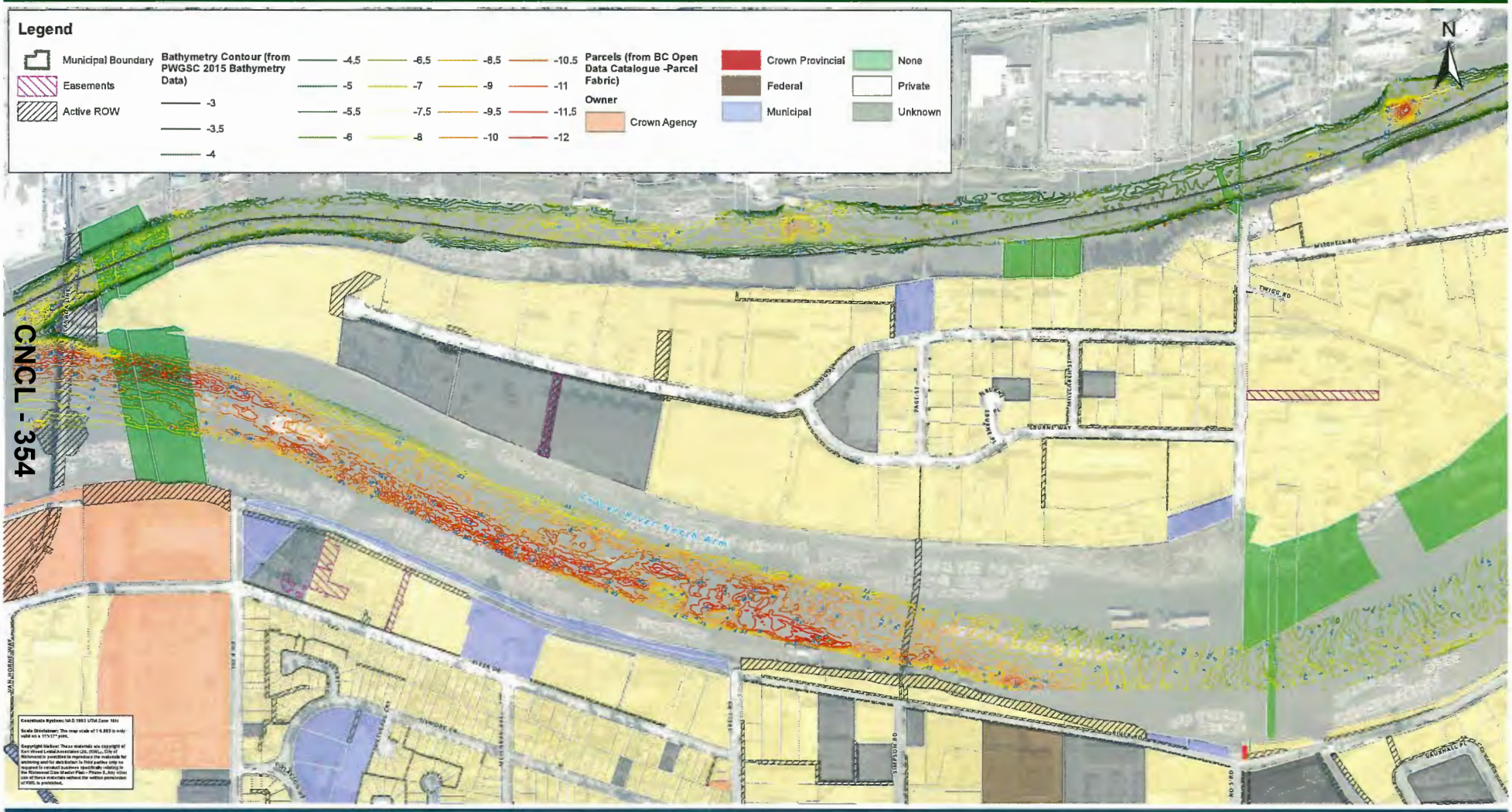
Figure 2-4

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Bathymetry Contours - Mitchell Island

Figure 2-5

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Bathymetry Contours - Sea Island

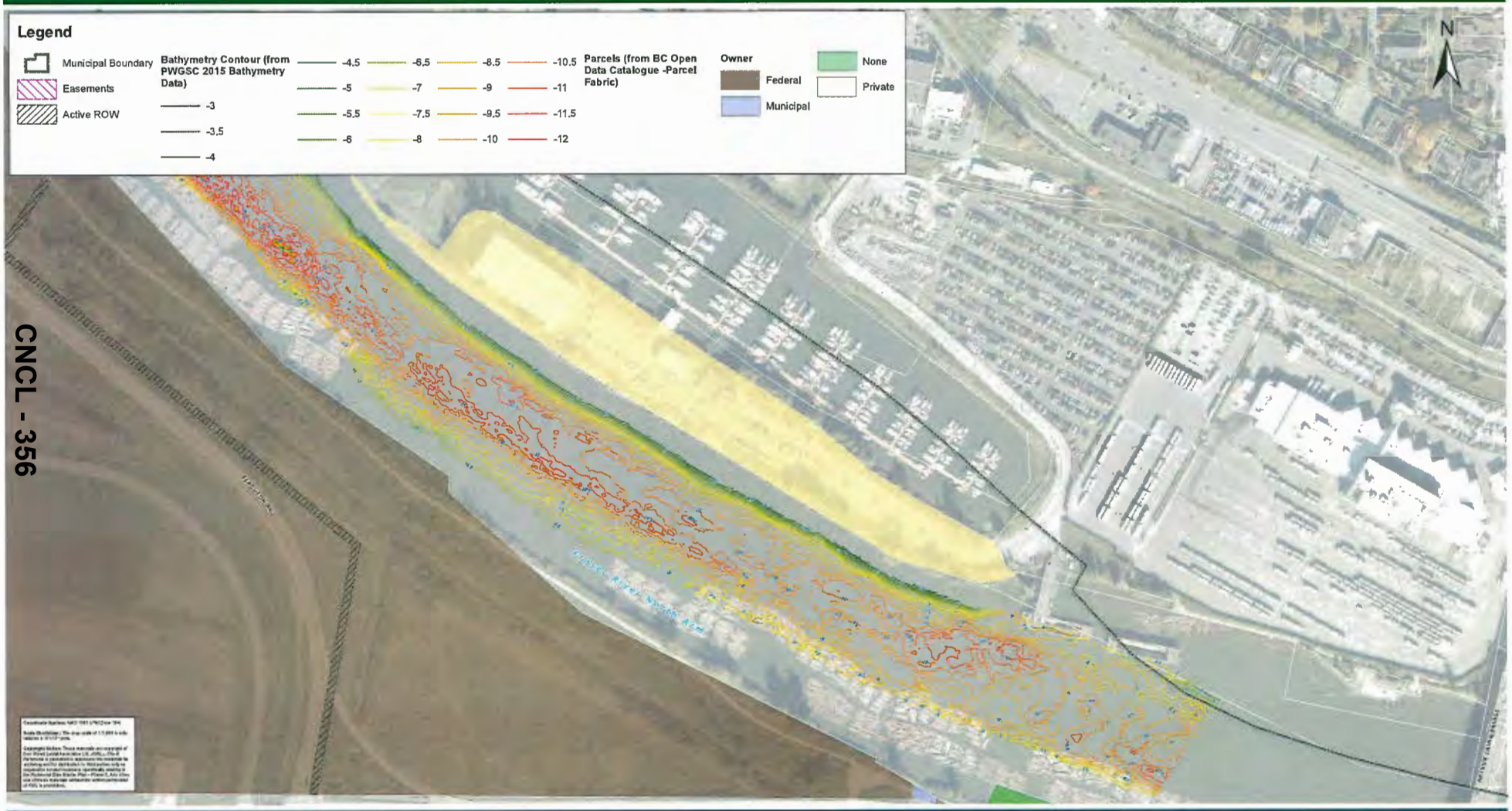
Figure 2-6

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Date February 2019

Scale 1:3,000

50 25 0 50 m

Bathymetry Contours - Richmond Island

Figure 2-7

3. Options Assessment

This section summarizes the options assessment process, including the following components:

- design considerations and design criteria;
- upgrading strategies;
- upgrading options and concepts;
- summary of external stakeholder consultation;
- options evaluation; and
- recommended options for implementation.

3.1 Design Considerations

This section summarizes the main themes and issues that have informed the development of upgrading strategies and options for Phase 5. This includes general design considerations applicable for all three islands, and site-specific considerations for each island as described below.

Dike Performance, Maintenance, and Upgrading

Dike performance, maintenance, and upgrading are the most important design considerations for the Dike Master Plan.

The following themes define an ideal vision for dike upgrading:

1. **Level of Protection:** The City's 2008-2031 Flood Protection Management Strategy sets a target level of protection for structural measures. The City is presently developing an updated Flood Protection Management Strategy that will have an even more ambitious flood protection level target. The level of protection translates to a hazard-based design flood scenario to be incorporated into the Dike Master Plan. At this time, the proposed design flood scenario for the City's perimeter dikes is the 500-year return period flood event (0.2 % annual exceedance probability, AEP) with climate change allowances including 1 m of sea level rise. For the river dikes, including those in Phase 5, this is determined as the site-specific maximum of spring freshet flood and a coastal winter flood (combination of tide/storm surge with Fraser River winter flow). However, the Dike Master Plan should be flexible to accommodate a future change in the design flood scenario in the future.
2. **Form and Performance:** The preferred form of a dike is a continuous, compacted dike fill embankment with standard or better geometry. Walls and other non-standard forms are less reliable and are not preferred. Phase 5 considers alternative structural flood protection options apart from a dike in undiked areas. The level of performance of flood protection works for Sea Island, Richmond Island, and Mitchell Island should be in line with the moderate population (mainly Sea Island) and assets that the dike protects. The dike should meet all relevant design guidelines of the day and in some cases, exceed guidelines to provide a higher level of performance. Dike performance can be expressed in terms of freeboard above the design flood scenario water level and factors of safety against various failure processes, including flood conditions and internal erosion (piping). The dike design should consider the need for regular and emergency maintenance.
3. **Passive Operation:** Minimal human or mechanical intervention or operation should be required to achieve full dike performance. To achieve this, the dike should not have any gaps, gates, or stop log structures.

4. **Enhance Performance** (slow failure)**:** There will always be uncertainties in dike design and performance, and completely preventing any dike failures cannot be guaranteed. However, the likelihood of a catastrophic dike failure causing significant flood damages can be reduced by design features that aim to slow down failure processes, provide redundancy, and provide time to implement emergency repairs. In general, failure can be slowed or controlled with additional setback, crest width, and armouring of the river-side slope, crest, and land-side slope. Such measures can slow the impacts of river erosion, overtopping erosion, and stability failures. Increased monitoring approaches and technology may also be helpful.
5. **Post-earthquake Protection:** The dike should provide adequate protection following a major earthquake until permanent repairs can be implemented. In general, this means avoiding dike conditions where a major earthquake results in a sudden and full failure of the dike cross-section into the river, referred to as a 'flowslide failure'. Other conditions where the dike crest settles, but still provides sufficient freeboard and factors of safety until repairs can be conducted may be acceptable. In general, increased crest width, crest elevation, and setback from the river may be undertaken to help achieve adequate post-earthquake protection. In some cases, improved seismic performance will also require ground improvement and densification works. The specifics of post-earthquake protection requirements are dependent on the seismic performance criteria currently under review as part of the Richmond Flood Protection Management Strategy update.
6. **Future Upgrading:** Uncertainty in climate change, particularly sea level rise timing, may require the City to further upgrade the dike sooner or higher than anticipated by current guidelines and policies. Sufficient space should be reserved under secured land tenure for future upgrading based on standard geometry. Conceptual design is provided for design flood levels which incorporate 1 m of sea level rise, and proof-of-concept design is provided for design flood levels which incorporate another 1 m water level increase for further climate change impacts (i.e. 2 m of sea level rise).

Some specific design considerations related to the above principles are presented in Table 3-1.

Table 3-1: Ideal Dike Design Principles and Considerations

Design Principle	Ideal Design Principles and Considerations
Level of Protection	• Currently proposed: 500-year return period (0.2% AEP) with climate change allowances as per provincial studies
Form and Performance	• Continuous, compacted dike fill with standard or better geometry • Crest elevation and adequate freeboard • Factors of safety against stability • Minimal infrastructure within the dike corridor • Adequate bank protection works or setback
Passive operation	• No gaps, gates, or stop logs • Passive monitoring (e.g. SCADA water levels)
Enhance Performance (slow failure)	• Wide dike crest • Armoured river-bank slope to resist erosion • Paved/armoured crest and/or land-side slope to resist overtopping • Wide setback from the river

Design Principle	Ideal Design Principles and Considerations
Post-earthquake Protection	• No loss of full dike geometry into the river ("flowslide failure") up to a return period to be determined • Adequate post-earthquake freeboard and stability until repairs • Wide dike crest and/or wide setback from the river
Future upgrading	• Space and tenure for upgrading (standard or better geometry) • Avoid need for future infrastructure relocation or land acquisition

Road Safety and Access

Dikes are often located adjacent to or under roads. The safety of drivers, cyclists, and pedestrians on existing roadways is a consideration in Phase 5. In Phase 5, some design options consider relocating the dike to an existing road (Sea Island) or raising roads to provide emergency egress (Mitchell Island). This includes Cessna Drive, Russ Baker Way, Lysander Lane, and Hudson Avenue on Sea Island, and potentially the entire road network on Mitchell Island.

City transportation engineering staff were consulted during the master plan development to provide input on dike upgrading concepts that will also improve road safety. Current options include providing the same level of service for vehicles, pedestrians, and cyclists as already provided. Travel lane and multi-use path widths are documented in the design criteria in Section 3.2.

Vehicle access to properties located along proposed upgrade areas is also an important consideration. Dike raising alignments that raise roadways will impact driveway access for commercial and industrial landowners. Land-use on these properties includes industrial and commercial. As such, a variety of vehicles, including semi-trailer trucks, need safe access from the roadways to these properties. Currently, these properties are generally at grade with and access is provided via asphalt or gravel driveways.

Driveway access was considered in options development by identifying several access upgrading concepts including land filling to raise sites to the dike/road level and raising driveways to tie-in with the upgraded roadways.

Shared Dike Responsibility with YVR on Sea Island

As previously noted, YVR and the City of Richmond share responsibility for the Sea Island perimeter dike. The options development and assessment only include concepts for the reach of the dike that the City is responsible for: from the Moray Channel Bridge to the southern property boundary of BCIT (approximately 1.1 km). The boundaries of YVR and Richmond jurisdiction have been discussed during consultation for the Dike Master Plan, and the figures in the report represent the discussed boundaries based on property ownership along this reach. Shared responsibility requires coordination with YVR at tie-in locations, and to ensure consistent dike upgrade criteria are used for the dike system.

Other reaches of the dike where the City owns land (discussed in Section 2) are understood to be YVR's responsibility, and the City will be consulted as YVR plans upgrades to the dike on City land. YVR has met with the City and noted its plans and progress to upgrade the Sea Island dike to 4.7 m CGVD28. YVR has already upgraded portions of the dike to this elevation along the south airfield and near Grauer Road. YVR plans to complete its own Dike Master Plan in the coming years to guide long-term dike upgrading.

As part of consultation with YVR, it was agreed that the two parties would work toward formalizing an agreement on dike jurisdiction.

Existing Commercial and Industrial Developments

Sea Island

The dike on the eastern side of Sea Island is closely hemmed in by the river and existing development. Dike improvements will impact waterfront access, the existing developments, and pedestrian access. Major developments along the dike include BCIT, Pacific Autism Family Center, Lysander Holdings Ltd, and the Pacific Gateway Hotel (Van-Ari Holdings Ltd). In addition, the dike closely parallels Cessna Drive in one location with no established dike right-of-way and a low crest elevation. Dike upgrading options consider limiting impacts to these developments while maintaining flood protection.

Mitchell Island

Mitchell Island is tightly constrained by industrial and commercial facilities, including private water-oriented industries and other commercial and industrial sites along the river bank with little setback or access. Dike construction would require significant land acquisition (discussed further below), and consideration of the functionality of industrial sites.

Future dike construction on Mitchell Island may be challenging due to conflicts with site functionality for water-oriented industries as the dike height increases, lack of existing or need for new dike rights-of-way, and limited access to the river bank. The Dike Master Plan considers non-standard dike structures to reduce space required, opportunities to separate the dike alignment from water-oriented industries, and land raising by property owners to allow for continued use of the industrial spaces.

Internal Drainage System

As with any diked area, the drainage for the protected interior area must be integrated with the flood protection measures such that the protected area does not experience flooding due to conflicting functions between the drainage of water from the interior area and prevention of flooding from water exterior to the dike system.

The Phase 5 islands have limited locations where drainage infrastructure is located within likely dike upgrade / construction areas. Drainage infrastructure along the current or potential future dike alignment is limited to pump stations with associated drainage ditches and several drainage pipes that cross the dike with outfalls in the Fraser River. Existing drainage pipes that cross dike upgrades may need to be relocated or upgraded to accommodate the proposed section. As part of upgrades at pump stations, the existing intakes, associated ditch, and outfall may need to be modified or extended, and the pump station piping should be reviewed to consider structural impacts of the preferred dike section. In addition, pump station upgrades in the future should consider higher outfall water levels due to sea level rise and the associated higher required pump capacity.

Land Raising and Acquisition

Land acquisition is an important consideration for the development and evaluation of dike upgrading options. In many areas, the existing dike corridor and river bank (in undiked areas) is confined on both sides by private property with little to no room for expansion of the dike footprint or construction of a new dike. On Mitchell Island in particular, the river bank is very densely developed with no existing dike corridor and minimal land tenure in favour of the City. In options development, the City noted it would prefer securing rights-of-way over acquiring land.

The master plan identifies land acquisition needs for various upgrading options for comparison.

An alternative to land acquisition may be land use planning and development control tools to raise private properties to the dike elevation to create a wide raised platform (similar to recent developments along the Middle Arm (e.g. Olympic Oval).

River Scour

Dike design along the Fraser River should consider the potential for scour that may undermine the dike. Bathymetry data is collected by the Vancouver Fraser Port Authority ("Port") in the main channel of the river to ensure navigation is unimpeded. Due to the navigational focus of the data collection, near-shore bathymetry along the islands in the Fraser River is not collected. In further stages of design beyond the Dike Master Plan, dike upgrades should consider local scour risks and potential collection of additional near-shore bathymetry data where the Port data indicates scour may be occurring. Due to the large size of the river, constructing bank protection works (riprap or other), below the scour depth is often not practical. Design could consider filling scour holes (see existing scour holes on Figures 2-4 to 2-7), or investigation of site-specific scour protection.

Sea Island Bridges

The Sea Island dike alignment at the north end of the City's reach ties into the Moray Channel Bridge (Ministry of Transportation ownership). The land between the Moray Channel Bridge and the Airport Connector Bridge (YVR ownership) is above the current dike level of 3.5 m CGVD28, based on 2016 EMBC LiDAR data. For future raises, the land between the bridges would need to be raised, but more significantly, the Moray Channel Bridge deck is below 4.7 m CGVD28 and poses a gap in the dike for the future design flood level. In the long term, it would be preferred if the bridge was replaced with a higher deck structure that at least meets the upgrade dike elevation of 4.7 m CGVD28 and exceeds the future dike elevation of 5.5 m CGVD28. The area north of the Miller Road right-of-way is on federal land and the dike in this area is understood to be YVR's responsibility. The City should consult with YVR and MOTI regarding raising the dike north of the Miller Road, the land between the two bridges, and Moray Channel Bridge in the long-term.

Mitchell Island Contamination

As a result of the long history of industry and fill from unknown sources, it is expected that a significant portion of Mitchell Island may be contaminated (according to City staff). This has implications for dike design in that material excavated may be contaminated and land acquisition would have greater cost and liability to address potential contamination. In addition, current land use on the island includes industries with oil, fuel, metals, and other potential pollutants, which present an environmental risk if the island were flooded.

Environmental Considerations

City of Richmond Bylaws

The City's Official Community Plan (OCP) bylaw (2012) includes an Ecological Network Management Strategy (ENMS) that identifies ecologically important areas in the City's Ecological Network (EN). These areas include Environmentally Sensitive Areas (ESAs), Riparian Management Areas (RMAs), and EN components (hubs, sites, and corridors, shoreline, city parks).

ESAs are designated as Development Permit Areas (DPAs) with specific restrictions and guidelines for development controlled through a review and permitting process (City of Richmond 2012). There are

five ESA types, based on habitat, each with specific management objectives. These are summarized in Table 3-2 and more detailed guidelines can be found in HB Lanarc-Golder and Raincoast Applied Ecology (2012). According to Richmond's OCP, dike maintenance is exempt from development permits in ESAs. However, the guidelines provide useful direction that can be used to minimize impacts to these areas and provincial and federal legislation (see below) still applies to these areas.

RMAs are setbacks that were implemented in accordance with the Provincial *Riparian Areas Regulation* of the *Riparian Areas Protection Act* (formerly the *Fish Protection Act*) and act as pre-determined Streamside and Protection Areas (SPEAs) under the Act. They extend 5 m or 15 m back from the top of bank of the City's higher value drainage channels or more natural watercourses and are to remain free from development unless authorized by the City (City of Richmond, 2017). RMAs are not present in Phase 5 reaches.

Hubs, sites, and corridors are components of the City of Richmond's EN, which aren't specifically afforded protection, but often overlap ESAs and RMAs, which are protected. These components are present on Sea Island and Richmond Island.

Dike upgrade options will consider the potential impacts to these areas.

Table 3-2: City of Richmond ESA Type Management Objectives

ESA Type	Reaches Where Present	Management Objectives
Intertidal	All	• Prevent infilling or direct disturbance to vegetation and soil in the intertidal zones • Maintain ecosystem processes such as drainage or sediment that sustain intertidal zones
Shoreline	All	• Preserve existing shoreline vegetation and soils, and increase natural vegetation in developed areas during development or retrofitting
Upland Forest	None	• Maintain stands or patches of healthy upland forests by preventing or limiting tree removal or damage, and maintaining ecological processes that sustain forests over the long-term
Old Fields and Shrublands	None	• Maintain the extent and condition of old fields and shrublands, while recognizing the dynamic nature of these ecosystems • Preservation should recognize the balance between habitat loss and creation with the overall objective of preventing permanent loss of old fields and shrublands
Freshwater Wetland	None	• Maintain the areal extent and condition of freshwater wetland ESAs by preserving vegetation and soils, and maintaining predevelopment hydrology, drainage patterns, and water quality
Source: (City of Richmond 2012)		

Fish Habitat and Offsetting

Fish and aquatic habitat is protected by the federal *Fisheries Act*. Under the Act, *serious harm to fish* must be authorized by the Minister of Fisheries and Oceans and impacts that cannot be avoided or mitigated must be balanced through offsetting. Offsetting plans are negotiated on a case-by-case basis and may require consultation with Aboriginal groups and the Province. Offsetting measures may include habitat restoration or enhancement and habitat creation, and must be proportional to the loss caused by the project.

Often, the amount of offsetting habitat created is greater than the area of habitat impacted. The area of offsetting may need to be increased to account for uncertainty with the effectiveness and time lag between impacts and offsetting. Selecting offsetting locations and beginning habitat creation works prior to all impacts occurring can help to reduce requirements for additional offsetting area required due to lag time. Creation of a smaller number of larger area habitat restoration, enhancement, or creation sites would allow for a more efficient use of resources and potentially reduce uncertainty.

Where possible, impacts to existing habitat compensation sites should be avoided. Where impacts to these sites are not avoidable, habitat offsetting will likely be required, and requirements will be determined through discussions with Fisheries and Oceans Canada (DFO).

Wildlife Considerations

Migratory birds, their eggs, and active nests are protected by the *Migratory Birds Convention Act* and appropriate measures must be taken to avoid incidental take. The most effective and efficient of these measures includes scheduling vegetation clearing outside of the migratory bird nesting season. If this is not possible, bird nest surveys can be completed immediately prior to vegetation clearing to identify active nests and delay vegetation clearing until the nest is no longer active.

The nests of Bald Eagles, herons and other raptors (both active and inactive) are protected under the provincial *Wildlife Act*. It is also prohibited under the *Wildlife Act* to disturb or harm birds and their eggs. The detailed design stage for dike upgrading should attempt to avoid the removal of trees where bald eagle nests are located.

Native amphibian species may use the drainage channels on the land side of the dike at certain times of year. These species are protected by the provincial *Wildlife Act* and detailed design should also consider potential impacts to these species

3.2 Design Criteria

This section describes the main design criteria used in the Phase 5 Dike Master Plan. These criteria were developed and reviewed in collaboration with City staff.

Table 3-3 presents a summary of the criteria and is followed by additional discussion. The criteria are presented in terms of both what is the minimum acceptable level and the preferred level.

Table 3-3: Phase 5 Design Criteria Summary

Item	Value and Description	
	Minimum Acceptable	Preferred
Proposed Dike Crest Elevation	4.7 m CGVD28 downstream of Nelson Road (all of Phase 5)	
Future Dike Crest Elevation (for proof-of-concept design)	5.5 m CGVD28 downstream of Nelson Road (all of Phase 5)	
Geometry and Stability	4 m wide crest with dike fill core 3H:1V land-side slope 3H:1V river-side slope (or 2H:1V with riprap revetment) Retaining walls minimized Sheetpile walls acceptable only with minimum 4 m wide dike fill core behind wall No standalone flood walls Meet minimum geotechnical factors of safety	Meets or exceed provincial dike standard and City dike standard
Land Tenure	Registered standard right-of-way	Dike located on City-owned land
Infrastructure in Dike	Crossings designed with seepage control Locate parallel infrastructure to land-side away from dike core	No infrastructure in dike
Land Adjacent to Dike	Land is raised as much as is practical	Land is raised to meet or exceed dike crest elevation
Seismic Performance	Seismic performance criteria currently under review as part of the pending Richmond Flood Protection Management Strategy update and further consultation with the Province.	
River-side Slope, Setback, and Vegetation	2H:1V bank slope with riprap revetment designed for freshet flow velocities and vessel-generated waves Vegetation in/near the dike should adhere to provincial guidelines	>10 m setback between river top of bank and dike river-side slope toe 3H:1V river-side bank slope with acceptable vegetation
Crest Surfacing, Land-side Slope Treatment, and Vegetation	Crest surfacing: 150 mm thick road mulch Land-side slope treatment: hydraulically seeded grass Vegetation in/near the dike should adhere to provincial guidelines	Meet or exceed provincial dike standard and City dike standard Consider paved crest and land-side slope vegetation/armouring to add robustness against overtopping
Road Design Width[a]	0.5 m allowance for barrier & 0.6 m min horizontal clearance on road shoulders 3.5 m travel lanes (to existing service level) 3.0 m multi-use path for non-industrial Total width (2-lanes): 9.2 m	0.5 m allowance for barrier & 0.6 m min horizontal clearance on road shoulders 1.5 m min. boulevard along shoulders 1.5 m sidewalks or 3 m two-way path [b] 3.0 m two-way cycling path to replace existing facilities [b] 3.5 m travel lanes (to existing service level)

a. Based on City of Richmond Engineering Design Specifications for Roadworks (2008) and City staff input. https://www.richmond.ca/__shared/assets/Roadworks20127.pdf
b. For industrial areas (Mitchell Island), cycling facilities and two-way paths are not included (maintains current level of service).

Dike Crest Elevation

At this time, the Province has not established an official Fraser River flood profile and dike design profile that considers sea level rise and climate change. It is understood that the Fraser Basin Council's Lower Mainland Flood Management Strategy project may produce a recommended future flood profile. The most recent available flood profile information is provided in the Province's 2014 study of climate change and sea level rise effects on the Fraser River flood hazard (MFLNRO, 2014).

The designated flood profile for developing the master plan is proposed as the site-specific maximum of the following flood scenarios:

- 500-year return period coastal water level with 1 m of sea level rise (no wind/wave effects) with winter Fraser River flood flow; and
- 500-year return period freshet with moderate climate change impacts and 1 m of sea level rise.

Figure 3-1 shows the estimated flood profile water levels (in CGVD28 vertical datum, excluding wind/wave effects and freeboard) along the river in the study area. As shown on the figure, the coastal flood scenario governs from the Ocean upstream to approximately Nelson Road.

Dike crest elevations are derived by adding freeboard and an allowance for land subsidence to the flood level. Adequate information on wind/wave effects is not available at this time and is a consideration in the pending Richmond Flood Protection Management Strategy update. However, it is generally assumed that the dike reaches within Phase 5 are not significantly impacted by wind/wave effects. This assumption should be confirmed during detailed design. Table 3-4 presents the components that sum to the proposed dike crest elevation for Phase 5, which is entirely located in the area governed by the coastal flood hazard.

Table 3-4: Phase 5 Flood Levels and Dike Crest Elevations

Item	Downstream of Nelson Road
Governing Flood Hazard	Tide + storm surge (with historic winter Fraser River flow)
Level of Performance	500-year return period (0.2% annual exceedance probability)
Climate Change Allowance	1 m sea level rise
Designated Flood Level (m, CGVD28) [a]	3.8
Wind/Wave Effects Allowance (m)	None
Freeboard (m)	0.6
Land Subsidence Allowance (m)	0.2
Minimum Dike Crest Elevation (m, CGVD28) [b]	4.7[d]
Future Dike Crest Elevation (m, CGVD28) [c]	5.5[d]

Notes:
a) From (BC MFLNRO, 2014).
b) The City's adopted downstream design crest elevation (4.7 m) exceeds the minimum required elevation (4.6 m). This is a result of updated coastal water level analysis methods (joint probability analysis) that result in a discrepancy when compared to previous methods (additive method).
c) Expandable for an additional 1 m of sea level rise (no additional freeboard or land subsidence allowance).
d) Dikes may need to be overbuilt to achieve target crest elevation following post-construction settlement. This should be addressed by an additional site-specific crest elevation allowance to be determined during detailed design.

The master plan also allows for further upgrading by providing proof of concept for raising to between 5.5 m downstream of Nelson Road (coastal).

Seismic Performance

The current provincial seismic performance criteria for dikes[3] are generally difficult to meet without costly and impractical ground improvement works. Additionally, the guidelines are considered very conservative in some situations because they require performance under extremely rare scenarios. For example, the guidelines require dikes to maintain 0.3 m freeboard in the event of a 10-year return period flood occurring following a 2,475-year return period earthquake which has a probability of 0.004% in a 1-year period. This is significantly rarer than the design event for the dike crest elevation (500-year return period event has a 0.2% annual exceedance probability).

It is understood that the Province is conducting a review of the current criteria and associated guidelines. In January 2019[4], the Province released a status update for the two components of the review and clarifications on the existing guidelines:

- Dike Consequence Classification (anticipated to be completed in 2019); and
- Seismic Assessment and Geotechnical Investigation of Lower Mainland Dikes (anticipated to be completed in 2021).

The seismic performance criteria for dikes in Richmond are currently under review as part of the pending update to the Richmond Flood Protection Management Strategy, with consideration of potential alternative performance approaches. As a result, City-specific seismic performance criteria are not established as a part of Dike Master Plan Phase 5, with the expectation that this will be further developed and discussed as part of the Flood Protection Management Strategy, and in discussion with the Province.

Vegetation

Vegetation on and adjacent to the dike should adhere to provincial vegetation guidelines[5]. These guidelines limit vegetation on the dike crest, side slopes, and landside toe predominantly to trimmed grass, with specific situations where other vegetation may be allowed (overwide dikes, natural levees, setback dikes). The guidelines include consideration for variations that may be considered for sensitive habitat:

> "Where environmental agencies have significant concerns for areas of sensitive habitat (such as historically overgrown works and/or FREMP red-coded areas), variations from these guidelines may be considered to increase protection of habitat where practical and economic, provided public safety is not compromised."

Richmond could consider developing more prescriptive City-wide dike vegetation management guidelines, which would require acceptance by the Province. Such guidelines could consider opportunities to increase the robustness of dikes, while accommodating vegetation beyond trimmed grass (e.g. exploring methods to armour dikes against overtopping erosion while accommodating shrubs and small trees).

[3] Seismic Design Criteria for Dike. 2nd Edition, June 2014. Ministry of Forests, Lands, and Natural Resource Operations Flood Safety Section. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/seismic_guidelines_dikes-2014-2nd_edition.pdf
[4] https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/iod_letter_re_seismic_2019.pdf
[5] Environmental Guidelines for Vegetation Management on Flood Protection Works to Protect Public Safety and the Environment. http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/env_gd_veg_man.pdf

3.3 Alternative Upgrading Strategies

Several high-level upgrading strategies, summarized in Table 3-5, were considered to inform the development of specific options for the Dike Master Plan.

Table 3-5: High-level Dike Upgrading Strategies

Strategy	Advantages	Disadvantages
Road Dike *Raise adjacent road to dike crest elevation*	• Smaller footprint • Wider crest (more robust) • Smaller impacts to habitat	• Operation and maintenance challenges • Infrastructure within dike • High cost to raise dike in the future
Raise Riverbank Dike *Conventional dike along riverbank extending land-side*	• Minimize footprint	• Limited space • Impacts to river side riparian and intertidal habitat and land side riparian and aquatic habitat • Reduced seismic performance • Erosion hazard
Fill River-Side Dike *Build into river to achieve conventional dike*	• Less impacts to existing development and on-shore infrastructure	• Larger impacts to river side riparian and intertidal habitat • Reduced seismic performance • Erosion hazard
Setback Dike *Realign significantly away from river*	• Increased seismic performance • Reduced erosion hazard • Increased opportunities for riparian and intertidal habitat enhancement	• Increase in unprotected development • High infrastructure impacts • High cost to construct new dike alignment
Land Raising ("superdike") *Raise development and roads adjacent to dike*	• Wider crest (more robust) • Reduced grading issues (after implementation) • Less impacts to raise a dike in the future	• Timing and phasing depends on development • High cost to raise large lots with low-density land use • Grading and access issues for water-oriented developments
Bank Protection Works Only *Protect the river bank from erosion*	• No City responsibility for a dike • Reduced impacts to industrial and commercial activities	• Reliance on private development reliance for land raising • Acceptance by property owners of flood risk • Environmental impact (river works and flooding related contamination)

3.4 Options and Concepts

Through a series of meetings and site visits with City staff, the high-level upgrading strategies have been narrowed down to a set of options and concepts that may be appropriate for each island. The broad overall options developed for Phase 5 are listed below, with specific options by island in the following sections.

- Option 1: Build/raise dike
    - Option 1a: Build/raise standard river dike and extend land-side
    - Option 1b: Build/raise standard river dike and extend river-side
    - Option 1c: Build/raise dike with land-side retaining wall
- Option 2: Raise land
    - Option 2a: Raise land to dike elevation
    - Option 2b: Raise land to acceptable level of flood protection
- Option 3: Maintain/install bank protection works only
- Option 4: No structural improvements

In addition to the above general options, the following options have been developed to address site-specific issues at water-oriented industries and at select other locations.

- Option 1d: Build/raise dike with sheetpile wall on river-side (Mitchell Island water-oriented industry)
- Option 1e: Build setback dike along Cessna Drive North of BCIT
- Option 1f: Build setback dike around hotel on Sea Island
- Option 1g: Raise dike with river-side sheetpile wall and land-side retaining wall along hotel on Sea Island (interim option)
- Option 2c: Raise roadways with required land raising on private property on Mitchell Island

Table 3-6 presents a summary of the options as applied to each island based on discussions with City staff and is followed by a discussion of the options.

Table 3-6: Major Dike Alignment and Cross-section Options

Reach ID & Name	Alignment and Cross-section Options
Mitchell Island: General	• Option 1a: Build standard river dike and extend land-side • Option 1b: Build standard river dike and extend river-side • Option 1c: Build dike with land-side retaining wall • Option 2a: Raise land to dike elevation • Option 2b: Raise land to acceptable flooding level • Option 2c: Raise roadways with required land raising on private property • Option 3: Maintain/install bank protection works only • Option 4: No structural improvements
Mitchell Island: Water Oriented Industries	• Option 1d: Build dike with sheetpile wall on river-side
Sea Island: General	• Option 1a: Raise standard river dike and extend land-side • Option 1b: Raise standard river dike and extend river-side • Option 1c: Raise dike with land-side retaining wall (at constrained locations) • Option 2a: Raise land to dike elevation

Reach ID & Name	Alignment and Cross-section Options
Sea Island: Pacific Gateway Hotel and at Cessna Drive north of BCIT	• Option 1e: Build setback dike on Cessna Drive North of BCIT • Option 1f: Build setback dike around hotel • Option 1g: Raise dike with sheetpile wall on river-side and land-side retaining wall (interim option)
Richmond Island: General	• Option 2a: Raise land to dike elevation • Option 2b: Raise land to acceptable flooding level • Option 4: No structural improvements

Option 1A: Build/Raise Standard River Dike and Extend Land-side

The primary option developed for Mitchell Island and Sea Island involves raising or constructing a standard dike and extending the footprint of the fill towards the land-side. Figure 3-2 presents a typical cross-section for this option, and Appendix A contains plan and section views of the footprint of this option for Sea Island.

Figure 3-2 shows a 10 m wide dike crest for a dike elevation of 4.7 m CGVD28. This overwide dike allows for raising to 5.5 m CGVD28 without additional dike footprint needs. Alternatively, the dike could be narrowed to a 4 m crest initially, which would require additional land for future raises. The river bank slope of the dike would include riprap bank protection works. This option is favourable as it would provide a standard dike as per the provincial dike design guidelines without impacting the foreshore beyond the installation of bank protection works. Where bank protection works is not already present, its installation will result in the loss of riparian habitat, which will require offsetting. There is no loss of riparian or aquatic habitat anticipated on the land side of the dike.

On Sea Island, this option is feasible for the majority of the City's dike reach and requires on average an additional 10 to 12 m beyond the current dike toe. However, there are several locations where this dike option could not currently be constructed due to limited space available for the dike (near hotel buildings/infrastructure, the marina, and Cessna Drive immediately north of BCIT). There may also be insufficient space in some additional locations for the future raise to 5.5 m CGVD28 (along BCIT and near Lysander Lane). Rights-of-way or land acquisition is required north of Lysander Lane and for a small section immediately north of the BCIT property. The dike upgrade may require upgrades at the Miller Road Drainage Pump Station, and relocation existing utilities and lighting along the dike path. The existing multi-use path would be maintained at the crest.

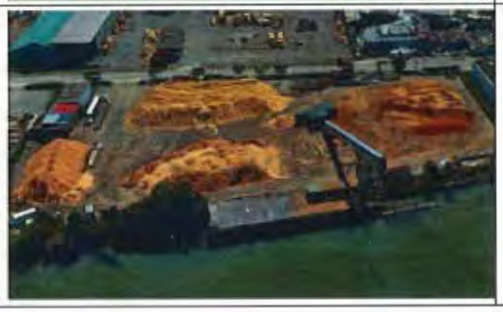
On Mitchell Island, there is currently no dike (or the previous dike has not been maintained or inspected). As a result, building a standard dike would require land acquisition or right-of-way for the entire perimeter of the island, with the exception of one small section where a right-of-way already exists. On average, this option would require 7 to 8 m of land from the riverbank landwards. There are several locations on Mitchell Island where construction of a dike would impact permanent or temporary structures, and many more where it would impact industrial operations. For some industrial sites, water access is required, and a standard dike may not be preferable. Any dike upgrade would require upgrades at the Tipping Road South and Mitchell Road South drainage pump stations. For all options, the Twigg Island sanitary forcemain (north side) and a watermain south of Paige Street underly the proposed dike and would need to be considered during detailed design. As Mitchell Island is industrial, a multi-use path would not be included along the dyke crest.

The areas with the most severe space limitations and potential options to address the access issues are presented in Table 3-9.

Table 3-7: Significant Space Limitations and Access Issues

Reach / Location / Description	Photo	Options to Address Footprint and Access
Sea Island Cessna Road north of BCIT property STA 0+430 to 0+460 (refer to Appendix A)		• Retaining wall on landside • Move dike towards River (see Option 1B) • Replace pump station during dike upgrades
Sea Island Pacific Gateway Hotel and Marina STA 0+850 to 1+000 (refer to Appendix A)		• Retaining walls and raised Marina access (see Option 1C) • Relocation of existing utilities and movement of temporary infrastructure
Sea Island Moray Channel Bridge and Airport Connector Bridge STA 1+070 to 1+130 (refer to Appendix A)		• Consider dike elevation in future bridge replacement deck elevation • Raise the land between the two bridges to dike elevation in the interim

Reach / Location / Description	Photo	Options to Address Footprint and Access
Mitchell Island Lafarge 13340-13360 Mitchell Rd STA 0+320 to 0+520 (refer to Appendix A)		• Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D)
Mitchell Island Terminal Forest Products Ltd. (south side) 12480-12380 Mitchell Rd STA 1+200 to 1+350 (refer to Appendix A)		• Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D)
Mitchell Island Richmond Steel Recycling - Broadway Properties Ltd 11760 Mitchell Road STA 1+400 to 1+450 (refer to Appendix A)		• Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D)
Mitchell Island Ontrack Systems Inc. (Container West & Platinum Marine) 11660-11580 Mitchell Rd STA 1+900 to 1+700 (refer to Appendix A)		• Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D)

Reach / Location / Description	Photo	Options to Address Footprint and Access
Mitchell Island Tipping Road South Drainage Pump Station STA 2+000 (refer to Appendix A)		• Replace pump station during dike upgrades
Mitchell Island Mitchell Road South Drainage Pump Station STA 2+000 (refer to Appendix A)		• Replace pump station during dike upgrades
Mitchell Island Grand Hale Marine Products Ltd. 11551-11571 Twigg Pl STA 5+150 to 5+400 (refer to Appendix A)		• Raise existing access points and provide dike crest access • Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D)
Mitchell Island Terminal Forest Products Ltd. (south side) 12191 Mitchell Rd STA 5+800 to 5+950 (refer to Appendix A)		• Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D)

Reach / Location / Description	Photo	Options to Address Footprint and Access
Mitchell Island Lehigh Hanson Materials Ltd. 12571 Mitchell Rd STA 6+150 to 6+350 (refer to Appendix A)		• Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D)
Mitchell Island Goldwood Industries Ltd. 12691 Mitchell Rd STA 6+350 to 6+520 (refer to Appendix A)		• Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D) *currently operating partially on City of Richmond road dedication
Mitchell Island Savo Lazarian (owner) 13611 Mitchell Rd STA 7+300 to 7+400 (refer to Appendix A)		• Raise existing access points and provide dike crest access • Raise parcel of land at time of redevelopment (see Option 2) • Install sheetpile wall on the riverbank to allow continued river access (see Option 1D)

Option 1B: Build/Raise Standard River Dike and Extend River-Side

A secondary option developed for Mitchell Island and Sea Island involves raising or constructing a dike by extending the footprint of the fill towards to the river-side (onto the Fraser River foreshore in some locations. Figure 3-3 presents a typical cross-section for this option.

Figure 3-3 shows a 10 m wide dike crest, which would be wide enough to accommodate a dike upgrade to 5.5 m CGVD28 without increasing the footprint. This approach would reduce the frequency of impact to the riparian or intertidal habitat by disturbing it more initially to prevent disturbance again when it is upgraded. Alternatively, the dike could be only 4 m wide initially, and require extension for future upgrades. Option 1B would result in the loss of aquatic habitat, which would need to be offset. The river bank slope of the dike would include riprap bank protection works at a minimum, but it could also include a riparian planting bench, saltmarsh, or bioengineering bank protection works to offset riparian habitat impacts. Work in the foreshore would require land acquisition, rights-of-way, or lease from the Province. This option provides a standard dike as per the provincial dike design guidelines and reduces impacts to adjacent properties; however, it would have negative environmental impacts and is not preferred for stability considerations building onto the river foreshore.

On Sea Island, this option could be considered in specific locations that are presently constrained (Cessna Drive north of BCIT), or locations that will be constrained in the future (Lysander Lane and BCIT). This option is generally not preferred for the entire dike reach, due to constraints near the hotel and at the Miller Road pump station, stability building on the foreshore, and habitat impacts. At Cessna Drive north of BCIT, only a small length of the dike runs directly along Cessna Drive and the dike is set back from the river bank. As a result, Option 1B could be selected for a short length in this location with relatively limited environmental impacts and without requiring any construction down the river bank itself. The existing multi-use path would be maintained at the crest.

On Mitchell Island, this option would reduce the need for land acquisition but the need for rights-of-way and access remains the same, given the present lack of access to the riverbank. Option 1B could be considered to reduce impacts to existing operations, though it was not preferred by the City in options development. As Mitchell Island is industrial, a multi-use path would not be included along the dyke crest.

The significant access and space constraints described in Table 3-8 are generally applicable to Option 1B as well.

Option 1C: Build/Raise Dike with Land-Side Retaining Wall

Option 1C involves building a dike with a landside retaining wall. This option was developed for specific locations on Mitchell Island and Sea Island where space is constrained by existing buildings on the land-side. No habitat impacts are anticipated on the land side of the dike in these locations. Riprap installation would, however, impact riparian habitat on the river side. Figure 3-4 presents a typical cross-section for this option.

Figure 3-4 shows a 7 m wide dike crest and retaining wall, which would be wide enough to accommodate a dike upgrade to 5.5 m CGVD28 without increasing the footprint. Alternatively, a narrower (~4.5 m) retaining wall dike could be considered as an interim measure and an alternative option be implemented when a site is redeveloped. Retaining walls should consider the need for handrails for safety, in accordance with applicable regulations.

On Sea Island, this option could be considered in several locations, as described below. The existing multi-use path would be maintained at the crest.

- Along the northern end of the BCIT building where the existing space may not be sufficient for a future raise to 5.5 m CGVD28.
- Immediately north of the BCIT property at Cessna Dr, where the existing space is not sufficient for a dike upgrade without impacting Cessna Dr. or moving the dike towards the river side. A retaining wall would likely not be sufficient to raise to 5.5 m without moving the dike towards the river.

On Mitchell Island, retaining walls are commonly used, and the City has recently approved a development with lock block walls used to reach the required elevation for flood protection. Dikes with retaining walls could be considered as an interim measure until redevelopment, or in locations where water access for industry is not required but the footprint needs to be narrower than a standard dike. As Mitchell Island is industrial, a multi-use path would not be included along the dyke crest.

The significant access and space constraints described in Table 3-8 are generally applicable to Option 1B as well, though it may be able to address some of the concerns on Sea Island.

Option 1D: Build/Raise Dike with Sheetpile Wall on River-Side

Option 1D involves building a dike with a river-side sheetpile wall. This option is only considered for specific locations on Mitchell Island where access is required for water-oriented industries (see Table 3-8), or potentially at pump stations to reduce space requirements. Figure 3-5 presents a typical cross-section for this option.

Figure 3-5 shows a 4 m wide dike crest and sheetpile wall, which would require raising and an increase in footprint for future upgrades. This approach reduces the overall footprint at first. Alternatively, the dike could be widened to a 7 m crest initially, which would allow for future upgrading to 5.5 m CGVD28 without extending the footprint. The sheetpile wall could provide a vertical surface for easier barge access (as it is in several locations currently on Mitchell Island), or it could be setback and the existing river bank slope maintained. A sheetpile wall could also be considered in conjunction with land raising (Option 2). This option would limit impacts to riparian and aquatic habitat. As Mitchell Island is industrial, a multi-use path would not be included along the dyke crest.

Option 1E: Build Setback Dike on Cessna Drive North of BCIT (Sea Island)

This option considers an alternative dike alignment on Sea Island that follows Cessna Drive from the northern end of the BCIT property to Miller road and ties back into the dike at the Miller Road drainage pump station. Figure 3-6 presents a typical cross-section and Figure 3-7 presents a plan conceptual alignment.

Cessna Drive directly parallels Russ Baker Way with only a concrete no-post barrier between, and as a result, creating a setback dike along Cessna Drive would also require raising Russ Baker Way. An alternative to raising Russ Baser Way would be to construct a retaining wall for Cessna Drive, which has not been shown in the attached figures. Figure 3-6 shows Cessna Drive raised with an 11.7 m wide crest, with two driving lanes and a sidewalk on the east side, to match existing amenities. The existing utilities that run along Cessna Drive would need to be relocated. Russ Baker Way would be raised to the 4.7 m CGVD28, with three lanes of traffic on either side of the road and a 1.2 m wide median diving the road. The raised road would tie into the existing high-ground/berm that around the eastern side of Burkeville. To better allow for future raises on Cessna Drive and to improve cycling safety, this option proposes that the north and southbound bike lanes be separated from the roadway and located on the berm above Burkeville. This option would require realignment of the existing drainage ditch and pump station, or relocation closer to Russ Baker Way.

The benefits of this option are that it creates a wide "superdike" (more stable), reduces the risk of dike erosion by setting it back from the river bank, does not require impacts to aquatic or riparian vegetation, and raises an important transportation corridor that could provide egress in a dike breach scenario. However, this option has significant drawbacks as it would be a significant cost to raise such a major roadway and relocate utilities, disrupt traffic on a busy corridor, and it would leave four properties outside of the dike without City flood protection, one of which recently built a 4.7 m CGVD dike.

Option 1F: Build Setback Dike around Hotel (Sea Island)

Option 1F considers an alternative dike alignment on Sea Island around the Pacific Gateway Hotel, which would place the hotel outside of the dike. The existing dike is closely hemmed in by the hotel and the marina and restaurant on the landside. There is no room for a standard dike raise in this location without relocating buildings and infrastructure or constructing a non-standard dike with a retaining wall or similar. In the long term (to achieve 5.5 m CGVD28), maintaining the current dike alignment would require removal or relocation of some buildings and on-site infrastructure, which could occur when the site is eventually redeveloped. In addition, ongoing work along this section has installed infrastructure in or along the dike without consideration of impacts to the dike. Figure 3-7 presents a plan conceptual alignment for the setback dike.

Figure 3-7 shows the setback dike following Lysander Lane, connecting to Cessna Drive, and tying back into the existing dike alignment at the Miller Road drainage pump station. Land acquisition on the border of the hotel property could be considered to avoid raising Cessna Drive where it is directly adjacent to Russ Baker Way, to avoid also needing to raise Russ Baker Way. Alternatively, Russ Baker Way could also be raised, similar to the description in Option 1E. The existing utilities that run along Cessna Drive, and Lysander Lane would need to be relocated to the water or landside toe. This option would require realignment of the existing drainage ditch and pump station or relocation closer to Russ Baker Way.

This option could provide a wider and more stable dike setback from the river and associated erosion risk and impacts to riparian and aquatic habitat would be limited. However, the dike in its current location is already afforded some protection by the adjacent Marina and setting back the dike leaves the hotel property unprotected from flooding.

Option 1G: Raise Dike with River-Side Sheetpile Wall and Land-Side Retaining Wall (Interim Option on Sea Island by Hotel and Marina)

Option 1G involves an interim non-standard dike raise to 4.7 m CGVD28 with a sheetpile wall on the along the river bank and a landside retaining wall. This option would only be appropriate for the Sea Island dike along the Pacific Gateway Hotel and adjacent marina, where the developments limit raising a standard dike without redevelopment. When the site is developed, a standard dike (Option 1A) could be established. An interim option is considered for this location as it is currently one of the lowest elevation areas on the Sea Island dike, with several locations below the current dike design elevation of 3.5 m CGVD28. Figure 3-8 presents a conceptual cross-section for the interim dike.

Figure 3-8 shows a 4 m wide dike crest with sheetpile wall along the top of the existing river bank and a landside retaining wall. Retaining walls should consider the need for handrails for safety, in accordance with applicable regulations. The existing multi-use path would be maintained at the crest. This option would require raising the access ramps to the marina restaurant. This reduced footprint would result in less loss of riparian and aquatic habitat area.

Option 2: Raise Land to Dike Elevation (2A) or Lower Acceptable Level (2B)

Option 2A and 2B both involve raising the land adjacent to the riverbank, rather than building a dike. For option 2A, land would be raised to the dike elevation or higher, and in Option 2B land would be raised to a lower level that would result in an acceptable level of flood protection, which could be determined by the City during the Dike Master Plan and through stakeholder consultation. It is expected that land raising would either be required by the City when sites redevelop (cost to owners) or that the City would purchase land, raise it, and resell it as improved land. This could be considered on Mitchell Island or Richmond Island. Option 2B would not be considered for Sea Island. Figure 3-9 shows a typical section of land raising.

In both options, bank protection works would be recommended, and it could be installed and maintained by property owners or by the City. The benefit of this option is that it would provide more robust flood protection by raising all of the land on the river bank rather than constructing only a perimeter dike; however, the City would likely need to stipulate acceptable fill and compaction standards to avoid the use of unacceptable or contaminated fill. The downside of this option is that it would likely delay flood protection upgrades until a site develops (in some instances this may not occur for a significant length of time. In such instances, the City may need to consider interim flood protection options or purchasing of the land to expedite upgrades. Riprap bank protection works would result in the loss of riparian habitat which will need to be offset.

On Sea Island, Option 2A could be considered along the entire reach in the long-term, but it might be particularly applicable for the hotel property due to the tight constraints for the existing dike alignment. In this location, the dike could be raised with a retaining wall or similar in the short-term, with a long-term plan to raise the property. On Mitchell Island, raising the land is favourable as the City does not have access or a right-of-way to establish a dike. In addition, land raising by owners would likely have fewer impacts on water-oriented industries than a perimeter dike, which would require appropriate access for the industrial activities. Land raising in these instances could be considered with a sheetpile wall along the waterfront, as exists in several locations already.

Option 2C: Raise Roadways with Required Land Raising on Private Property (Mitchell Island)

Option 2C involves raising the entire road network on Mitchell Island to the dike elevation or lower level and providing access to property owners, with the requirement for private properties to raise their land to dike elevation through redevelopment. This would provide flexibility to properties where land raising is in conflict with industrial activities, but it would maintain an egress route (raised road) for all properties. In addition, this option would include progressive right-of-way acquisition for a future perimeter dike as properties redevelop. Figures 3-10 and 3-11 show a conceptual plan and section of raising the roads on Mitchell Island to 4.1 m CGVD28 (dike elevation less freeboard of 0.6 m); raising roads to the full dike elevation of 4.7 m CGVD28 could be considered in the longer term as sites raise land. Figure 3-12 shows a typical cross-section for right-of-way acquisition along the river.

Figures 3-10 and 3-11 show a 12 m wide roadway with sidewalks and boulevards on both sides, to match existing conditions, which results in an approximately 18 m wide roadway, as per the City of Richmond Engineering Design Specifications for Roadworks. No cycling facilities would be provided given the industrial zoning of Mitchell Island. Driveway accesses would be 13 m wide at a maximum grade of 8%. The current road elevations are 2 to 3 m CGVD28, and as a result raising the roads to the dike elevation would 1 to 2 m of road raising, as shown on Figure 3-10. For road raising with adjacent low properties, the design would need to consider narrowing roadways or constructing retaining walls to avoid impacting private property. Right-of-way acquisition around the riverbank would allow for

maintenance or construction of bank protection works if required and construction of a perimeter dike in the future for dike elevations beyond 4.7 m CGVD28.

The most challenging aspects of this option would be balancing road raising with site access and existing building located along the roadways. As the island is largely industrial, acceptable grades and widths are important for industrial traffic and operations, and there are many locations where current buildings are located directly along the roads with little to no setback. As a result, the implementation would need to consider impacts to adjacent properties, timing of property redevelopment with roadways, and acceptable access. However, this option would provide a raised emergency egress in the event of a flood and allows property owners to raise lands to meet the road over time. Fraser River riparian or aquatic habitat are not anticipated to be impacted by this option, though impacts of private property raising would need to be assessed by land owner.

Option 3: Maintain/Install Bank Protection Works Only (Mitchell Island)

Option 3 considers the alternative where the only flood protection works the City is responsible for is installation and maintenance of bank protection works. This is only considered an option for Mitchell Island, as Sea Island has an existing dike, and Richmond Island is one private lot. On Mitchell Island, all bank protection works are private works and there is no requirement for owners to protect their properties from erosion. However, erosion starting at one unprotected property may place adjacent properties at risk as erosion progresses. City installation and maintenance of bank protection works would provide consistent protection around the island and reduce the risk of erosion and damage to adjacent property as a result of a neighbouring property's negligence. Figure 3-13 shows a section of Option 3.

This option could be considered in conjunction with other flood protection strategies, such as land raising and FCL's or restrictive covenants (covered in the 2008-2031 Flood Protection Strategy and the pending update ,and not the Dike Master Plan). Bank protection works in areas where not already present would result in impact to riparian habitat and require offsetting.

Option 4: No Structural Improvements

Option 4 is considered to be the status quo for Mitchell Island and Richmond Island, both of which only have private flood protection infrastructure in place. The Province's dike database indicates an unregulated dike on Mitchell Island under Richmond's authority, though no evidence of a dike is apparent on the island.

On Richmond Island, as described previously, a covenant is in place that acknowledges that the City has no plans to protect the Island from flooding and releases the City from any damage or losses caused by flooding or erosion. In addition, the majority of Richmond Island is located above 5.5 m CGVD28, with the exception of the causeway that connects the island to the City of Vancouver. The more significant flooding and erosion concern is expected to be the ongoing scour along the Fraser River North Arm in this location, which the City may wish to notify the owner of, if they are not already aware.

On Mitchell Island, this option would maintain status quo and would not infringe on industrial and commercial operations. In the absence of structural flood mitigation works, consideration could still be given to non-structural measures such as increasing FCL's or covenants that acknowledge that the property is not protected against flooding or erosion. For Mitchell Island, this option is not expected to be preferred as it does not meet the City's general vision of not allowing any part of Richmond to flood. In addition, flooding of the island would have economic and property losses and may cause environmental contamination.

3.5 Stakeholder Engagement

Stakeholder engagement for Phases 3 and 5 of the Dike Master Plan was completed jointly in two stages. Prior to initial City Council review, initial stakeholder engagement was completed that included meetings with internal City departments and some government agencies (also including Phase 4). This initial stakeholder engagement allowed for input from City groups on options developed, additional background, and future coordination, with the goal of informing the preferred upgrade options. Following Council review, additional stakeholder engagement was completed, which included reaching out for meetings with specific stakeholder groups and several public consultation events. The second stage of stakeholder engagement was intended to inform the public on the draft recommended options and seek any feedback the City may wish to consider in finalizing the Dike Master Plan and moving toward implementation.

For Phase 5, the City engaged the following parties:

- City of Richmond internal stakeholders:
    - Transportation,
    - Development Applications,
    - Policy Planning,
    - Engineering and Public Works,
    - Real Estate,
    - Parks Planning, Design & Construction,
    - Parks Operations;
- Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (MFLNRO), including Inspector of Dikes, Flood Safety, and Water Authorizations staff;
- Fisheries and Oceans Canada (DFO);
- Ministry of Transportation and Infrastructure;
- Environment Canada;
- Sea Island commercial interests;
- Sea Island Community Association;
- Vancouver Airport Authority (YVR);
- Mitchell Island Business Association;
- Urban Development Institute (UDI);
- Translink; and
- general public.

The City and KWL met with internal stakeholders, YVR, and MFLNRO and hosted public open houses. All other parties contacted requested engagement closer to project planning in areas that may affect their operations. DFO declined to meet with the City, stating that input would be provided during later stages in the established review and approvals process. Additionally, Richmond is within the traditional territory of the Coast Salish people and the City works with Nations on various projects where appropriate. Feedback from external stakeholders is summarized in Table 3-8.

Table 3-8: External Stakeholder Feedback

Stakeholder	Summary of Comments
Vancouver Airport Authority (YVR)	It was noted that land use does not always correspond to property ownership along the dike. Based purely on land ownership along the eastern reach, Richmond's portion of the dike extends from the northern end of the Miller Road right-of-way to the south end of the BCIT property. However, Richmond also has several other rights-of-way and land ownership that crosses the dike in areas typically maintained by YVR. The City and YVR agreed to continue discussions and work with their respective legal departments to establish a formal agreement for dike responsibility on Sea Island. It was noted that this is not a simple matter as the airport development involved complex right-of-way and land swapping between the provincial and federal governments, which has not been resolved in some areas. YVR is currently working on upgrading its perimeter dike to 4.7 m CGVD28 and intends to complete a Dike Master Plan in the coming years.
Ministry of Forests Lands and Natural Resource Operations and Rural Development (MFLNRO) Inspector of Dikes	Currently there are two projects that may impact the application of the Seismic Design Guidelines for Dikes: The Dike Consequence Classification (lead by the Province), and the Seismic Assessment and Geotechnical Investigation of Lower Mainland Dikes (lead by the Fraser Basin Council). Until this work is completed, all applicants for Dike Maintenance Act approvals are to continue to follow the 2014 Seismic Design Guidelines for Dikes – 2nd Edition, where the dike is considered a high consequence dike. IOD is generally open to flexibility in specific scenarios but is looking for consistency with seismic standards. It is unlikely that an expedited application process would be considered. The flood protection structure noted in the provincial dike database on Mitchell Island is not regulated; it is possible that there were private works at one point that were documented in the case that they became flood protection works. The Dike Maintenance Act (DMA) does not apply to a single property and as a result would not apply to Richmond Island.
Ministry of Forests Lands and Natural Resource Operations and Rural Development (MFLNRO) Water Authorizations	Noted that the Province provides emergency bulletin to property owners to remove harmful substances in the floodplain in high water/flood scenarios, in order to reduce risk of environmental contamination from flooding. Generally interested in larger scale compensation for impacts of large-scale dike upgrades in Richmond to achieve more meaningful compensation. There is still a need to compensate locally. This could potentially include approval of overall compensation program and plan, but it would still require project by project approvals (approval in principle of the plan already). This method hasn't been developed before and would need to be developed with Richmond.

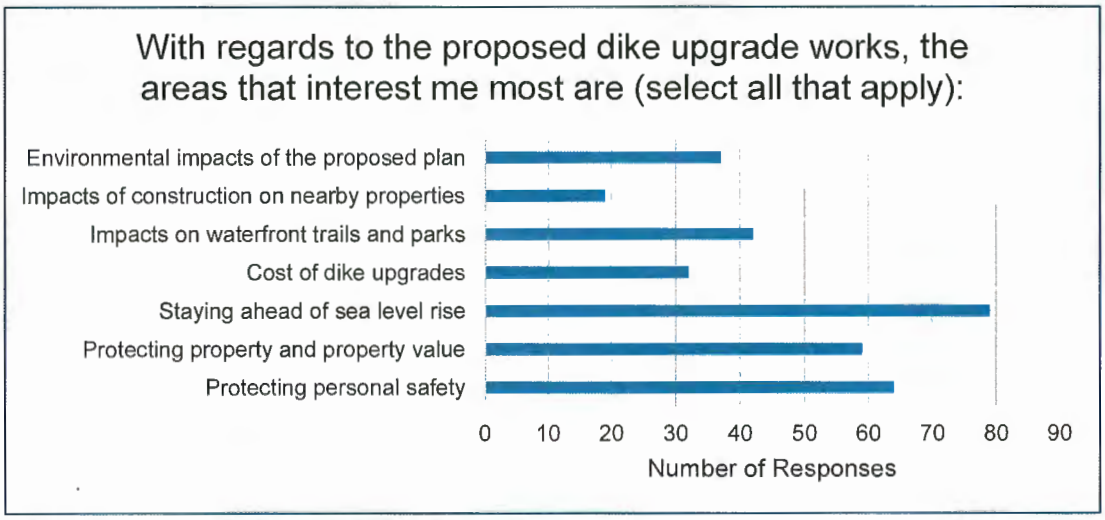
Stakeholder	Summary of Comments
Translink	No further engagement is required unless the proposed dike improvements result in any new trucking prohibitions, changes to the major road network, or impacts bus stops. In these situations, TransLink is to be contacted prior to finalizing detailed drawings.
Urban Development Institute (UDI)	No comments at this time. UDI requested a general presentation on the Dike Master Plans when they are endorsed by Council.
Ministry of Transportation and Infrastructure (MOTI)	No further comments at this time.
Fisheries and Oceans Canada (DFO)	DFO declined meeting regarding the Richmond Dike Master Plans. DFO expects that engagement with regards to fish habitat will take place through the established federal review process.

Two public open houses were held for Phase 3 and 5 jointly, including one event at the City Centre Community Centre on January 15, and another event at City Hall on January 23. In addition, City staff participated at a Smart Cities event with the public consultation materials on January 17. A total of 75 people attended the open houses. Draft reports and information poster boards were also available online at LetsTalkRichmond.ca with 518 visits to the site during the consultation window (January 14 to February 2). A survey to seek feedback was provided at open houses and online, and a total of 92 responses were received. Feedback from public consultation is summarized in Table 3-9 and Infographic 3-1.

Table 3-9: Summary of Public Consultation Feedback

Topic	Summary of Comments
Proactive Planning / Flood Protection	Many comments appreciating the proactive approach for dike planning, the robust concepts, and the long-reaching strategies. Several comments relating to expediting the dike raising process in anticipation of accelerated sea level rise. A couple questions received on earthquake effects, the application of a secondary inland diking system, and the role of internal drainage related to flood protection. Over 80% of participants rank perimeter dike upgrading as being either very important or extremely important.
Dike Aesthetics / Recreational Use	Many comments received noting the importance of maintaining pedestrian-friendly, multi-use trails. Suggestions relating to recreational use include paved pathways, distance markers, additional lighting, benches, and establishing a continuous perimeter trail. Two commenters like the opportunity to upgrade infrastructure and trails in the Hamilton area. One comment about improving trails around Crown Packaging.
Development / Property Value	Several commenters like the Plans with respect to protection of properties and future development. A commenter suggested research into riverside expansion of the dike. One commenter suggested residential construction standards. One commenter does not support superdikes (development on the dike).

Topic	Summary of Comments
Thoroughness/Consultation	Several comments appreciating the thoroughness of the report; the phasing methodology and clear concepts made the Plan easy to understand. One suggestion to further consult utility stakeholders who may cross the dike.
Priority Areas / Safety	Many commenters like that the City is taking action with regards to community safety. Single commenters noted priority areas which include: Phase 3, Steveston, Terra Nova. A single comment on the west dike as a priority location and for barrier islands to be built. A single comment questioning how Britannia will be protected and concern for houses along Dyke Road.
Environment / Habitat	A few comments and questions on the importance of maintaining habitat and the environment. One comment on using free fill material for the dike rather than other forms of disposal. One commenter is concerned about removal shrubs, trees, logs, and habitat along the dike.
Climate Change / Sea Level Rise	Several questions were received relating to level of protection, climate change, and sea level rise science. A couple of comments suggested that raising the dikes are premature and that sea level rise may not happen.
Cost	Several questions on cost to taxpayers and Provincial/Federal involvement in paying for flood protection upgrades. One question relating to evaluating the cost of managed retreats from certain areas.
General	One comment on providing more information on social media. One question about elevation of areas adjacent to dikes. One commenter requesting additional signage in project areas.



Infographic 3-1: Summary of Pubic Responses

It is expected that there will be opportunity for more engagement with stakeholders during detailed design of dike upgrades.

3.6 Options Evaluation and Selection

The options described in Section 3.4 have been evaluated based on the design considerations and feedback from the stakeholder meetings. Recommended options have been identified and are described below. As noted previously, the recommended options are intended to provide a basis for dike upgrades and planning, with the immediate goal is to raise the dikes to allow for 1 m of sea level rise, and to allow for further upgrading in the future. Environmental impacts, drainage impacts, and geotechnical considerations associated with the recommended options are also summarized below.

It is understood that the recommended options will be confirmed through Council review.

The recommended options are summarized in Table 3-10 and Figure 3-14, and further described in the following sub-sections.

