City of Richmond

Agenda

Public Works and Transportation Committee

Anderson Room, City Hall
6911 No. 3 Road

Wednesday, June 19, 2019
4:00 p.m.

Pg. # ITEM

MINUTES

PWT-5 ***Motion to adopt the minutes of the meeting of the Public Works and Transportation Committee held on May 23, 2019.***

NEXT COMMITTEE MEETING DATE

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

PLANNING AND DEVELOPMENT DIVISION

1. **TRANSLINK-METRO VANCOUVER 2018 REGIONAL PARKING STUDY- KEY FINDINGS**
(File Ref. No. 01-0157-01) (REDMS No. 6183199 v. 2)

PWT-10 See Page **PWT-10** for full report

Designated Speaker: Sonali Hingorani

STAFF RECOMMENDATION

That the staff report titled "TransLink-Metro Vancouver 2018 Regional Parking Study – Key Findings" dated May 10, 2019, from the Director, Transportation, regarding vehicle parking supply and demand at residential and mixed use developments across the region, be received for information.

2. **MULTI-PASSENGER BICYCLE BUSINESS PROPOSAL**
(File Ref. No. 12-8275-06) (REDMS No. 6182789)

PWT-18 See Page **PWT-18** for full report

Designated Speaker: Sonali Hingorani

STAFF RECOMMENDATION

That a sole business licence for a quadricycle to be operated by Brew Bike Tours as a pilot program in Steveston Village be issued subject to the terms and conditions outlined in the attached staff report titled "Multi-Passenger Bicycle Business Proposal" dated June 4, 2019 from the Director, Transportation.

3. **REVIEW OF COLLISION PRONE INTERSECTIONS**
(File Ref. No. 10-6450-09-01) (REDMS No. 6188336 v. 6)

PWT-24 See Page **PWT-24** for full report

Designated Speaker: Fred Lin

STAFF RECOMMENDATION

(1) That the proposed short-term improvements, with respect to the top 20 high collision intersections in Richmond, be included in the 5 Year (2020-2024) Financial Plan, as outlined in the staff report titled "Review of Collision Prone Intersections" dated May 17, 2019 from the Director, Transportation; and

(2) That the City request the Minister of Public Safety and Solicitor General to provide automated speed enforcement technology at those intersections where the data indicates that speeding is a contributing factor to collisions.

ENGINEERING AND PUBLIC WORKS DIVISION

4. **CITY CENTRE DISTRICT ENERGY UTILITY BYLAW NO. 9895, AMENDMENT BYLAW NO. 10012**
(File Ref. No. 12-8060-20-01012) (REDMS No. 6147348 v. 9; 6147412)

PWT-81 See Page **PWT-81** for full report

Designated Speaker: Alen Postolka

STAFF RECOMMENDATION

That the City Centre District Energy Utility Bylaw No. 9895, Amendment Bylaw No. 10012 presented in the "City Centre District Energy Utility Bylaw No. 9895, Amendment Bylaw No. 10012" report dated April 29, 2019, from the Senior Manager, Sustainability and District Energy be introduced and given first, second, and third readings.

5. **2018 ANNUAL WATER QUALITY REPORT**
(File Ref. No. 10-6000-00) (REDMS No. 6183337)

PWT-91 See Page **PWT-91** for full report

Designated Speaker: Bryan Shepherd

STAFF RECOMMENDATION

That the staff report titled "2018 Annual Water Quality Report" dated May 6, 2019 from the Director, Public Works, be endorsed and made available to the community through the City's website and through various communication tools including social media and as part of community outreach activities.

6. **STEVESTON ISLAND FLOOD PROTECTION UPDATE**
(File Ref. No. 10-6060-04-01) (REDMS No. 6193875 v. 7)

PWT-190 See Page **PWT-190** for full report

Designated Speaker: Jason Ho

STAFF RECOMMENDATION

That the staff report titled "Steveston Island Flood Protection Update", dated May 17, 2019 from the Acting Director, Engineering, be received for information.

7. **FLOOD PROTECTION MANAGEMENT STRATEGY 2019 - FINAL REPORT**
(File Ref. No. 10-6060-04-01) (REDMS No. 6161241 v. 7)

PWT-201 See Page **PWT-201** for full report

Designated Speaker: Jason Ho

STAFF RECOMMENDATION

That the "Flood Protection Management Strategy 2019" attached to the staff report titled, "Flood Protection Management Strategy 2019 – Final Report", dated May 17, 2019 from the Acting Director, Engineering, be endorsed.

8. **MANAGER'S REPORT**

ADJOURNMENT

City of Richmond

Minutes

Public Works and Transportation Committee

Date:	Thursday, May 23, 2019
Place:	Anderson Room Richmond City Hall
Present:	Councillor Chak Au, Chair Councillor Linda McPhail Councillor Kelly Greene Councillor Alexa Loo Councillor Michael Wolfe
Also Present:	Councillor Carol Day – entered at 4:05 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 Public Works and Transportation Committee held on April 17, 2019, be adopted as circulated.

CARRIED

NEXT COMMITTEE MEETING DATE

June 19, 2019, (tentative date) at 4:00 p.m. in the Anderson Room

PLANNING AND DEVELOPMENT DIVISION

1. **VANCOUVER FRASER PORT AUTHORITY APPLICATIONS TO NATIONAL TRADE CORRIDORS FUND**
(File Ref. No. 01-0140-20-PMVA1) (REDMS No. 6148884 v. 3)

In reply to queries from Committee, Donna Chan, Manager, Transportation Planning, advised that the six-laning of Highway 91 project was an option presented by the Vancouver Fraser Port Authority and is not being considered at this time. She then noted that should the project proceed in the future, funding would be determined at that time.

It was moved and seconded
That the City provide a letter of support for the Vancouver Fraser Port Authority's submission of the following three projects for consideration of cost-share funding from the Government of Canada's National Trade Corridors Fund, as described in the report titled "Vancouver Fraser Port Authority Applications to National Trade Corridors Fund" dated April 12, 2019 from the Director, Transportation:

(1) Supply chain visibility program;

(2) Short sea shipping concept development; and

(3) Portside Road-Blundell Road overpass and upgrade, subject to:

(a) No capital costs to be borne by the City of Richmond;

(b) No operating, maintenance, rehabilitation and replacement costs of the Portside Road-Blundell Road overpass including any raised portions of City roadway and No. 7 Road canal crossing structures to be borne by the City of Richmond;

(c) Continued City involvement in all aspects of the design process including adherence to the City's design standards; and

(d) Retention and accommodation of local community access for motorists, pedestrians and cyclists.

CARRIED

2. **AMENDMENT TO PARKING (OFF-STREET) REGULATION BYLAW NO. 7403 TO REVISE DEFINITION OF CITY PROPERTY**
(File Ref. No. 10-6455-00) (REDMS No. 6157470 v. 4; 6139378)

In reply to queries from Committee, Sonali Hingorani, Transportation Engineer, advised that there is a property in Steveston Village that has parking for public use secured through a right-of-way on private property and that this amendment allows for the expansion of the existing definition of City property to include that type of tenure. She then noted there is currently only one property that has a right of way secured on the site; however there could be more sites in the future.

In reply to further queries from Committee, Lloyd Bie, Director, Transportation, advised that staff are not certain whether the private parking lot operator in Steveston Village has moved their pay machine; however more information can be provided in a staff memorandum.

It was moved and seconded
That Parking (Off-Street) Regulation Bylaw No. 7403, Amendment Bylaw No. 10002, to revise the definition of City property, be introduced and given first, second and third readings.

CARRIED

ENGINEERING AND PUBLIC WORKS DIVISION

3. **WORKS AND SERVICES COST RECOVERY BYLAW AMENDMENT**
(File Ref. No. 10-6000-01) (REDMS No. 6142786 v. 4)

Discussion took place regarding adjusting the recovery costs to include inflation.

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

It was moved and seconded
That the Works and Services Cost Recovery Bylaw No. 8752 be adjusted to include inflation.

Councillor Day entered the meeting (4:05 p.m.).

The question on the motion was not called as discussion ensued regarding (i) inclusion of inflation for cost recovery for all future projects, (ii) lack of cost recovery practices in past years, (iii) current Richmond practices for cost recovery, and (iv) cost recovery practices in other municipalities.

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

It was moved and seconded
That the staff report titled "Works and Services Cost Recovery Bylaw Amendment" be referred back to staff for more information and options with regard to inflation.

CARRIED

COMMUNITY SAFETY DIVISION

4. INFORMATION ON KATER CABS OPERATED BY RICHMOND TAXI

(File Ref. No. 12-8275-02) (REDMS No. 6168947 v. 2)

In reply to queries from Committee, Carli Williams, Manager, Community Bylaws and Licencing, advised that (i) there are other taxi companies operating under this type of ride-hailing system in other municipalities, (ii) this model will be reviewed in a year or such time as new legislation is introduced, (iii) should a new taxi cab company wish to operate in Richmond, approval from the Passenger Transportation Board and Council is required, (iv) taxi cab companies are allowed to drop-off anywhere; however require approval from each municipality in order to pick-up in that city.

It was moved and seconded
That the staff report titled "Information on Kater Cabs Operated by Richmond Taxi", dated April 16, 2019, from the General Manager Community Safety be received for information.

CARRIED

5. MANAGER'S REPORT

Public Works Open House

Tom Stewart, Director, Public Works Operations, highlighted that the Annual Public Works Open House on May 11, 2019, was a success with excellent attendance by the public.

ADJOURNMENT

It was moved and seconded
That the meeting adjourn (4:24 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 Thursday, May 23, 2019.

Councillor Chak Au
Chair

Sarah Goddard
Recording Secretary

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	May 10, 2019
From:	Lloyd Bie, P.Eng. Director, Transportation	**File:**	01-0157-01/2019-Vol 01
Re:	**TransLink-Metro Vancouver 2018 Regional Parking Study – Key Findings**		

Staff Recommendation

That the staff report titled "TransLink-Metro Vancouver 2018 Regional Parking Study – Key Findings" dated May 10, 2019, from the Director, Transportation, regarding vehicle parking supply and demand at residential and mixed use developments across the region, be received for information.

Lloyd Bie, P.Eng.
Director, Transportation
(604-276-4131)

Att. 1

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

Staff Report

Origin

In July 2017, staff presented a report for information to the Public Works and Transportation Committee regarding the initiation by TransLink and Metro Vancouver of a Regional Parking Study (the Study) to gather updated evidence on automobile parking supply and demand. This report presents the key findings of the Study and next steps for Richmond.

Findings of Fact

Policy Context

Metro Vancouver's *Regional Growth Strategy* and TransLink's *Regional Transportation Strategy – Strategic Framework* both include policies to encourage vehicle parking requirements for residential and commercial developments that are not excessive and reflect the available choice of other travel modes (e.g., walking , cycling transit, car-share), local demographics and housing tenure, especially in Urban Centres and areas with Frequent Transit Network (FTN) service.

To improve the understanding of parking supply and demand, particularly near transit infrastructure, Metro Vancouver and TransLink have undertaken regular studies and background research related to vehicle parking and demand over the past several years.[1]

2018 Regional Parking Study

The 2018 Regional Parking Study is an update to the 2012 Apartment Parking Study, which was the first regional study of apartment parking supply and demand in Metro Vancouver. The 2018 Study collected data on 73 apartment sites across the region (see map in Attachment 1), including seven in Richmond, during Fall/Winter 2017 and comprises three components: Parking Facility Survey, Street Parking Survey and Household Survey.

- *Parking Facility Survey*: captured data regarding on-site parking utilization at peak times in a selection of apartment sites throughout the region. Counts were completed generally after 11:00 pm on weeknights (i.e., Monday-Thursday) to ensure that the highest parking utilization was being captured. Data was also collected on: the number of residential and visitor parking stalls in the building; the numbers of parked vehicles and vacant spaces; the presence of secured bicycle parking; and the presence of dedicated plug-in electric vehicle chargers.

- *Street Parking Survey*: captured parking utilization on the streets within walking distance (~200 m) of the surveyed apartment sites. Surveys were undertaken on weekday evenings after 6:30 pm.

- *Household Survey*: additional contextual information about the residents who live in the participating apartment buildings, such as: vehicle ownership; whether they own or rent their dwelling unit and parking stall(s); visitor parking patterns (e.g., do visitors typically park on-

[1] Past Metro Vancouver Regional Parking Studies: http://www.metrovancouver.org/services/regional-planning/transportation/regional-parking-studies/Pages/default.aspx.

site or on-street); bicycle parking conditions; interest in purchasing plug-in electric vehicles; willingness to forgo a parking stall; and basic demographic information.

Analysis

Key Findings

The key findings of the 2018 Regional Parking Study are consistent with those in the 2012 study, with some new insights about street parking. The key regional findings are summarized below.

(1) Apartment parking supply exceeds use across the region for both rental and strata buildings

- For strata apartment buildings, 42% of parking spaces were vacant
- For market rental apartment buildings, 35% of parking spaces were vacant
- For mixed tenure (strata and rental) and mixed rental (market and non-market) apartment buildings, 41% of parking spaces were vacant
- Small strata or market rental units (studio or 1 bedroom units or unit less than 800 ft^2) tend to have at most 1 parked vehicle per unit

(2) Apartment parking supply and use is lower for buildings closer to frequent transit

- For strata apartment buildings, parking use near frequent transit (bus or SkyTrain) ranges 0.86-0.97 vehicles per unit, compared to 1.09 for buildings further away
- For market rental sites, parking use near frequent transit ranges 0.35-0.72 vehicles per unit, compared to 0.99 for sites further away from the FTN

(3) Transit use is generally higher where apartment parking use is lower, especially for rental buildings

- Transit boardings (bus boardings within 400 m and SkyTrain/SeaBus boardings within 800 m of the apartments) are higher when apartment residential parking use is lower
- The relationship is stronger for rental apartment sites, than for strata sites

(4) Street parking is complex in mixed-use neighbourhoods. The surveys did not present any clear patterns between street parking utilization and apartment parking utilization and further research is warranted. Some of the factors contributing to street parking use include:

- Visitors to non-residential land uses in the evenings
- Apartment visitors on weekends, holidays, and special occasions
- Some apartment residents parking on a nearby street

(5) The design and capacity of bicycle parking facilities in apartment buildings appear to discourage use by many residents

- About one-third of bicycle-owning households do not use their building's secured bicycle parking facility
- The most frequently cited concerns were risk of damage to or loss of the bicycles, crowded facilities, and adverse perceptions of safety and convenience

Key Findings Specific to Richmond

Tables 1 and 2 illustrate that residential parking supply and use for the selected sites in Richmond are consistent with the Study's regional findings.

Table 1: Residential Parking Supply and Use across Region

Sub-region	Strata Sites				Rental Sites			
	# Sites	Parking Supply (Stalls/DU)	Parking Use (Veh/DU)	Parking Oversupply Estimate	# Sites	Parking Supply (Stalls/DU)	Parking Use (Veh/DU)	Parking Oversupply Estimate
Burnaby/NW	10	1.18	0.82	+45%	-	-	-	-
North Shore	6	1.28	0.97	+32%	2	0.87	0.70	+24%
Northeast Sector	13	1.33	0.98	+36%	1	1.47	1.12	+30%
Richmond	5	1.29	0.82	+58%	2	1.07	0.77	+39%
South of Fraser	14	1.46	1.00	+45%	5	1.51	1.10	+38%
Vancouver/UBC	2	1.15	0.83	+40%	13	0.85	0.59	+44%

Table 2: Residential Parking Supply and Use at Selected Sites in Richmond

Building Name	Tenure	Parking Supply (Stalls per DU)	Parking Use (Vehicles per DU)	Parking Oversupply Estimate
Azalea at the Gardens	Strata	1.41	0.82	+72%
Camellia at the Gardens	Market Rental	1.05	0.74	+42%
Magnolia at the Gardens	Strata	1.45	0.88	+65%
Circa Residences	Market Rental	1.28	0.85	+51%
Modena	Strata	1.29	0.75	+72%
Parc Riviera	Strata	1.70	1.10	+55%
Quintet Towers	Strata	1.16	0.69	+68%

With respect to street parking, data was collected on 65 street networks associated with the surveyed apartment sites. The vast majority of street networks experienced less than 85% utilization.[2] Seven street networks exceeded 85% utilization on two of the three surveyed periods including one location in Richmond (i.e., Quintet on Ackroyd Road and Firbridge Way). This result is attributed to on-site pay parking for non-residential uses and the availability of free street parking nearby. Table 3 provides a breakdown of street parking utilization around the seven apartment sites in Richmond.

Table 3: Street Parking Use around Richmond Apartment Sites

Building Name	Estimated Street Parking Spaces(1)	Street Parking Utilization		
		Weekday Evening	Weekday Late Night	Saturday Evening
Azalea at the Gardens	20	0%	0%	10%
Camellia at the Gardens				
Magnolia at the Gardens				
Circa Residences	57	35%	25%	25%
Modena	169	37%	43%	58%
Parc Riviera	59	53%	49%	63%
Quintet Towers	43	100%	77%	98%

(1) As estimated by the 2018 Regional Parking Study.

[2] An oft-cited threshold for determining whether street parking spaces are being used optimally is 85%. The premise is that parking, like any scarce resource, should be regulated and/or priced to ensure that 15% of the total parking spaces in a given area are available for parking at any given time.

Future Regional Parking Studies

The Study outlines some of the issues, challenges and opportunities associated with parking regulation and management not yet explored. These future considerations include: the implications of ride-hailing on parking requirements and management of the curb-side for pick up and drop off; the opportunities and challenges of shared parking facilities; trends in increasing personal and commercial vehicle sizes; and, accessibility needs with an aging population. These issues and others may be explored during the forthcoming updates to TransLink's *Regional Transportation Strategy* and Metro Vancouver's *Metro 2040*.

Zoning Bylaw 8500 – Review of Parking & Loading Requirements

Section 7 (Parking and Loading) of the City's Zoning Bylaw 8500 identifies the requirements for off-street parking (motor vehicles and bicycles) and loading spaces for residential, commercial and other land uses. The last major amendments to this section were made in 2008. Since these last amendments, significant experience has been gained regarding parking and loading requirements through the on-going processing of development applications, interactions with the development industry, dialogue with and research undertaken by other jurisdictions, and monitoring the supply and demand of other travel options (e.g., car-share, transit). Accordingly, staff have initiated a review of Section 7 of Zoning Bylaw 8500 with the intent of proposing further amendments in order to:

- incorporate the best practices and research of other municipalities and agencies in Metro Vancouver;
- respond to feedback from the development community;
- reflect changing housing market trends including the increasing stock in affordable housing;
- improve the clarity and consistency of language in the interpretation of bylaw parking and loading requirements;
- better align parking and loading requirements with the goals and objectives of the *Official Community Plan* and *Community Energy and Emissions Plan*; and
- ensure the effective use of valuable urban space for living (as opposed to the storage of automobiles).

The results of the Regional Parking Study and staff's review of Section 7 of Zoning Bylaw 8500 will be used to inform staff's development of proposed Zoning Bylaw amendments (and OCP Bylaw amendments as required) regarding parking and loading requirements, which are anticipated to be brought forth for Council consideration in the fourth quarter of 2019.

Financial Impact

None.

Conclusion

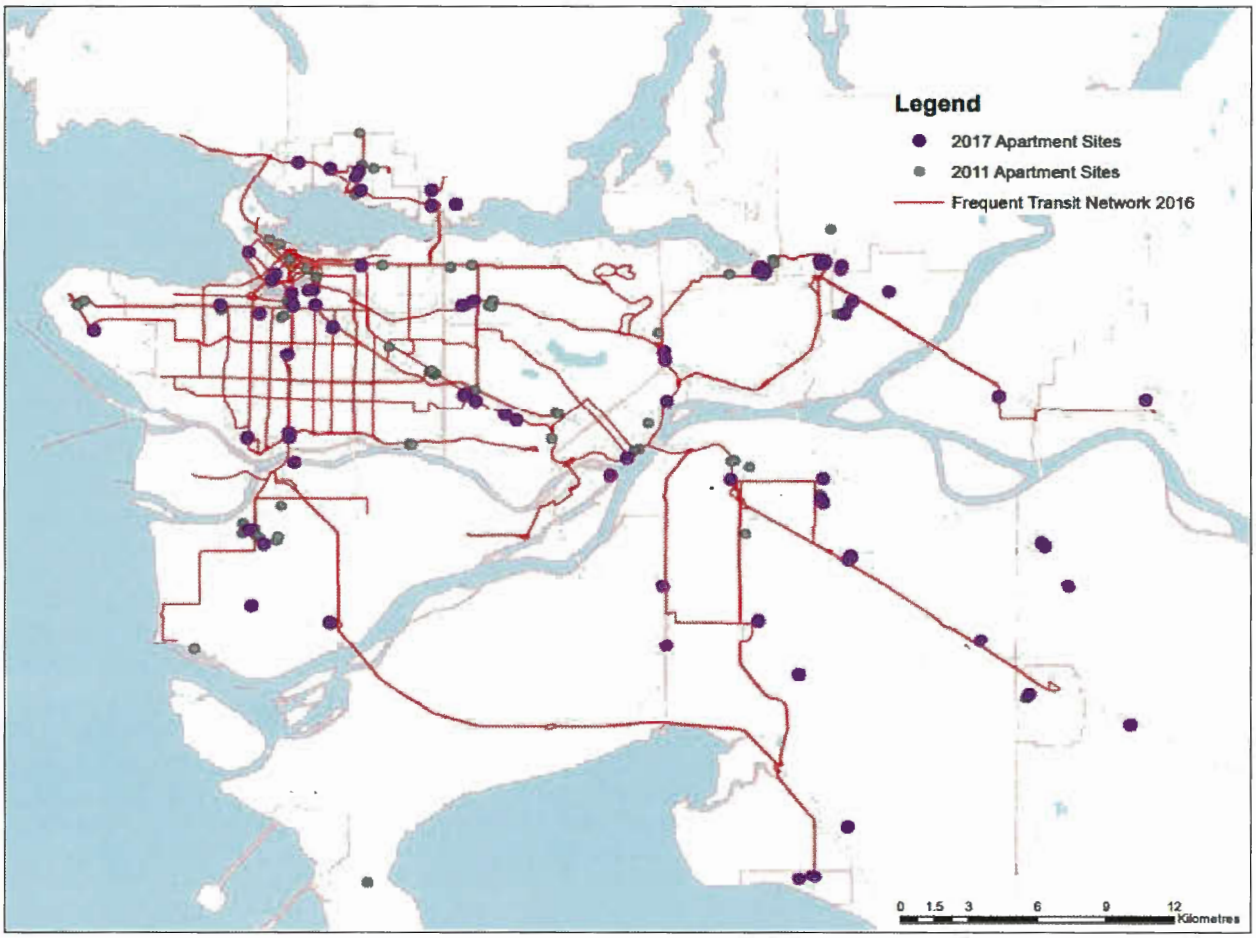
Metro Vancouver and TransLink have jointly completed a Regional Parking Study to increase the understanding of local parking demand and supply in residential and mixed use developments across the region. The results yield valuable data that will be useful for staff in the formulation of proposed amendments to on-site parking and loading requirements specified in Zoning Bylaw 8500.

Joan Caravan
Transportation Planner
(604-276-4035)
JC:jc

Sonali Hingorani, P.Eng.
Transportation Engineer
(604-276-4049)

Att. 1: Surveyed Apartment Sites for 2018 Regional Parking Study

Surveyed Apartment Sites for 2018 Regional Parking Study



Surveyed Apartment Sites in Richmond

Site	Building Name	Address	Tenure
1	Azalea at the Gardens	10880 No. 5 Rd	Strata
2	Camellia at the Gardens	10820 No. 5 Road	Market Rental
3	Magnolia at the Gardens	12339 Steveston Hwy	Strata
4	Circa Residences	10020 Dunoon Dr	Market Rental
5	Modena	6600 Cooney Road	Strata
	Modena	6611 Eckersley Road	
6	Parc Riviera	10033 River Drive	Strata
	Parc Riviera	10155 River Drive	
	Parc Riviera	10119/10133 River Drive	
	Parc Riviera	10011 River Drive	
7	Quintet Tower A	7988 Ackroyd Road	Strata
	Quintet Tower B	7979 Firbridge Way	
	Quintet Tower C	7733 Firbridge Way	
	Quintet Tower D	7788 Ackroyd Road	
	Quintet Tower E	7888 Ackroyd Road	

Surveyed Apartment Sites

Surveyed Apartment Sites in Richmond

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	June 4, 2019
From:	Lloyd Bie, P.Eng. Director, Transportation	**File:**	12-8275-06/2019-Vol 01
Re:	**Multi-Passenger Bicycle Business Proposal**		

Staff Recommendation

That a sole business licence for a quadricycle to be operated by Brew Bike Tours as a pilot program in Steveston Village be issued subject to the terms and conditions outlined in the attached staff report titled "Multi-Passenger Bicycle Business Proposal" dated June 4, 2019 from the Director, Transportation.

Lloyd Bie, P.Eng.
Director, Transportation
(604-276-4131)

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Economic Development	☑	
Law	☑	
Risk Management	☑	
Parks Services	☑	
Business Licences	☑	
Community Bylaws	☑	
RCMP	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** CJ	**APPROVED BY CAO**

Staff Report

Origin

The City has received a business licence request from Brew Bike Tours Ltd. to provide guided tours using a multi-person quadricycle in the Steveston Village area from July to October 2019. This report outlines the necessary terms and conditions required of the proponent in order to grant a business license for this service as a pilot program in Richmond.

Findings of Fact

What is a Quadricycle?

The BC *Bicycle Safety Helmet Exemption Regulation* that is part of the BC *Motor Vehicle Act* defines a quadricycle (Figure 1) as a cycle that:

(a) has a track width of not less than 1 metre,
(b) has a rear track width that is greater than the height of the seat frame as measured from level ground to the seat frame,
(c) is equipped with at least 2 sets of pedals for motive power,
(d) is equipped with disc or drum brakes, and
(e) is controlled by a single operator.

Figure 1: 15-person Quadricycle

Per the Regulation, the operator of, and each passenger carried by, a quadricycle is exempt from the requirement to wear a bicycle helmet.

A quadricycle typically has a wooden, rectangular shaped central counter around which guests sit facing each other. For a 15-person unit, there are six seats on either side, five of them having pedals and two non-pedal seats located above the rear wheels. There is also a three-person bench on the rear of the quadricycle.

Operation of the quadricycle involves a driver who sits in the front middle section and controls the brakes and steering. Passengers provide the energy to move the bike by pedalling simultaneously. The travel speed of the quadricyle is typically eight to twelve kilometres per hour.

Analysis

Brew Bike Tours

Brew Bike Tours has been providing guided tours using a quadricycle as Smile Cycle Tours in Kelowna (since Spring 2017) and Penticton (since Spring 2018). Similar businesses operate in Victoria, North Vancouver, Kelowna, and Calgary. Prospective guests book their tours online or in person. A typical tour is two hours with guests riding for 5-10 minutes at a time between multiple stops. The business will not be serving, providing or allowing customers to drink alcoholic beverages on board.

The proposed quadricycle will accommodate up to 15 passengers; a minimum of six passengers are required to propel the bike but the recommended number is eight to 10 passengers. The driver/tour guide will be a Brew Bike Tours employee and must have a driver's licence. The unit will include storage for repair tools, first-aid kit and a fire extinguisher. The driver has a brake near the right foot and there is a handbrake to the right of the driver's seat. The unit has LED turn-signals and running lights to provide enhance visibility for motorists. Helmets are mandatory for guests 16 years of age or younger and optional for those over 16 years of age.

Proposal for Steveston Village

Brew Bike Tours is proposing three themed guided tours in the Steveston Village area with various stops including both private businesses and tourist sites (e.g., Gulf of Georgia Cannery, Steveston Tram Barn). At each stop, passengers will disembark for 20-25 minutes and the driver will remain with the unit at all times. The service will operate seven days per week from 9:00 am to early evening (typically 8:00 pm). The business will not operate at night. The quadricycle will operate only in vehicle lanes and driveways (i.e., no use of off-street pathways or sidewalks).

Staff met with Brew Bike Tours to confirm the prescribed routes for each tour and the parking spaces for the unit while on tour and when not in service. The routes are confined to the Steveston Village area and designed to minimize travel on those roads with relatively higher traffic volumes and avoid sections with relatively higher levels of bus activity (Attachment 1). The business will operate completely within the area where the speed limit is restricted to 30 km/h. All stops must be accommodated either off-street or, if on-street, cannot impact any existing vehicle parking spaces.

Stakeholder Consultation

Brew Bike Tours has established relationships with some businesses in Steveston as they will be stops on the tours. The company discussed its proposed business with the Steveston Merchants Association on May 2, 2019 and has received a letter of support. The operators also met with the Steveston 20/20 Group on May 23, 2019 who are supportive and did not identify any concerns. The company has additional letters of support from Tourism Richmond and the Gulf of Georgia Cannery.

Proposed Conditions of Business Licence

The City's *Business Licence Bylaw* and *Business Regulation – Vehicle for Hire Bylaw* currently do not define Brew Bike Tour's proposed business. To facilitate the timely operation of the service for the coming Summer season, staff propose that a sole business licence be issued to Brew Bike Tours as a pilot program subject to the following terms and conditions:

- License valid from July 2, 2019 to October 1, 2019;
- Compliance with all City bylaws and provincial regulations pertaining to the operation of this business;
- Mandatory helmets for passengers 16 years of age or younger and optional for passengers over 16 years of age;
- No alcohol or cannabis to be consumed on the quadricycle;
- No use of transit stops, taxi/tour bus stops, loading zones/bays, or vehicle, motorcycle or accessible parking spaces;
- Operation in the vehicle lane and driveway only;
- Hours of operation from 9:00 am to 7:00 pm;
- Operation restricted to Steveston Village only on routes approved by the City;
- Any deviation from the approved routes or stop-over locations to be approved by the City;
- Minimum driver age of 19 years;
- $10 million liability insurance with City named as additional insured; and
- City's ability to terminate the pilot at any time should the conditions of the licence not be fulfilled by the operator.

Should the pilot program be successful, staff would bring forth the required amendments to the *Business Licence Bylaw* and *Business Regulation – Vehicle for Hire Bylaw*, which would allow other operators to provide a similar service.

Financial Impact

None.

Conclusion

Brew Bike Tours' proposal offers an interactive and environmentally friendly means of touring Steveston Village and learning about the history, culture and heritage of the area. Staff recommend that a sole business licence with conditions be issued to Brew Bike Tours as a pilot program for 2019 only.

Joan Caravan
Transportation Planner
(604-276-4035)

Sonali Hingorani, P.Eng.
Transportation Engineer
(604-276-4049)

JC:jc

Att. 1: Streets in Steveston Permitted to be Used by Quadricycle


Steveston Quadricycle Permitted Streets
English Ave
Eastthope Ave
South Arm Fraser River
No.1 Rd
Richmond St
Broadway St
1st Ave
Chatham St
Moncton St
Bayview St
2nd Ave
3rd Ave
4th Ave
5th Ave
6th Ave
7th Ave

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	May 17, 2019
From:	Lloyd Bie, P.Eng. Director, Transportation	**File:**	10-6450-09-01/2019-Vol 01
Re:	**Review of Collision Prone Intersections**		

Staff Recommendation

1. That the proposed short-term improvements, with respect to the top 20 high collision intersections in Richmond, be included in the 5 Year (2020-2024) Financial Plan, as outlined in the staff report titled "Review of Collision Prone Intersections" dated May 17, 2019 from the Director, Transportation; and,

2. That the City request the Minister of Public Safety and Solicitor General to provide automated speed enforcement technology at those intersections where the data indicates that speeding is a contributing factor to collisions.

Lloyd Bie, P.Eng.
Director, Transportation
(604-276-4131)

Att. 3

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

Staff Report

Origin

At the November 21, 2018 meeting of the Public Works and Transportation Committee, the following referral was carried:

That staff investigate:

(1) potential options to improve the left turn lanes in the intersections of No. 5 Road and Cambie Road and Cambie Road and Jacombs Road including cycling lanes; and

(2) other intersections with high incident rates;

and report back.

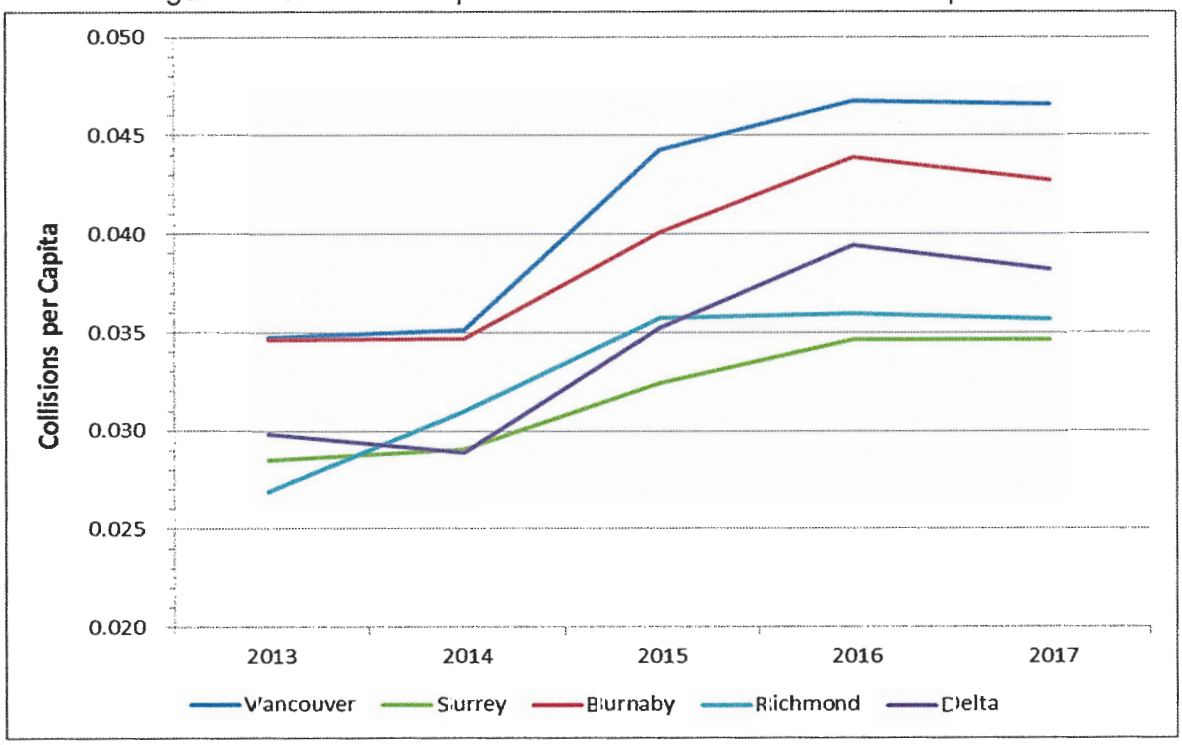
This report responds to Part (2) of the referral. Part (1) of the referral is addressed in a separate report.

Analysis

City-Wide Collision Data

Roadway collision data for Richmond and four other municipalities (Vancouver, Surrey, Delta, and Burnaby) was obtained from ICBC for the period from January 2013 to December 2017. Figure 1 illustrates the annual per capita collision rate for all collision types (fatality, injury and property damage only) for the five municipalities reviewed.

Figure 1: Annual Per Capita Collision Rate for Selected Municipalities



Notes:
(1) Data only includes crashes where sufficient location information is available to determine a latitude and longitude.
(2) Crashes on boundaries appear for both cities.

Richmond's annual per capita collision rate is on the low end for the municipalities reviewed. The highest crash locations in Richmond are at water crossings (i.e., bridges and the George Massey Tunnel) plus the on- and off-ramps for Highways 91 and 99, which are not within the City's jurisdiction. The network screening process described below focuses on City-controlled intersections with the long-term goal of decreasing the per capita collision rate for the city.

Network Screening Study

The City currently reviews the traffic safety performance of individual intersections as issues arise. A Network Screening Study is an opportunity for a holistic city-wide review of all intersections to identify those locations with the highest risk of collisions. The City partnered with ICBC on the Network Screening Study (the Study) to identify and prioritize high collision locations in order to determine where road safety improvement investments should be directed to achieve the greatest safety benefits.

The Study employs a systematic process based on the *Transportation Association of Canada Canadian Guide to In-service Road Safety Review.* Specifically, the Study uses insurance claims records and traffic volume data to assess the risk and potential to mitigate motorist, pedestrian and cyclist collisions. The output of the network screening process is a list of prioritized collision prone intersections and the identification of potential short-term and medium/long term improvements that will reduce crash rates. This information helps to determine where road safety resources can be most optimally allocated.

The Executive Summary of the Study is found in Attachment 1. The methodology and key outcomes are described briefly below.

Study Methodology

The Study was conducted in two phases; an initial screening and a secondary screening to ultimately identify a short list of the top 20 collision prone intersections.

Initial Screening

Table 1 provides a breakdown of the total number of intersections in Richmond. The initial screening began with the 818 intersections (50% of all intersections) for which ICBC collision data is available (total of 22,373 claims for the 2013-2017 period). As the five-year claims data indicated that 82% of the collisions (18,288) occurred at signalized intersections, subsequent analysis was focused on these 161 signalized intersections. Of the total number of collisions at these 161 signalized intersections, 0.08% were fatalities (14), 38% were injuries (6,946) and 62% were property damage only (11,328).

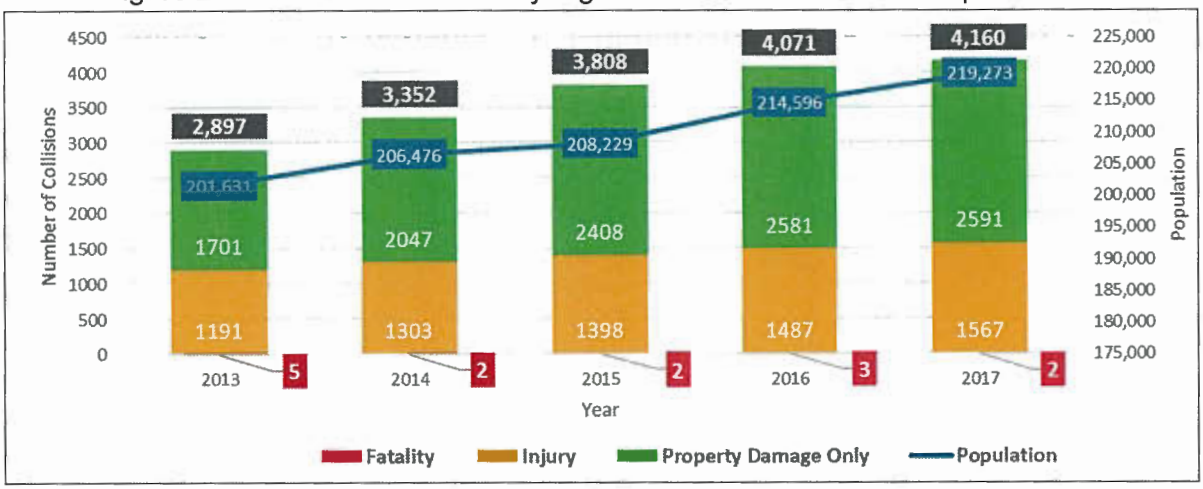
Table 1: Intersections in Richmond by Type

Intersection Type[1]	# of City Intersections			# of City Intersections with ICBC Data		
	Signalized	Non-signalized	Total	Signalized	Non-signalized	Total
City-MoTI	6	2	8	6	2	8
Major-Major	113	32	145	113	25	138
Major-Minor	43	391	434	42	326	368
Minor-Minor	0	1,030	1,030	0	304	304
Total	**162**	**1,455**	**1,617**	**161**	**657**	**818**

Notes:
(1) City-MoTI: Shared jurisdiction between City and Ministry of Transportation and Infrastructure (MoTI).
(2) Major: roadway is classified as an arterial or collector road.
(3) Minor: roadway is a local street.

Figure 2 illustrates that the annual number of collisions at the 161 signalized intersections increased from 2013 (2,897 collisions) to 2017 (4,160 collisions), indicating an 8.7% annual growth rate that outpaces the population annual growth rate of 1.7%.

Figure 2: Annual Collisions at City Signalized Intersections and Population Trend



The Study then focuses on intersections with an annual collision frequency equal to or greater than 25 collisions in the five-year period. This step resulted in 47 high collision intersections. These 47 intersections represent 29% of the 161 signalized intersections but account for 65% of the collisions.

Secondary Screening

The preliminary list of 47 high collision intersections was further prioritized using:

(1) Collision Severity Index: measures whether or not a location experiences more severe crashes (i.e., injury or fatality versus property damage only) than the City average for all intersections.

(2) Observed Collision Rate > Critical Collision Rate: this measure accounts for collision pattern randomness to ensure that only statistically meaningful locations are selected.

(3) Pedestrian-Involved Collisions: the number of pedestrian-involved collisions greater than five for the 2013-2017 period,

The Secondary Screening resulted in 20 intersections (2.4% of all Richmond intersections with collision data), which account for 23% of all ICBC claims in Richmond over the five-year period.

Intersection Safety Review Reports

Field reviews of the selected 20 intersections as well as a detailed collision analysis for the top 20 intersections were conducted using three-year data (2015-2017) to establish the most up-to-date collision patterns and identify the intersection improvements. The results of the collision data reviews and field reviews were compiled and summarized in a two-page Intersection Safety Review Report for each of the 20 intersections (Attachment 2) that includes:

- intersection layout and traffic volumes;
- collision pattern, including information of fatal collisions;
- field review observation and identified safety issues; and
- potential improvements (short-term and medium-/long-term).

Recommendations and Next Steps

Short-Term Improvements

The proposed short-term infrastructure improvements involve readily implementable measures such as improved traffic/parking signage, new or refreshed pavement markings, trimming of foliage to improve sightlines, and/or traffic signal modifications (e.g., added left-turn phase, larger lenses to improve visibility, change in signal phasing to assign priority to vulnerable road uses, etc). Additional proposed improvements include increased enforcement and education.

Attachment 3 summarizes the proposed improvements and estimated costs per intersection as well as the high-level estimate of safety benefits of the proposed improvements expressed as the percent of total collisions. The total estimated cost of the short-term improvements for all 20 intersections is approximately $500,000. Staff will include these short-term improvements in the 5 Year (2020-2024) Financial Plan, which is subject to Council approval.

Enforcement of Speeding and Red Light Running

Based on the Study findings, increased enforcement is recommended for 13 of the 20 intersections to address speeding and/or red light running violations as shown in Table 2. Of these 13 intersections, four have a red light enforcement camera (Shell Road-Alderbridge Way, No. 5 Road-Westminster Hwy, No. 5 Road-Cambie Road, and Gilbert Road-Blundell Road) and one has a red light camera that will be upgraded to provide automated speed enforcement (Garden City Road-Cambie Road). These programs operate 24 hours per day, seven days per week.

The red light camera and automated speed enforcement programs are within provincial jurisdiction. Therefore, staff recommend that the City request the Minister of Public Safety and Solicitor General to upgrade the existing four red light cameras and add cameras at the remaining eight intersections in order to provide red light and automated speed enforcement at all 13 intersections where the crash history reveals that speeding is a chronic contributing factor to collisions.

Table 2: Intersections Recommended for Increased Enforcement

Intersection	Red Light Camera?
Shell Rd-Alderbridge Way/Hwy 91	✓
Garden City Rd-Sea Island Way	×
No. 2 Rd-Westminster Hwy	×
No. 4 Rd-Alderbridge Way	×
No. 5 Rd-Westminster Hwy	✓
No. 5 Rd-Cambie Rd	✓
No. 4 Rd-Westminster Hwy	×
Garden City Rd-Cambie Rd	✓*
No. 2 Rd-Blundell Rd	×
No. 4 Rd-Cambie Rd	×
Minoru Blvd-Granville Ave	×
Gilbert Rd-Blundell Rd	✓
No. 5 Rd-Blundell Rd	×

* to be upgraded to automated speed enforcement

Staff will also share the Intersection Safety Review Reports with Richmond RCMP to enhance the targeted deployment of road safety enforcement.

Medium- and Long-Term Improvements

The proposed medium- and long-term infrastructure improvements involve substantial road geometry changes such as the road widening, addition or lengthening of left-turn lanes, redesign of existing channelized right-turn lanes, completion of pedestrian and cycling connections, and relocation of driveways. Given the scope of the proposed improvements, further analysis, design and consultation with affected property owners are required. In addition, some of the identified road improvements will require additional road right-of-way and can only proceed when the necessary additional right-of-way is available.

Staff recommend that a detailed intersection safety study and/or design be undertaken for each of the 20 intersections to confirm the exact scope of medium-/long-term improvements. Implementation of the final design will be included for Council consideration in future successive 5 Year Financial Plans, with the improvements starting with the higher ranked intersections. At that time, staff will seek potential cost-share funding from external agencies such as TransLink and ICBC.

Financial Impact

None.