Table 3-10: Recommended Dike Upgrading Options (Phase 5)

Reach # and Name	Recommended Options
1 – Mitchell Island	• Option 2C: Raise roadways with required land raising on private property
2 – Sea Island	• Option 1A: Raise standard river dike and extend land-side *Site specific options in constrained locations (northern end of the BCIT building, at Cessna Drive, and at Lysander Lane):* • Option 1B: Raise standard river dike and extend river-side • Option 1C: Raise dike with land-side retaining wall *Site specific interim option at hotel and marina:* • Option 1G: Raise dike with river-side sheetpile wall and land-side retaining wall
3 – Richmond Island	• Option 4: No flood protection works

Recommended Option: Reach 1 - Mitchell Island

Mitchell Island has no existing flood protection works other than private bank protection works (riprap and sheetpiles) around most of the island. Due to this, the City may consider diking or other alternatives. There are many locations around the perimeter of the island that are well below the current design dike crest elevation of 3.5 m CGVD28 (in some locations as low as approximately 2.5 m). The island is densely developed with industrial and commercial operations, many of which actively access the Fraser River for their businesses.

As a result, a perimeter dike would be highly disruptive to business and would require significant right-of-way or land acquisition. Alternatively, progressive land raising by redevelopment would provide the benefit of flood protection at a timeline that is not disruptive to business. By raising roadways and providing driveways, the City can provide emergency egress and access for properties as they are gradually raised. This would also reduce cost to the City by requiring developments to cover the cost of raising the majority of the land. The drawback to this approach is that in the short term, low properties below the current dike elevation will continue to be at risk of flooding and related environmental contamination. This may warrant short-term collaboration with owners to reduce these risks. Raising roads in advance of property raising would also require trade-offs between reduced road size and amenities, or infringement onto private properties. To partially address this, road raising could initially be

conducted to 4.1 m CGVD28 (dike elevation less freeboard) or a lower elevation selected by the City. Land raising should also consider impacts to drainage servicing, including potential alteration of rainwater overland flow routes on a site-specific basis. This could be further investigated through a land raising and drainage assessment study.

The following option is recommended for Mitchell Island.

- **Raise Roadways with Required Land Raising on Private Property (Option 2C):**
  - Raise all roadways to dike elevation by the City to provide emergency egress (considering partial raises in low areas to reduce impacts to operations).
  - Require owners to raise parcels to dike elevation during redevelopment.
  - Acquire rights-of-way and access during redevelopment along the riverbank for a future dike to 5.5 m CGVD28 and bank protection works.
  - Work with low elevation (below current dike crest elevation of 3.5 m CGVD28) property owners in the short term to mitigate flood and related environmental contamination risks.

The recommended approach, and properties below the current dike elevation of 3.5 m CGVD28, are shown in Figures 3-10, 3-11, and 3-12. Appendix A shows potential right-of-way acquisition around the perimeter of the island.

Recommended Option: Reach 2 - Sea Island

Responsibility for flood protection on Sea Island is shared by YVR and the City. Jurisdictional boundaries and land ownership along the dike are unclear in some locations, including several spots where the City either owns land or has a road dedication along a section of the dike that YVR has assumed responsibility for. The City's portion of the Sea Island dike is generally agreed to be along the eastern portion of the island from BCIT to the north edge of the Miller Road right-of-way.

The dike within this reach can be upgraded to a standard dike, with the exception of a few locations where space is constrained by existing buildings or roadways. In these locations, moving the dike alignment towards the river, or using retaining walls can be considered. This would limit infrastructure impacts and cost. In particular, the dike between the hotel and marina is below the current dike crest elevation of 3.5 m CGVD28, and there is not enough space to raise any standard form of dike to 4.7 m or 5.5 m CGVD28. As a result, an interim solution would be required for this location until the site redevelops. This could include either a setback dike around the building or a narrower dike with retaining walls.

The following option is recommended for the majority of City's portion of the Sea Island dike.

- **Raise Standard River Dike and Extend Land-Side (Option 1A):**
  - Continue to work with YVR to formalize jurisdiction boundaries for the dike.
  - Raise the existing dike along the current alignment with a standard dike wide enough to accommodate a raise to 5.5 m CGVD28 (except in the short-term along the hotel and marina). At the northern end of the BCIT building, at Cessna Drive, and at Lysander Lane, this would require either moving the dike towards the river (Option 1B), building retaining walls (Option 1C), and/or raising the road for short sections.

- When the Miller Road Drainage Pump Station is upgraded (planned for 10 to 15 years in the future), provide structural capacity for loading due to the dike raise and ensure there is sufficient space for the dike raise.
- Consult with MOTI to have the Moray Channel Bridge replaced with a higher structure that is above 5.5 m CGVD28 (when it is at the end of its design life) and raise the land between the two bridges.
- Acquire and widen existing rights-of-way for City access to the dike.

The following option is recommended as an interim solution at the hotel and marina.

- **Raise Dike with River-Side Sheetpile Wall and Land-Side Retaining Wall (Options 1G):**
  - At the hotel and marina, raise the dike to 4.7 m CGVD 28 with a sheetpile wall embedded along the river-side and a land-side retaining wall.
  - When the hotel area is redeveloped, establish a standard dike in accordance with the remainder of the reach.

The recommended options are shown in Figures 3-2, 3-3, 3-4, and 3-8. Appendix A contains plans and sections of the long-term upgrading recommendation.

A general recommendation for flood protection on Sea Island is to target land raising of the areas behind the dike. For areas where City property is located on the YVR portion of the dike, it is recommended that the City works with YVR to raise the dike at Richmond road crossings.

Recommended Option: Reach 3 - Richmond Island

The majority of Richmond Island is currently above the 5.5 m CGVD28 future dike crest elevation. Richmond Island is a single lot owned by North Fraser Terminals Inc., and leased to Milltown Marina & Boatyard Ltd. The development is connected to the City of Vancouver and its utility network and does not pay the City of Richmond Drainage Utility tax.

A restrictive covenant[6] was registered against the land title in November 27, 2012 (between North Fraser Terminals Inc., the Milltown Marina & Boatyard Ltd., and the City of Richmond) that:

- acknowledges the risk of flooding and erosion on Richmond Island;
- notes that the City has no plans to protect the island from flood and erosion; and
- releases the City from any damage or losses caused by flooding or erosion.

The following option is recommended for Richmond Island.

- **No Structural Flood Protection Works (Option 4)**
  - The covenant appropriately addresses the existing situation. In the event of future redevelopment, flood protection on Richmond Island could be reconsidered.

The City may wish to inform/consult with the owners regarding scour in the North Arm.

[6] CA2885848. RCVD: 2012-11-27.

Drainage Impact Assessment

Mitchell Island

The Mitchell Road South and Tipping Road South Drainage Pump Stations may be impacted by the road upgrades. Considerations for these two pump stations may include structural review and upgrade of the inlet bays and piping, as well as the outfall elevations of the pumps relative to projected sea level rise.

The drainage system within Mitchell Island would also be affected by the proposed road upgrades. Drainage services for the properties on Mitchell Island would need to be maintained, which would require further assessment and consideration during design of road raising. Road raising design should also consider future drainage servicing needs for parcels to be raised through redevelopment. The increase in road surface elevations would require adjustments to catch basin inlets and manholes on all roads where the surface would be raised. Some roads currently have drainage in roadside ditches with culverts at driveway crossings. These ditches would likely be required to be either replaced with storm sewer pipes beneath the roadway and additional catch basin inlets to collect runoff or be filled in and moved to be outside the new toe of the raised roadway.

Sea Island

The drainage system on Sea Island is not complete in the City's GIS database and the full range of potential impacts from proposed dike upgrading are not known at this time. The Miller Road Drainage Pump Station will be impacted by dike upgrades, where structural changes may be required to accommodate the increased dike section. In addition, extension of the pump station outlet and review of outfall elevations relative to projected sea level rise should be completed. There may also be impacts to the drainage system where the dike is constrained by Cessna Drive between chainage 0+400 and 0+450, but there is no drainage shown for the road in this location.

Richmond Island

On Richmond Island, no changes are proposed and there is therefore no impact on drainage.

Habitat Impact Assessment

Initial habitat impact assessments based on desktop review are summarized in Table 3-11 and described below.

Mitchell Island

Based on initial desktop review, road raising on Mitchell Island is not anticipated to result in impacts to riparian or aquatic habitat. Future raising of land parcels by landowners will need to consider environmental impacts including impacts to riparian and aquatic habitat, and the need for offsetting.

Sea Island

The recommended option for Sea Island will result in an estimated impact of 1,000 m^2 of high-quality Fraser River intertidal habitat and 2,000 m^2 of high-quality Fraser River riparian habitat. These areas represent an estimate based on FREMP habitat mapping (2007), and City of Richmond orthoimagery interpretation (2017). Not all Fraser River riparian and intertidal habitat was quantified. The desktop review only quantified high-quality riparian and intertidal habitat types on the Fraser River side of the existing dike. The remaining habitat area, while not calculated, would also be required in calculations for determining offsetting requirements. A more precise calculation of the area of impact would require an aquatic habitat survey, and an aquatic effects assessment.

The estimated area of overlap of proposed dike improvements with the city's ESA's is 300 m^2 of Intertidal ESA and 13,100 m^2 of Shoreline ESA. ESAs often overlap with high quality habitat (i.e. high quality Fraser River intertidal, high quality Fraser River riparian) but they can also include modified habitat (i.e. dikes), low quality habitat (e.g. areas infested with invasive plant species) and developed areas (e.g. buildings and roads) which do not provide habitat value. If ESAs are to be disturbed due to dike upgrades, mitigation and compensation may be required. In order to properly assess the environment values that may be disturbed by dike improvements in ESAs, and thus the amount of compensation that is required, detailed site specific assessments are recommended.

Richmond Island

As no structural flood protection works are proposed for Richmond Island, no associated impacts to riparian and aquatic habitat will occur.

Table 3-11: Reach-by-Reach Summary of Potential Habitat Impacts and ESA Overlap

Reach # and Name	High-Quality Fraser River Intertidal (m^2)	High Quality Fraser River Riparian (m^2)	Overlap with ESA Types (m^2)
1 – Mitchell Island	0	0	Shoreline: 1400
2 – Sea Island	1,000	2,000	Intertidal: 300 Shoreline: 13,100
3 – Richmond Island	No flood mitigation works recommended (no impacts)		

Geotechnical Considerations for Recommended Options

The proposed dike improvements were assessed with consideration for the BC Seismic Design Guidelines for Dikes.

Thurber Engineering Ltd. (Thurber) assessed 2 sample river dike cross-sections (one for Sea Island and one for Mitchell Island) to estimate the potential deformation resulting from seismic events. The cross-sections were provided by KWL based on a standard river dike cross-section at what was judged to be the most susceptible areas for deformation. Soil conditions were determined by cone penetration tests conducted by Thurber. The analysis included seismic events representing 100, 475 and 2475-year return period events. Seismic performance was assessed using 2 methods: 1-D (i.e. flat ground) liquefaction assessment to estimate reconsolidation settlements, and 2-D numerical deformation assessment to estimate dynamic deformations. The methods are complimentary, and the results are interpreted together.

The preliminary geotechnical report is attached in Appendix B.

The key results of the geotechnical analysis are summarized below.

- Proposed dike cross-sections will not meet the performance requirements of the BC Seismic Design Guidelines for Dikes based on numerical deformation analysis, without ground improvement or alternative approaches.
- The liquefaction hazard is considered insignificant for earthquakes up to the 100-year return period event.
- The liquefaction hazard is considered moderate and high for the 475 and 2475-year return period events respectively. The resulting deformations would be large.

- Liquefaction may result in a flowslide into the river for dike alignments along the river-bank due to lateral spreading, whereas it would result only in vertical deformation for dike alignments significantly set back from the river bank.
- The deformation analysis indicates that dikes may meet the performance requirements of the seismic design guidelines if they are typically set back 50 m to 100 m from the river-bank and have flat slopes or some localized ground improvement.

Options to address seismically induced deformations, and opinions on each, are provided below.

- **Densification** – The typical approach to densification is to install stone columns beneath a dike. To be effective against the liquefaction expected to follow the 2475-year return period event, densification would have to extend the depth of the liquefaction zone, and for a similar width. In a typical scenario, this can be considered as a 30 m (width) by 30 m (depth) densification located at the river-side toe of the dike. Such densification can be very costly (e.g. $9,000 to $18,000 per lineal metre of dike). Alternate experimental techniques are being tested by the City that may offer a more economic solution.
- **Higher Crest** – For the 100-year return period event, additional crest elevation may compensate for deformations caused by settlement. For events that cause liquefaction, added height just results in added deformation, so it is less effective. This is not an effective strategy by itself for return periods above 100-year due to lateral spreading and large vertical deformations.
- **Setback and Slope** – Flatter dike side slopes improve seismic stability. However, to prevent large deformations in the 2475-year return period event, the maximum acceptable slope between the river channel invert and the dike crest would need to be approximately 2%, which would require a significant setback between the dike and river.
- **Wide Crest ("superdikes")** – A very wide dike (e.g. several hundred metres) could be used to extend the dike beyond the limit of significant lateral spreading due to liquefaction. A portion of the wide crest could be considered sacrificial in the even to major lateral spreading. The minimum distance for each fill area should be based on a geotechnical evaluation of the setback required for the superdike to retain its hydraulic integrity under seismic design performance criteria (seismic stability and flowslide). Raising the land inland of the dike is desirable for related flood protection reasons and may be desired by the City for other reasons such as land use planning. It has already been done as part of multiple family, commercial, and industrial development projects in some waterfront areas. Buildings in this zone should be built above the dike crest elevation and have densified foundations capable of withstanding liquefaction.
- **Dike Relocation** – Place the dike inland of the liquefaction lateral spreading zone (a setback dike approach) or place a secondary dike inland of the liquefaction lateral spreading zone. The wider option above would essentially include a secondary dike. Relocating the dike inland would be a form of retreat and would leave property and buildings exposed outside the dike.

Additionally, the City may wish to use alternative seismic performance criteria, as is considered in the pending update to the Flood Protection Management Strategy

Considerations to manage the seismic risk are provided below.

- Consider alternative seismic performance criteria as considered in the pending Flood Protection Management Strategy. Review the criteria if/when the Province issues updated guidelines for seismic performance of dikes.
- Fill a wide swath of land (several hundred metres) inland of the dike to the design dike crest elevation. Buildings in this zone should be built above the dike crest elevation and have densified foudations capable of withstanding liquefaction. The required distance requires some additional evaluation and may be addressed in the pending update to the Flood Protection Management Strategy.
- Continue to investigate practical densification options, and consider earthquake induced dike deformations in emergency response and recovery planning.

3.7 Cost Opinions

Cost opinions for the recommended option in each reach are provided to help the City consider the financial implications for planning and comparing options. A breakdown is provided to help understand the proportional cost for items such as separating and raising the road.

Costs are based on unit rate cost estimates and tender results for similar works. The most relevant rates are from the City's Gilbert Road dike project. The City provided a summary of the cost estimate prepared by WSP for this project.

Rates from recent tenders for diking on the Lower Fraser River and other locations within the Lower Mainland were used to check the reasonableness of the rates and estimate other features such as sheet piles or large diameter drain pipes.

The costs were estimated for each island. They were also broken down into the main features that coincide with options that the City may wish to consider further. The cost estimate for the recommended option includes construction from existing condition to recommended option, without considering any potential interim works. Cost estimates for interim works are provided, and it is expected that there would be some cost saving associated with upgrading the interim dike to the long-term option, which are not accounted for. These features are described below.

- **Dike Raising** – this is the core element required to provide flood protection. It includes a 10 m crest width that can be raised while still achieving a 4 m crest width. This includes site preparation, fill, hydroseeding, minor drainage changes, and erosion protection.
- **Road Structure and Utilities** – this includes stripping, subgrade preparation, pavement structure, drainage and utilities.
- **Road Raising** – this includes the additional fill required to raise the road to the dike crest elevation (4.1 m CGVD28 road raising initially).
- **Other** – features such as landscaping, multi-use paths, driveway ramps and other amenities typically have a combined impact of less that 10%, so are lumped together for conciseness. This category was used to capture utilities if the option did not include road construction.
- **Contingency** – A 40% contingency is provided because the costs are based on concept plans only.

Table 3-12 presents a summary of all reaches with cost breakdowns for the items described above. Costs for each reach are also provided in the Reach Summary Sheets in Section 5.

Table 3-12: Summary of Construction Costs ($ in Millions)

Item	Mitchell Island[b]	Sea Island[c]	Sea Island Interim Works[d]	Richmond Island 4	Total
Dike Raising	-	$3.6 M	$.8 M	No Flood Protection Works	$4.4 M
Road Structure and Utilities	$15. M	$0.1 M	-		$15.1 M
Road Raising	$36.5 M	$0.2 M	-		$36.7 M
Other[a]	$8.3 M	$0.8 M	$.1 M		$9.1 M
Contingency (40%)	$23.9 M	$1.9 M	$.3 M		$26.1 M
TOTAL	**$83.6 M**	**$6.5 M**	**$1.2 M**		**$91.4 M**

a. Driveway ramps and pathways
b. Includes approximately 5.3 kilometres of road raising, reconstruction, and industrial driveway ramps.
c. Includes approximately 0.9 km of dike raising and road raising at McDonald and Shannon Roads.
d. Interim works refer to 150 m long sheetpile and retaining wall dike along the Pacific Gateway Hotel with access to the marina and hotel land.

Costs that are not included are noted below:

- Land acquisition is not included. Rights-of-way either exist or will be acquired during redevelopment. Similarly, there may be opportunities to have dike improvements tied to adjacent development.
- Seismic performance measures are not included. Raising land to inside the dike is likely a preferred strategy to deal with liquefaction. If the road and land behind the dike is not raised, then densification may be appropriate. Current techniques such as stone columns would cost approximately $9,000 to $18,000 per metre of dike.
- Habitat enhancement and off-site habitat compensation projects are not included. Such cost could be roughly 5% of the construction cost. It is understood that a separate Dike Master Plan may be prepared to address habitat compensation by identifying and developing medium to large habitat compensation concepts.
- Professional fees (engineering, surveying, environmental, archeological, etc.) are not included. Such costs could be in the range of 10% to 15% of the construction cost.
- Shoreline protection works and land raising on industrials sites on Mitchell Island are not included. Similarly, raising the land behind the dike is not included on Sea Island. These costs are proposed to be a condition of development behind the dike, with the cost and benefit attributed to property owners.
- Contaminated site remediation on Mitchell Island is not included. To ensure land raising keeps pace with increasing flood risk and sea level rise, the City may consider acquiring, raising, and reselling select properties. Based on historical land use on Mitchell Island, land acquisition is expected to involve site investigation for contamination. Contaminated sites investigations include the following, with approximate average cost estimates provided by City staff[7]:
    - Phase 1 Site Investigation (desktop) - $1,500 per property;
    - Phase 2 Site Investigation (sampling) - $25,000 per property; and
    - additional investigation and remediation for a Certificate of Compliance - $250,000 per property.

  City staff estimate that all properties on Mitchell Island will require Phase 1 investigations, approximately 75% of properties may require Phase 2 investigations, and approximately 40% of properties may require additional investigation and remediation.

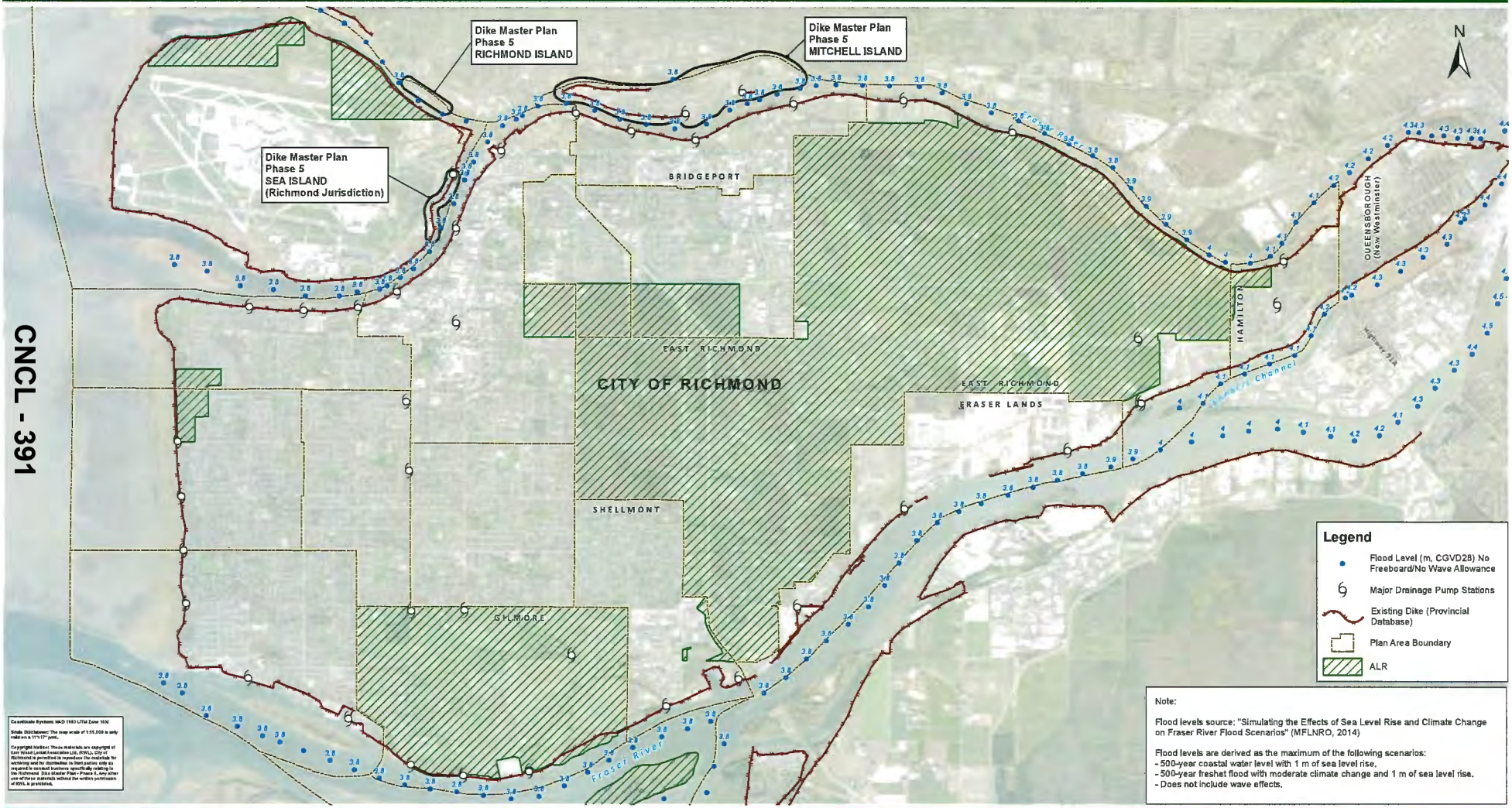
[7] City Hall Transmittal #5905343 Mitchell Island Pollution Prevention and Known Contamination

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City of Richmond

Richmond Dike Master Plan - Phase 5

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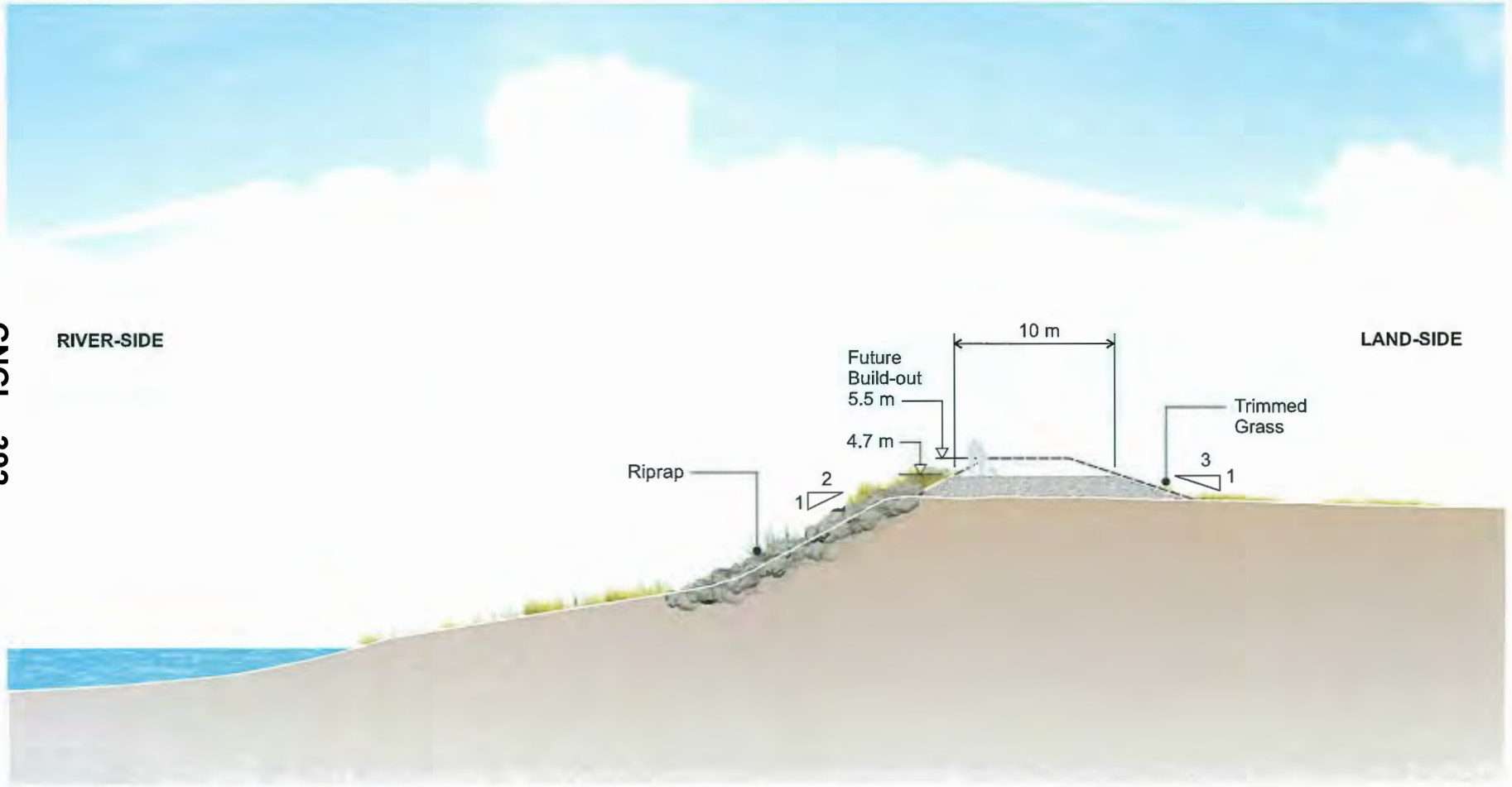
Fraser River Flood Elevations

Figure 3-1

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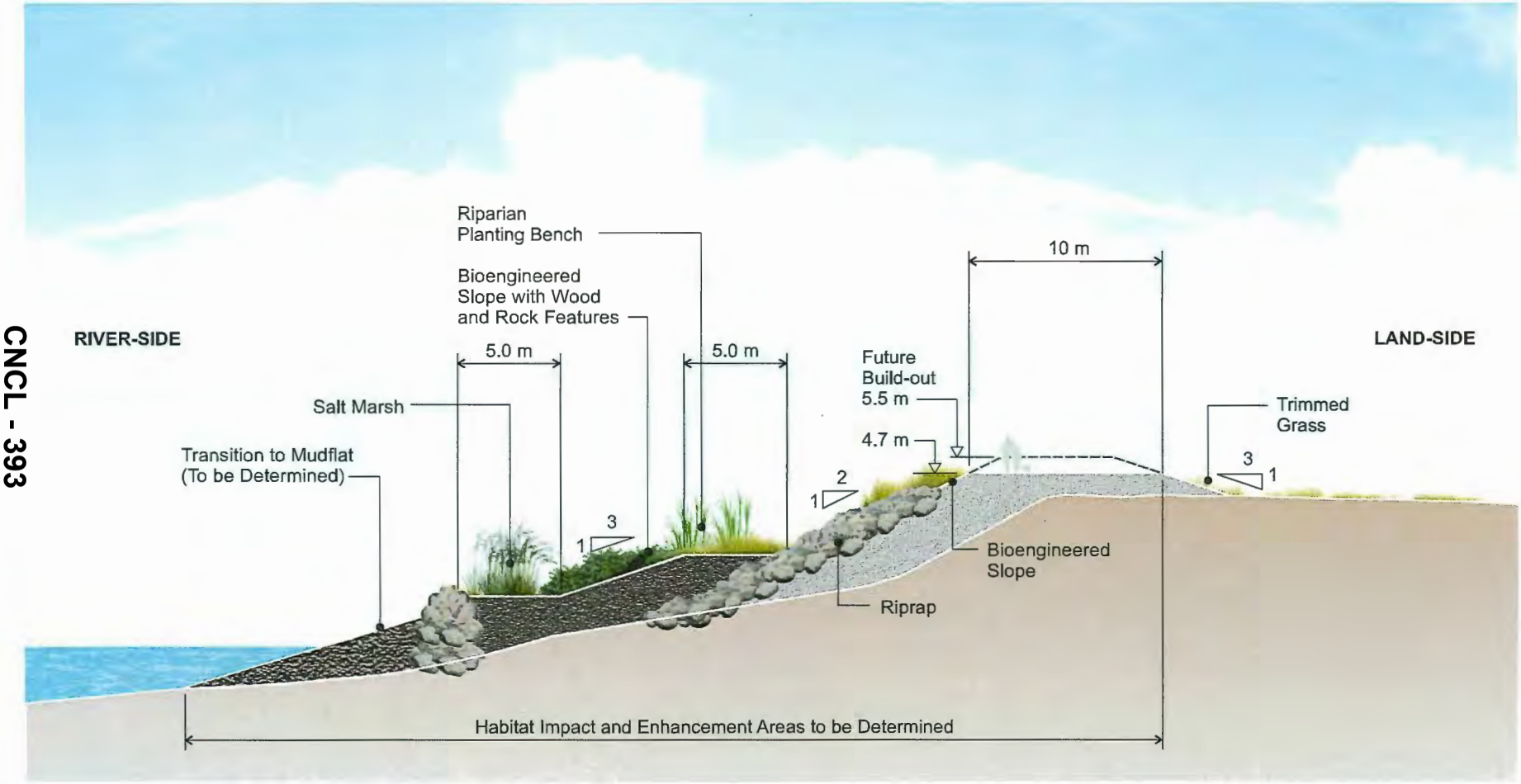


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Date	February 2019
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Option 1A: Build/Raise Standard River Dike and Extend Land-Side

Figure 3-2



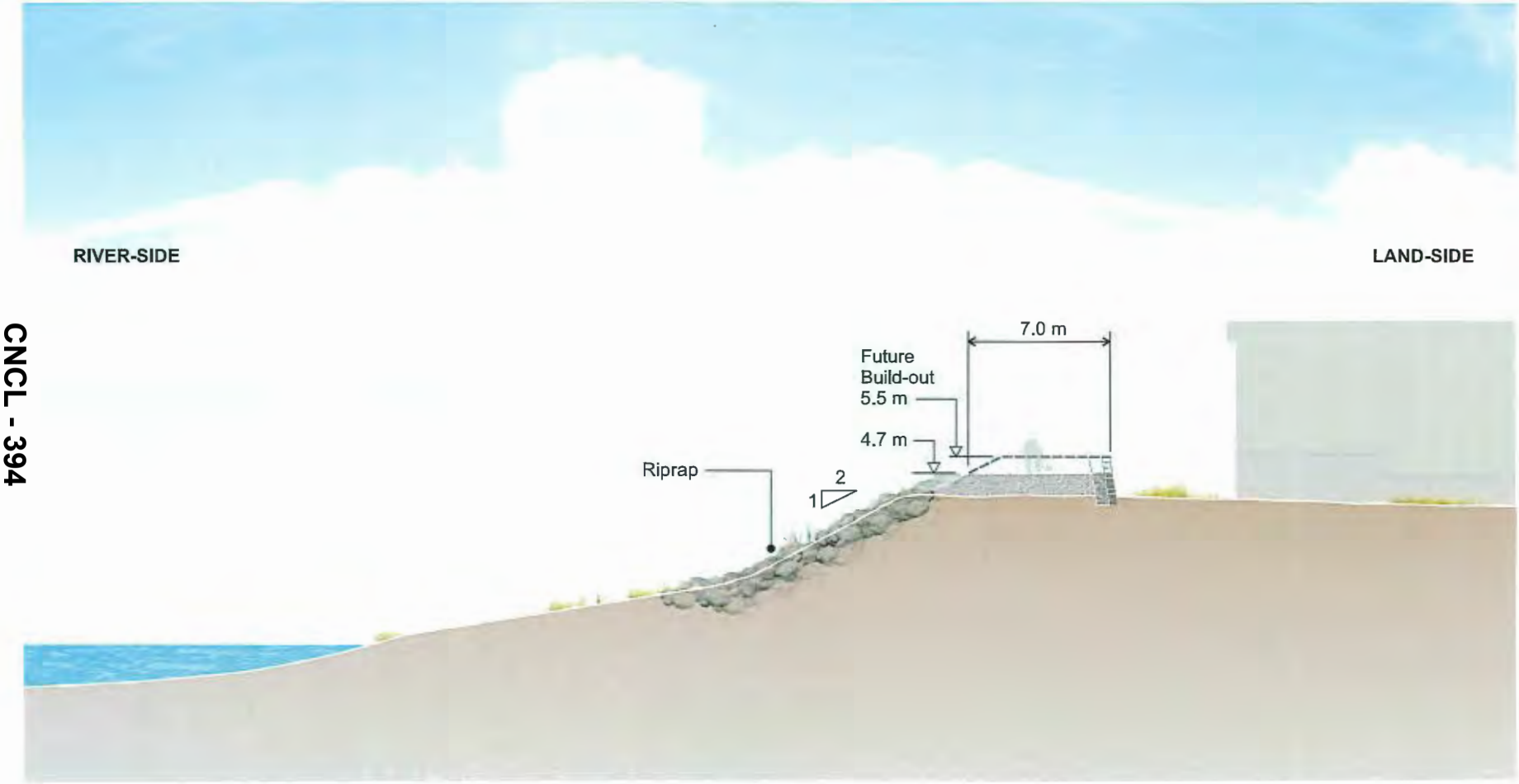
Project No.	651.129
Date	February 2019
Scale	Not to Scale

Option 1B: Build/Raise Standard River Dike and Extend River-Side

Figure 3-3

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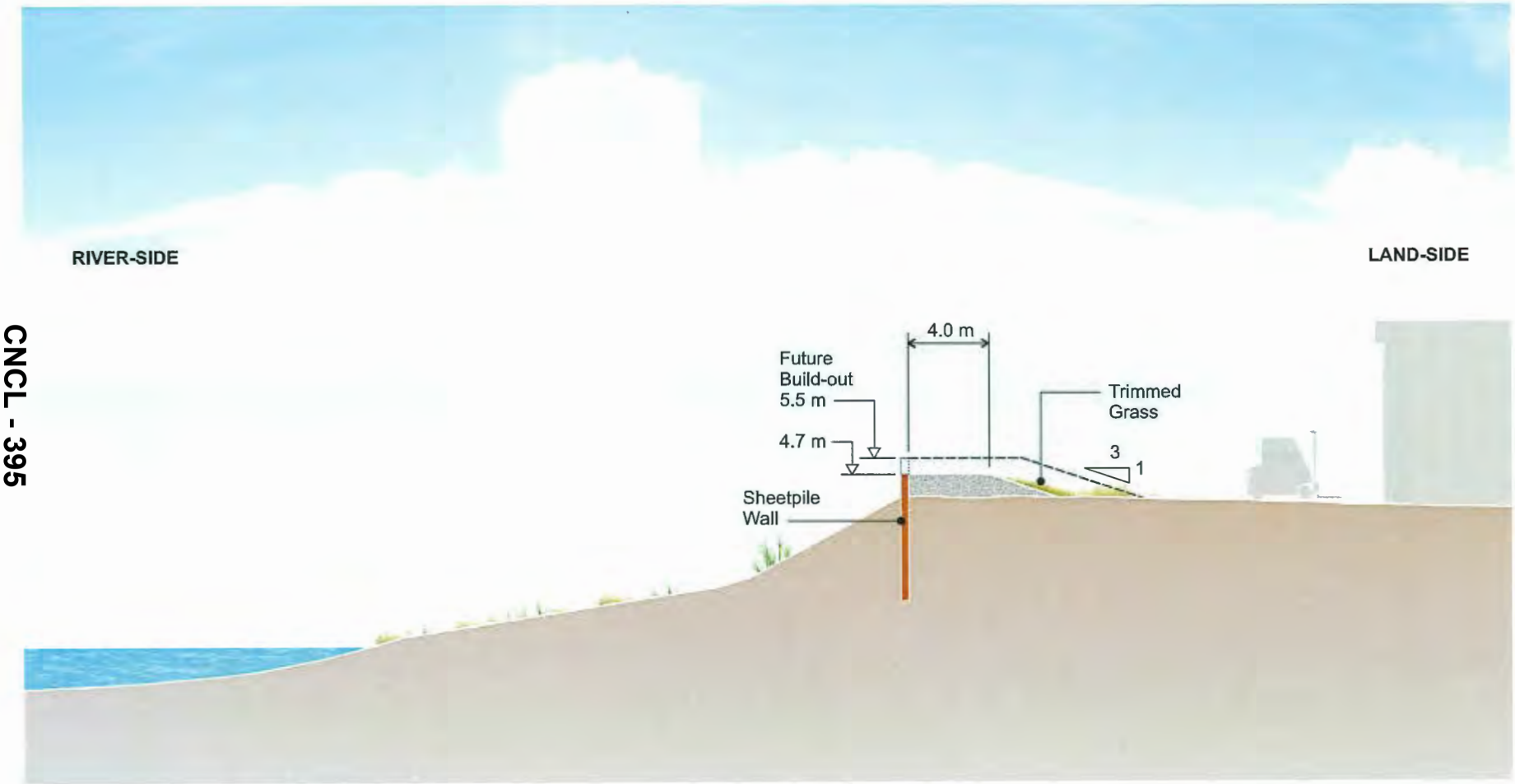
Project No.	651.129
Date	February 2019
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Option 1C: Build/Raise Dike with Land-Side Retaining Wall

Figure 3-4

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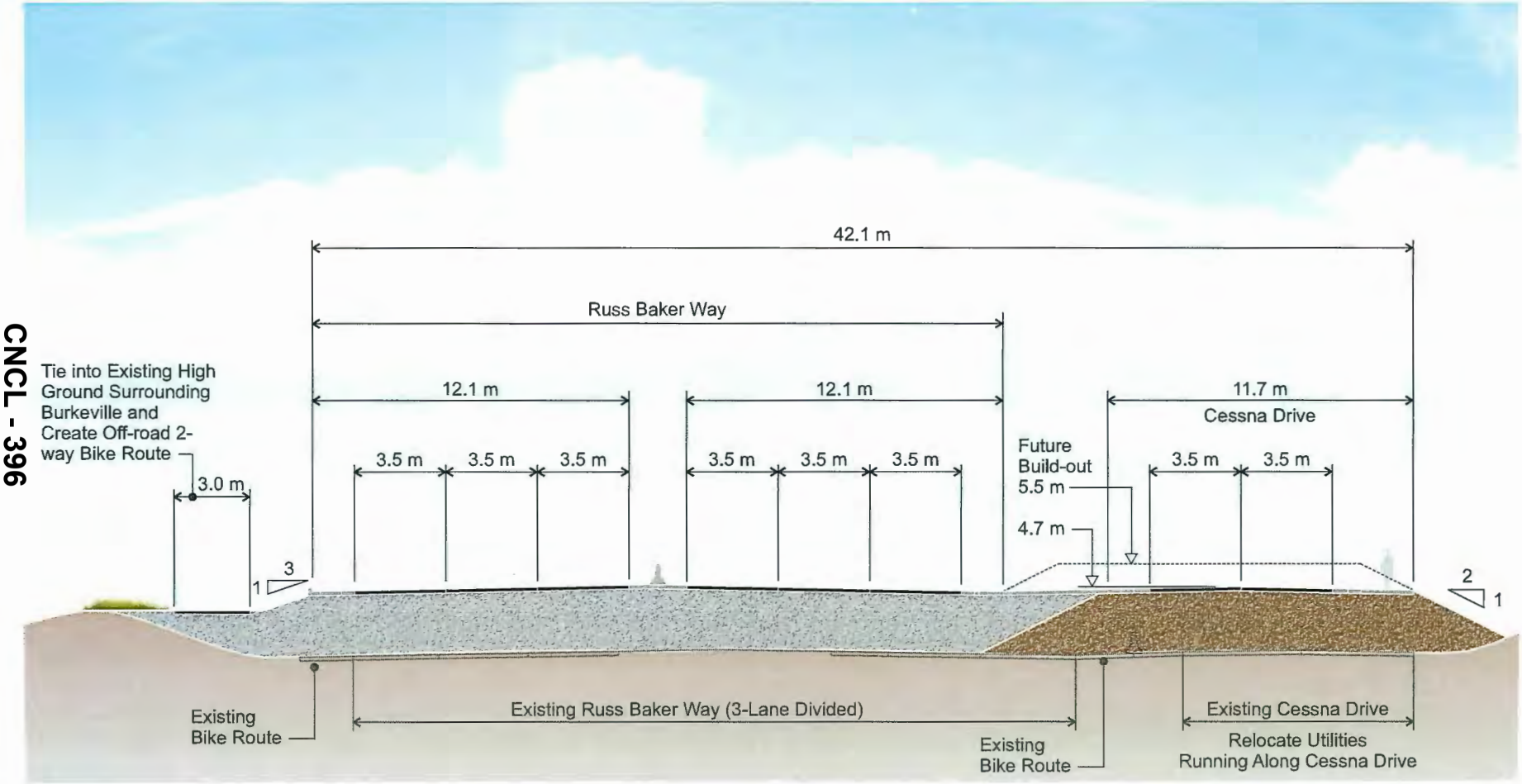
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consulting engineers



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Date	February 2019
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Option 1D: Build/Raise Dike with Sheetpile Wall on River-Side

Figure 3-5



CNCL - 396

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Scale	Not to Scale

Option 1E: Build Setback Dike along Cessna Dr. North of BCIT

Figure 3-6

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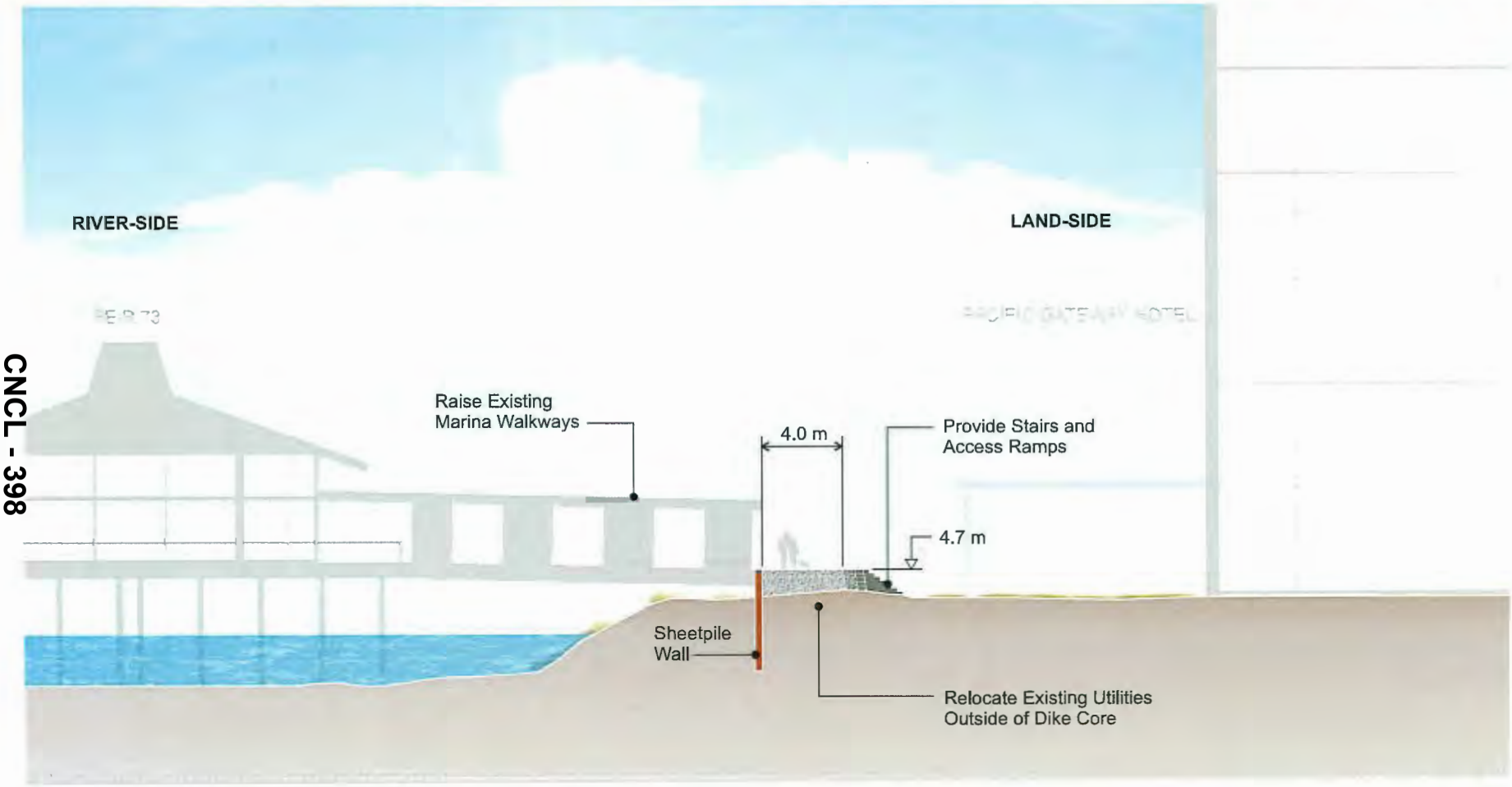
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Option 1E and 1F: Build Setback Dike Along Cessna Drive

Figure 3-7

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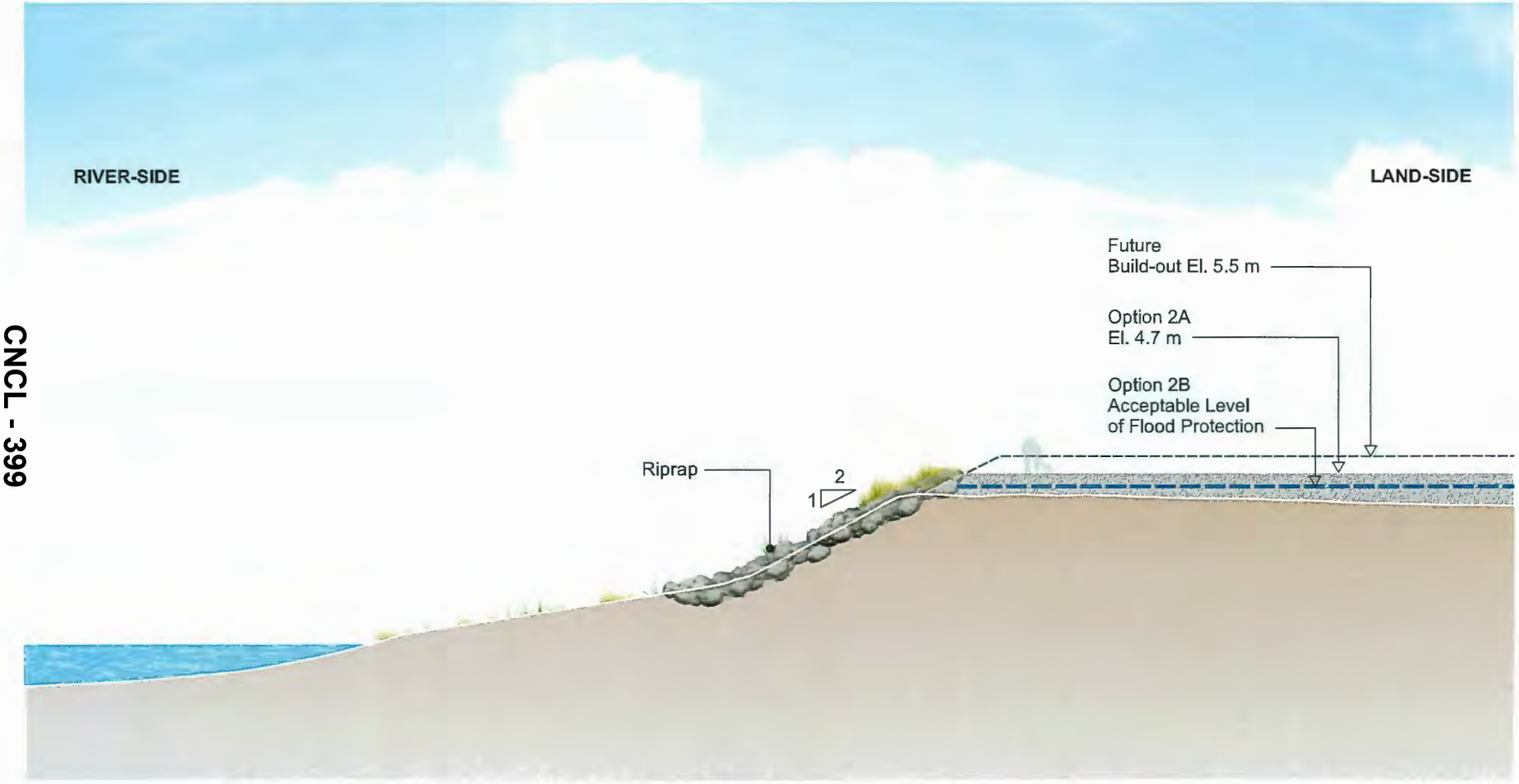


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Option 1G: Raise Dike with River-Side Sheetpile Wall and Land-Side Retaining Wall (Interim Option)

Figure 3-8



Project No.	651.129
Date	February 2019
Scale	Not to Scale

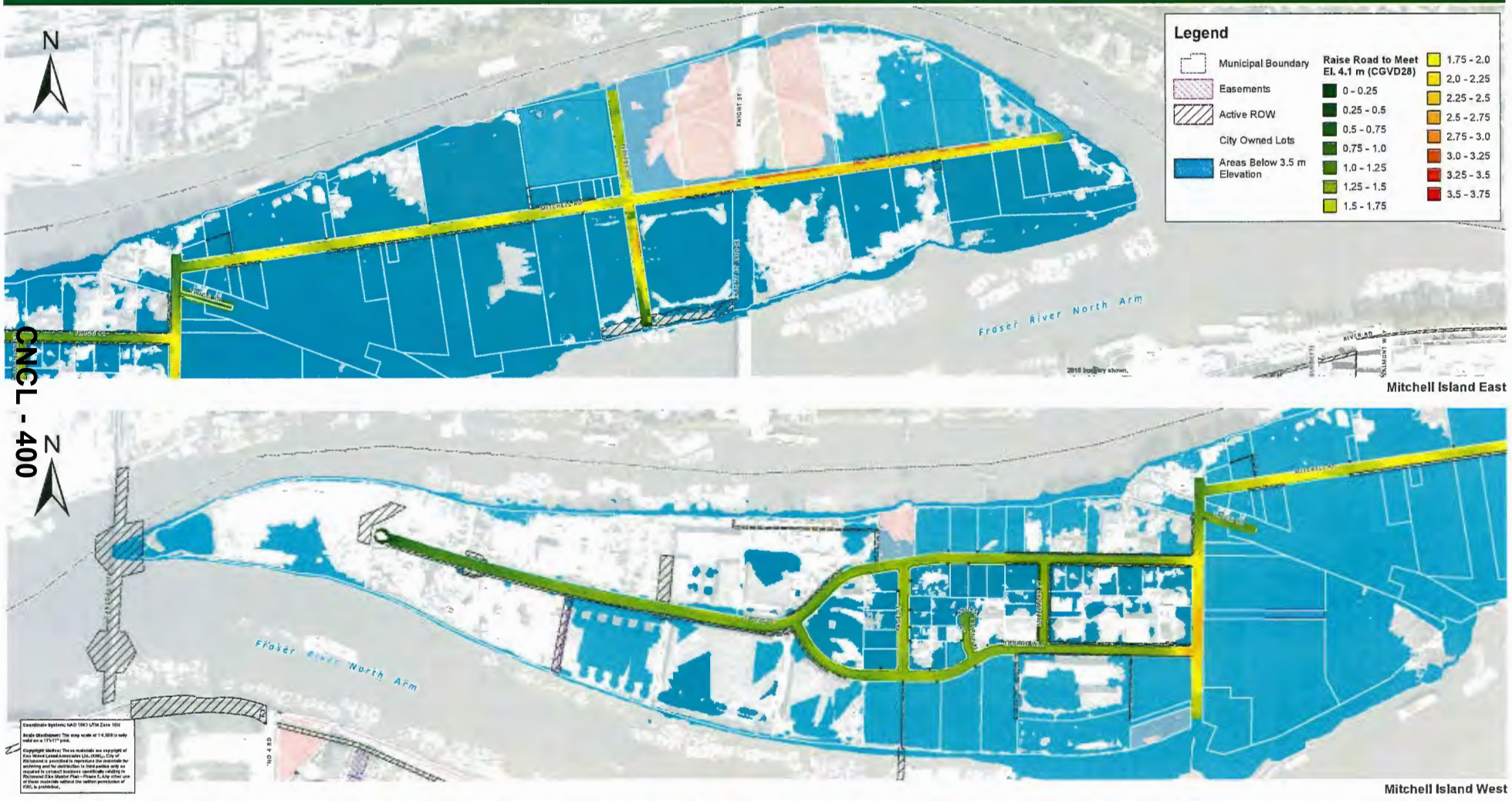
Option 2A and 2B: Raise Land

Figure 3-9

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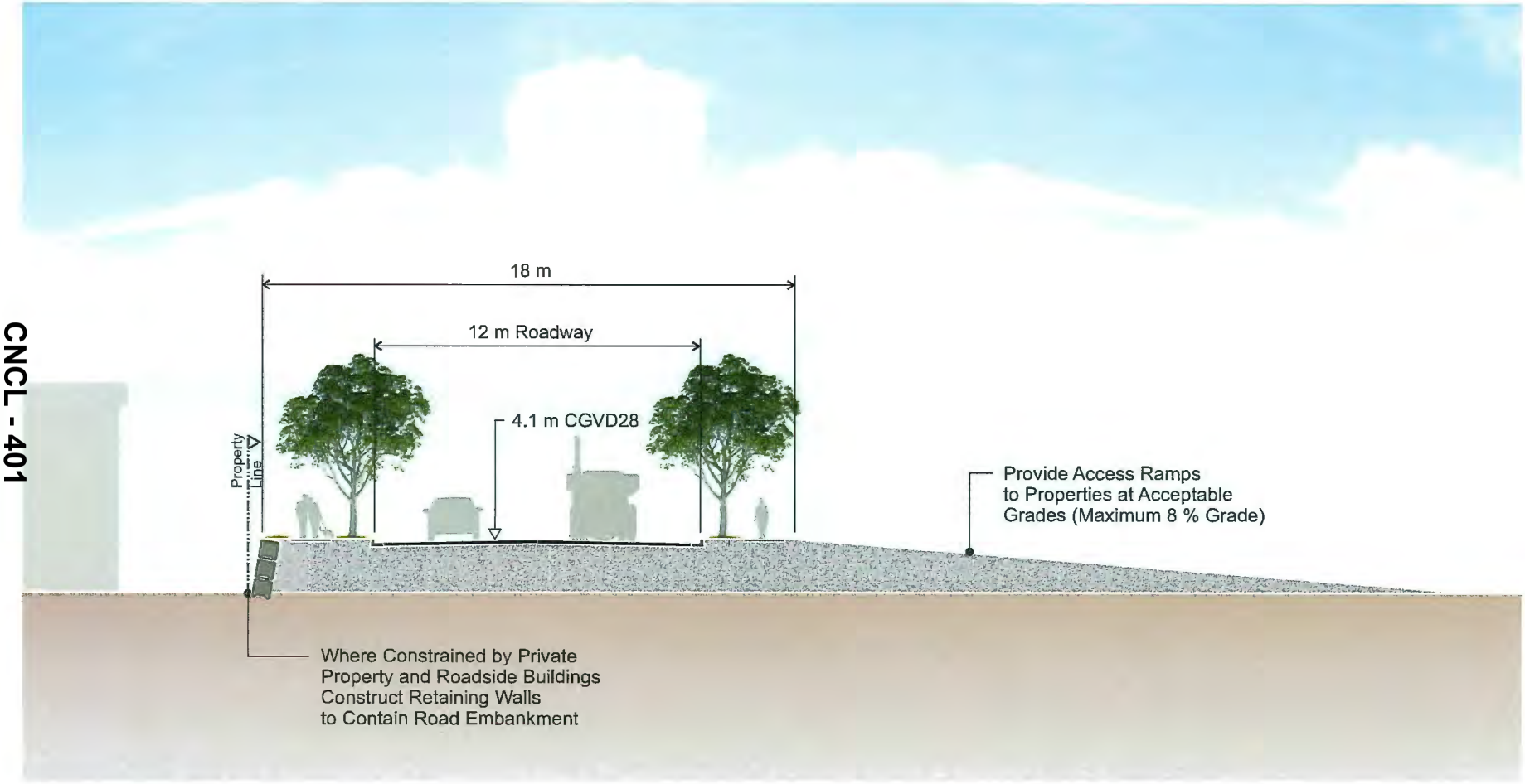
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Option 2C: Raise Roadways with Required Land Raising on Private Property (Plan)

Figure 3-10

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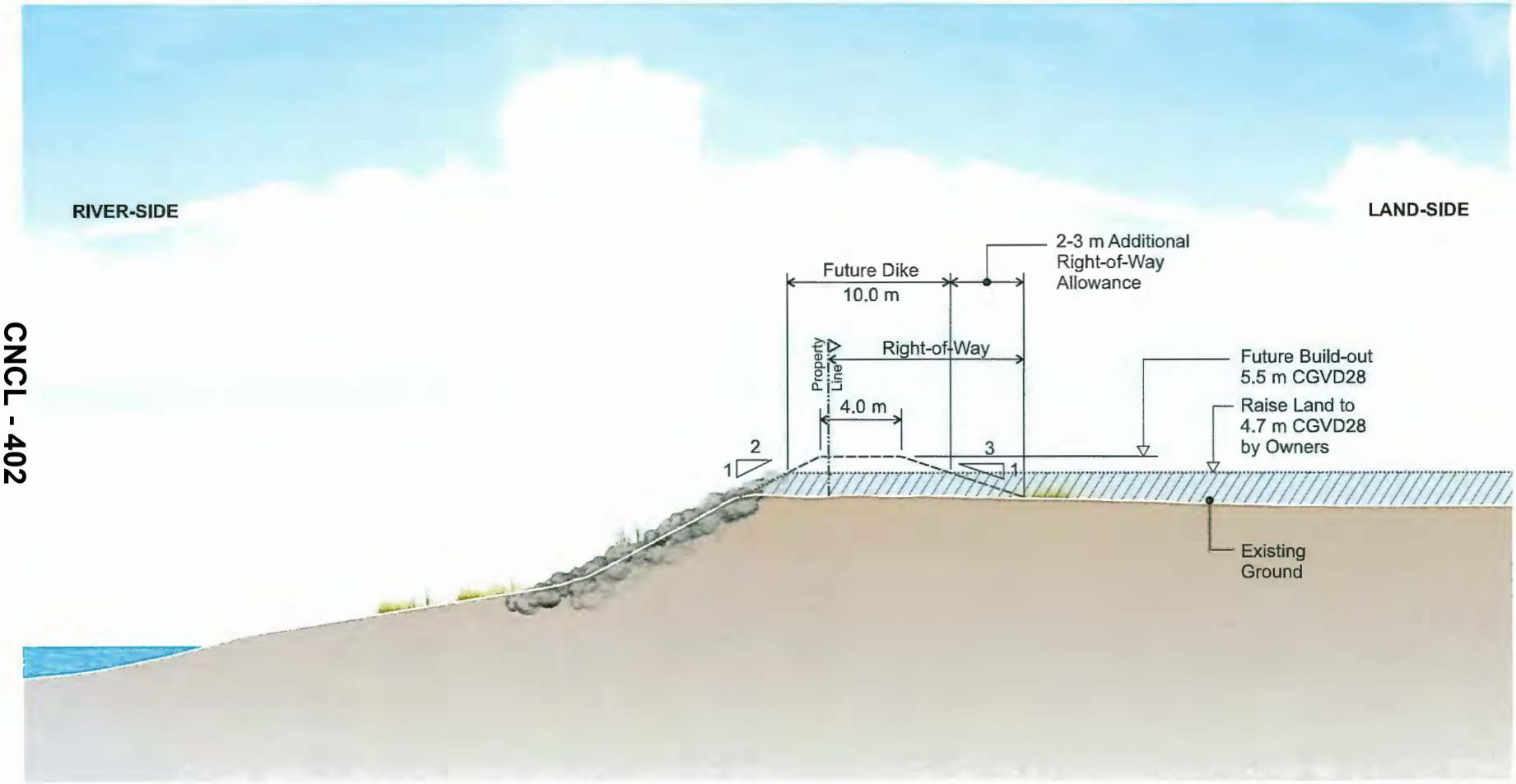
Option 2C: Raise Roadways with Required Land Raising on Private Property (Road Typical Section)

Figure 3-11

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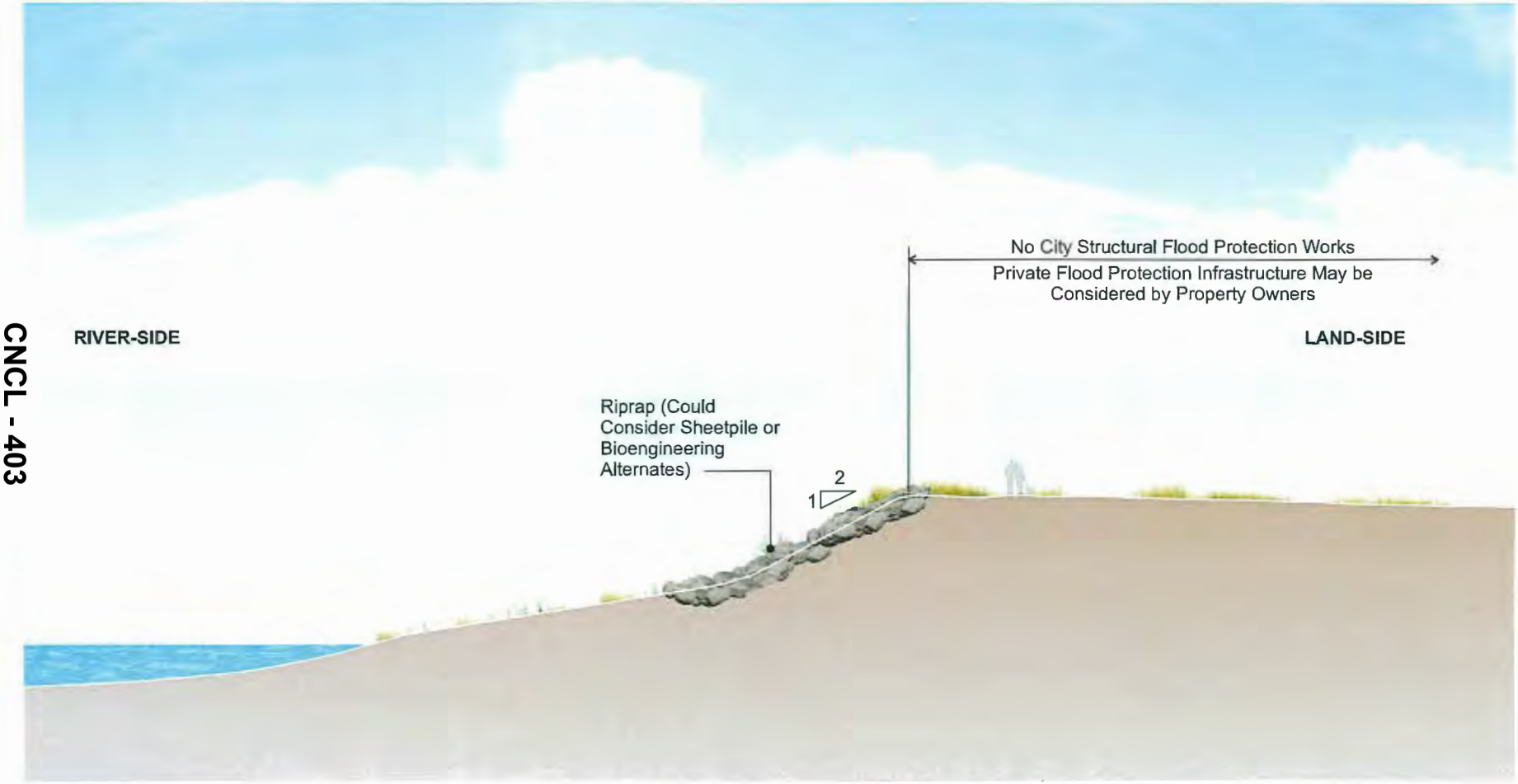


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Option 2C: Raise Roadways with Required Land Raising on Private Property (Riverbank Section)

Figure 3-12



Project No.	651.129
Date	February 2019
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Option 3: Install/Maintain Bank Protection Works Only

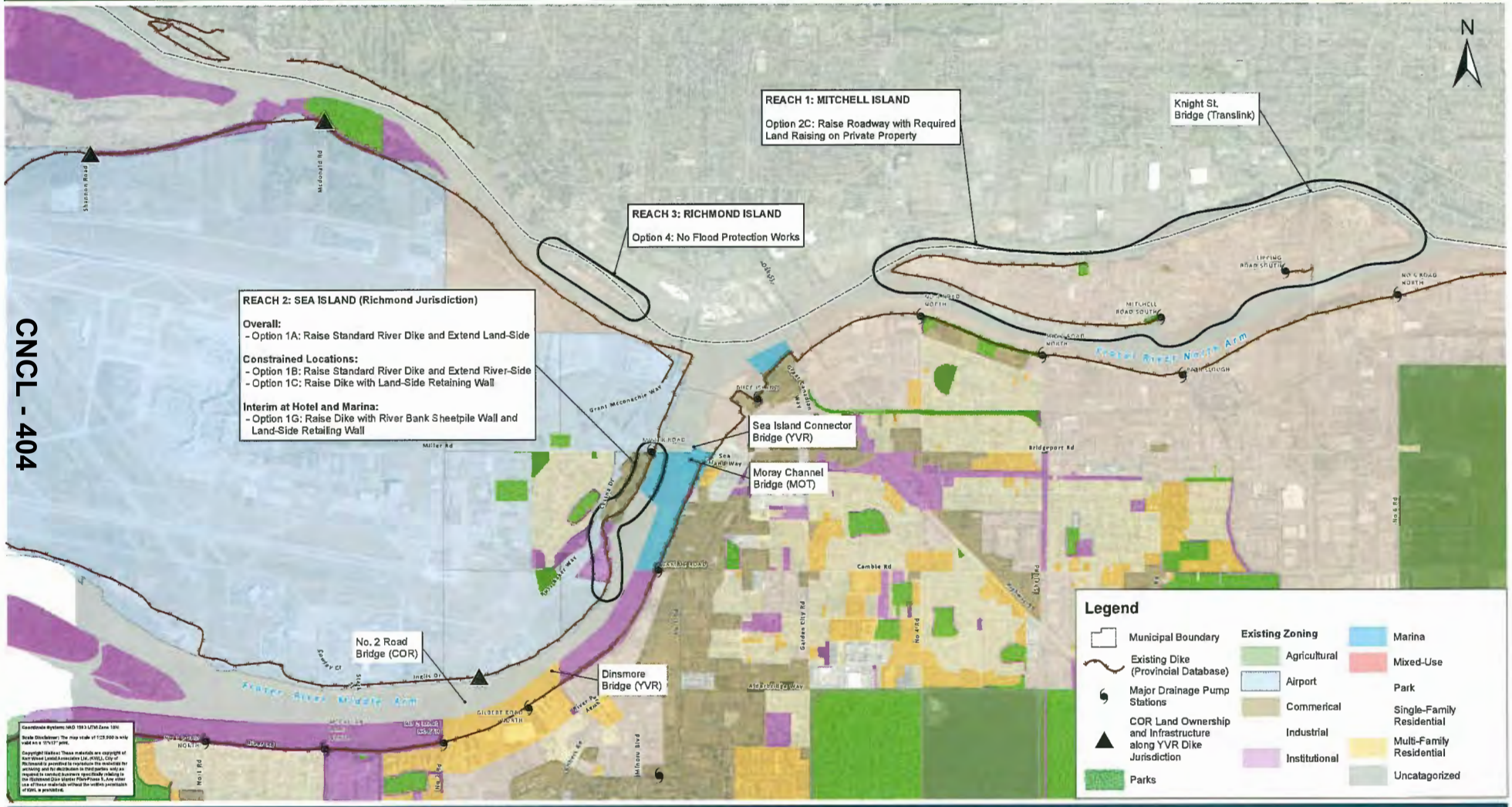
Figure 3-13

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Richmond Dike Master Plan - Phase 5

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Date February 2019
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Phase 5 Dike Master Plan Recommended Upgrade Options

Figure 3-14

4. Implementation Strategy

The implementation strategy is intended to guide the City in progressing the Dike Master Plan from an engineering planning document to constructed works. It suggests priority within Phase 5, key considerations moving forwards, coordination with other parties, and it addresses potential challenges. The implementation strategy for Phase 5 is described below by Island, given the unique recommendations for each area.