Conclusion

The Network Screening Study is a comprehensive road safety analysis of City intersections that follows a standardized methodology using ICBC claims data and traffic volume data to identify high collision prone intersections. The result is a prioritized list of the top 20 high crash intersections and a customized list of short-term and medium-/long-term improvements for each intersection.

The phased implementation of the proposed improvements starting with the higher ranked intersections as part of future successive 5 Year Financial Plans are anticipated to significantly improve road safety for all users.

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Transportation Planner
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FL:jc

Att. 1: Network Screening Study: Executive Summary
2: Intersection Road Safety Reports for Top 20 Intersections
3: Top 20 Intersections: Summary of Proposed Short-Term Improvements

Executive Summary

Background, Objective and Methodology

The **City of Richmond (the City)** approached the **Insurance Corporation of British Columbia (ICBC)** to undertake a joint exercise to identify high collision intersections around the City. Since 1990, ICBC has been working with the City, to invest in road safety improvements through its **Road Improvement Program (RIP)**. One of the major goals of the Program is to implement road safety improvements at collision-prone intersections in order to reduce the number of collisions and the associated claims costs to ICBC and impacts to the community as a whole.

The City and ICBC retained **ISL Engineering and Land Services (ISL)**, in association with **G. Ho Engineering Consultants (GHEC)** to undertake a **Network Screening Study** to identify collision-prone intersections within the City. The study involves a systematic process which uses insurance claims records, traffic volume data, and safety performance indicators to identify the high collision intersections. The output from the process is a list of collision-prone intersections within the City and identification of potential short-term and medium/long-term improvements.

The study methodology was comprised of three key phases: Project Initiation, Initial Screening (Selection of Candidate Intersections), and Secondary Screening (Analysis of Selected Intersections). The methodology flowchart could be found in ***Figure ES.1***.

Initial Screening

Based on the standard practice for road safety review studies, five-year of ICBC claim data for the City-wide intersections, between January 1, 2013 and December 31, 2017, was collected and reviewed. A total of **22,373** claims were identified at 818 City intersections, including 161 signalized intersections and 657 un-signalized intersections, in the five-year study period. It was found out that 18,288 collisions (82%) occurred at the signalized intersections, and high collision intersections are all controlled by traffic signals. Hence, the study focused on signalized intersections as the study intersections and their data set forms the basis of the analysis. The breakdown of the reported collisions at 161 study intersections was as follows and the collision severity summary for each intersection can be found in ***Table ES.1***:

- 14 fatal collisions (0.08% of total collisions);
- 6,946 injury collisions (38% of total collisions), which include injured drivers, passengers, cyclists, and/or pedestrians; and,
- 11,328 property damage only (PDO) collisions (62% of total collisions).

Based on the *Transportation Association of Canada Canadian Guide to In-service Road Safety Review (TAC Road Safety Review Guide)* and previous similar network screening studies in the province, the following safety performance indicator was applied to identify the high collision intersections out of the 161 study intersections:

- Annual Collision Frequency being equal or over 25 collisions (i.e. equal or over 125 collisions in five years), which accounts for collision occurrence. After filtering the collision data by removing the claims at the parking lots and unknown locations, 47 intersections were identified as high collision intersections.

Secondary Screening

Intersections with planned modifications and recent improvements (completed after the year 2013) were taken into account in selecting the top 20 collision-prone intersections; there were 6 intersections out of the 47 high collision intersections identified in Initial Screening that were removed. Based on the *TAC Road Safety Review Guide*, the remaining 41 high collision intersections were further screened based on the following safety performance indicators and process to select the top 20 collision-prone intersections:

- Collision Severity Index being greater than the City's average of 4.50, which accounts for collision severity. This resulted in 25 intersections.

The 25 intersections were shortlisted to 20 by applying the following criteria:

- Observed Collision Rate greater than the Critical Collision Rate, which accounts for collision pattern randomness. This resulted in 9 intersections.
- The number of 5-year pedestrian-involved collisions greater than 5, which accounts for the vulnerable user safety concerns. This resulted in 6 more intersections, bringing the total to 15.
- Highest Collision Severity Index. Out of the 47 intersections not yet shortlisted, the top 5 with the highest Collision Severity Index were selected to achieve the top 20 intersections.

Based on the selection criteria, the results could be found in ***Table ES.2***. ***Figure ES.2*** included the locations of the selected 20 collision-prone intersections while ***Table ES.3*** shows the safety performance indicators for these locations.

Field Review

Field reviews of the selected 20 collision-prone intersections were conducted in April 2019 by three experienced Road Safety Reviewers. All 20 selected intersections were examined by drive-through/walk-through for all intersection approaches, providing safety reviewers with driver's/pedestrian's/cyclist's perspective of potential traffic safety issues. During the field reviews, potential safety issues were identified for all road modes (passenger cars, trucks, cycling, walking, and transit vehicles), using the *Site Visit Sample Observation Report* from the *TAC Road Safety Review Guide*.

Intersection Safety Review Report

Collision analysis for the selected 20 collision-prone intersections was focused on the most recent available 3-year period (2015-2017), in order to establish the most up-to-date collision patterns and identify the most relevant intersection improvements. The results of the collision data reviews (2015-2017) and field reviews were compiled and summarized in a two-page *Safety Review Report* for each of the 20 intersections, including:

- Intersection Layout and Traffic Volumes
- Collision Pattern, including information of fatal collisions
- Field Review Observation and Identified Safety Issues
- Potential Improvements (Short-term and Medium-/Long-term)

Fatal Collisions

Although the number of fatal collisions has already been included in calculating the collision severity index at each intersection, the occurrence of fatal collisions generates significant impacts to the community as a whole. It is noted that the selected 20 collision-prone intersections include 10 out of 14 fatal collisions, and the information of these fatal collisions were reviewed and discussed in the corresponding Intersection Safety Review Report. The locations and information of the remaining fatal collisions (four collisions) at City's intersections were as follow and it is suggested that an in-depth review of the contributing factors causing these fatal collisions needs to be conducted in the future studies:

- Knight Street and Westminster Highway: *a rear-end collision occurred at the westbound approach in the afternoon of May 2013*
- Garden City Road and Westminster Highway: *an off-road collision occurred at the eastbound approach in the morning of July 2013*
- Gilbert Road and River Road: *an off-road collision occurred at the southbound approach in the morning of October 2014*
- No. 3 Road and Westminster Highway: *no details were available for a collision occurred in the afternoon of October 2016*

Conclusion and Recommendations

From the Intersection safety review reports for the selected 20 collision-prone intersections, the site-specific short-term, medium-term, and long-term improvements were identified. In general, these proposed mitigation measures could be grouped into four categories (4E's): Engineering, Enforcement, Evaluation & Monitoring, and Education & Encouragement.

Engineering – improving/designing transportation systems/facilities/ infrastructures to anticipate human error so the consequence is not death or severe injury, for example:

- Construct new infrastructure, signals, street lighting, pedestrian and bicycle facilities, etc.
- Optimize and (re) prioritize existing transportation infrastructure and operations (e.g. traffic signals, roads, etc.) to enhance safety for all road users
- Upgrade signage and pavement markings to retain visibility and conspicuity

Enforcement – working with local law enforcement to enhance education, awareness, and enforcement in adjusting high-risk behaviours (speeding, disobeying, illegal movements, etc.) by:

- Increase enforcement and education on vehicle infractions
- Increase enforcement and education on cyclist infractions
- Increase enforcement and education on pedestrian infractions

Evaluation or **Monitoring** – monitoring if road safety strategies work through observing behaviour, surveying conflicts, monitoring programs/initiatives, as well as adjusting legislation (if needed), for example:

- Review the lane configuration at intersections based on traffic volumes/delays
- Review adequate pedestrian/bicycle connections to the nearest bus stops
- Review posted speed limits to confirm appropriateness and collect speed data

Education or **Encouragement** – teaching, encouraging, engaging all road users within the community, including drivers and vulnerable users (pedestrians/cyclists – i.e. students) to change behaviours through road safety, such as:

- Encourage the use of alternate mode and provide public information (Traffic Safety Awareness Week)
- Educate campaigns to school students (STARS – Safer Traffic Around Richmond Schools)
- Encourage the importance of road safety for truck drivers

It is recommended that the City of Richmond implement the suggested short-term improvements. In addition to the suggested medium/long-term improvements, it is recommended that the City could consider the following:

- Undertake a detailed intersection safety study and/or design at each of the 20 intersections
- Conduct a corridor-wide improvement strategy that may provide a more comprehensive strategy to deal with the safety issues more effectively, compared to improvements at isolated intersections, such as Blundell Road and No. 4 Road. Corridor-wide strategies can often be expected to provide a "halo" effect (i.e. the implementation of the improvement could impact the extent of the corridor).
- Work with ICBC through its Road Improvement Program (RIP) to conduct a traffic operation and road safety review for the selected intersections or corridors.
- Continue to collaborate with partners (such as RCMP, School Board, and Province Government) on road safety programs/initiatives.

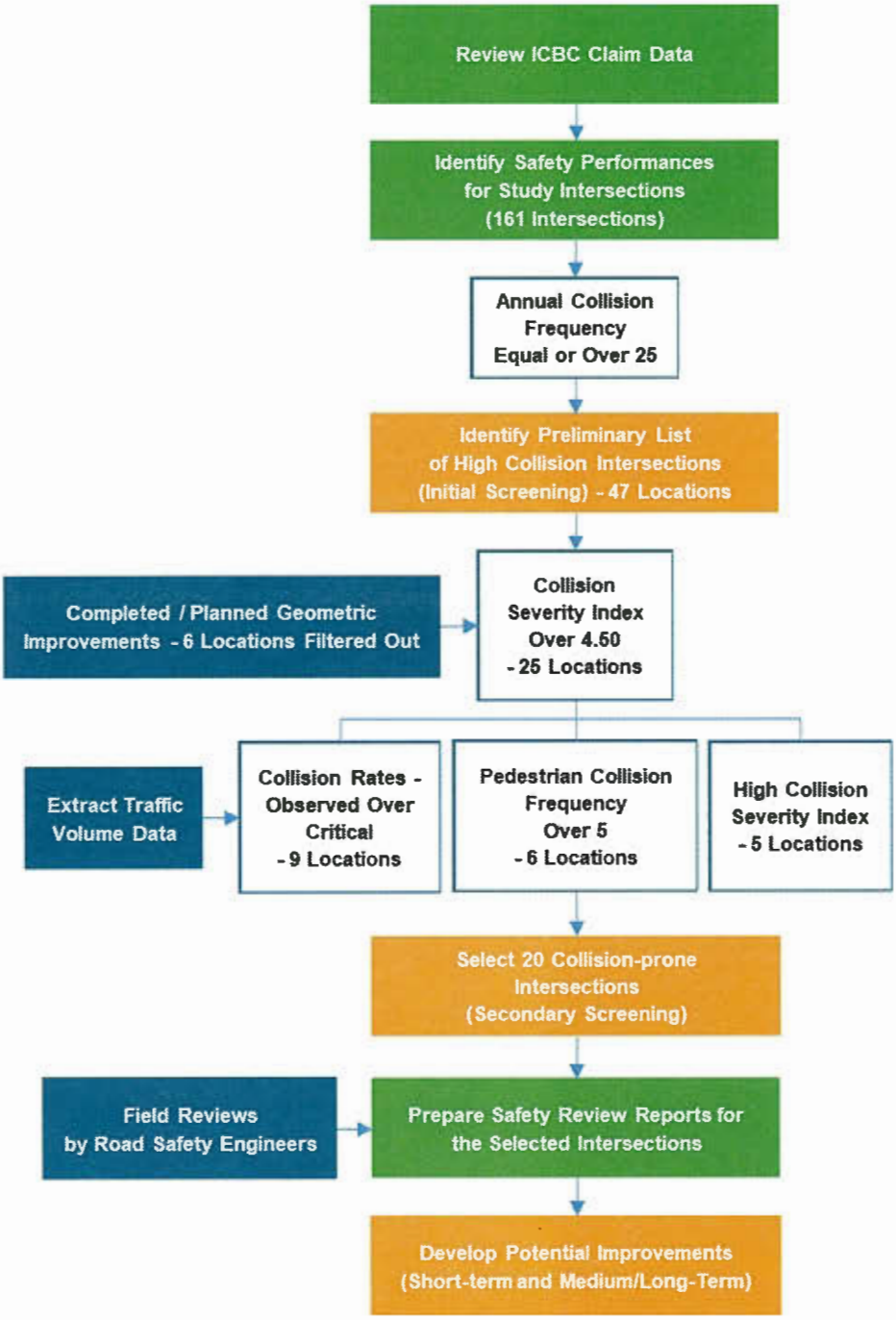


Figure ES.1 Study Methodology Flowchart

Table ES.1 Summary of 5-year ICBC Unfiltered Collision Data for Study Intersections (161 Signalized Intersections)

	Collision Data	ICBC Claim Data (2013-2017)				
No.	Intersection	Fatal	Injury	Property Damage Only	Total	Annual Frequency
1	No. 5 Road & Steveston Highway		172	471	643	128.6
2	Shell Road & Alderbridge Way / Highway 91	1	267	283	551	110.2
3	Garden City Road & Westminster Highway	1	178	334	513	102.6
4	No. 3 Road & Westminster Highway	1	134	372	507	101.4
5	Garden City Road & Alderbridge Way		191	307	498	99.6
6	No. 3 Road & Alderbridge Way		131	266	397	79.4
7	Garden City Road & Sea Island Way	1	152	244	397	79.4
8	No. 2 Road & Westminster Highway		164	224	388	77.6
9	No. 5 Road & Westminster Highway		169	219	388	77.6
10	No. 4 Road & Alderbridge Way		158	224	382	76.4
11	No. 5 Road & Cambie Road	1	140	217	358	71.6
12	Great Canadian Way & Bridgeport Road		108	230	338	67.6
13	No. 4 Road & Westminster Highway	2	133	164	299	59.8
14	Garden City Road & Cambie Road	1	105	167	273	54.6
15	No. 5 Road & Bridgeport Road		89	179	268	53.6
16	No. 3 Road & Cambie Road		58	199	257	51.4
17	No. 2 Road & Blundell Road		107	146	253	50.6
18	Garden City Road & Granville Avenue		103	142	245	49.0
19	No. 3 Road & Granville Avenue	1	91	143	235	47.0
20	Sweden Way & Bridgeport Road		82	152	234	46.8
21	Minoru Boulevard & Westminster Highway		77	152	229	45.8
22	No. 3 Road & Blundell Road		76	152	228	45.6
23	Gilbert Road & Westminster Highway		74	152	226	45.2
24	No. 4 Road & Blundell Road		109	104	213	42.6
25	No. 4 Road & Cambie Road		86	111	197	39.4
26	Hazelbridge Way / Mall Access & Alderbridge Way		63	122	185	37.0
27	Garden City Road & Blundell Road	2	85	95	182	36.4
28	No. 2 Road & Granville Avenue		67	108	175	35.0
29	Minoru Boulevard & Granville Avenue		69	105	174	34.8
30	Shell Road & Bridgeport Road		85	86	171	34.2
31	No. 3 Road & Lansdowne Road		56	111	167	33.4
32	No. 3 Road & Leslie Road		41	123	164	32.8
33	No. 1 Road & Francis Road		65	95	160	32.0
34	Cooney Road & Westminster Highway		45	112	157	31.4
35	Shell Road & Cambie Road		67	89	156	31.2
36	Garden City Road & Lansdowne Road		62	92	154	30.8
37	Knight Street & Westminster Highway	1	52	94	147	29.4
38	Gilbert Road & Granville Avenue		53	88	141	28.2
39	Jacombs Road / Sidaway Road & Westminster Highway		60	81	141	28.2
40	Shell Road & Westminster Highway		56	80	136	27.2
41	Cooney Road / St. Albans Road & Granville Avenue		41	91	132	26.4
42	No. 1 Road & Steveston Highway		56	76	132	26.4
43	No. 3 Road & Saba Road		38	93	131	26.2
44	Hazelbridge Way & Cambie Road		32	98	130	26.0
45	Gilbert Road & Blundell Road		64	64	128	25.6
46	Gilbert Road & River Road (River Parkway)	1	45	82	128	25.6
47	No. 3 Road & Williams Road		52	75	127	25.4
48	No. 6 Road & Westminster Highway		55	71	126	25.2
49	No. 5 Road & Blundell Road	1	61	63	125	25.0
50	No. 3 Road & Cook Road		41	84	125	25.0
51	No. 2 Road & Francis Road		58	67	125	25.0
52	Bridgeport Road & Viking Way		44	79	123	24.6
53	Kwantlen Street & Alderbridge Way		33	90	123	24.6
54	No. 3 Road & Ackroyd Road		36	85	121	24.2
55	No. 2 Road & Steveston Highway		42	78	120	24.0
56	Alexandra Road & Hazelbridge Way		37	80	117	23.4
57	Garden City Road & Odlin Road		39	76	115	23.0
58	Nelson Road & Westminster Highway		43	71	114	22.8
59	No. 3 Road & Francis Road		51	62	113	22.6
60	No. 4 Road & Williams Road		41	71	112	22.4
61	Coppersmith Place & Steveston Highway		37	74	111	22.2
62	Ackroyd Road & Cooney Road		41	66	107	21.4
63	No. 1 Road & Blundell Road		38	68	106	21.2
64	Blundell Road & St Albans Road		44	60	104	20.8
65	Elmbridge Way & Gilbert Road		35	69	104	20.8
66	Blundell Road & Railway Avenue		52	46	98	19.6
67	Cook Road & Garden City Road		34	63	97	19.4
68	Granville Avenue & No. 4 Road		50	47	97	19.4
69	No. 4 Road & Steveston Highway		33	64	97	19.4
70	Cooney Road & Lansdowne Road / Mall Access		35	61	96	19.2
71	No. 1 Road & Westminster Highway		34	60	94	18.8
72	No. 2 Road & Williams Road		50	44	94	18.8
73	Cambie Road & No. 6 Road		39	53	92	18.4
74	Cambie Road & Jacombs Road		38	51	89	17.8
75	Cook Road & Cooney Road		39	46	85	17.0
76	Sexsmith Road & Sea Island Way		35	50	85	17.0
77	No. 1 Road & Williams Road		47	37	84	16.8
78	Shell Road & Westminster Highway		33	49	82	16.4
79	Capstan Way & Garden City Road		35	43	78	15.6
80	Alderbridge Way & Minoru Boulevard		22	53	75	15.0
81	Gilbert Road & Williams Road		35	40	75	15.0
82	Francis Road & Gilbert Road		35	38	73	14.6
83	Railway Avenue & Steveston Highway		27	45	72	14.4
84	Cambie Road & St Edwards Drive		33	38	71	14.2
85	Francis Road & Railway Avenue		40	31	71	14.2
86	Granville Avenue & No. 1 Road		37	33	70	14.0
87	No. 3 Road & Park Road & Mall Access		29	41	70	14.0
88	Capstan Way & No. 3 Road		23	45	68	13.6
89	No. 3 Road & Steveston Highway		28	40	68	13.6
90	Cambie Road & Sexsmith Road		25	42	67	13.4
91	Browngate Road & Hazelbridge Way		15	50	65	13.0
92	Alderbridge Way & Lansdowne Road		26	37	63	12.6
93	Alderbridge Way & Westminster Highway		27	36	63	12.6
94	Bridgeport Road & St EdwaRoads Drive		22	41	63	12.6
95	Alderbridge Way & Elmbridge Way		15	47	62	12.4
96	Hazelbridge Way & Leslie Road		12	50	62	12.4
97	Kwantlen Street & Lansdowne Road		27	34	61	12.2
98	Bridgeport Road & Simpson Road		29	29	58	11.6
99	Buswell Street & Granville Avenue		17	41	58	11.6
100	Gilbert Road & Lansdowne Road		22	36	58	11.6
101	Blundell Road & Minoru Boulevard		16	41	57	11.4
102	Bridgeport Road & No. 6 Road		21	36	57	11.4
103	No. 5 Road & Williams Road		26	31	57	11.4
104	No. 4 Road & Odlin Road		26	29	55	11.0
105	Gilbert Road & Steveston Highway		22	32	54	10.8
106	Browngate Road & No. 3 Road		18	35	53	10.6
107	Francis Road & GaRoaden City Road		24	27	51	10.2
108	GaRoaden Cty Road & Williams Road		24	26	50	10.0
109	Francis Road & No. 4 Road		17	32	49	9.8
110	Cambie Road & Viking Way		20	28	48	9.6
111	Lynas Lane & Westminster Highway		19	27	46	9.2
112	Graybar Road & Westminster Highway		14	31	45	9.0
113	Granville Avenue & Railway Avenue		19	25	44	8.8
114	No. 8 Road & Westminster Highway		21	23	44	8.8
115	No. 2 Road & WoodwaRoads Road		25	18	43	8.6
116	Buswell Street & Cook Road		15	27	42	8.4
117	Lansdowne Road & Minoru Boulevard		13	28	41	8.2
118	Moncton Street & No. 1 Road		4	36	40	8.0
119	Railway Avenue & Williams Road		15	25	40	8.0
120	Fraserwood Place & Westminster Highway		17	22	39	7.8
121	Hollybridge Way & River Road		16	22	38	7.6
122	Horseshoe Way & No. 5 Road & Riverside Way		6	32	38	7.6
123	Alberta Road & No. 4 Road		14	23	37	7.4
124	Garrison Road & No. 2 Road		15	20	35	7.0
125	Ackroyd Road & Elmbridge Way & Minoru Boulevard		15	18	33	6.6
126	SeawaRoad Gate & Steveston Highway		13	19	32	6.4
127	Blundell Road & No. 8 Road		10	21	31	6.2
128	Mortfield Gate & Steveston Highway		15	15	30	6.0
129	Chatham Street & No. 1 Road		7	22	29	5.8
130	Elmbridge Way & Westminster Highway		12	16	28	5.6
131	Capstan Way & Sexsmith Road		10	15	25	5.0
132	Buswell Street & Saba Road		12	12	24	4.8
133	Cooney Road & Saba Road		9	15	24	4.8
134	Maple Road & No. 2 Road		3	21	24	4.8
135	Mclean Avenue & Westminster Highway		12	12	24	4.8
136	Bridgeport Road & Mclennan Avenue		8	15	23	4.6
137	Great Canadian Way & Van Horne Way		8	13	21	4.2
138	Mcmillan Way & Westminster Highway		7	13	20	4.0
139	Minoru Boulevard & Minoru Gate & Mall Access		7	11	18	3.6
140	Garry Street & No. 1 Road		5	12	17	3.4
141	Gilley Road & Westminster Highway		7	10	17	3.4
142	Mayfield Place & No. 6 Road		9	8	17	3.4
143	Cambie Road & Stolberg Street		9	7	16	3.2
144	Alderbridge Way & Cedarbridge Way		7	8	15	3.0
145	Great Canadian Way & River Road		3	9	12	2.4
146	Elmbridge Way & Hollybridge Way		1	10	11	2.2
147	Gollner Avenue & Minoru Boulevard		3	8	11	2.2
148	Oval Way & River Road		6	5	11	2.2
149	Mcclelland Road & Alderbridge Way		2	9	11	2.2
150	Commerce Parkway & No. 6 Road		5	4	9	1.8
151	Greenland Drive & No. 5 Road		3	5	8	1.6
152	Jacombs Road & Smallwood Place		3	5	8	1.6
153	No. 1 Road & Osmond Avenue		4	4	8	1.6
154	No. 2 Road & Wallace Road		3	5	8	1.6
155	Alderbridge Way & May Drive		3	4	7	1.4
156	Cedarbridge Way & Lansdowne Road		3	3	6	1.2
157	Hazelbridge Way & Sweet Avenue		3	3	6	1.2
158	Moncton Street & Railway Avenue		4	2	6	1.2
159	Minoru Boulevard & MuRoadoch Avenue & Mall Access		2	2	4	0.8
160	Hollybridge Way & Lansdowne Road		2		2	0.4
161	Pearson Way & River Road			2	2	0.4