4.1 General

1. Use the Dike Master Plan as a planning tool with City land use planning to acquire land during redevelopment, and to rezone land with conditions for land raising inland of the dike.
2. Prioritize implementation in areas below the current design dike elevations of 3.5 m CGVD28.
    a. This includes low-lying properties on Mitchell Island, and the dike on Sea Island from Lysander Lane northwards.
3. In conjunction with other Dike Master Plan phases, develop habitat compensation opportunities in Richmond. By considering all Dike Master Plan phase impacts together, habitat compensation work could be completed at a larger scale and provide more significant habitat, as opposed to small site-by-site compensation.
    a. Consult and coordinate this work with MFLNRO to develop compensation opportunities amenable to the Province, to streamline and reduce uncertainty during the approvals process.
4. Develop an overall phasing strategy and timeline for dike upgrades for all of Richmond, considering other phases of the Dike Master Plan.
5. Consider the need for an appropriate building setback from the land-side toe of any future flood protection works in view of the current BC setback guideline of 7.5 m. This should consider the planned dike upgrade to 4.7 m CGVD28, as well as future buildout to 5.5 m CGVD28. This may require consultation with the Inspector of Dikes.

4.2 Mitchell Island

1. Work with low elevation (below current dike crest elevation of 3.5 m CGVD28) property owners in the short term to mitigate flood and related environmental contamination risks. This could include consultation, development of emergency policies, and short-term private flood protection measures. Consultation with low properties may also inform the sequencing of road raising.
2. Establish development policies on Mitchell Island that require the following at redevelopment:
    a. right-of-way acquisition along the riverbank to provide a 12 m wide band of access for the City along the entire perimeter of Mitchell Island, and
    b. land raising to 4.7 m on all properties (including considerations for excavation of contaminated soil and fill quality to reduce environmental contamination).
3. Consult with IOD regarding removal of listed flood protection infrastructure on Mitchell Island from the provincial inventory.

4. Progressively raise all roadways to dike elevation. Newer developments on Mitchell Island are relatively high, given the current Mitchell Island FCL of 4.35 m CGVD28, and as a result, raising the roads in these areas may improve access. Conversely, low lying areas (as low as 2 to 2.5 m CGVD28) would require access ramps to allow for continued operations and retaining walls or narrower roads to avoid impacts to private property. To address access challenges in low areas, the City could consider progressive raising or raising in conjunction with redevelopment. A road elevation of 4.1 m CGVD28 (dike elevation less freeboard) would be appropriate as an initial target, with refinement for specific areas. As part of road raising, assess and modify drainage system infrastructure to maintain drainage services for lots before and after land raising. Consider the impacts to existing utilities and the needs for modifications as part of the design of raised roads.
5. As rights-of-way are acquired around the perimeter of the island, assess the need for additional bank protection works. Consider whether bank protection works should be the responsibility of the City or private land owners.
6. In the long term, if low-lying sites are not redeveloping or raising land and may be putting other property at risk as sea levels rise, consider purchasing and raising the land to be resold.
7. To achieve the future scenario dike elevation of 5.5 m CGVD28, consider further land raising or establish a perimeter dike.

4.3 Sea Island

1. Continue to work with YVR to resolve long-standing dike jurisdiction and land ownership uncertainties as they relate to the dike on Sea Island.
2. Work with YVR to raise the dike at Richmond road crossings. This includes the jurisdiction boundaries of the City's dike and agreements for locations where City land is located along a portion of the dike that is operated by YVR (such as at McDonald Beach Park).
3. Raise the existing dike along the current alignment, prioritizing dike upgrades from Lysander Lane northwards first, to target low areas below the current dike design elevation of 3.5 m CGVD28.
4. Consult with YVR regarding opportunities to raise the dike at Cessna Drive to 4.7 m CGVD28 in conjunction with planned bike path improvements.
5. Consult with the Pacific Gateway Hotel and marina to develop an interim design to raise the dike to 4.7 m CGVD28 along the current alignment, while allowing for access for each business. When the site eventually redevelops, establish a standard dike in accordance with the remainder of the reach.
6. At Lysander Lane, consider either raising the road or constructing a retaining wall to avoid moving the dike towards the river.
7. When the Miller Road drainage pump station is upgraded (planned for 10 to 15 years in the future), provide structural capacity for loading due to the dike raise and ensure there is sufficient space for the dike raise. To reduce overall construction costs, consider designing and constructing pump station and floodbox upgrades in conjunction with dike raising.
8. When the Moray Channel Bridge is at the end of its design life, replace it with a higher structure that is above 5.5 m CGVD28 and raise the land between the two bridges.
9. The current dike along BCIT limits the recommended dike upgrade option and would require moving the dike towards the river or retaining walls. Consider raising dike with a landside retaining wall, moving towards the river, or raising with a narrower crest initially until the site redevelops in the long term.

10. Consider establishing development policies on Sea Island that require land raising to dike elevation during site redevelopment.

4.4 Richmond Island

1. No flood protection works are recommended as the island is predominantly above 5.5 m CGVD28.
2. Consider informing the owner of Richmond Island of the scour risk that has been identified in the North Arm of the Fraser River adjacent to the Richmond Island.

5. Reach Summary Sheets

The following section contains 2-page, reach-by-reach summary sheets that summarize the existing conditions, design considerations and potential constraints for each reach of Phase 5. The second sheet summarizes the features of the master plan through each reach including typical cross-sections, plan features, costs and priority for upgrade. The second sheet will be completed after stakeholder consultation and option selection.

Mitchell Island





Existing Conditions

The island is heavily developed with industrial and commercial operations, including sawmills, cement manufacturing, recycling, mechanics, warehouses, and more. Water oriented lots often have sheeptile walls along the river bank that allow for easier access and riprap bank protection works along the bank in adjacent areas.

An unmaintained private dike is located on the western perimeter of the island. There is no existing dike on Mitchell Island that meets current standards. Private bank protection works installed on the majority of the river bank, with sheetpile walls in several locations.

Unique Features

- Complex patchwork of properties with full occupancy of the lot right up to the river bank.
- Drainage pump stations at Tipping Road South and Mitchell Road South.
- No access to the riverbank for dikes except at a few isolated locations.
- Industrial operations that use the river to conduct their work, with sheetpile walls and barge facilities.
- Twigg Island sanitary forcemain crosses from Vancouver.
- Watermain below Page Street.
- Limited riparian habitat around the island.
- Two small existing Richmond parks.
- Log boom storage along the river bank.
- Two sawmills located directly on the water.

Considerations

Flood Protection

- Dike alignment
- Dike crest elevation
- Erosion protection
- Seismic performance
- Static stability and seepage
- River toe stability and setbacks
- Boat waves

Industrial

- Water access for industrial sites along the Fraser River
- Land acquisition or rights-of-way required to build and maintain flood protection works
- Road design and driveway grade to accommodate large trucks

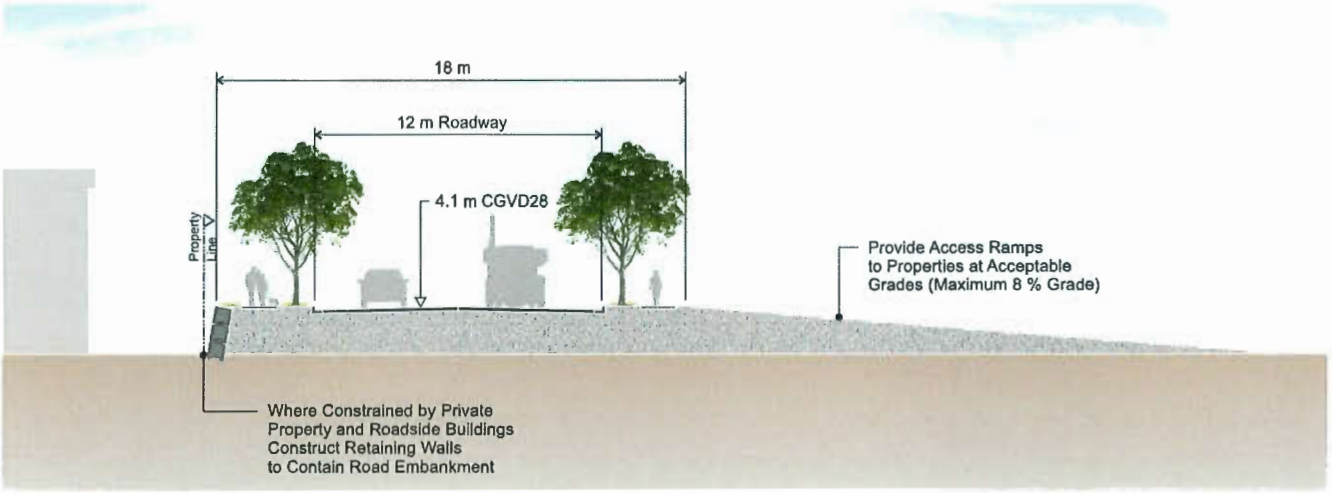
Social

- Mitchell Island Pier
- Park at south end of Mitchell Road
- Align with 2009 Waterfront Strategy
- Connect to existing and planned trails and public amenities
- Wayfinding and public information signs

Environmental

- High quality intertidal habitat in many locations
- Limited riparian habitat
- Log boom storage along the foreshore in many locations
- Several large habitat compensation projects completed around Mitchell Island
- Shoreline and Intertidal ESAs present around perimeter of island

Mitchell Island - Recommended Improvements



Master Plan Features

Flood Protection

Raise roads to dike elevation to provide emergency egress

Require landowners to raise land to dike elevation at redevelopment

Acquire rights-of-way around the island perimeter for future bank protection works or perimeter dike

Industrial

Work with low industrial properties to mitigate short term flood and environmental contamination risks

Provide access driveways to properties during road raising

Social

No plans for additional parks or trails around Mitchell Island

Raise land at current parks and trails and reconstruct as needed

Environmental

No anticipated impacts to riparian or aquatic habitat caused by road raising

Landowner management of environmental impacts during raising

Excavation and fill standards to consider historical contamination risks

Mitigation and compensation for disturbance to ESAs may be required

Priority

Priority is secondary to Sea Island as the majority of Mitchell Island is higher than Sea Island. Implementation priority on Mitchell Island is described below.

1. Work with low properties to mitigate flood and related environmental contamination risks.
2. Establish redevelopment policies on Mitchell Island that require right-of-way acquisition along the riverbank and land raising to 4.7 m on all properties.
3. Progressively raise roads to dike elevation, considering interim raises in low areas to reduce impacts to access and operations.
4. As rights-of-way are acquired around the perimeter of the island, assess the condition and presence of existing bank protection and consider the need for City-owned and maintained bank protection works.
5. In the long term, if low-lying sites are not redeveloping or raising land, consider purchasing and raising the land to be resold.

Construction Cost

Dike works are proposed to be fully funded as part of site raising with redevelopment over long term. 5.3 km of road costs for are expected to be borne by the City that would include driveway access ramps for private properties.

Item	Cost per metre	Cost
Road Structure	$2,900	$15,000,000
Raise Road to Dike Height	$6,900	$36,500,000
Other (Driveways)	$1,600	$8,300,000
Contingency (40%)	$4,500	$23,900,000
Total	**$15,900**	**$83,600,000**

Cost opinions are in 2018 Canadian Dollars.

Sea Island





Existing Conditions

The City of Richmond reach of the Sea Island dike stretches from BCIT north to the Miller Road Pump Station. The remainder of the dike is YVR responsibility.

This reach has a gravel/paved walking path along the crest and is bordered by four large commercial lots including BCIT, the Pacific Autism Family Centre, and the Pacific Gateway Hotel.

The Moray Channel Bridge located at the north end of the reach is lower than the proposed future dike elevation.

The dike is tightly hemmed in by the hotel and adjacent marina with private utilities installed along it. There is little to no bank protection works along the dike.

Unique Features

- Dike tie in at the Moray Channel and YVR Connector Bridges
- Miller Road drainage pump station
- Sanitary forcemain crossing
- Lack of right of way north of BCIT with low spot in the dike near Cessna Drive
- One section of the dike has already been raised to 4.7 m CGVD28 (design elevation)
- Evidence of old timber crib wall

Considerations

Flood Protection

Dike alignment
Dike crest elevation
Erosion protection
Seismic performance
Static stability and seepage
River toe stability and setbacks
Boat waves

Industrial

Commercial and institutional space
Russ Baker Way borders the existing dike
Access and use of the marina

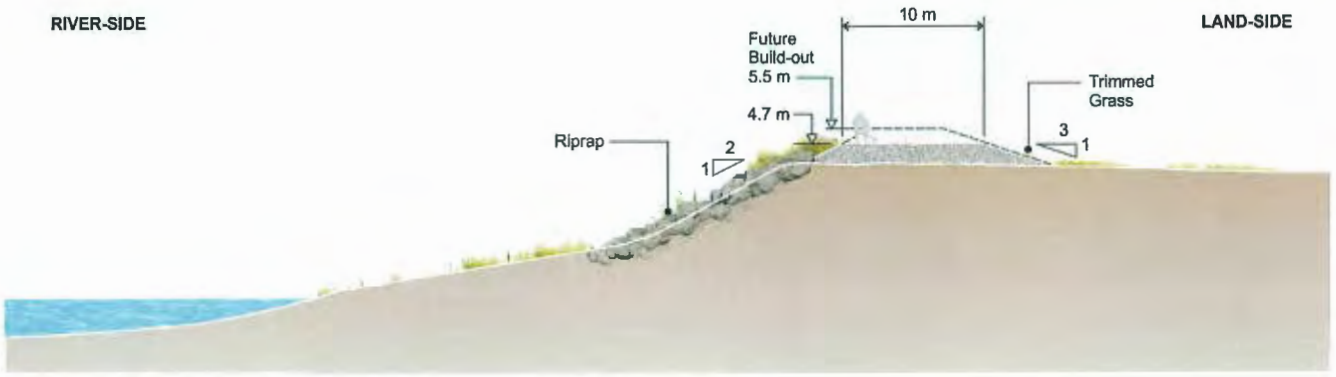
Social

Align with 2009 Waterfront Strategy
Connect to existing and planned trails and public amenities (consideration for YVR trails)
Wayfinding and public information signs

Environmental

High quality intertidal habitat for majority of the reach
High quality riparian habitat for majority of the reach
FREMP habitat mapping did not include the area in front of the hotel and marina. Further investigation would be required to characterize this area.
One existing habitat compensation site near the Miller Road Drainage Pump Station
Shoreline and Intertidal ESAs present in existing dike footprint

Sea Island - Recommended Improvements



Master Plan Features

Flood Protection

Raise dike along existing alignment wide enough to accommodate future raise

Consider moving dike towards river-side or building retaining walls in constrained locations

Along the hotel and marina, raise the dike with sheetpile and retaining wall in the interim

At end of life, replace the Moray Channel Bridge with a higher structure

Acquire and widen rights-of-way

Industrial

Short Term

Reduce impacts to infrastructure along hotel with interim non-standard dike raise.

Raise access ramps at Marina during dike raise.

Long Term

Upgrade the dike along the hotel in accordance with the overall recommended option for a 10 m wide dike.

Social

Provide landside pedestrian access to the dike along the hotel

Maintain existing multi-use path on the dike crest

Environmental

Dike raise towards the landside where feasible to reduce habitat impacts

The proposed footprint would impact an estimated 1,100 m^2 of high quality Fraser River intertidal habitat and 1,900 m^2 high quality Fraser River riparian habitat

An aquatic habitat survey and aquatic effects assessment would need to be completed to confirm impacts during design

Mitigation and compensation for disturbance to ESAs may be required

Sea Island - Recommended Improvements

Priority

Sea Island is the first priority reach in Phase 5. Implementation priority on Sea Island is described below.

1. Continue to work with YVR to resolve dike jurisdiction and land ownership uncertainties.
2. Raise the existing dike along the current alignment, prioritizing dike upgrades from Lysander Lane northwards first (below 3.5 m CGVD28).
3. Consult with the Pacific Gateway Hotel and marina to develop an interim design to raise the dike to 4.7 m CGVD28 along the current alignment.
4. At the Miller Road drainage pump station, consider designing and constructing pump station and floodbox upgrades in conjunction with dike raising.
5. Work with MOT to have the Moray Channel Bridge replaced with a higher structure that is above 5.5 m CGVD28 and raise the land between the two bridges.
6. Establish development policies that require land raising to dike elevation for river bank properties.

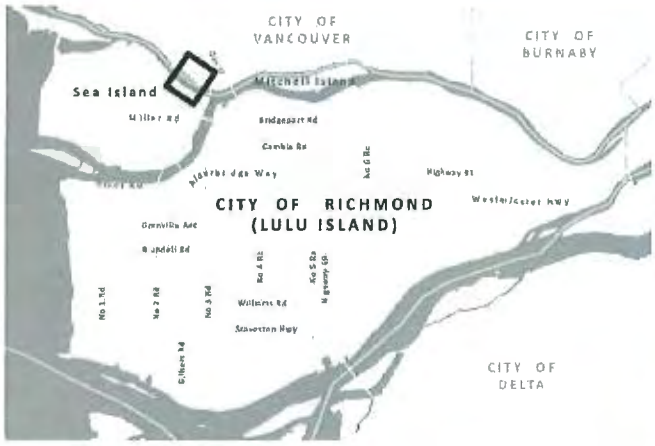
Cost

1.1 km of dike works may be funded as part of site raising with redevelopment or by the City, with 200 m that has already been raised to 4.7 m CGVD28. 40 m of dikes in City road rights-of-way may be covered as part of YVR dike improvements (Shannon and McDonald Roads). 150 m of interim works along the hotel.

Item	Cost per metre	Cost
Interim Dike Raising at Pacific Gateway Hotel	$6,000	$900,000
Dike Raising	$4,500	$3,600,000
Road End Improvements (McDonald Beach, Shannon Road)	$7,200	$300,000
Other (Pathway and access)	$1,000	$800,000
Contingency (40%)	$2,100	$2,200,000
Total	**$7,100**	**$7,800,000**

Cost opinions are in 2018 Canadian Dollars.

Richmond Island





Existing Conditions

Richmond Island is connected to the City of Vancouver via a small causeway. There is no existing dike on Richmond Island. The majority of the island is above both the dike upgrade elevation of 4.7 m CGVD28 and the future allowance to 5.5 m CGVD28, with the exception of the causeway. The entire Island is one private lot.

In 2012, a covenant was established that acknowledges that the City has not plans to protect the island from flooding and releases the City from any damage or losses covered by flooding or erosion.

The Fraser River North Arm is deep, and bathymetry indicates scour along this section. Riprap bank protection is in place around the island.

Utilities are provided by the City of Vancouver.

Unique Features

- Richmond Island is one private lot with a restaurant and marina that is serviced by the City of Vancouver.
- Covenant in place that acknowledges Richmond has no plans to protect the island from flooding or erosion.
- Fraser River north arm along this reach is deep due to scour.
- The majority of the island is above the dike elevation of 4.7 m CGVD28.

Considerations

Flood Protection

- Dike alignment
- Dike crest elevation
- Erosion protection
- Seismic performance
- Static stability and seepage
- River toe stability and setbacks
- Boat waves

Industrial

- Private marina on north side of the island.
- Road design and driveway grade

Social

- Align with 2009 Waterfront Strategy
- Connect to existing and planned trails and public amenities
- Wayfinding and public information signs

Environmental

- High quality intertidal habitat around the island
- FREMP mapping did not include riparian area, though based on orthimagery interpretation, riparian habitat is present
- Large habitat compensation project is located at the western tip of the island
- Shoreline and Intertidal ESAs present around perimeter of island

Richmond Island - Recommended Improvements

No Works Proposed

Master Plan Features

Flood Protection

No flood or erosion protection works by the City

Inform property owner of scour risk in the North Arm

Industrial

No impacts to business or industry

Social

No impacts to public infrastructure

Environmental

No impacts to existing habitat

Priority

1. Consider informing the property owner on Richmond Island of the scour risk that has been identified in the North Arm of the Fraser River adjacent to the Richmond Island.

Cost

No works are proposed. Flood protection to remain the responsibility of this single lot.

6. Recommendations

It is recommended that the City adopt the Phase 5 Dike Master Plan as documented in this report, including the main features described below.

Mitchell Island

- During redevelopment, require private properties to be raised to dike elevation and acquire rights-of-way along the river bank. Rights-of-way allow for a future dike and bank protection works.
- As rights-of-way are acquired around the perimeter of Mitchell island, assess the condition of existing bank protection works and consider whether the works should be the responsibility of the City or private land owners.
- Raise roadways to dike elevation to provide emergency egress (consider partial raises in low areas to reduce impacts to operations). Assess and modify drainage system infrastructure to maintain drainage services for lots before and after land raising.
- Work with low elevation properties to mitigate flood and associated contamination risks.

Sea Island

- Raise the dike crest to 4.7 m CGVD28 to allow for 1 m of sea level rise. Widen the dike on the land side rather than into the Fraser River Middle Arm. Retaining walls or extending the dike towards the riparian area may be considered in site-specific constrained areas. Recent raises have been completed on some sections of the dike, including up to 4.7 m CGVD28 in one location.
- Establish development policies on Sea Island that require land raising to dike elevation during site redevelopment.
- Coordinate dike upgrades with upgrades to the Miller Road Drainage Pump Station and the Moray Channel Bridge (MOTI).
- As an interim measure along the Pacific Gateway Hotel, raise the dike to 4.7 m CGVD 28 with a sheetpile wall embedded along the river-side and a land-side retaining wall.
- Coordinate dike improvements with YVR and establish agreed upon dike jurisdictions.

Richmond Island

- No changes by the City are proposed as the island is predominantly above 5.5 m CGVD28. Flood protection responsibility is recommended to remain with the property owner.
- Inform the property owner on Richmond Island of the scour risk that has been identified in the North Arm of the Fraser River adjacent to the Richmond Island.

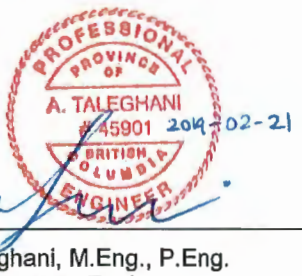
For all phases of the Dike Master Plan, the City should continue to research alternative densification strategies for seismic stability, consider alternative seismic performance criteria, and consider filling a wide swath of land (several hundred metres) inside the dike. The latter two points (seismic criteria and fill inside the dike) are considerations in the pending Flood Protection Management Strategy update.

It is also recommended that the City prepare a comprehensive implementation plan for dike upgrading that incorporates the elements of Phase 5 and the other Dike Master Plans. To address habitat compensation issues associated with the Dike Master Plans, it is further recommended that the City consider development of a habitat banking program that could provide effective large-scale compensation for the environmental impacts of dike upgrading.

Report Submission

Prepared by:

KERR WOOD LEIDAL ASSOCIATES LTD.



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This document is a copy of the sealed and signed hard copy original retained on file. The content of the electronically transmitted document can be confirmed by referring to the filed original.

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Senior Biologist

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Revision History

Revision #	Date	Status	Revision	Author
0	February 21, 2019	FINAL	Issued to client as final	ARM

IQQM CERTIFIED

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consulting engineers

Appendix A

Plans and Sections for Richmond Dike Master Plan – Phase 5

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City of Richmond
Richmond Dike Master Plan - Phase 5

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Legend

- Easements
- Active ROW
- City Owned Lots
- Parcels (from BC Open Data Catalogue -Parcel Fabric)
- Existing Dike (Provincial Database)

Water Network
- Water Service Lateral
- Watermain
- Alternate Node
- Blow Off
- Cap
- Hydrant
- PRV Chamber
- Valve
- Valve Chamber

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- Drainage Ditch
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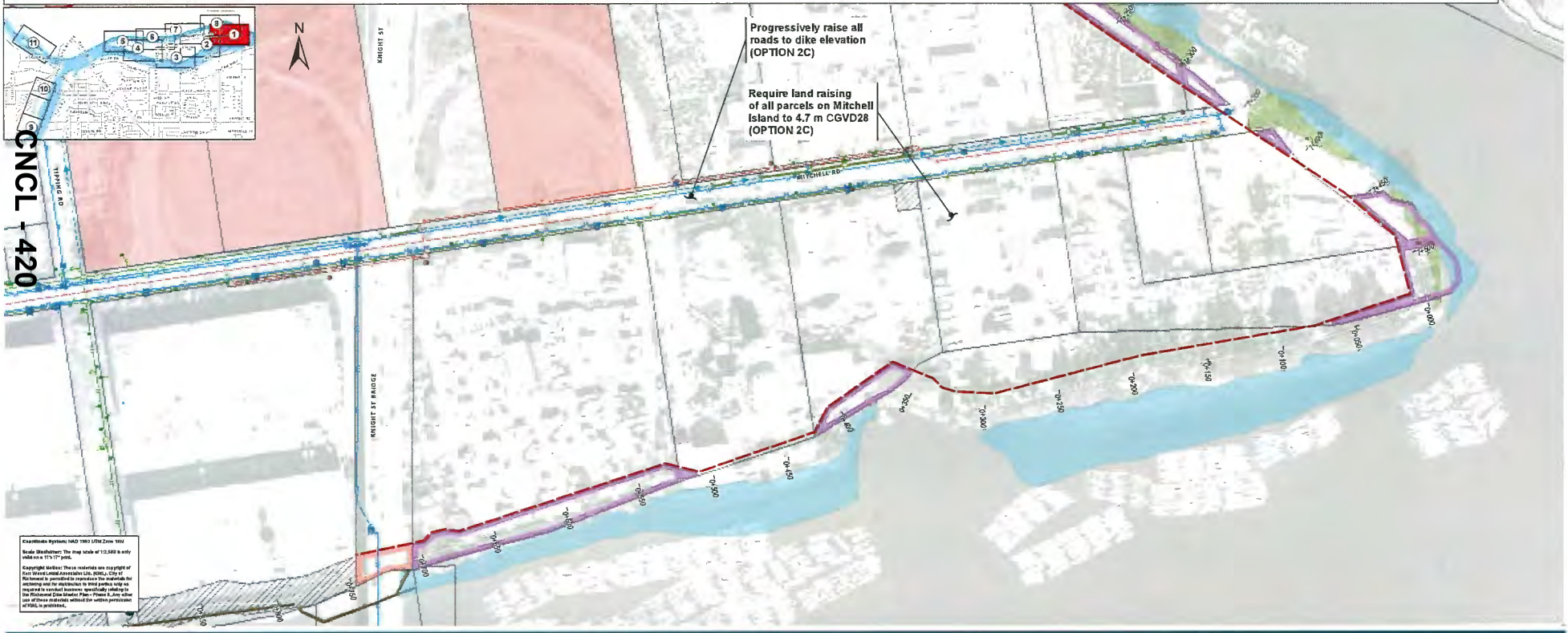
- Fish Habitat Compensation Sites

Habitat Quality & Type
- High Quality Intertidal
- High Quality Riparian

- Possible ROW Limit to be Acquired for Dike Option

Possible Parcel Area to Acquire for ROW (Owner Type)
- Municipal
- Private

Note: 2016 Imagery Shown.



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Richmond Dike Master Plan - Phase 5
Mitchell Island

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City of Richmond
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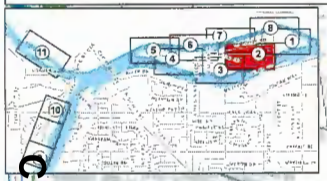
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- Private

Note: 2016 Imagery Shown.



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KNIGHT ST BRIDGE

RIVER RD

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Richmond Dike Master Plan - Phase 5
Mitchell Island

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City of Richmond
Richmond Dike Master Plan - Phase 5

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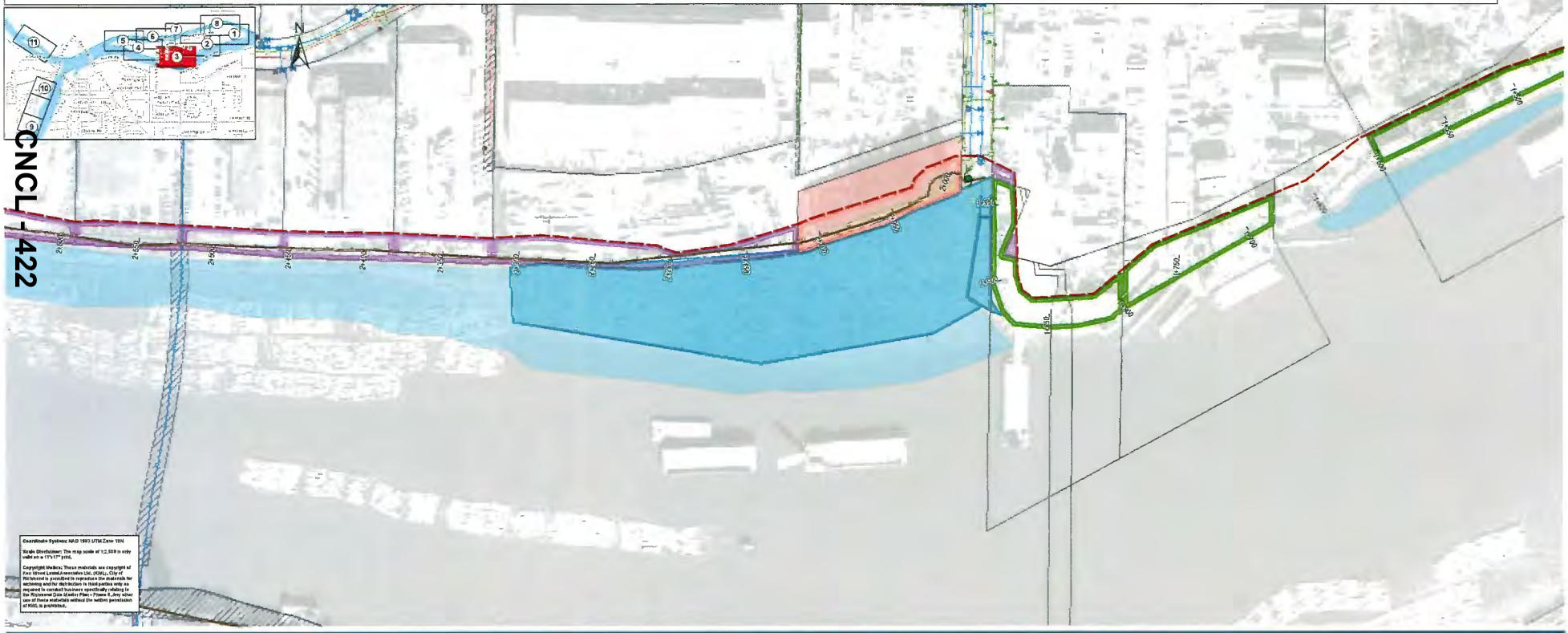
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- None
- Private

Note: 2016 Imagery Shown.



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Richmond Dike Master Plan - Phase 5
Mitchell Island

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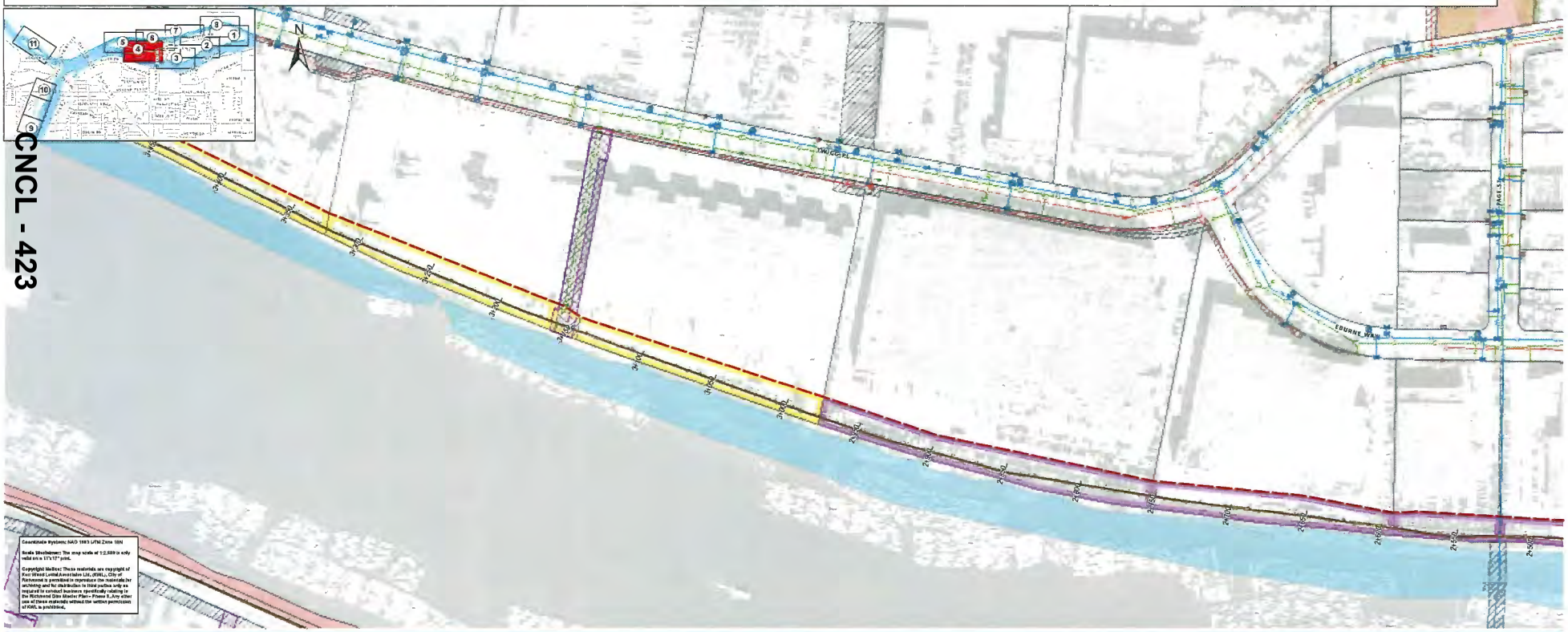
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- Sanitary Manhole
- Sanitary Pump

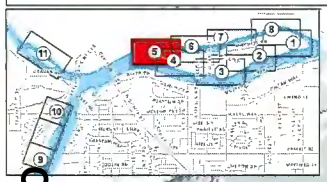
- Fish Habitat Compensation Sites

Habitat Quality & Type
- High Quality Intertidal

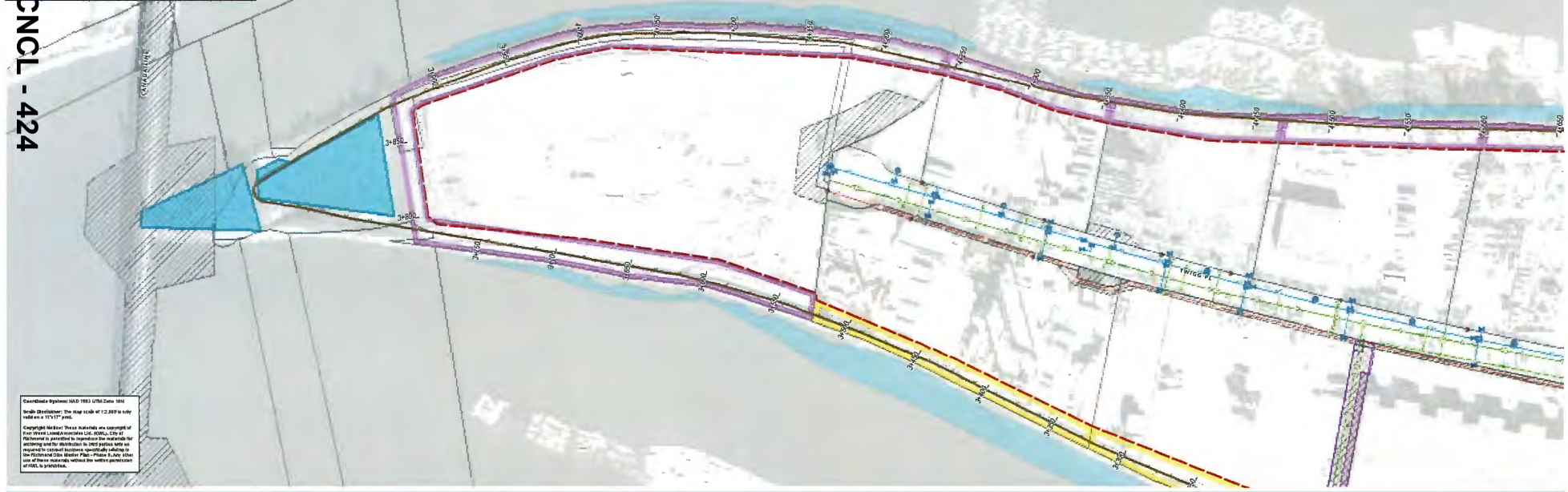
- Possible ROW Limit to be Acquired for Dike Option

Possible Parcel Area to Acquire for ROW (Owner Type)
- Private
- Unknown

Note: 2016 Imagery Shown.



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Coordinate System: NAD 1983 UTM Zone 10N

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Date February 2019
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Richmond Dike Master Plan - Phase 5
Mitchell Island

5

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City of Richmond
Richmond Dike Master Plan - Phase 5

KERR WOOD LEIDAL consulting engineers

Legend

- Easements
- Active ROW
- City Owned Lots
- Parcels (from BC Open Data Catalogue -Parcel Fabric)
- Existing Dike (Provincial Database)

Water Network
- Water Service Lateral
- Watermain
- Alternate Node
- Blow Off
- Cap
- Hydrant
- PRV Chamber
- Valve
- Valve Chamber

Storm Network
- Storm Main
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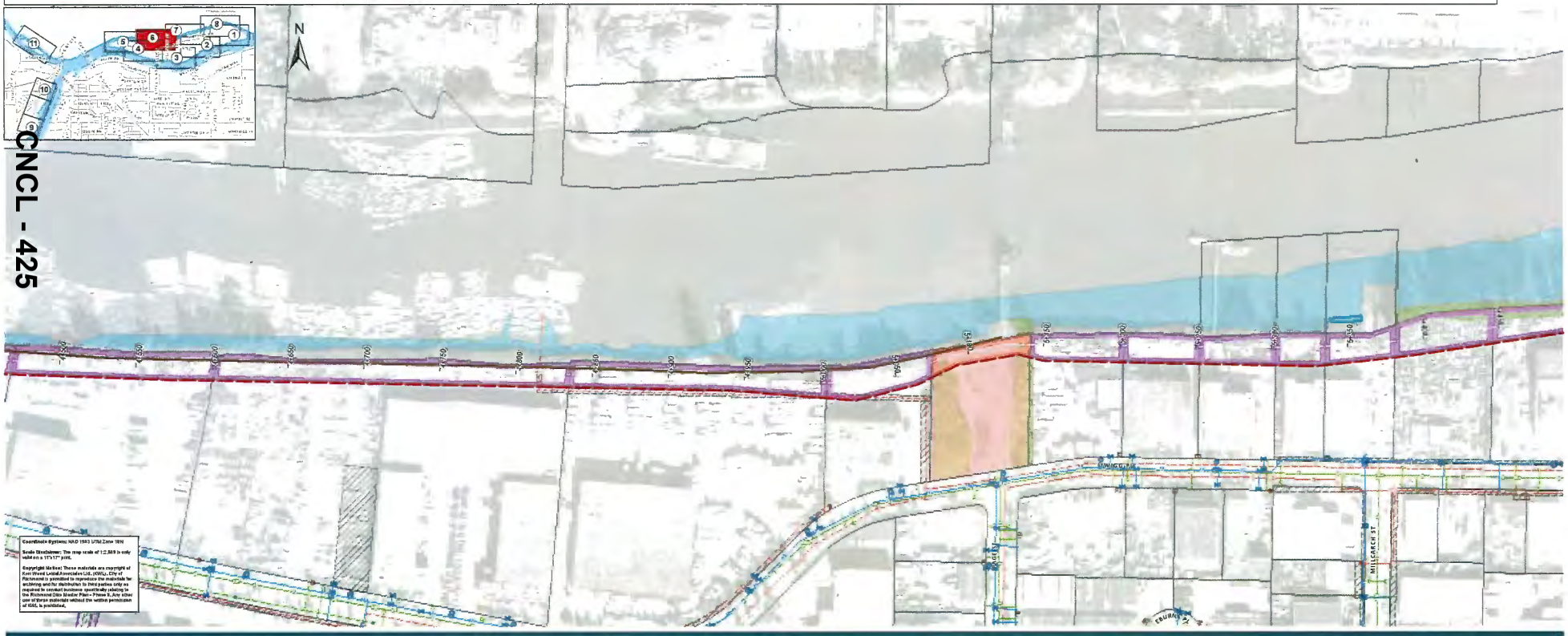
- Fish Habitat Compensation Sites

Habitat Quality & Type
- High Quality Intertidal
- High Quality Riparian

- Possible ROW Limit to be Acquired for Dike Option

Possible Parcel Area to Acquire for ROW (Owner Type)
- Municipal
- Private

Note: 2016 Imagery Shown.



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Richmond Dike Master Plan - Phase 5
Mitchell Island

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City of Richmond
Richmond Dike Master Plan - Phase 5

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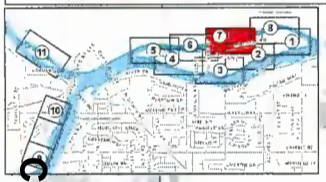
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Habitat Quality & Type
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- High Quality Riparian

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Possible Parcel Area to Acquire for ROW (Owner Type)
- Private

Note: 2016 Imagery Shown.



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MITCHELL RD

TWIGG RD

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Project No. 651.129
Date February 2019
Scale 1:2,500

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Richmond Dike Master Plan - Phase 5
Mitchell Island

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City of Richmond
Richmond Dike Master Plan - Phase 5

KERR WOOD LEIDAL consulting engineers

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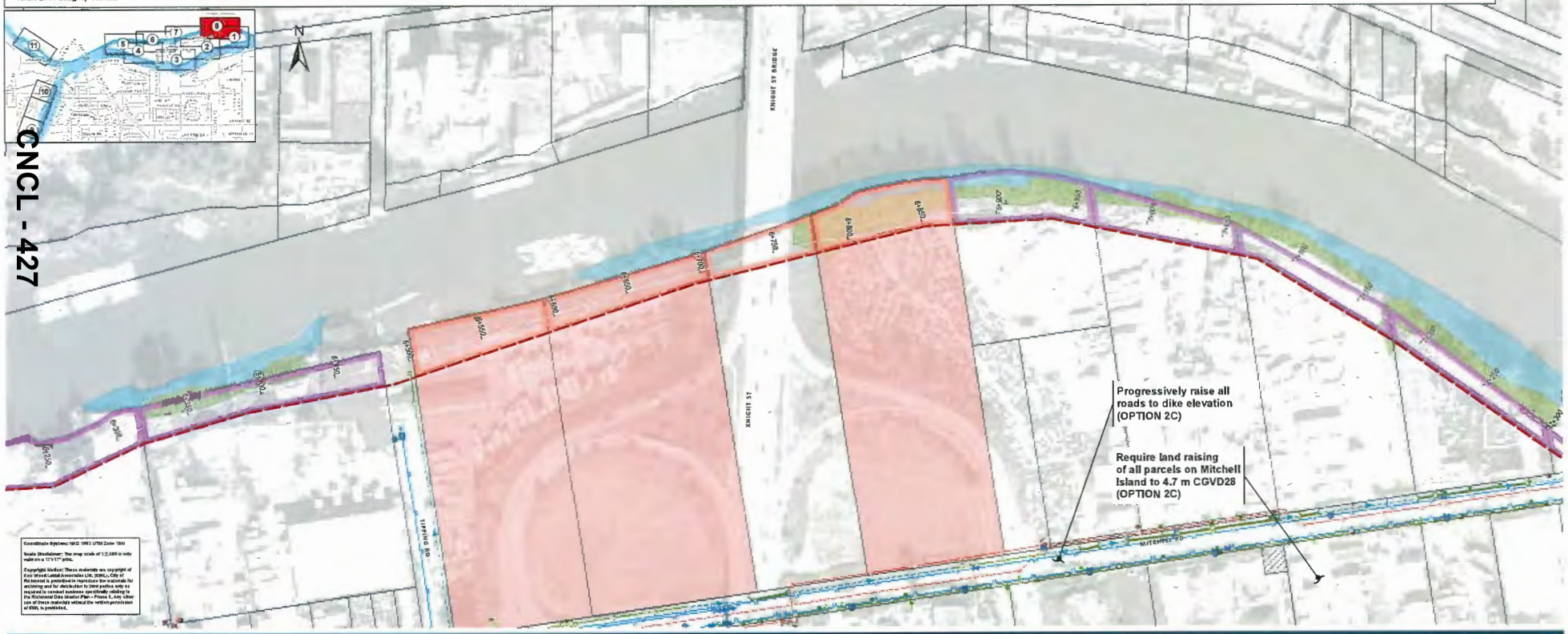
- Fish Habitat Compensation Sites

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Note: 2016 Imagery Shown.



CNCL - 427

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Richmond Dike Master Plan - Phase 5
Mitchell Island

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City of Richmond
Richmond Dike Master Plan - Phase 5

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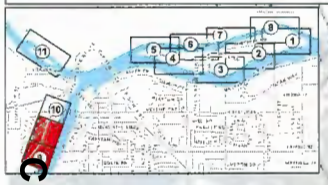
Sanitary Network
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- Fish Habitat Compensation Sites

Habitat Quality & Type
- High Quality Intertidal
- High Quality Riparian

Recommended Upgrade
- Top of Bank /Crest
- Bank Slope
- Dike Fill Extent

Note: 2016 Imagery Shown.



Overall Long-Term Recommended Upgrade: OPTION 1A: Raise standard river dike and extend land-side.

Continue to work with YVR to formalize jurisdiction boundaries for the dike.

For constrained locations at the northern end of the BCIT building and at Cessna Drive, either move the dike towards the river (OPTION 1B) or build a retaining wall on the land-side (OPTION 1C). Footprints shows OPTION 1A.

Project No. 651.129
Date February 2019
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Richmond Dike Master Plan - Phase 5
Sea Island

CNCL - 428

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City of Richmond
Richmond Dike Master Plan - Phase 5

KERR WOOD LEIDAL consulting engineers

Legend

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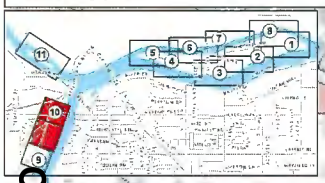
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- Fish Habitat Compensation Sites

Habitat Quality & Type
- High Quality Intertidal
- High Quality Riparian

Recommended Upgrade
- Top of Bank /Crest
- Bank Slope
- Dike Fill Extent

Note: 2016 Imagery Shown.



Acquire rights-of-way where none exists along dike and widen existing for future upgrades.

When the Miller Road drainage pump station is upgraded, provide space and structural capacity for loading due to future dike upgrades.

Acquire rights-of-way where none exist along dike and widen existing for future upgrades.

Continue to work with YVR to formalize jurisdiction boundaries for the dike. Boundary shown is based on consultation during the Dike Master Plans's development.

Where constrained at Lysander Lane, either raise Lysander Lane, move the dike towards the river (OPTION 1B), or build a retaining wall (OPTION 1C) to avoid impacting the road. Footprint shows OPTION 1A.

Where constrained at hotel and marina, raise the dike to 4.7 m CGVD28 with a river bank sheetpile wall and land-side retaining wall (OPTION 1G) in the interim, until redevelopment of the site occurs. Footprint shows OPTION 1A.

Consult with MOT to have the Moray Channel Bridge replaced with a structure above 5.5 m CGVD28 and the land raised between the bridges, when the bridge is at the end of its design life.

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Project No. 651.129
Date February 2019
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Richmond Dike Master Plan - Phase 5
Sea Island

CNCL - 429

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City of Richmond
Richmond Dike Master Plan - Phase 5

KERR WOOD LEIDAL consulting engineers

Legend

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Water Network
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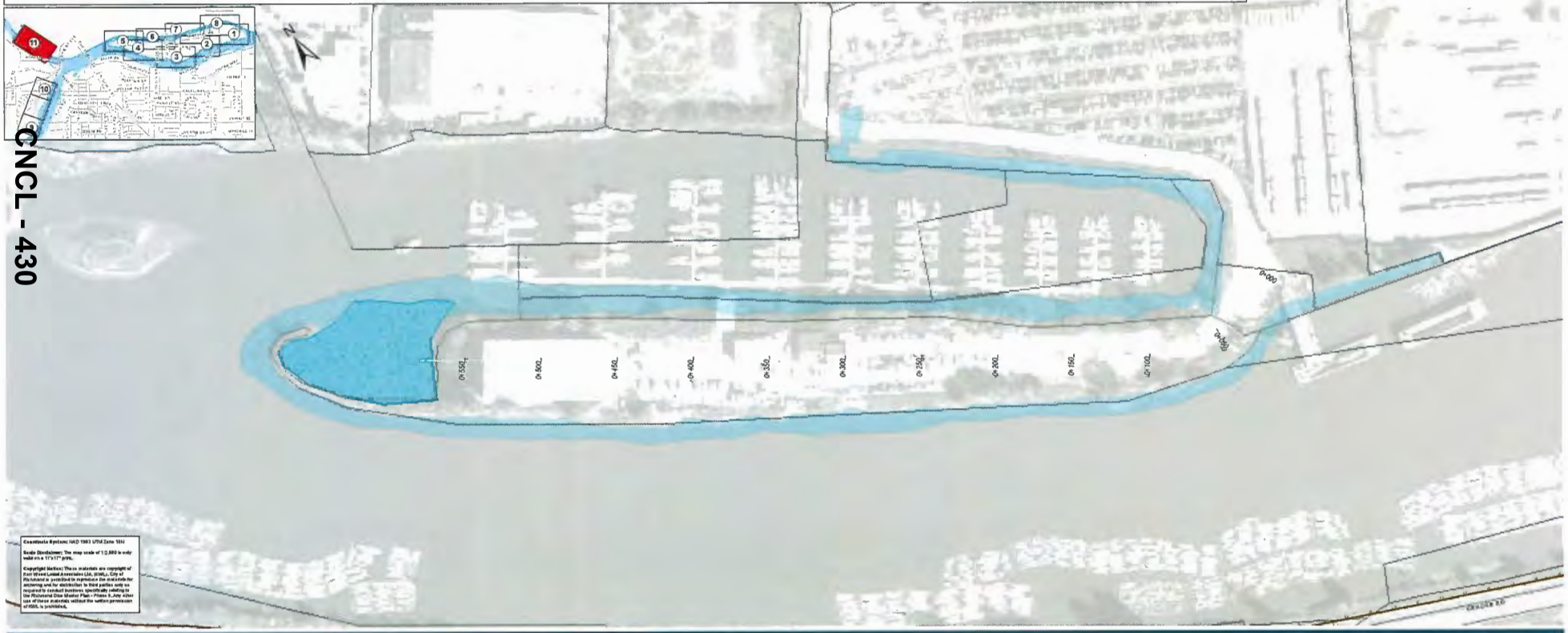
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- Sanitary Pump

- Fish Habitat Compensation Sites

Habitat Quality & Type
- High Quality Intertidal

Note: 2016 Imagery Shown.



Coordinate System: NAD 1983 UTM Zone 10N

Scale Disclaimer: The map scale of 1:2,500 is only valid on a 11"x17" print.

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Project No. 651.129
Date February 2019
Scale 1:2,500

50 25 0 50 m

Richmond Dike Master Plan - Phase 5
Richmond Island

11

CNCL - 430

KERR WOOD LEIDAL
consulting engineers

Appendix B

Geotechnical Engineering Analysis Report (Thurber)

THURBER ENGINEERING LTD.

October 16, 2018 File: 17991

Kerr Wood Leidal Associates Ltd.
200 4185A Still Creek Drive
Burnaby, BC V5C 6G9

Attention: Colin Kristiansen, P.Eng.

LULU ISLAND DIKE MASTER PLAN - PHASES 3, 4 AND 5
GEOTECHNICAL SEISMIC ASSESSMENT OF FLOOD CONTROL DIKES
PRELIMINARY REPORT

Dear Colin:

As requested, Thurber Engineering Ltd. (Thurber) has carried out numerical seismic deformation analyses for the above project using the software program Plaxis. This report presents the results of the deformation analysis and a preliminary assessment of the performance of flood control measures in the context of provincial design requirements for high-consequence dikes. It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

1. INTRODUCTION

The City of Richmond (the City) requires input to identify dike upgrade options for Phases 3, 4 and 5 of the Lulu Island Dike Master Plan. The purpose of the Dike Master Plan is to address the short, medium and long-term needs of the Lulu Island diking system. Phase 1 of the plan was carried out in 2012 and included input on the Steveston Dike and south section of the West Dike. Phase 2 of the plan included the north section of the West Dike and the North Dike.

Phase 3 comprises about 20 km of the South Dike on the south arm of the Fraser River. Phase 4 includes the North Dike, extending from No. 6 Road to Boundary Rd. Phase 5 includes Mitchell Island, Richmond Island, and the Richmond part of Sea Island (from the southern end of the BCIT campus North to the Moray Rd. Bridge).

These high-consequence dikes are required to consider seismic performance as described in the Ministry of Forests Lands and Natural Resource Operations' (MFLNRO's) 2014 Seismic Design Guidelines for Dikes. (2014 Seismic Guidelines). Additionally, the dikes are anticipated to be raised in the future to address sea level rise.

Accordingly, this report presents the preliminary results of our numerical seismic deformation analyses for eight dike sections: three in each of the Phase 3 and Phase 4 study areas, and two in the Phase 5 study area. The analyses presented below follow the analytical methods described in the 2014 Seismic Guidelines.

THURBER

2. SEISMIC ASSESSMENT BASIS

Seismic assessments were carried out for the eight dike sections at the locations in the table below. The assessments for the Phase 3 dike sections were carried out using cone penetration test (CPT) data provided by the City. Geotechnical investigations were carried out specifically for this project at the five sections in the Phase 4 and 5 study areas. The locations of the dike sections were selected by KWL. Profile drawings showing the section analysed at each location were prepared by KWL and are included in Appendix A. Our analyses followed the analytical methods described in the 2014 Seismic Guidelines.

Section	Phase	Test Hole
53+900	3	Tetra Tech CPT17-02
61+900	3	GeoPacific CPT06-03, CPT 06-06
67+600	3	MEG CPT17-03
11+700	4	CPT 18-03
16+400	4	CPT 18-04
18+750	4	CPT 18-05
1+000	5	CPT 18-01
5+700	5	CPT 18-02

The 2014 Seismic Guidelines recommend designing high-consequence dikes and appurtenant structures to control seismic deformations within prescribed limits. The seismic deformation limits vary depending on the seismic hazard return period as shown in the table below.

Seismic hazard return period (year)	Maximum allowable displacement (mm)	
	Horizontal	Vertical
1 in 100	<30	<30
1 in 475	300	150
1 in 2,475	900	500

The analyses used earthquake time-histories that were developed for the George Massey Tunnel replacement project. The earthquake time-histories were scaled for each dike section location using Natural Resources Canada's on-line seismic hazard calculator. The analyses were carried out for the crustal, inslab, and interface (i.e. Cascadia subduction event) scenario earthquakes. Three earthquake time histories for each scenario earthquake were developed for each of the 1 in 100, 475 and 2,475-year return period seismic hazards.

We carried out 1-dimensional site-specific response analyses (SSRAs) using each of the time histories. The SSRAs were carried out using the software program DEEPSOIL published by the University of Illinois. The SSRAs were completed using three crustal, three in-slab and three interface earthquake time-histories for each of the 1 in 100, 475 and 2,475-year return period

seismic hazards, for a total of 27 SSRAs per dike section. The results of the SSRAs were used in both the liquefaction assessment and numerical deformation analysis. The SSRAs used the shear wave velocity data from the CPTs to estimate the site-specific seismic accelerations and seismically induced shear stresses and strains.

The numerical deformation modelling analyses were completed using one crustal, one inslab and one interface earthquake for each of the slope sections analysed. The time history for each scenario earthquake type (i.e. crustal, inslab and interface/subduction) used in the numerical analyses was selected by choosing the earthquake that had the median maximum shear stress profile obtained from the SSRAs. The soil stiffness and damping parameters used in the numerical deformation analyses were calibrated based on the maximum shear strain profile and ground response obtained from the SSRAs.

The seismic assessment included liquefaction analyses and numerical deformation analyses using the results from the SSRAs and the data from the CPTs. The numerical deformation analyses were based on the dike sections provided by KWL.

3. GEOTECHNICAL INVESTIGATION

3.1 Program of work

The field investigation was carried out July 5 and 6, 2018 and comprised a combination of auger drilling and CPT profiling. The CPTs included two seismic CPTs (i.e. SCPTs), which are CPTs with the addition of shear wave velocity profiling. The CPT profiles, test hole logs and a test hole location plans (Drawings 17991-1 to 17991-5) are attached in Appendix B.

The CPTs were advanced to depths of 30 m. Two CPTs (CPT 18-02 to 18-05) were supplemented with shear wave velocity measurements. The CPT provides a continuous trace of cone tip resistance, sleeve friction and pore pressure. This data was used to interpret the soil stratigraphy and estimate soil properties (e.g. strength and density). The SCPT includes shear wave velocity measurements that were used to estimate the small-strain shear modulus of the soil. The small-strain shear modulus has been used in the SSRAs and numerical deformation analyses. The CPTs were drilled out to depths of nominally 7.5 m with a solid stem auger to confirm the soil profile and obtain disturbed samples.

The soil and groundwater conditions in the test holes were logged in the field by an experienced geotechnical engineer and representative disturbed samples were collected for routine moisture content testing and visual classification in our laboratory. Fines content analyses (% passing 75 µm sieve) and Atterberg limit testing were carried out on select representative samples.

All test holes located on the dike and within the dike right-of-way were grouted in general accordance with B.C. groundwater protection regulations and MFLNRO requirements.

THURBER

3.2 Results

The results of the investigation and laboratory testing are summarized on the attached test hole and CPT logs. The logs provide a complete, detailed description of the conditions encountered and should be used in preference to the generalized descriptions given below. The soil descriptions provided on the CPT logs are Gregg Drilling and Testing Canada's interpretations of the CPT data using generally accepted correlations and should be considered approximate.

At TH/CPTs 18-04 and 18-05, which are at the east end of Lulu Island, the conditions encountered comprised a thick silt layer at the surface underlain by Fraser River sand. The silt layer was about 17 m to 20 m thick and comprised clayey organic silt to sandy silt. The underlying Fraser River Sand was encountered to the maximum depth investigated (30 m).

At TH/CPTs 18-01, 18-02 and 18-03 the subsurface conditions comprised a silt crust that varied from about 4 m to 7 m thick. Below the crust, Fraser River sand was encountered to depths of about 23 m to 24 m. Silt was encountered below this to the maximum depth investigated.

The interpretation of the CPT data provided by the City for the three Phase 3 dike sections indicates the subsurface conditions at these locations are similar to the conditions encountered at TH/CPTs 18-01, 18-02 and 18-03. We expect that conditions in this phase typically comprise a 2 m to 7 m thick clay first overlaying Fraser River sand to depths of about 20 m to 25 m.

The results of the investigation were consistent with the British Columbia Geological Survey's Map 2010-2 "Quaternary Geology of Richmond, British Columbia", which is attached for reference. This map indicates that surficial geology of most of Lulu Island comprises a silt crust at the surface that is typically 2 m to 7 m thick, underlain by Fraser River sand extending to depths of about 25 m. The map shows that the surficial geology on the east end of Lulu Island comprises organic silts and peat up to 12 m thick underlain by Fraser River Sand.

Groundwater levels are anticipated to generally follow water levels in the Fraser River and can be expected to vary with rainfall, drainage and infiltration.

4. SEISMIC PERFORMANCE

4.1 Liquefaction Assessment

Liquefaction assessments using empirical methods were carried out to assess the degree of liquefaction under each of the seismic hazard return periods for each earthquake scenario type and to provide estimates of reconsolidation settlement. These liquefaction assessments were also used to compare the liquefaction predicted using empirical methods against the liquefaction predicted from the 1D numerical models.

Liquefaction assessments were carried out for flat ground (i.e. 1D) conditions for each of the three design earthquake levels using the software program CLiq published by Geologismiki.

These assessments followed the methods described by Idriss and Boulanger (2008 and 2014) to evaluate the resistance to liquefaction (i.e. the cyclic resistance ratio (CRR)). The shear stress triggering liquefaction (i.e. the cyclic stress ratio (CSR)) was calculated by averaging the maximum stress ratio profiles for each scenario earthquake (e.g. the CSR for the 1 in 100-year crustal earthquake was calculated using the average of the maximum stress ratio profiles from the three crustal time-histories).

The results of the liquefaction triggering analyses are presented on the plots generated by CLiq in Appendix C. These plots show layers where liquefaction is anticipated (i.e. where the CSR is greater than the CRR, or the factor of safety is less than one against liquefaction) and also provide estimates of post-liquefaction reconsolidation settlement.

The liquefaction triggering assessment shows that liquefaction is anticipated to be insignificant under all of the scenario earthquakes for the 1 in 100-year return period seismic hazard. This corresponds to "No liquefaction (L0)" per the 2014 Seismic Guidelines. The assessment also indicates that the sand encountered is generally liquefiable under all of the scenario earthquakes for the 1 in 475 and 2,475-year return period seismic hazards. We have inferred that the extent of liquefaction of the sand layers under the 1 in 475-year return period earthquakes is "Mild liquefaction (L1)" to "Moderate liquefaction (L2). The extent of liquefaction under the 1 in 2,475-year return period seismic hazards is inferred be "High liquefaction (L3)".

The reconsolidation settlements under the 1 in 475 and 2475-year return period seismic hazards are anticipated to be typically between about 400 mm to 1000 mm. The exception to this is at the sections at the east end of Lulu Island where a thick layer of surficial silt was encountered. At these locations, reconsolidation settlements are anticipated to be about 50 to 400 mm under the 1 in 475 and 2475-year return period seismic hazards. For the 1 in 100-year return period seismic hazard, reconsolidation settlements are anticipated to be less than 100 mm at all of the dike sections analysed for all earthquake scenario types. The reconsolidation settlements typically nominally meet or exceed the performance requirements of the 2014 Seismic Guidelines.

For reference we have attached the British Columbia Geological Survey's Map 2010-3 "Liquefaction Hazard Map of Richmond, British Columbia" which shows a qualitative assessment of the liquefaction risk. The results of our liquefaction assessment are consistent with the information shown on the map.

4.2 Numerical Deformation Analysis

We carried out seismic numerical deformation analyses using the software program Plaxis 2D. Plaxis 2D is an advanced finite element modelling program that allows for complex modelling of cyclic soil behaviour, similar to the software program FLAC, but with a user-friendly interface that allows for more rapid model construction and a faster computation routine. The deformation analyses incorporated complex cyclic soil behaviour using the UBCSand soil model, which is the same model used in FLAC for similar numerical deformation analysis.

The numerical deformation analysis used the site-specific earthquake acceleration time histories output from the SSRAs. The numerical deformation analyses were carried out for the 1 in 100, 475 and 2,475-year return period seismic hazards for each of the earthquake scenario types.

One time-history was run for each of the scenario earthquakes for each return period seismic hazard. The time histories were selected by taking the scenario earthquake time-histories that had the median CSRs for each scenario earthquake type.

In keeping with the intent of the concept that the dikes must perform under a uniform hazard framework consistent with the NRC's probabilistic seismic hazard assessment, we have taken the performance under each earthquake return period as the largest displacements of the scenario earthquakes. The largest displacements for all of the sections analysed was the crustal scenario earthquake for the 1 in 100-year return period seismic hazards. For the 1 in 475 and 2,475-year return period seismic hazards, the subduction scenario earthquake resulted in the largest displacements for all of the dike sections.

The output from the Plaxis analyses provided in Appendix D presents the results from the earthquake scenario type that had the largest seismic displacements. The output includes plots of vertical and horizontal displacements for comparison with the performance requirements of the 2014 Seismic Guidelines. We have also included plots showing total displacement as this provides a clearer interpretation of the pattern of displacements.

The numerical deformation analyses indicate that the dikes will not meet the performance requirements of the 2014 Seismic Guidelines for any of the return period seismic hazards. The analyses indicate that typically the required dike setback will be about 50 m to 100 m. The actual setback will depend on the dike height and configuration and site-specific conditions.

5. DISCUSSION

We understand that the intent of the 2014 Seismic Guidelines is for construction of conventional dikes using alignments or reasonable design features to meet the required seismic performance criteria. However, extensive ground improvement is not necessarily required if the seismic performance criteria are not met. The 2014 Seismic Guidelines acknowledge that ground improvement methods are "costly and may only be practical for short sections or at appurtenant structures", such as pump stations or flood gates. Accordingly, if cost-prohibitive ground improvement is the only way to conform to the guidelines, alternatives should be considered.

The 2014 Seismic Guidelines suggest alternatives such as: 1) realigning dikes to less seismically vulnerable areas, 2) overbuilding dikes to accommodate seismic displacements, 3) building very wide "superdikes", and 4) developing comprehensive flood risk and flood protection strategies, including post-earthquake dike repair plans.

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The analysis indicates that ground improvement or other remedial measures will be required to meet the performance requirements of the 2014 Seismic Guidelines for dikes near riverbanks.. The critical location for ground improvement is under the waterside toes/slopes of the dikes, where the shear stress bias is the highest. In some situations, such as where the dikes are high, ground improvement may also be required under the landside toes/slopes of the dikes. Sufficient deformation control could probably be achieved using ground improvement with an aspect ratio of between 0.75H:1V and 1H:1V extending to the bottom of the deepest liquefiable layer (i.e. in profile view, the width of the ground improvement should be 75% to 100% of the depth of liquefaction).