Table ES.2 Summary of Selection Criteria Assessment for 47 High Collision Intersections

ID	Intersection	Annual Collision Frequency (Equal or Over 25.0)	Collision Severity Index (Over 4.50)	Observed Collision Rate (Over Critical Collision Rate)	Total Pedestrian-involved Collisions (Over 5)	"Selection Rationale"
1	No. 5 Road & Steveston Highway	✓	×			Not Selected - Recently Improved and Does not meet the Criteria
2	Shell Road & Alderbridge Way / Highway 91	✓	✓	✓		Selected - Meets the Criteria
3	Garden City Road & Westminster Highway	✓	×			Not Selected - Does not meet the Criteria
4	Garden City Road & Alderbridge Way	✓	✓			Not Selected - Recently Improved
5	No. 3 Road & Westminster Highway	✓	×			Not Selected - Does not meet the Criteria
6	Garden City Road & Sea Island Way	✓	✓	✓		Selected - Meets the Criteria
7	No. 3 Road & Alderbridge Way	✓	×			Not Selected - To Be Modified and Does not meet the Criteria
8	No. 2 Road & Westminster Highway	✓	✓	✓		Selected - Meets the Criteria
9	No. 4 Road & Alderbridge Way	✓	✓	✓		Selected - Meets the Criteria
10	No. 5 Road & Westminster Highway	✓	✓	✓		Selected - Meets the Criteria
11	No. 5 Road & Cambie Road	✓	✓	✓		Selected - Meets the Criteria
12	Great Canadian Way & Bridgeport Road	✓	×			Not Selected - Does not meet the Criteria
13	No. 4 Road & Westminster Highway	✓	✓	×	×	Selected - Meets the Criteria (i.e. High CSI)
14	Garden City Road & Cambie Road	✓	✓	×	✓	Selected - Meets the Criteria
15	No. 5 Road & Bridgeport Road	✓	×			Not Selected - Does not meet the Criteria
16	Garden City Road & Granville Avenue	✓	✓	✓		Selected - Meets the Criteria
17	Sweden Way & Bridgeport Road	✓	×			Not Selected - Does not meet the Criteria
18	Minoru Boulevard & Westminster Highway	✓	×			Not Selected - Does not meet the Criteria
19	No. 2 Road & Blundell Road	✓	✓	✓		Selected - Meets the Criteria
20	No. 3 Road & Granville Avenue	✓	✓	×	✓	Selected - Meets the Criteria
21	No. 3 Road & Blundell Road	✓	×			Not Selected - Does not meet the Criteria
22	Gilbert Road & Westminster Highway	✓	×			Not Selected - Does not meet the Criteria
23	No. 4 Road & Blundell Road	✓	✓	✓		Selected - Meets the Criteria
24	No. 3 Road & Cambie Road	✓	×			Not Selected - Does not meet the Criteria
25	No. 4 Road & Cambie Road	✓	✓	×	✓	Selected - Meets the Criteria
26	Hazelbridge Way / Mall Access & Alderbridge Way	✓	×			Not Selected - Does not meet the Criteria
27	No. 2 Road & Granville Avenue	✓	×			Not Selected - Does not meet the Criteria
28	Shell Road & Bridgeport Road	✓	✓	×	×	Selected - Meets the Criteria (i.e. High CSI)
29	Minoru Boulevard & Granville Avenue	✓	✓	×	✓	Selected - Meets the Criteria
30	No. 3 Road & Lansdowne Road	✓	×			Not Selected - Does not meet the Criteria
31	Garden City Road & Blundell Road	✓	✓	×	✓	Selected - Meets the Criteria
32	No. 3 Road & Leslie Road	✓	×			Not Selected - Does not meet the Criteria
33	Shell Road & Cambie Road	✓	✓	×	×	Not Selected - Does not meet the Criteria (i.e. Low CSI)
34	Garden City Road & Lansdowne Road	✓	✓	×	×	Not Selected - Does not meet the Criteria (i.e. Low CSI)
35	Cooney Road & Westminster Highway	✓	×			Not Selected - Does not meet the Criteria
36	No. 1 Road & Francis Road	✓	✓	×	×	Selected - Meets the Criteria (i.e. High CSI)
37	Knight Street & Westminster Highway	✓	✓	×	×	Not Selected - Does not meet the Criteria (i.e. Low CSI)
38	Jacombs Road / Sidaway Road & Westminster Highway	✓	✓	×	×	Not Selected - Does not meet the Criteria (i.e. Low CSI)
39	Gilbert Road & Granville Avenue	✓	×			Not Selected - Does not meet the Criteria
40	Shell Road & Westminster Highway	✓	✓	×	×	Not Selected - Does not meet the Criteria (i.e. Low CSI)
41	Cooney Road / St. Albans Road & Granville Avenue	✓	×			Not Selected - Recently Improved and Does not meet the Criteria
42	No. 1 Road & Steveston Highway	✓	✓	×	✓	Selected - Meets the Criteria
43	Gilbert Road & Blundell Road	✓	✓	×	×	Selected - Meets the Criteria (i.e. High CSI)
44	Gilbert Road & River Road (River Parkway)	✓	✓			Not Selected - To Be Modified
45	No. 5 Road & Blundell Road	✓	✓	×	×	Selected - Meets the Criteria (i.e. High CSI)
46	Hazelbridge Way & Cambie Road	✓	×			Not Selected - Does not meet the Criteria
47	No. 2 Road & Francis Road	✓	✓			Not Selected - To Be Modified

Figure ES.2 Locations of the 20 Selected Collision-Prone Intersections

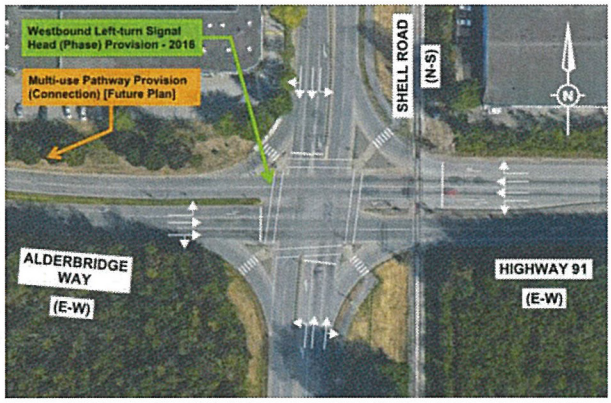
Table ES.3 Safety Performance Summary for the 20 Selected Collision-Prone Intersections

Site #	Intersection	Annual Collision Frequency	Collision Severity Index	Observed / Critical Collision Rate	Total 5-Year Number of Pedestrian involved Collisions	Total 5-Year Number of Fatal Collisions
1	Shell Road & Alderbridge Way / Highway 91	110.2	5.54	5.23 / 3.27	0	1
2	Garden City Road & Sea Island Way	79.2	4.70	3.51 / 3.26	2	1
3	No. 2 Road & Westminster Highway	76.6	4.85	3.63 / 3.27	3	0
4	No. 4 Road & Alderbridge Way	76.4	4.72	3.54 / 3.27	0	0
5	No. 5 Road & Westminster Highway	76.2	4.97	4.28 / 3.30	1	0
6	No. 5 Road & Cambie Road	66.2	4.97	4.91 / 3.35	4	1
7	No. 4 Road & Westminster Highway	59.8	5.67	2.57 / 3.26	0	2
8	Garden City Road & Cambie Road	52.4	4.95	3.08 / 3.31	7	1
9	Garden City Road & Granville Avenue	48.8	4.80	5.27 / 3.42	3	0
10	No. 2 Road & Blundell Road	44.4	5.14	3.64 / 3.36	5	0
11	No. 3 Road & Granville Avenue	44.2	4.95	2.44 / 3.30	14	1
12	No. 4 Road & Blundell Road	42.6	5.61	3.39 / 3.36	0	0
13	No. 4 Road & Cambie Road	39.0	4.97	3.08 / 3.36	5	0
14	Shell Road & Bridgeport Road	34.2	5.47	2.83 / 3.37	3	0
15	Minoru Boulevard & Granville Avenue	34.2	4.63	2.65 / 3.35	12	0
16	Garden City Road & Blundell Road	32.2	6.65	3.35 / 3.41	8	2
17	No. 1 Road & Francis Road	29.6	4.89	2.99 / 3.41	0	0
18	No. 1 Road & Steveston Highway	26.0	4.88	2.08 / 3.36	5	0
19	Gilbert Road & Blundell Road	25.6	5.50	2.14 / 3.37	3	0
20	No. 5 Road & Blundell Road	25.0	6.18	2.73 / 3.42	0	1

SHELL ROAD & ALDERBRIDGE WAY / HIGHWAY 91

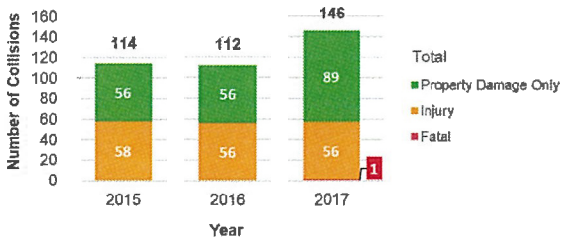
INTERSECTION INFORMATION

Site #:	1
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for SB & E-W
N-S Street Classification:	Arterial (Bike Route - MUP)
E-W Street Classification:	Provincial - Arterial (MRN)
Surrounding Land Use:	Commercial / Industrial
Daily Traffic Volume (2015):	57,800 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	124.0 per year	(Total = 372)
Collision Severity Index:	5.38	(Casualty = 46%)
Collision Rate OBS. / CRT.:	5.23 / 3.27	[2013-2017]
Collision with Pedestrian:	0	
Collision with Cyclist:	1	



Highest % Month:	December (10%)
Highest % Day of Week:	Friday (22%)
Highest % Time Period:	3 PM - 6 PM (30%)
Top 3 Collision Types:	Rear End (70%) Left Turn (13%) Sideswipe (8%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Rural perception at wide intersection with channelized right-turn islands – *overall*
- Lane drop after intersection – *south leg*
- Inadequate sight distance due to nearby foliage – *southwest corner*
- Presence of railway crossing – *east leg; two sets of westbound signal heads with one stop bar*

Signal:

- Lack of left-turn phase – *northbound approach*

Vulnerable Road User:

- Long pedestrian crossing distance – *north-south directions*
- Old pedestrian pushbuttons – *east side corners; along multi-use pathway*

Collision (Data Review):

- High collision frequency (over 50.0), high collision severity index (over 5.00), and a collision-prone location (observed over critical collision rate)
- Annual number of collisions increased in 2017
- High number of rear-end collisions reported on Highway 91 westbound – *103 out of total 254 collisions*
- High number of right-turn rear-end collisions occurred at Highway 91 westbound designated/channelized right-turn – *over 50% of total 30 collisions; unexpected yield control with high vehicle speed*
- High proportion of left-turn opposing collisions occurred in the east-west directions – *over 80% of total; 22 collisions involved westbound (horizontal curve on the eastbound approach) and 15 collisions involved eastbound*
- High proportion of sideswipe collisions occurred with east-west movements – *16 out of total 29 collisions; changing lanes to avoid right-turn vehicles to merge*
- Three collisions reported in the north-south directions due to U-turn movements
- One fatal collision reported involving a westbound left-turn opposing collision and hitting a third vehicle on Shell Road during Friday noon on August 2017

SHELL ROAD & ALDERBRIDGE WAY / HIGHWAY 91

Operational (Field Review):

- Congestion / long queues during peak periods – *east-west approaches*
- Significant left-/right-turn volumes/queues during peak periods – *southbound and east-west approaches; high number of turning-related conflicts were observed*
- Significant lane changing/weaving activities – *east-west legs; to avoid merging vehicles from right-turns*
- High vehicle speed – *east-west legs (free flow, especially to/from highway); presence of red-light camera for eastbound approach*
- Unexpected yield control with designated right-turn lane – *east side corners; designated right-turn bay for westbound approach*
- Broken motor vehicle parts were noticed at the southeast channelized island

Other:

- Missing/inconsistent pavement marking – *east leg; no elephant feet and green bike path marking on crosswalks connecting multi-use pathways, similar to the southeast corner*
- Faded pavement marking – *southeast corner; dashed merge line*
- Missing road sign – *all corners (no pedestrian crosswalk signage) and south leg (no merge sign)*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 20 to 30% of Total Collisions):

- Upgrade pedestrian pushbuttons to the latest standard – *east side corners; to be consistent overall*
- Provide pedestrian crosswalk signs – *all corners*
- Provide merge sign – *south leg (southbound)*
- Regularly repaint dashed merge line – *southeast corner*
- Regularly trim foliage to provide adequate sight distance – *southwest corner*
- Paint elephant feet and green bike path pavement marking along crosswalk – *east leg; similar to the southeast corner*
- Install enlarged Yield sign or two Yield signs – *westbound approach*
- Consider the provision of protected-only left-turn phase – *westbound approach*
- Conduct warrant analysis for adding left-turn phase – *northbound approach*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *all approaches*

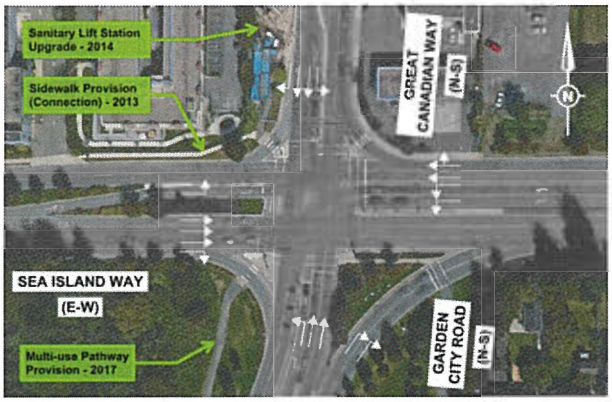
Medium/Long-Term:

- Add left-turn phase (if warranted) – *northbound approach*
- Provide clear gateway signage, such as "Freeway Ends" – *westbound approach*
- Install speed radar board – *westbound direction*
- Remove or modify angle of channelized right-turn in coordination with MoTI – *east side corners (to/from highway); traffic operation and geometric design to confirm*
- Increase property setback with future redevelopment – *southwest corner*
- Review the need of installing advance warning flasher in coordination with MoTI – *westbound approach*
- Work with MoTI to lower speed zones before the intersection – *westbound approach*
- Explore the feasibility to increase left-turn storage in coordination with MoTI – *eastbound and westbound approaches*
- Consider a feasibility study to provide the grade separation in coordination with MoTI and CP Railway – *east-west movements; connecting Alderbridge Way and Highway 91*
- Enhance police enforcements for vehicle speeding violations in coordination with RCMP – *all approaches*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding and right-turn lanes

GARDEN CITY ROAD / GREAT CANADIAN WAY & SEA ISLAND WAY

INTERSECTION INFORMATION

Site #:	2
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for EB
N-S Street Classification:	Arterial (Bike Route & MUP)
E-W Street Classification:	Provincial (Bike Route - WL)
Surrounding Land Use:	Retail / Residential
Daily Traffic Volume (2015):	61,800 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	81.3 per year	(Total = 244)
Collision Severity Index:	4.80	(Casualty = 38%)
Collision Rate OBS. / CRT.:	3.51 / 3.26	[2013-2017]
Collision with Pedestrian:	2	
Collision with Cyclist:	1	

Highest % Month:	December (12%)
Highest % Day of Week:	Thursday (18%)
Highest % Time Period:	3 PM - 6 PM (30%)
Top 3 Collision Types:	Rear End (52%) Sideswipe (27%) Left Turn (12%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- First signalized intersection from Oak Street Bridge (southbound)
- Horizontal curve immediately before/after intersection – *south leg*
- Dual right-turn lanes with signal operation – *northbound approach; limited sight distance to crossing pedestrians and eastbound vehicles*
- Commercial driveways close to intersection – *northeast quadrant (gas station)*
- Inadequate sight distance due to nearby foliage – *southwest corner; conflict between eastbound right-turn vehicles and northbound pedestrians/bicycles*

Signal:

- Protected-permissive left-turn phase for eastbound single lane and protected-only left-turn phase for westbound dual lanes
- Long gap for pedestrian crossing green time after red signal for vehicles – *northbound channelized right-turn*

Vulnerable Road User:

- Inadequate bicycle facility – *west leg (no elephant feet on crosswalks connecting multi-use pathways) and northeast corner (narrow shoulder on the west side of the island, not consistent with southeast island)*
- Northbound bike lane is disappeared along the channelized right-turn island
- Long pedestrian crossing distance – *north-south directions*

Collision (Data Review):

- High collision frequency (over 50.0), and a collision-prone location (observed over critical collision rate)
- High proportion of rear-end collisions reported on Sea Island Way approaches – *70% of total 121 collisions*
- High number of right-turn rear-end collisions occurred at westbound channelized right-turn – *over 50% of total 30 collisions*
- High number of left-turn opposing collisions occurred with eastbound left-turns – *20 collisions*
- High proportion of "red-light running" collisions occurred in the eastbound direction – *8 out of total 12 collisions*
- High number of sideswipe collisions occurred with northbound movements – *24 collisions (39% of total)*
- One fatal collision reported during a weekday afternoon on December 2017; location and type are not available

GARDEN CITY ROAD / GREAT CANADIAN WAY & SEA ISLAND WAY

Operational (Field Review):

- Congestion / long queues during peak periods – *all directions*
- Significant left/right-turn volumes/queues during peak periods – *all approaches*
- Significant lane changing/weaving activities – *northbound and east-west directions; especially to/from highway*
- Vehicle queue spillback from downstream – *north (signalized intersection) and east (interchange on-ramp) legs*

Other:

- Missing pavement marking – *north side corners; dashed merge line (similar to southwest corner)*
- Missing road sign – *north side and southwest corners; no pedestrian/bicycle crosswalk signage as well as object marker signage*
- Inappropriate road sign – *north side and southwest corners; yield sign far from actual merge point and before pedestrian crosswalk*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 5 to 15% of Total Collisions):

- Regularly trim foliage to provide adequate sight distance – *southwest corner*
- Paint elephant feet along crosswalk – *west leg*
- Paint dashed merge line – *north side corners; similar to southwest corner*
- Provide pedestrian/bicycle crosswalk signage – *north side and southwest corners*
- Provide object marker signage – *north side and southwest corners*
- Consider the provision of protected-only left-turn phase – *eastbound approach*

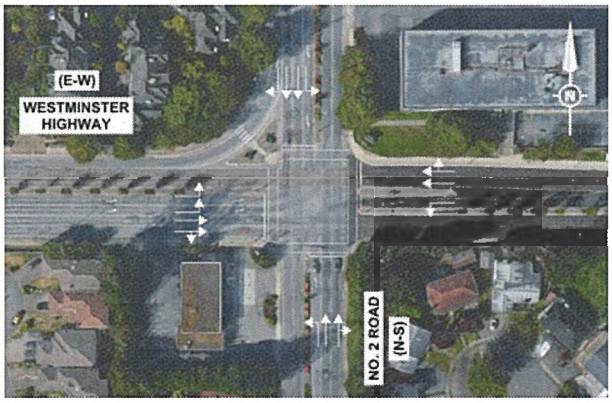
Medium/Long-Term:

- Review and update the Garden City Road signal coordination with the signal at Bridgeport Road in coordination with MoTI – *overall*
- Remove or modify angle of channelized right-turn in coordination with MoTI – *east-west approaches; traffic operation and geometric design to confirm*
- Realign northbound dual right-turn lane in coordination with MoTI to improve sight line and eliminate the lane drop by developing the right-turn lanes as auxiliary lanes with future redevelopment – *south leg*
- Provide westbound right-turn lane with future redevelopment – *southwest quadrants*
- Review driveway locations with future redevelopment – *northeast quadrant*
- Design for adequate sight distance with future redevelopment – *southwest corner*
- Enhance police enforcement for speeding and red-light running violation in coordination with RCMP and ICBC – *all approaches*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding and right-turn lanes

NO. 2 ROAD & WESTMINSTER HIGHWAY

INTERSECTION INFORMATION

Site #:	3
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT in all directions
N-S Street Classification:	Arterial (MRN) (Bike Route - NL)
E-W Street Classification:	Arterial (MRN - EL)
Surrounding Land Use:	Retail / Office / Residential
Daily Traffic Volume (2015):	57,800 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	71.7 per year	(Total = 215)
Collision Severity Index:	4.47	(Casualty = 39%)
Collision Rate OBS. / CRT.:	3.63 / 3.27	[2013-2017]
Collision with Pedestrian:	2	
Collision with Cyclist:	2	

Highest % Month:	February (11%)
Highest % Day of Week:	Friday (19%)
Highest % Time Period:	3 PM - 6 PM (20%)
Top 3 Collision Types:	Rear End (58%) Left Turn (16%) Sideswipe (12%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Misalignment of left-turn lanes – *north-south approaches*
- Commercial driveways close to intersection – *southwest quadrant (gas station)*
- Inadequate sight distance due to nearby foliage and insufficient property setback – *northwest (channelized right-turn) and south side corners*
- Wide left-turn crossing distance – *southbound approach; especially for heavy vehicles*
- Long designated channelized right-turn with auxiliary lane – *southbound approach (wide turning radius); high vehicle speed conflicts between crossing pedestrians and weaving vehicles to designated right-turn lane to Lynas Lane*

Signal:

- Dual left-turn lanes with protected/permitted phase – *eastbound approach (right-turn-on-red is prohibited for westbound approach); conflict with east-west crossing pedestrians*

Vulnerable Road User:

- Limited visibility to crosswalk for right-turn drivers – *southbound approach*
- Narrow sidewalk with the presence of utility poles – *south side*
- Long pedestrian crossing distance – *north-south directions*
- On-street bike lane ended at channelized right-turn lane – *southbound approach*
- On-street near-side bus stop – *westbound approach*

Collision (Data Review):

- High collision frequency (over 50.0), and a collision-prone location (observed over critical collision rate)
- High proportion of rear-end collisions reported in southbound direction (35%), followed by westbound (24%)
- High proportion of left-turn opposing collisions reported in the east-west directions – *70% of total; eastbound with 13 collisions and westbound with 8 collisions*
- High proportion of sideswipe collisions occurred with southbound movements – *12 collisions (48% of total)*
- Two pedestrian-involved collisions reported between eastbound left-turn vehicles and pedestrians crossing No. 2 Road on north leg

NO. 2 ROAD & WESTMINSTER HIGHWAY

Collision (Data Review) – *CONTINUED*:

- One cyclist-involved collision reported between northbound left-turn vehicle and a bicycle crossing Westminster Highway on west leg, the other collision occurred between a bicycle on No. 2 Road and vehicle exiting a parking lot turning right

Operational (Field Review):

- Congestion / long queues during peak periods – *all directions*
- Significant left/right-turn volumes/queues during peak periods – *all approaches*
- High vehicle speed during non-congested periods – *north leg; to/from No. 2 Road Bridge*
- Unexpected auxiliary lane with designated right-turn lane – *southbound approach; right-turn vehicles stopped to yield westbound through traffic*
- Unexpected vehicle slow down to enter commercial driveway – *southbound direction; to gas station*
- Broken vehicle parts were found at the southbound right-turn channelized island

Other:

- Missing road sign – *northwest corner; no Added Lane Sign for eastbound drivers and no object marker sign for westbound drivers*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 20 to 30% of Total Collisions):

- Consider conducting a detailed traffic operations and safety review study, including the functional design of the recommended geometric layout – *overall*
- Regularly trim foliage – *northwest and south side corners*
- Provide additional signage and pavement markings for designated right-turn only lane further upstream – *southbound approach*
- Provide Added Lane Sign – *southbound approach*
- Paint guiding line – *southbound approach*
- Check intergreen time to verify the possible contributing cause for high number of left-turn opposing collisions – *overall*
- Change left-turn signal phasing from protected/permission to protected-only – *eastbound and westbound approach*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – all approaches

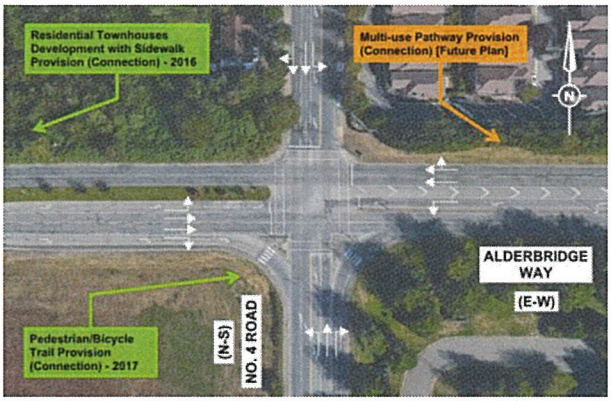
Medium/Long-Term:

- Install advance warning flashers (if warranted) – *southbound approach*
- Provide adequate sight distance with future redevelopment – *south side corners*
- Enhance police enforcements for vehicle speeding violations in coordination with RCMP – *all approaches, particularly southbound*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding and right-turn lanes

NO. 4 ROAD & ALDERBRIDGE WAY

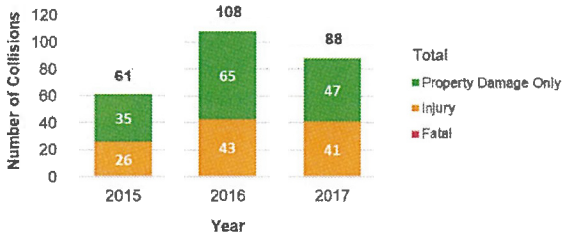
INTERSECTION INFORMATION

Site #:	4
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for E-W
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial (MRN)
Surrounding Land Use:	Residential / Recreational / Civic
Daily Traffic Volume (2015):	59,200 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	85.7 per year	(Total = 257)
Collision Severity Index:	4.85	(Casualty = 43%)
Collision Rate OBS. / CRT.:	3.54 / 3.27	[2013-2017]
Collision with Pedestrian:	0	
Collision with Cyclist:	0	



Highest % Month:	October (12%)
Highest % Day of Week:	Wednesday (20%)
Highest % Time Period:	3 PM - 6 PM (23%)
Top 3 Collision Types:	Rear End (79%)
	Left Turn (11%)
	Sideswipe (5%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Rural perception at wide intersection with channelized right-turn islands – *overall*
- Misalignment of left-turn bays with wide medians – *east-west approaches; westbound vehicles were spotted crossing the painted median*
- Lane drop from through to designated right-turn lane – *northbound approach*
- Residential driveways close to intersection – *southbound approach*
- Designated right-turn lane with yield control to through traffic – *eastbound and northbound approaches*

Signal:

- Lack of left-turn phase with left-turn bay provided – *north-south approaches*

Vulnerable Road User:

- Long pedestrian crossing distance – *north-south directions*
- Incomplete pedestrian connection – *northwest corner*
- Old pedestrian pushbuttons – *southwest corner*

Collision (Data Review):

- High collision frequency (over 50.0), and a collision-prone location (observed over critical collision rate)
- High number of rear-end collisions reported on northbound direction – *88 collisions (49% of total 180 collisions), majority were* right-turn rear-end collisions – *76 collisions*
- High proportion of left-turn rear-end collisions reported on westbound– *10 out of total 17 collisions*
- High proportion of sideswipe collisions occurred on east-west approaches – *10 out of total 13 collisions*
- High proportion of left-turn opposing collisions reported in the east-west directions – *over 80% of total; westbound with 11 collisions and eastbound with 10 collisions*
- Four right-angle collisions reported – *3 collisions occurred due to red-light running in the north-south directions*

Operational (Field Review):

- Congestion / long queues during peak periods – *all approaches*
- Significant lane changing/weaving activities – *northbound approach*
- High vehicle speed – *east-west legs; especially to/from highway*

NO. 4 ROAD & ALDERBRIDGE WAY

Operational (Field Review) – *CONTINUED*:

- Unexpected yield control with designated right-turn lane and high vehicle speed – *northbound and eastbound approach*
- Faded pavement marking – *southeast corner; dashed merge lines*
- Poor pavement condition – *overall intersection*

Other:

- Missing road sign – *northbound and eastbound approaches (no pedestrian crosswalk signs at channelized islands)*
- Broken vehicle parts were found at the eastbound channelized island
- Insufficient street lighting – *south side corner*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 20 to 30% of Total Collisions):

- Provide pedestrian crosswalk signs – *south side corners; at channelized islands*
- Upgrade pedestrian pushbuttons to the latest standard – *southwest corner*
- Regularly repaint dashed merge line – *southeast corner*
- Review signal progression – *east-west approaches*
- Conduct warrant analysis for adding left-turn phase – *north-south approaches*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *all approaches*
- Install enlarged Yield Sign or two Yield signs at channelized right-turn lane – *eastbound and northbound approaches*

Medium/Long-Term:

- Add left-turn phase (if warranted) – *north-south approaches*
- Remove or reconstruct right-turn channelized island – *south side corners*
- Consider to install red-light camera (under ICBC jurisdiction) – *east-west approaches*
- Complete pedestrian connection with future redevelopment – *northwest corner*
- Review and improve street lighting (if required) – *south side corners*
- Enhance police enforcements for vehicle speeding and red-light running violations in coordination with RCMP and ICBC – *east-west approaches*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding and right-turn lanes

NO. 5 ROAD & WESTMINSTER HIGHWAY

INTERSECTION INFORMATION

Site #:	5
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT in all directions
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial (MRN) (Bike Route)
Surrounding Land Use:	Retail / Residential
Daily Traffic Volume (2015):	48,800 Entering Vehicles

COLLISION STATISTICS (2015-2017)

Collision Frequency:	85.3 per year	(Total = 256)
Collision Severity Index:	4.90	(Casualty = 34%)
Collision Rate OBS. / CRT.:	4.28 / 3.30	[2013-2017]
Collision with Pedestrian:	0	
Collision with Cyclist:	1	

Highest % Month:	December (11%)
Highest % Day of Week:	Wednesday/Thursday (18%)
Highest % Time Period:	3 PM - 6 PM (34%)
Top 3 Collision Types:	Rear End (65%) Sideswipe (15%) Left Turn (8%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Rural perception at wide intersection with channelized right-turn islands – *overall*
- Undivided roadway – *south leg; conflicts with traffic turning to/from commercial driveways were observed*
- Short merging distance after intersection – *south leg*
- Right-turn lane immediately after intersection – *west leg; to Nature Park*

Signal:

- None

Vulnerable Road User:

- Inadequate/inconsistent bicycle facility – *east-west directions (no pavement markings east leg)*
- Long pedestrian crossing distance – *north-south directions*

Collision (Data Review):

- High collision frequency (over 50.0), and a collision-prone location (observed over critical collision rate)
- Annual number of collisions slightly increased from 2015 to 2017
- High number of rear-end collisions reported on southbound (37%), followed by westbound (27%)
- High number of right-turn rear-end collisions on southbound – *41 collisions (26% of total collisions)*
- High number of sideswipe collisions occurred on Westminster Highway approaches – *20 out of 37 total collisions*
- High proportion of left-turn opposing collisions reported in the east-west direction – 62% of total; *eastbound with 6 collisions and westbound with 6 collisions*
- Four collisions occurred by U-turn movements – *2 on westbound and 2 on northbound*
- One cyclist-involved collision reported as a bicycle hit by eastbound vehicle turning right onto gas station

Operational (Field Review):

- Congestion / long queues during peak periods – *east-west directions; to/from highways*
- Significant lane changing/weaving activities – *all directions; conflicts between southbound left-turn and northbound right turn vehicles*
- High vehicle speed – *all directions; especially southbound and westbound from highways; presence of red-light camera for northbound approach*

NO. 5 ROAD & WESTMINSTER HIGHWAY

Operational (Field Review) – *CONTINUED*:

- Commercial driveways close to intersection – *southeast quadrant (gas station)*
- Heavy vehicle was observed to roll over to the southwest corner curb

Other:

- Faded pavement marking – *east leg (lane merge arrows)*
- Missing road sign – *north side corners; pedestrian crosswalk signs at channelized islands*
- Inadequate/inconsistent road sign – *all approaches (designated right-turn lane signs)*
- Insufficient street lighting – *southeast corners*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 15 to 25% of Total Collisions):

- Provide pedestrian crosswalk signs – *north side corners*
- Regularly repaint lane merge arrow pavement markings – *east leg*
- Paint green bike path markings – *northeast corner; similar to the northwest corner*
- Provide additional designated right-turn signs – *southbound and east-west approaches*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *all approaches*
- Install enlarged Yield Sign or two Yield signs at channelized right-turn lane – *southbound and westbound approaches*

Medium/Long-Term:

- Remove or reconstruct right-turn channelized island – *north side corners*
- Review and redesign designated and channelized right-turn – *westbound approach (to northbound); adding auxiliary lane instead of yield control*
- Review the posted speed limit of Westminster Highway – *reduce from 60 to 50 kilometres per hour (if warranted)*
- Improve bike connection – *east-west direction; provision of off-road multi-use pathway with green paint and elephant's feet crossing instead of single file operation*
- Review and improve street lighting (if required) – *southeast corner*
- Enhance police enforcements for vehicle speeding, red-light running, and U-turn violations in coordination with RCMP and ICBC – *all approaches*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding and right-turn lanes

NO. 5 ROAD & CAMBIE ROAD

INTERSECTION INFORMATION

Site #:	6
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT in all directions
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial (MRN)
Surrounding Land Use:	Retail / School / Residential
Daily Traffic Volume (2015):	37,000 Entering Vehicles

COLLISION STATISTICS (2015-2017)

Collision Frequency:	76.0 per year	(Total = 228)
Collision Severity Index:	4.87	(Casualty = 43%)
Collision Rate OBS. / CRT.:	4.91 / 3.35	[2013-2017]
Collision with Pedestrian:	5	
Collision with Cyclist:	1	

Highest % Month:	September/December (12%)
Highest % Day of Week:	Friday (21%)
Highest % Time Period:	3 PM - 6 PM (36%)
Top 3 Collision Types:	Rear End (44%) Left Turn (26%) Sideswipe (22%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lack of left-turn bay – *all approaches; limited visibility of through traffic for left-turn drivers*
- Commercial and residential driveways close to intersection – *northwest, southeast, and southwest quadrants*
- Missing/broken flexile delineator – *west leg; at the commercial driveway location (most likely accessing/egressing)*

Signal:

- Provision of left-turn phase without left-turn bay – *all approaches*
- No countdown for pedestrian signal phases – *all directions*

Vulnerable Road User:

- Inadequate pedestrian facility – *overall (narrow letdowns) and northeast corner (small waiting area)*
- Substantial pedestrian crossing activities – *all legs (to/from school, shopping centre, and nearby southeast park, etc.)*

Collision (Data Review):

- High collision frequency (over 50.0), and a collision-prone location (observed over critical collision rate)
- High number of rear-end collisions reported on Cambie Road approaches – *over 60% of total 90 collisions*
- High number of left-turn opposing collisions reported for westbound (18) and eastbound (15)
- High number of sideswipe collisions occurred on all approaches
- One fatal collision reported including a driver who had fallen asleep and hit a cyclist (exact location is not available) around 3 AM on September 2013

Operational (Field Review):

- Congestion / long queues during peak periods – *eastbound and westbound directions*
- Significant lane changing/weaving activities – *all approaches; due to lack of left-turn bays*
- Left-turn vehicles from commercial driveway created conflicts with Cambie Road traffic – *east-west direction*
- Future development in close vicinity – *northwest and southeast quadrants (townhouses and commercial building; generate more traffic in the near future)*
- Drivers did not identify when left-turn phase will be provided, generating weaving activities, particularly with vehicles turning from commercial driveways
- High vehicle speed – *east-west directions; presence of red-light camera for eastbound approach*

NO. 5 ROAD & CAMBIE ROAD

Operational (Field Review) – *CONTINUED*:

- Jaywalkers were observed crossing No. 5 Road between commercial stores

Other:

- None

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 20 to 30% of Total Collisions):

- Replace and install flexible delineators to restrict left-turn movements – *west leg*
- Review and adjust signal timing to provide priority and/or dedicated pedestrian phase during high pedestrian crossing activities – *after school and weekends*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *east-west approaches*

Medium/Long-Term:

- Add left-turn bay with future redevelopment – *all approaches, particularly east-west directions*
- Review driveway locations with future redevelopment – *northwest, southeast, ad southwest quadrants*
- Conduct detailed in-service operation and safety study, including collisions at shopping centre driveways – *overall*
- Review and widen letdown and increase waiting area (if required) – *overall*

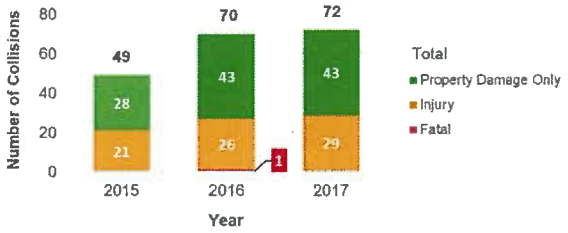
NO. 4 ROAD & WESTMINSTER HIGHWAY

INTERSECTION INFORMATION

Site #:	7
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT in all directions
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial (MRN) (Bike Route)
Surrounding Land Use:	Resi. / Rec. / Inst.
Daily Traffic Volume (2015):	63,800 Entering Vehicles

COLLISION STATISTICS (2015-2017)

Collision Frequency:	63.7 per year	(Total = 191)
Collision Severity Index:	5.10	(Casualty = 40%)
Collision Rate OBS. / CRT.:	2.57 / 3.26	[2013-2017]
Collision with Pedestrian:	0	
Collision with Cyclist:	1	



Highest % Month:	November (15%)
Highest % Day of Week:	Thursday (18%)
Highest % Time Period:	3 PM - 6 PM (35%)
Top 3 Collision Types:	Rear End (63%) Sideswipe (15%) Left Turn (15%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Misalignment of left-turn bays with wide medians – *east-west approaches*
- Lane drop after intersection due to on-street parking during off-peak periods – *south leg*
- Institutional driveways close to intersection – *southeast quadrant (vet hospital)*

Signal:

- Old pedestrian pushbuttons – *southwest corner*

Vulnerable Road User:

- Narrow sidewalk with the presence of utility poles – *northeast, southeast, and southwest quadrants*
- Inadequate pedestrian facility/connection – *east-west legs; no raised sidewalk and road curb*
- Inadequate bicycle facility on bike route – *east-west approach; signed and pavement markings*
- Long pedestrian crossing distance – *north-south directions*
- On-street near-side bus stop – *eastbound approach*

Collision (Data Review):

- High collision frequency (over 50.0), and high collision severity index (over 5.00)
- Annual number of collisions increased from 2015 to 2017
- High number of rear-end collisions reported on Westminster Highway approaches – *65% of total 114 collisions*
- High number of left-turn opposing collisions reported for eastbound (13) and northbound (5)
- High number of sideswipe collisions reported on eastbound and southbound directions – *8 collisions each*
- 3 collisions occurred between northbound vehicles and vehicles exiting the vet hospital parking lot turning left onto No. 4 Road
- One cyclist-involved collision occurred between southbound right-turn vehicle and bicycle crossing Westminster Highway on west leg
- One fatal collision reported due to a eastbound left-turn opposing collision and hitting a third vehicle stopped on No. 4 Road southbound during Sunday noon in October 2016
- One fatal collision reported with no clear descriptions during Saturday PM peak period on November 2013

NO. 4 ROAD & WESTMINSTER HIGHWAY

Operational (Field Review):

- Congestion / long queues during peak periods – *east-west directions*
- High vehicle speed – *east-west directions and northbound*

Operational (Field Review) – *CONTINUED*:

- Future development nearby and in close vicinity – *southwest (residential) and southeast quadrants; generate more traffic in the near future*
- Insufficient road sign – *east-west legs; bike signage and pavement markings, especially to alert right-turn vehicles*
- Damaged signal pole with heavy tire marks and broken vehicle parts were noticed at the northwest corner; suspect westbound off-road collision to the right side

Other:

- Insufficient street lighting – *northwest and southeast corners*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 15 to 25% of Total Collisions):

- Upgrade pedestrian pushbuttons to the latest standard – *southwest corners*
- Provide bike route related signage and pavement markings before/after intersection – *east-west legs*
- Improve east-west crossings for cyclists – *elephant's feet and green paint*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *all approaches*

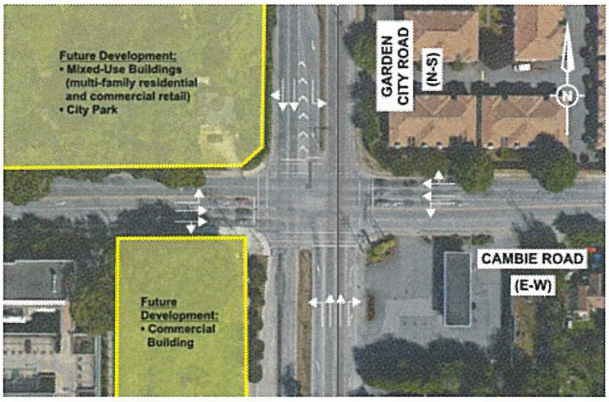
Medium/Long-Term:

- Extend left-turn bay with future redevelopment – *east-west approaches*
- Review driveway locations with future redevelopment – *northeast, southeast, and southwest quadrants*
- Improve pedestrian facility/connection with future redevelopment – *northeast, southeast, and southwest quadrants*
- Review and widen letdown and increase waiting area (if required) – *overall*
- Review and improve street lighting (if required) – *northwest and southeast corners*
- Enhance police enforcements for vehicle speeding violations in coordination with RCMP – *east-west approaches*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding
- Consider to install red-light camera (under ICBC jurisdiction) – *westbound approach*

GARDEN CITY ROAD & CAMBIE ROAD

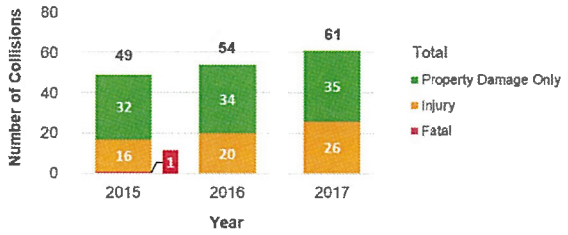
INTERSECTION INFORMATION

Site #:	8
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for NB & E-W
N-S Street Classification:	Arterial (Bike Route)
E-W Street Classification:	Arterial (MRN)
Surrounding Land Use:	Residential / Commercial
Daily Traffic Volume (2015):	46,600 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	54.7 per year	(Total = 164)
Collision Severity Index:	5.01	(Casualty = 38%)
Collision Rate OBS. / CRT.:	3.08 / 3.31	[2013-2017]
Collision with Pedestrian:	5	
Collision with Cyclist:	0	



Highest % Month:	November (14%)
Highest % Day of Week:	Saturday (21%)
Highest % Time Period:	3 PM - 6 PM (32%)
Top 3 Collision Types:	Rear End (57%) Sideswipe (16%) Left Turn (11%)

IDENTIFIED OPERATION AND SAFETY ISSUES

Geometric:

- Misalignment of left-turn bays with wide medians – *north-south approaches*
- Designated right-turn bay adjacent to commercial driveways – *northbound approach; increase lane weaving activities*
- Commercial driveways close to intersection – *southeast quadrants (gas station)*
- Inadequate sight distance due to nearby foliage – *northwest corner*

Signal:

- Lack of left-turn phase with left-turn bay provided – *southbound approach*

Vulnerable Road User:

- Narrow sidewalk with the presence of utility poles – *west side*
- No raised sidewalk – *south leg (east side)*
- Bike lane transition from designated to single file with vehicles – *northbound approach*
- Long pedestrian crossing distance – *east-west directions*
- On-street near-side bus stop – *westbound approach*

Collision (Data Review):