It is our opinion that ground improvement using stone columns is probably the most suitable ground improvement method for the contemplated dike upgrade. Stone columns typically cost about $\$15/m^3$ on a treated volume basis. Compaction piles, soil mixing and jet grouting are other alternatives to increase the strength of the sand to limit liquefaction. These alternatives typically cost more and could be more difficult to adapt to changing or unexpected subsurface conditions than stone columns.

Compaction piles would also probably need to be straight (i.e. without taper) displacement piles. Although timber piles are commonly used as compaction piles, because they are tapered they may not be able to densify the soil at depth. Accordingly, they are not recommended. Compaction piles comprising precast concrete or steel pipe piles are expected to cost about 20 times stone columns on a volume basis.

Soil mixing methods include deep soil mixing (DSM) and cutter soil mixing (CSM). These methods are typically about five times the cost of stone columns per treated soil volume. Jet grouting also costs more, at about seven times the cost of stone columns.

As a potential alternative to ground improvement, the dikes could be set back from the river bank. Based on the results of the Plaxis deformation analyses, the required distance could be in the order of 50 m to 100 m. Setback dikes could either require flat slopes or some ground improvement to mitigate seismic deformations (i.e. lateral spreading of the dike embankment).

6. CLOSURE

We trust that this letter provides sufficient information for your needs at this time. Should you require clarification of any item or additional information, please do not hesitate to contact us.

Yours truly,

Thurber Engineering Ltd.
David Regehr, P.Eng.
Review Principal



Steven Coulter, P.Eng.
Project Engineer

Attachments

- Statement of Limitations and Conditions (1 page)
- Appendix A – KWL Dike Sections (9 pages)
- Appendix B – Geotechnical Investigation (15 pages)
- Appendix C – Liquefaction assessment CLiq output (72 pages)
- Appendix D – Numerical deformation analyses Plaxis output (72 pages)
- British Columbia Geological Survey Map 2010-2 "Quaternary Geology of Richmond, British Columbia"
- British Columbia Geological Survey Map 2010-3 "Liquefaction Hazard Map of Richmond, British Columbia"

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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.

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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.

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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.

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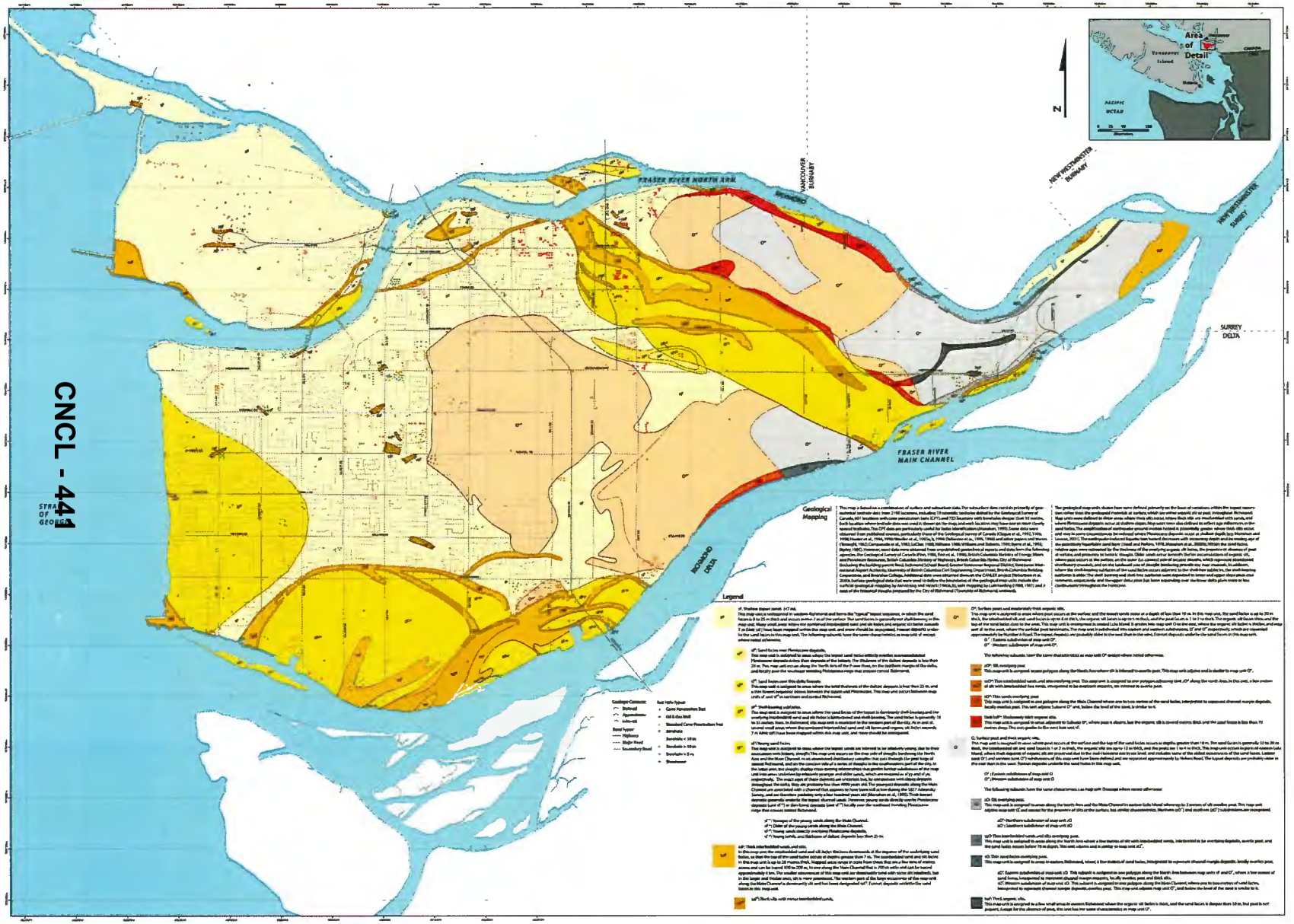
d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted 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.

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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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The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



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STRATA OF GEORGIA

British Columbia Geological Survey
Geoscience Map 2010-2

QUATERNARY GEOLOGY OF RICHMOND, BRITISH COLUMBIA

parts of NTS 092G/03 and 092G/06

Patrick A. Monahan, Victor M. Levson and Ben Kerr

Metric

Projection: Universal Transverse Mercator, Zone 10 North.
Datum: North American Datum 1983

Scale 1:20 000 (when printed on 36×48 inch paper)

This map shows geological variation in the Quaternary deposits underlying the City of Richmond, British Columbia, and has been prepared as part of an earthquake hazard mapping project in the city. Richmond is located in one of the most seismically active regions in Canada (Rogers, 1998), and the deltaic sediments on which the city is built can amplify ground motions and are susceptible to earthquake induced liquefaction (e.g. Byrne, 1978; Finn et al., 1989; Byrne and Anderson, 1991; Clague et al., 1992, 1997, 1998; Watts et al., 1992; Rogers et al., 1998; Harris et al., 1995, 1998; Cassidy et al., 1997; Cassidy and Rogers, 1999; Levson and Monahan, 2004). Because the variation in earthquake hazards is most affected by geological conditions in the upper 20 to 30 metres, this map primarily reflects geological variation in the upper 20 to 30 metres of the Quaternary sequence.

Quaternary Geology Framework

Richmond is located entirely within the Fraser River delta, which is the largest delta in western Canada. This deltaic deposition initially began as far east as the Pleistocene glaciomarin sediments (Clague et al., 1983, 1997, 1998; Luternauer et al., 1994). The thickness of the deltaic deposits underlying Richmond varies from less than 20 metres locally along the North Arm of the Fraser to a maximum known thickness of 302 m beneath City Hall (Luternauer et al., 1986). Deltaic deposits are generally thicker than 10 m at distances greater than 1 km from the delta margin, and the southern margin is located immediately north of the North Arm in the southernmost parts of Vancouver and Burnaby. However, a buried valley of Pleistocene sediments, above which deltaic deposits are locally less than 20 metres thick, trends southeast across the city from the western edge of Marshall Island, which is located in the North Arm of the Fraser.

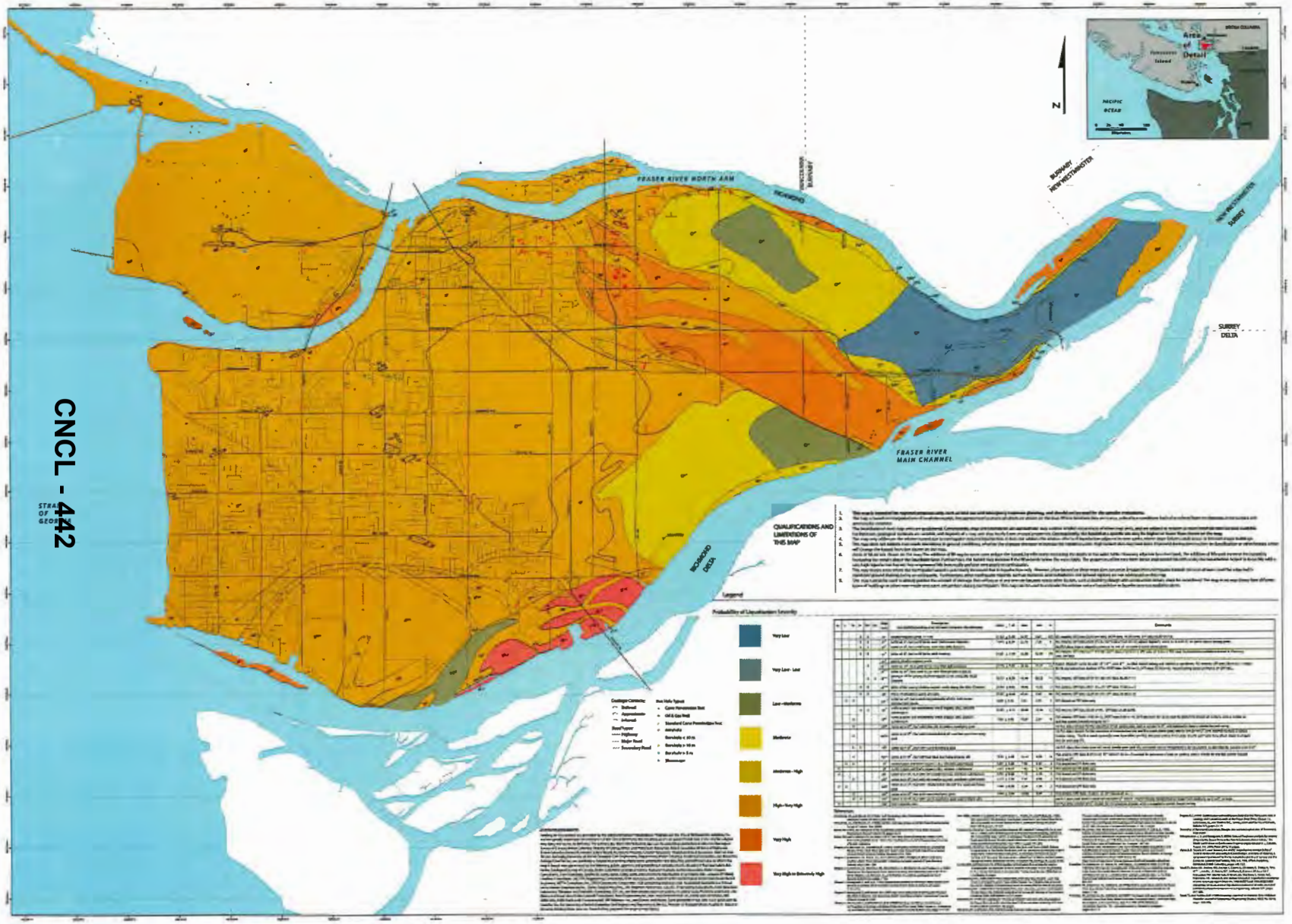
Monahan et al. (1987, 2008b); Clague et al. (1998a), and Monahan (1999) provide descriptions of the stratigraphy of the delta. The oldest section can be subdivided into topset, foreset, and bottomset units. Topset deposits were deposited on the delta plain in river channel, tidal flat and floodplain environments, and consist of sand, silt and locally peat. The topset forms the uppermost 20 to 25 metres of the deltaic sequence, so it also this map primarily reflects sedimentary variations in the topset, which are discussed in more detail below. Foreset sediments underlie the topset sequence and were deposited on the delta slope beyond the river mouth. They are up to 165 metres thick, consist of sand, and silt interbedded on a variety of scales and are characterized by seismic facies that are commonly 10 m or more thick. The bottomset deposits (equivalents of the former are currently being deposited on the delta slope offshore of Sand Heads. Bottomset deposits were deposited beyond the delta slope and consist of mainly clayey silt. They occur only in deeper offshore locations, where they are up to 120 metres thick. Pleistocene deposits underlying the delta generally consist of silts and other sediments that have been overridden by glaciers, and are overconsolidated. However, in the western portion, we have a few meters of normally consolidated Late Pleistocene glaciomarine clay and silt occur between the deltaic sediments and overconsolidated clayey Pleistocene deposits.

Fraser Delta Topset Deposits

In Richmond, the topset deposits are from 20 metres in eastern Lulu Island, near the apex of the delta, to 20 metres or less at the toe (base along western Lulu Island (Clague et al., 1983; Williams and Roberts, 1989; Monahan et al., 1991, 1993; Monahan, 1998). The westerly slowing of the topset is the result of a relative sea level rise of 11 metres during the Holocene, most of which occurred between 8000 and 4000 years B.P (Clague et al., 1983; Williams and Roberts, 1989, 1992). The topset beds are named based upon exposure that grades up from a lower sand facies, through an interbedded sand and silt facies, to an upper organic silt facies. The latter is by far the most widely present.

The topset is dominated by the lower sand facies, which is generally 8 to 18 metres thick. It has an erosional base with several metres of basal relief, and is commonly organized into one or more discernable cycle fining upward sequences. It has been cross-sectioned to represent a complex of distributary channel deposits (Monahan et al., 1990, 1993, 1997; Hutchinson et al., 1995; Monahan, 1998). The westerly slowing of the topset is the result of a relative sea level rise of 11 metres during the Holocene, most of which occurred between 8000 and 4000 years B.P (Clague et al., 1983; Williams and Roberts, 1989, 1992). The topset beds are named based upon exposure that grades up from a lower sand facies, through an interbedded sand and silt facies, to an upper organic silt facies. The latter is by far the most widely present.

Tree rootbeds at the sand facies exist at Richmond and with the overlying interbedded sand and silt facies (Levson and Monahan, 1994; Monahan et al., 1995, 1997; Clague et al., 1998a; Monahan, 1999). In the first instance, the sand facies includes shell debris, particularly near the base. The interbedded sand and silt facies is up to 3 m thick, and in the Steveston area and along the western edge of Lulu Island (Williams and Roberts, 1989). The sand facies is generally thicker than 5 m and is commonly overlain by a thin (generally <2 metres) layer of fine sand and silt. Locally, the interbedded sand and silt facies is



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LIQUEFACTION HAZARD MAP OF RICHMOND, BRITISH COLUMBIA

Patrick A. Monahan, Victor M. Levson and Ben Kerr

Ministry of Energy, Mines and Petroleum Resources
British Columbia Geological Survey
Geoscience Map 2010-3

The City of Richmond, British Columbia, is located in one of the most seismically active regions in Canada (Rogers, 1998). The effects of earthquakes are not only dependent upon the magnitude of the earthquake and the distance from the source, but can vary considerably due to local geological conditions. These conditions can be mapped using existing geological and geotechnical data. This map shows the variation in the earthquake-induced liquefaction hazard in City of Richmond, British Columbia. The city is located entirely within the modern Fraser River delta, and the deltaic sediments on which the city is built are particularly susceptible to earthquake induced liquefaction (e.g. Byrne, 1978; Finn et al., 1989; Byrne and Anderson, 1991; Clague et al., 1992, 1997, 1998a; Watts et al., 1992). This map has been prepared as part of an earthquake hazard mapping project in the city. An accompanying map shows the Quaternary geology of the Richmond area.

This map is intended for regional purposes only, such as land use and emergency response planning, and should not be used for site-specific evaluations. This map can be used with other criteria to help planners select potential areas for development, avoid geologically vulnerable areas, and prioritize seismic upgrading programs. *However, this map does not replace the need for site-specific geotechnical evaluations* prior to new construction or upgrading of buildings and other facilities. The qualifications and limitations of this map are discussed in more detail below.

Liquefaction Hazard Mapping

Liquefaction is the transformation that occurs when earthquake shaking (or other disturbance) causes a saturated granular soil (e.g. sand) to lose its strength and behave like a liquid. Liquefaction can be one of the most severe effects of damage during an earthquake. The susceptibility of a site to liquefaction is dependent upon the depth to the water table and the density, grain size and age of the underlying deposits (e.g. Youd and Perkins, 1978).

The initial step in the regional assessment of the liquefaction hazard of the Fraser River delta was the preparation of a geological map that reflects subsurface variations in the Quaternary stratigraphy, not just the surficial geological materials, which are rather organic-rich in part throughout Richmond. Because the variation in earthquake hazards is most affected by geological conditions in the upper 20 to 30 metres, the geological map primarily reflects the variations within the Fraser delta deposit, which forms the upper 20 to 25 metres of the deltaic succession. The upper terms are mostly fining-upward sequences that grades up from a lower sand facies, through an interbedded sand and silt facies, to an upper organic silt facies, which is locally overlain by peat (Clague et al. 1983, 1998a; Williams and Roberts, 1989; Monahan et al., 1993, 1997; Monahan, 1999). The sand facies distribution (at depth) and is 5–30 metres thick. Geological map units were defined to show areas where these units occur across the sand facies, where areas also include interbedded sands, where Pleistocene deposits occur at shallow depth, and to reflect any differences in the sand facies. The map units were defined on the basis of the geological materials at surface only where they provide information about the sediments below. The stratification of earthquake-induced stress history is greater where thick peat deposits occur, and areas of organic silt and peat at surface, and preserved, in historic sloughs. Other sands occur beneath thicker accumulations of organic silt, where peat occurs at the surface, on the water (i.e. current) side of organic sloughs, which represent abandoned distributary channels, and on the landward side of modern bounding organic silty clays channels. In addition, where the well-sorting variations of the sand facies occurs adjacent to the shell-free subfacies, the most-favoring variations in value.

The geological map is based on a combination of surface and subsurface data. The subsurface data consists primarily of geotechnical borehole data from 2183 locations, including 19 scientific boreholes drilled by the Geological Survey of Canada, 687 locations with cone penetration tests (CPTs), 21 dynamic cone penetration tests (DCPT), and 26 standard penetration tests (SPTs). Because of the greater repeatability of CPT data, these were used preferentially, and analyses were carried out for other forms of data where CPT data were not available.

The CPT_DCPT and SPT data were analyzed according the procedures recommended by Youd et al. (2001). The method compares the cyclic resistance ratio (CRR), which is a measure of the resistance of the soil to liquefaction, to the cyclic stress ratio (CSR), which is a measure of the strength of the earthquake shaking. Where the CSR is greater than the CRR, liquefaction can be triggered.

The liquefaction susceptibility at the various sites has been quantified here by calculation of the Probability of Liquefaction Severity (PLS; Lenson et al., 1998a, 1999; Monahan et al., 1998, 2000a). PLS is defined by:

$$PLS = \frac{1}{1+(P/(1-P))^{-2}}$$

where P is the probability of liquefaction at depth z calculated from z to 20 metres, which is calculated from CRR and the probability, P_L, National Building Code of Canada, model (S Cassidy, Geological Survey of Canada, 2000, personal communication), H_z is the layer thickness and W_z is a depth weighting function that decreases linearly from 0.1 at the surface to 0 at 20 metres.

Calculation of PLS provides not only a relative index of liquefaction susceptibility within an area, but also provides comparison of the liquefaction hazard between areas of different seismicity because it takes into account both seismicity and/or the liquefaction susceptibility. Hazard ratings have been assigned to specific PLS ranges (Table 1).

Table 1. Liquefaction Hazard Ratings (modified from Lenson et al., 1998a; Monahan et al., 1998, 2000a)

PLS for 20 ground	Hazard Rating
40%	extremely high
30–35%	very high
25–30%	high
5–15%	moderate
2–5%	low
0–2%	very low

The objective of this map is to show the relative natural hazard without anthropogenic influences. However, a few metres of anthropogenic fill can have a significant effect on the PLS, which is strongly influenced by small changes in the depth to the water table. Consequently, the PLS was calculated for each site with the effects of fill removed. To do this, the data were normalized using the conditions at the site when the land was undisturbed, that is with the fill in place and using the observed water table, according to the procedures recommended by Youd et al. (2001). The PLS was then calculated from the normalized data, using the depth to the relative natural ground level. Furthermore, the PLS was calculated assuming a water table that is 2 metres below the natural surface based on the assumption that the deltaic surface is at approximately the same elevation throughout the delta. This method was used in order to remove the effects of artificial drainage and to be able to compare the relative hazard at each site.

Calculation of the PLS was simplified by assuming a Magnitude 7 earthquake rather than a range of earthquake magnitudes, based on the assumption that most of the liquefaction hazard is derived from a Magnitude 7 earthquake. A correlation magnitude scaling factor of 1.19 was applied to the analyses (Youd et al., 2001). Although this simplification does introduce the real effects of earthquake magnitude, it enabled the processing of a large volume of data. Because all data were analyzed in the same way, the relative differences in liquefaction hazard are valid.

A western exaggeration of liquefaction resulting from the sediments of deltaic soils was used in the PLS calculation and was based on the ratio of the change between the fines content in the sediments recommended by Byrne and Anderson (1991) for use in the Fraser River delta. This simplification is more questionable because amplification varies with the thickness of the deltaic section (e.g. Monahan et al., 2000b). However the thickness of the deltaic section is not well constrained beyond the northern margin of the delta in northern Richmond, so that the effect of the variation in these thickness should not be consistently applied.

In the calculation of the CRR using CPT data, penetration resistance values in layers, as compressed by Youd et al. (2001), those other investigations by the Chinese criteria, with some caveats, as a means to identify potentially liquefiable soils as determined

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	February 21, 2019
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6060-04-01/2019-Vol 01
Re:	**Flood Protection Management Strategy 2019 – Public and Stakeholder Engagement**		

Staff Recommendation

That the public and key stakeholders be engaged as identified in the staff report titled "Flood Protection Management Strategy 2019 – Public and Stakeholder Engagement" from the Director, Engineering, dated February 21, 2019.

John Irving, P.Eng. MPA
Director, Engineering
(604-276-4140)

Att. 1

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Real Estate Services	☑	
Parks Services	☑	
Roads & Construction	☑	
Sewerage & Drainage	☑	
Development Applications	☑	
Policy Planning	☑	
Transportation	☑	
Emergency Programs	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

The 2008 – 2031 Richmond Flood Protection Strategy (2008 Strategy) is a high-level guidance document for management of flood risk in the City of Richmond. Since Council's endorsement of the 2008 Strategy, Staff have implemented flood protection updates in policy, partnered with the Provincial and Federal government to secure funding, completed Dike Master Plans in anticipation of climate change induced sea level rise, and constructed drainage and dike upgrades in priority locations.

The 2008 – 2031 Richmond Flood Protection Strategy recommends periodic review to incorporate new information on flood hazard management.

On October 24, 2016, Council endorsed the City's submission to the National Disaster Mitigation Program requesting funding to complete the City of Richmond's Flood Protection Management Strategy 2019 (Strategy). The project was approved and is funded through the grant to a maximum of $150,000.

The purpose of this staff report is to present at a high level the flood mitigation work completed since the City's adoption of the 2008 – 2031 Flood Protection Strategy, new information included in the Flood Protection Management Strategy 2019, and seek Council's endorsement to engage the public and key stakeholders for feedback on the updated Strategy.

Background

The City of Richmond has made significant progress in the flood protection program since adopting the 2008 Strategy. All of the short term goals and the majority of mid to long term goals have been accomplished. Following the 2008 Strategy's work plan and recommendations, the following work has been completed or is underway as a part of the long-term flood protection program.

Infrastructure Improvements

In 2002, Council established a drainage utility to provide dedicated funding for drainage improvements. Since then the City has done significant upgrades or rebuilt 15 of its 39 drainage pump stations and replaced over 180 kilometers of drainage piping. Since the adoption of the 2008 Strategy the City has completed over $100 million in flood protection works.

The next project to enter the construction phase is the upgrade of the south dike between Gilbert Road and No. 3 Road. Upgrades include raising and widening approximately 650 m of dikes and improving the adjacent multi-use path to enhance the safety and accessibility of pedestrians and cyclists. Construction is expected to commence in spring 2019.

In addition to flood protection upgrades completed as part of the Capital program, 6.2 km of dike has been re-armoured with rip-rap as part of the City's Dike Maintenance Program over the last 10 years.

The City has successfully partnered with developers to secure dike upgrades through development. In particular, the City is actively pursuing opportunities to construct superdikes, where land supporting development behind the dike is filled to the same elevation as the dike crest. This eliminates visual impacts of a raised dike structure on waterfront views while providing an enhanced flood protection structure for the City.

Superdikes secured through development include sections of the north dike near the Richmond Olympic Oval and at the Imperial Landing and Kawaki developments in Steveston. Superdike construction is expected to continue at the Parc Riviera development and the River Green developments on the north side of Lulu Island in 2019. Staff estimate that up to 20% of dike upgrades along Lulu Island's perimeter dikes will be completed through development.

Dike Master Plans

A key action identified in the City's 2008 – 2031 Flood Protection Strategy involves preparing and implementing a comprehensive program to raise the City's perimeter dikes to address climate change induced sea level rise and land subsidence. The City's Dike Master Plans address this need by recommending dike upgrade options for each dike reach throughout the City.

Dike Master Plan Phases 1 and 2 have been completed.

Public consultation for Dike Master Plan Phases 3 and 5 have been completed. Finalized plans that incorporate the feedback received through public consultation will be brought forward to Council for consideration in spring 2019. Preparation of Dike Master Plan Phase 4 is underway and a draft will be brought forward to Council in 2019.

Other studies related to long term flood protection were also completed, such as the Mid Island Dike Study and East Richmond Agricultural Water Supply Study.

Policy and Development

The Flood Plain Designation and Protection Bylaw No. 8204 was adopted in 2008, as recommended by the 2006 – 2031 Flood Protection Management Strategy, and outlines building, landfill, and structure setback strategies for flood protection. Elevation requirements include Flood Construction Level (FCL) guidelines or exemptions for those in specific development areas; an example is Area A (Schedule B of Bylaw No. 8204) where buildings are exempt from FCL guidelines if the floor system or pad is 0.3 m above the crown of the road adjacent to the parcel. This bylaw has been progressively updated to ensure that current requirements for flood protection are followed.

Funding and Partnerships

The Drainage and Diking Utility currently generates $11.6 million annually to maintain and upgrade Richmond's flood protection infrastructure.

The 2008 Strategy identifies a target of 50% funding for dike improvement efforts from senior government. Over the last 10 years, the City has been successful in securing over $30 million in

senior government grants that go towards implementing over $48 million of dike and pump station improvements as well as flood protection assessments, exceeding the 2008 Strategy's target of 50%. As of January 2019, additional applications for over $15 million in grant funding for flood protection upgrades have been submitted and are pending senior government review.

Analysis

Flood Protection Strategy Update

The 2008 – 2031 Richmond Flood Protection Strategy is a landmark document that:

- documented climate change and sea level rise as emerging issues that the City would need to address;
- recognized the Lulu Island perimeter dike as the City's primary flood defences;
- initiated a dike master planning process for dike upgrading;
- identified the need for seismic dike design review;
- identified the need for an updated floodplain designation and protection bylaw to regulate development;
- provided for widespread land raising to be considered in the planning process; and
- recommended the review secondary inland dikes.

The focus of this Strategy is to identify and incorporate learning and new information, and thus further protect the City, its assets and its residents. These features are summarized below.

Changes in Risk and Flood Level

The flood risk in Richmond and other coastal areas is gradually changing. In Richmond this is due to three primary factors: rising sea levels, land subsidence, and changing precipitation. Sea level rise has been measured at an average rate of 3 mm/year and this number is expected to increase as the climate warms. Climate change models predict that sea level rise will accelerate due to thermal expansion of the oceans as well as the melting of glaciers and ice sheets.

The Flood Protection Management Strategy 2019 looks at relevant research and standards to determine the changes in flood risk and mitigation strategies for the City of Richmond.

Program Vision

The City of Richmond is recognized as a leading dike authority in British Columbia. The City's dikes meet or exceed the 2006 BC design guidelines based on the 1894 flood of record. The City is now upgrading dikes to meet the new BC design criteria to allow for 1m of sea level rise by 2100. As the population and economic investment in Richmond continues to increase, the City's priorities and management of flood risk needs to be reviewed.

The Flood Protection Management Strategy 2019 reviews the City of Richmond's vision, regional guidelines, and innovation in flood protection to establish a world-class standard for Richmond's flood protection system.

Future Considerations and Recommendations

The 2008 – 2031 Flood Protection Strategy provides short to long-term goals to guide Richmond's flood protection program. Similarly, the Flood Protection Management Strategy 2019 will include an Implementation Program outlining next steps and long-term strategies for policy planning, infrastructure upgrades, and other areas related to flood risk mitigation.

Public Engagement – Next Steps

Staff recommend engagement with key external stakeholders and the public on areas of interest. Key stakeholders include:

- Richmond residents and the general public
- Agricultural Advisory Committee (AAC)
- CN Rail
- Environment Canada
- Port of Vancouver
- Department of Fisheries and Oceans
- BC Inspector of Dikes
- Advisory Committee on the Environment (ACE)
- Urban Development Institute (UDI)
- Lafarge
- BC Ferries
- Ministry of Transportation and Infrastructure
- Ministry of Forests, Lands, Natural Resource Operations and Rural Development
- City of New Westminster
- Crown Packaging
- Canadian Fishing Company
- Finn Slough Heritage & Wetland Society
- Mitchell Island Businesses
- Vancouver Airport Authority
- Milltown Marina
- Translink
- City of Vancouver
- Sea Island Community Association

The key external stakeholder group will be engaged through ongoing meetings, social media, and LetsTalkRichmond.ca. Public engagement will include two public open houses. The results of external stakeholder engagement and any updates to the Flood Protection Management Strategy 2019 will be presented to Council in a subsequent report for Council's consideration.

Financial Impact

None at this time.

Project costs will be presented for Council consideration as individual initiatives and programs through the annual budget process.

Conclusion

The City of Richmond's 2008 – 2031 Flood Protection Strategy has been revisited to address current climate change science, provide long-term flood mitigation planning, and update the goals for future work in Richmond's flood protection program.

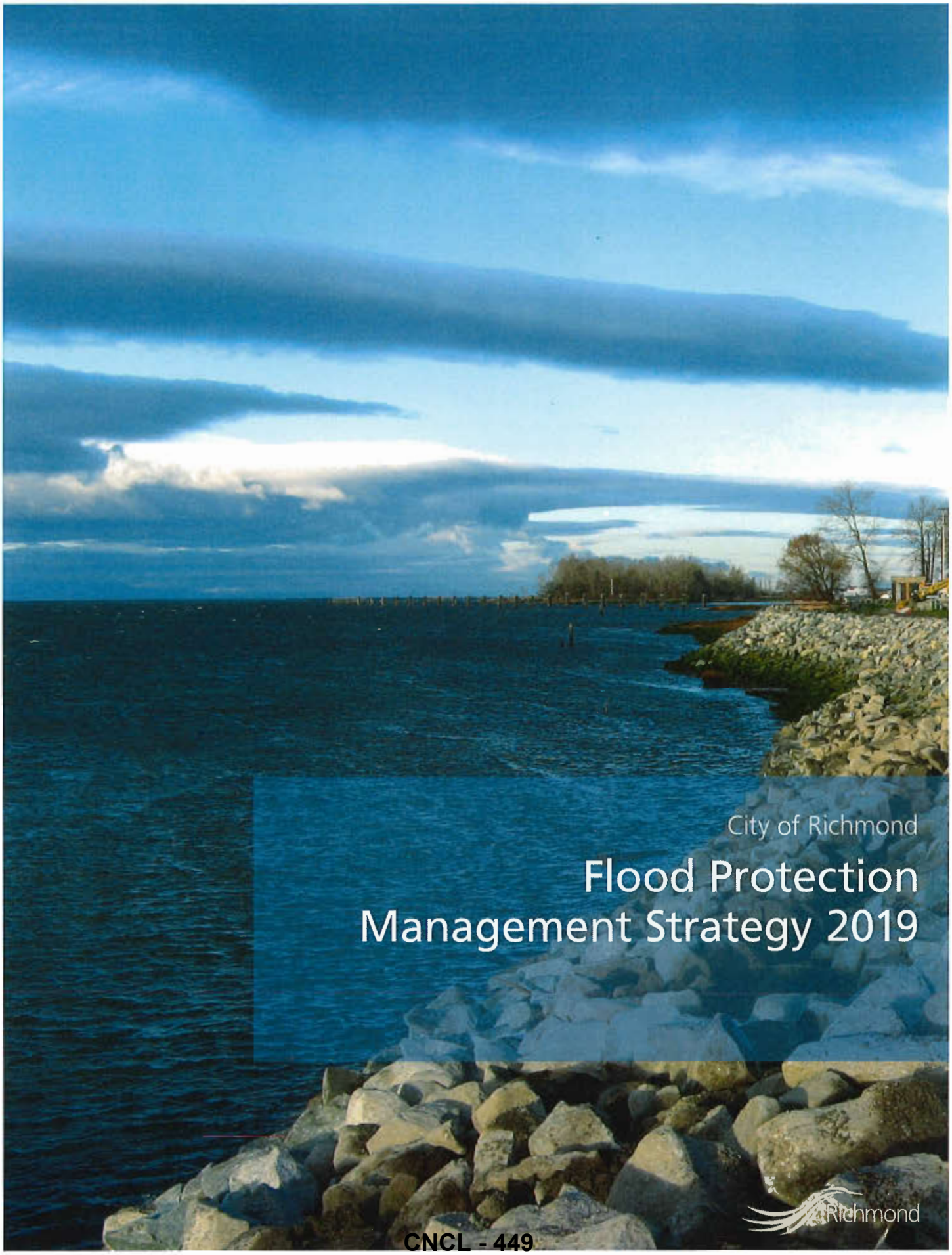
Staff request Council's endorsement to engage public and external stakeholders regarding the Flood Protection Management Strategy 2019 and obtain their feedback. Feedback will be utilized to update and finalize the report, which will subsequently be presented to Council for consideration.

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Att. 1: Flood Protection Management Strategy 2019



City of Richmond

Flood Protection Management Strategy 2019

Richmond

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Preface

The 2008–2031 Flood Protection Strategy (2008 Strategy) is a high-level guidance document for the management of flood risk in the City of Richmond. Since Council's endorsement of the 2008 Strategy, Staff have implemented flood protection updates in policy, partnered with the Provincial and Federal government to secure funding, completed Dike Master Plans, and constructed drainage and dike upgrades in priority locations.

The proposed Implementation Program objectives from the 2008 Strategy have been substantially achieved as shown below:

A list of planning goals from the 2008 Flood Protection Strategy and their statuses are noted in Table 1.

Table 1: 2008–2031 Flood Protection Strategy Implementation Program – Planning Goals

Goal	Actions Taken
Examine and pursue senior government cost sharing to implement the FPMS (Engineering; Public Works; Finance).	Successfully secured over $30 million in senior government grants for implementation of the FPMS. ***Completed***
Collaborate among City Engineering, Building Approvals, Policy Planning [PPD], Development Applications, Facilities Divisions to develop a phased plan for overall land grade increases (Engineering; Planning).	Adopted Bylaw No. 8204 to establish Flood Construction Levels (FCLs) for flood protection. Waterfront developments are encouraged to build superdikes. ***Completed***
Pursue and plan for appropriate grade changes in City area plans (e.g. City Centre Area Plan update) (PPD).	The City Centre plans are captured in the 2041 Official Community Plan (OCP). ***Completed***
Consult at timely intervals with experts (e.g., MoE, Canadian Hydrographic Service, FBC) and monitor the latest long-range ocean/ climate change forecasts and science for their implications (Engineering).	The most applicable and current references have been used to complete the Flood Protection Management Strategy 2019. ***Completed***
Improve the City's ability to obtain data and undertake direct measurements (e.g., monitoring local sea level changes through City operated gauging stations (Engineering; Public Works).	Staff use a combination of river level, internal drainage water level, and rain gauges to control and monitor flood risk in the City. ***Completed***
Establish a protocol for obtaining dike rights of way for Mitchell Island (Engineering).	Dike rights of way are negotiated through the rezoning and development application process. ***Completed***



The City of Richmond has pursued and been awarded over $30 million in grant funding from senior government to implement the 2008 Strategy. Using this funding the City has completed Dike Master Plans, rehabilitated pump stations, and increased the City's overall resilience to flooding.



City crews continually maintain and upgrade the City's diking infrastructure. The Dike Master Plans Phases 1 to 5, anticipated for completion in 2019, specify upgrade requirements for Richmond's dikes according to current climate change science.

Goal	Actions Taken
Work with Department of Fisheries and Oceans (DFO) on a plan for widening the perimeter dikes—inside and outside existing dikes, addressing related mitigation and compensation requirements (Engineering).	Staff work with the DFO on all diking projects that may impact habitat or are in close proximity to water; draft Dike Master Plans have been shared with the DFO with no further comments at this point. ***Completed***
Work with external agencies (such as the Agricultural Land Commission) to develop a protocol that will allow for these changes in use through rezoning, development permits, etc. (PPD).	Diking rights of way, land raising, and other diking requirements are currently established through the development and rezoning permit process that engages agencies. ***Completed***
Prepare plans and policies (e.g., OCP, area plans) to support increased density adjacent to dikes but require grade increases and contributions to dike improvements. Retain dike rights of ways and access (PPD, Real Estate).	The 2041 OCP, Bylaw No. 8204, and Dike Master Plans guide floodplain management and dike upgrades; contributions to dike improvements are established through the development or rezoning process. ***Completed***
Ensure that emergency facilities and refuge areas are located in areas not subject to flooding (Engineering; Emergency & Environmental Programs; PPD, Dev Apps).	Emergency facilities are strategically located and built to the required Flood Construction Levels per Richmond Bylaw No. 8204. ***Completed***
Review implementation plans for refuge areas, emergency routes, and create public awareness (Engineering; Emergency & Environmental Programs)	As most of Richmond is a designated flood plain, emergency routes generally lead to raised refuge areas such as Area A in Bylaw No. 8204. ***Completed***
Review this Strategy approximately every five (5) years to ensure that new information is reflected (All).	Review of the 2008–2031 Flood Protection Strategy has been completed. ***Completed***
Develop on-going public evacuation and communication programs (Engineering; Emergency & Environmental Programs).	Richmond BC Alert, an emergency notification system, launched in 2015 is an ongoing campaign for communication and public involvement. ***Completed***
Direct staff to update the City's Flood Response Plan as part of the overall Emergency Response Plan (updated on basis of new modeling and technical information) (Engineering; Emergency & Environmental Programs).	The Flood Management Plan was updated in 2010. The Emergency Management Plan is scheduled for review in 2019. ***Completed***
Remove and relocate or replace toe ditches adjacent to dikes (Engineering).	Plans are in place through Dike Master Plans to remove or relocate toe ditches; strategies will be project specific. ***Completed***

Goal	Actions Taken
Encourage the City of New Westminster to harmonize their flood protection levels with Richmond's strategy (Engineering).	Engineering departments are working together to unify flood protection objectives; established partnership agreement for Boundary Road pump station. ***Completed***
Work with VIAA (YVR) to clarify jurisdiction, maintenance standards and improvement programs for the Sea Island dikes (Engineering).	YVR is involved as a stakeholder for Dike Master Plan Phase 5 planning. ***Completed***

All bylaw-related goals have been completed and are shown in Table 2.

Table 2: 2008–2031 Flood Protection Strategy Implementation Program – Bylaws Goals

Goal	Actions Taken
Rescind Floodplain Management Implementation Strategy Policy 7000 (PPD).	Policy 7000 has been replaced by Bylaw No. 8204, as recommended by the City's 2006–2031 Flood Protection Management Strategy. ***Completed***
Prepare a Floodplain Bylaw including the new FCLs and the requirement for covenants/ indemnity (Estimated cost–$7,500 for legal input) (Engineering; PPD; Law).	Adopted Bylaw No. 8204 to establish building setback, FCLs and exemption areas. ***Completed***
Adopt other mechanisms and techniques (All).	Development to follow BC Dike Design Guidelines; Zoning Bylaw No. 8500 for developer and builder reference. ***Completed***
Ensure issues of flood protection, grade levels, as well as refuge areas are considered in the development of local area plans (planning; engineering; Emergency & Environmental Programs).	Staff have integrated processes that use software (Amanda) or document review (department concurrences) to provide input on development. ***Completed***



Flood Plain Designation and Protection Bylaw No. 8204 was adopted by Council in 2008 to guide development setback, Flood Construction Levels (FCL), and exemption areas.

All goals and their current status for dikes from the 2008–2031 Flood Protection Strategy are listed in Table 3.

Table 3: 2008–2031 Flood Protection Strategy Implementation Program – Diking Goals

Goal	Actions Taken
Establish protocol for obtaining dike rights of way for Mitchell Island (Engineering, Law).	Dike rights of way are established through the rezoning and development permit process. ***Completed***
Seek direction from Province on new acceptable probability criteria that will address sea level rise and climate related extremes for the next 100 years • (Current city standard is 1:200 for sea level event, and the 1894 discharge of the Fraser River plus freeboard as per provincial standards, versus 1:1250 conditionally recommended by UMA). • (Potential additional sea level/ subsidence study cost estimate—$5,000) (Engineering).	The City of Richmond is currently in the process of adopting revised BC Dike Design guidelines for 1:500 tidal and river flood events with 0.6m freeboard plus 1m sea level rise and 0.2m subsidence to the year 2100. ***Completed***
Review dike maintenance programs at ongoing 3 to 5 year intervals (Engineering; Public Works).	Staff review the dike maintenance program on an annual basis. ***Completed***
Support sustainable funding for a federal (VFPA) river dredging program to maintain river profile (Engineering).	The Port of Vancouver is responsible for continuing the dredging program for the South Arm of the Fraser River. ***Completed***
Establish in City budget annual amount for land for access rights to waterfront and dike areas (All).	The City is constantly looking for opportunities to establish waterfront access with funding from Capital budgets. ***Completed***
Establish and maintain inventory of rights of way and access agreements to diking system (Engineering).	Rights of way and agreements are tracked in Amanda and Engineering's GIS. ***Completed***
Update existing procedural policy of comprehensive dike maintenance (Engineering, Public Works).	The City has a comprehensive dike maintenance program. The program is continually updated with best practices and research. ***Completed***
Prepare and implement a comprehensive perimeter dike improvement program (researching, strengthening and widening dikes to reduce the level of risk) (Engineering).	Richmond's perimeter diking program is established through the Dike Master Plans; upgrades are ongoing. ***Ongoing 80% Complete***

Goal	Actions Taken
Establish a program for phasing/ prioritizing perimeter dike improvement (e.g., seismically weak areas first, the mid-island barrier, overall perimeter dike improvements) (Engineering).	Priorities are established through the Dike Master Plans (Phases 1–5) which are anticipated for completion in 2019. ***Ongoing 80% Complete***

The goals for the Mid-Island Dike are shown in Table 4 below. The Mid-Island Dike concept was studied (Delcan, 2009) and determined to provide a lower cost-benefit ratio when compared to upgrading the perimeter dike to a 10,000-year return period flood protection level. With this understanding, the Mid-Island Dike concept will be addressed after the perimeter dike has been fully upgraded or as opportunities to cost-share become available.

Table 4: 2008–2031 Flood Protection Strategy Implementation Program – Proposed Mid-Island Dike Goals

Goal	Actions Taken
Work with the BC MoT and others on a program to study, plan and cost share in the building of the Highway 99/Knight Street mid-island barrier (may require a Multiple Account Evaluation of interior barrier options—study cost estimate—$100,000) (Engineering).	The completed 2009 Mid-Island Dike study (Delcan) showed that raising the perimeter dikes would result in higher overall benefit for the cost; the current focus is to raise all perimeter dikes to a minimum of 4.7m above mean sea level. ***Completed***
Once Mid-Island Barrier technical details are finalized: • established a phased implementation program; and • seek senior government cost sharing.	The Mid-Island Dike concept will be re-evaluated once the perimeter dike has been raised. ***Ongoing***
Pursue development of the mid-island barrier along the Highway 99/Knight Street Corridor (Construction cost estimate—$16 million) (Engineering).	The Mid-Island Dike concept will be re-evaluated once the perimeter dike has been raised. ***Ongoing***

While the 2008–2031 Richmond Flood Protection Strategy continues to provide a sound basis for the City's flood risk management program, an update is warranted to fully encompass new learnings, analysis, and re-emphasize the City's commitment to achieving world-class flood protection.

Part 1: The Flood Protection Management Strategy

1.1 Purpose of Strategy

The purpose of the Flood Protection Management Strategy 2019 (Strategy) is to guide the ongoing development of world-class flood protection for Richmond that will:

- keep Richmond a safe place to live, work, and play;
- compliment the Corporate Strategic Vision of making Richmond the most appealing, liveable, and well-managed community in Canada; and
- establish an integrated, sustainable Strategy which better:
  - enhances the City's ability to reduce flood risk, prevent flooding, increase flood protection, minimize flood damage, improve flood-proofing and responses to floods;
  - co-ordinates and manages dike integrity, land use, infrastructure, emergency response and sustainability;
  - defines partnerships, roles, responsibilities and cost sharing; and
  - address climate change implications specific to Richmond.

This report provides an update to the 2008–2031 Flood Protection Strategy which recommends periodic review to address current climate change science and flood mitigation guidelines.

1.2 Extent of Application

This Strategy applies to those areas within Richmond's municipal boundaries where the City has the legislative mandate and primary responsibility to address flood protection.

In locations where the City does not have the jurisdictional authority, such as the Port of Vancouver lands in Richmond, lands held or controlled by either the Federal or Provincial Governments (e.g., most of Sea Island), the City's Strategy encourages interagency cooperation to address mutual flood protection interests and benefits based on the Strategy principles and site circumstances.

Unless noted otherwise, all elevations in this report refer to the Canadian Geodetic Vertical Datum of 1928 (CGVD28). Should the newer CGVD2013 vertical datum be adopted, updating of the elevation references will be required at that time.

1.3 Principles

The Flood Protection Management Strategy is based on the following principles:

Principle	Emphasis
Safety	Richmond is an island city located between the Fraser River and the Strait of Georgia. The City's residents, businesses and infrastructure are to be safeguarded from flood hazards with a range of methods including an appropriate: • level of flood protection; • emergency response preparedness; and • flood recovery plans and programs.
Proactive Prevention	The City will proactively continue its efforts to: • research, plan, design, and implement a world-class flood protection program.
Risk Avoidance	The City will continue to minimize the risks and potential damage associated with flooding.
Sustainability	Flood prevention approaches are to be: • socially, economically, environmentally sustainable; and • able to achieve the City's long term planning, growth and development objectives.
Coordinated Partnerships	The City will coordinate its Strategy in partnership with senior governments, regional agencies, other municipalities, NGOs, emergency service agencies and the private sector.
Research	The City will continue its flood protection research with others to: • take advantage of the latest science, best practices, innovative solutions, and cost sharing; and • improve its understanding of flood risks and management.
Integrated Flood Planning	The City will prepare and update a range of flood protection documents including this Flood Protection Management Strategy 2019, Dike Master Plans, a Floodplain Bylaw, flood infrastructure plans, flood preparedness plans, emergency response plans, flood recovery plans and other plans, as necessary.
Adaptation	The Strategy is the City's primary response to adapt to the projected impacts of Climate Change on flood risks. Mitigation of Climate Change is addressed through the City's Community Energy and Emissions Plan (CEEP) and other strategies.

Principle	Emphasis
Standards	The City will establish and follow a variety of flood protection standards including: *Provincial Standards:* • Updated guidelines recommend planning for 1m of sea level rise to year 2100 and for 2m of sea level rise by 2200. • Provincial Dike Design Standards. • The Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use (2011) and Provincial Flood Hazard Area Land Use Management Guidelines (amended 2018). • Other, as necessary. *City Standards:* • Flood Construction Levels (FCL) standards for buildings and structures. • Flood proofing standards. • Alternate requirements for authorized exemptions to basic standards. • Other, as necessary.
Flood Protection System	The City will provide an integrated physical flood protection system which includes: • a Perimeter Dike as the primary system of defence; • long-term raising of land levels above the floodplain, strategically and economically, through policy and by specifying FCLs for new construction; • infrastructure (e.g. drainage system and pumping stations), • floodproofing buildings and structures; • maintenance programs—cleaning of infrastructure and upkeep of dikes; • stormwater retention/detention—best practices and implementation; • dredging (a Port of Vancouver responsibility); and • other, as necessary.
Incremental Solutions	The City will implement the Strategy incrementally, as cost effective solutions are identified.
Cost Effectiveness	The City: • will implement the Strategy in a cost effective manner, appropriate to existing and planned growth and development; and • recognizes that such costs are part of growth and development.
Cost Sharing	The City will actively solicit partnerships with other levels of government, NGOs and the private sector, to share the benefits and costs of implementing the Strategy. Senior government funding is the historic primary source of funding for flood protection in the Province and is critical for successful implementation going forward.

1.4 Legislative Framework, Roles and Responsibilities

City of Richmond's Role

The City is the primary actor and service provider for flood protection.

1. The City is responsible for local flood protection and management including the ongoing operation and maintenance of the dike infrastructure;

- Planning for perimeter dike upgrades is nearing completion with Dike Master Plans Phases 3, 4, and 5 which are expected to be finalized in 2019.
- The Dike Master Plans guide City designs for perimeter dike upgrades to the year 2100 with considerations for climate change induced sea level rise, land subsidence, and area plans.
- City of Richmond Engineering & Public Works staff monitor and maintain the City's dikes on a continual basis. Upgrades to the City's dikes are completed as Capital projects which are approved by Council in an annual process.

2. The City has a legislated duty, through the *Emergency Program Act*, to respond first to emergency situations within its jurisdiction and to have an emergency plan in place;

- The City's Emergency Management Office (EMO) works together with senior governments and regional authorities to establish emergency management and recovery plans.
- The City's Engineering & Public Works Division, in coordination with the EMO, have prepared the 2010 Flood Response Plan.
- Threat specific plans are integrated by EMO into an overall management strategy.
- The Emergency Management Plan is scheduled for review in 2019.

3. The City has the authority, through the *Local Government Act*, to designate a floodplain and to set construction requirements for development, subject to Provincial policies and standards (e.g., the Provincial Flood Hazard Area Land Use Management Guidelines);

- Floodplain Designation and Protection Bylaw No. 8204 was adopted in 2008 and guides building setback, Flood Constructions Levels, exemption areas and alternative conditions.

4. The City reviews Discretionary Development Applications (i.e., Rezonings, Development Permits). The City has the authority to set conditions and to require the registration of restrictive covenants for development on land which may be subject to flooding for all discretionary development applications; and

5. The City reviews Non-Discretionary Applications (e.g., building permit approvals). The City has the authority, through the *Local Government Act*, to set conditions and to require registration of restrictive covenants for non-discretionary applications, when exemptions to the provisions of the floodplain bylaw are given.

Provincial Role

In 2004, the provincial role with regard to flood protection and management was significantly altered with legislative changes made to a number of statutes—notably to the *Land Title Act*, *Local Government Act*, the *Flood Hazard Statutes Amendment Act, 2003* and the *Miscellaneous Statutes Amendment Act (No. 2), 2004*.

1. Under the *Dike Maintenance Act*, responsibility and general supervision relative to construction and maintenance of dikes lies with the office of the Inspector of Dikes.

- The Provincial Inspector of Dikes can require reports, inspect records, audit diking authorities, make regulations and prescribe trusts.
- Approval from the Provincial Inspector of Dikes is required for:
  - the construction of a new dikes and flood barriers (*Dike Maintenance Act* Approvals: MoE 2007);
  - changes or alterations to the cross section or crest elevation of a dike;
  - the installation of culverts, pipes, flood-boxes, utility lines, pump stations, or any structure through, on or over a dike;
  - the construction of any works on or over a dike right of way, including structures, excavations and placement of fill or other materials;
  - the alteration of the foreshore or stream channel where the works could increase flood levels or impact the integrity of a dike such as dredging; and
  - construction of erosion protection works bridges and other in-stream works.

2. BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRO)

- FLNRO, through the Office of the Inspector of Dikes, provides guidelines for development in flood hazard areas, guidance and technical information

3. Subdivision Approval

- Provincial approval for subdivision is no longer required, unless the lots are in proximity to a Provincial highway.
- In those cases, the BC Ministry of Transportation and Infrastructure (MoTI) Approving Officers can now consider flooding and erosion potential.

4. Approval of Municipal Floodplain Bylaws

- Provincial approval of municipal floodplain bylaws is no longer required.

5. FLNRO Establishing Flood Protection Standards

- The Office of the Inspector of Dikes establishes standards for municipal dike design, construction, operation and maintenance plans.
- The Office of the Inspector of Dikes reviews and approves these.

- The Province has adopted a new flood profile standard for the Fraser River which is defined by the 2008 study profile completed by Northwest Hydraulic Consultants. The Fraser River flood profile exceeds the coastal flood level for areas of Richmond east (upstream) of Nelson Road.
  - This new standard establishes flood design standards, for freshet, summer, winter and tidal flood threats, to safely convey the largest historical flood of record which occurred in 1894.
  - For Richmond, the new profile varies from approximately 2.8m GSC near Steveston to 3.3m GSC near Queensborough. This does not consider sea level rise or wave effects.
- Sea Level Rise Threats
  - The most recent study completed by the Province suggests a median projection of 1m of sea level rise by year 2100 and 2m of sea level rise by year 2200.
  - The Intergovernmental Panel on Climate Change (IPCC) reports on climate change (IPCC, 2018) estimate a lower increase in global mean sea level rise when compared to Provincial studies.
  - Additional research is needed to refine these values given the variability in current climate change science. As sea level rise is realized and more data is available the projections can be adjusted.
- For Subsidence Flood Threats
  - The most recent studies indicate that subsidence in Richmond is approximately 2mm/year.
  - These values will continue to be monitored and will inform flood protection planning.

6. Research

- The Province conducts research with others (e.g., contributions to the Fraser River Hydraulic Modelling study, assessment of current seismic guidelines).
- Ongoing Provincial research is encouraged.

7. Funding

- The Province was the primary source of funding for flood protection prior to the transition of diking authority to municipalities.
- In October 2007, the Province announced new flood protection funding for BC of $10 million per year for 10 years.
- In 2012, the City was awarded $3.6 million for pump station upgrades.
- In 2016, the City was awarded $16.6 million for pump station and dike upgrades.
- In 2017, the City was awarded $400,000 for flood protection planning.
- Ongoing Provincial funding is encouraged.

8. BC Provincial Emergency Program (PEP) Emergency Preparedness and Recovery

- The Province operates a BC Provincial Emergency Program (PEP) which coordinates aspects such as:
  - emergency preparedness training and funding;
  - disaster response including military assistance; and
  - recovery funding and assistance.
- PEP will respond to emergency calls from local governments and emergency personnel. Ongoing PEP assistance is encouraged.

9. Provincial (FLNRO) Approval of the City's Strategy

- Provincial Jurisdiction: The Province has jurisdiction to approve those items that are directly related to the dike system (i.e., any proposed modifications or additions).
- No Provincial Jurisdiction: For the City's Strategy, the Province is likely to provide only comments or advice.

10. Foreshore & Water

- Existing off-shore structures (navigation jetties) are controlled by senior governments. Contemplated offshore structures and nature-based concepts for wave attenuation (e.g. Sturgeon Banks) will also require land tenure and approvals from senior government.

11. Summary

- The City is committed to co-operating with the Provincial government.

Federal Government

The federal role has primarily been related to issues of national significance or to situations where the capacity or authority of a provincial government to deal with the situation is exceeded. Federal legislation such as the Emergencies Act enables the Federal Government to act in such situations. Much of the responsibility for flood protection has been turned over to the provinces and subsequently the municipality, with the Federal Government providing assistance through enabling funding and research.

1. The focus of Public Safety Canada (PSC) includes:

- Critical Infrastructure Protection;
- Emergency Preparedness; and
- Disaster Mitigation.

Programs under these topics are still evolving particularly with regard to critical infrastructure protection.

2. Establishing Flood Protection Standards

- The Federal Government does not currently establish flood standards; however, CMHC funding for urban development, or post disaster recovery funding may be limited in designated floodplain areas, unless adequate floodproofing measures have been taken.

- The City intends to establish adequate flood protection measure through this Strategy and a range of implementation measures.

3. Research

- The Federal Government provides research assistance (e.g., climate change).
- Ongoing Federal research is encouraged.

4. Funding

- The Federal Government may assist in funding studies, capital dike improvements, preparedness and recovery programs. Periodically, the Federal Government co-funds with the Provincial Government programs for flood protection, for example:
  - the Federal Government provided funds toward the 2006 Lower Fraser Hydraulic Modeling study which was completed by the Fraser Basin Council (FBC);
  - in 2007, $33 million for flood mitigation initiatives to address concerns related to anticipated spring freshet water levels;
  - in 2009 and 2010, $6.3 million was awarded to Richmond through the Federal and Provincially funded Flood Protection Program;
  - in 2013, $2 million was awarded to Richmond through the Federal and Provincially funded BC Building Canada Fund;
  - in 2016, $1.7 million was awarded to Richmond through the Federal and Provincially funded National Disaster Mitigation Fund; and
  - in 2017 the City of Richmond was awarded $1.1 million for flood protection planning through the National Disaster Mitigation Program.
- Ongoing Federal funding is encouraged.

5. Dredging & Foreshore

- The Port of Vancouver completes annual dredging of the South Arm of the Fraser River.
- There is considerable federal land along the perimeter dikes on Lulu Island and Sea Island. The City works together with the Fisheries and Oceans Canada, as well as other Federal stakeholders, on a project-specific basis to identify any concerns or opportunities while completing flood protection upgrades.

6. Summary

- The City is committed to co-operating with the Federal Government and encourages ongoing Federal flood protection programs and funding assistance.

Regional Role

There is no direct role for Metro Vancouver or other Lower Mainland jurisdictions with regard to the City's development and implementation of the Flood Protection Management Strategy, with the exception of coordination with New Westminster on infrastructure in the Hamilton-Queensborough area.

Fraser Basin Council (FBC)

Although it lacks a mandate or authority to oversee flood protection works or emergency services, the Fraser Basin Council has been working with federal, provincial, local government agencies and organizations to highlight flood risks through the Joint Program Committee (JPC) for Integrated Flood Hazard Management. This program has coordinated recent flood plain mapping exercises in the Lower Fraser and lead the recent study to update the Fraser Flood Profile.

In 2014, FBC initiated the Lower Mainland Flood Management Strategy to promote collaborative, regional flood management on the lower Fraser River and the coast between partners spanning all levels of government, including the City, other local governments, and non-governmental organizations.

FBC is the facilitator and administrator working on behalf of the partners to develop the strategy through three phases:

- Phase 1 "Building a better understanding";
- Phase 2 "Developing a regional action plan"; and
- Phase 3 "Implementation".

Phase 1, completed in 2016, focused on flood hazards, vulnerabilities, and existing structural and non-structural flood protection measures. Phase 1 produced the following components:

- analysis of future flood scenarios;
- regional assessment of flood vulnerabilities;
- Lower Mainland dike assessment; and
- review of flood management policies and practices.

Phase 2, initiated in 2017, is expected to include the following components:

- assessment of regional flood mitigation options; and
- assessment of decision-making models and cost sharing options.

The final strategy, anticipated in 2019, is expected to include specific commitments for partners and a cost-sharing approach to support implementation.

The City has been an active participant and funding partner in the Fraser Basin Council's JPC and is committed to the management of growth both within an overall regional context and in terms of its Official Community Plan (OCP).

Richmond intends to continue participating in the Fraser Basin Council and with other stakeholders to better address flood prevention and protection.

1.5 Strategic Framework

As a community within the floodplain, the City acknowledges that an element of flood risk will always exist for those areas that are not raised above the floodplain.

This Strategy provides an integrated flood protection framework which emphasizes:

- preventing flooding, and
- minimizing the impacts of a flood event, should such an event occur.

The integrated Flood Protection Management Strategy elements identified below addresses dike safety, land use management and emergency management.

1. Sustainable Approaches

- As the City of Richmond is committed to improving sustainability, where practical and cost effective, sustainable approaches will be undertaken when implementing the Flood Protection Management Strategy 2019. Flood prevention approaches are to be socially, economically, environmentally sound and sustainable, and able to achieve Richmond City Council's long term planning, growth and development objectives.

2. Flood Protection System

- The City's integrated flood protection system includes:
  - a Perimeter Dike;
  - raising land levels strategically and economically;
  - requiring Flood Construction Levels (FCLs) for new construction;
  - floodproofing buildings and structures;
  - infrastructure (drainage system and pumping stations);
  - maintenance programs—cleaning of infrastructure; and
  - other, as necessary.

3. Dike Integrity and Management

- Richmond's Flood Protection Management Strategy 2019 recognizes both storm surge and river flood threats.
- Richmond's perimeter dike is the primary flood protection system.

New Dike Crest Elevation Standard

The City is committed to meeting or exceeding the Province's coastal still-water flood level of 2.9m. In combination with 1m of sea level rise, a 0.2m land subsidence allowance, and 0.6m freeboard, this yields a design dike crest elevation of 4.7m.

This standard is designed to accommodate the largest historical flood of record which occurred in 1894, sea level rise, and land subsidence to the year 2100.

The City will continue to work with the Provincial, Federal and regional agencies to secure funding for research and construction to meet or exceed the provincial dike standards.

Perimeter Dike Improvement Program

In conjunction with Provincial Diking Authorities, the City is currently upgrading priority sections of the perimeter dike. Completion of the Dike Master Plans will further guide efforts to upgrade the City's primary system of defence against flood hazards.

4. Managing Sea Level Rise Risks

- Sea level rise is monitored and the City will adjust flood protection strategies and implementation timelines to address climate change induced flood hazards as defined by the IPCC and subsequent regional analysis. Currently the City's design for perimeter dike upgrades includes an allowance for 1m of sea level rise to the 2100 and 2m of sea level rise to the year 2200 (baseline at year 2000).
- The City will participate in research studies, in partnership with others, to ensure that climate change induced sea level rise is monitored and proactive adjustments are made to the Strategy.

5. Monitoring Subsidence

- While geological subsidence is very slow and minor relative to sea level rise, it should be monitored and addressed.
- Current levels of subsidence are monitored and the City has made allowances to accommodate additional flood risks due to subsidence.
- The City will participate in research studies, in partnership with others, to ensure that there is proactive planning for land subsidence.

6. Flood Construction Levels (FCL):

- Floodplain Designation and Protection Bylaw No. 8204 establishes the floodplain boundaries, construction setback requirements, Flood Construction Levels, and exemption areas for the City of Richmond.
- Bylaw No. 8204, in consideration of Provincial guidelines, defines certain classes of use and geographic areas within which construction elevations will not be required to meet the established flood levels.
- Examples of exemptions (e.g., to raising the land, to building to FCLs, may include:
  - agricultural buildings and structures (except residential dwellings and accessory buildings); and
  - the Steveston Village Heritage Area where the introduction of grade changes for new construction would detrimentally affect the important heritage character of the area.

7. Raising Land Levels

- As an overall long term objective, the City will seek to raise the average grade of land within all areas of the City.
- To achieve this, the City at its discretion, will strategically and incrementally encourage or require ground levels to be raised, for example where:
  - development opportunities exist (e.g., through rezoning and property redevelopment);

- site size is sufficiently large to enable it to be achieved effectively;
- negative impacts can be reasonably mitigated; and
- land raising is being proposed to meet other objectives such as agricultural viability.

West Cambie example: This approach was taken for the West Cambie area, where the whole Alexandria quarter section was raised during redevelopment.

8. Interface Areas

Between areas of different required raised land height and FCL construction level requirements, the City may establish land and FCL transition requirements and techniques to manage grade changes with minimal problems.

In these situations, the City will determine specific raised land and FCL requirements, on a site by site basis.

9. Ongoing Analysis

The City will monitor the latest flood protection and climate change science (e.g. sea level rise, subsidence, river, ocean conditions), best practices, the effectiveness of its flood protection system and the Strategy. Improvements will be made as necessary.

10. Annual Flood Protection System Improvements

Each year the City will improve its Flood Protection System. This will be achieved by preparing an Implementation Program for Council's consideration as a part of this Strategy. Funding will be through the designated diking utility and grant opportunities.

Individual projects will be submitted through the annual Capital Program for Council's consideration.

11. Emergency Management

- City Emergency Management Office (EMO): The City has established an Emergency Management Office [EMO] which works with Richmond's protective service agencies and City departments to prepare response plans and programs that establish and implement mitigation, preparedness, response and recovery measures for emergency events.
- City Emergency Plan: Under the EMO's guidance, the City has established an Emergency Plan that provides overall direction to guide the City's actions to prepare for, respond to and recover from major disasters. This Plan identifies the key hazards, such as flooding, which threaten the community, priority actions to be taken by threat, roles and responsibilities of staff and key response agencies responsible for managing the City's response and recovery from disasters.
- Flood Response Operational Plan: The City Flood Response Operational Plan outlines the City's strategies for preparedness, response, and recovery surrounding the seasonal spring freshet and any flood events that may result from this annual event.

- City Flood Response Plan: Through the direction of the EMO, a series of threat specific plans have been, or are in the process of being prepared. With direct reference to flood protection management, a City Flood Response Plan has been prepared and operationalized through the City's Public Works Roads and Construction Department and a City Flood Evacuation Plan is currently being drafted.
- Key Emergency Management Elements: Some of the key emergency management elements imbedded within the Implementation Program include:
  - the co-ordination of community planning and emergency facilities to ensure that City refuge/public gathering areas during disasters are located in areas which do not flood;
  - the preparation and on-going updating of City public evacuation and communication programs;
  - reviewing and implementing plans for refuge areas, emergency routes, and creating public awareness;
  - establishing a protocol for dike restoration (e.g., City procedural response plan); and
  - updating the City's existing procedural policy of comprehensive dike maintenance.

12. Funding

- Each year, to implement this Strategy, the City intends to:
  - budget to implement this Strategy, subject to corporate priorities and funding,
  - seek senior government funding.

13. Senior Government and Partner Funding

- The success of the Strategy requires senior government and partner funding.
- The City will seek senior government and partner funding for a wide range of flood prevention and protection research, monitoring, studies, planning and improvements.

14. City Diking and Drainage Utility

- In 2006, the City established a City Diking and Drainage utility for the purpose of funding dike and drainage improvements. The City intends to continue and grow this utility.

15. Annual City Dike Improvement Capital Funding

- The City establishes an annual City capital budget to ensure that each year funds are available to undertake flood protection studies and work. The City intends to continue this funding mechanism.

16. Implementation (see Part 2)

- The City will implement the Strategy by establishing an Implementation Program.
- The Strategy will guide all City Flood Protection actions and is to be referenced in all relevant City proposals and senior government funding requests.