- High collision frequency (over 50.0), and high collision severity index (over 5.00)
- Annual number of collisions increased from 2015 to 2017
- High number of rear-end collisions reported on Garden City approaches – *over 60% of total 91 collisions*
- High number of sideswipe collisions occurred on Cambie Road approaches – *17 collisions (74% of total)*
- One fatal collision reported of a vehicle turning left from Cambie Road onto Garden City Road (direction is not available) and hitting a pedestrian crossing Garden City Road during weekday PM peak period on January 2015

Operational (Field Review):

- Congestion / long queues during peak periods – *all directions*
- Significant left/right-turn volumes/queues during peak periods – *all approaches*
- Significant lane changing/weaving activities – *east-west legs*
- *High vehicle speed – southbound approach (mainly to/from highway); presence of red-light camera for northbound approach*

GARDEN CITY ROAD & CAMBIE ROAD

Operational (Field Review) – *CONTINUED*:

- Vehicle queue spillback from downstream – *east leg; unexpected vehicle slow down to enter gas station*
- Long left-turn queue block through traffic lane – *northbound*
- Future development nearby – *northwest (mixed-use) and southwest (commercial) quadrants; generate more traffic in the near future*
- Notices to look for collision incident witnesses on June 2017 were found on utility poles at the intersection

Other:

- Insufficient street lighting – *northeast and southwest corners*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 15 to 25% of Total Collisions):

- Conduct warrant analysis for adding left-turn phase – *southbound approach*
- Consider the provision of protected-only left-turn phase – *north-south directions*
- Regularly trim foliage – *northwest corner*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *all approaches*

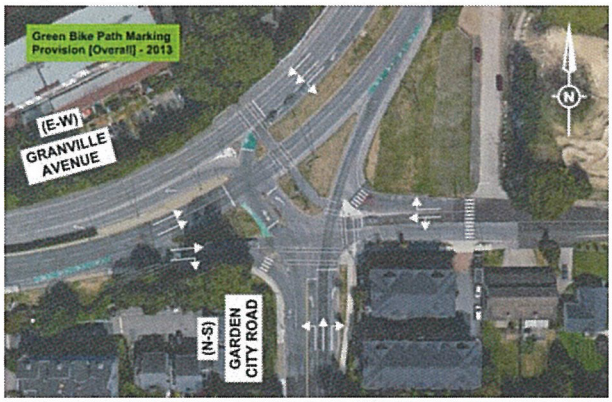
Medium/Long-Term:

- Add left-turn phase (if warranted) – *southbound approach*
- Review driveway locations with future redevelopment – *northwest and south side quadrants*
- Review and widen sidewalk with future redevelopment (if required) – *west side and south leg (east side)*
- Provide designated bike lane with future redevelopment – *northbound approach*
- Provide designated right-turn bay with future redevelopment – *southbound approach*
- Review and improve street lighting (if required) – *northeast and southwest corners*

GARDEN CITY ROAD & GRANVILLE AVENUE

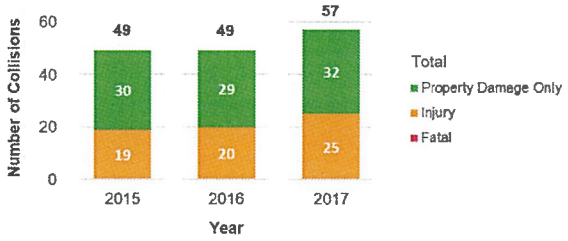
INTERSECTION INFORMATION

Site #:	9
Intersection Type:	3/4-Legged (Non-typical and busy)
Traffic Control Type:	Signalized
N-S Street Classification:	Arterial (Bike Route - NL)
E-W Street Classification:	Arterial (Bike Route - WL)
Surrounding Land Use:	Residential / Park
Daily Traffic Volume (2015):	25,400 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	51.7 per year	(Total = 155)
Collision Severity Index:	4.72	(Casualty = 41%)
Collision Rate OBS. / CRT.:	5.27 / 3.42	[2013-2017]
Collision with Pedestrian:	3	
Collision with Cyclist:	5	



Highest % Month:	April/October/November (10%)
Highest % Day of Week:	Saturday (18%)
Highest % Time Period:	3 PM - 6 PM (23%)
Top 3 Collision Types:	Rear End (77%) Sideswipe (11%) Cyclist Involved (3%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Confusing intersection layout with major traffic flow on westbound left-turn and southbound right-turn
- Left-turn merging to through traffic – *northbound from Garden City Road to Granville Avenue*
- Horizontal curve immediately before/after intersection – *north and west legs (poor visibility to intersection)*
- Skewed intersection layout – *central section and merging/auxiliary area (undesirable skew angles)*
- Channelized right-turn auxiliary lane – *east and south legs (increase lane changing/merging activities)*
- Sharp right-turn corner – *westbound approach; to Garden City Road (northbound)*
- Residential driveways close to intersection – *east leg*

Signal:

- Complex signal operation due to traffic layout and major vehicle movements
- Limited signal visibility – *southbound on Garden City Road*
- No countdown for pedestrian signal phases – *all directions*

Vulnerable Road User:

- Segmented and long pedestrian waiting time to cross intersection – *overall*
- Not ideal experience for cyclist – *overall; especially crossing by channelized island*
- On-street bus stop close to intersection – *east leg (eastbound)*

Collision (Data Review):

- High collision frequency (over 50.0), and a collision-prone location (observed over critical collision rate)
- Annual number of collisions increased from 2016 to 2017
- High number of rear-end collisions reported on northbound far-side merging to Garden City – *50 out of total 115 collisions*
- 12 right-turn rear-end collisions occurred on westbound channelized right-turn
- High number of sideswipe collisions occurred with northbound major movements – *10 collisions (59% of total)*
- Three pedestrian-involved collisions occurred – *one collision between westbound vehicle and a pedestrian crossing Granville Avenue on east leg, one collision between southbound vehicle and a pedestrian crossing Garden City Road on north leg, and one collision without any details*

GARDEN CITY ROAD & GRANVILLE AVENUE

Collision (Data Review) – *CONTINUED*:

- Five cyclist-involved collision occurred – *three collisions between eastbound right-turn vehicles and eastbound through bicycles, one collision between westbound right-turn vehicle and northbound bicycle, and one collision between northbound right-turn vehicle and southbound left-turn bicycle*

Operational (Field Review):

- Congestion / long queues during peak periods – *southbound and eastbound approaches*
- Vehicle queue spillback from downstream – *northbound and eastbound approaches*

Other:

- Inadequate pavement marking – *southeast (no dashed merge line) and southwest corner (no green bike lane marking)*
- Inappropriate pavement marking – *east leg; marked and signed crosswalk end at residential driveway*
- Missing road sign – *east-west approaches (no designated right-turn only signs) and southwest corner (no pedestrian crosswalk signs)*
- Inappropriate road sign – *eastbound approach (yield sign instead of Added Lane Sign); some right-turn drivers were confuse to stop or not*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 15 to 25% of Total Collisions):

- Consider conducting a feasibility study for intersection configuration options
- Replace Yield sign with Added Lane sign – *eastbound approach*
- Paint guiding line – *southbound approach; specifically for bicycles*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *all approaches*

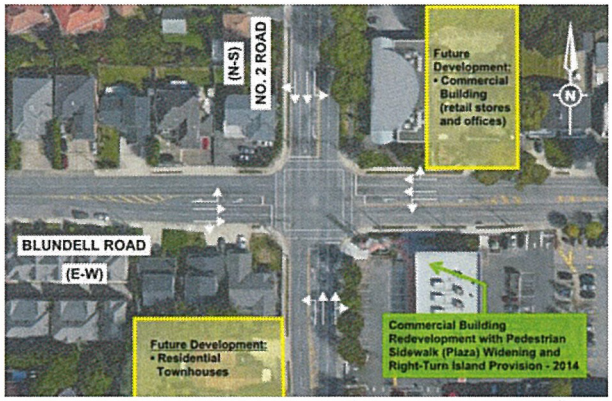
Medium/Long-Term:

- Remove or modify angle of channelized right-turn – *eastbound and westbound approaches; traffic operation and geometric design to confirm*

NO. 2 ROAD & BLUNDELL ROAD

INTERSECTION INFORMATION

Site #:	10
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT in all directions
N-S Street Classification:	Arterial (MRN)
E-W Street Classification:	Arterial
Surrounding Land Use:	Commercial / Residential
Daily Traffic Volume (2015):	33,400 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	35.0 per year	(Total = 105)
Collision Severity Index:	4.51	(Casualty = 39%)
Collision Rate OBS. / CRT.:	3.64 / 3.36	[2013-2017]
Collision with Pedestrian:	1	
Collision with Cyclist:	0	

Highest % Month:	May / September (143%)
Highest % Day of Week:	Wednesday (20%)
Highest % Time Period:	9 AM - 12 PM (26%)
Top 3 Collision Types:	Rear End (49%) Sideswipe (26%) Left Turn (7%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lane drop after intersection due to on-street parking during off-peak period – *west leg*
- Residential driveways close to intersection – *south (west side) and west (vehicles turning left to exit from driveways) legs*

Signal:

- No countdown for pedestrian signal phases – *all directions*

Vulnerable Road User:

- Substantial pedestrian crossing activities – *all directions*; *to/from retail stores and nearby schools*

Collision (Data Review):

- A collision-prone location (observed over critical collision rate)
- Annual number of collisions dropped from 2015
- High proportion of total number of collisions occurred during late morning peak period (9 AM to 12 PM) due to high shopping activities
- High number of rear-end collisions reported on No. 2 Road approaches – *33 out of total 48 collisions*
- High proportion of sideswipe collisions occurred at the north-south legs – *15 out of total 25 collisions*
- High proportion of left-turn opposing collisions occurred with northbound left-turn movements – *4 out of total 7 collisions*
- The pedestrian-involved collision reported between a southbound left-turn vehicle and a pedestrian crossing east leg
- 24 extra collisions reported at the signalized intersection of No. 2 Road and Blundell Centre driveway (south of the study intersection)

Operational (Field Review):

- Heavy traffic volumes – *all directions; peak (commuting trips) and off-peak (shopping trips) periods*
- Significant lane changing/weaving activities – *south and east legs; crossing two/three lanes to/from commercial driveways*

NO. 2 ROAD & BLUNDELL ROAD

Operational (Field Review) – *CONTINUED*:

- High vehicle speed – *southbound and eastbound approaches; long distance of nearby traffic controls for through movements*
- Future development nearby – *northeast (commercial) and southwest (residential) quadrants; generate more traffic in the near future*

Other:

- Broken flexible delineators – *south leg; which were installed on the centreline to restrict left-turn movements from commercial and residential driveways*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 5 to 15% of Total Collisions):

- Review and relocate/remove on-street parking close to the intersection – *west leg*
- Replace broken flexible delineators – *south leg*
- Provide signal progression for traffic signals at Blundell Road and Blundell Centre driveway – *north-south approaches*

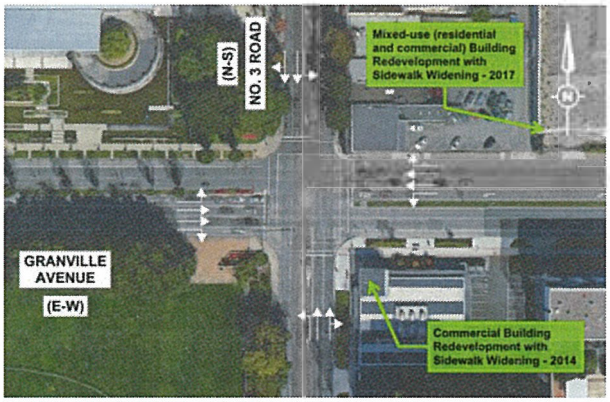
Medium/Long-Term:

- Increase left-turn bay storage length with future development – *northbound approach*
- Enhance police enforcements on vehicle speeding violations in coordination with RCMP – *southbound direction*
- Consider left-turn movement restriction at driveways for future development – *east leg*
- Consider adding left-turn bay to commercial development with future redevelopment – southbound
- Review on-site vehicle circulation and access with strip mall owner to reduce left-in and left-out movements into and out of the mall, especially the access on the south leg – *overall*
- Conduct detailed in-service operation and safety study, including collisions at shopping centre driveways – *overall*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding

NO. 3 ROAD & GRANVILLE AVENUE

INTERSECTION INFORMATION

Site #:	11
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT in all directions
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial (Bike Route)
Surrounding Land Use:	Retail / Park / Civic / Residential
Daily Traffic Volume (2015):	49,600 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	47.3 per year	(Total = 142)
Collision Severity Index:	5.88	(Casualty = 47%)
Collision Rate OBS. / CRT.:	2.44 / 3.30	[2013-2017]
Collision with Pedestrian:	12	(1 Fatal)
Collision with Cyclist:	5	

Highest % Month:	November (13%)
Highest % Day of Week:	Wednesday (16%)
Highest % Time Period:	3 PM - 6 PM (30%)
Top 3 Collision Types:	Rear End (59%)
	Sideswipe (15%)
	Pedestrian Involved (9%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Designated right-turn bays at a busy intersection – *east-west approaches*
- Sharp right-turn corner – *northeast corner*
- Long left-turn distance – *north-south approaches; damaged central island on the east leg (most likely chipped by southbound left-turn vehicles)*
- Inadequate sight distance due to insufficient property setback – *northeast corner*
- Special crosswalks immediately before/after intersection – *north leg*

Signal:

- No countdown for pedestrian signal phases – *all directions*

Vulnerable Road User:

- Substantial pedestrian/bicycle crossing activities – *all legs (to/from City Hall, park, retail stores, bus stops, shopping centre, etc.)*
- Long pedestrian crossing distance – *north-south directions*
- Bike lane share with right-turn lane – *east-west approaches*
- On-street near-side bus stop – *southbound approach*

Collision (Data Review):

- High collision severity index (over 5.00); high pedestrian-related incidents
- Annual number of collisions were similar in three years
- High number of left-turn rear-end collisions occurred on Granville Avenue approaches – *12 out of total 15 collisions*
- All right-turn rear-end collisions occurred on No. 3 Road approaches – *6 collisions*
- High proportion of sideswipe collisions occurred with northbound movement – *47% of total (9 collisions)*
- 7 out of 12 total pedestrian-involved collisions occurred between eastbound left-turn vehicles and pedestrians crossing north leg (3) and between northbound left-turn vehicles and pedestrians crossing west leg (4)
- One fatal collision reported of a westbound vehicle turning left from No. 3 Road northbound onto Granville Avenue hitting a pedestrian crossing Granville Avenue during noon time on November 2015

NO. 3 ROAD & GRANVILLE AVENUE

Operational (Field Review):

- Congestion / long queues during peak periods – *north-south directions*
- Significant left-/right-turn volumes/queues during peak periods – *all approaches; right-turn vehicles merge in advance along on-street bike lane to avoid any queue*
- Lots of pedestrian crossing activities during the red pedestrian signal phase – *all approaches*

Other:

- Insufficient street lighting – *northeast corner*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 20 to 30% of Total Collisions):

- Review and adjust signal timing to provide priority and/or dedicated pedestrian phase – *all directions*
- Delay turning traffic for pedestrian/bicycle crossing – *overall*
- Paint guiding line – *north-south approaches*
- Paint coloured pavement marking for crosswalk to alert drivers for substantial pedestrian/bicycle crossing activities (i.e. the City typically uses Redwood, Pantone #18-1443) – *all legs*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *all approaches*

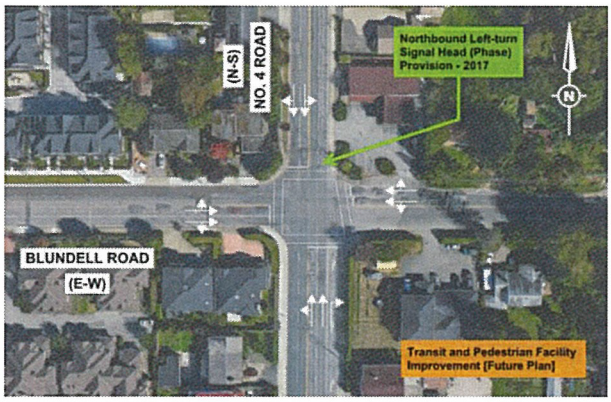
Medium/Long-Term:

- Review and widen corner and provide adequate sight distance with future redevelopment (if required) – *northeast corner*
- Provide designated bike lane by separating with right-turn lane with future redevelopments – *east-west approaches*
- Enhance police enforcements for pedestrian crossing violations in coordination with RCMP – *all approaches*

NO. 4 ROAD & BLUNDELL ROAD

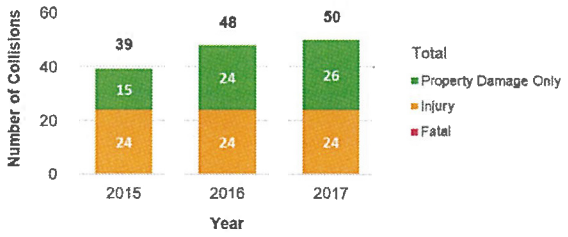
INTERSECTION INFORMATION

Site #:	12
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for N-S & EB
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial
Surrounding Land Use:	Residential / Institutional
Daily Traffic Volume (2015):	34,500 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	45.7 per year	(Total = 137)
Collision Severity Index:	5.73	(Casualty = 53%)
Collision Rate OBS. / CRT.:	3.39 / 3.36	[2013-2017]
Collision with Pedestrian:	1	
Collision with Cyclist:	1	



Highest % Month:	January (15%)
Highest % Day of Week:	Friday (20%)
Highest % Time Period:	3 PM - 6 PM (36%)
Top 3 Collision Types:	Rear End (42%) Left Turn (28%) Sideswipe (13%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lack of left-turn bay – *all approaches; limited visibility of through traffic for left-turn drivers*
- Wide receiving lane – *east leg; conflicts between northbound right-turn and southbound left-turn vehicles*
- Lane drop with short merge lane after intersection – *east leg*
- Residential and institutional driveways close to intersection – *north, east, and west legs*
- Inadequate sight distance due to nearby foliage and insufficient property setback – *northwest and south side corners*

Signal:

- Provision of left-turn phase without left-turn bay – *north-south and eastbound approaches*
- Lack of left-turn phase – *westbound approach*

Vulnerable Road User:

- No raised sidewalk and road curb – *east leg*
- Narrow sidewalk – *east side*
- Small pedestrian waiting area – *all corners*
- Narrow letdown – *north side corners*

Collision (Data Review):

- Annual number of collisions increased from 2015 to 2017
- High collision severity index (over 5.00), and a collision-prone location (observed over critical collision rate)
- High number of rear-end collisions reported on the westbound approach (33%), followed by northbound (29%)
- High proportions of left-turn opposing collisions occurred in north-south directions – over 60% of total; *12 collisions involved northbound left-turns and 11 collisions involved southbound left-turns*
- High proportions of sideswipe collisions occurred in the southbound direction (35%), followed by eastbound (29%)
- 11 right-angle collisions occurred in total – *3 collisions were reported when there was a power outage and intersection was operating as four-way stop-controlled; north-south directions had the highest number of collisions due to running the red light*
- A pedestrian-involved collision reported between a southbound through vehicle and a pedestrian crossing No. 4 Road (north/south leg)
- A cyclist-involved collision reported between a westbound left-turn vehicle and a bicycle crossing south leg

NO. 4 ROAD & BLUNDELL ROAD

Operational (Field Review):

- Heavy traffic volume – *east-west directions*
- Significant lane changing/weaving activities – *all directions; due to lack of left-turn bays and existence of lane drop*
- On-street parking close to intersection during off-peak periods – *west leg*
- Future development in close vicinity – *northeast and northwest quadrants (residential); generate more traffic in the near future*

Other:

- None

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 10 to 20% of Total Collisions):

- Re-paint approach lanes as left-turn only lane and shared through-right lane – *eastbound and westbound approach; reduce receiving lane as one lane with pavement marking*
- Review and relocate/remove on-street parking – *west leg*

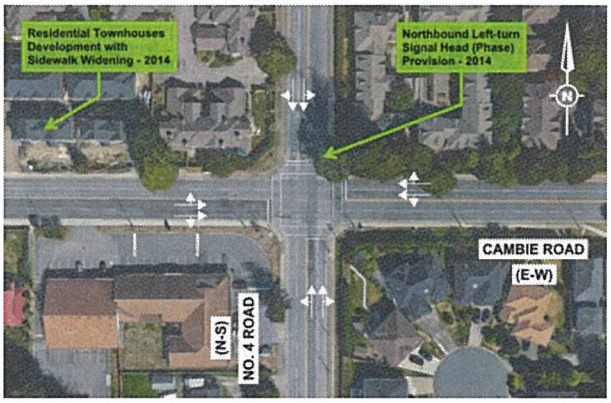
Medium/Long-Term:

- Add left-turn bay with future development – *north-south approaches then east-west approaches; traffic operation and geometric design to confirm*
- Consider to install red-light camera (under ICBC jurisdiction) – *southbound approach*
- Review driveway locations with future redevelopment – *overall*
- Design for adequate sight distance with future redevelopment – *overall*
- Review and widen pedestrian sidewalks, waiting areas, and letdowns (if required) – *overall*

NO. 4 ROAD & CAMBIE ROAD

INTERSECTION INFORMATION

Site #:	13
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for N-S & WB
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial (MRN)
Surrounding Land Use:	Residential / Retail
Daily Traffic Volume (2015):	34,700 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	39.3 per year	(Total = 118)
Collision Severity Index:	4.97	(Casualty = 44%)
Collision Rate OBS. / CRT.:	3.08 / 3.36	[2013-2017]
Collision with Pedestrian:	4	
Collision with Cyclist:	0	

Highest % Month:	November (19%)
Highest % Day of Week:	Friday (22%)
Highest % Time Period:	3 PM - 6 PM (22%)
Top 3 Collision Types:	Rear End (42%) Left Turn (29%) Sideswipe (18%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lack of left-turn bay – *all approaches; limited visibility of through traffic for left-turn drivers*
- Lane drop after intersection – *north leg*
- Commercial driveways close to intersection – *south leg*
- Inadequate sight distance due to nearby tree trunk – *northeast corner*

Signal:

- Limited signal head visibility – *northern approach; due to nearby foliage and signal pole setback and foliage at the northeast corner*
- Provision of left-turn phase without left-turn bay – *north-south and westbound approaches*
- Lack of left-turn phase – *eastbound approach*
- Delay pedestrian crossing timing – *east leg; for southbound left-turn movement*

Vulnerable Road User:

- Narrow sidewalk with the presence of utility poles – *east leg (south side)*
- Narrow letdown – *all corners*

Collision (Data Review):