Part 2: The Implementation Program

The 2008–2031 Flood Protection Strategy was intended to be a living document—one which evolved over time as new science, information, concepts, techniques, programs and cost sharing opportunities arose. The updated Flood Protection Management Strategy 2019 provides this information and recommendations for future work related to flood protection.

The City also recognizes that the Strategy requires:

- jurisdictional, economic and cost sharing partnerships;
- the involvement and direction, of senior governments, specifically regarding dike standards; and
- on-going actions to enhance the City's knowledge and ability to prevent flooding.

The Flood Protection Management Strategy 2019 will be reviewed and updated, as required.

The Flood Protection Management Strategy 2019 will be implemented through an Implementation Program.

The Implementation Program Chart below identifies:

- some of the key tasks;
- the approximate completion dates;
- status of projects;
- cost estimates (where available); and
- City Division responsibilities.

Implementation will occur, subject to City corporate priorities and funding.

Detailed implementation will be determined by Council annually.

The City's Engineering and Public Works Division will lead the Strategy and Implementation Program in a proactive and collaborative manner with other City division sections including Policy Planning, Finance, Building Approvals, Development Applications and the Emergency Management Office.

Implementation Program – Next Steps

Category	Action
Program Management	Ensure that the flood risk reduction program is supported by leading edge technical investigations. Short-term priorities should include a wave runup analysis, and definition of the potential flowslide zone around the island perimeter.
Lulu Island Perimeter Dike	Finalize Phases 3, 4, and 5 of the Dike Master Plans to complete the conceptual framework for upgrading the City's perimeter dike.
	Review the Phase 1 Dike Master Plan to determine whether the proposed Steveston Island offshore dike / sea gate continues to be cost effective in view of the seismic design standard, and to update/ complete the construction cost estimate.
	Update the Phase 2 Dike Master Plan to include construction cost estimates.
	Establish a target timeframe for completion of dike upgrading as per the current Dike Master Plans, along with a system to report progress on this important objective.
	Adopt a world class standard for the next round of Lulu Island Dike Master Plans (10,000-year return period flood, current sea level rise projection for 100-year horizon, consideration of sea level rise for 200-year horizon, conservative wave runup allowance). Support such determination with a risk-based approach.
	Develop and adopt a seismic dike design standard that considers the specific situation in Richmond, and is also acceptable to the Province.
Floodplain Designation and Protection Bylaw	Update the flood construction levels of the bylaw to reflect the most recent Fraser River flood profile and current coastal flood level (including sea level rise). This would ideally involve updated dike breach inundation modeling.
	Update the other provisions of the bylaw as noted in this report. Endeavour to reduce the number of situations in which exemptions and relaxations are provided.

Category	Action
Secondary Dikes on Lulu Island	Consider potential other effective secondary dikes on Lulu Island that would reduce the extent of flooding from a dike breach and/or help to achieve the desired level of seismic performance.
	Proceed with the Boundary Road secondary dike as per the Phase 3 and Phase 4 Dike Master Plans, with the intent to provide redundancy in flood protection, and also fulfil seismic performance objectives.
	Proceed with the mid island secondary dike on an opportunistic basis, either in conjunction with Highway 99 upgrading, or with large-scale land raising.
Internal Drainage on Lulu Island	Review and update design criteria for drainage pump stations and floodboxes (key issues include increasing flood level, increased duration of pumping, increasing internal runoff, and fish passage). Also consider whether some or all stations should be able to provide post-disaster service (key issues include seismic performance, standby power, and emergency access).
	Update the master drainage plan to accommodate the soon to be completed Dike Master Plans (in particular, moving drainage channels away from the perimeter dike) and Local Area Plans and Sub-Area Plans (with respect to land raising).
Dike Operation and Maintenance	Establish a consolidated dike operation and maintenance manual, organized by dike master planning reach (including Sea Island, Mitchell Island and Richmond Island) to provide a thorough record of dike design drawings, inspection reports, maintenance work, and miscellaneous activity along the dike.
Management of Lulu Island Perimeter Dike Corridor	Designate a wide (perhaps several hundred metres) strip of land along the perimeter dike corridor as a development permit area for flood protection purposes. The purpose would be to ensure that all activity in this area gives priority to long-term flood protection objectives.
	Integrate the above-noted development permit area provision for flood protection purposes with other City programs such as the Waterfront Strategy and the Ecological Network Management Strategy.
Sea Island	In the Burkeville residential area, consider flood protection concepts as noted above for Lulu Island (land raising, updated flood construction levels, and internal drainage are particularly applicable).

Category	Action
Mitchell Island	Proceed with a program of road raising, with future development areas raised to the flood construction level (as is recommended in the Phase 5 Dike Master Plan).
Habitat Compensation	Recognizing that dike upgrading will impact the fisheries resource, and that on-site mitigation of impacts is not always effective and/or practical, develop a broad-scale habitat compensation program to address the cumulative impacts of dike upgrading in all areas of the City (possibly as a dike master plan phase).

Implementation Program – Continuing Strategies

Category	Action
Program Management	Continue to have a senior staff position designated as the leader of the City's flood risk management program.
	Enhance monitoring of river/sea level, wind and wave effects, dike fill, internal water level and dike crest elevation.
	Review the level of funding for the Drainage and Diking Utility to ensure an appropriate rate of construction of structural flood protection works.
River Engineering Considerations	Work with the Port of Vancouver, and possibly other local governments in the Fraser River estuary, to ensure that key river monitoring activities are undertaken. This includes bathymetric survey, dredging management, and river engineering assessment.
Lulu Island Perimeter Dike	Continue to upgrade the Lulu Island perimeter dike as the top flood protection priority.
	Promote and enable widespread land raising on Lulu Island through Local Area Plans and Sub-Area Plans.
	Investigate regional soil disposal and dredging material as cost-effective sources of fill.
	Ensure that major underground utilities that cross Lulu Island are designed to accommodate significant future landfill that would be associated with widespread land raising.
	Encourage the City of New Westminster to adopt a similar standard and approach for upgrading of its portion of the Lulu Island Perimeter dike.
Internal Drainage on Lulu Island	As pump stations are upgraded, ensure that location is consistent with the long-term dike alignment.
	Pursue an effective approach to rehabilitation of box culverts within the internal drainage system.

Category	Action
Sea Island	Continue to cooperate with the Vancouver Airport Authority to upgrade the Sea Island perimeter dike, and on other flood protection issues.
Richmond Island	Continue with flood protection as a responsibility of the single land owner on the island (as is recommended in the Phase 5 Dike Master Plan).
Emergency Management	Continue with an integrated emergency management planning approach both internally and with recognition of other agencies and partners the City will rely on during significant events.
	Continue to work with transportation authorities with the objective of making bridges and the tunnels able to function as post-disaster structures as key components of an emergency evacuation plan.
	Continue to enhance capabilities for emergency planning, flood response and flood recovery.
Periodic Program Review	Continue to review the Flood Protection Management Strategy annually and consider formal updates on a 5-year cycle.

Appendix 1: Analysis

Introduction

This section was prepared by the City of Richmond with assistance from Kerr Wood Leidal Associates Ltd. and sub-consultants who provided expert advice on environmental, geotechnical, and other fields related to flood protection.

Purpose

The purpose of the Flood Protection Management Strategy 2019 is to enhance the City's ability to prevent flooding and minimize the risk and effects of flood damage by monitoring climate change, implementing proactive policies and partnerships, and upgrading critical flood protection infrastructure.

Context

The City of Richmond is comprised of islands and is located in the floodplain of the Fraser River.

The three most developed islands are:

- Lulu Island on which lies the developing urban portion (60%) of the City (West Richmond) and a considerable amount of valuable agricultural land (40%) in the provincial Agricultural Land Reserve;
- Sea Island on which lies the Vancouver International Airport (YVR) and the community of Burkeville; and
- Mitchell Island which consists of industrial related activities.

Richmond is bounded by the Fraser River and the Strait of Georgia, and is subject to flood risks from the Fraser River and the sea. The City is also subject to other flood-related hazards, including dike breach, seismic effects, internal drainage, and river instability. The City recognizes that with the human investment in both urban development and agriculture, the need for the protection of residents, farming and infrastructure is paramount.

Until 2004, when the Province terminated its floodplain management program, flood protection requirements and construction levels were regulated by the Province. These have now become largely the responsibility of the City as the local Diking Authority.

The principal method of protecting life and property on Lulu Island from flooding has been a structural one, primarily diking.

Richmond and New Westminster rely on each other for flood protection on Lulu Island as they share responsibility for the Lulu Island perimeter dike. The Lulu Island perimeter dike is approximately 56km in total length, of which approximately 49km (88%) is under the City's jurisdiction. Richmond relies on New Westminster for flood protection at the critical

upstream end of Lulu Island (Queensborough). New Westminster relies on Richmond for flood protection in a broader sense, given that the greater proportion of the perimeter dike is within Richmond.

Richmond and the Vancouver Airport Authority rely on each other for flood protection on Sea Island as they also share responsibility for the perimeter dike. The Sea Island perimeter dike is approximately 15km in length, of which approximately 1.1km (7%) is under the City's jurisdiction.

2008–2031 Flood Protection Strategy

At a high level, the 2008–2031 Flood Protection Strategy:

- documented climate change and sea level rise as emerging issues that the City would need to address;
- recognized the Lulu Island perimeter dike as the cornerstone of the City's flood defences;
- initiated a dike master planning process for dike upgrading;
- identified the need for further consideration of seismic risk;
- identified the need for an updated floodplain bylaw to regulate development;
- provided for widespread land raising to be considered in the planning process; and
- recommended the review secondary inland dikes.

Key Factors Influencing the Strategy

Climate Change

Climate change induced sea level rise, higher intensity storms, and increase in freshet flows are primary considerations in the Flood Protection Management Strategy 2019 due to their significance in increasing flood risk. Models that project future climate suggest that the rate of sea level rise will accelerate as the climate warms. The effects of long-term subsidence also need to be considered due to its impact on relative sea level rise. Review of these projected conditions will guide infrastructure upgrades and land use considerations.

Provincial Guidelines & Regional Considerations

The Province has significantly updated their sea level rise and dike design guidelines (e.g., Flood Hazard Area Land Use Management Guidelines) since the 2008–2031 Flood Protection Strategy was endorsed. These changes, including regional initiatives and guidance documents, such as those presented by the Fraser Basin Council, contribute to Richmond's updated design standards for flood protection.

New Information

The availability of improved information on climate change, variation in land use over the years, and the need to examine both structural and non-structural issues related to floodplain management, further demonstrates the need to review the 2008 Strategy.

Project Context

Flood Risks

Flood Hazards – Summary

The City faces the following primary flood hazards:

- A dike breach that may occur as a result of water overtopping the dikes;
- The liquefaction of soils under the dikes as a consequence of an earthquake or dike breach;
- Piping through a dike caused by water under pressure, eroding soil particles to cause a tunnel through the dike; and
- Human damage to a dike.

The Strategy addresses these flood hazards in a comprehensive manner, in particular, those that:

- originate from high tidal ocean levels; and
- are caused by high freshet discharges in the Fraser River.

It is unlikely that both extreme high ocean levels and extreme high river discharges will occur at the same time.

Most of the land surface of Lulu Island that has not been raised by fill placement lie between an elevation of 0.5m to 2.5m geodetic, with the average land level in Richmond between elevation 1.0m and 1.5m.

Contributing Factors

For floodwater to enter the interior of Lulu Island from the river or the sea, it must either overflow the perimeter dikes, or these dikes must be breached in some manner. Given the current design and generally good condition of the existing dikes, an overflow would likely only result from:

- an extreme high water condition in the river or tidal sea;
- from a lowering of the dike crest; or
- an increase in the level of the Fraser River exceeding the dike crest, by extreme freshet discharges in the Fraser River.

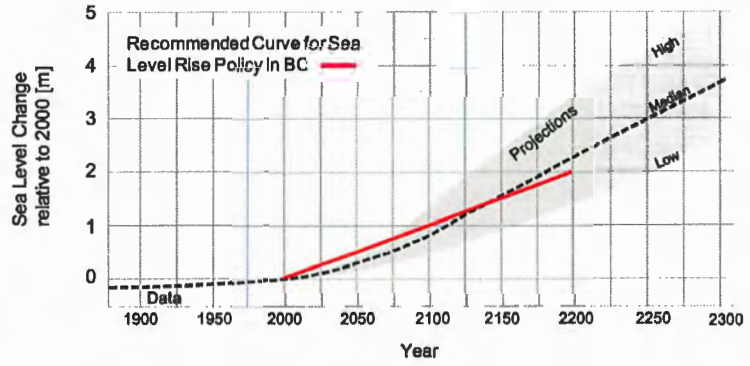
When water overflows an earth dike, it may erode the embankment and breach the dike. The possibility of a breach developing from an overflow depends on the magnitude, nature and duration of the flow and the design and surface materials of the dike.

Climate Change – Sea Level Rise

Sea level rise projections currently referenced by the Province is shown on Figure 1. The recommended linear projection will allow municipalities to overbuild their dikes in advance of the median projection. The City of Richmond has adopted 1m of sea level rise by 2100 and 2m of sea level rise by the year 2200 (relative to the year 2000) in current perimeter dike designs.

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Figure 1: Sea Level Rise Projections (BC, Delcan, 2009)



Climate Change – Temperatures and Snow Melt

Climate change will increase average temperatures across BC. While precipitation will increase slightly, the fraction falling as snow will decrease. By mid-century, models suggest this will result in substantial declines in snow accumulation at lower and mid elevations across the watershed (Islam et al., 2017).

While average snowpacks and high-flow conditions are expected to decrease, climate change will also increase variability. Given the extensive uncertainties associated with climate change, a precautionary approach is appropriate.

Sedimentation, Dredging and Erosion

The Fraser River transports about 20 million metric tonnes of sand and silt to the sea each year, with about 80% of the annual delivery occurring during the spring freshet (Williams and Roberts, 1989). The material is transported as both bedload (along the river bottom) and suspended load (within the water column).

For the period between April 2006 and March 2007, the Fraser River Estuary Management Program (FREMP) reported the removal of 3.18 Mm3 for the navigation channel (FREMP, 2007). The need for removal of sediment by dredging needs to consider environmental impacts and ensure that river erosion is not increased in other areas.

As a result of dredging and flood protection projects by various authorities on the lower Fraser River, the river has been relatively stable in the past century. Trifurcation works are maintained at New Westminster to control the flow split between the North Arm, South Arm and Annacis Channel. The potential remains for the river alignment to abruptly change in the future, most likely during a large flood. This could result in increased bank erosion where the redirected flow hits a vulnerable river bank. Such potential is greatest on the South Arm due to a higher percentage of flow that is directed into it.

Wind Setup

Wind setup is a local increase in water depth near the shoreline caused by the shear force of an wind blowing over the water surface towards the land. The magnitude of wind setup depends on the available wind fetch and water depth, and will be greatest where there are extensive areas of shallower water. Sturgeon Bank is an example of an area that could contribute to wind setup along the western shoreline of the city.

Because of its local nature, a "typical" value for wind setup cannot be defined for Richmond. Where applicable, site-specific values must be determined and added to the still-water coastal flood level. A case study of the West Dike in the 2011 Sea Dike Guidelines (Ausenco Sandwell, 2011a) includes a local wind setup allowance of 0.3m to 0.4m.

Wave Effects

Wave effects can greatly exacerbate coastal flood hazards in unprotected areas. Historically, the western shorelines of Lulu Island and Sea Island have benefitted from the protection provided by Sturgeon Bank. This extensive complex of sand banks, mud flats and intertidal marshes follows the west side of the two islands from the Fraser River North Arm to the main South Arm. The shallow features help to dissipate wave energy during storms, causing the largest waves to break before reaching the foreshore.

Tsunamis

Tsunamis generated by major earthquakes at remote locations around the Pacific Rim are not a major hazard to Richmond. The City is protected by Vancouver Island, and a tsunami generated at a distant location would lose considerable energy passing through the Juan de Fuca Strait and Strait of Georgia.

Earthquakes

Potential impacts of an earthquake on the dike system include:

- settlement of the dike crest, which increases the likelihood of overtopping;
- deformation of the dike cross-section, which decreases geotechnical stability while increasing seepage and the potential for internal erosion; and/or
- liquefaction of the dike fill and/or underlying river bank, triggering in a "flowslide" where some or all of the liquefied material flows into the river or foreshore.

Liquefaction is considered the most severe of the above impacts, since a major flowslide could conceivably result in the complete loss of a dike section, resulting in flooding at the next high tide.

Regional Opportunities and Challenges

Federal

Federal jurisdiction relates to dredging of the Fraser River. Prior to 1998, the Coast Guard reported to Transport Canada and were responsible for dredging. In 1998 the Coast Guard began reporting to DFO, and through this, were given a revised mandate that does not include dredging (largely due to costs). As a result, dredging has become the responsibility of the Port Authorities.

According to a 2014 report on Fraser River dredging (City of Richmond, 2014), bigger vessels have resulted in a need to increase the navigable river depth from 8.7m in the 1960s to the current depth of 11.5m.

Provincial

In 2014 the Province established new guidelines for dike seismic design, replacing the standards from 1998. The current BC Seismic Design Guidelines for Dikes outline an approach that is considered difficult to meet without costly and impractical ground improvement works. Additionally, the guidelines are considered very conservative in some situations because they require performance under extremely rare scenarios. For example, the guidelines require dikes to maintain 0.3m freeboard in the event of a 10-year return period flood occurring following a 2,475-year return period earthquake which has a probability of 0.004% in a 1-year period. This is significantly rarer than the design event for the dike crest elevation (500-year return period event has a 0.2% annual exceedance probability). It is understood that the Province is currently reviewing the guidelines, and an updated version may be forthcoming by 2021. This is considered to be an emerging area of regulation where the end result is uncertain.

City of Richmond

Raising Land

City of Richmond Council adopted a Floodplain Management Implementation Policy 7000 on September 11, 1989. The strategy established:

- flood construction levels;
- procedures for development occurring within an exempt area (the principal urban portions of Richmond); and
- priority dike construction and improvements.

Bylaw No. 8204, recommended by the 2006–2031 Flood Protection Management Strategy and adopted in September 2008, has since replaced the Floodplain Management Implementation Policy 7000 and provides guidance on development setback, Flood Construction Levels, and exemption conditions.

The general exemption for Area A is notable in that it covers a high population, urban area of the City, as shown on Figure 2. Structures within Area A are generally exempted from the above-noted FCL requirements, and are instead required to have the lowest level (underside of a floor system, pad, etc.) set at minimum 0.3m above the highest elevation of the crown of any road adjacent to the parcel. The Richmond existing ground elevation map (Figure 3) shows that the majority of land within Area A lies at or below elevation 1m. Therefore, it is interpreted that the Area A exemption would result in building lowest level elevations of 1.3m or less. This would be more than 1.5m lower than the 2.9m FCL prescribed for the area without the exemption.

Review of the current large area exemptions could allow for more opportunities to raise land with development.

Figure 2: Bylaw No. 8204 Schedule B – Flood Construction Levels

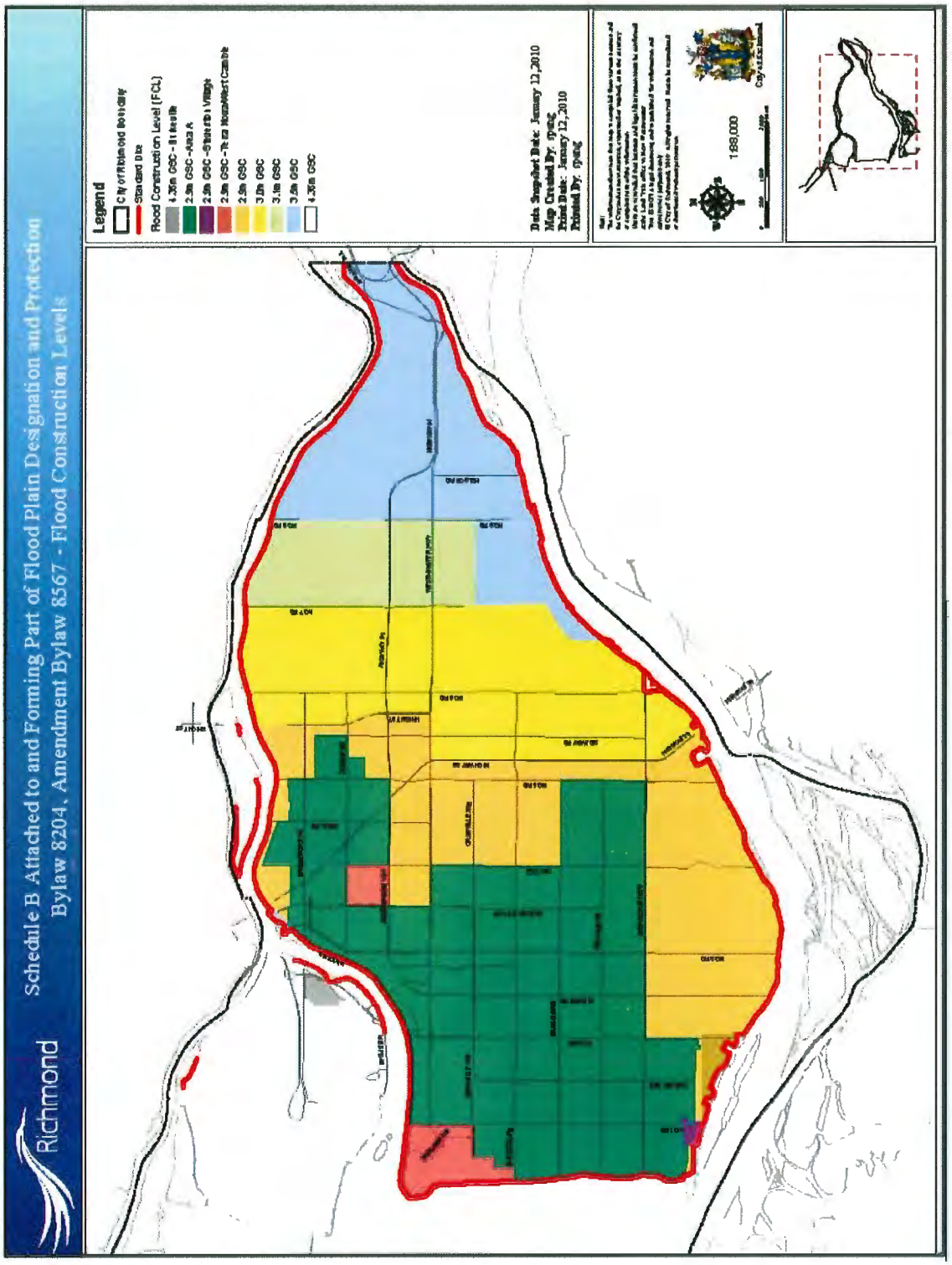
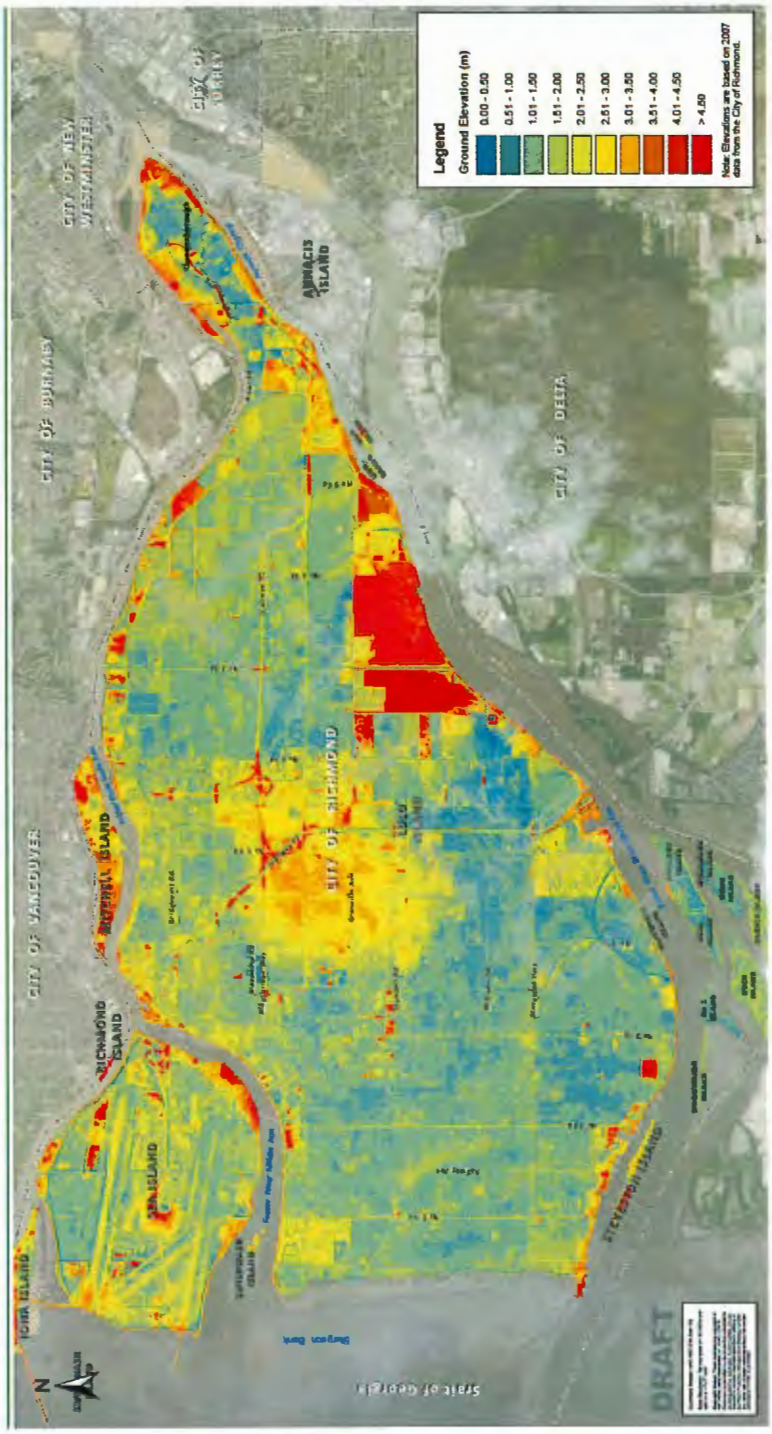


Figure 3: City of Richmond Elevation Map (2016)



Hazard-Based vs Risk-Based Level of Performance

A literature review was conducted to learn how other jurisdictions determine level of performance standards for structural and non-structural flood risk reduction measures.

Two major high-level approaches were identified:

1. Hazard-based level of performance

A legal/political decision is made to set the performance of measures to a specific flood hazard intensity (e.g. 200-year return period/0.5% annual exceedance probability). Often, the specific level is based on a historic event. This is the current system in British Columbia (200-year return period/1894 Fraser River flood). This approach often does not take into account the consequences and overall risk associated with failure of the flood risk reduction measures.

2. Risk-based level of performance

A technical analysis of flood risk (a product of flood probability and flood consequences) is used in conjunction with a legal/political decision on societally tolerable risk to determine the suite of structural and non-structural measures needed to reduce the flood risk to an acceptable level.

Two local jurisdictions are currently using the risk-based approach, these being the District of Squamish and the District of North Vancouver.

Legal Considerations

To take full advantage of the regulatory authority provided under the *Local Government Act*, Richmond has adopted Bylaw No. 8204 to guide developments in the City. In addition to allowing the municipality to regulate setbacks, flood construction levels and provisions for use, the Act provides the ability to require a statutory covenant and establish indemnity to the City and the Province for new construction in areas where flooding could occur.

Under the Community Charter where the Building Inspector thinks that a flood hazard exists a geotechnical report can be required but once requested, the Building Inspector must abide by the report without deviation and the building permits can only be issued with a covenant. While a Section 910 bylaw is seen as the preferred and more flexible option for regulating flood protection measures, uncertainty exists as to how the following section of the Compensation and Disaster Financial Assistance regulation of the Emergency Program Act will be interpreted in the aftermath of a significant flood event:

"If an area is designated under the Municipal Act as a floodplain and a public facility is built or installed in that area after the area has been so designated, no assistance will be provided to repair, rebuild or replace the public facility if it is damaged in a flood unless the structure was determined by the Minister of Environment, Lands and Parks or by Canada Mortgage and Housing Corporation to have been properly flood protected."

The regulation also places similar constraints upon new public facilities.

Financial Considerations

As part of any new strategic initiatives, dike improvements, maintenance, as well as construction, requires substantial capital investments. Richmond has an established dike utility which is used to address seismic/stability improvements to some of the weaker portions of the perimeter dike system. However the City will not have the resources to undertake such capital improvements on its own. Thus, there is a need to pursue partnerships, senior government assistance as well as to, broaden the use of City Development Cost Charges (DCCs) to include dike improvements, and other initiatives.

At a current level of utility funding of nearly $12M per year, and assuming that 75% of the funding is applied to dike upgrading, at least 60 years (and likely more) of dike upgrading work will be required to meet the performance level reflected in the current Dike Master Plans. Further work would be needed to implement any higher dike standard that may be desired.

Changes to sea level rise and other flood hazards may require review of the current funding allocations. If flood hazards increase at a faster rate than currently projected, the City may need to adjust funding priorities to mitigate the additional risk.

Flood Risk Mitigation Analysis

Flood Event Return Period

For the lower Fraser River, the river flood design profile has been derived based on the largest contemporary flood peak which occurred in 1894. This flood design profile and the extreme sea level recorded at Point Atkinson has been commonly used as the provincial standard for deriving design dike profiles for the Lower Fraser River and flood construction levels in the adjacent floodplains. The peak discharge at Hope for the 1894 event has been estimated at 17,000m3/s.

Historically, the design flood level has been the site-specific maximum of the 200-year return period coastal flood (0.5% annual exceedance probability) and the 1894 Fraser River freshet flood of record.

During the development of this Strategy, a decision was made to provide a higher standard of flood protection in Richmond by considering the 500-year return period flood event with sea level rise allowance, land subsidence and seismic events. This was based on the following:

- a flood event greater than the current design event could occur;
- to ensure that the substantial increases in Richmond's population, development, and investment, are best protected;
- to maximize "Safety" and "Prevention", which are major City priorities;
- to increase the confidence in the City's flood protection assumptions and planning; and
- to consider the combined effect of a significant seismic and flood event occurring within the same year.

For deriving the design sea level, the City has adopted the Province's coastal still-water flood level of 2.9m defined by the 2008 study completed by Northwest Hydraulic Consultants. In combination with the largest historical flood of record which occurred in 1894, 1m of sea level rise, a 0.2m land subsidence allowance, and 0.6m freeboard, this yields a design dike crest elevation of 4.7m for most of Richmond's perimeter dike.

The Fraser Basin Council is completing other studies which will increase our knowledge of flood event levels and regional flood protection management. The City will consider this information in its on-going monitoring.

Uncertainties

While the type of hazards can be defined, including the probability of certain water levels being realized, current knowledge is insufficient to determine the actual risk or probability of a dike breach or failure. Dikes are now designed to be higher than a certain water level, and it is assumed that the defense system will not fail until at least that level is reached.

Accurately assessing the probability of a dike breach is technically complex and requires a variety of detailed data.

Information is required about:

- load characteristics (e.g., flood levels, wave effects, earthquake models, climate change assumptions, etc.);
- potential failure modes (overtopping, piping, erosion, earthquake, etc.); and
- performance characteristics of the dike structure (e.g. foundation conditions, crest elevation, geometry, fill materials, compaction, site-specific seismic response soil data, etc.).

Data on dike performance characteristics are much more limited for many of the dikes in BC's Lower Mainland. Most of the local dikes were originally built (or re-built) around the turn of the century without comprehensive engineering design standards or records. A significant data collection and monitoring program would be required to support on-going analysis of the likelihood of dike breaches. Some of this information (e.g., accurate and detailed crest profile drawings) is considered critical for the effective operation of any high-consequence dike system; obtaining this information is a priority for the City. The City of Richmond continues to collect and analyze dike performance data in coordination with regional diking authorities.

The City has completed assessments of hydraulic (flood) loads and is currently looking into wave effects, seismic events, and performance characteristics of the City's dikes.

Combined Frequency Analysis

Earthquakes and floods can individually result in dike breaches through flowslide failures associated with earthquakes and overtopping, piping and other processes associated with floods.

Earthquake and flood hazards can also interact to intensify dike breach hazards.

While the potential for damage to the dike would be high, the likelihood of a major earthquake and a minor to major flood occurring at the exact same time is effectively zero. Consideration should therefore be placed in the scenario where seismic events damage the dikes and Richmond is exposed to an elevated flood risk until repairs are completed.

Table 5 presents the probability that a flood occurs within 1 year of a major earthquake for a range of earthquake and flood intensities. This effectively represents the situation where an earthquake occurs and it takes 1 year to complete repairs to the dike system. For example, for any given year there would be a 1 in 24,750 chance or 0.004% probability of a 2,475-year return period earthquake and 10-year return period flood occurring within the same year.

Table 5: Combined Probability of Earthquake and Flood Occurring in the Same Year

Earthquake Return Period (Years)	Flood Return Period (Years)		
	≥ 10	≥ 200	≥ 500
≥ 100	1:1,000	1:20,000	1:50,000
≥ 475	1:4,750	1:95,000	1:237,500
≥ 2,475	1:24,750	1:495,000	1:1,237,500

Site-specific geotechnical seismic performance analysis and water level frequency analysis is required to assess this hazard. In general, the probability of this combination of events for various earthquake and flood event combinations can be determined using the following steps:

1. Residual Crest Elevation

Estimate the post-earthquake crest elevation of the dike (for a non-flowslide event).

2. Minimum Overtopping Event

Estimate the minimum return period water level event that would cause reduced freeboard such that overtopping is likely (e.g., 0.3m or less).

3. Exposure Period

Estimate a reasonable duration of time that would be required following the earthquake to repair the dike, including raising the crest to the pre-earthquake/design level.

4. Probability

Calculate the probability that the minimum return period overtopping water level occurs within the exposure period.

Contemplated Approach in Richmond

Recognizing the unique situation in Richmond, an alternative approach and criteria have been developed as part of the strategy and current dike master planning activities. This represents some variance with the current BC Seismic Design Guidelines for Dikes.

The purpose of this alternative approach is to harmonize the level of performance between seismic and non-seismic (i.e., overtopping, piping, etc.) dike failure modes. This will allow the City to more efficiently identify, prioritize, and address the areas of highest risk regardless of the governing failure process.

The approach is conceptually simple, but requires confirmation of multiple scenarios. Should flowslide failure be anticipated under the 475-year return period earthquake, additional mitigation measures should be implemented. The alternative approach calculates the post-earthquake dike elevation for the specified area and identifies the flood return period which would result in unacceptable wave overtopping. Assuming a 1-year exposure period for dike repair (this value can be modified) the method then calculates the total overtopping risk by combining the probabilities for the earthquake and flood scenarios. This calculated probability is then compared with the performance criterion (e.g., the adopted flood risk return period) to determine if seismic performance is acceptable.

The most important aspect of seismic dike protection in the City is to identify potential flowslide areas, and to implement appropriate counter measures. As improvements in and around the dike are not likely to be effective in most flowslide situations, further investigation into large area land raising to mitigate flowslide failure may be warranted.

Options for Minimizing the Potential for Flooding

In addition to diking, there are a number of other approaches available to prevent and mitigate flooding. These include the following:

Raise Land Levels

The rationale for raising the level of the land is similar to that which led to the establishment of flood construction levels. It is an attempt to retroactively institute consistent flood construction levels related to design flood levels for all parts of Lulu Island, even those which are currently in the Floodplain Exemption Area.

Flood Construction Levels

It is appropriate to periodically update the FCL's that are specified in the bylaw. This may be based on four considerations:

- updated dike breach modelling in consideration of current sea level rise projections and estimated Fraser River flood level;
- the extent to which land raising may be practically performed in various parts of the City in accordance with existing grade constraints;
- the degree to which it is appropriate to require structural elevation of buildings (as opposed to landfill); and
- specific direction for portions of buildings that may be below the FCL.

Further to the last bullet, further restriction of building use and/or configuration below the FCL could be required where achieving the FCL by structural means is permitted. The need for further structural, waterproofing and flood protection measures for building areas below the FCL (underground parking areas and basements) could also be considered.

Flood Proofing

Flood proofing is achieved by raising habitable space on fill, or on a crawlspace or carport or garage that can survive flooding.

An alternative called wet "flood proofing" allows habitable space below the FCL, but relies on the use of flood resistant building materials and construction methods to mitigate the flood impact.

Management of Dike Corridor

Under the *Local Government Act*, a municipality may designate Development Permit Areas in its Official Community Plan for one or more of the following purposes: protection of the natural environment; protection of development from hazardous conditions; protection of farming; revitalization of an area in which a commercial use is permitted; and establishment of objectives for the form and character of intensive residential, commercial, industrial and multi-family development.

There may be merit in the City expanding the designation of development permit areas along the dike corridor, and developing additional guidelines to encourage land development to achieve the above-noted ideal scenario for the perimeter dike.

Potential benefits may include:

- bring the perimeter dike issue more broadly to the attention of the public and the development community;
- giving the City an additional tool to appropriately oversee/regulate all activities along the dike that may impact the dike;
- consider options for raising land inside the dike in conjunction with land development (i.e. establish a superdike); and
- promote the concept of widespread land raising inside the dike.

Land Use and Environmental Considerations

Growth

Most of the residential, commercial and administrative nodes of the city are situated within the 'floodplain exemption area' in West Richmond. Residential growth, as well as commercial expansion, has continued, but is confined largely to the western portions of the city (with the Hamilton area on the New Westminster boundary and Burkeville on Sea Island being notable exceptions). This additional development further emphasizes the need for continued monitoring and flood mitigation planning, since the added population and investment in the area has significantly increased the potential for damage from a flood event. Agriculture predominates in the eastern portions of Lulu Island, with

extensive cranberry fields towards No. 8 Road and Nelson Road. This has been a growing sector over the past few years, and now over 850 hectares of the agricultural crop land is devoted to cranberry production (the next largest crop is hay with about 430 hectares). Special drainage canals, ditches and dikes are required for the seasonal harvesting of cranberries.

Land Use Changes

Land use change has been dramatic since the initial adoption of the 1989 flood management strategy. Notable is the expansion of the residential development in the City Centre and industrial and business park base. Major new activities include the development of the Port of Vancouver lands which extend along the south arm of the Fraser River at the southern ends of No. 7 Road, No. 8 Road and Nelson Road. Large warehousing and distribution centres characterize this area. The area has been developed on an extensive volume of fill sand taken from the dredging operations conducted by the Port of Vancouver. This fill creates a substantial area of high elevation topography in Richmond with a land surface situated above even the worst case extreme flood levels. The Port of Vancouver (Richmond lands) will ultimately provide for about 1,000 hectares of industrial use in this location, and the elevation of the land here functions as a significant flood barrier.

Environment

The City considers the environment to be of significant importance and has successfully protected several natural areas such as foreshore areas, the Richmond Nature Park, the Northeast Bog Forest and the Terra Nova Natural Area. In 1991, the City amended its Official Community Plan to include an inventory of environmentally sensitive areas such as bogs, estuaries, and sloughs as valuable natural habitats. In 2005, parks and protected areas accounted for 9.7% (1248ha) of the municipality's land base.

The City's 2022 Parks and Open Space Strategy (2013), Ecological Network Management Strategy (2015), Waterfront Strategy (2009), and Trail Strategy (2010) are all considered as a part of Richmond's Flood Protection Mitigation Strategy.

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City of Richmond

Report to Committee

To:	Planning Committee	**Date:**	March 12, 2019
From:	Barry Konkin Manager, Policy Planning	**File:**	RZ 19-850784

Re: **Application by Wing Kuen Becky Chan for Rezoning at 11120 Granville Avenue from "Agriculture (AG1)" to a Site Specific Agriculture Zone to Permit a Larger House Size**

Staff Recommendation

That the application for the rezoning of 11120 Granville Avenue from "Agriculture (AG1)" to a Site Specific Agriculture Zone, to permit a house up to 500 m^2 in floor area, be denied.

Barry Konkin
Manager, Policy Planning

BK:sds
Att. 7

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Development Applications	☑	

Staff Report

Origin

Wing Kuen Becky Chan has applied to the City of Richmond for permission to rezone the property at 11120 Granville Avenue from the "Agriculture (AG1)" zone to a Site Specific Agriculture Zone, in order to permit a single-family dwelling with a floor area of 500 m^2 (5,382 ft^2). The maximum floor area permitted in the existing "Agriculture (AG1)" zone for a single-family dwelling (and all accessory buildings or structures) is 400 m^2 (4,306 ft^2). The subject property is approximately 0.44 acres (0.18 hectares) in area and is located within the Agricultural Land Reserve (ALR). A location map and aerial photograph are provided in Attachment 1.

The subject site is currently occupied by a vacant single-family dwelling, which is proposed to be demolished. A Building Permit (B7 18-843077) was submitted on December 17, 2018 for a new single-family dwelling with a total floor area of 500 m^2 (5,382 ft^2). The Building Permit was submitted during the Council endorsed withholding period for Building Permits that conflicted with the bylaw amendments under preparation and consideration by Council, which included reducing the maximum floor area permitted in the "Agriculture (AG1)" zone to 400 m^2 (4,306 ft^2). The amendments to the AG1 zone were adopted by Council on December 17, 2018, and the Building Permit was subsequently cancelled as it did not comply with the new regulations (maximum house size of 400 m^2). The applicant submitted the subject rezoning application in order to permit a single-family dwelling with a maximum floor area of 500 m^2 (5,382 ft^2). The proposed Site Plan for the house is provided in Attachment 2.

Findings of Fact

A Development Application Data Sheet providing details about the development proposal is attached (Attachment 3).

Surrounding Development

To the North:	Across Granville Avenue, single-family dwellings and agricultural uses on lots zoned "Agriculture (AG1)", located within the Agricultural Land Reserve (ALR).
To the South:	No access parcels zoned "Agriculture (AG1)", located in the ALR.
To the East & West:	Single-family dwellings and agricultural uses on lots zoned "Agriculture (AG1)" fronting Granville Avenue, located within the ALR.

Related Policies & Studies

Official Community Plan/East Richmond Area McLennan Sub-Area Plan

The Official Community Plan (OCP) land use designation for the subject site is "Agriculture (AGR)". The East Richmond Area McLennan Sub-Area Plan land use designation for the subject site is "Agriculture" (Attachment 4). The "Agriculture" designation comprises of those

areas of the City where the principal use is agriculture and food production, but may include other land uses as permitted under the Agricultural Land Commission Act (ALCA).

The OCP includes policies on residential development in the ALR, including limiting the area used for residential development on properties in the ALR. As per Section 7.0 of the OCP (p. 7-4) (Attachment 5), the following policies are provided as guidelines which may be applied by Council, in a flexible manner, individual or together, to increase house size in the City's agricultural areas:

- the need to accommodate a variety of a cultural and inter-generational family needs and farm situations;
- verification that the site has been or can be used for agricultural production;
- verification that the applicant has been farming in Richmond or elsewhere, for a significant period of time, or if they are a new farmer, they can demonstrate that they are, or will be, capable of farming;
- demonstration that there is a need for a larger farm house, to accommodate existing and/or anticipated workers on the site, through the submission of a detailed report from a Professional Agrologist indicating such, or through other information;
- submission of a farm plan which is acceptable to Council that may include justifying any proposed on-site infrastructure, or farm improvements including providing financial security to ensure that the approved farm plan is implemented.

The applicant has advised that some farming is proposed at the rear of the property (i.e. chickens and vegetable growing); however, the applicant's stated reason for the proposed rezoning is the timing of the withholding period and cancellation of the previous Building Permit. The applicant's statement of intent is provided in Attachment 6. Therefore, the above-noted guidelines cannot be applied in this context and the proposal is not consistent with OCP policies.

Public Consultation

A rezoning sign has been installed on the subject property. Staff have not received any comments from the public about the rezoning application in response to the placement of the rezoning sign on the property.

Analysis

Proposed Rezoning Application

On December 17, 2018, Council adopted amendments to the "Agriculture (AG1)" zone to limit residential development on agriculturally zoned lands, including:

- a maximum house size of 400 m^2 (4,306 ft^2);
- a maximum two storey building height;
- a maximum house footprint of 60% of the total floor area;
- a maximum farm home plate of 1,000 m^2 (10,764 ft^2); and

- requiring the septic field to be located within the farm home plate.

Prior to adoption, there was a withholding period of building permits that conflicted with the bylaws in preparation and consideration by Council, from November 13, 2018 to December 17, 2018. The associated Building Permit for the subject property was submitted during the withholding period and subsequently cancelled after the withholding period ended, as it did not comply with the new regulations. A timeline of applicable events is provided in Attachment 7.

The proposal is not consistent with the 400 m^2 (4,306 ft^2) maximum floor area requirements of the "Agriculture (AG1)" zone. The Development Application Data Sheet in Attachment 3 provides details about the development proposal in comparison to the current requirements of the AG1 zone.

On November 27, 2018, Bill 52 (*Agricultural Land Commission Amendment Act, 2018*) was given third reading and royal assent. This legislation establishes a maximum single-family dwelling size of 500 m^2 (5,382 ft^2) in total floor area for land located within the Agricultural Land Reserve (ALR). On February 22, 2019, the new ALR Regulation changes brought the changes as per Bill 52 into force and effect. Although the subject property is located in the ALR, the proposal is within the Provincial limit and thus not required to submit a non-farm use application to the Agricultural Land Commission (ALC).

Conclusion

Wing Kuen Becky Chan has applied to the City of Richmond for permission to rezone the property at 11120 Granville Avenue from the "Agriculture (AG1)" zone to a Site Specific Agriculture Zone, in order to permit a single-family dwelling up to a maximum floor area of 500 m^2 (5,382 ft^2).

The application is not consistent with the current AG1 zone and does not comply with applicable policies contained within the OCP and Area Plan for construction of a single-family dwelling larger than 400 m^2 (4,306 ft^2) on the subject site.

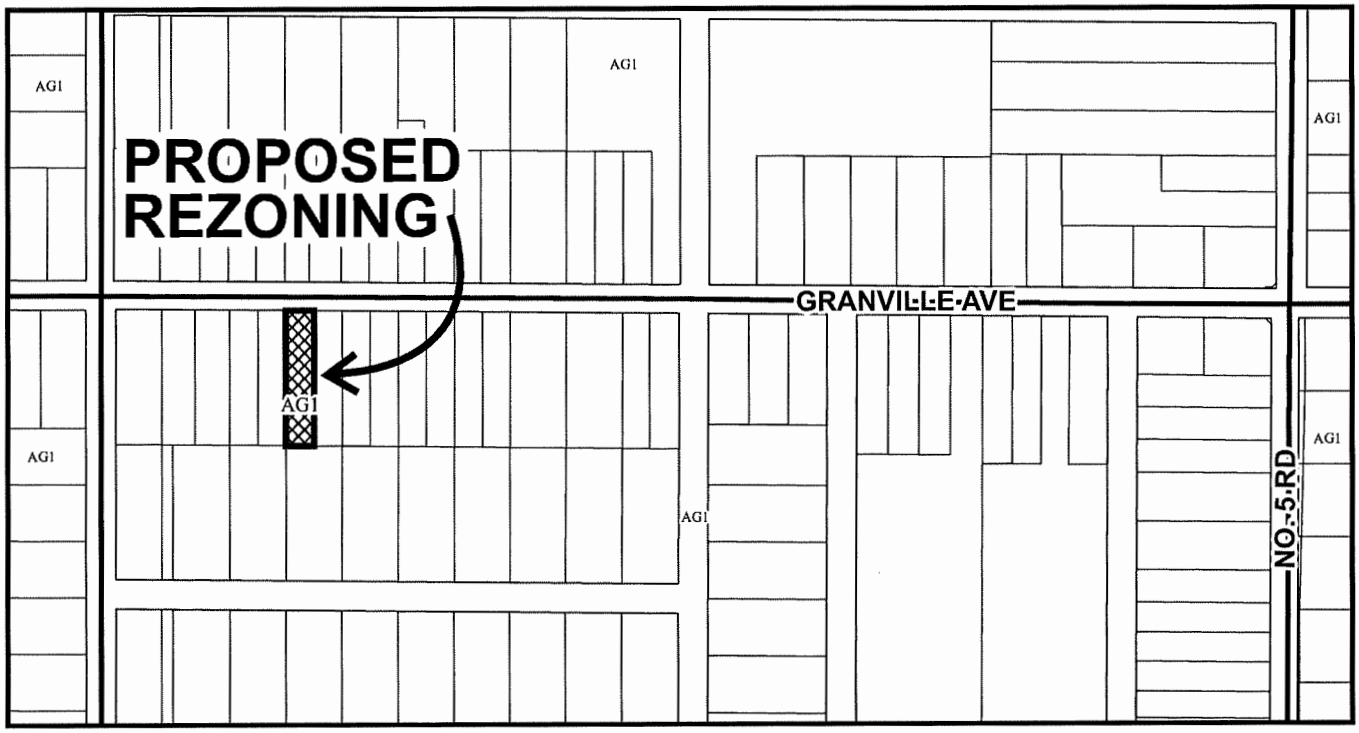
On this basis, it is recommended that the application be denied.

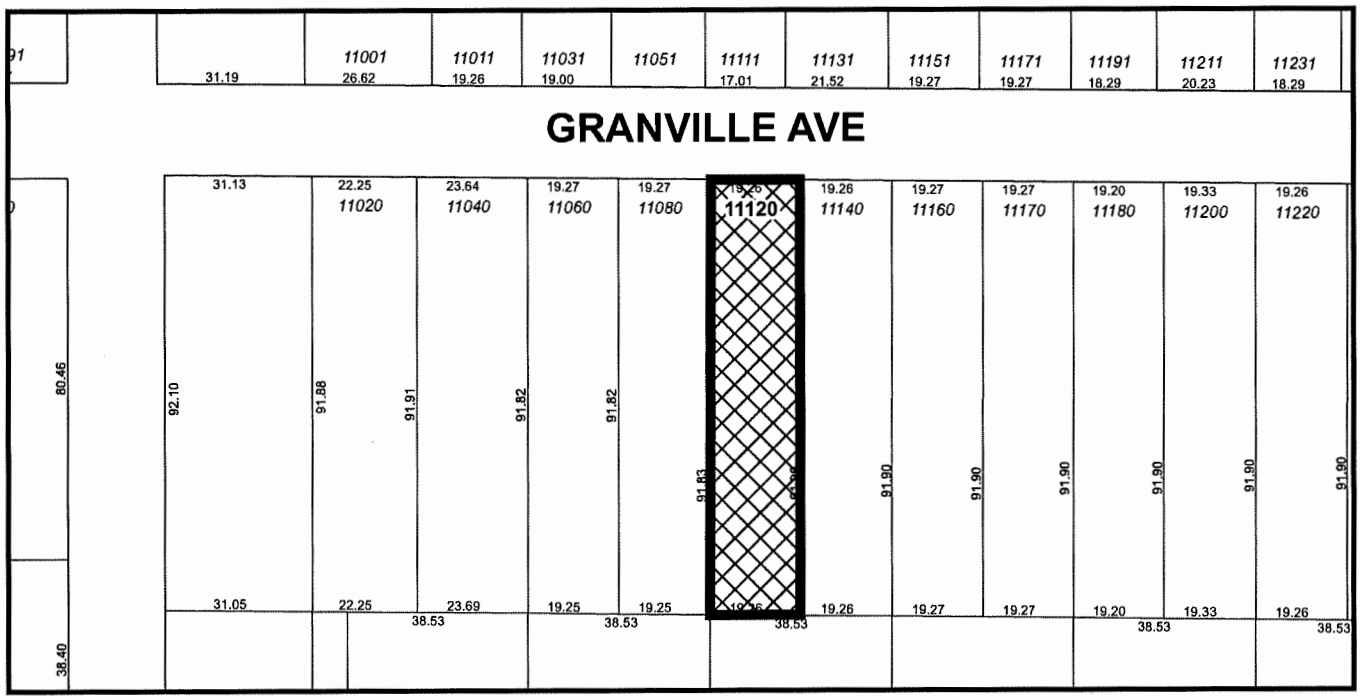
Steven De Sousa
Planner 1

SDS:cas

Attachment 1: Location Map and Aerial Photo
Attachment 2: Conceptual Development Plans
Attachment 3: Development Application Data Sheet
Attachment 4: East Richmond Area McLennan Sub-Area Plan Land Use Map
Attachment 5: Official Community Plan Section 7-4
Attachment 6: Statement of Intent
Attachment 7: Timeline of Events

City of Richmond





N	RZ 19-850784	Original Date: 01/18/19 Revision Date: Note: Dimensions are in METRES

City of
Richmond

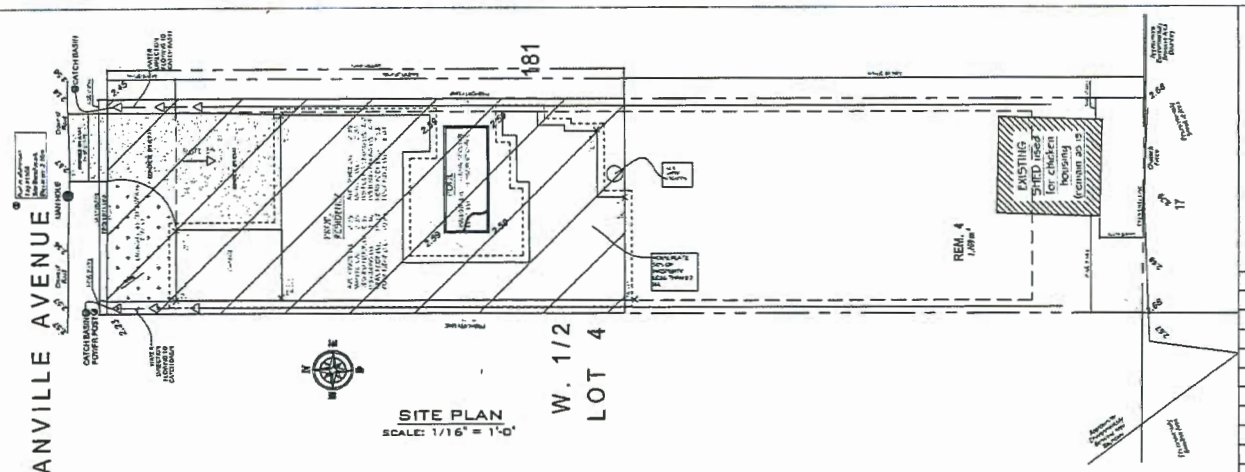


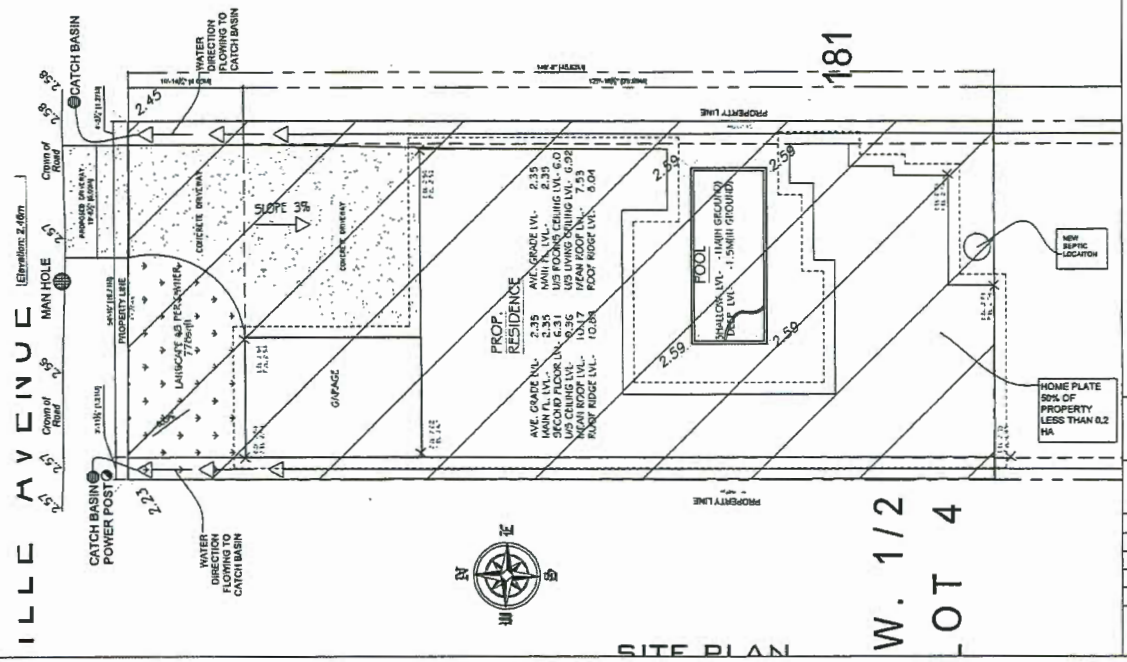
RZ 19-850784

Original Date: 01/18/19

Revision Date:

Note: Dimensions are in METRES





PROJECT DATA:

CIVIC ADDRESS: 11120 GRANVILLE AVE, RICHMOND BC

LOT 4 SECTION 13
BLK4N RG8W PL NWMP1177
PID 012-027-856
LOT AREA = 1771 SQ.M. =19,062 SFT

LOT COVERAGE

PERMITTED LOT COVERAGE 1771@35% = 630 S.M.
PROPOSED LOT COVERAGE 409 S.M. 23%
(HOUSE 4000+ POOL 403) =4403 sqft

PROVIDED TOTAL FLOOR AREA:

PERMITTED MAX GARAGE FSR-538sqft
PERMITTED MAX HOUSING FSR-5380sqft
PERMITTED TOTAL FSR-5918sqft

PROPOSED GARAGE: 600 S.F (538 garage, remaining 62 into housing fsr)
PROPOSED MAIN FLOOR: 3750 S.F
PROPOSED UPPER FLOOR: 1568 S.F
THE ABOVE AREAS NOT INCLUDING SUNDECKS, OPEN AREA

BUILDING HEIGHT:

MAX. PERMITTED HEIGHT: (10.5M)
PROPOSED HEIGHT: (7.82M)

NOTES:

1. WRITTEN DIMENSIONS SHALL HAVE PRECEDENCE OVER SCALE DIMENSIONS.
2. CONTRACTOR SHALL VERIFY ALL ON SITE CONDITIONS PRIOR TO COMMENCEMENT OF THE WORK.
3. ALL WORK SHALL CONFORM TO THE REQUIREMENT OF BRITISH COLUMBIA CODE 2012 EDITION.
4. ALL CONCRETE WORK SHALL CONFORM TO THE REQUIREMENT OF C.S.A. A-23.1 LATEST EDITION.
5. CONCRETE STRENGTH AT 28 DAYS, MINIMUM 3,000 PSI.
6. ALL FRAMING AND NAILING SHALL CONFORM TO B.C. BUILDING CODE PART 9 AND DESIGN TO C.S.A. LATEST EDITION.
7. ALL FRAMING LUMBER SHALL BE DOUGLAS FIR #2 OR BETTER.
8. WOOD TRUSSES SHALL BE DESIGNED AND SEALED BY P.ENG. REGISTERED IN B.C.
9. ALL PLYWOOD SHALL BE SOUDAS FIR CONFORM TO C.S.A 0121 LATEST EDITION.
10. OWNER IS TO BE ENTIRELY RESPONSIBLE FOR ALL STRUCTURAL ENGINEERING REQUIREMENT.
11. ALL DIMENSIONS ARE TO BE CHECKED ON SITE BEFORE WORK COMMENCES.
12. SURVEYOR TO CONFORM BUILDING SIZE AND LOCATION.

ESA:
FRWT - FRESH WATER

HOME PLATE
HOME PLATE
50% OF PROPERTY LESS THAN 0.2 HA
- SHOWN ON PLAN

PRELIMINARY

PRECISION POINT

Precision Point Design
2564 Lefeuvre Road
Abbotsford, V4X1H5, BC
P.604.807.6861
E.precisionpointdesign@gmail.com

no.	description	date

date:	DECEMBER 11 2018
scale:	AS INDICATED
drawn:	ANDY
checked:	ANDY
project no.	43928.13
sheet no.	1/5

City of Richmond

Development Application Data Sheet

Development Applications Department

RZ 19-850784 **Attachment 3**

Address: 11120 Granville Avenue

Applicant: Wing Kuen Becky Chan

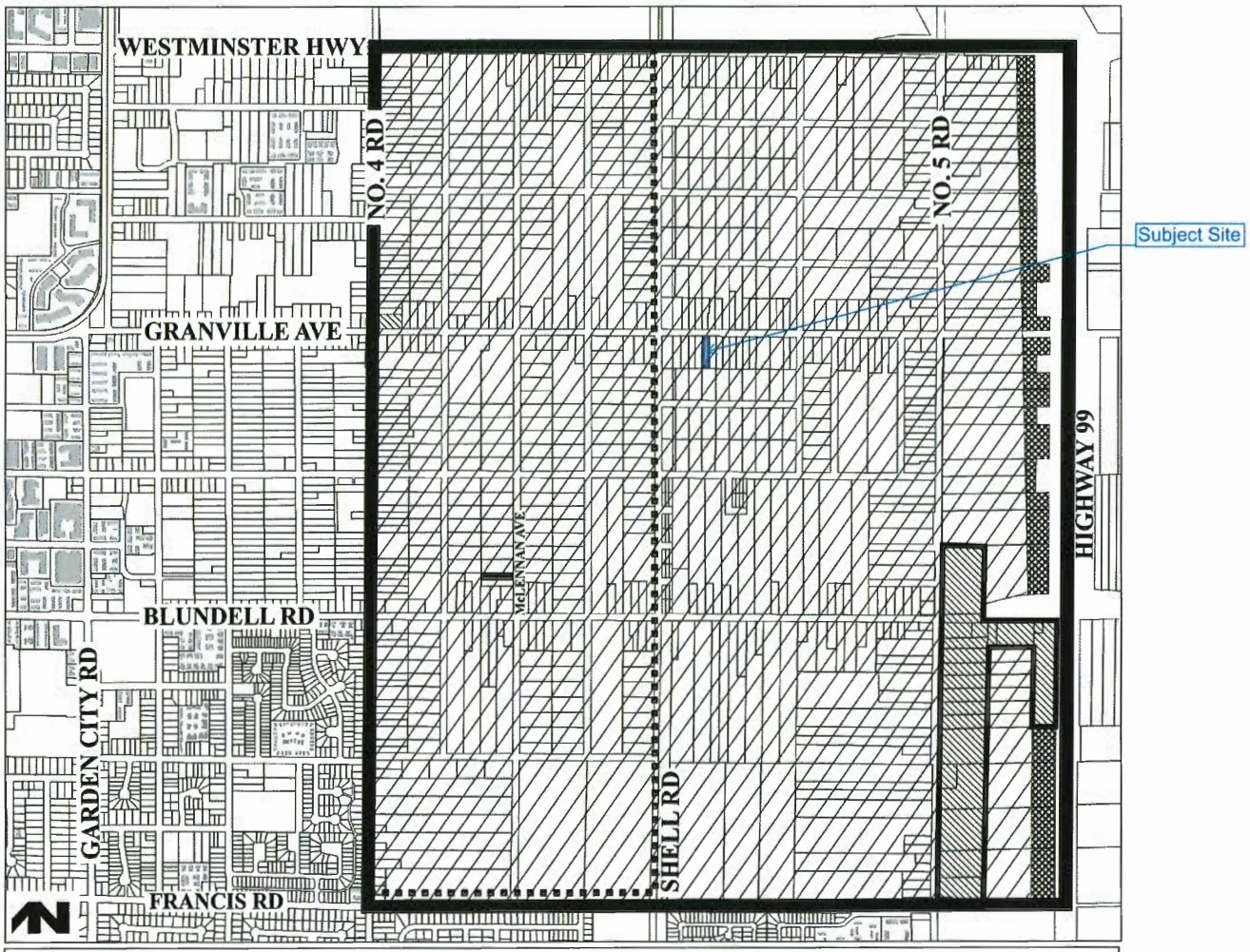
Planning Area(s): East Richmond

	Existing	Proposed
Owner:	W. Chan	No change
Site Size:	1,771 m^2 (0.44 ac / 0.18 ha)	No change
Land Uses:	Single-family residential	No change
OCP Designation:	Agriculture (AGR)	No change
Area Plan Designation:	Agriculture	No change
Zoning:	Agriculture (AG1)	Site Specific Agriculture Zone to permit a larger house size

	Bylaw Requirement (AG1)	Proposed	Variance
Buildable Floor Area:	Max. 400 m^2 (4,306 ft^2)	500 m^2 (5,382 ft^2)	**Rezoning Requested**
Farm Home Plate:	Max. 50% of the lot area for lots less than 0.2 ha	50% of the lot area	None
House Footprint:	Max. 60% of the maximum floor area ratio	60%	None
Setback – Farm Home Plate:	Max. 75 m	Complies	None
Setback – Single Detached Housing Building:	Max. 50 m	Complies	None
Setback – Front:	Min. 6.0 m	6.0 m	None
Setback – Interior Side:	Min. 1.2 m	1.2 m	None
Setback – Other Side:	Min. 4.0 m	Min. 4.0 m	None
Setback – Rear:	Min. 10.0 m	45 m	None
Height:	Max. 2 storeys (9.0 m)	2 storeys (7.8 m)	None

Land Use Map

Bylaw 8791
2012/09/10





Bylaw 9706 2017/05/17

Residential Development

f) limit the area used for residential development on properties in the Agricultural Land Reserve. The following policies are to be regarded as guidelines which may be applied by Council, in a flexible manner, individually or together, on a case-by-case basis, when considering rezoning applications, to increase house size in the City's agricultural areas:

- the need to accommodate a variety of a cultural and inter-generational family needs and farm situations;
- verification that the site has been or can be used for agricultural production;
- verification that the applicant has been farming in Richmond or elsewhere, for a significant period of time, or if they are a new farmer, they can demonstrate that they are, or will be, capable of farming;
- demonstration that there is a need for a larger farm house, to accommodate existing and / or anticipated workers on the site, through the submission of a detailed report from a Professional Agrologist indicating such, or through other information;
- submission of a farm plan which is acceptable to Council that may include justifying any proposed on-site infrastructure, or farm improvements including providing financial security to ensure that the approved farm plan is implemented;

Bylaw 9869 2018/06/18

g) limit the number of principal dwelling units to one (1) on agriculturally zoned properties, and only permit one (1) additional dwelling unit provided the property is 8 ha (20 ac.) in area or greater, the property is classified as a farm under the BC *Assessment Act*, and if the owner provides a statutory declaration that the additional dwelling unit is for full-time farm workers only, and submits a report from a Professional Agrologist which demonstrates that:

- full-time farm labour is required to live on the farm;
- the secondary farmhouse is subordinate to the principal farm dwelling unit.

Any proposals for more than one (1) additional dwelling unit on agriculturally zoned land would be considered through a rezoning application and would be reviewed on a case-by-case basis.

January 14, 2019

Subject Property: 11120 Granville Ave

To whom it may concern,

My name is Becky Chan, I have been a Richmond resident for over 30 years. During these past 30+ years I have worked and raised my family in Richmond, we love the city and cannot imagine living anywhere else.

I bought the subject property 11120 Granville Ave to build a house for myself and my son and his family. When I made an offer for this property, we can build on 60% on the site area and were planning to build a 7500SF home. After becoming a firm offer, the city changed the rules to limit the house size to 500 square meters maximum. We completed the sale of the property on June 1, 2017 and started planning for the new house. The current house on the property is not in a livable condition since I bought it. We started working on the planning, the architect, geo-tech, engineering, septic tank design, landscape design, land survey, asbestos removal, etc. We needed to do all this one by one and it took a lot of time.

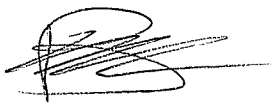
My son had actually tried to submit the application for building a couple times before the deadline, but had missing information and we had to make changes. At the last time he tried, the lady at the city told him not to worry because we are not planning a 10000SF monster house. At the end, our submission date was Dec. 13, 2018 and our application fee was accepted.

I am building this house for myself and my extended family. I am the owner of ABC Realty for over 26 years, my son and daughter-in-law are also a part of the company now. They have a baby of 10 months old, and another one on the way. I need to move in with my son and his family so they can take over the business and I can look after his children. I am also 65 years old and its time for me to retire and help out my son and his family. They will be looking after me when I get older, as I am a diabetic patient with a family history of strokes and cancer.

We are planning to build this "forever home" for us and 400 Square meters is too small for our growing family and needs. We are not planning to re-sell this house for profit. We found 500 square meters is just enough for our minimum requirements, and urge you to let us pass this application.

Thank you for your consideration.

Yours truly,



Becky Chan

Timeline of Events

Date	Event
November 6, 2018 (Special Council)	• Council directed staff to prepare a bylaw that limits residential development in the "Agriculture (AG1)" zone, which included a maximum house size of 500 m^2. • Council resolution included a withholding period for all Building Permit applications in conflict with the proposed bylaws in preparation, received more than 7 days after the passage of the resolution.
November 13, 2018 (Regular Council)	• The proposed bylaws to limit residential development in the AG1 zone (Bylaw 9965, 9966, 9967 & 9968) were introduced for Council's consideration. • The proposed bylaws were amended by Council to limit house size on agricultural land to a maximum floor area of 400 m^2. • The proposed bylaws received first reading and were forwarded to the following Public Hearing (December 17, 2018).
November 13, 2018 (Withholding period begins)	• Withholding period begins for all Building Permit applications in conflict with the proposed bylaws noted above, which included a maximum house size of 400 m^2.
November 27, 2018	• Bill 52 (*Agricultural Land Commission Amendment Act*, 2018) was given third reading and royal assent, which included a maximum house size of 500 m^2.
December 13, 2018	• Submission of associated Building Permit for the subject property for a single-family dwelling of 500 m^2 (B7 18-843077).
December 17, 2018 (Public Hearing)	• Council adopted the bylaws limiting residential development in the AG1 zone (Bylaw 9965, 9966, 9967 & 9968), which included a maximum house size of 400 m^2.
December 17, 2018 (Withholding period ends)	• Withholding period for all Building Permit applications in conflict with the proposed bylaws ends. • Building Permits submitted during the withholding period were cancelled (did not comply with the new regulations). • All Building Permit applications must now comply with the adopted changes to the AG1 zone.
January 14, 2019	• Subject Rezoning application (RZ 19-850784) submitted in order to permit a larger house size than permitted in the AG1 zone, as per the previous Building Permit submitted.
February 22, 2019	• Agricultural Land Reserve (ALR) Regulation amended to reflect the changes as per Bill 52, including a maximum house size of 500 m^2 for properties located in the ALR.

City of Richmond

Memorandum

Planning and Development Division
Policy Planning

To:	Mayor and Council	**Date:**	March 22, 2019
From:	Barry Konkin Manager, Policy Planning	**File:**	RZ 19-851176
Re:	**Zoning Bylaw 8500 Amendment Bylaw 10017 for 22260 River Road (RZ 19-851176)**		

Purpose

The purpose of this memo is to respond to the referral passed at the Planning Committee meeting on March 19, 2019:

> ***"That the application for the rezoning of 22260 River Road from "Agriculture (AG1)" to a Site Specific Agriculture Zone, to permit a house up to 500 m^2 in floor area, be forwarded to Council for consideration of first reading."***

In response to the referral, staff have prepared Zoning Bylaw 8500 Amendment Bylaw 10017 (Attachment 1) to rezone the subject site at 22260 River Road from the "Agriculture (AG1)" zone to a site specific agricultural zone "Agriculture (ZA5) – River Road (Hamilton)", for Council's consideration. Staff have also prepared Rezoning Considerations (Attachment 2), which have been agreed to and signed by the applicant.

Background

The applicant applied for a Building Permit (B7 18-843161) on December 14, 2018 for a single-family dwelling over 400 m^2 (4,306 ft^2). The Building Permit was submitted during the Council endorsed withholding period (November 13, 2018 to December 17, 2018) for Building Permits that conflicted with the bylaw amendments under preparation and consideration by Council, which included reducing the maximum floor area permitted in the "Agriculture (AG1)" zone to 400 m^2 (4,306 ft^2). The amendments to the AG1 zone were adopted by Council on December 17, 2018. The Building Permit associated with the subject property was subsequently cancelled as it did not comply with the new regulations.

Analysis

The subject site is currently vacant and site preparation works have been conducted in anticipation of constructing a new single-family dwelling. The site was previously occupied by a single-family dwelling, which was demolished in October 2018 (demolition permit application number D7 18-829634). The subject site is approximately 0.35 acres (1,429 m^2 / 0.14 hectares) and located in the Agricultural Land Reserve (ALR). There is a Riparian Management Area (RMA) buffer of approximately 15 m from the top-of-bank, which extends onto the subject property. There is also an Environmentally Sensitive Area (ESA) at the rear of the subject property. The RMA and ESA are predominately within the required setbacks of the zone, resulting in minimal impact to the buildable area.

The proposed single-family dwelling includes a partially below ground lower floor which would be constructed below the required flood construction level. This lower floor is proposed to be solely used for uninhabitable space, including vehicle parking, accessible corridors, an elevator shaft, and stairs to the upper level. The applicant has advised that the new house would be occupied by the owner and family, including a mobility challenged older relative who requires corridor and elevator access for a person in a wheelchair. The preliminary Building Plans are provided in Attachment 3.

The proposed site specific agricultural zone "Agriculture (ZA5) – River Road (Hamilton)" permits a maximum floor area of 400 m^2 (4,306 ft^2) (consistent with the AG1 zone), with an exemption up to 100 m^2 (1,076 ft^2) for floor area below the flood construction level which cannot be used for habitable space. This would allow for the lower floor of the proposed single-family dwelling to be exempt from the floor area calculations. The proposed zone also exempts the lower floor from the calculation of height to allow the proposed building design, as the lower portion of the building is inhabitable and is below the minimum flood plain elevation.

The proposed site specific agriculture zone "Agriculture (ZA5) – River Road (Hamilton)" is a zone that is unique to the situation of this property due to the RMA and ESA siting constraints, and the proposed accessible features of the house such as the larger garage, accessible corridors, and elevator shaft. The zone would not be applicable or suitable for other sites in the City.

Rezoning Considerations

As with all rezoning applications, there are various rezoning considerations that must be addressed prior to final adoption of the Zoning Bylaw Amendment (Bylaw 10017). The applicant has received the conditions which have been identified at this time (Attachment 2), and has agreed with these conditions. A signed copy of the rezoning considerations is on file.

Potential for Other Rezoning Applications

In response to Committee's inquiries regarding the potential for other similar applications, the following information is provided:

- There are currently three active rezoning applications requesting to increase the maximum floor area for the single-family dwelling from 400 m^2 (4,306 ft^2) to 500 m^2 (5,382 ft^2) on properties zoned "Agriculture (AG1)" due to cancellation of a previous Building Permit submitted during the withholding period, including:
    - 22260 River Road (RZ 19-851176) (subject property) submitted on January 21, 2019 and presented to Planning Committee on March 19, 2019.
    - 11120 Granville Avenue (RZ 19-850784) submitted on January 14, 2019 and presented to Planning Committee on March 19, 2019.
    - 11951 Blundell Road (RZ 19-855349) submitted on March 4, 2019 and currently in-circulation.
- 28 Demolition Permits were applied for in 2018 to demolish an existing single-family dwelling on a lot zoned AG1. Of those 28 properties, 24 submitted Building Permits for a new single-family home prior to the withholding period.

- Of the four properties that submitted a Building Permit application during the withholding period and were subsequently cancelled:
    - Three of those four properties have submitted rezoning applications to increase the permitted house size to approximately 500m^2 on each lot as per the original Building Permit (as identified above); and
    - Two of the properties have completed the demolition of the house prior to the Building Permit being cancelled (22260 River Road [subject property] and 11951 Blundell Road).

Permitting a house larger than the 400m^2 (4,306 ft^2) size limit will likely be seen as a precedent, and staff anticipate that other property owners may also apply for a similar rezoning. Each application will be reviewed by staff and presented to Council on a case-by-case basis.

In response to Committee's inquiries regarding small lots in the ALR, additional information is provided below. There are a total of 1,274 AG1 zoned parcels in Richmond with road access, including:

1. 263 properties less than 0.2 ha (0.5 ac);
2. 121 properties that are smaller than the subject property (less than 0.35 acres); and
3. 19 properties of a similar size to the subject property (0.3-0.4 acres).

The Committee also discussed the Agricultural Land Commission (ALC) "Homesite Severance on ALR Lands" Policy (Policy L-11), which allows a property owner who owned and occupied their principal residence since December 21, 1972 to dispose of the parcel, but retain a homesite on the land through a subdivision application under the Agricultural Land Commission Act (subject to ALC's approval). The subject property was not a result of this Policy as the subdivision of the property occurred on October 13, 1971.

Should Council grant first reading to the proposed bylaw, the application will be forwarded to the following Public Hearing on April 15, 2019.

If you have any questions, please contact me directly at 604-246-4139.

Barry Konkin
Manager, Policy Planning

BK:sds:jh

Attachment 1: Zoning Bylaw 8500 Amendment Bylaw 10017
Attachment 2: Rezoning Considerations
Attachment 3: Preliminary Building Plans

pc: Wayne Craig, Director of Development
James Cooper, Director of Building Approvals
Senior Management Team (SMT)

City of Richmond

Bylaw 10017

Richmond Zoning Bylaw 8500
Amendment Bylaw 10017 (RZ 19-851176)
22260 River Road

The Council of the City of Richmond, in open meeting assembled, enacts as follows:

1. Richmond Zoning Bylaw 8500, as amended, is further amended by:

   a) Inserting the following into Section 25 (Site Specific Agriculture Zones), in numerical order:

25.5 Agriculture (ZA5) – River Road (Hamilton)

25.5.1 Purpose

The **zone** provides for a wide range of farming and compatible uses consistent with the provisions of the **Agricultural Land Reserve**.

25.5.2 Permitted Uses

- **farm business**
- **housing, single detached**

25.5.3 A. Secondary Uses

- **boarding and lodging**
- **community care facility, minor**
- **home business**
- **secondary suite**

25.5.4 Permitted Density

1. a) The maximum **floor area ratio** for all **buildings** and **structures** is 0.60, except where greenhouses are located on the **lot**, in which case the maximum **floor area ratio** is 0.75, of which at least 0.70 **floor area ratio** must be used for greenhouses.

   b) The maximum **floor area** for a **principal dwelling unit** and all **accessory buildings** or **accessory structures** to the **principal dwelling unit** is 400 m^2.

   c) The following items are not included in the calculation of maximum **floor area**:

      i) Up to a maximum of 100 m^2 of **floor area** below the **flood plain construction level**, which is not used for **habitable space**; and

      ii) **Floor area** used exclusively for covered areas of the **principal building** which are always open on two or more sides and never enclosed, and below the **flood plain construction level**.

   d) The maximum size for each residential **accessory building** or **accessory structure** is 70 m^2.

2. The maximum residential **density** is one **principal dwelling unit** per **lot**.

3. **Agricultural buildings and structures** and greenhouses solely for supporting a **farm business** or for growing, producing, raising or keeping animals and plants are not permitted to have concrete construction, **hardsurfacing** or other impermeable **structure** or construction sunk into, at or below the **natural grade** of the **site** except:

   a) where **Agricultural buildings and structures,** excluding greenhouses, are supported by a system of columns or posts, where each supporting column or post has a minimum radius of 3 m to the next adjacent column or post and that the maximum footprint area for each concrete footing associated with each column or post is 0.5 m^2; and

   b) concrete grade beams connecting concrete pad foundations are not permitted.

4. **Agricultural buildings and structures**, excluding greenhouses, are permitted a maximum of 10% coverage of the **gross floor area** at the ground level of the **building** to be covered by impermeable surfaces.

5. The provisions of Section 25.5.4.3 and 25.5.4.4 do not apply for:

   a) **agricultural buildings and structures** on a **lot**, excluding greenhouses, with a cumulative **lot coverage** equal to or less than 750 m^2 in total area for all existing and proposed **agricultural buildings and structures**.

25.5.5 Farm Home Plate

1. The maximum area of the **farm home plate** is 50% of the **lot area**.

25.5.6 Permitted Lot Coverage

1. The maximum **lot coverage** for **agricultural buildings and structures** is:

   a) 75% for greenhouses; and

   b) 35% for all other agricultural buildings and structures.

2. The maximum farm house footprint is 60% of the maximum **floor area** as permitted under Section 25.5.4 of this bylaw. The farm house footprint means the total horizontal area of the **farm home plate** that may be occupied by the **first storey** of a **single detached housing** unit.

25.5.7 Yards & Setbacks

1. The maximum **farm home plate setback** from the **front lot line** to the rear of the **farm home plate** is 75 m.

2. No portion of a **single detached housing building**, including any additional **dwelling units**, shall be located further than 50.0 m from a constructed public **road abutting** the property.

3. The minimum **yards** for **single detached housing**, including any additional **dwelling units** and all **accessory buildings** or **accessory structures** to the **single detached housing** are:

a) 6.0 m in the **front yard**;

b) 1.2 m on one **interior side yard** and 4.0 m on the other **interior side yard**;

c) 10.0 m in the **rear yard** for **single detached housing**, including any additional **dwelling units**.

4. All **accessory buildings** or **accessory structures** to the **single detached housing** shall have a minimum **building separation space** of 1.2 m.

5. The minimum **yards** for all **agricultural buildings and structures** for:

a) **front yard** and **exterior side yard** is:

i) 15.0 m for mushroom barns, livestock barns, poultry brooder houses, confined livestock areas, fur farming sheds, livestock shelters, milking facilities, stables and hatcheries; and

ii) 7.5 m for all other **agricultural buildings and structures**.

b) **interior side yard** and **rear yard** is:

i) 15.0 m for livestock barns, poultry brooder houses, confined livestock areas, fur farming shelters, livestock sheds, milking facilities, stables and hatcheries;

ii) 7.5 m for mushroom barns, apiculture hives, honey houses and shelters; and

iii) 4.5 m for all other **agricultural buildings and structures**.

25.5.8 Permitted Heights

1. The maximum **height** for **single detached housing**, including any additional **dwelling units**, is 2 **storeys**, together with an additional **storey** below the **flood plain construction** level not used for **habitable space**, but shall not exceed 9.5 m.

2. The maximum **height** for **accessory buildings** to the **single detached housing** and to any additional **dwelling units** is 5.0 m or 1 ½ **storeys**.

3. The maximum **height** for **accessory structures** to the **single detached housing** and to any additional **dwelling units** is 9.0 m.

4. The maximum **height** for **agricultural buildings and structures** is 35.0 m.

5. The maximum **height** for all other **accessory structures** is 20.0 m.

25.5.9 Subdivision Provisions/Minimum Lot Size

1. **Subdivision** of land in the **Agricultural Land Reserve** shall not be permitted unless approved by the Provincial Agricultural Land Commission. Where the approval of the Provincial Agricultural Land Commission is not required, the minimum **lot area** shall be 2.0 ha.

25.5.10 Landscaping & Screening

1. **Landscaping** and **screening** shall be provided according to the provisions of Section 6.0.

25.5.11 On-Site Parking and Loading

1. On-site **vehicle** parking shall be provided according to the standards set out in Section 7.0.

25.5.12 Other Regulations

1. A **home business** shall be limited to a maximum **floor area** of 100.0 m^2 and must be located and carried out wholly within the **dwelling unit** and not an **accessory building**.

2. All **accessory buildings** to the **single detached housing** shall:
   a) not contain a **kitchen** or any **habitable space**;
   b) be limited to one washroom with a maximum **floor area** of 10.0 m^2, which must not contain a bathtub and which must be located on the ground floor; and
   c) be designed and used for the storage and parking of **vehicles** on the ground floor, with pedestrian **access** to:
      i) the 1st **storey** being limited to one door which must be to and through the **vehicle** storage parking area; and
      ii) any ½ **storey** being limited to the inside of the **accessory building** from the **vehicle** storage and parking area only.

3. **Accessory buildings** that are not accessory to the **single detached housing** shall:
   a) be designed and used for agricultural purposes; and
   b) only be permitted on a property that is assessed as "farm" under the *BC Assessment Act*.

4. **Telecommunication antenna** shall not occupy more than 100.0 m^2 for equipment, **buildings** and installations for each **lot** if located in the **Agricultural Land Reserve**.

5. If a **minor community care facility** is located on the **Agricultural Land Reserve**, the facility shall be:
   a) limited to a maximum of 8 people; and
   b) subject to the provisions in the *Agricultural Land Commission Act*.

6. The following provisions shall apply where existing **single detached housing** is added to or expanded on, but do not apply to a legal **secondary suite** which must not exceed a total **floor area** of 90.0 m^2 or to an addition or expansion having a **lot coverage** of 35 m^2 or less:
   a) if the existing single detached housing has:

i) four exterior walls, one wall of the new addition or expansion must be permanently attached to the entire wall face of one of the four exterior walls of the existing **single detached housing**;

ii) more than four exterior walls, one wall of the new addition or expansion must be permanently attached to the wall face of one of the exterior walls of the existing **single detached housing** and that attachment must be either at least 7.62 m (25 ft.) wide or 10% of the total of all exterior walls of the existing **single detached housing**, whichever is greater;

b) the roof of the existing **single detached housing** must:

i) extend over the new addition or expansion so as to become one continuous roof with the same pitch, slope or design if the existing **single detached housing** and the new addition or expansion have the same number of floors (e.g., both are one **storey** or both are two **storeys**);

ii) have a similar style pitch, slope and design if the existing **single detached housing** and the new addition or expansion have a different number of floors (e.g., one is one **storey** and the other is two **storeys**);

c) the addition or expansion must:

i) not be attached by a breezeway, but be integrated with the existing **single detached housing** to form one **single detached housing** unit;

ii) be incidental and integrated with the existing **single detached housing** so as not to externally appear or be internally laid out to be a separate unit (e.g., should add to or expand an existing **kitchen**, create a common living/family/great room or have a hallway connection with no internal doors);

d) there must be only one door, whether an entrance door into the **dwelling** or a sliding door onto a deck or **patio**, to the **single detached housing** and the new addition or expansion facing the **road** on an **interior lot** and no additional doors facing the other **road** on a **corner lot** or a **double fronting lot**;

e) both the primary **kitchen** and any permitted secondary **kitchen** must be located in either the existing **single detached housing** or the new addition or expansion, but not in both;

f) there must be only one **garage** that is shared and used for both the **single detached housing** and the new addition or expansion; and

g) the building inspector may impose additional design limitations if the effect of a proposed addition or expansion would, in the opinion of the building inspector, either give the **single detached housing** an external appearance of being two units or have the capability of being separated into two units.

7. In addition to the regulations listed above, the General Development Regulations in Section 4.0 and the Specific Use Regulations in Section 5.0 apply.

2. The Zoning Map of the City of Richmond, which accompanies and forms part of Richmond Zoning Bylaw 8500, is amended by repealing the existing zoning designation of the following area and by designating it **"AGRICULTURE (ZA5) – River Road (Hamilton)".**

   P.I.D. 004-944-895
   Lot 13 Section 35 Block 5 North Range 4 West New Westminster District Plan 40165.

3. This Bylaw may be cited as **"Richmond Zoning Bylaw 8500, Amendment Bylaw 10017".**

FIRST READING _____

A PUBLIC HEARING WAS HELD ON _____

SECOND READING _____

THIRD READING _____

OTHER CONDITIONS SATISFIED _____

ADOPTED _____

CITY OF RICHMOND
APPROVED by
APPROVED by Director or Solicitor

_____ _____

MAYOR CORPORATE OFFICER

City of Richmond

Rezoning Considerations

Development Applications Department
6911 No. 3 Road, Richmond, BC V6Y 2C1

Address: 22260 River Road **File No.:** RZ 19-851176

Prior to Building Permit* Issuance, the developer must complete the following requirements:

1. Submission of revised Building Permit plans, which comply with the provisions of the Site Specific Agriculture Zone "Agriculture (ZA5) – River Road (Hamilton)" and all other applicable provisions of Zoning Bylaw 8500.
2. No disturbance of the Environmentally Sensitive Area (ESA) except landscape restoration under the guidance of a Qualified Environmental Professional (QEP) and in accordance with a City approved permit.
3. No alteration to the Riparian Management Area (RMA) except in accordance with a City approved permit.
4. Submission of a cash contribution, based on the City's cost estimate for the works, for the City to undertake the following works at development stage:

Water Works:

a. Using the OCP Model, there is 257 L/s of water available at a 20 psi residual at the River Road frontage. Based on your proposed development, your site requires a minimum fire flow of 95 L/s.
b. At Developer's cost, the Developer is required to:
   i) Submit Fire Underwriter Survey (FUS) or International Organization for Standardization (ISO) fire flow calculations to confirm development has adequate fire flow for onsite fire protection. Calculations must be signed and sealed by a Professional Engineer and be based on Building Permit Stage building designs.
c. At Developer's cost, the City will:
   i) Cut and cap the existing water service connection at main.
   ii) Install a new 25 mm water connection complete with meter and meter box.

Storm Sewer Works:

d. At Developer's cost, the Developer is required to:
   - Assess the condition of the existing privately owned culvert crossing and confirm whether repairs or replacement is necessary. All work to be in conformance with the Watercourse Protection and Crossing Bylaw 8441.
e. At Developer's cost, the City will:
   i) Confirm the capacity and condition of the existing storm connection. If the existing storm connection is adequate to be reused, it may be retained; if not, it shall be replaced by the City at the developer's cost.

Sanitary Sewer Works:

f. No connection to the City's sanitary sewer system is permitted to properties within the Agricultural Land Reserve. An On-site Sanitary Disposal System is required as per City of Richmond Policy 7401.
g. An On-site Sanitary Disposal System is required to be designed by a Professional Engineer at the developer's cost.

Frontage Improvements:

h. Through future dike upgrades, River Road is expected to be raised to elevation 5.0 m geodetic and relocated closer towards the subject site's property line. It is noted that relocation/reconfiguration of the subject site's driveway may be required in the future to manage the grade transition from elevation 5.0 m down to the proposed garage elevation at 1.3 m. It is recommended to consider at this time how the driveway grade will meet the future road elevation.
i. At Developer's cost, the Developer is required to:
   - Provide a 10 m-wide statutory right-of-way along the entire north property line of the site for the purpose of access, construction, and maintenance of future road, dike, and utility works by the City. The SRW shall prohibit any excavation or construction within the SRW and provide the City with unrestricted vehicular and man access to all sections of the SRW.
   - Coordinate with BC Hydro, Telus and other private communication service providers:

Initial: _____

  - When relocating/modifying any of the existing power poles and/or guy wires within the property frontages.
  - To determine if above ground structures are required and coordinate their locations onsite (e.g. Vista, PMT, LPT, Shaw cabinets, Telus Kiosks, etc).
- Complete other frontage improvements as per Transportation requirements.

j. Transportation requirements:
- Sole vehicular access to be from River Road. The width of the driveway should be max. 5.0m as per Bylaw 7222. Appropriate legal means (legal agreement or covenant on title) to restrict additional vehicular access to/from the site.
- Ensure on-site parking meets the Bylaw requirements.
- Transportation recommends that guardrails (or other equivalent physical measures) be provided along the edges of the driveway, between to property line to road edge. The purpose of the traffic measure is to protect vehicles from driving off road into the ditch and define the edge of the driveway.
- Prior to issuance of BP, provide a construction parking and traffic management plan to the Transportation Division (Ref: http://www.richmond.ca/services/ttp/special.htm)

General Items:

k. At Developer's cost, the Developer is required to:

i) Enter into, if required, additional legal agreements, as determined via the subject development's Servicing Agreement(s) and/or Development Permit(s), and/or Building Permit(s) to the satisfaction of the Director of Engineering, including, but not limited to, site investigation, testing, monitoring, site preparation, de-watering, drilling, underpinning, anchoring, shoring, piling, pre-loading, ground densification or other activities that may result in settlement, displacement, subsidence, damage or nuisance to City and private utility infrastructure.

Note:

* This requires a separate application.

- Where the Director of Development deems appropriate, the preceding agreements are to be drawn not only as personal covenants of the property owner but also as covenants pursuant to Section 219 of the Land Title Act.

  All agreements to be registered in the Land Title Office shall have priority over all such liens, charges and encumbrances as is considered advisable by the Director of Development. All agreements to be registered in the Land Title Office shall, unless the Director of Development determines otherwise, be fully registered in the Land Title Office prior to enactment of the appropriate bylaw.

  The preceding agreements shall provide security to the City including indemnities, warranties, equitable/rent charges, letters of credit and withholding permits, as deemed necessary or advisable by the Director of Development. All agreements shall be in a form and content satisfactory to the Director of Development.

- Additional legal agreements, as determined via the subject development's Servicing Agreement(s) and/or Development Permit(s), and/or Building Permit(s) to the satisfaction of the Director of Engineering may be required including, but not limited to, site investigation, testing, monitoring, site preparation, de-watering, drilling, underpinning, anchoring, shoring, piling, pre-loading, ground densification or other activities that may result in settlement, displacement, subsidence, damage or nuisance to City and private utility infrastructure.

- Applicants for all City Permits are required to comply at all times with the conditions of the Provincial *Wildlife Act* and Federal *Migratory Birds Convention Act*, which contain prohibitions on the removal or disturbance of both birds and their nests. Issuance of Municipal permits does not give an individual authority to contravene these legislations. The City of Richmond recommends that where significant trees or vegetation exists on site, the services of a Qualified Environmental Professional (QEP) be secured to perform a survey and ensure that development activities are in compliance with all relevant legislation.

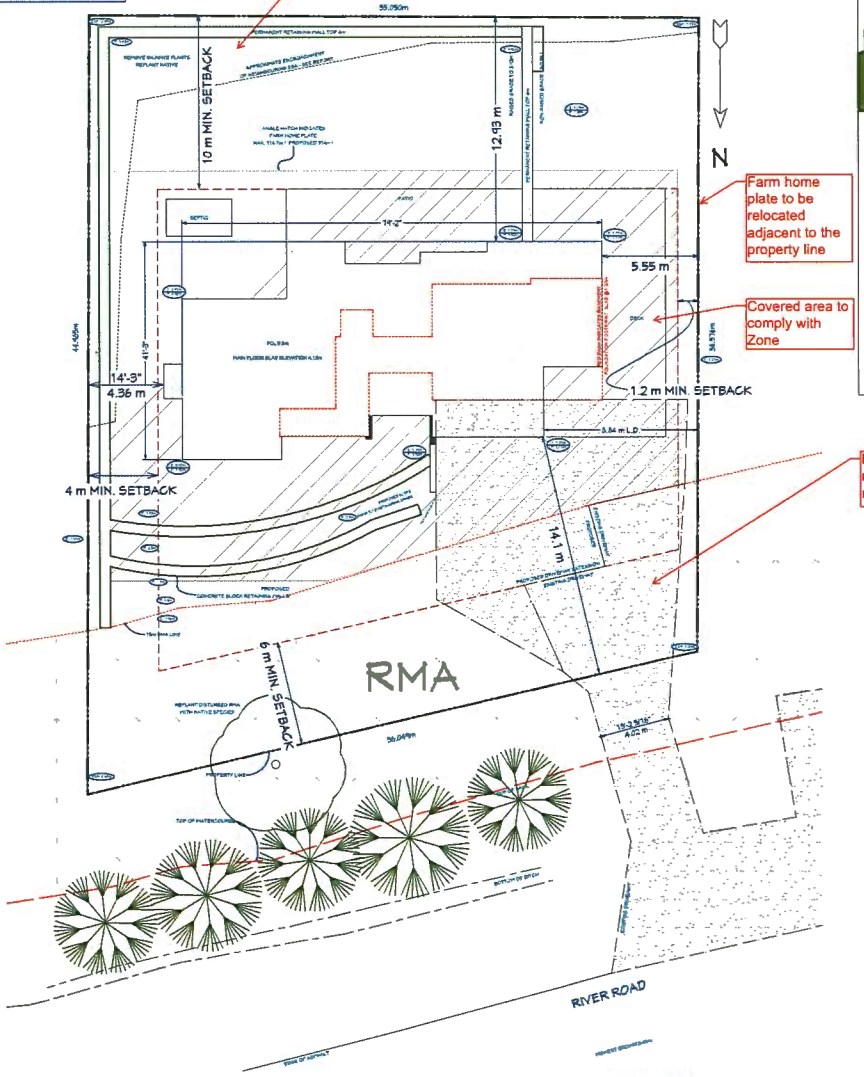
Signed _____ Date _____

ATTACHMENT 3

GRADING CALCULATIONS

LOT CORNERS	BLDG CORNERS
0.90m	3.92m
0.70m	3.92m
0.70m	1.20m
1.20m	1.20m
3.5m +	10.24m

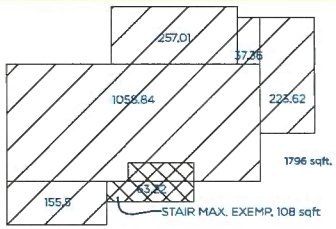
= 13.74m /8 = 1.72m AVERAGE



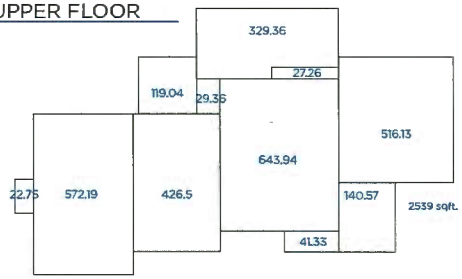
SITE PLAN
SCALE: 3/32" = 1'-0"





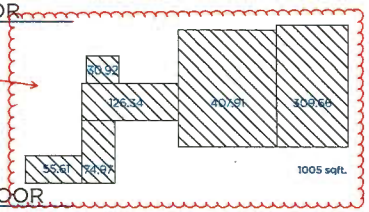


SCHEMATIC UPPER FLOOR
SCALE: 3/32" = 1'-0"



SCHEMATIC MAIN FLOOR
SCALE: 3/32" = 1'-0"

Floor area below flood construction level, not used for habitable space, is exempt



SCHEMATIC LOWER FLOOR
SCALE: 3/32" = 1'-0"

PROPERTY INFORMATION

CIVIC:
22260 RIVER ROAD, RICHMOND, BC

LEGAL:
LOT 13 SECTION 35 BLOCK 5 NORTH RANGE 4 WEST NEW WESTMINSTER DISTRICT, PLAN 40165

ZONE:
CITY OF RICHMOND AG-1

PROPERTY CALCULATIONS

LOT AREA:
1429.4m² / 15,386 sqft

PERMITTED FLOOR AREA:
AG-1 LESS THAN 0.2ha ALLOWS
MAX. 500m² (5,382 sqft)
INCL. ACCESSORY BLDGS

PROPOSED FLOOR AREA:

LOWER FLOOR	1005
MAIN FLOOR	2539
UPPER FLOOR	1796
COVERED OUTDOOR	329
TOTAL	5669 sqft

LESS ALLOWANCES:
COVERED (UP TO 10%) -329
STAIRS (UP TO 10m²) -108
TOTAL F.A.R. 5232 sqft PROPOSED

LOT COVERAGE:
n/a

FARM HOME PLATE:
50% OF LOT AREA FOR LOTS LESS THAN 0.2ha
1429.4m² x 50% = 714.7m²
PROPOSED: 714m²

MAXIMUM BUILDING HEIGHT:
MAX. 9.0 m
PROPOSED: 9.0 m

GENERAL NOTES
ALL NOTES CONTAINED ON ALL PAGES OF THIS PLAN APPLY TO ALL OTHER PAGES

THESE PLANS CONFORM TO BC BUILDING CODE 2018 (LATEST EDITION)

RIPARIAN MANAGEMENT AREA (RMA)
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REVISION TABLE		
LABEL	DATE	DESCRIPTION
REV-00	2018-12-13	ISSUED FOR BP APPL.

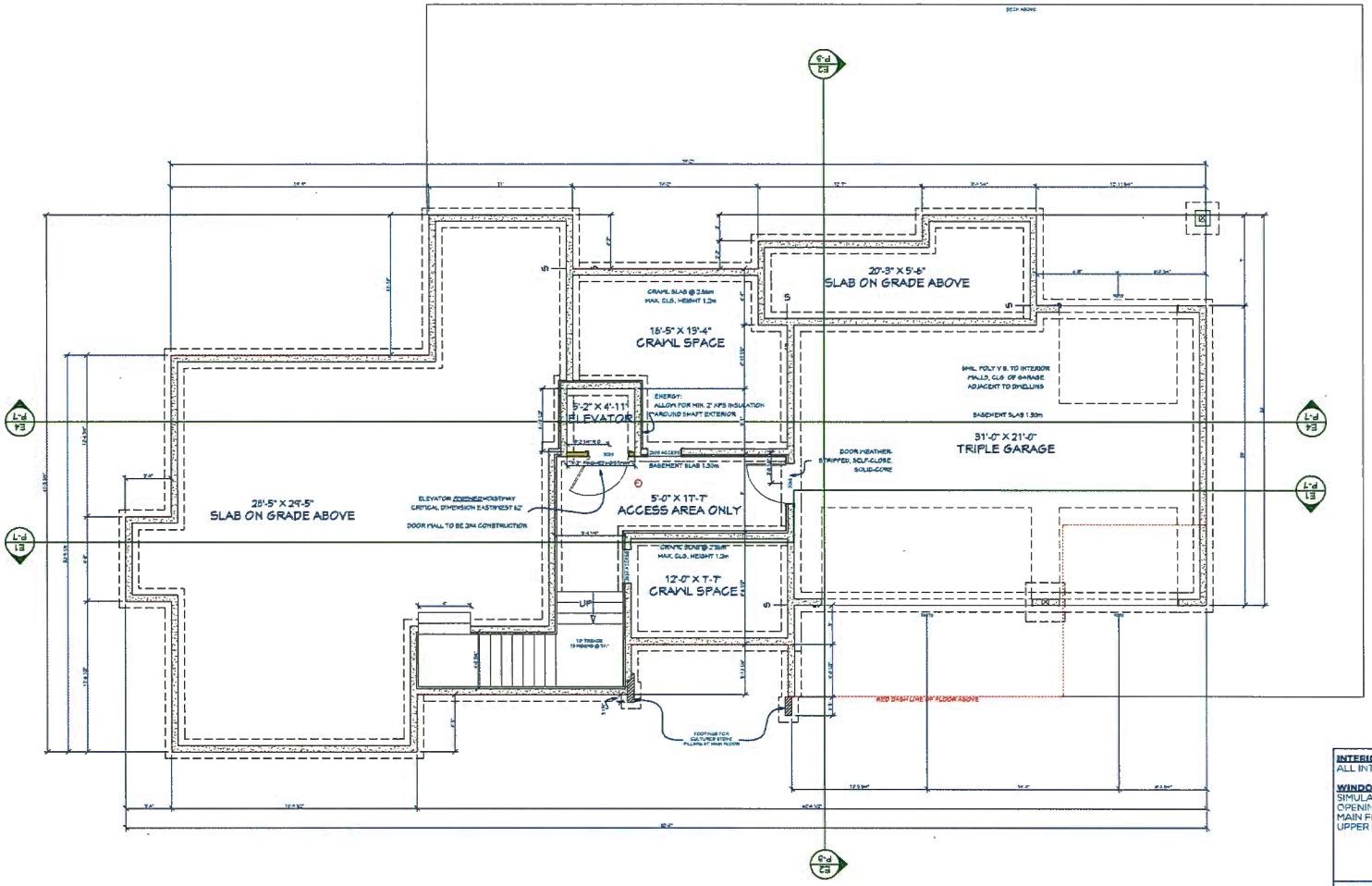
Project: Kalani Custom Residence
22260 River Road, Richmond

Site Plan

CNCL - 519

DESIGN & PROVIDED BY: H. WHITEHEAD
VERITÉ DESIGN GROUP INC.

DATE: 2018-12-13
SCALE:
SHEET: P-1



Floor area below flood construction level, not used for habitable space, is exempt

INTERIOR DOORS
ALL INTERIOR DOORS TO BE 6'-8"H U.N.O.

WINDOWS
SIMULATED DIVIDED LITES AS SHOWN
OPENINGS/OPERATION AS SHOWN
MAIN FLOOR LINTELS 107" U.N.O.
UPPER FLOOR LINTELS 95" U.N.O.

DIMENSIONS
ROOM LABEL DIMENSIONS INDICATE FINISHED SURFACES-,
INTERIOR DIMENSIONS TO STUD CENTRES,
EXTERIOR DIMENSIONS TO FACE OF EXT. WALL SHEATHING

BASEMENT FLOOR PLAN
SCALE: ¼" = 1'-0"

REVISION TABLE

LABEL	DATE	DESCRIPTION
REV-00	2018-12-13	ISSUED FOR BP APPL.

Kalani Custom Residence
12260 River Road, Richmond

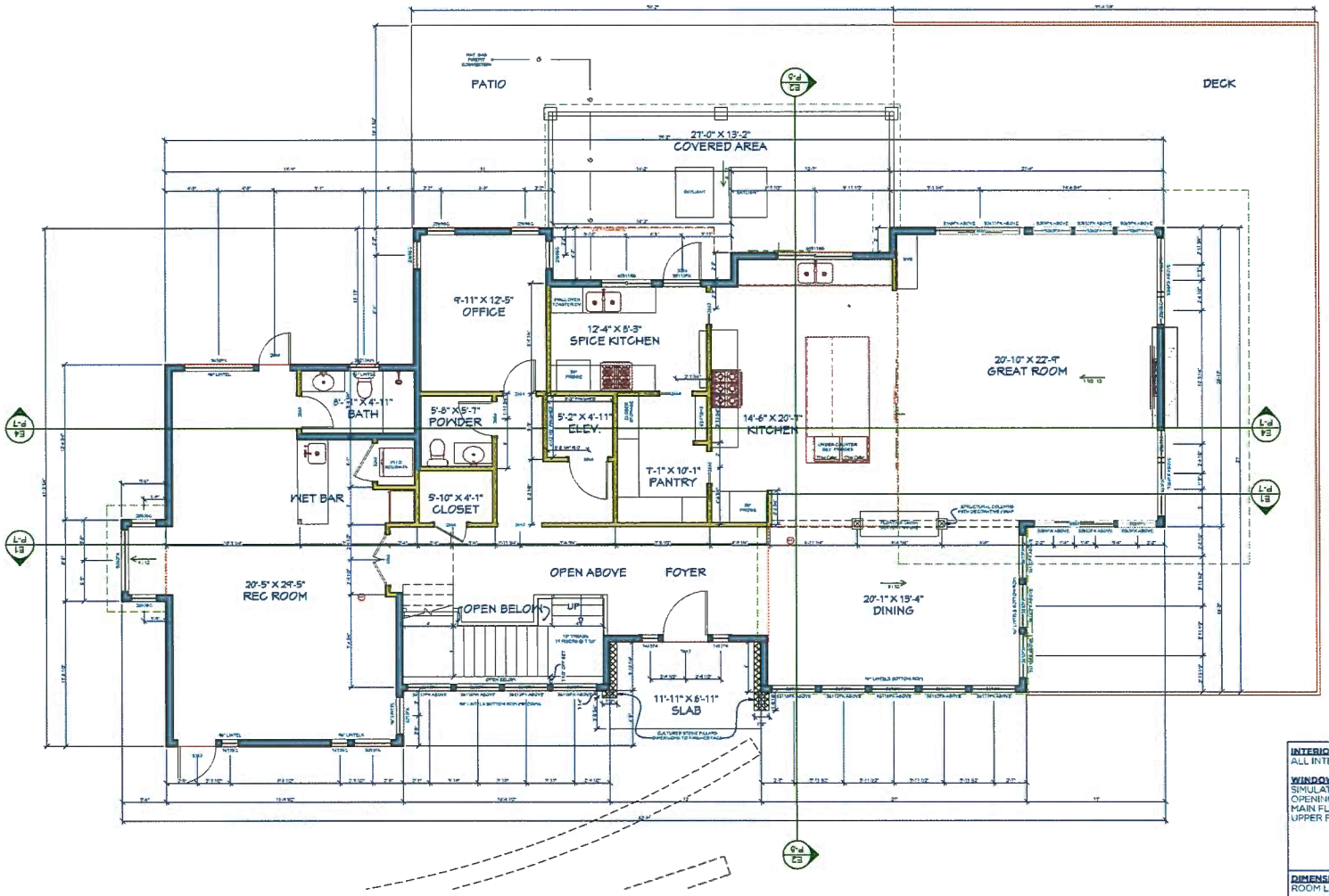
FCNGL - 520
Foundation

DESIGN & PROVIDED BY: H. WHITEHEAD
VERITÉ
VERITÉ DESIGN GROUP INC.

DATE: 2018-12-13

SCALE:

SHEET: P-4



MAIN FLOOR PLAN
SCALE: ¼" = 1'-0"

TRUSS ROOF
MAIN FLOOR 10 FT. CEILINGS, WITH TRUSS VAULTS

UPPER FLOOR 10 FT TRUSS CLG WITH VAULTS & 12" FURRING DOWN TO 9 FT.

OVERHANGS FROM SHEATHING TO OUTSIDE OF FASCIA

INTERIOR DOORS
ALL INTERIOR DOORS TO BE 6'-8"H U.N.O.

WINDOWS
SIMULATED DIVIDED LITES AS SHOWN
OPENINGS/OPERATION AS SHOWN
MAIN FLOOR LINTELS 107" U.N.O.
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INTERIOR DIMENSIONS TO STUD CENTRES.

EXTERIOR DIMENSIONS TO FACE OF EXT. WALL SHEATHING

REVISION TABLE

LABEL	DATE	DESCRIPTION
REV-001	2018-12-13	ISSUED FOR BP APPL.

Kalani Custom Residence
2200 River Road, Richmond

Floor Plan - 521

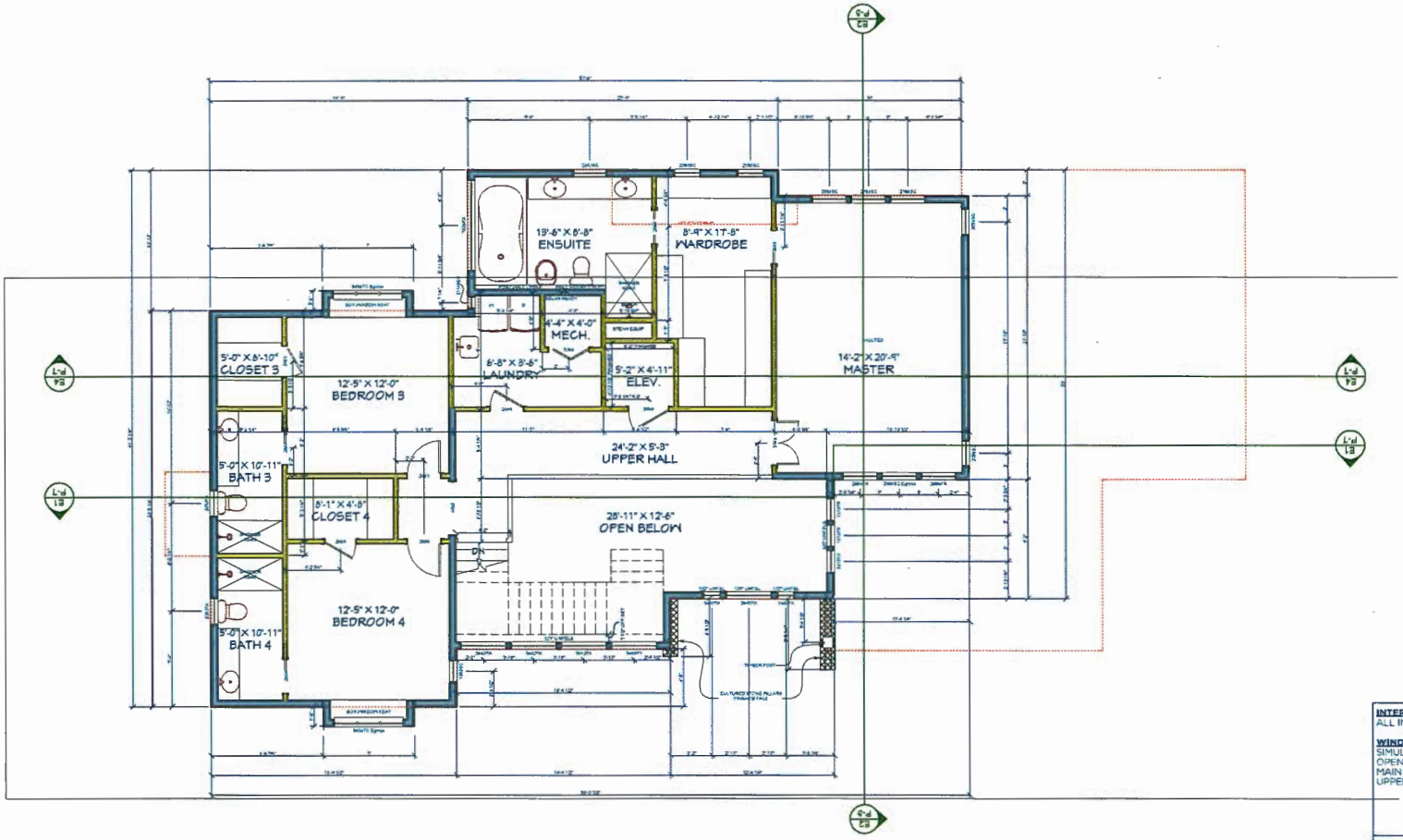
DESIGN & PROVIDED BY: H. WHITEHEAD
VERITÉ
VERITE DESIGN GROUP INC.

DATE: 2018-12-13

SCALE:

SHEET: P-5

GNCL



UPPER FLOOR PLAN
SCALE: 1/4" = 1'-0"

TRUSS ROOF
MAIN FLOOR 10 FT. CEILINGS, WITH TRUSS VAULTS

UPPER FLOOR 10 FT TRUSS CLG WITH VAULTS & 12" FURRING DOWN TO 9 FT.

OVERHANGS FROM SHEATHING TO OUTSIDE OF FASCIA

INTERIOR DOORS
ALL INTERIOR DOORS TO BE 6'-8"H U.N.O.

WINDOWS
SIMULATED DIVIDED LITES AS SHOWN
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DIMENSIONS
ROOM LABEL DIMENSIONS INDICATE FINISHED SURFACES-.

INTERIOR DIMENSIONS TO STUD CENTRES.

EXTERIOR DIMENSIONS TO FACE OF EXT. WALL SHEATHING

DESCRIPTION TABLE		
LABEL	DATE	DESCRIPTION
REV-001	2018-12-13	ISSUED FOR BP APPL.

Kalani Custom Residence
2260 River Road, Richmond
Floor Plans
Roof Plan

CNCL - 522

DESIGN is PROVIDED BY: H. WHITEHEAD
VERITÉ
VERITÉ DESIGN GROUP INC.

DATE: 2018-12-13

SCALE:

SHEET: P-6

City of Richmond

Report to Committee

To:	Planning Committee	**Date:**	March 12, 2019
From:	Barry Konkin Manager, Policy Planning	**File:**	RZ 19-851176
Re:	**Application by Clive Alladin for Rezoning at 22260 River Road from "Agriculture (AG1)" to a Site Specific Agriculture Zone to Permit a Larger House Size**		

Staff Recommendation

That the application for the rezoning of 22260 River Road from "Agriculture (AG1)" to a Site Specific Agriculture Zone, to permit a house up to 500 m^2 in floor area, be denied.

Barry Konkin
Manager, Policy Planning

BK:sds
Att. 8

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Development Applications	☑	

Staff Report

Origin

Clive Alladin has applied to the City of Richmond for permission to rezone the property at 22260 River Road from the "Agriculture (AG1)" zone to a Site Specific Agriculture Zone, in order to permit a single-family dwelling up to a maximum floor area of 500 m^2 (5,382 ft^2). The maximum floor area permitted in the existing "Agriculture (AG1)" zone for a single-family dwelling (and all accessory buildings or structures) is 400 m^2 (4,306 ft^2). The subject property is approximately 0.35 acres (0.14 hectares) in area and is located within the Agricultural Land Reserve (ALR). A location map and aerial photograph are provided in Attachment 1.

The subject site is currently vacant, but was previously occupied by a single-family dwelling, which was demolished in 2018 (D7 18-829634). A Building Permit (B7 18-843161) was submitted on December 14, 2018 for a new single-family dwelling of approximately 486 m^2 (5,232 ft^2) in total floor area. The Building Permit was submitted during the Council endorsed withholding period for Building Permits that conflicted with the bylaw amendments under preparation and consideration by Council, which included reducing the maximum floor area permitted in the "Agriculture (AG1)" zone to 400 m^2 (4,306 ft^2). The amendments to the AG1 zone were adopted by Council on December 17, 2018, and the Building Permit was subsequently cancelled as it did not comply with the new regulations (maximum house size of 400 m^2). The applicant does not wish to redesign the single-family dwelling to comply with the new maximum floor area and has submitted the subject rezoning application in order to permit a single-family dwelling up to a maximum floor area of 500 m^2 (5,382 ft^2). The proposed Site Plan for the house is provided in Attachment 2.

Findings of Fact

A Development Application Data Sheet providing details about the development proposal is attached (Attachment 3).

Surrounding Development

To the North:	Across River Road, the Fraser River.
To the South & East:	Agricultural uses on an approximately 8 acre lot zoned "Agriculture (AG1)" fronting River Road, located within the ALR.
To the West:	Single-family dwellings and agricultural uses on lots zoned "Agriculture (AG1)" fronting River Road, located within the ALR.

Related Policies & Studies

Official Community Plan/Hamilton Area Plan

The Official Community Plan (OCP) land use designation for the subject site is "Agriculture (AGR)". The Hamilton Area Plan land use designation for the subject site is "Agriculture" (Attachment 4). The "Agriculture" designation comprises of those areas of the City where the

principal use is agriculture and food production, but may include other land uses as permitted under the Agricultural Land Commission Act (ALCA).

The OCP includes policies on residential development in the ALR, including limiting the area used for residential development on properties in the ALR. As per Section 7.0 of the OCP (p. 7-4) (Attachment 5), the following policies are provided as guidelines which may be applied by Council, in a flexible manner, individual or together, to increase house size in the City's agricultural areas:

- the need to accommodate a variety of a cultural and inter-generational family needs and farm situations;
- verification that the site has been or can be used for agricultural production;
- verification that the applicant has been farming in Richmond or elsewhere, for a significant period of time, or if they are a new farmer, they can demonstrate that they are, or will be, capable of farming;
- demonstration that there is a need for a larger farm house, to accommodate existing and/or anticipated workers on the site, through the submission of a detailed report from a Professional Agrologist indicating such, or through other information;
- submission of a farm plan which is acceptable to Council that may include justifying any proposed on-site infrastructure, or farm improvements including providing financial security to ensure that the approved farm plan is implemented.

The applicant has advised staff that they do not intend to actively farm the subject property and no verification or demonstration of farming has been provided. The applicant's stated reason for the proposed rezoning is the timing of the withholding period and cancellation of the previous Building Permit. The applicant's statement of intent is provided in Attachment 6. Therefore, the above-noted guidelines cannot be applied in this context and the proposal is not consistent with OCP policies.

Public Consultation

A rezoning sign has been installed on the subject property. Staff have not received any comments from the public about the rezoning application in response to the placement of the rezoning sign on the property.

Correspondence has been received from the neighbouring property at 22160 River Road indicating support of the proposal (Attachment 7).

Analysis

Proposed Rezoning Application

On December 17, 2018, Council adopted amendments to the "Agriculture (AG1)" zone to limit residential development on agriculturally zoned lands, including:

- a maximum house size of 400 m^2 (4,306 ft^2);

- a maximum two storey building height;
- a maximum house footprint of 60% of the total floor area;
- a maximum farm home plate of 1,000 m^2 (10,764 ft^2); and
- requiring the septic field to be located within the farm home plate.

Prior to adoption, there was a withholding period of building permits that conflicted with the bylaws in preparation and consideration by Council, from November 13, 2018 to December 17, 2018. The associated Building Permit for the subject property was submitted during the withholding period and subsequently cancelled after the withholding period ended, as it did not comply with the new regulations. A timeline of applicable events is provided in Attachment 8.

The proposal is not consistent with the 400 m^2 (4,306 ft^2) maximum floor area requirements of the "Agriculture (AG1)" zone. The Development Application Data Sheet in Attachment 3 provides details about the development proposal in comparison to the current requirements of the AG1 zone.

On November 27, 2018, Bill 52 (*Agricultural Land Commission Amendment Act, 2018*) was given third reading and royal assent. This legislation establishes a maximum single-family dwelling size of 500 m^2 (5,382 ft^2) in total floor area for land located within the Agricultural Land Reserve (ALR). On February 22, 2019, the new ALR Regulation changes brought the changes as per Bill 52 into force and effect. Although the subject property is located in the ALR, the proposal is within the Provincial limit and thus not required to submit a non-farm use application to the Agricultural Land Commission (ALC).

Conclusion

Clive Alladin has applied to the City of Richmond for permission to rezone the property at 22260 River Road from the "Agriculture (AG1)" zone to a Site Specific Agriculture Zone, in order to permit a single-family dwelling up to a maximum floor area of 500 m^2 (5,382 ft^2).

The application is not consistent with the current AG1 zone and does not comply with applicable policies contained within the OCP and Area Plan for construction of a single-family dwelling larger than 400 m^2 (4,306 ft^2) on the subject site.

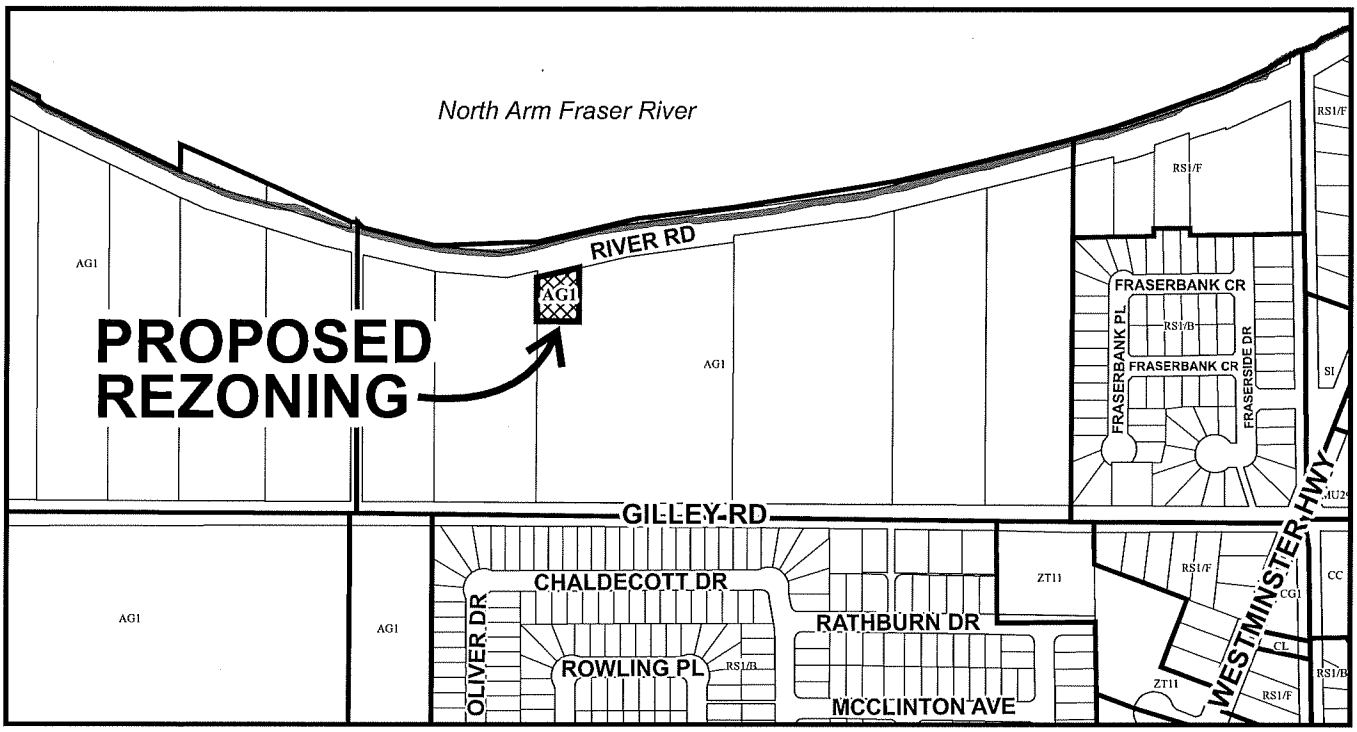
On this basis, it is recommended that the application be denied.

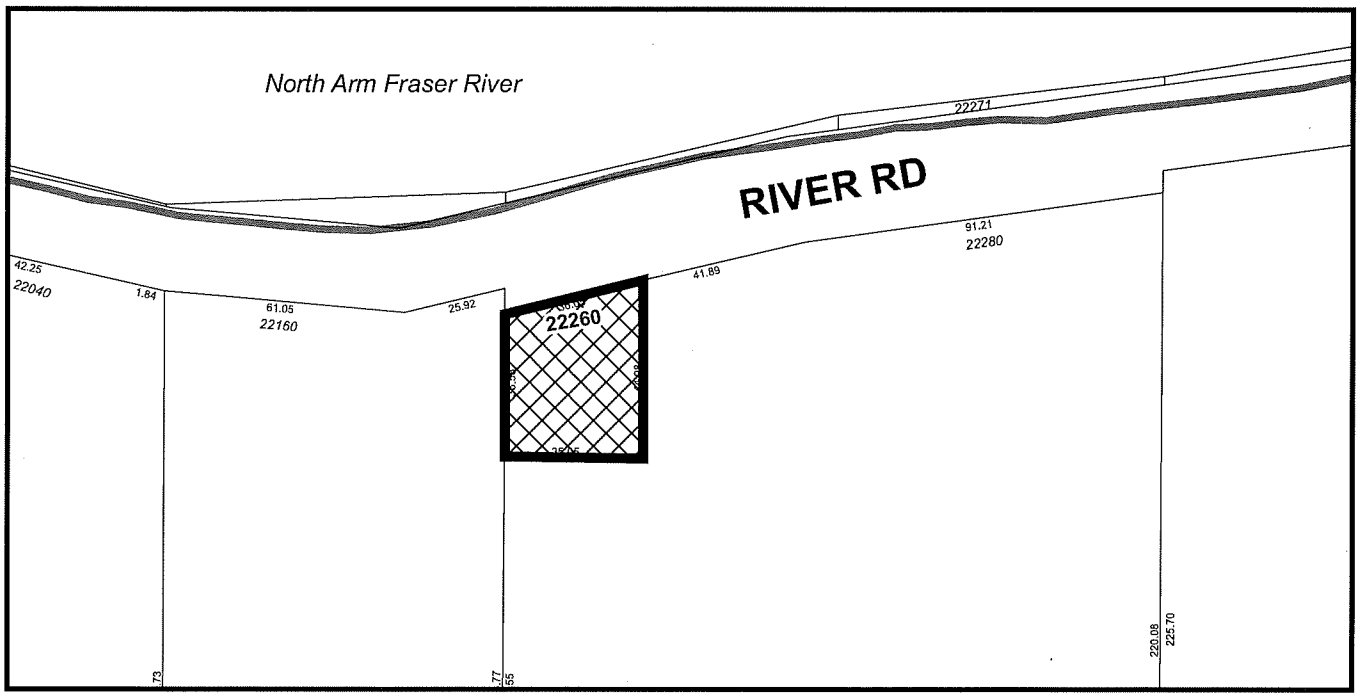
Steven De Sousa
Planner 1

SDS:cas

Attachment 1: Location Map and Aerial Photo
Attachment 2: Conceptual Development Plans
Attachment 3: Development Application Data Sheet
Attachment 4: Hamilton Area Plan Land Use Map
Attachment 5: Official Community Plan Section 7-4
Attachment 6: Statement of Intent
Attachment 7: Correspondence
Attachment 8: Timeline of Events

City of Richmond





RZ 19-851176

Original Date: 01/30/19

Revision Date:

Note: Dimensions are in METRES

City of
Richmond



RZ 19-851176

Original Date: 01/30/19

Revision Date:

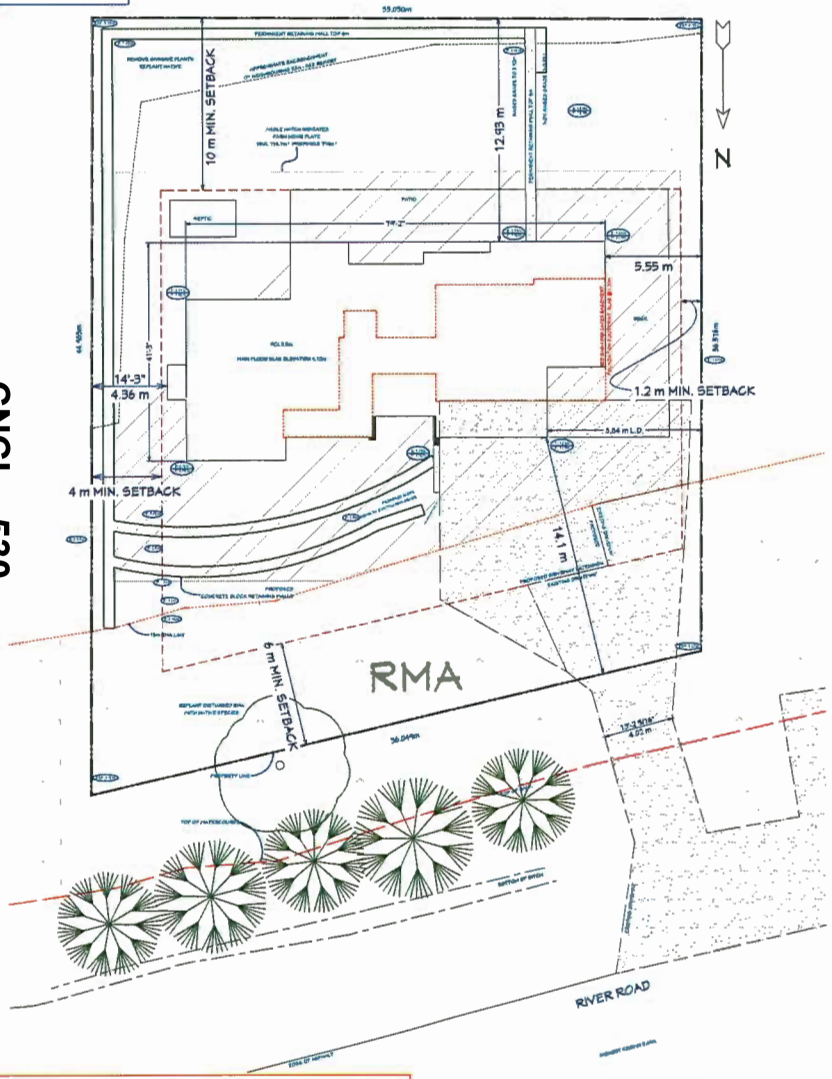
Note: Dimensions are in METRES

CNCL - 530

GRADING CALCULATIONS

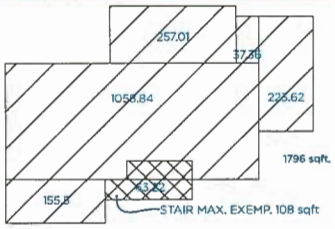
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PRELIMINARY

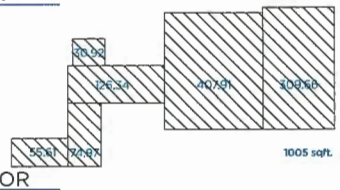




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CITY OF RICHMOND AG-1

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REVISION TABLE

LABEL	DATE	DESCRIPTION
REV-00	2018-12-13	ISSUED FOR BP APPL

Kabani Custom Residence
22260 River Road, Richmond

Project Overview & Site Plan

DESIGN & PROVIDED BY: H. WHITEHEAD
VERITÉ
VERITE DESIGN GROUP INC.