- Annual number of collisions increased from 2015 to 2017
- High number of rear-end collisions reported on eastbound approach – *37% of total 47 collisions*
- High number of left-turn opposing collisions reported for northbound (16 collisions) and for westbound (7 collisions)
- High number of sideswipe collisions occurred with southbound movement – *21 collisions (39% of total)*
- All pedestrian-involved collisions (4 collisions) occurred between vehicles turning left/right from No. 4 Road onto Cambie Road while pedestrians crossing Cambie Road

Operational (Field Review):

- Congestion / long queues during peak periods – *east-west approaches*
- Significant lane changing/weaving activities – *all approaches; due to lack of left-turn bays*
- High vehicle speed – *east-west legs; to/from overpass*

NO. 4 ROAD & CAMBIE ROAD

Operational (Field Review) – *CONTINUED*:

- "SPEED KILLS" sign was noted in the eastbound approach indicating high vehicle speed identified
- Notices looking for witnesses on a vehicle collisions dated September 2018 were found on utility poles

Other:

- Insufficient street lighting – *northeast corner*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 15 to 25% of Total Collisions):

- Regularly trim foliage – *northeast corner*
- Add a near-side tertiary traffic signal head – *northbound approach*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *east-west approaches*
- Conduct warrant analysis for adding left-turn phase – *eastbound approach*
- Add left-turn bay – *east-west approaches; traffic operation and geometric design to confirm (feasibility/design)*
- Review and adjust signal timing to provide priority and/or dedicated pedestrian phase – all approaches
- Advance merge sign before the intersection OR provide two exit lane and merge further north – *northbound approach*

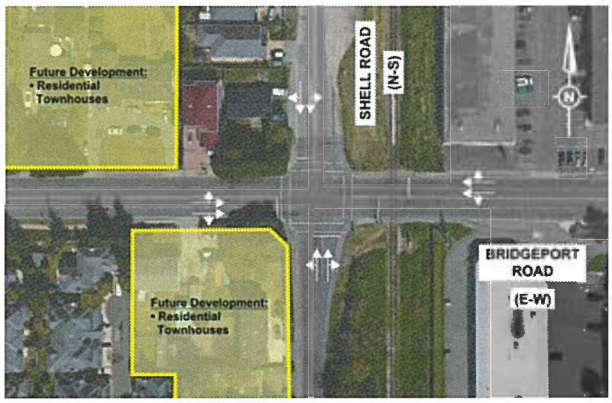
Medium/Long-Term:

- Add left-turn phase (if warranted) – *eastbound approach*
- Add left-turn bay – *east-west approaches; traffic operation and geometric design to confirm (construction)*
- Review and widen sidewalk and letdowns (if required) – *overall*
- Enhance police enforcements for vehicle speeding violations in coordination with RCMP – *east-west approaches*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding
- Consider to install red-light camera (under ICBC jurisdiction) – *westbound approach*

SHELL ROAD & BRIDGEPORT ROAD

INTERSECTION INFORMATION

Site #:	14
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for WB
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial (MRN)
Surrounding Land Use:	Residential / Industrial
Daily Traffic Volume (2015):	33,200 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	37.7 per year	(Total = 113)
Collision Severity Index:	6.18	(Casualty = 58%)
Collision Rate OBS. / CRT.:	2.83 / 3.37	[2013-2017]
Collision with Pedestrian:	5	
Collision with Cyclist:	0	

Highest % Month:	July (12%)
Highest % Day of Week:	Monday (18%)
Highest % Time Period:	9 AM - 12 PM / 3 PM - 6 PM (23%)
Top 3 Collision Types:	Rear End (49%) Left Turn (23%) Sideswipe (11%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lack of left-turn bay – *all approaches; limited visibility of through traffic for left-turn drivers*
- Wide receiving lane – *north leg; conflicts between westbound right-turn and eastbound left-turn vehicles and two northbound through vehicles*
- Short merge lane after intersection – *north leg*
- Residential driveways close to intersection – *north and west legs*
- Inadequate sight distance due to nearby foliage and insufficient property setback – *west side corners*
- Presence of railway crossing – *east leg; two sets of westbound signal heads with one stop bar*

Signal:

- Lack of left-turn phase – *north-south and eastbound approaches*
- Provision of left-turn phase without left-turn bay – *westbound approach*

Vulnerable Road User:

- Inadequate pedestrian/bicycle facility/connection – *overall intersection; conflicts between right-turn vehicles and crossing pedestrians/bicycles*

Collision (Data Review):

- Annual number of collisions increased from 2015 to 2017
- High collision severity index (over 5.00)
- High number of rear-end collisions reported on Bridgeport Road approaches – *85%; 25 occurred on westbound*
- All left-turn opposing collisions occurred in the east-west directions – *14 for westbound and 11 for eastbound*
- High number of sideswipe collisions occurred on westbound (6 collisions), followed by eastbound (3 collisions)
- Two pedestrian-involved collisions (out of five) reported between vehicles turning right from Shell Road onto Bridgeport Road and pedestrians crossing Bridgeport Road

Operational (Field Review):

- Significant left-turn volumes/queues during peak periods – *east-west approaches; aggressive turning manoeuvers*
- Significant lane changing/weaving activities – *all directions; due to lack of left-turn bays*
- On-street parking close to intersection – *north leg; right-angle parking stalls along east side*

SHELL ROAD & BRIDGEPORT ROAD

Operational (Field Review) – *CONTINUED*:

- Future development nearby – *west side (residential); generate more traffic in the near future*
- Notices to look for collision incident witnesses on February 2019 were found on utility poles at the intersection

Other:

- Insufficient street lighting – *southwest corner*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 5 to 15% of Total Collisions):

- Review and relocate/remove right-angle parking spaces close to the intersection – *north leg*
- Regularly trim foliage to provide adequate sight distance – southwest corner

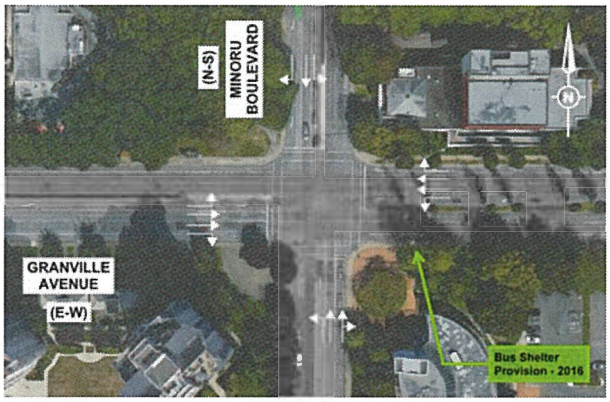
Medium/Long-Term:

- Repaint pavement marking to realign/convert approaches to one left-turn (align with opposite left-turn) with one shared through-right lane – *north-south approaches*
- Add left-turn bays with future redevelopments – *east-west approaches*
- Rearrange or relocate driveway locations away from the intersection with future redevelopment – *west side*
- Improve pedestrian/bicycle facility/connection – *overall*
- Review and improve street lighting (if required) – *southwest corner*

MINORU BOULEVARD & GRANVILLE AVENUE

INTERSECTION INFORMATION

Site #:	15
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for SB & E-W
N-S Street Classification:	Arterial (Bike Route - NL)
E-W Street Classification:	Arterial (Bike Route)
Surrounding Land Use:	Residential / Office / Civic / Park
Daily Traffic Volume (2015):	35,400 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	34.0 per year	(Total = 102)
Collision Severity Index:	5.24	(Casualty = 47%)
Collision Rate OBS. / CRT.:	2.65 / 3.35	[2013-2017]
Collision with Pedestrian:	12	
Collision with Cyclist:	0	

Highest % Month:	September (22%)
Highest % Day of Week:	Wednesday (22%)
Highest % Time Period:	9 AM - 12 AM (25%)
Top 3 Collision Types:	Rear End (55%) Sideswipe (16%) Pedestrian Involved (12%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Horizontal curve as well as institutional driveway before intersection – *southbound approach; vehicles weaving between the library loading area and intersection turning bays*
- Designated right-turn bays at a busy intersection – *east-west approaches*
- Lane drop from through to designated right-turn lane – *southbound approach*
- Wide receiving lane – *south leg; conflict between eastbound right-turn and westbound left-turn vehicles*
- On-street parking close to intersection – *south leg*

Signal:

- Lack of left-turn phase with left-turn bay provided – *northbound approach*
- No countdown for pedestrian signal phases – *all directions*

Vulnerable Road User:

- Substantial pedestrian/bicycle crossing activities – *all legs (to/from community centres, school, City Hall, shopping centre, park, etc.)*
- Special crosswalks near intersection – *north leg*

Collision (Data Review):

- Annual number of collisions increased in 2017
- High collision severity index (over 5.00)
- High number of rear-end collisions reported on southbound direction (39%), followed by eastbound (35%)
- High proportion of left-turn rear-end collisions occurred on eastbound – *11 out of total 13 collisions*
- High proportion of sideswipe collisions occurred on Granville Avenue approaches – *11 collisions (69% of total)*
- 7 right-angle collisions occurred – *4 collisions reported due to southbound vehicles running the red light*
- 6 out of 12 total pedestrian-involved collisions (50%) occurred between northbound left-turn vehicles (no left-turn phase) and pedestrians crossing west leg

Operational (Field Review):

- Congestion / long queues during peak periods – *east-west approaches*
- Significant left/right-turn volumes/queues during peak periods – *all approaches; conflict between right-turn vehicles and crossing pedestrians/bicycles*

MINORU BOULEVARD & GRANVILLE AVENUE

Operational (Field Review) – *CONTINUED*:

- Significant lane changing/weaving activities – *southbound approach (marked on-street bicycle lane crossing designated right-turn lane) and east-west directions (conflicts between right-turn vehicles and through bicycles/buses)*
- Existing bike facility is confusing to drivers/cyclists and too much information to process – *southbound; just before the taper, road user sees "Bike Lane Ends", overhead lane designation signs, green paint, bike symbol, Yield to Bike Cycle sign, and lane drop.*

Other:

- Insufficient street lighting – *northwest and south side corners*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 15 to 25% of Total Collisions):

- Review and adjust signal timing to provide priority and/or dedicated pedestrian phase – *all directions*
- Review and increase pedestrian crossing timing (if warranted) – *north-south directions*
- Conduct warrant analysis for adding left-turn phase – *northbound approach*
- Review and extend signal timings – *eastbound approach (specifically left-turn)*
- Paint green to crosswalk to alert drivers for high crossing activities – *all approaches*
- Enlarge signal lenses to 300-300-300 millimetres for primary traffic signal heads – *all approaches*

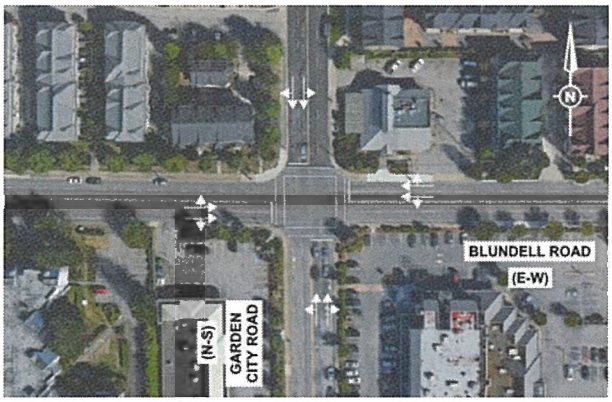
Medium/Long-Term:

- Add left-turn phase (if warranted) – *northbound approach*
- Consider conducting redesign of southbound approach to improve the crossing facilities
- Provide off-street multi-use pathway – *south leg (west side)*
- Consider to install red-light camera (under ICBC jurisdiction) – *westbound approach*
- Review and improve street lighting (if required) – *northwest and south side corners*
- Enhance police enforcements for vehicle red-light running violations in coordination with RCMP and ICBC – *all approaches*
- Enhance police enforcements for pedestrian crossing violations in coordination with RCMP – *all approaches*

GARDEN CITY ROAD & BLUNDELL ROAD

INTERSECTION INFORMATION

Site #:	16
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT in all directions
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial
Surrounding Land Use:	Commercial / Residential
Daily Traffic Volume (2015):	26,400 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	22.0 per year	(Total = 66)
Collision Severity Index:	4.68	(Casualty = 41%)
Collision Rate OBS. / CRT.:	3.35 / 3.41	[2013-2017]
Collision with Pedestrian:	1	
Collision with Cyclist:	0	

Highest % Month:	April / November (14%)
Highest % Day of Week:	Thursday (24%)
Highest % Time Period:	3 PM - 6 PM (30%)
Top 3 Collision Types:	Rear End (44%)
	Sideswipe (34%)
	Left Turn (15%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lack of left-turn bay – *all approaches; limited visibility of through traffic for left-turn drivers*
- Lane drop after intersection due to on-street parking during off-peak periods – *north, south, and west legs*
- Commercial driveways close to intersection – *northeast and southwest quadrants*

Signal:

- Provision of left-turn phase without left-turn bay – *all approaches*
- No countdown for pedestrian signal phases – *all directions*

Vulnerable Road User:

- Narrow letdown – *northeast corner*
- Substantial pedestrian/bicycle crossing activities – *all legs (to/from retail stores and nearby schools); conflict between left/right-turn vehicles and crossing pedestrians*

Collision (Data Review):

- Annual number of collisions were similar in three years
- High number of rear-end collisions reported on westbound (54%), followed by northbound (25%)
- High number of sideswipe collisions occurred on westbound (40%), followed by southbound (25%)
- High number of left-turn opposing collisions reported for E-W direction (over 65% of total)
- The pedestrian-involved collision occurred between a right-turning vehicle from Garden City Road (NB/SB) and a pedestrian crossing Blundell Road
- 26 extra collisions reported at the driveways (south and east legs) of Garden City Shopping Centre, located on the southeast corner of study intersection
- A fatal collision occurred between a vehicle exiting the shopping centre driveway to go westbound on Blundell Road and an eastbound vehicle during weekday AM peak period on February 2016
- Another fatal collision reported including an eastbound vehicle hitting a pedestrian who was jaywalking across Blundell Road during weekday AM peak period on October 2014

Operational (Field Review):

- Congestion / long queues during peak periods – *all approaches; especially shopping trips during weekend afternoon*

GARDEN CITY ROAD & BLUNDELL ROAD

Operational (Field Review) – *CONTINUED*:

- Significant lane changing/weaving activities – *all directions; due to lack of left-turn bays and allowance of on-street parking*
- On-street parking close to intersection – *northbound approaches; blocking through traffic from using curb lane and then change lane to avoid left-turn vehicles*
- Unfamiliar drivers may be confuse when the left-turn phase is on in each approach
- Jaywalkers crossing Garden City Road and Blundell Road were observed

Other:

- None

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 5 to15% of Total Collisions):

- Review and relocate/remove on-street parking next to shopping centre and close to intersection – *northbound approach*

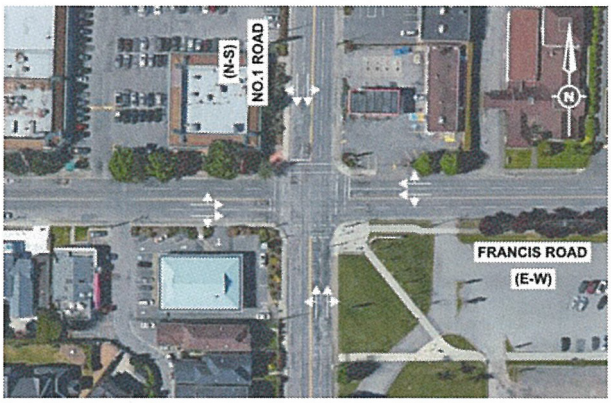
Medium/Long-Term:

- Provide left-turn bays with future redevelopments in the future – *overall*
- Conduct detailed in-service operation and safety study, including collisions at shopping centre driveways – *overall*
- Review and widen letdown (if required) – *northeast corner*

NO. 1 ROAD & FRANCIS ROAD

INTERSECTION INFORMATION

Site #:	17
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for N-S & WB
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial
Surrounding Land Use:	Comm. / Rec. / Inst. / Resi.
Daily Traffic Volume (2015):	27,200 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	27.3 per year	(Total = 82)
Collision Severity Index:	4.73	(Casualty = 41%)
Collision Rate OBS. / CRT.:	2.99 / 3.41	[2013-2017]
Collision with Pedestrian:	0	
Collision with Cyclist:	2	

Highest % Month:	May / June (13%)
Highest % Day of Week:	Friday / Wednesday (20%)
Highest % Time Period:	3 PM - 6 PM (29%)
Top 3 Collision Types:	Rear End (31%) Left Turn (30%) Sideswipe (26%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lack of left-turn bay – *all approaches; limited visibility of through traffic for left-turn drivers*
- Lane drop after intersection due to on-street parking during off-peak periods – *south, east, and west legs*
- Commercial and recreational driveways close to intersection – *north, east, and west legs*

Signal:

- Lack of left-turn phase – *eastbound approach*
- Provision of left-turn phase without left-turn bay – *north-south and westbound approaches*
- No countdown for pedestrian signal phases – *all directions*

Vulnerable Road User:

- Substantial pedestrian crossing activities – *all legs (to/from retail stores and nearby community centres and schools); conflict between left/right-turn vehicles and crossing pedestrians*
- No bicycle facilities provided – *overall intersection*

Collision (Data Review):

- High number of rear-end collisions occurred on No. 1 Road approaches – *10 for northbound and 7 for southbound; out of total 24 collisions*
- High number of left-turn opposing collisions occurred on N-S direction – *85%; 22 out of total 23 collisions*
- High proportion of sideswipe collisions reported for northbound (6), followed by eastbound/southbound (4); out of total 20 collisions
- Two cyclist-involved collisions occurred between vehicles turning left/right from No. 1 Road onto Francis Road and bicycle crossing east/west leg of the study intersection
- 20 extra collisions reported at the driveways of Seafair Centre (shopping plaza) located on the northwest corner of the intersection – *14 collisions at the driveway along No. 1 Road and 6 collisions at the driveway to Francis Road*

Operational (Field Review):

- Significant left-turn volumes/queues during commuter and school peak periods – *north-south approaches; aggressive turning manoeuvers*
- Significant lane changing/weaving activities – *all directions; due to lack of left-turn bays*
- Road work and lane closure on the northwest corner during the field review in early April

NO. 1 ROAD & FRANCIS ROAD

Other:

- None

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 10 to 20% of Total Collisions):

- Review and adjust signal timing to provide priority and/or dedicated pedestrian phase – *all approaches*
- Paint green pavement marking for crosswalk to alert drivers for substantial pedestrian crossing activities – *all legs*
- Review and relocate/remove on-street parking close to intersection – *south, east, and west legs*
- Conduct warrant analysis for adding left-turn phase – *eastbound approach*
- Educate community centre children and school students regarding safe pedestrian crossing – *overall*

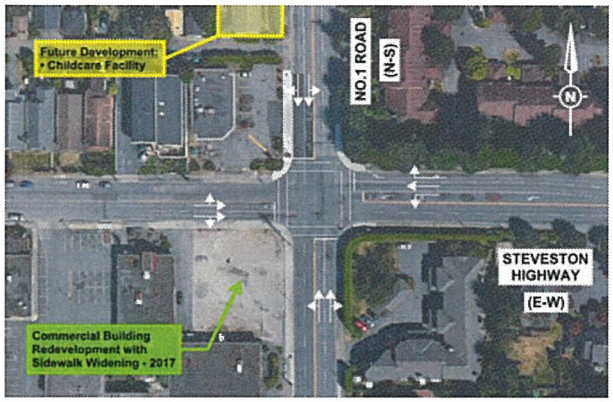
Medium/Long-Term:

- Consolidate commercial driveways with future redevelopment – *north leg*
- Add left-turn phase (if warranted) – *eastbound approach*
- Add left-turn bays with future redevelopments in the future – *all approaches, particular north-south directions*
- Conduct a detailed in-service operation and safety study to include the safety review of nearby commercial driveways – *overall*

NO. 1 ROAD & STEVESTON HIGHWAY

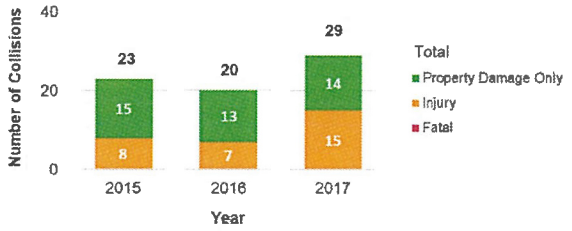
INTERSECTION INFORMATION

Site #:	18
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for SB & WB
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial
Surrounding Land Use:	Commercial / Residential
Daily Traffic Volume (2015):	34,300 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	24.0 per year	(Total = 72)
Collision Severity Index:	4.75	(Casualty = 42%)
Collision Rate OBS. / CRT.:	2.08 / 3.36	[2013-2017]
Collision with Pedestrian:	3	
Collision with Cyclist:	0	



Highest % Month:	December (14%)
Highest % Day of Week:	Saturday (19%)
Highest % Time Period:	3 PM - 6 PM (19%)
Top 3 Collision Types:	Rear End (30%) Left Turn (30%) Sideswipe (19%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lack of left-turn bay – *north-south and eastbound approaches; limited visibility of through traffic for left-turn drivers*
- Misalignment of left-turn lanes – *east-west approaches*
- Wide receiving lane – *west leg; conflicts between southbound right-turn and northbound left-turn vehicles*
- Commercial driveways and laneway close to intersection – *north and west legs*
- Inadequate sight distance due to nearby foliage and insufficient property setback – *east side corners*

Signal:

- Lack of left-turn phase – *northbound and eastbound approaches*
- Provision of left-turn phase without left-turn bay – *southbound approach*
- No countdown for pedestrian signal phases – *all directions*

Vulnerable Road User:

- Substantial pedestrian crossing activities – *all legs (to/from retail stores and nearby community centres and schools); conflict between left/right-turn vehicles and crossing pedestrians*
- Narrow letdown – *southeast corner*
- Small pedestrian waiting area – *northwest corner*

Collision (Data Review):

- High number of rear-end collisions occurred on westbound (7) and northbound (7), out of total 20 collisions
- High number of left-turn opposing collisions occurred for westbound (7) and southbound (7), out of total 19 collisions
- High number of sideswipe collisions reported for northbound and eastbound (4 each), out of total 11 collisions
- 7 right-angle collisions occurred – *4 collisions occurred when there was a power outage and intersection was operating as four-way stop-controlled*
- Two pedestrian-involved collisions occurred between westbound left-turn vehicles and pedestrians crossing south leg, and one pedestrian-involved collision reported between a southbound left-turn vehicle and a pedestrian crossing east leg
- High number of collisions occurred on Saturday due to high shopping activities and pedestrians walking to Steveston Village