DATE: 2018-12-13

SCALE:

SHEET: P-1

ATTACHMENT 2

City of Richmond

Development Application Data Sheet

Development Applications Department

RZ 19-851176 **Attachment 3**

Address: 22260 River Road

Applicant: Clive Alladin

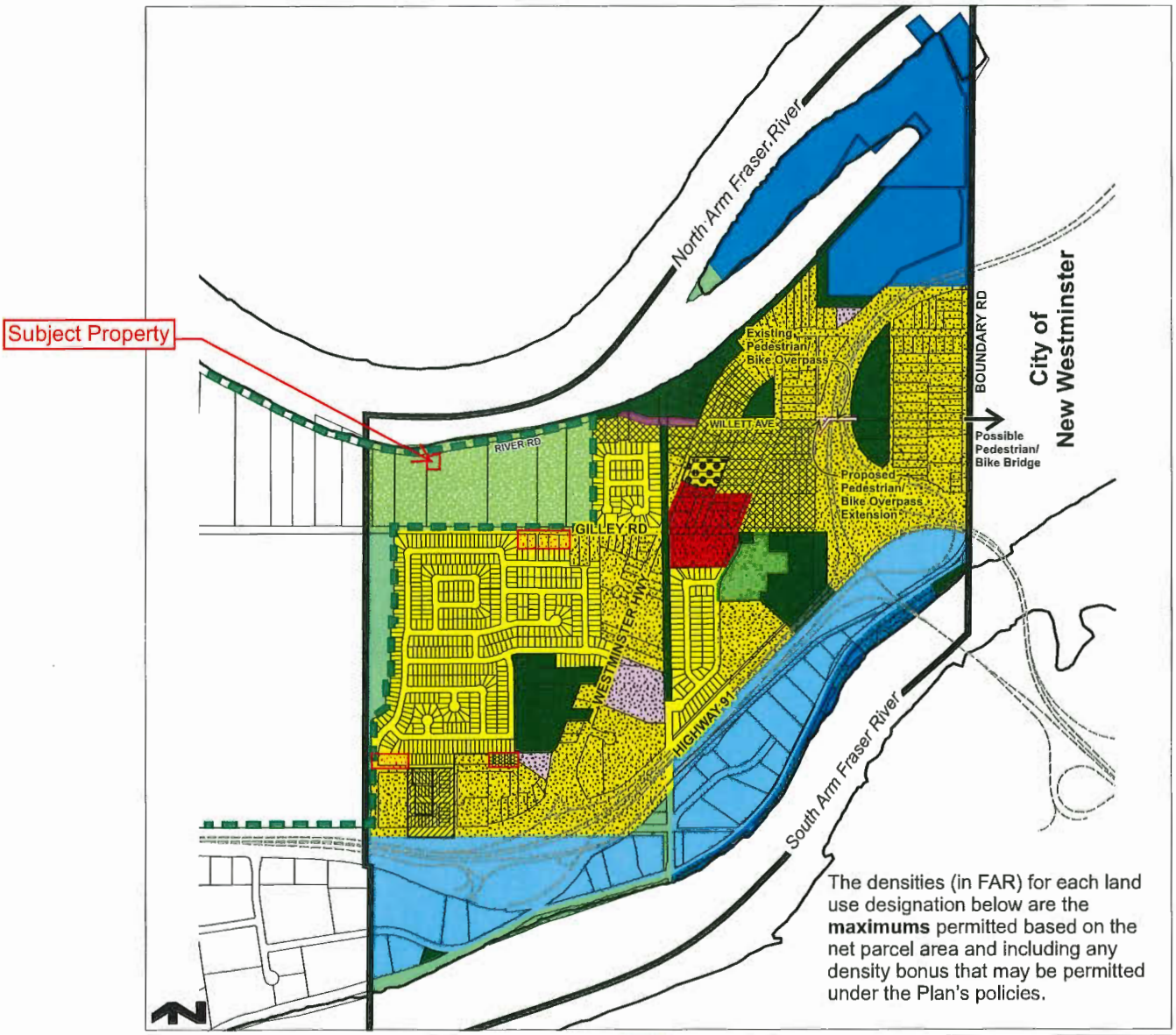
Planning Area(s): Hamilton

	Existing	Proposed
Owner:	N. & M. Kabani	No change
Site Size:	1,429 m^2 / 0.35 ac / 0.14 ha	No change
Land Uses:	Single-family residential	No change
OCP Designation:	Agriculture (AGR)	No change
Area Plan Designation:	Agriculture	No change
Zoning:	Agriculture (AG1)	Site Specific Agriculture Zone to permit a larger house size

	Bylaw Requirement (AG1)	Proposed	Variance
Buildable Floor Area:	Max. 400 m^2 (4,306 ft^2)	486 m^2 (5,232 ft^2)	**Rezoning Requested**
Farm Home Plate:	Max. 50% of the lot area for lots less than 0.2 ha	Max. 50% of the lot area	None
House Footprint:	Max. 60% of the maximum floor area ratio	60%	None
Setback – Farm Home Plate:	Max. 75 m	Complies	None
Setback – Single Detached Housing Building:	Max. 50 m	Complies	None
Setback – Front:	Min. 6.0 m	14.1 m	None
Setback – Interior Side:	Min. 1.2 m	1.2 m	None
Setback – Other Side:	Min. 4.0 m	4.3 m	None
Setback – Rear:	Min. 10.0 m	12.9 m	None
Height:	Max. 2 storeys (9.0 m)	Max. 2 storeys (9.0 m)	None

Land Use Map

Bylaw 9260
2017/06/12





Bylaw 9706 2017/05/17

Residential Development

f) limit the area used for residential development on properties in the Agricultural Land Reserve. The following policies are to be regarded as guidelines which may be applied by Council, in a flexible manner, individually or together, on a case-by-case basis, when considering rezoning applications, to increase house size in the City's agricultural areas:

- the need to accommodate a variety of a cultural and inter-generational family needs and farm situations;
- verification that the site has been or can be used for agricultural production;
- verification that the applicant has been farming in Richmond or elsewhere, for a significant period of time, or if they are a new farmer, they can demonstrate that they are, or will be, capable of farming;
- demonstration that there is a need for a larger farm house, to accommodate existing and / or anticipated workers on the site, through the submission of a detailed report from a Professional Agrologist indicating such, or through other information;
- submission of a farm plan which is acceptable to Council that may include justifying any proposed on-site infrastructure, or farm improvements including providing financial security to ensure that the approved farm plan is implemented;

Bylaw 9869 2018/06/18

g) limit the number of principal dwelling units to one (1) on agriculturally zoned properties, and only permit one (1) additional dwelling unit provided the property is 8 ha (20 ac.) in area or greater, the property is classified as a farm under the BC *Assessment Act*, and if the owner provides a statutory declaration that the additional dwelling unit is for full-time farm workers only, and submits a report from a Professional Agrologist which demonstrates that:

- full-time farm labour is required to live on the farm;
- the secondary farmhouse is subordinate to the principal farm dwelling unit.

Any proposals for more than one (1) additional dwelling unit on agriculturally zoned land would be considered through a rezoning application and would be reviewed on a case-by-case basis.

March 12, 2019

City of Richmond

Re: Application for site specific rezoning 22260 River Road

I am applying to the City of Richmond to rezone this property in order to build a new wheelchair accessible house in order to accommodate my multigenerational family. We are 30 year residents of Richmond and love the city.

I have a family of four and wanted to move my mother in law (who is in her 70's and a widow) as we would like to look after her in her glory years. My wife is an only child so there is no one else to look after her. I also wanted to move in my wife's grandmother, who currently resides at Minoru residence as she is wheelchair bound from a car accident a few years ago. This would free up a much needed space at Minoru residence if we can accommodate her in our new home.

I purchased this property in the spring of 2018 and before closing this transaction had put in subjects that I consult the city to see if I could in fact build a new house of this size on this property.

Clive Alladin and his team from Balandra Development consulted with the city extensively and the city had given guidance that it would be possible to build this house providing we meet a number of conditions as this property has significant RMA and ESA area's that make up more than 50% of the property.

We went through all the conditions the city had laid out and hired multiple professionals ect.. to perform the necessary surveys, reports, and permits ect...

This process was very time consuming and we did all as per the city's request.

In Nov 2018 the bylaw reducing home size on ALR property was passed to 400 m2, our proposed house is just over that size. Th house size is 4600 sq ft plus the wheelchair accessible garage of 700 sq ft.

The reason this house is slightly larger is because it is completely wheelchair accessible and has an elevator servicing all floors including from the garage.

We were significantly far along in our process and feel we did everything by the book and now after spending tens of thousands of dollars our application was rejected just by a few weeks. We now cannot afford to spend thousands more to redesign and start all over again.

More than 50% of our property cannot be farmed or built on due to the RMA and ESA issues, which basically leaves us with a 7500 sq ft building lot... this property has been a single family residence since the 1950's. There will be no negative effect on farming in Richmond by this development but will free up 3 homes for affordable rental and unite my family.

Your consideration in this application is very much appreciated.

Naizer and Mubina Kabani

De Sousa,Steven

From: MayorandCouncillors
Sent: Thursday, 28 February 2019 09:19
To: Craig,Wayne; De Sousa,Steven
Cc: Powell, Jo Anne
Subject: FW: Site Specific Rezoning Application - 22260 River Road

Follow Up Flag: Follow up
Flag Status: Flagged

-----Original Message-----
From: MayorandCouncillors
Sent: Thursday, 28 February 2019 09:19
To: 'Trudy Haywood'
Subject: RE: Site Specific Rezoning Application - 22260 River Road

Hello,

This is to acknowledge and thank you for your email. Please be advised that copies of your email have been forwarded to the Mayor and each Councillor. In addition, your email has been forwarded to Wayne Craig, Director, Development.

Thank you again for taking the time to share your views with Richmond City Council.

Hanieh Berg | Legislative Services Coordinator City Clerk's Office | City of Richmond
6911 No. 3 Road, Richmond, BC V6Y 2C1

-----Original Message-----
From: Trudy Haywood [mailto:haywoods@shaw.ca]
Sent: Wednesday, 27 February 2019 08:31
To: MayorandCouncillors
Subject: Site Specific Rezoning Application - 22260 River Road

> To Mayor Brodie and Councillors,
>
> We understand that our new neighbours, Mubina and Nick Kabani have applied to the city for a site specific rezoning of the property they bought at 22260 River Road in order to build a 4600 square foot house plus a 700 square foot garage (5300 square feet in total).
>
> As neighbours on their west side we do not have a problem with them building a house of that size. .
>
> We realize that a bylaw was passed in December of 2018 limiting the size of a new home in the ALR to 4305 square feet. We believe the Kabani's had their house plans drawn up at considerable expense long before this bylaw was

passed. Because the land had to be filled up to the flood plain which takes a considerable amount of time we believe they didn't see the need to hurry to get approval of their house plan.
>
> We have for the past 40 years had a neighbour on our east side and we look forward to when the Kabani's home is finished to once again have a neighbour close by.
>
> Sincerely,
>
> Trudy & Dave Haywood,
> 22160 River Road,
> Richmond V6V 1M4

Timeline of Events

Date	Event
November 6, 2018 (Special Council)	• Council directed staff to prepare a bylaw that limits residential development in the "Agriculture (AG1)" zone, which included a maximum house size of 500 m^2. • Council resolution included a withholding period for all Building Permit applications in conflict with the proposed bylaws in preparation, received more than 7 days after the passage of the resolution.
November 13, 2018 (Regular Council)	• The proposed bylaws to limit residential development in the AG1 zone (Bylaw 9965, 9966, 9967 & 9968) were introduced for Council's consideration. • The proposed bylaws were amended by Council to limit house size on agricultural land to a maximum floor area of 400 m^2. • The proposed bylaws received first reading and were forwarded to the following Public Hearing (December 17, 2018).
November 13, 2018 (Withholding period begins)	• Withholding period begins for all Building Permit applications in conflict with the proposed bylaws noted above, which included a maximum house size of 400 m^2.
November 27, 2018	• Bill 52 (*Agricultural Land Commission Amendment Act*, 2018) was given third reading and royal assent, which included a maximum house size of 500 m^2.
December 14, 2018	• Submission of associated Building Permit for the subject property for a single-family dwelling of 486 m^2 (B7 18-843161).
December 17, 2018 (Public Hearing)	• Council adopted the bylaws limiting residential development in the AG1 zone (Bylaw 9965, 9966, 9967 & 9968), which included a maximum house size of 400 m^2.
December 17, 2018 (Withholding period ends)	• Withholding period for all Building Permit applications in conflict with the proposed bylaws ends. • Building Permits submitted during the withholding period were cancelled (did not comply with the new regulations). • All Building Permit applications must now comply with the adopted changes to the AG1 zone.
January 21, 2019	• Subject Rezoning application (RZ 19-851176) submitted in order to permit a larger house size than permitted in the AG1 zone, as per the previous Building Permit submitted.
February 22, 2019	• Agricultural Land Reserve (ALR) Regulation amended to reflect the changes as per Bill 52, including a maximum house size of 500 m^2 for properties located in the ALR.

City of Richmond

Report to Council

To:	Richmond City Council	**Date:**	March 19, 2019
From:	Lloyd Bie, P.Eng. Director, Transportation	**File:**	10-6350-05-08/2019-Vol 01
Re:	**George Massey Crossing – Preliminary Principles, Goals and Objectives**		

Staff Recommendation

That a letter be sent to the Minister of Transportation and Infrastructure requesting that their work on the George Massey Crossing project include:

(i) the incorporation of the comments as detailed in the staff report titled "George Massey Crossing – Preliminary Principles, Goals and Objectives" dated March 19, 2019 from the Director, Transportation;

(ii) request to Ministry staff to work with Richmond staff in any work to define the scope of the project and develop potential crossing options including potential interim solutions, and

(iii) request to Ministry staff to work with Richmond staff in any work to define the scope of the short-term improvements at the Steveston Highway interchange.

Lloyd Bie, P.Eng.
Director, Transportation
(604-276-4131)
Att. 1

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Economic Development	☑	
Engineering	☑	
Fire-Rescue	☑	
Intergovernmental Relations & Protocol Unit	☑	
Parks Services	☑	
Policy Planning	☑	
Sustainability	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

At the March 18, 2019 General Purposes Committee, representatives from the Ministry of Transportation and Infrastructure delegated to:

(i) provide an update on the George Massey Crossing Project,

(ii) request Council's input in developing goals and objectives, and

(iii) seek authorization to work with Richmond staff to develop potential crossing options including potential interim solutions.

The following referral motion was then carried:

That the Ministry of Transportation and Infrastructure's presentation on the George Massey Crossing project be referred to staff for comment and to report back as soon as possible in an effort to meet the Ministry's deadline for input of April 1, 2019.

This report responds to that referral.

Analysis

Ministry's Presentation to General Purposes Committee

The Ministry delegation indicated that the work on the George Massey Crossing project will better align with regional plans than the previous 10-lane bridge and three-level Steveston Highway interchange concept and that the Ministry will engage with and consider the preferences of the local and regional governments including the City of Richmond, stakeholders and the general public. In addition, there will be continued progress in addressing the immediate improvements to address safety at the existing tunnel and approaches and interim improvements at the Steveston Highway interchange. A copy of the delegation's slide presentation is included in this report as Attachment 1.

The delegation noted their understanding of the City's interests which include:

- Minimize impacts to agriculture, local traffic and the Fraser River,
- Increase transit and limit increased single-occupant vehicle (SOV) travel,
- Traffic demand measures including limiting truck traffic at peak hours,
- Consider road network impacts (e.g. Oak Street), and
- Interim improvements to address congestion at the Steveston Highway Interchange.

The preliminary principles identified by the Ministry for the George Massey Crossing project are:

- Alignment with regional plans,
- Safety,
- Reliability, and
- Connectivity.

The preliminary goals identified by the Ministry for the George Massey Crossing project are:

1. Support sustainability of South of Fraser Communities,
2. Facilitate increased share of sustainable modes of transport,
3. Enhance regional goods movement and commerce, and
4. Support a healthy environment.

The delegation asked that any further input from the City be provided by April 1, 2019.

General Purposes Committee Comments

Key issues raised by General Purposes Committee members at the March 18, 2019 meeting include:

- **Crossing Options**: That only tunnel options be considered.
- **Rapid Transit**: That all crossing solutions include rapid transit.
- **BC Hydro Infrastructure**: That the transmission lines remain underground and not replaced with an overhead crossing.
- **Truck Traffic Utilizing the Crossing**: The Province should mandate that trucks be restricted during peak periods.
- **Blundell Interchange**: That the City be consulted should a Blundell Interchange be considered as part of the George Massey Crossing project.
- **Transit**: Expand rapid bus service along the Highway 99 corridor, reduce demand for parking at Bridgeport Station by providing a Park and Ride station on the south side of the tunnel, and include Light Rapid Transit between Richmond and Ladner with rapid bus connection to White Rock.
- **Steveston Highway Interchange**: Requires upgrading as soon as possible and needs to accommodate rapid transit.

- **Rice Mill Road**: That Rice Mill Road be considered as part of a plan to relieve congestion at the Steveston Highway interchange.

- **Interchange at Highway 99 and Westminster Highway**: That the Environmentally Sensitive Area Development Permit Area adjacent to the Highway 99 and Westminster Highway interchange be considered as part of the project.

Staff Comments

Staff have the following additional comments on the preliminary principles, goals and objectives identified by the Ministry:

- **Preliminary Principle of Alignment with Regional Plans**: That, as Richmond is one of two municipalities directly impacted by the George Massey Crossing project, this principle be expanded so the project is consistent with Richmond's OCP as well as other City plans, bylaws and strategies including the Dike Master Plans, Flood Protection Strategy, Emergency Management Plans, Ecological Network Management Strategy, Community Energy and Emissions Plan, etc.

- **Mobility Pricing**: That should a toll be considered, the tolling policy be consistent with the region's Mobility Pricing initiative. Focusing tolls only on river crossings penalizes Richmond as an island city and will likely shift traffic towards free (untolled) alternatives.

- **Preliminary Goal #1 to Support Sustainability of South of Fraser Communities**: That this goal be amended to support regional sustainability.

- **Scope of Project**: That City staff be included in any work to define the scope of the project.

- **Preliminary Objectives to Goal #1 to Manage Congestion on the Corridor**: That this goal be expanded to include impacts to the City's road network.

- **Preliminary Objectives to Goal #2 to Provide Safe and Convenient Options for Pedestrians and Cyclists**: That, consistent with the Province's cycling policy which states: "Provision for cyclists are made on all new and upgraded provincial highways", a regional cycling facility within the Highway 99 corridor or on parallel local roads be identified and included as part of the project.

- **Preliminary Objectives to Goal #4 to Support a Healthy Environment**: That the scale of the required and proposed infrastructure including the height of the Steveston Highway interchange be such that noise, lighting and visual impacts on adjacent residential, park and business uses are minimized and mitigated. Add a project goal/objective that the project have little to no net adverse effects on the environment. In addition, the project should adhere to the *Pan-Canadian Framework on Clean Growth and Climate Change* signed by the Prime Minister and Province of BC in 2016.

- **Diking and Flood Protection**: That any crossing option be compatible with the City's current and future dike and flood protection needs. Also, any impacts of the project on the City infrastructure, including drainage pump stations and the dike, are to be minimized and mitigated.

- **Mid-Island Dike**: That any improvements along the Highway 99 corridor be compatible with or form a component of a mid-island dike.

- **Short-Term Improvements:** That the Ministry pursue strategic improvements to the Steveston Highway interchange in the short-term and expedite the tender process in order to reduce congestion as soon as possible.

Financial Impact

None.

Conclusion

The Ministry's proposed principles, goals and objectives as presented at the March 18, 2019 General Purposes Committee meeting generally address some of the City's concerns raised with the previous project.

Staff recommend that these principles, goals and objectives be modified to ensure they include and are consistent with the issues discussed at the meeting and in this report.

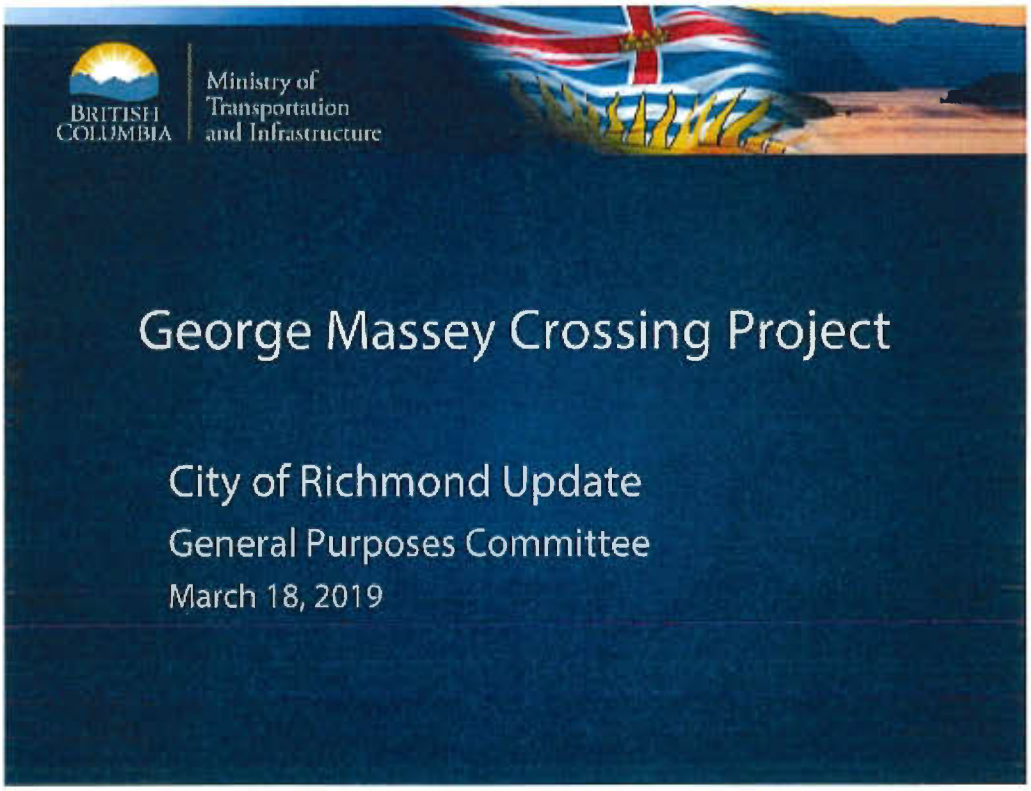
If endorsed by Council, staff will prepare a letter requesting the Ministry to incorporate these comments as part of the short-term and long-term works for the project and will submit this in time for the Ministry's April 1, 2019 deadline.

Donna Chan, P. Eng., PTOE
Manager, Transportation Planning
(604-276-4126)

DC:dc

Att. 1: The Ministry's presentation slides to the March 18, 2019 General Purposes Committee

Attachment 1





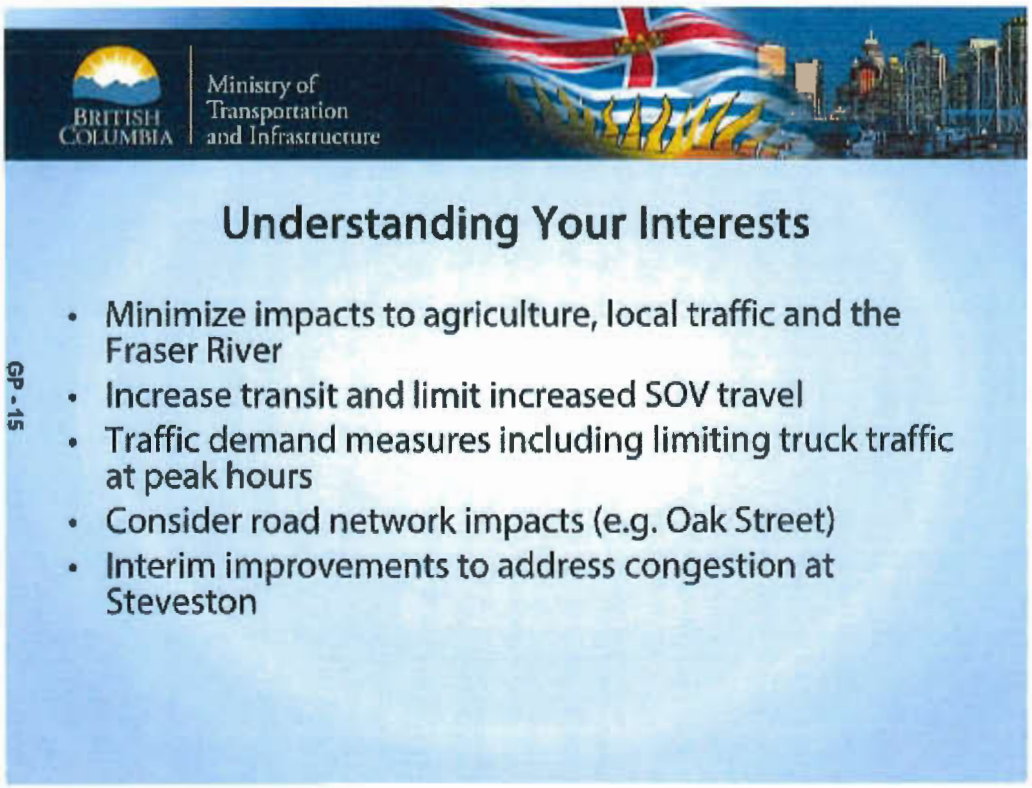
GP - 12

Attachment 1 continued





Attachment 1 continued



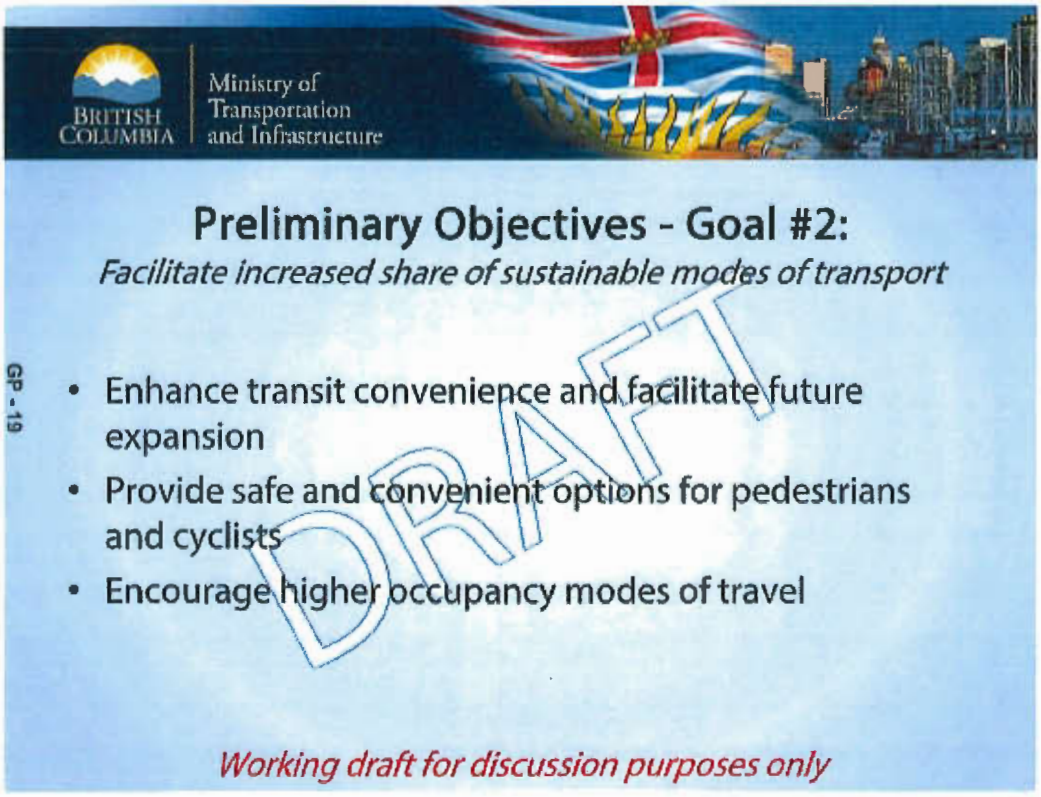


Attachment 1 continued





Attachment 1 continued





Attachment 1 continued





City of Richmond

Bylaw 9963

Credit Card Payment Service Fee Bylaw No. 9536, Amendment Bylaw No. 9963

The Council of the City of Richmond enacts as follows:

1. Credit Card Payment Service Fee Bylaw No. 9536 is amended by deleting Section 1 and replacing it with the following:

"1. Except as set out in section 2, when a credit card or a mobile device is used to pay for fees and charges payable to the City of Richmond in both card-present and card-not-present environments, a service charge of 1.75% of the final transaction amount, net of all discounts and rebates, shall be assessed and charged to the payor in addition to the final transaction amount.

2. The service charge imposed under section 1 does not apply to the following exempt fees or charges:

a) Recreation program registrations and services processed via the City's parks and recreation system
b) Library services
c) Business licence applications and renewals
d) Dog licence applications and renewals
e) Bylaw violation tickets and fines
f) Pay parking
g) Criminal record check services at RCMP detachment
h) Garbage tags and garbage disposal vouchers
i) Miscellaneous items sold at the Richmond Recycling Depot

3. The service charges assessed and charged under this Bylaw are non-refundable."

2. This Bylaw is cited as **"Credit Card Payment Service Fee Bylaw No. 9536, Amendment Bylaw No. 9963"**.

FIRST READING	MAR 1 1 2019
SECOND READING	MAR 1 1 2019
THIRD READING	MAR 1 1 2019
ADOPTED	

CITY OF RICHMOND
APPROVED for content by originating Division
VN
APPROVED for legality by Solicitor
JB

MAYOR

CORPORATE OFFICER

City of Richmond

Bylaw 9997

REVENUE ANTICIPATION BORROWING (2019) BYLAW NO. 9997

The Council of the City of Richmond enacts as follows:

1. Council shall be and is hereby empowered and authorized to borrow upon the credit of the City, from a financial institution, a sum not exceeding $9,500,000 at such times as may be required.

2. The form of obligation to be given as acknowledgement of the liability shall be $3,000,000 in the form of standby letters of credit, demand promissory notes or bank overdraft, $4,500,000 in the form of leasing lines of credit, and $2,000,000 in the form of commercial credit card facility.

3. All unpaid taxes and the taxes of the current year (2019) when levied or so much thereof as may be necessary shall, when collected, be used to repay the money so borrowed.

4. Revenue Anticipation Borrowing (2018) Bylaw No. 9831 is hereby repealed.

5. This Bylaw is cited as **"Revenue Anticipation Borrowing (2019) Bylaw No. 9997".**

FIRST READING	MAR 1 1 2019
SECOND READING	MAR 1 1 2019
THIRD READING	MAR 1 1 2019
ADOPTED	

CITY OF RICHMOND
APPROVED for content by originating dept.
VN
APPROVED for legality by Solicitor
BRB

MAYOR

CORPORATE OFFICER

City of Richmond

Bylaw 9948

Richmond Zoning Bylaw 8500 Amendment Bylaw 9948 (ZT 18-818765) 13100 Smallwood Place

The Council of the City of Richmond, in open meeting assembled, enacts as follows:

1. Richmond Zoning Bylaw 8500, section 10.7 entitled "Vehicle Sales (CV)", is amended by deleting subsection 10.7.4.1 d) in its entirety and replacing with the following:

   d) 0.82
   13100 Smallwood Place
   P.I.D. 000-955-574
   Lot 7 Section 5 Block 4 North Range 5 West New Westminster District Plan 68775 Except Plan EPP72489

2. This Bylaw may be cited as **"Richmond Zoning Bylaw 8500, Amendment Bylaw 9948".**

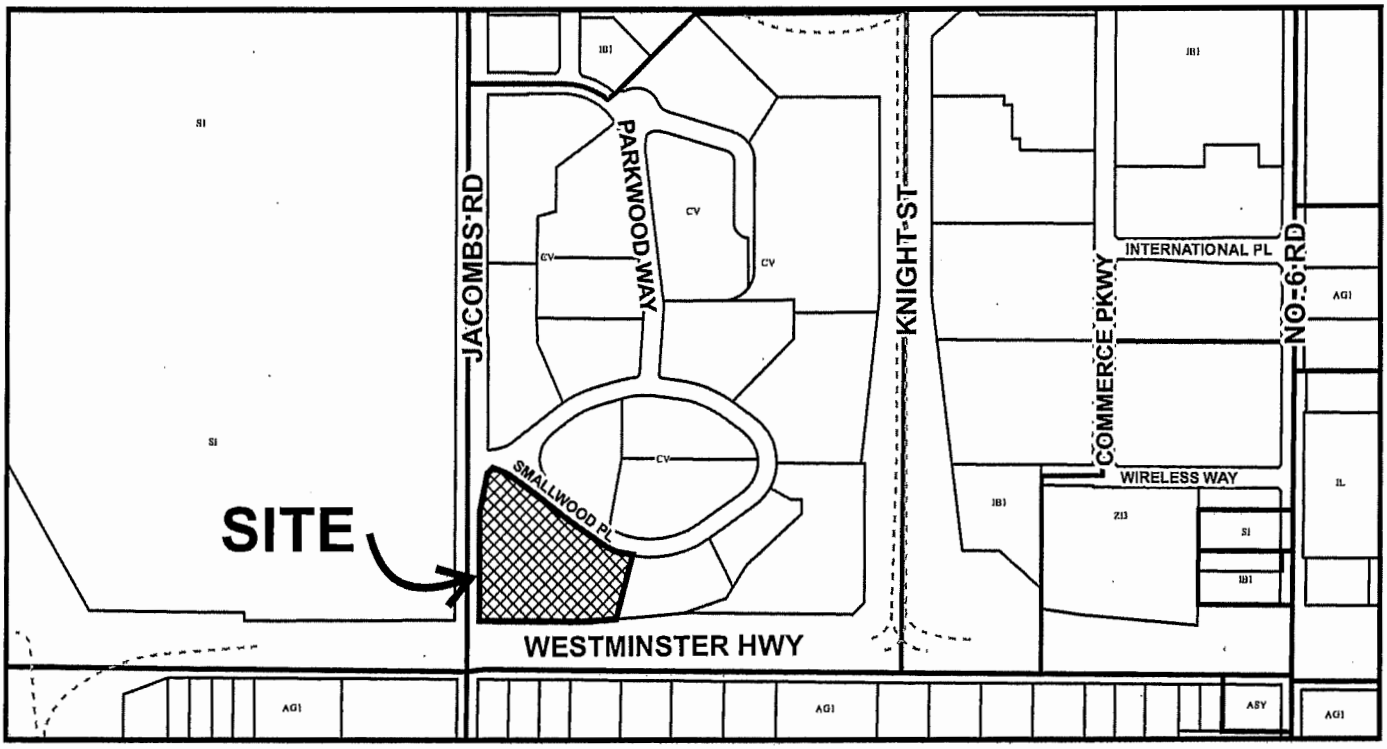
FIRST READING	DEC 19 2018
PUBLIC HEARING	JAN 21 2019
SECOND READING	JAN 21 2019
THIRD READING	JAN 21 2019
MINISTRY OF TRANSPORTATION APPROVAL	MAR 06 2019
OTHER CONDITIONS SATISFIED	MAR 20 2019
ADOPTED	

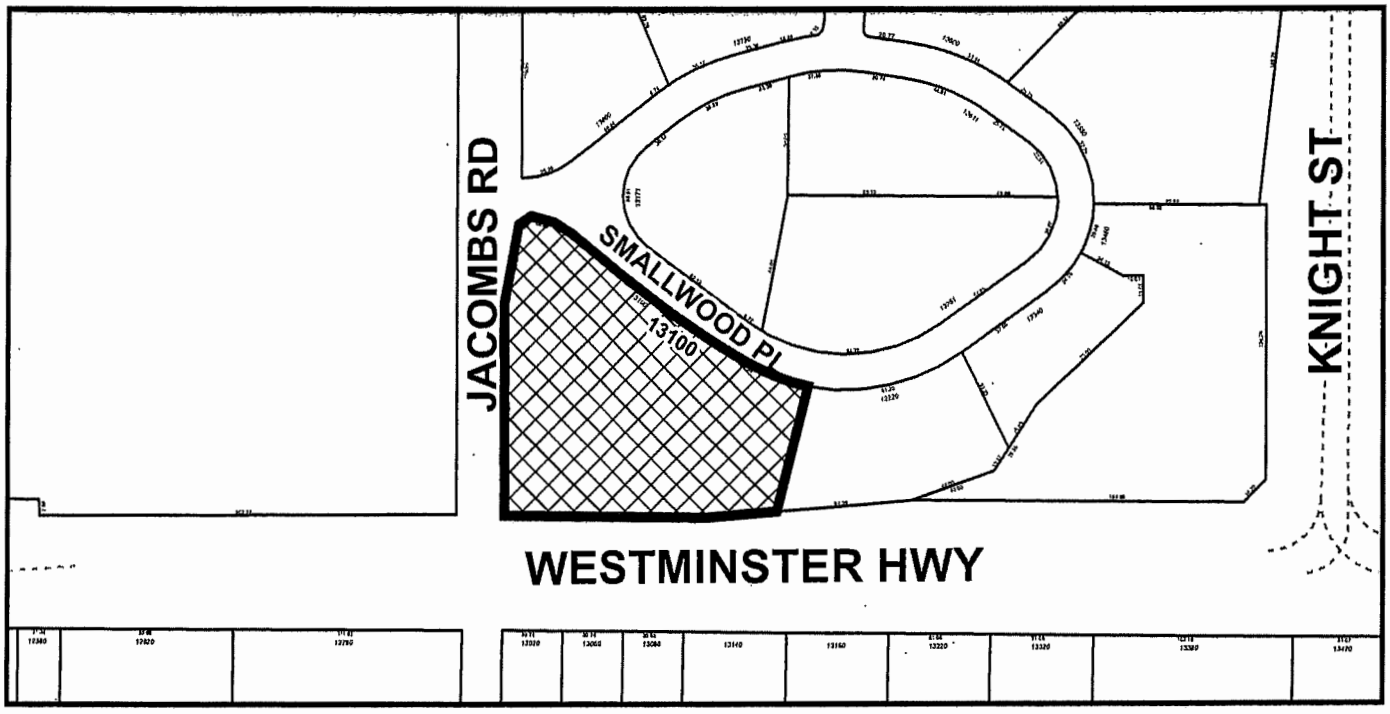
CITY OF RICHMOND
APPROVED by
APPROVED by Director or Solicitor

MAYOR

CORPORATE OFFICER

City of
Richmond





ZT 18-818765

Original Date: 05/09/18

Revision Date:

Note: Dimensions are in METRES

City of Richmond

Minutes

Development Permit Panel
Wednesday, February 27, 2019

Time:	3:30 p.m.
Place:	Council Chambers Richmond City Hall
Present:	John Irving, Chair Laurie Bachynski, Director, Corporate Business Service Solutions Peter Russell, Senior Manager, Sustainability and District Energy

The meeting was called to order at 3:30 p.m.

Minutes

It was moved and seconded
That the minutes of the meeting of the Development Permit Panel held on February 13, 2019 be adopted.

CARRIED

1. DEVELOPMENT PERMIT 18-818762
(REDMS No. 6027231)

APPLICANT:	Christopher Bozyk Architects on behalf of Open Road Toyota
PROPERTY LOCATION:	13100 Smallwood Place

INTENT OF PERMIT:

1. Permit the construction of two additional floors of parking/vehicle inventory storage overtop of the existing Toyota dealership at 13100 Smallwood Place on a site zoned "Vehicle Sales (CV)"; and
2. Vary the provisions of Richmond Zoning Bylaw 8500 to increase the maximum building height to accommodate:
   (a) a parkade rooftop height of 15.1 m;
   (b) a parapet height of 16.2 m;
   (c) a stair tower height of 18.0 m; and
   (d) an elevator over-run height of 19.9 m.

Applicant's Comments

Keiran Walsh, Christopher Bozyk Architects, Inc., provided background information on the proposed development, noting that the current development application is proposing additional two levels of parkade over the original two-level car dealership building proposed in the previously approved development permit application.

In addition, Mr. Walsh noted that the current development application is proposing changes to the site including (i) the relocation of the garbage and recycling facility to facilitate easier pick-up, (ii) the removal of 20 surface parking spaces to increase landscaping on the site, and (iii) an increase in the number of native species to be planted on-site.

Also, Mr. Walsh reviewed the proposed facade treatment for the additional two levels of parkade, noting that the perforated cadmium white cladding panels integrate well with the existing material and colour palette of the building and allow natural ventilation and lighting into the parkade.

In closing, Mr. Walsh noted that the proposed rooftop solar panels are a significant sustainability feature of the proposed development.

In response to queries from the Panel, Mr. Walsh noted that (i) a height variance is proposed to increase the maximum building height, and (ii) planting along the Westminster Road frontage has been increased.

Staff Comments

Wayne Craig, Director, Development noted that (i) the Servicing Agreement associated with the original rezoning and development permit applications for the site includes frontage works and site service connections, (ii) electric vehicle charging stations are proposed on-site, and (iii) 107 rooftop solar panels will be installed in the proposed development.

Panel Discussion

In reply to queries from the Panel, Mr. Walsh acknowledged that (i) the location of the rooftop solar panels was determined through a shadow study, (ii) three on-site electric vehicle charging stations are provided for public access, (iii) there will be an increase in shadowing as a result of the proposed increase in building height, although shadowing of the Richmond Nature Park is limited to early morning hours and (iv) the building structure was designed to accommodate the weight of the additional levels of parkade.

In reply to a query from the Panel, Mr. Walsh reviewed the details of the proposed façade treatment for the additional levels of parkade facing the nature park to the west of the subject site, noting that the proposed cladding material is designed to mitigate potential bird strikes on the building.

Correspondence

None.

Panel Discussion

The Panel expressed support for the project and appreciated the proposed façade treatment for the additional levels of parkade and the provision of rooftop solar panels on the building are appreciated.

Panel Decision

It was moved and seconded
That a Development Permit be issued which would:

1. ***permit the construction of two additional floors of parking/vehicle inventory storage overtop of the existing Toyota dealership at 13100 Smallwood Place on a site zoned "Vehicle Sales (CV)"; and***
2. ***vary the provisions of Richmond Zoning Bylaw 8500 to increase the maximum building height to accommodate:***
   - ***(a) a parkade rooftop height of 15.1 m;***
   - ***(b) a parapet height of 16.2 m;***
   - ***(c) a stair tower height of 18.0 m; and***
   - ***(d) an elevator over-run height of 19.9 m.***

CARRIED

2. DEVELOPMENT PERMIT 18-825006

(REDMS No. 6119296 v. 2)

APPLICANT: IBI Group Architects (Canada) Inc.

PROPERTY LOCATION: 9455 and 9533 Bridgeport Road

INTENT OF PERMIT:

Permit the construction of two hotels at 9455 and 9533 Bridgeport Road on sites zoned "Light Industrial, Office and Hotel (ZI10) – Bridgeport Village (City Centre)".

Applicant's Comments

Martin Bruckner, IBI Group Architects, Inc., provided background information on the proposed development, noting that a development permit was previously issued to the proposed two hotels and the adjacent business centre building; however, the current development permit application includes only the two hotels, on which design modifications are proposed to meet the requirements of the hotels' operator.

Mr. Bruckner highlighted the following:

- the siting of the two hotels and the business centre remains the same;
- a new north-south road will continue to be constructed on-site, which straddles the two hotels, connects Bridgeport Road and Beckwith Road, and provides vehicle and pedestrian access to the subject site;
- the proposed modifications to the two hotels include minor changes to the external design of buildings, parking, loading and recycling areas, tree retention and landscaping;
- a major proposed change for Hotel 1 (east hotel) is the increase in height from 9 to 10 storeys;
- the proposed modifications will result in an overall increase in the total number of hotel rooms;
- while the overall design of the two hotel buildings continues to be similar and the building design differences remain generally the same, the revised design has reduced the use of exposed concrete and metal panels and increased the amount of glazing; and
- lighting elements have been added to the hotel buildings to improve the public realm and enhance the prominence of the buildings; however, lighting levels will be controlled as a condition of building permit issuance.

Mark van der Zalm, van der Zalm Associates Inc., briefed the Panel on the main landscaping features of the project, noting that the overall landscaping for the current development application has remained generally the same as in the previously approved development permit application.

In addition, Mr. van der Zalm noted that modifications to the original landscaping include, among others, (i) the use of a more reflective paving material for the new north-south road to reduce heat island effect, (ii) additional planting of trees and other plant materials on-site, and (iii) the addition of comprehensive irrigation to the landscape plans.

Mr. van der Zalm further noted that the current proposal continues to provide, among others, bicycle parking, designated bus layby parking, amenity spaces in the hotels' interior, Live green roofs which can support small shrubs, a tree retention area which will be enlarged, and lighter grade permeable paving for the parking spaces.

In reply to queries from the Panel, Mr. Bruckner acknowledged that a parkade is provided within the business centre in addition to on-site surface parking spaces for shared use between the two hotels and the business centre.

Staff Comments

Mr. Craig noted that (i) the Servicing Agreement associated with the original development permit includes frontage works to Bridgeport Road and Beckwith Road and design coordination with the north-south road through the site, (ii) the tree retention area on the northeast corner of the site includes the retention of a stand of 10 trees, (iii) the tree retention area is expected to be expanded as part of the rezoning application which is currently under review for 9250 Beckwith Road, (iv) there was consultation with the Ministry of Transportation and Infrastructure (MOTI) as Bridgeport Road is under the administration and control of MOTI, (v) through the construction process, additional permits will be required from MOTI as well as Kinder Morgan related to jet fuel line, and (vi) the project has been designed to meet LEED Silver version 4 equivalent standards and ready for future connection to a District Energy Utility (DEU) facility .

Panel Discussion

In reply to queries from the Panel, the design team noted that (i) each hotel is self-sufficient in terms of amenities provided, (ii) on-site surface parking spaces and the parkade within the business centre are for shared use between the two hotels and the business centre, (iii) the tree retention area will be protected and monitored during project construction, (iv) a sod boulevard, concrete sidewalk, and layered planting of trees and shrubs provide an interface to Bridgeport Road, (v) no pedestrian access is provided along Bridgeport Road other than the publicly accessible pedestrian walkways on both sides of the main site entry at the new north-south road, and (vi) no speed bumps are currently proposed for the 24 feet wide north-south road as its scored concrete paving treatment provides a traffic calming feature.

In reply to a query from the Panel, Mr. Craig noted that there is no requirement for electric vehicle charging for the subject site as the City's Zoning Bylaw requires the provision of electric vehicle charging only for residential units and not for commercial uses.

In reply to a further query from the Panel, Mr. Bruckner confirmed that 10 percent of on-site surface parking stalls will be provided with electric vehicle charging.

Gallery Comments

Mr. Popazivanov, owner of a neighbouring property on Beckwith Road, sought clarification regarding the location of the main access to the subject site, noting that both Beckwith Road and Bridgeport Road are currently experiencing heavy vehicular traffic.

Mr. Popazivanov also expressed concern regarding the congestion of Beckwith Road due to the large number of vehicles parked on both sides of the street due to the proximity of existing commercial developments in the area. He questioned whether the proposed development is necessary considering the presence of existing hotels in the area and its potential to worsen existing vehicular traffic and parking situation on Beckwith Road.

In closing, Mr. Popazivanov also expressed concern regarding the potential shadowing of the proposed development on his property and the damage to his property caused by pre-construction activities being undertaken in the area.

Todd Harris, 9451 Beckwith Road, expressed concern regarding (i) the use of Beckwith Road to access the subject site during construction as it would pose a safety concern for pedestrians, (ii) airborne dust and other debris generated by pre-construction and construction proper activities which pose a health concern to residents in the area, and the (iii) the damage to his property such as cracked concrete floors as a result of ground shaking generated by pre-construction activities in the subject site.

In addition, Mr. Harris queried whether (i) there is a precedent in the City for a large development causing damage to neighbouring properties due to pre-construction activities, and (ii) a sprinkler system could be installed on the subject site to mitigate the impact of dust pollution to neighbouring properties during project construction especially during the dry season.

In closing, Mr. Harris suggested that speed bumps be installed on the proposed north-south road on the subject site and was of the opinion that it is a more effective traffic calming measure than scored concrete paving treatment for speeding vehicles accessing the north-south road to get onto Beckwith Road.

In response to the concerns raised by Mr. Popazivanov and Mr. Harris, the Chair advised that their construction-related concerns are covered by relevant City bylaws and outside the jurisdiction of the Panel; however, they could be assisted by appropriate City staff to address their constructed-related concerns.

With regard to vehicular traffic concerns on Beckwith Road and Bridgeport Road, Mr. Craig noted that a traffic volume and traffic impact assessment was conducted as part of the original rezoning application for the subject site and the applicant has demonstrated that there is sufficient capacity for adjacent road networks to handle traffic to be generated from the subject site.

Mr. Craig further noted that (i) there will be improvements on Beckwith Road and Bridgeport including road widening along the frontage of the subject site, (ii) the sidewalk along the subject site's Beckwith Road frontage will extend eastward up to the driveway on Airport Gateway Plaza to the east of the subject site, (iii) there are currently no parking restrictions on Beckwith Road; however, the City's parking bylaw prohibits parking on private residences for more than three hours during the day, and (iv) the City's Community Bylaws Department is addressing parking concerns on Beckwith Road.

With regard to the proposal to install speed bumps on the new north-south road, Mr. Craig advised that staff will work with the applicant to ensure that speed bumps will be included in the road design prior to Council consideration of the subject development permit application.

With regard to the query regarding access to the subject site, Mr. Craig advised that all driveway access to the subject site will be from the new north-south road.

With regard to parking concerns on Beckwith Road, Mr. Craig further advised that (i) 107 surface parking stalls and 70 parking stalls in the parkade within the business centre building are provided for the two hotels, (ii) a total of 436 parking spaces are provided for the overall development, including the office building, and (iii) staff will refer the proposal for a residents' only parking restriction on Beckwith Road to the City's Transportation Division for their consideration.

With regard to potential shadowing on adjacent properties along Beckwith Road, Mr. Bruckner reviewed the shadow impact study provided by the applicant.

The Panel noted that the shadow diagrams may not be accurate and directed staff to review the shadow study and confirm whether the shadows beyond the hotel will not extend beyond Beckwith Road.

In response to a query from the Panel, the project's contractor acknowledged that (i) access to the hotel sites during construction is from Bridgeport Road and (ii) the business centre building site is accessed from Beckwith Road during construction.

Correspondence

Ramon Carfrae, neighbouring property (no address provided) (Schedule 1)

Seana Alexander, 9431 Beckwith Road (Schedule 1)

Miles Smart, 9571 Beckwith Road and 2271 No. 4 Road (Schedule 2)

Sharon Betker (on behalf of Naidae Betker), 9400 Beckwith Road (Schedule 3)

Vera Smart, neighbouring property (no address provided) (Schedule 4)

Todd Harris, 9451 Beckwith Road (Schedule 5)

Mr. Craig summarized the concerns expressed by neighbouring residents, noting that majority of their concerns are related to traffic, parking and construction-related impacts.

Panel Discussion

The Panel expressed support for the project, noting that (i) appropriate City staff could assist residents on construction-related impacts, (ii) the developer and contractor are expected to adhere to construction-related bylaws and address construction-related impacts to neighbouring properties, (iii) speed bumps could be installed on the new north-south road as a traffic calming measure, (iv) more accurate shadow diagrams need to be provided by the applicant to address shadowing concerns, (v) parking provision for the proposed development is adequate as confirmed by the traffic study, and (vi) minor changes to the original design of the project including landscaping meet the City's requirements.

In addition, the Panel expressed appreciation for (i) the form and character of the proposed development, (ii) the proposed colour scheme, (iii) the proposed landscaping including the provision of green roofs, and (iv) the applicant's response to address the City's concerns regarding the proposed development.

Panel Decision

It was moved and seconded
That a Development Permit be issued which would permit the construction of two hotels at 9455 and 9533 Bridgeport Road on sites zoned "Light Industrial, Office and Hotel (ZI10) – Bridgeport Village (City Centre)".

CARRIED

3. Date of Next Meeting: March 13, 2019

4. Adjournment

It was moved and seconded
That the meeting be adjourned at 4:50 p.m.

CARRIED

Certified a true and correct copy of the Minutes of the meeting of the Development Permit Panel of the Council of the City of Richmond held on Wednesday, February 27, 2019.

John Irving
Chair

Rustico Agawin
Committee Clerk

Schedule 1 to the Minutes of the Development Permit Panel meeting held on Wednesday, February 27, 2019.

To Development Permit Panel
Date: FEBRUARY 27, 2019
Item # 2
Re: DP 18-825006

To Mark.

I agree as well that the construction site traffic enter and exit off Bridgeport road.

At the present time we are working with Richmond Bylaws to have no parking signs installed in front of our homes. We get choked off regularly by Costco shoppers parking here and we know the limitations of our small street. I feel that many large vehicles on our street would be a hardship for ourselves and our neighbours.

Best regards
Ramon Carfrae

-----Original Message-----
From: Seana Alexander <seana.lynn@hotmail.com>
Sent: February 26, 2019 5:19 PM
To: mmcmullen@richmond.ca
Cc: vsmart@mac.com; toddharris@me.com; mudflatter@gmail.com; Seana Alexander <seana.lynn@hotmail.com>; Ramon Carfrae <info@richmondcedarworks.ca>; Ellen Bodnarik <evilsockhaven@shaw.ca>; Jennifer Schmidt <jenniferschmidt@hotmail.com>; bpopaziv@shaw.ca; qualicum_tom@hotmail.com
Subject: Resident concerns on development permit number 18-825006

Dear Mark,

Thank you for taking my call today and hearing my concerns regarding some of the safety issues that I feel need to be heard and addressed at the upcoming meeting of the major development of 9455 and 9533 Bridgeport Road. We have all been long time residents of this small residential street of Beckwith Road East of the Oak bridge. Resident family members have built their homes here and the some of oldest residents being in their 90's who walk and around our small neighbourhood. I walk my child to school and my concern as well as others who will be contacting is the the large dump trucks coming down Beckwith. There is no side walk and we have to be carful as it is and we would like to be able to walk safely in our neighbourhood.

We all are very aware that this area is under much development. However, we request that the developers acknowledge and make a safety traffic plan alongside with the city to keep our all of our residents safe with these very large moving vehicles.

We strongly request that the dump trucks, large trucks, excavators and or vehicles enter/exit off Bridgeport access point.

Sincerely,

Seana Alexander
9431 Beckwith Road
604-442-9663

Schedule 2 to the Minutes of the Development Permit Panel meeting held on Wednesday, February 27, 2019.

CityClerk

From: McMullen, Mark
Sent: Wednesday, 27 February 2019 08:54
To: CityClerk
Cc: Craig,Wayne; Lin, Fred; Agawin,Rustico Romualdo
Subject: FW: Resident concerns on development permit number 18-825006 (Three Emails For Feb. 27/19 DP Panel)

The following includes emails sent in chain-form from three residents.

From: Miles Smart [mailto:qualicum_tom@hotmail.com]
Sent: Tuesday, 26 February 2019 19:03
To: McMullen, Mark
Cc: vsmart@mac.com; toddharris@me.com; Ellen Bodnarik; Jennifer Schmidt; bpopaziv@shaw.ca; Seana Alexander; Ramon Carfrae
Subject: Resident concerns on development permit number 18-825006

Mark,

I operate Cherry Lane Farm at the end of Beckwith Rd. and have some concerns that I need to voice about the development occurring on our street.

Me and Mr Carfrae regularly have problems entering and exiting with with our work trailers due to the poor parking skills and lack of courtesy given by the slew of people who park their vehicles on Beckwith while shopping at Costco. Something needs to be done not only about this, but also keeping construction traffic limited to entering and exiting off of Bridgeport. Our ability to run our businesses (and keep our sanity) is limited by the existing buffoonery and we just can't cope with the extra traffic.

Also, Seana mentioned in a previous email that the lack of sidewalks pose a hazard—are the developers going to be required to install a sidewalk on the south side of Beckwith? I seem to recall that the townhouse complex and condos in the making at No 4 Rd and River Road (North Arm of the Fraser) were required to build a sidewalk up No 4 Rd. to join up to Bridgeport. Should they be required to build this sidewalk, wouldn't it make sense to build it over the existing ditch and widen the road?

Thank you very much for your time,

Miles Smart
9571 Beckwith Rd. & 2271 No 4 Rd.

Get Outlook for iOS

To Development Permit Panel
Date: FEBRUARY 27, 2019
Item # 2
Re: DP 18-825006

From: Ramon Carfrae <info@richmondcedarworks.ca>
Sent: Tuesday, February 26, 2019 5:26 PM
To: Seana Alexander; mmcmullen@richmond.ca
Cc: vsmart@mac.com; toddharris@me.com; mudflatter@gmail.com; Ellen Bodnarik; Jennifer Schmidt; bpopaziv@shaw.ca; qualicum_tom@hotmail.com
Subject: RE: Resident concerns on development permit number 18-825006

CityClerk

From: McMullen, Mark
Sent: Wednesday, 27 February 2019 09:02
To: CityClerk
Cc: Craig,Wayne; Lin, Fred; Agawin,Rustico Romualdo
Subject: FW: Development permit for 9455 and 9533 Bridgeport Road 18-825006 (For Feb. 27/19 DP Panel)

From: Sharon Betker [mailto:mudflatter@gmail.com]
Sent: Tuesday, 26 February 2019 19:39
To: McMullen, Mark
Cc: Seana Alexander
Subject: Development permit for 9455 and 9533 Bridgeport Road 18-825006

Let me start off with some background. My father built our home at 9400 Beckwith Road over 60 years ago. Over that time a good piece of our land was taken to build the Oak Street Bridge and again in recent years we were threatened again with losing more land for the development of the Massey Bridge project. The property next to us had been covered over with gravel at allow a short lived container storage. The fill did not allow our property to drain resulting in 6 inches of water covering our back yard and threatening to enter the house. They opened up a small ditch and left the premises to "rot". Now we are faced with 8 foot high blackberry brushes that have destroyed our hedges and invaded our yard making it unusable.
This morning I wake up to the sounds of earth moving equipment on the other side of our property for a so-called staging area for the hotel development. More worries that we will be flooded out again during the next major rainstorm. This development has brought more than one concern. Cracked walks due to the constant shaking of the site preparation, an outside door which now jams and will have to be sanded down in order to open it safely, blowing sand onto all our vehicles and entering the home, and now the worry about increased traffic on an already congested deadend road. The road is very narrow with a ditch on one side so the Costco shoppers who regularly descend on our street often park, not on the boulevard, but well onto the road limiting access to and from our properties. Now it appears that even more traffic in the way of construction vehicles will also be using our street! I implore council to consider redirecting this additional traffic off Beckwith Road. Not only is there a huge safely issue with access limited to emergency vehicles but we, ourselves, have to deal with the constant congestion in a family neighbourhood.
I hope to attend the meeting on Wednesday if my health permits.
Sincerely,
Sharon Betker on behalf of Naidae Betker
9400 Beckwith Road
Mudflatter@gmail.com

To Development Permit Panel
Date: FEBRUARY 27, 2019
Item # 2
Re: DP 18-825006

CityClerk

From: McMullen, Mark
Sent: Wednesday, 27 February 2019 09:04
To: CityClerk
Cc: Craig,Wayne; Lin, Fred; Agawin,Rustico Romualdo
Subject: FW: Development permit #18-825006 (For Feb. 27/19 DP Panel)

-----Original Message-----
From: vera smart [mailto:vsmart@mac.com]
Sent: Tuesday, 26 February 2019 21:58
To: McMullen, Mark; seana.lynn@hotmail.com; evilsockhaven@shaw.ca; jenniferschmidt@hotmail.com; bpopaziv@shaw.ca; toddharris@me.com; mudflatter@gmail.com; qualicum_tom@hotmail.com
Subject: Development permit #18-825006

Dear Mr. McMullen,
I am writing you today in regards to this development that is happening on Bridgeport Rd. (# 18-825006) Many of us long time residents are concerned about safety and quality of living in the neighbourhood. Especially for our 3 elderly ladies in their late 80's and 90's. And our youngest resident, a young 7 year old.
All of them actively use Beckwith road, As does Miles at Cherry Lane farm and Ramon C. (and Richmond's Flame Heating)
Many are hoping that construction traffic is not permitted to impact them, their businesses, farms or their safety.
Many residents have been here since the 1950's and 1960's and are hoping that you take our/ their concerns seriously.
Thank you for your attention to this. As we all hope to have a pleasant, neighbourly relationship. Having Beckwith not included as a construction road would help with our concerns. We aren't wanting to complain- just want our safety concerns heard.
Thank you for your time.
-Vera Smart

Sent from my iPhone

To Development Permit Panel
Date: FEBRUARY 27, 2019
Item # 2
Re: DP 18 - 825006

From: McMullen, Mark
Sent: Wednesday, 27 February 2019 10:49
To: CityClerk
Cc: Craig,Wayne; Reis,Joshua; Lin, Fred; Dhaliwal,Bill; Agawin,Rustico Romualdo
Subject: FW: Resident concerns on development permit number 18-825006 (For Feb 27/19 DP Panel)

From: Todd Harris [mailto:toddharris@me.com]
Sent: Wednesday, 27 February 2019 10:43
To: McMullen, Mark
Cc: Cc: vsmart@mac.com; toddharris@me.com; mudflatter@gmail.com; Seana Alexander <seana.lynn@hotmail.com>; Ramon Carfrae <info@richmondcedarworks.ca>; Ellen Bodnarik <evilsockhaven@shaw.ca>; Jennifer Schmidt ; bpopaziv@shaw.ca; qualicum_tom@hotmail.com
Subject: Re: Resident concerns on development permit number 18-825006

Hello Mark,
My name is Todd Harris and I am also a concerned resident of 9451 Beckwith Rd. I have lived here since 1986.
1- From a safety perspective Beckwith Rd. Should not be used as construction access to this building site.
There are dozens of pedestrians that use Beckwith Rd. To commute from 4rd.area to sky train/Costco/casino. Bridgeport rd is not a good/safe option for them. The Bridgeport pathway to the north is isolated and not lite.
2- What will be done to limit the airborne pollutants, some of which could be toxic from drifting towards our residents. The wind is predominant towards us.
Will there be Constant sprinklers to keep the dust down. This would be a MAJOR health concern. I'm sure there would be a similar Precedent on this concern.
3- We are experiencing constant seismic activity from this development. My front concrete stairs have cracked as has the foundation. The constant shaking is ruining my house.
Mark , is there any precedent that you know of in City of Richmond for major development damaging older residential property's/ Infrastructure due to shaking the ground constantly ? Or where could I find this out? I am very concerned.
Thank you,
Sincerely
Todd Harris
Sent from my iPad

To Development Permit Panel
Date: FEBRUARY 27, 2019
Item # 2
Re: DP 18-825006

City of Richmond

Minutes

Development Permit Panel
Wednesday, March 13, 2019

Time:	3:30 p.m.
Place:	Council Chambers Richmond City Hall
Present:	John Irving, Chair Laurie Bachynski, Director, Corporate Business Service Solutions Peter Russell, Senior Manager, Sustainability and District Energy

The meeting was called to order at 3:30 p.m.

Minutes

It was moved and seconded
That the minutes of the meeting of the Development Permit Panel held on February 27, 2019 be adopted.

CARRIED

1. DEVELOPMENT PERMIT 16-741329
(REDMS No. 5737467)

APPLICANT: 0908206 BC Ltd.

PROPERTY LOCATION: 9560, 9580 and 9584 Granville Avenue

INTENT OF PERMIT:

1. Permit the construction of 16 two-storey townhouse units at 9560, 9580, and 9584 Granville Avenue on a site zoned "Medium Density Townhouses (RTM2)"; and
2. Vary the provisions of Richmond Zoning Bylaw 8500 to increase the maximum lot coverage for buildings from 40% to 45%.

Applicant's Comments

Eric Law, Eric Law Architect, Inc., provided background information on the proposed development, noting that (i) the design of the proposed townhouse development is sensitive to its neighbouring two-storey townhouse developments and single-family homes, (ii) the requested increase in lot coverage will be mitigated by the proposed increases in lot coverage for porous surfaces and landscaping with live plants, (iii) two convertible units are proposed for the project, and (iv) the project has been designed to achieve an EnerGuide 82 rating for energy efficiency.

Donald Duncan, Donald V.S. Duncan Development Consultant, briefed the Panel on the main landscaping features for the project and highlighted the following:

- the proposed landscaping for the subject site is consistent with its single-family environment;
- the extensive use of permeable pavers in the project will enhance on-site stormwater management;
- coloured pavers are proposed for on-site pedestrian routes for better identification and to enhance safety to pedestrians;
- proposed interface with adjacent developments include, among others, wooden fencing with trellis elements on top in key locations;
- colourful trees and shrubs are proposed on the site to provide visual interest;
- the large tree at the northeast corner will be retained and protected; and
- the proposed children's play area provides a variety of play and learning opportunities.

Staff Comments

Wayne Craig, Director, Development noted that (i) a Servicing Agreement associated with the project which includes frontage works and site service connections will be entered into prior to Building Permit issuance, and (ii) the proposed building lot coverage variance was identified at rezoning stage and no concerns were noted at the public hearing for the rezoning of the subject site.

Panel Discussion

In reply to queries from the Panel, the project's design team acknowledged that (i) an arbour will be mounted on top of the proposed fence at both ends of the east-west internal drive aisle, (ii) there is no cross-access connection to the adjacent existing townhouse development to the west, (ii) rollover curbs are not provided along the pedestrian walkways on the internal drive aisle; however, a different colour treatment is proposed for the permeable paving on pedestrian pathways to enhance pedestrian safety, (iii) the outdoor amenity area is gated to provide safety to children, and (iv) wood fences will be installed on the east, west and south property lines.

In reply to further queries from the Panel, the design team noted that (i) the proposed height of the two-storey buildings in the subject site is slightly higher than the adjacent single-family homes to the east but below the maximum permitted height of 12 meters for townhouses, (ii) all parking stalls in the townhouse units are provided with Level 2 electric vehicle charging outlets, and (iii) garbage and recycling enclosures are located at the entry driveway to facilitate pick-ups.

Gallery Comments

Jenny Xu, Unit 8 7028 Ash Street, owner of the end unit of the existing two-storey townhouse development immediately adjacent to the west of the subject development, sought clarification regarding (i) the height of the proposed buildings on the subject site, (ii) the distance between the subject development and her property, and (iii) proposed measures by the applicant to address potential privacy and overlook concerns to the immediate neighbours to the west.

Rosa Liu, 9600 Granville Avenue, owner of the single-family home immediately adjacent to the east of the subject site, expressed concern regarding the damage to her property as a result of previous pre-construction activities undertaken in the subject site.

Ms. Liu noted that the concrete sidewalk and patio on her property and the wooden fence along her property's west property line adjacent to the subject site were damaged as these were observed to be sloping down toward the subject site. She expressed concern that her property's foundation could have been damaged as well.

In closing, Ms. Liu further noted that she had relayed her concerns to the project's developer and queried whether the developer's proposal to build a new retaining wall would impact the old retaining wall within her property.

With regard to the concerns raised by the neighbouring residents, the Chair advised that the Panel's mandate is to review the form and character of the proposed development and that construction impacts could be coordinated with City staff and should be addressed by the developer.

With regard to the project's proposed interface with the adjacent townhouse development to the west to provide separation and privacy, the project's design team acknowledged that (i) a six-foot high wood fence and hedging materials will be installed along the site's west property line to provide a buffer between the subject site and the adjacent townhouse development to the west, (ii) the distance between the west side of the buildings on the subject site and the east side of the buildings on the adjacent townhouse development to the east is approximately six meters, and (iii) the site grade on the subject site will be raised to match the existing site grades on the adjacent properties.

In response to a query from the Panel, Mr. Craig confirmed that the building setback from the west property line of the subject site is slightly larger than the required minimum of three meters.

With regard to the project's interface with the adjacent single-family home to the east, the design team acknowledged that similar fencing and hedging materials proposed along the west property line would also be installed along the east property line.

In addition, Mr. Craig noted that (i) perimeter drainage will be installed along all property lines on the subject site, (ii) the applicant intends to match the site grade on the subject site to the existing site grade on the adjacent property to the east, and (iii) the applicant intends to retain the existing retaining wall to the east; however, the developer had indicated that he could replace the east retaining wall if necessary.

Khalid Hasan, developer for the project, confirmed that (i) the existing retaining wall to the east is within the neighbour's property, (ii) a new retaining wall along the east property line of the subject site could be installed if necessary, (iii) the site grade on the subject site will be raised to match the existing grade on the adjacent property to the east, and (iv) he has agreed to replace the damaged fence and three wooden gates in the neighbouring property.

Correspondence

Rosa Liu, 9600 Granville Avenue (Schedule 1)

Mr. Craig noted that in her letter, Ms. Liu expressed concern regarding issues with respect to potential property damage resulting from site preparation works and previous demolition of existing single-family homes on the subject site, and requested that the developer fulfill his commitment to address these issues.

Panel Discussion

The Panel expressed support for the project, noting that (i) increasing the site grade to match the existing grades on adjacent developments will help address adjacency concerns, (ii) the form and character of the proposed development is appropriate, and (iii) the proposed development works well with its site context.

Panel Decision

It was moved and seconded
That a Development Permit be issued which would:

1. *permit the construction of 16 two-storey townhouse units at 9560, 9580, and 9584 Granville Avenue on a site zoned "Medium Density Townhouses (RTM2)"; and*
2. *vary the provisions of Richmond Zoning Bylaw 8500 to increase the maximum lot coverage for buildings from 40% to 45%.*

CARRIED

2. DEVELOPMENT VARIANCE 18-825820
(REDMS No. 6107581)

APPLICANT: Urban Design Group Architects Ltd.

PROPERTY LOCATION: 12033 Riverside Way

INTENT OF DEVELOPMENT VARIANCE PERMIT:

Vary the provisions of Richmond Zoning Bylaw 8500 to:

1. reduce the number of required vehicle parking spaces from 92 to 89; and
2. reduce the minimum required standard vehicle parking spaces from 50% to 40%, to permit a childcare facility with a maximum 26 staff and 136 children to be located on a site at 12033 Riverside Way zoned "Industrial Business Park (IB1)".

Applicant's Comments

Fariba Gharaei, Urban Design Group, with the aid of a video presentation (attached to and forming part of these Minutes as Schedule 2) provided background information on the proposed development and highlighted the following:

- the proposed parking variances are requested to accommodate a new childcare facility on the ground floor of an existing three-storey office building;
- there are currently 92 parking spaces provided for the three-storey building;
- the total number of parking spaces required for the entire property as a result of the proposed addition of a childcare facility is 102 spaces; however, the Zoning Bylaw allows a 10 percent reduction to the minimum required parking spaces provided that Transportation Demand Management (TDM) measures are provided;
- 10 existing parking stalls are proposed to be removed to accommodate an outdoor play area for the proposed childcare facility;
- the remaining parking stalls will be re-striped to increase the number of small car parking spaces to provide 89 parking stalls, 14 of which will be restricted to short-term parking during peak demand hours for the childcare facility;

- changes to existing landscaping to accommodate the proposed outdoor play area include the removal of a portion of an existing landscaped area, addition of a new lawn and installation of perimeter fencing to enclose the play area; and
- outdoor and indoor bicycle parking will be provided for the proposed childcare facility.

Julia Lim, the project's traffic consultant, with the aid of a video presentation (attached to and forming part of these Minutes as Schedule 2) reviewed the results of the parking study conducted for the project.

Ms. Lim referenced the observed site parking demand, parking demand for comparable properties with office and childcare uses, and projected peak individual parking demand for the childcare facility to support the provision of 89 parking spaces for the subject property.

In addition, Ms. Lim noted that the project's proposed TDM measures include cycling end-of-trip facilities and a two-year, two-zone employee public transit pass program for childcare staff.

Staff Comments

Mr. Craig advised that staff had consulted with Vancouver Coastal Health Authority during the review process and noted their support for the proposed childcare facility on the subject site.

In addition, Mr. Craig clarified that (i) the total number of required parking stalls for the subject property including the office uses and childcare facility as per the City's Zoning Bylaw is 102 parking stalls, (ii) the applicant's proposed TDM measures allow for a 10 percent reduction of the required parking stalls or a minimum of 92 parking stalls, and (iii) the applicant is only able to physically fit 89 parking stalls on the site, so a parking variance is requested.

Gallery Comments

None.

Correspondence

None.

Panel Discussion

The Panel expressed support for the project, noting the applicant's thorough presentation of the project and clear rationale for the requested parking variances.

Panel Decision

It was moved and seconded
That a Development Variance Permit be issued which would vary provisions of Richmond Zoning Bylaw 8500 to:

1. *reduce the number of required vehicle parking spaces from 92 to 89; and*
2. *reduce the minimum required standard vehicle parking spaces from 50% to 40%, to permit a childcare facility with a maximum 26 staff and 136 children to be located on a site at 12033 Riverside Way zoned "Industrial Business Park (IB1)".*

CARRIED

3. New Business

It was moved and seconded
That the Development Permit Panel meeting scheduled on Wednesday, March 27, 2019 be cancelled.

CARRIED

4. Date of Next Meeting: April 10, 2019

5. Adjournment

It was moved and seconded
That the meeting be adjourned at 4:34 p.m.

CARRIED

Certified a true and correct copy of the Minutes of the meeting of the Development Permit Panel of the Council of the City of Richmond held on Wednesday, March 13, 2019.

John Irving
Chair

Rustico Agawin
Committee Clerk

Schedule 1 to the Minutes of the Development Permit Panel meeting held on Wednesday, March 13, 2019.

To Development Permit Panel
Date: March 13, 2019
Item # 1
Re: DP 16-741329

From: Rosa Liu <rosacga678@gmail.com>
Sent: Tuesday, 12 March 2019 11:15 PM
To: Weber,David
Cc: Rosa Liu
Subject: DP 16-741329 Meeting Record Notification, on Wednesday March 13, 2019
Attachments: 9600 Granville Ave City Notice.pdf; 9600 Granville letter to Developer.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Mr. David Weber:

Please find attached our communications on residential property damage issues as recorded in regards to the DP 16-741329. These should be addressed as part of the permit to construct meeting records.

Thank you,
Rosa Liu

CITY OF RICHMOND DATE MAR 13 2019 RECEIVED CITY CLERK'S OFFICE

9600 Granville Ave
Richmond BC V6Y 1R2

March 12, 2019

Attention: David Weber, Director, City Clerk's office

Dear Mr. David Weber:

Re: DP 16-741329, 16 two-storey townhouse

The Development Permit (DP 16-741329) panel meeting will be held tomorrow, March 13, 2019, and we have noted concerns that on the related impacts of this property development to our private residence.

Since September 2017, we have raised concerns on how development activities were causing private property damages from the development site, which may also have impacted the foundation to our house. As noted, our fence has fallen over, the sidewalk between our house and fence is shifting, and is together with a concrete pad, sloping downwards to the development site. In addition, the fence posts were ripped from the stucco house wall with the three fence gates rendered as unusable. Please see attached letter to the Developer dated March 4, 2019, including pictures.

The Developer did site inspections, and their proposed solution, as provided in the March 10th email (Appendix A), doesn't solve all of our stated concerns. This property damage is not from a long term settlement, as stated by the Developer. Besides the items the Developer's has agreed to resolve in his email dated March 10, 2019, we are requesting a professional assessment to the following:

- Inspection of the existing Retaining Wall to see if it needs to be professionally replaced, as recommended by the Developer.
- Repair/Replace the sloping concrete pad, and sidewalk, as noted.
- Examine the house foundation for damages from the property development (pre-loading soil, ground sloping/sinking, etc.).

The Developer (Mr. Khalid Hasan) has mentioned he would bring in a Professional Engineer to provide an assessment, but this has not happened yet. We encourage the City to be part of this assessment, so that city standards are maintained and considered fair and reasonable.

Any City of Richmond approved developments should not cause damage to existing properties in the neighbourhood, and if there are noted property damages this should be fully remedied by the Developer and supported by the City.

Thanks for your attention to this matter.

Sincerely,

Rosa Liu

Rosa Liu



Appendix A: Developer email, March 10, 2019

From: Team Khalid <info@khalidhasan.com>
Date: March 10, 2019 at 2:23:53 PM PDT
To: rosacga678@gmail.com
Subject: 9600 Granville Ave

Hi Rosa,

As per our meeting onsite today I confirm that we will be replacing the old fence on the East property line of our development site with a new fence and retaining wall as per requirements of City of Richmond and our landscape proposal as part of development and it also includes a new perimeter drainage.

The current retaining wall between our property and your property is still seems like in good shape as per our visual inspection today and seems like it is installed on our property but We will confirm from the surveyor about the exact location of the old retaining wall. With your written permission we can remove the existing old fence(on your property) and dispose off at our costs and will install new fence and replace the wooden gates as discussed at our costs for you. We will install the new retaining wall as per the requirements of the city of Richmond at our cost also.

The concrete sidewalks which are sloping away from your building seems like a result of long term soil settlement as evident from the North West corner sidewalk of your home.

The installation work for the retaining wall and fence will start in first week of April 2019 and should be completed with in 3 weeks. You can keep this email as our agreement to do the above work as described.

If you have any further questions please let us know.

0908206 BC Ltd
Khalid Hasan
604-786-8960
Sent from my iPhone

9600 Granville Ave
Richmond BC V6Y 1R2

March 4, 2019

Dear Nauman:

Re: property damage caused by your development site at 9560/9580/9584 Granville Ave. Richmond BC

We are concerned on the discussed property damage (sidewalk, patio concrete pad, fence and three fence gates) that is occurring to our private residence on 9600 Granville St. Richmond BC V6Y 1R2. Our claim is that a retaining wall should have been considered when we first notified you in 2017, and now we have additional property damage, and would like to know when these will be resolved by you prior to the review of your Development Permit (DP 16-741329) on March 13, 2019.

The actions we have taken with you, are summarized below, and show that if the retaining wall was supported correctly by you in September 2017, much of the subsequent property damage could have been avoided.

Record of Actions:

1. First contact notification: Sept 23, 2017, contacted KHALID (604.786.8960) indicating that fence was falling over, and was re-directed to contact you (604.500.9922). Sept 25 fence partially repaired with a piece of plywood nailed to fence post, and a one 2x4 cross beam as indicated in picture attached.
2. Texted you on Feb 10th, 2019 regarding more damage to fence and patio, and requested a site inspection (done on Feb 21, 2019) to the following new house damage:
    - 2 fence gates that were anchored to the house w/ metal spikes, were now ripped from the stucco wall - leaving holes in stucco wall, 2 side gates were now unusable, and gate spikes now exposed and considered dangerous;
    - Back door patio concrete slab was significantly cracked and separated into 2 slabs, where the one was slanting down to the fence area;
    - Side-walk between house and fence was inspected and noted to be gapping away from the house and sloping to the fence;
    - Back gate and fence between carport and house noted as unaligned and sloping to the Development site

Outcome of the Feb 21, 2019 site inspection concluded by you was that more soil was going to be added, and that the person who does this work would not be available until March 3, 2019. A request was made to get it done as early as possible to stop the continued effects on our private residence from this dangerous exposure.

Contacted you again on Feb 26th requesting an update on site inspection actions and received response that dirt would be backfilled and support to the retaining wall would be provided as a possible solution.

CITY OF RICHMOND
DATE
MAR 13 2019
RECEIVED
CITY CLERK'S OFFICE

We would like to have this resolved amicably, but we feel that given our communications with you since September 2017 that we must now have immediate action, and a formal repair plan approved before further damage is done and continues to occur. We are grateful that you have recently agreed to have the retaining wall supported properly, but we must ensure that this is done in accordance with good engineering standards to prevent further property damage (house structural and/or foundation).

Please contact Rosa Liu at 778-388-8598 or Dean Featherling at 778-960-0324 regarding this matter.

Thank you for your immediate attention to this matter. We are looking forward to hearing from you.

Yours truly,

Rosa Liu

Attachment: seventeen pictures

backyard



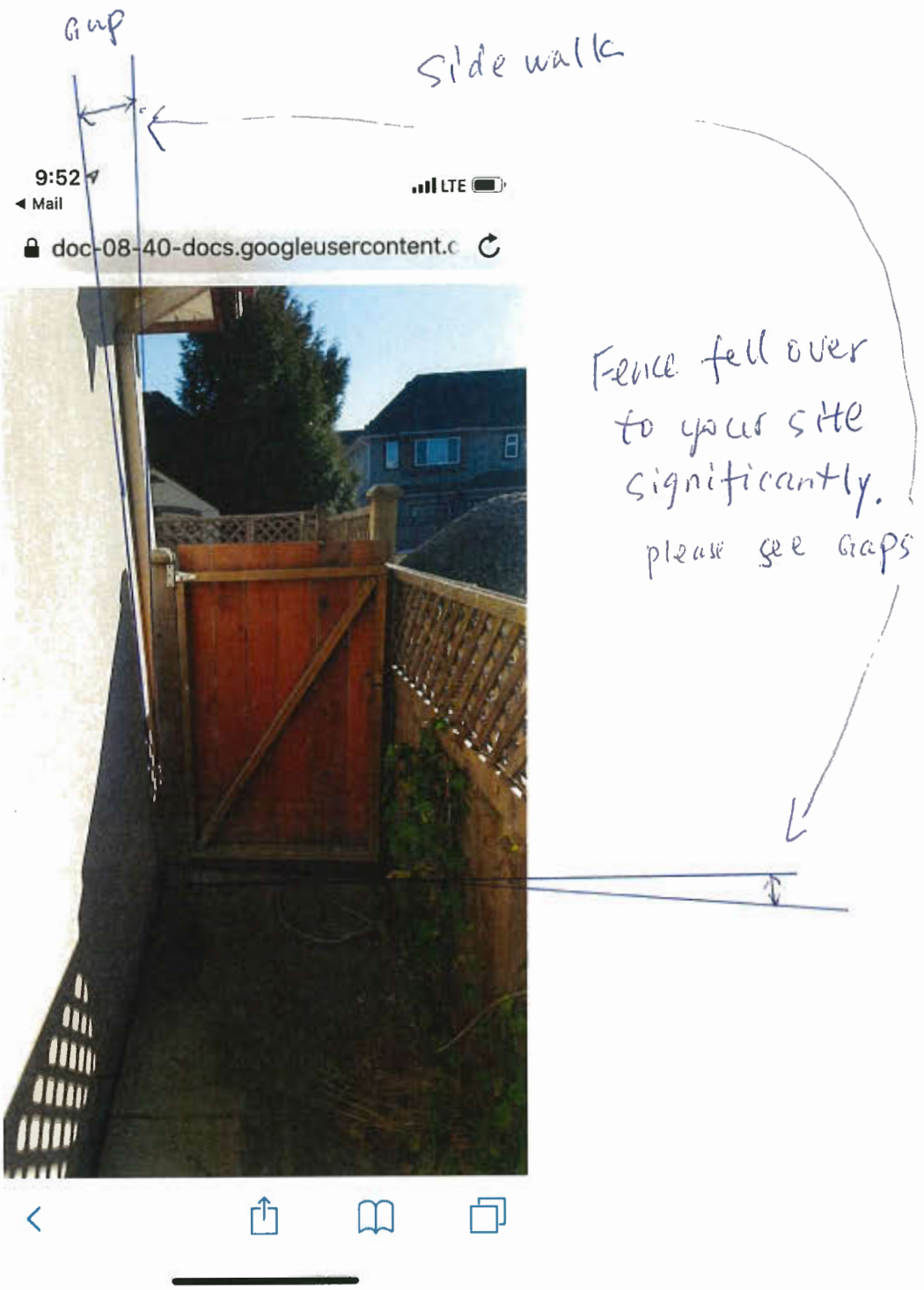
- cracked
- Gap gets bigger

Gap

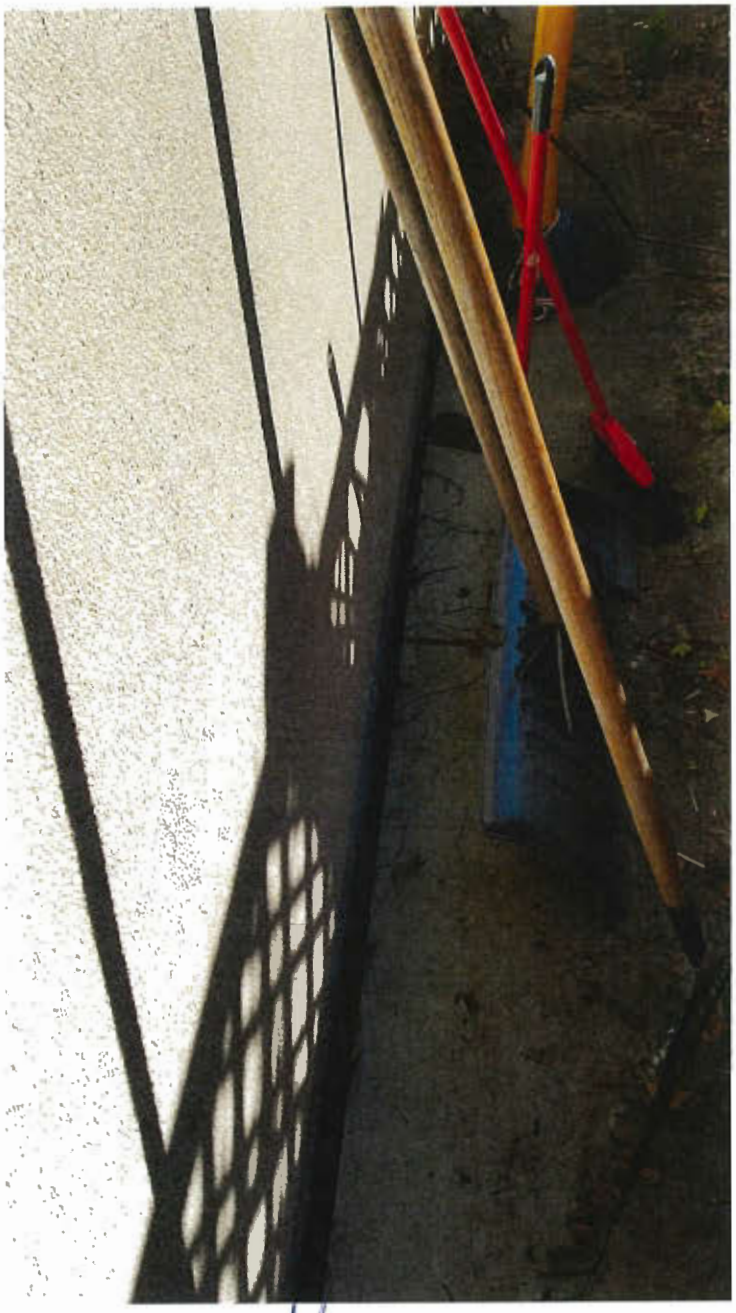
Side walk
between your site and my house



- Fence fell over to your site
- Fence post ripped off from stucco wall
- damages on stucco wall


Gap
Side walk
9:52
Mail
LTE
doc-08-40-docs.googleusercontent.c
Fence fell over to your site significantly.
please see Gaps

Sidewalk



Side walk
- Concrete Pad
Slop to your
Site away from
house foundation
- please see Gap
in the picture

Gap

back yard



-> cracked

-> Gap gets bigger

-> elevation created in between concrete pads.

Front Yard

elevation
Created a
-> sloping
to your
site

elevation

created

back yard

back yard



original line

backyard has sunk significantly.

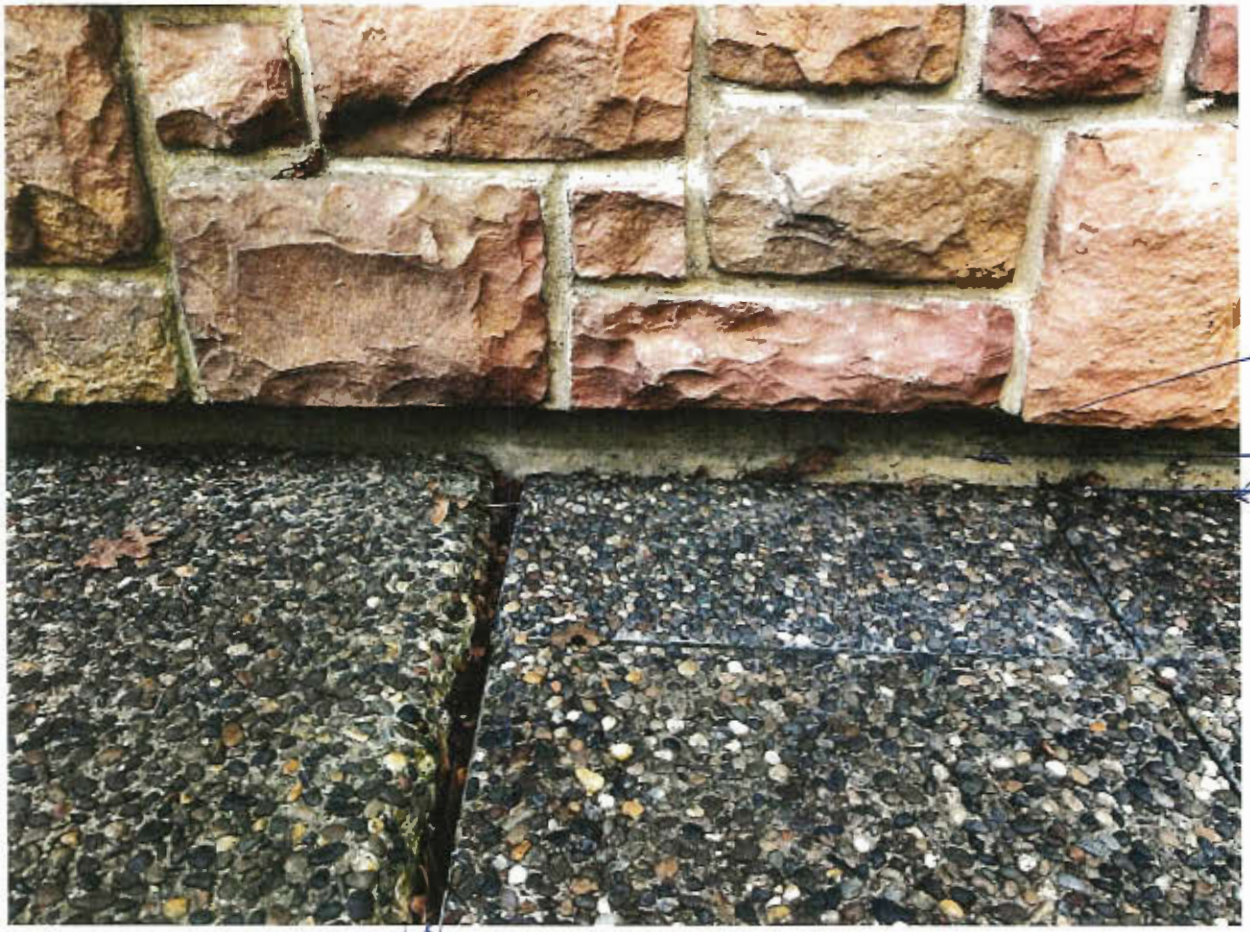
new line

CNCL - 586

back Yard

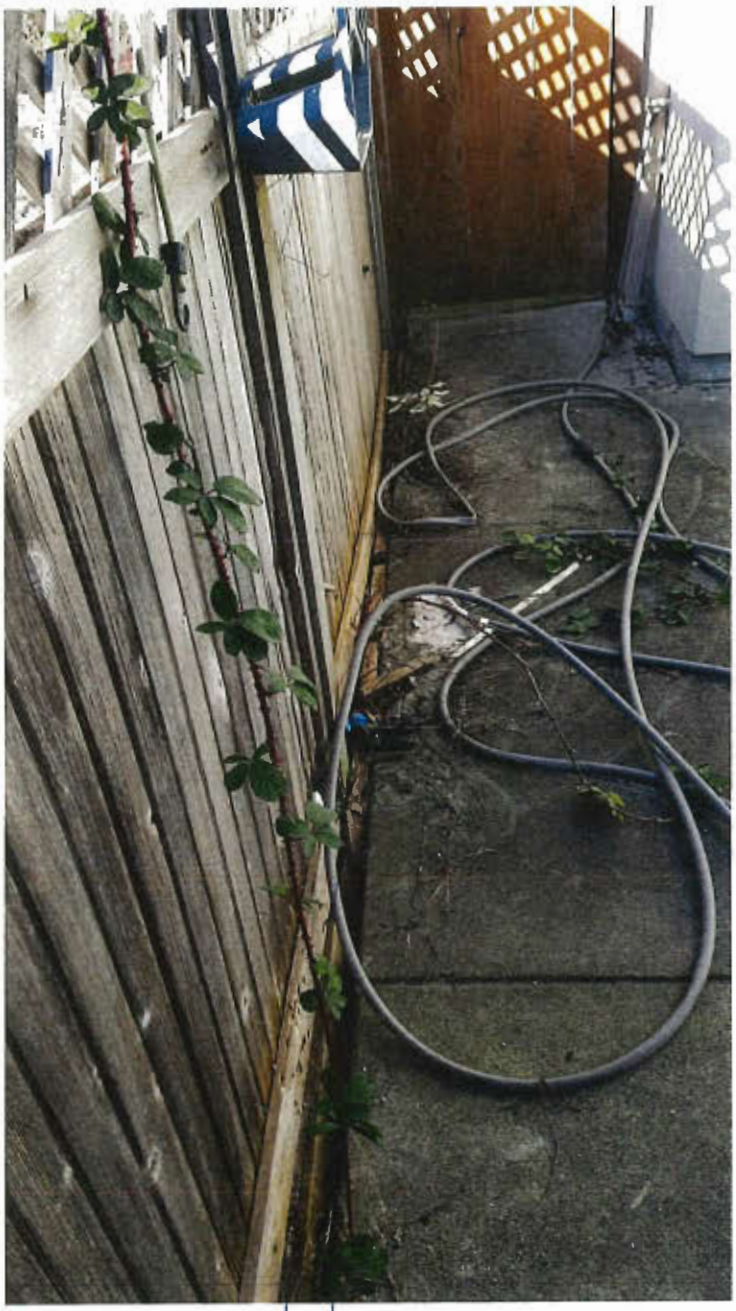

gap
now
original
gap
- concrete pads
slopping to
your site.
- huge gap
has been
created
→ cracked
see highlighted
in green

Front Yard



CNCL - 588

back yard



Huge Gap has been created because fences fell over to your site



- 2x4 cross beam supporting fence from tally over

→ see the damage on fence.

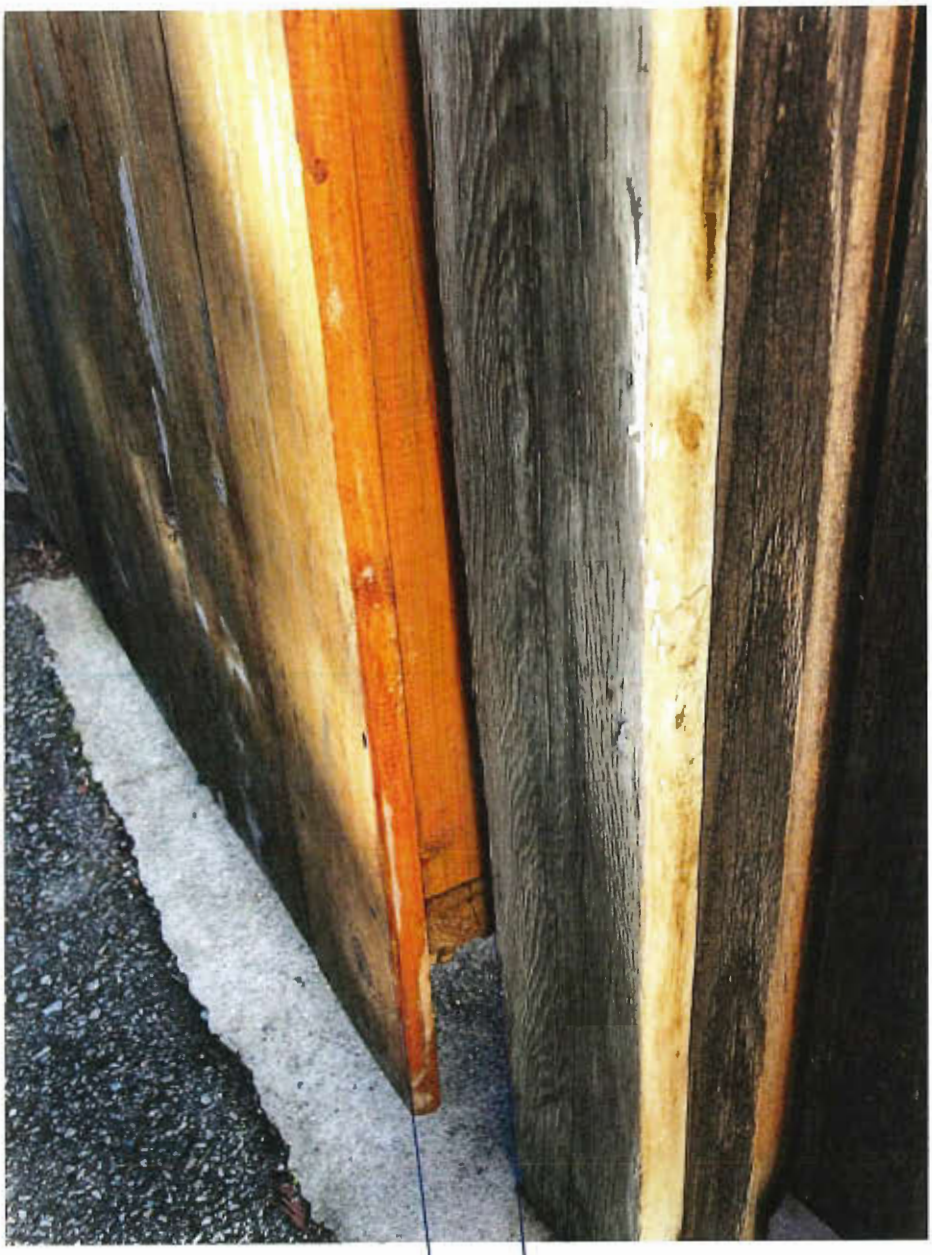
Front Yard



- Concrete pad at front yard has sunk.
- Big gap has been created

CNCL - 591

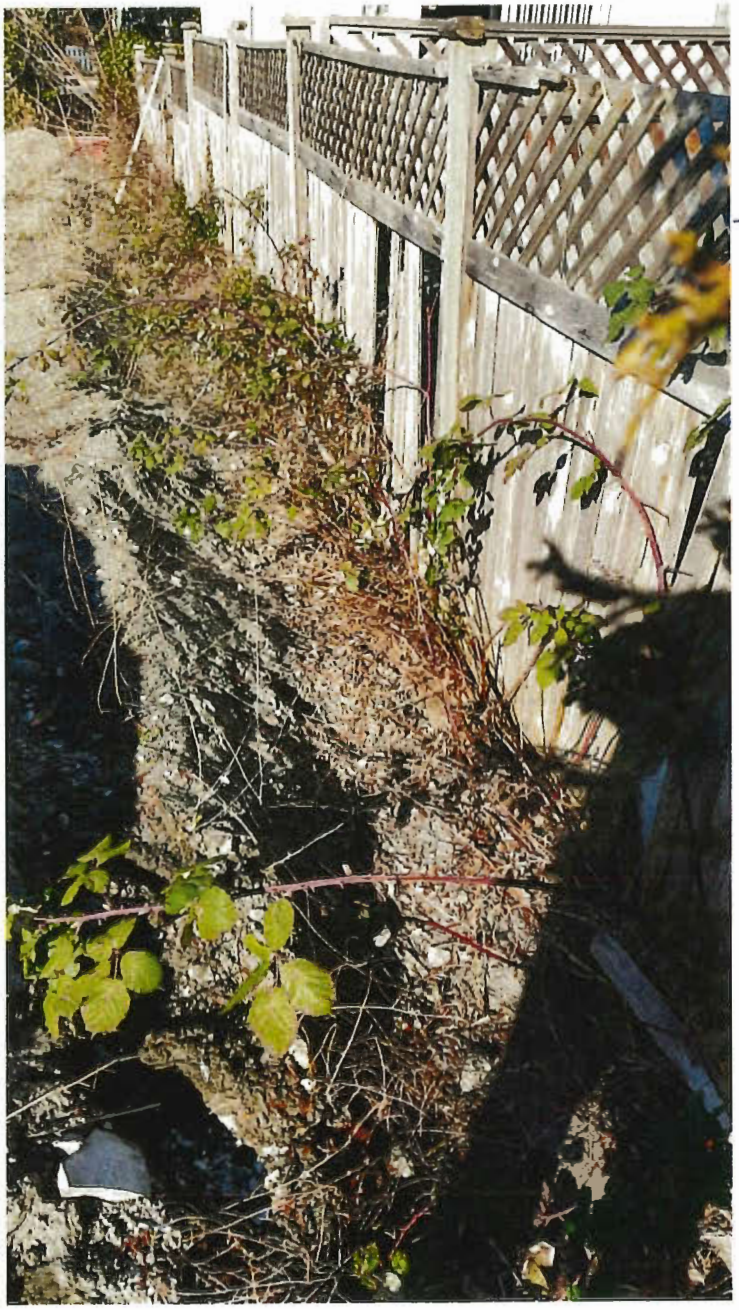
Back Yard.



-Gate has been out of alignment

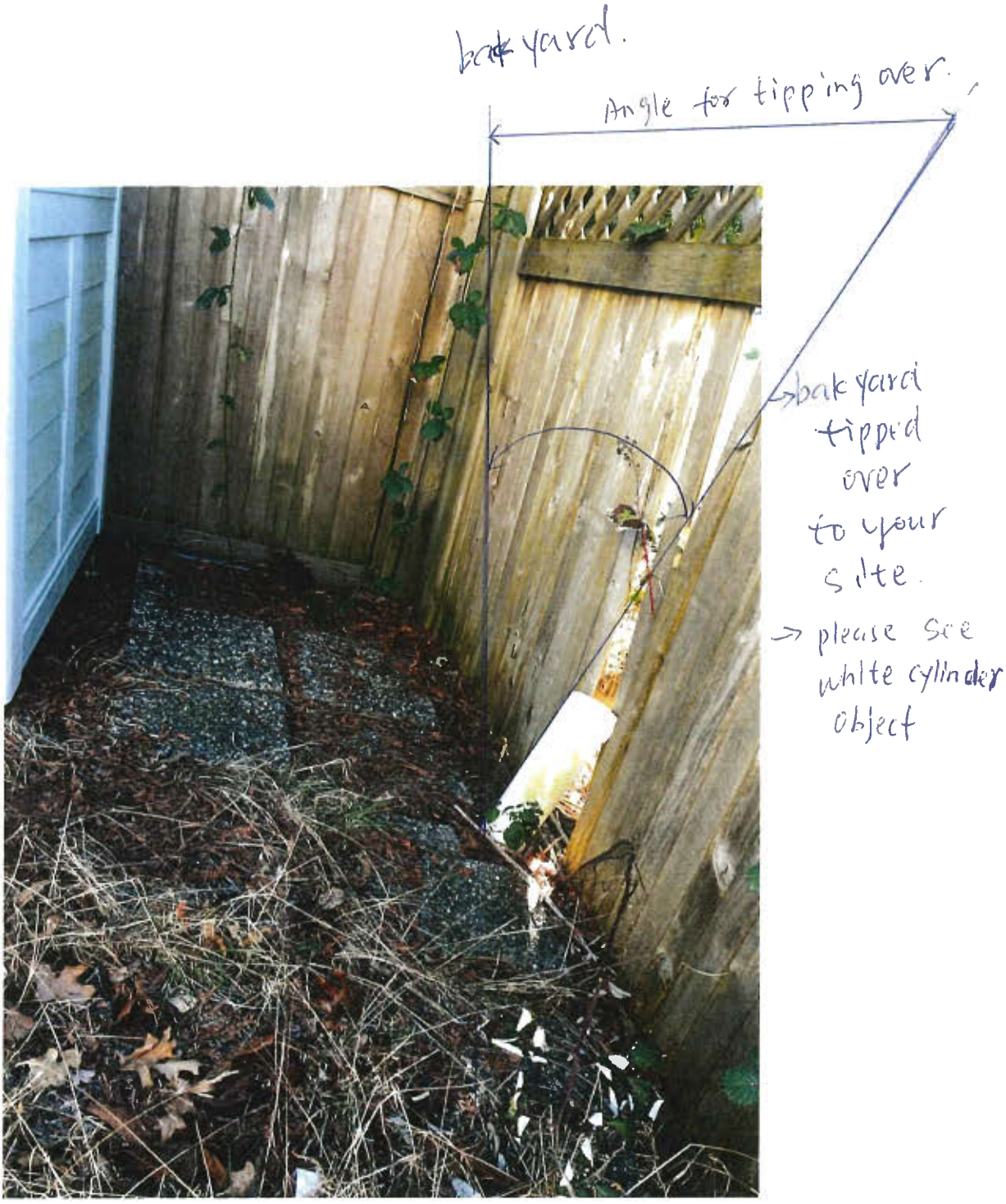
→ See gap in picture

Fence



→ No retaining wall

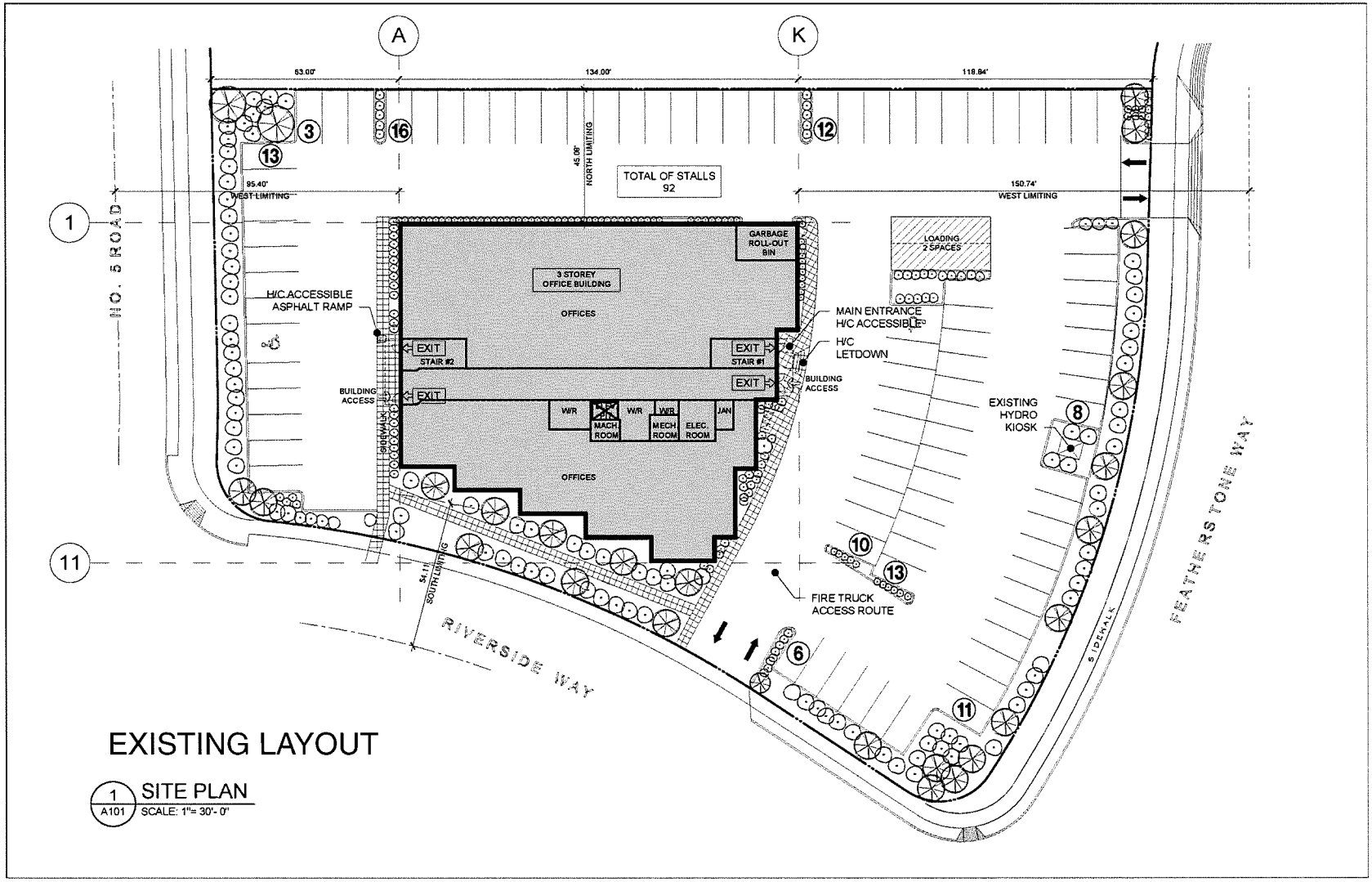
→ No support

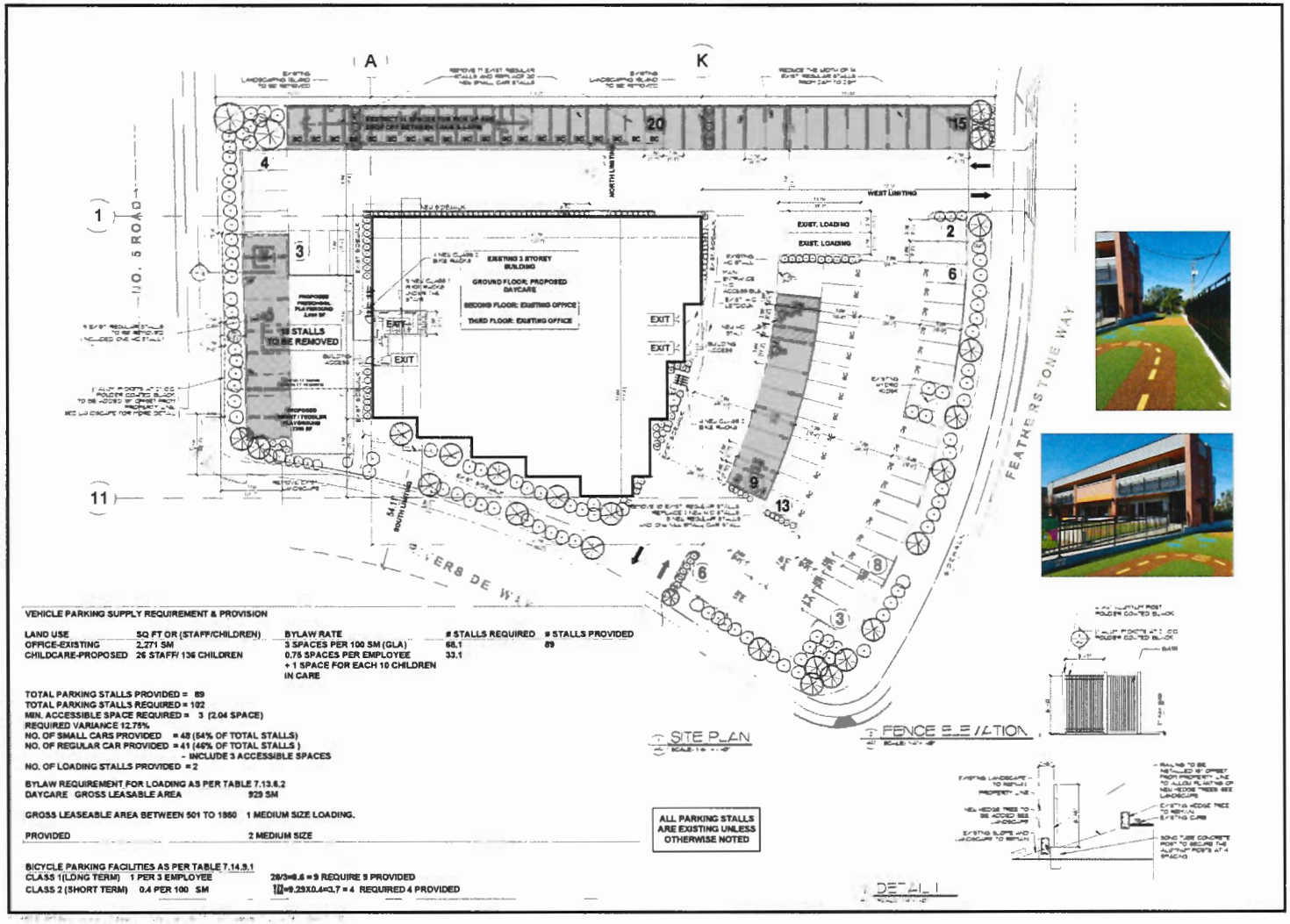

bak yard.
Angle for tipping over.
→bak yard tipped over to your site.
→ please see white cylinder object

Side walk
near front yard



Fence post
ripped off
from stucco
wall.


A
K
53.00'
134.00'
118.84'
TOTAL OF STALLS
92
95.40'
WEST LIMITING
45.06'
NORTH LIMITING
150.74'
WEST LIMITING
NO. 5 ROAD
1
11
3 STOREY
OFFICE BUILDING
OFFICES
OFFICES
GARBAGE
ROLL-OUT
BIN
LOADING
2 SPACES
H/C ACCESSIBLE
ASPHALT RAMP
MAIN ENTRANCE
H/C ACCESSIBLE
H/C
LETDOWN
EXIT
STAIR #2
EXIT
STAIR #1
EXIT
EXIT
BUILDING
ACCESS
BUILDING
ACCESS
W/R
W/R
W/R
JAN
MACH.
ROOM
MECH.
ROOM
ELEC.
ROOM
EXISTING
HYDRO
KIOSK
SIDEWALK
54.11'
SOUTH LIMITING
RIVERSIDE WAY
FIRE TRUCK
ACCESS ROUTE
SIDEWALK
FEATHERSTONE WAY
EXISTING LAYOUT
1
A101
SITE PLAN
SCALE: 1"= 30'- 0'



VEHICLE PARKING SUPPLY REQUIREMENT & PROVISION

LAND USE	SQ FT OR (STAFF/CHILDREN)	BYLAW RATE	# STALLS REQUIRED	# STALLS PROVIDED
OFFICE-EXISTING	2,271 SM	3 SPACES PER 100 SM (GLA)	68.1	89
CHILDCARE-PROPOSED	26 STAFF/ 136 CHILDREN	0.75 SPACES PER EMPLOYEE + 1 SPACE FOR EACH 10 CHILDREN IN CARE	33.1	

TOTAL PARKING STALLS PROVIDED = 89
TOTAL PARKING STALLS REQUIRED = 102
MIN. ACCESSIBLE SPACE REQUIRED = 3 (2.04 SPACE)
REQUIRED VARIANCE 12.75%
NO. OF SMALL CARS PROVIDED = 48 (54% OF TOTAL STALLS)
NO. OF REGULAR CAR PROVIDED = 41 (46% OF TOTAL STALLS)
- INCLUDE 3 ACCESSIBLE SPACES
NO. OF LOADING STALLS PROVIDED = 2

BYLAW REQUIREMENT FOR LOADING AS PER TABLE 7.13.6.2
DAYCARE GROSS LEASABLE AREA 929 SM

GROSS LEASEABLE AREA BETWEEN 501 TO 1860 1 MEDIUM SIZE LOADING.

PROVIDED 2 MEDIUM SIZE

ALL PARKING STALLS ARE EXISTING UNLESS OTHERWISE NOTED

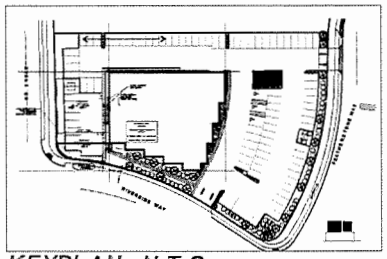
BICYCLE PARKING FACILITIES AS PER TABLE 7.14.9.1
CLASS 1(LONG TERM) 1 PER 3 EMPLOYEE 26/3=8.6 = 9 REQUIRE 9 PROVIDED
CLASS 2 (SHORT TERM) 0.4 PER 100 SM 1000=9.25X0.4=3.7 = 4 REQUIRED 4 PROVIDED

New Child Care Centre

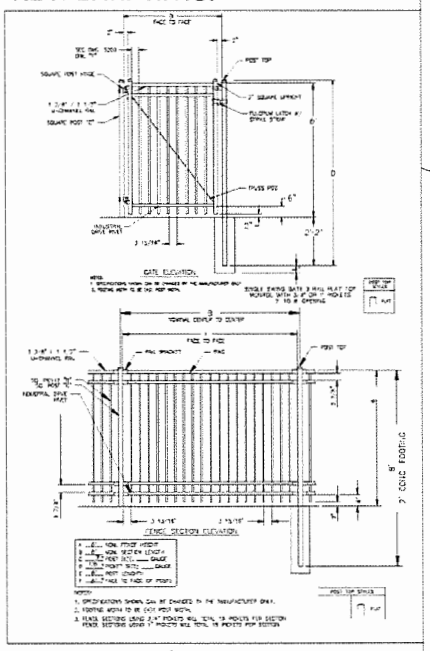
12033 Riverside Way, Richmond, BC

For: WILLOWBRAE ACADEMY CORPORATE

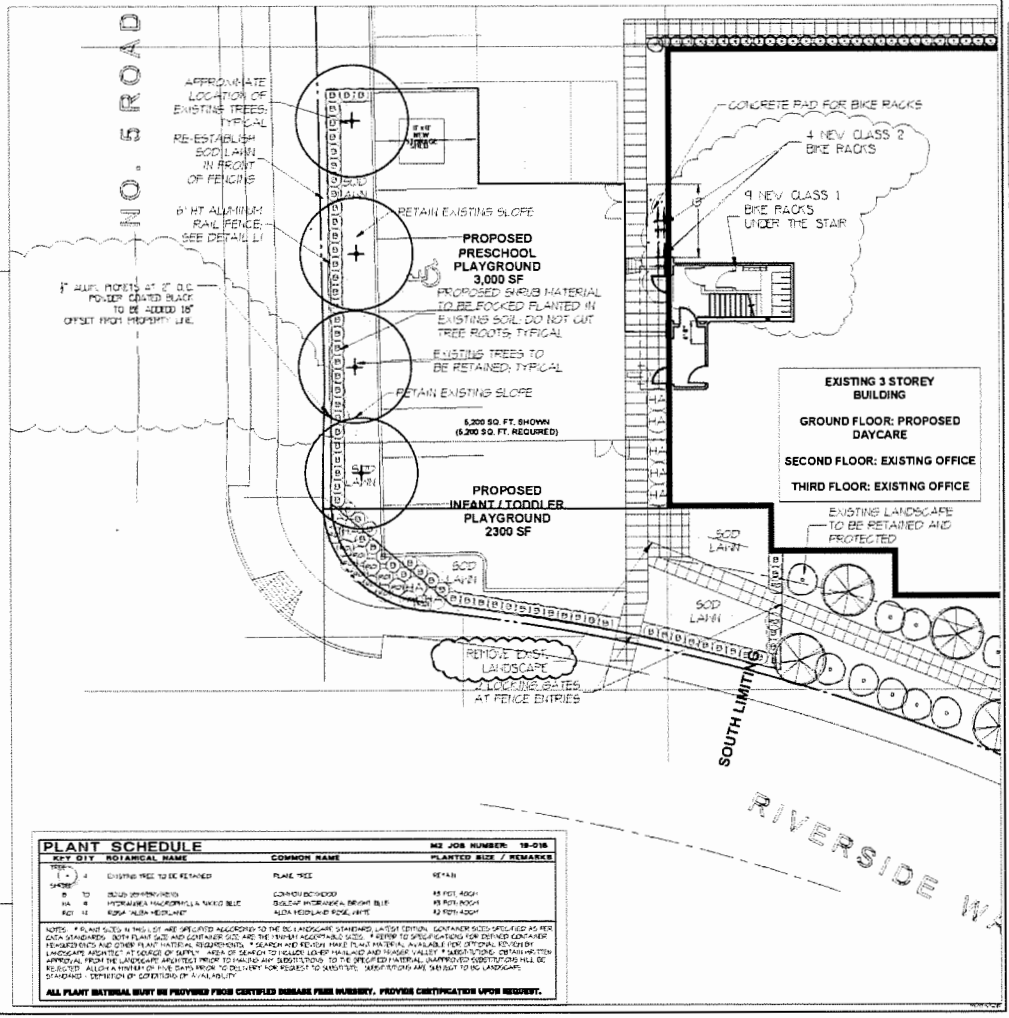
SITE PLAN



KEYPLAN: N.T.S.



FENCE DETAIL; ½"=1'-0"



PLANT SCHEDULE

M2 JOB NUMBER: 19-016

KEY	QTY	BOTANICAL NAME	COMMON NAME	PLANTED SIZE / REMARKS
TREES	4	EXISTING TREE TO BE RETAINED	PLANT TREE	RETAIN
SHRUBS				
BB	10	BERBERIS THUNBERGII	COMMON BARBERRY	#5 POT, 600CM
HA	8	HYDRANGEA MACROPHYLLA 'MAGICO BLUE'	MAGICAP HYDRANGEA 'BRIGHT BLUE'	#5 POT, 800CM
RGY	12	ROSA 'ALBA MEIDILAND'	ALBA MEIDILAND ROSE, WHITE	#2 POT, 400CM

NOTES: * PLANT SIZES IN THIS LIST ARE SPECIFIED ACCORDING TO THE BCLA LANDSCAPE STANDARD, LATEST EDITION. CONTAINER SIZES SPECIFIED AS PER BCNTA STANDARDS. BOTH PLANT SIZE AND CONTAINER SIZE ARE THE MINIMUM ACCEPTABLE SIZES. * REFER TO SPECIFICATIONS FOR DEFINED CONTAINER HANDLING ETC. AND OTHER PLANT MATERIAL REQUIREMENTS. * SEARCH AND REVIEW MAY BE REQUIRED FOR SPECIAL PLANT MATERIAL AVAILABILITY FOR OPTIONAL REVIEW BY LANDSCAPE ARCHITECT AT SOURCE OF SUPPLY. AREA OF SEARCH TO INCLUDE LOWER MAINLAND AND FRASER VALLEY. * SUBSTITUTIONS: OBTAIN WRITTEN APPROVAL FROM THE LANDSCAPE ARCHITECT PRIOR TO MAKING ANY SUBSTITUTIONS TO THE SPECIFIED MATERIAL. UNAPPROVED SUBSTITUTIONS WILL BE REJECTED. ALLOW A MINIMUM OF FIVE DAYS PRIOR TO DELIVERY FOR REQUEST TO SUBSTITUTE. SUBSTITUTIONS ARE SUBJECT TO ING LANDSCAPE STANDARD - DEFINITION OF CONDITIONS OF AVAILABILITY.

ALL PLANT MATERIAL MUST BE PROVIDED FROM CERTIFIED DISEASE FREE NURSERY. PROVIDE CERTIFICATION UPON REQUEST.

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M2
LANDSCAPE ARCHITECTURE
#220 - 26 Lorne Mews
New Westminster, British Columbia
V3M 3L7
Tel: 604.553.0044
Fax: 604.553.0045
Email: office@m2la.com

NO	DATE	REVISION DESCRIPTION	DR.

SEAL

PROJECT

DAYCARE RENO
12033 RIVERSIDE WAY
RICHMOND, B.C.

DRAWING TITLE

LANDSCAPE PLAN

DATE: APR/20/19	DRAWING NUMBER:
SCALE: 1/8"=1'-0"	L1
DRAWN: MCH	
DESIGN: MCH	
CHK'D	OF 2
M2LA PROJECT NUMBER:	19-016



Southwest View

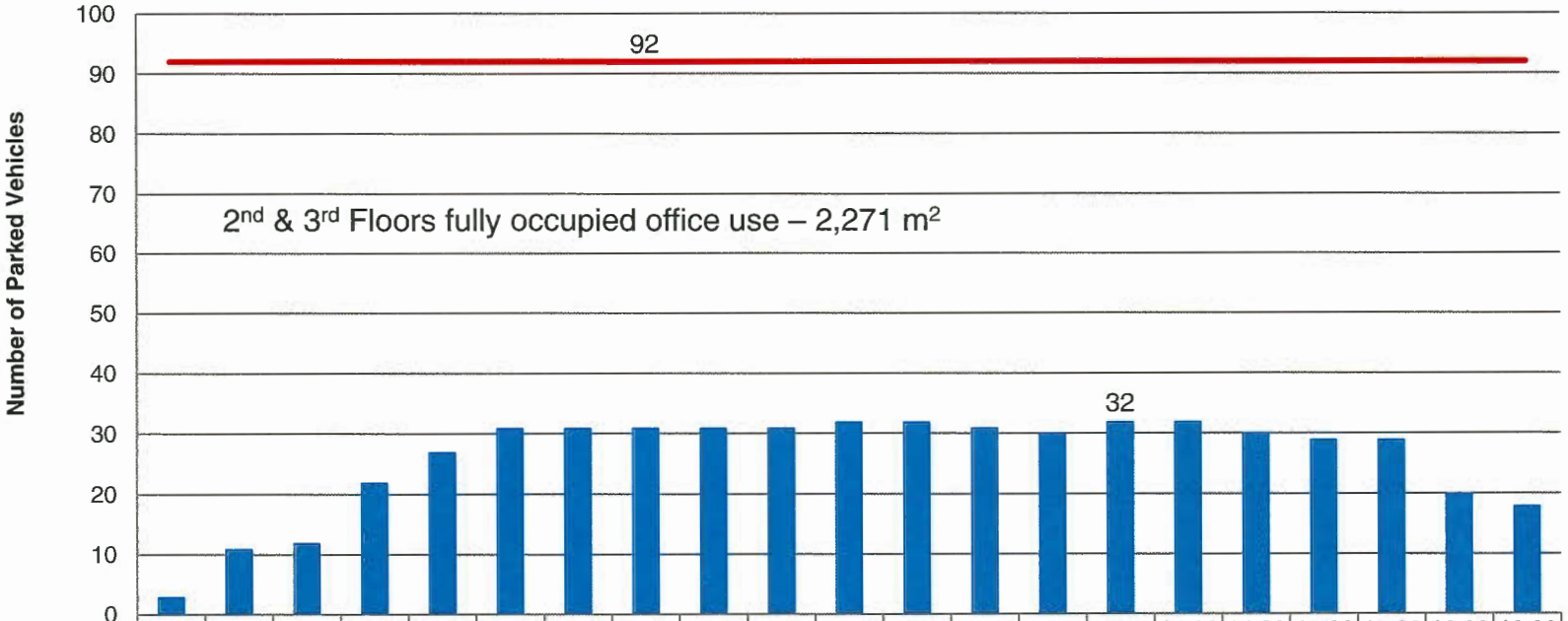


West View

Image from Google Street View

OBSERVED SITE PARKING DEMAND

Wednesday, April 25, 2018



	06:30	07:00	07:30	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:20
Parking Demand	3	11	12	22	27	31	31	31	31	31	32	32	31	30	32	32	30	29	29	20	18
Supply	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92	92

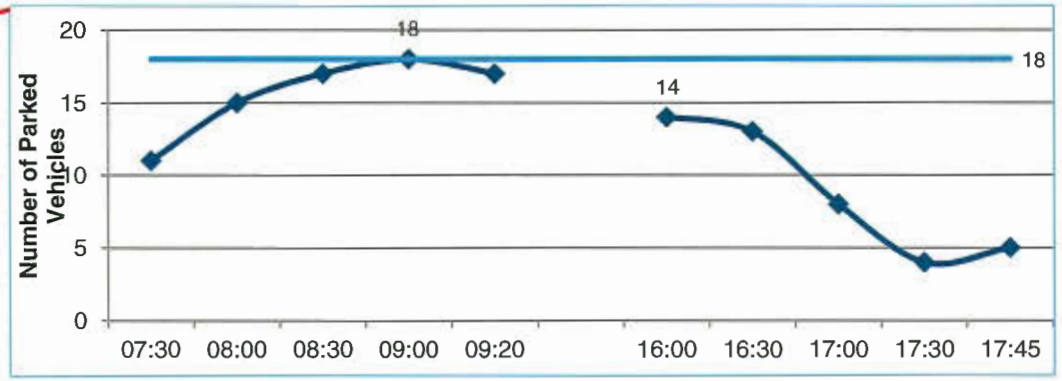
OBSERVED PARKING DEMAND at OTHER OFFICE LOCATIONS

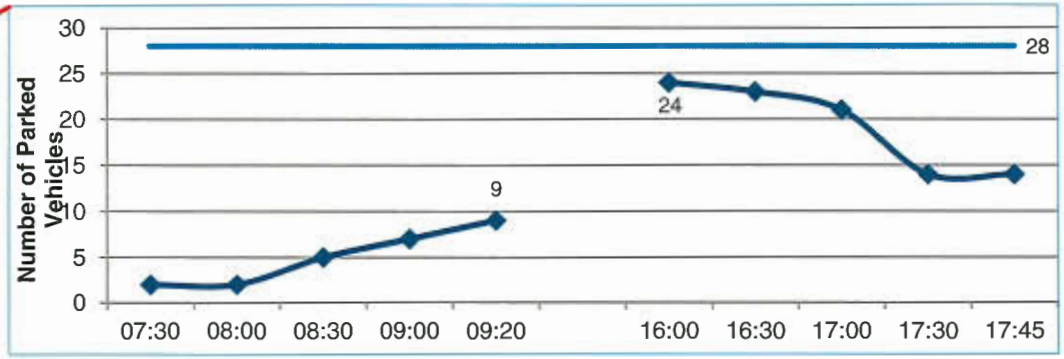
OFFICE ADDRESS	LEASEABLE FLOOR AREA	SUPPLY RATE (/ 100 M²)	SPACES SUPPLIED	PEAK DEMAND	OCCUPANCY	PEAK DEMAND RATE (/ 100 M²)
Fleetwood Office 1	2,000 m²	2.9	57	47	82 %	2.35
Fleetwood Office 2	1,950 m²	2.7	53	23	43 %	1.18
Panorama Office	2,460 m²	2.4	60	18	30 %	0.73
Cloverdale Office	3,600 m²	1.3	47	24	51 %	0.67
Newton Office	6,847 m²	3.1	214	119	56 %	1.74
Subject site: 12033 Riverside Way	2,271 m²	4.1	92	32	35 %	1.41
					WEIGHTED AVERAGE PEAK PARKING DEMAND RATE (PER 100 M²)	1.37
					85%ILE PEAK DEMAND RATE (PER 100 M²)	1.89

ON-STREET PARKING DEMAND

Wednesday, September 5, 2018







OBSERVED CHILDCARE PARKING DEMAND

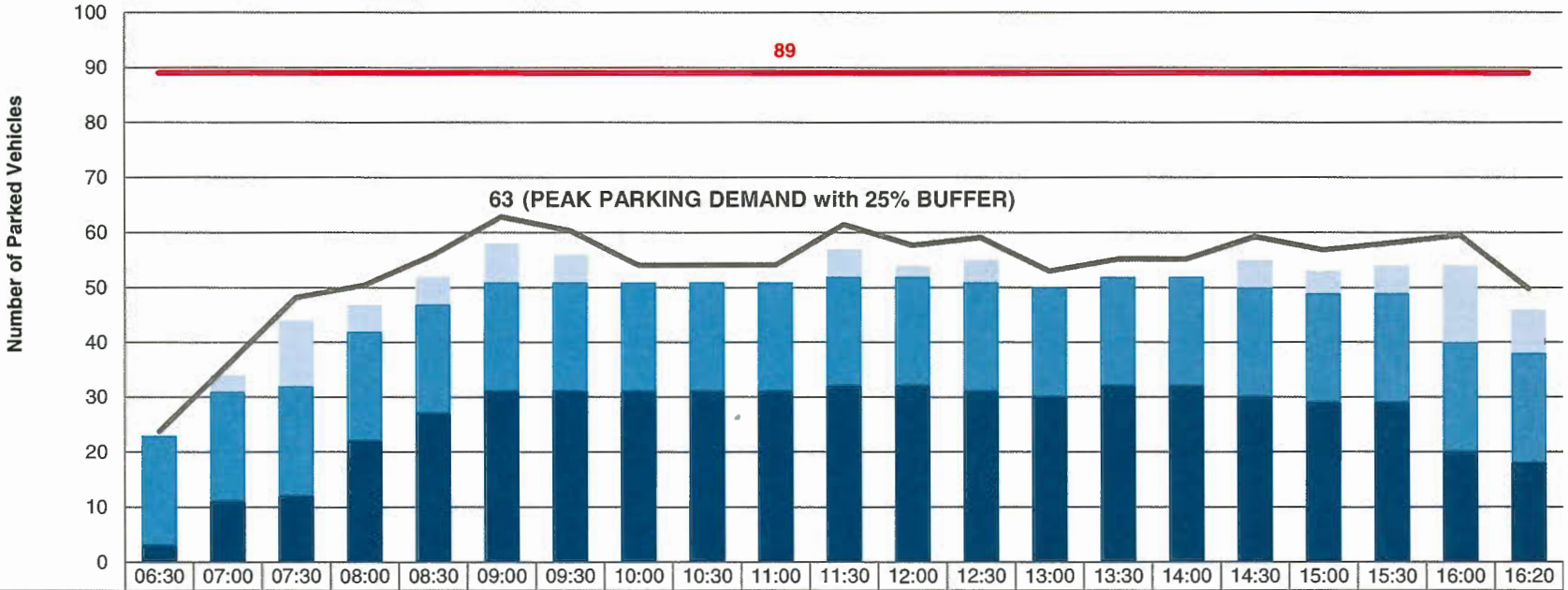
CHILDCARE ADDRESS	MAX # OF CHILDREN	# OF EMPLOYEES	ESTIMATED STAFF PARKING DEMAND (# PER STAFF)	PUDO MAX OCCUPANCY	PUDO SPACE PER CHILD
Fleetwood Childcare 1	20	2	1 (0.5)	6	0.30
Cloverdale Childcare	100	18	9 (0.5)	13	0.13
Fleetwood Childcare 2	30	9	N/A [1]	7	0.10
Newton Childcare	55	9	4 (0.4)	6	0.11
		AVERAGE RATE	0.5		0.15

PROJECTED INDIVIDUAL PEAK PARKING DEMAND

Component	PEAK DEMAND RATE	SIZE	# STALLS
Office	1.41 per 100 m^2	2,271 m^2	32
Childcare staff	0.75 per staff	26 staff	20
Childcare pick-up/drop-off	0.1 per child	136 children	14
	TOTAL		**66**

Office parking demand peaks after childcare drop-off activity and declines before childcare pick-up activity

PROJECTED PARKING DEMAND PROFILES



	06:30	07:00	07:30	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:20
DAYCARE PUDO	0	3	12	5	5	7	5	0	0	0	5	2	4	0	0	0	5	4	5	14	8
DAYCARE-STAFF	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
OFFICE	3	11	12	22	27	31	31	31	31	31	32	32	31	30	32	32	30	29	29	20	18
DEMAND W BUFFER	24	36	48	50	56	63	60	54	54	54	61	58	59	53	55	55	59	57	58	60	50
SUPPLY	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89

PROPOSED TDM MEASURES

- **End of Trip Facilities**
  - Clothing lockers
  - Barrier free washroom with washbasin
  - Shower
- **Transit Pass for Childcare Staff**

  Two zone monthly pass for 2-years

City of Richmond

Report to Council

To:	Richmond City Council	**Date:**	March 20, 2019
From:	John Irving Chair, Development Permit Panel	**File:**	01-0100-20-DPER1-01/2019-Vol 01
Re:	**Development Permit Panel Meeting Held on February 27, 2019**		

Staff Recommendation

That the recommendation of the Panel to authorize the issuance of a Development Permit (DP 18-818762) for the property at 13100 Smallwood Place be endorsed, and the Permit so issued.

John Irving
Chair, Development Permit Panel
(604-276-4140)

SB:blg

Panel Report

The Development Permit Panel considered the following item at its meeting held on February 27, 2019.

DP 18-818762 – CHRISTOPHER BOZYK ARCHITECTS ON BEHALF OF OPEN ROAD TOYOTA – 13100 SMALLWOOD PLACE
(February 27, 2019)

The Panel considered a Development Permit application to permit the construction of two additional floors of parking/vehicle inventory storage overtop of the existing Toyota dealership on a site zoned "Vehicle Sales (CV)". Variances are included in the proposal for increased building height to accommodate: rooftop parking, roof parapet, stair and an elevator access to the rooftop parking.

Keiran Walsh, of Christopher Bozyk Architects, Inc., provided a brief presentation, noting:

- Two additional levels of parkade are proposed over the originally approved two-level car dealership building.
- The relocation of the garbage and recycling facility is proposed to facilitate easier pick-up.
- The removal of 20 surface parking spaces allows for increased landscaping on the site.
- The number of native species proposed to be planted on-site has been increased.
- Perforated cadmium white cladding panels are proposed for the additional two levels of parkade, which integrate well with the existing material and colour palette of the building and allow natural ventilation and lighting into the parkade.
- The proposed rooftop solar panels are a significant sustainability feature of the proposal.

Staff noted that: (i) the Servicing Agreement associated with the original rezoning and Development Permit applications for the site includes frontage works and site service connections; (ii) electric vehicle charging stations are proposed on-site; and (iii) 107 rooftop solar panels will be installed in the proposed development.

In reply to Panel queries, Mr. Walsh advised that: (i) a building height variance is proposed; (ii) increased planting is proposed along the Westminster Road frontage; (iii) the location of the rooftop solar panels was determined through a shadow study; (iv) three electric vehicle charging stations will be provided on-site and available for public use; (v) there will be an increase in shadowing as a result of the proposed increase in building height; (vi) the building structure was designed to accommodate the weight of the additional levels of parkade; and (vii) the proposed cladding material additional levels of parkade does not pose a potential bird strike issue.

The Panel expressed support for the project and appreciated the proposed façade treatment for the additional levels of parkade and the provision of rooftop solar panels on the building.

No correspondence was submitted to the Panel regarding the Development Permit application.

The Panel recommends the Permit be issued.