NO. 1 ROAD & STEVESTON HIGHWAY

Operational (Field Review):

- Significant lane changing/weaving activities – *all approaches; due to lack of left-turn bays and existence of lane drop*
- On-street parking close to intersection – *west leg; no parking restriction with new development*
- Future development nearby – *northwest quadrant (institutional); generate more traffic in the near future*

Other:

- Missing pavement marking – *south leg (incomplete crosswalk)*
- Insufficient street lighting – *northwest corner*

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 15 to 25% of Total Collisions):

- Review and adjust signal timing to provide priority and/or dedicated pedestrian phase – *all approaches*
- Repaint approach to one left-turn lane plus one shared through-right lane and align with opposite left-turn lane – *eastbound approach*
- Add overhead lane designated sign – *westbound approach*
- Add on-street parking restriction zone close to intersection – *west leg*
- Add additional Designated Right-turn sign upstream – *westbound approach*
- Regularly trim foliage – *northeast corner*

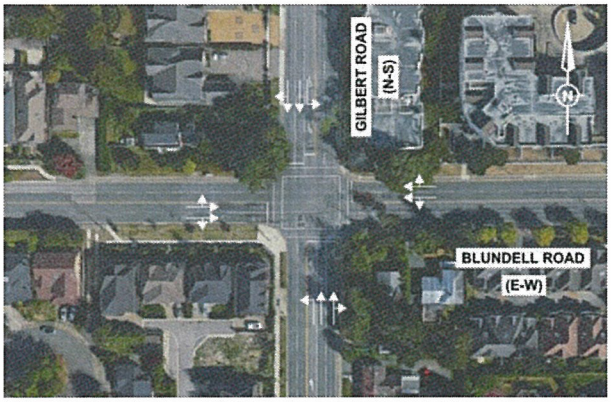
Medium/Long-Term:

- Add left-turn bays with future redevelopments in the future – *north-south approaches*
- Close driveways near intersection with future redevelopment – *north and west legs*

GILBERT ROAD & BLUNDELL ROAD

INTERSECTION INFORMATION

Site #:	19
Intersection Type:	4-Legged
Traffic Control Type:	Signalized - P/P LT for E-W
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial
Surrounding Land Use:	Residential
Daily Traffic Volume (2015):	32,700 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	25.7 per year	(Total = 77)
Collision Severity Index:	5.32	(Casualty = 48%)
Collision Rate OBS. / CRT.:	2.14 / 3.37	[2013-2017]
Collision with Pedestrian:	3	
Collision with Cyclist:	1	

Highest % Month:	May (14%)
Highest % Day of Week:	Tuesday (27%)
Highest % Time Period:	3 PM - 6 PM (29%)
Top 3 Collision Types:	Rear End (39%) Left Turn (23%) Sideswipe (16%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Lack of left-turn bay – *east-west approaches; limited visibility of through traffic for left-turn drivers*
- Lane drop after intersection due to on-street parking during off-peak periods – *east-west legs*
- Residential driveways and laneway close to intersection – *north, south, and east legs*
- Inadequate sight distance due to nearby foliage and insufficient property setback – *north side and southeast corners*

Signal:

- Lack of left-turn phase with left-turn bay provided – *north-south approaches*
- Provision of left-turn phase without left-turn bay – *east-west approaches*

Vulnerable Road User:

- Narrow letdown – *northeast corner*
- Small waiting area – *northeast corner; pedestrians close to tight right-turn vehicles*
- No bicycle facilities provided – *overall intersection*

Collision (Data Review):

- High collision severity index (over 5.00)
- High number of rear-end collisions occurred on westbound (11), followed by northbound (6); out of total 29 collisions
- High number of left-turn opposing collisions occurred for westbound (7), followed by southbound (4) out of total 17 collisions
- High number of sideswipe collisions reported for eastbound (42%) – *5 out of total 12 collisions*
- 9 right-angle collisions occurred – *6 collisions reported due to vehicles running the red light on in the east-west directions*
- Two out of total three pedestrian-involved collisions reported between left-turning vehicles and pedestrians crossing east leg and south leg
- The cyclist-involved collision reported between a vehicle turning right from Gilbert Road and a bicycle crossing Gilbert Road in front of the vehicle (north or south leg)

GILBERT ROAD & BLUNDELL ROAD

Operational (Field Review):

- Significant lane changing/weaving activities – *east-west approaches (due to lack of left-turn bays); two-way left-turn lane is also available on the north leg*
- High vehicle speed – *north-south legs; presence of red-light camera for westbound approach*

Other:

- None

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 10 to 20% of Total Collisions):

- Conduct warrant analysis for adding left-turn phase – *north-south approaches*
- Check intergreen time to verify the possible contributing cause for high number of right-angle collisions – *overall*
- Review and relocate/remove on-street parking close to intersection – *north, south, and east legs*
- Regularly trim foliage – *north side and southeast corners*

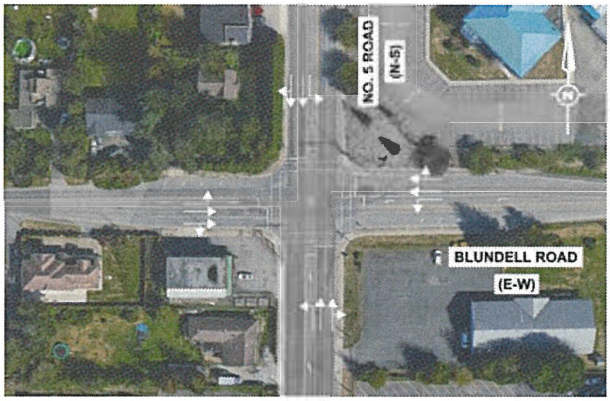
Medium/Long-Term:

- Add left-turn phase (if warranted) – *north-south approaches*
- Add left-turn bays with future redevelopments in the future – *east-west approaches*
- Enhance police enforcements for vehicle speeding violations in coordination with RCMP – *north-south legs*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding

NO. 5 ROAD & BLUNDELL ROAD

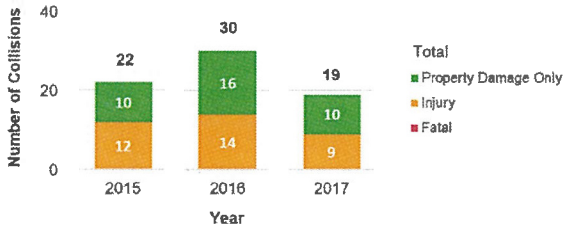
INTERSECTION INFORMATION

Site #:	20
Intersection Type:	4-Legged
Traffic Control Type:	Signalized
N-S Street Classification:	Arterial
E-W Street Classification:	Arterial
Surrounding Land Use:	Inst. / Comm. / Resi.
Daily Traffic Volume (2015):	25,100 Entering Vehicles



COLLISION STATISTICS (2015-2017)

Collision Frequency:	23.7 per year	(Total = 71)
Collision Severity Index:	5.44	(Casualty = 49%)
Collision Rate OBS. / CRT.:	2.73 / 3.42	[2013-2017]
Collision with Pedestrian:	0	
Collision with Cyclist:	0	



Highest % Month:	November (14%)
Highest % Day of Week:	Wednesday (24%)
Highest % Time Period:	3 PM - 6 PM (30%)
Top 3 Collision Types:	Rear End (59%) Sideswipe (16%) Left Turn (10%)

IDENTIFIED OPERATIONAL AND SAFETY ISSUES

Geometric:

- Horizontal and vertical curves before/after intersection – *east leg*
- Merge lane after intersection – *east-west legs*
- Lane drop after intersection due to on-street parking during off-peak periods – *north-south legs*
- Commercial, institutional, and residential driveways close to intersection – *south and west legs*
- Inadequate sight distance due to nearby foliage and insufficient property setback – *northwest corner*

Signal:

- Lack of left-turn phase with left-turn bay provided – *all approaches*
- Old pedestrian pushbuttons – *all corners*

Vulnerable Road User:

- Narrow sidewalk with utility poles – *northwest quadrant*
- No bicycle facilities provided – *overall intersection*

Collision (Data Review):

- High collision severity index (over 5.00)
- High number of rear-end collisions occurred on eastbound (14), followed by northbound (9); out of total 41 collisions
- High proportion of sideswipe collisions reported for eastbound – *40%; 4 out of total 11 collisions*
- High proportion of left-turn opposing collisions occurred for westbound left-turn movement – *3 out of total 6 collisions*
- 4 right-angle collisions occurred – *2 collisions occurred when there was a power outage and intersection was operating as four-way stop-controlled*
- A fatal collision reported between an eastbound vehicle going through the intersection and a northbound vehicle running the red light around weekday noon time on September 2013

Operational (Field Review):

- Significant left-turn volumes/queues during peak periods – *northbound and east-west approaches*
- Significant lane changing/weaving activities – *east-west directions*
- High vehicle speed – *north-south directions*

NO. 5 ROAD & BLUNDELL ROAD

Other:

- None

POTENTIAL IMPROVEMENTS

Short-Term (Potential Safety Benefit = 5 to 15% of Total Collisions):

- Conduct warrant analysis for adding left-turn phase – *east-west approaches*
- Convert curb lane to right-turn only lane to avoid sideswipes – *east-west approaches*
- Upgrade pedestrian pushbuttons to the latest standard – *all corners*
- Review and relocate/remove on-street parking close to intersection – *east-west legs*

Medium/Long-Term:

- Add left-turn phase (if warranted) – *east-west approaches*
- Consider widening Blundell at intersections from two to four lanes overall
- Review and relocate/remove commercial driveways close to intersection with future redevelopment – *southwest quadrant*
- Review and widen letdown (if required) – *northeast corner*
- Enhance police enforcements for vehicle speeding violations in coordination with RCMP – *north-south legs*
- Review traffic lane widths and curb return radii as a measure to reduce collisions involving speeding

Top 20 Intersections: Summary of Proposed Short-Term Improvements

Intersection		Pavement Markings & Barriers	Signage	Traffic Signals	Trim Foliage for Sightlines	Street Parking	Education / Study	Est. Total Cost	Est. Safety Benefit
1	Shell Rd-Alderbridge Way/Hwy 91	Upgrade Crosswalk Markings/ Repaint Merge Lines	Add Yield/ Merge/ Crosswalk Signs	Enlarge Lenses/ Upgrade Ped Buttons/ Warrant for LT Phase	SW Corner	-	-	$41,600	20-30%
		$13,700	$3,400	$23,000	$1,500	-	-		
2	Garden City Rd-Sea Island Way	Upgrade Crosswalk Markings/ Add Merge Lines	Add Object Marker/ Crosswalk Signs	Warrant for LT Phase	SW Corner	-	-	$6000	5-15%
		$3,000	$1,450	Staff Time	$1,500	-	-		
3	No. 2 Rd-Westminster Hwy	Add Guide Lines/Add RT Markings	Add New Lane/RT Only Lane Signs	Enlarge Lenses/ Warrant for LT Phase	SW Corner/ South Side	-	Traffic Operations & Safety Review	$54,600	20-30%
		$1,300	$800	$23,000	$4,500	-	$25,000		
4	No. 4 Rd-Alderbridge Way	Repaint Merge Lines	Add Yield/ Crosswalk Signs	Enlarge Lenses/ Review Signal Progression/ Upgrade Ped Buttons/ Warrant for LT Phase	-	-	-	$25,700	20-30%
		$900	$2,800	$22,000	-	-	-		
5	No. 5 Rd-Westminster Hwy	Upgrade Crosswalk Markings/ Add Merge Lines	Add Yield/ RT Lane/ Crosswalk Signs	Enlarge Lenses	-	-	-	$29,200	15-25%
		$4,600	$3,600	$21,000	-	-	-		
6	No. 5 Rd-Cambie Rd	Replace Barriers	-	Enlarge Lenses/Review Dedicated Ped Phase	-	-	-	$22,500	20-30%
		$1,500	-	$21,000	-	-	-		
7	No. 4 Rd-Westminster Hwy	Upgrade Crosswalk Markings	Add Bike Route Signs	Enlarge Lenses/ Upgrade Ped Buttons	-	-	-	$51,000	15-25%
		$26,600	$1,400	$23,000	-	-	-		
8	Garden City Rd-Cambie Rd	Add Guide Line	Add New Lane Sign	Enlarge Lenses/ Warrant for LT Phase	NW Corner	-	-	$23,500	15-25%
		$500	$250	$21,000	$1,500	-	-		
9	Garden City Rd-Granville Ave	Add Guide Line	Add New Lane Sign	Enlarge Lenses	-	-	Feasibilility Study Traffic Control Changes	$66,800	15-25%
		$500	$250	$16,000	-	-	$50,000		
10	No. 2 Rd-Blundell Rd	Replace Barriers	-	Review Signal Progression	-	Review Location on W Leg	-	$5,000	5-15%
		$5,000	-	Staff Time	-	Staff Time	-		

Top 20 Intersections by Location

Intersection		Pavement Markings & Barriers	Signage	Traffic Signals	Trim Foliage for Sightlines	Street Parking	Education / Study	Est. Total Cost	Est. Safety Benefit
11	No. 3 Rd-Granville Ave	Upgrade Crosswalk Markings/ Add Guide Line	-	Enlarge Lenses/Review Dedicated Ped Phase	-	-	-	$67,000	20-30%
		$46,000	-	$21,000	-	-	-		
12	No. 4 Rd-Blundell Rd	Repaint Lane Lines	-	-	-	Review Location on W Leg	-	$1,200	10-20%
		$1,200	-	-	-	Staff Time	-		
13	No. 4 Rd-Cambie Rd	-	Add Merge Sign	Add Tertiary Signal/ Enlarge Lenses/ Review Dedicated Ped Phase/ Warrant for LT Phase	NE Corner	-	Design to Add LT Bays	19000	15-25%
		-	$400	$17,000	$1,500	-	Staff Time		
14	Shell Rd-Bridgeport Rd	-	-	-	SW Corner	Review Location on N Leg	-	$1,500	5-15%
		-	-	-	$1,500	Staff Time	-		
15	Minoru Blvd-Granville Ave	Add Bike Lane Lines	-	Enlarge Lenses/ Review Dedicated Ped Phase/ Review Signal Timing/ Warrant for LT Phase	-	-	-	$31,000	15-25%
		$10,000	-	$21,000	-	-	-		
16	Garden City Rd-Blundell Rd	-	-	-	-	Review Location NB Approach	-	$0	5-15%
		-	-	-	-	Staff Time	-		
17	No. 1 Rd-Francis Rd	Add Bike Lane Lines	-	Review Dedicated Ped Phase/ Warrant for LT Phase	-	Review Location on S, E, W Legs	Pedestrian Education Campaign	$45,000	10-20%
		$45,000	-	-	-	Staff Time	Staff Time		
18	No. 1 Rd-Steveston Hwy	Repaint Lane Lines	Add RT/ Overhead Lane Signs	Review Dedicated Ped Phase	NE Corner	Restrict Parking on W Leg	-	$3500	15-25%
		$600	$950	-	$1,500	Staff Time	-		
19	Gilbert Rd-Blundell Rd	-	-	Warrant for LT Phase	North Side/ SE Corner	Review Location on N, S, E Legs	-	$4,500	10-20%
		-	-	-	$4,500	Staff Time	-		
20	No. 5 Rd-Blundell Rd	Convert Curb Lane to RT Lane	-	Upgrade Ped Buttons/ Warrant for LT Phase	-	Review Location on E, W Legs	-	$1,400	5-15%
		$1,400	-	-	-	Staff Time	-		
Total		**$161,800**	**$15,300**	**$229,000**	**$18,000**	**$0**	**$75,000**	**$499,100**	

Notes: RT = Right-Turn / LT = Left-Turn / N = North / S = South / W = West / E = East
Estimated Safety Benefit = % of collisions that improvement would address based on collision history

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	April 29, 2019
From:	Peter Russell, MCIP RPP Senior Manager, Sustainability and District Energy	**File:**	12-8060-20-009921/Vol 01
Re:	**City Centre District Energy Utility Bylaw No. 9895, Amendment Bylaw No. 10012**		

Staff Recommendation

1. That the City Centre District Energy Utility Bylaw No. 9895, Amendment Bylaw No. 10012 presented in the "City Centre District Energy Utility Bylaw No. 9895, Amendment Bylaw No. 10012" report dated April 29, 2019, from the Senior Manager, Sustainability and District Energy be introduced and given first, second, and third readings.

Peter Russell, MCIP RPP
Senior Manager, Sustainability and District Energy
(604-276-4130)

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Development Applications Law	☑ ☑	
REVIEWED BY SMT	**INITIALS:**	**APPROVED BY CAO**

Staff Report

Origin

In October 2015, Council endorsed the issuance of a Request for Expression of Interest (RFEOI) to identify a suitable utility partner to conduct a feasibility analysis to design, build, finance and operate a district energy utility (DEU) in the City Centre North area of Richmond, on the basis of the following guiding principles:

1. The DEU will provide end users with energy costs that are competitive with conventional energy costs based on the same level of service; and
2. Council will retain the authority of setting customer rates, fees and charges for DEU services.

LIEC staff issued a Request for Proposals (RFP) in September 2016 with an expanded scope for City Centre to the three proponents shortlisted under the RFEOI. LIEC executed a Memorandum of Understanding (MOU) with the lead proponent, Corix Utilities Inc. (Corix) in February 2018, as directed by LIEC Board and endorsed by Council.

As the City Centre DEU due diligence process has advanced, through rezoning applications and/or Official Community Plan (OCP) amendment applications, seven developments have committed to construct and transfer energy plants to the City or LIEC at no cost to the City or LIEC, so that LIEC can provide immediate service to these customers.

Council endorsed City Centre District Energy Utility Bylaw No. 9895 (CCDEU Bylaw) in September 2018, introducing a new district energy service area starting with five developments. The CCDEU Bylaw has since been amended to expand the service area to include two additional developments.

The purpose of this report is to recommend expansion of the service area to include a hotel development located at 8871, 8891, 8911, 8931, 8951, and 8971 Douglas Street, associated with rezoning application RZ 15-704980.

Background

District Energy Utilities as Part of a Sustainable Community

Richmond's 2041 Official Community Plan (OCP) establishes a target to reduce community greenhouse gas (GHG) emissions 33 per cent below 2007 levels by 2020 and 80 per cent by 2050. The OCP also includes a target to reduce energy use 10 per cent below 2007 levels by 2020. Richmond's Community Energy & Emissions Plan (CEEP) identifies that buildings account for about 64 per cent of energy consumption in Richmond, and 43 per cent of GHG emissions; residential developments especially are prime energy consumers in the community. Richmond is growing, with today's population expected to increase by 35 per cent by 2041, and employment by 22 per cent. This growth will be accompanied by new building development, the majority of which will occur in Richmond's City Centre.

Shifting to more sustainable energy systems for buildings will support the City's climate and energy targets. Sustainable energy systems have the following characteristics:

- Use energy wisely – e.g. they are efficient, minimize consumption, minimize waste energy, and use low-carbon sources of energy.
- Increase energy security by being reliant and resilient – e.g. they minimize price volatility, incorporate localized systems to avoid being completely dependent on external systems, and are adaptable to future technologies and energy sources.
- Have low-carbon intensity – e.g. they emit zero to low GHG emissions.
- Are cost-effective and do not result in unacceptable impacts (social, environmental or economic).

The City has identified district energy utilities (DEUs) as a key component of sustainable energy systems that can be implemented in neighbourhoods undergoing redevelopment. Some of the key benefits of a DEU are as follows:

- Reduced building capital and operations costs – DEUs replace the need for individual buildings to have their own boilers or furnaces, chillers or air conditioners, resulting in capital cost and maintenance cost savings.
- Efficiency – DEUs can operate more efficiently than typical stand-alone building mechanical systems, thereby reducing emissions and costs.
- Reduced GHG emissions through using renewable energy and waste energy sources – DEUs can use renewable sources such as sewer heat recovery, geothermal, biomass, combined heat and power generation, and other technologies with the potential for very low emissions. Moreover, DEUs can capture and use waste heat from industrial, commercial and institutional use (i.e. ice surfaces and wastewater treatment plants).
- Reliability – DEUs use proven technology; most DEU's operate with a high reliability rate.
- Resiliency – District energy systems' ability to make use of multiple different fuel sources allow DEUs to incorporate new energy source opportunities in the future, providing financial and environmental resiliency and mitigating the potential for volatility in thermal energy prices.

Many DEUs come to be identified by the energy source they are hooked up to, such as geothermal, biomass, or solar; however, the most critical elements of a DEU are the customer base and the distribution network, and when establishing the partnerships and legal framework of a DEU the primary focus should be on these elements. The specific system or technology that is used to generate the heat can be altered or switched out over the life of the DEU depending on the best available technology at the time.

<u>District Energy in Richmond</u>

The City incorporated Lulu Island Energy Company Ltd. (LIEC) in 2013 for the purposes of carrying out the City's district energy initiatives. These district energy initiatives have been

recognized for excellence and leadership in innovation and sustainability through receipt of fourteen awards ranging from the provincial to international scale.

LIEC operates the Oval Village District Energy (OVDEU) and Alexandra District Energy (ADEU) Utilities while concurrently advancing new district energy opportunities. Attachment 1 indicates the current and planned future DEU areas throughout Richmond.

LIEC currently services eight buildings in the OVDEU service area, containing over 1,700 residential units. Energy is currently supplied from the two interim energy centres with natural gas boilers which combined provide 11 MW of heating capacity. When enough buildings are connected to the system, a permanent energy centre will be built which will produce low-carbon energy. Currently the OVDEU is planned to harness energy from the Gilbert Trunk sanitary force main sewer through the implementation of the permanent energy centre in 2025. Over the next 30 years, the OVDEU system is anticipated to reduce GHG emissions by more than 52,000 tonnes of CO2 as compared to business as usual[1]. OVDEU is developed under a concession agreement with Corix. During the concession period (30 years), Corix will design, build, finance and operate the OVDEU and will supply energy services to LIEC; LIEC owns the assets and Council sets customer rates.

LIEC provides heating and cooling services to six residential buildings in the ADEU service area, the large commercial development at "Central at Garden City", the Richmond Jamatkhana temple and Fire Hall No. 3, in total connecting over 1,450 residential units and over 1.6 million square feet of floor area. While some electricity is consumed for pumping and equipment operations, almost 100% of this energy is currently produced locally from the geo-exchange fields in the greenway corridor and West Cambie Park, and highly efficient air source heat pumps. The backup and peaking natural gas boilers and cooling towers in the energy centre have operated for only a few days throughout the system's operation to date. LIEC staff estimate that this has eliminated over 2,340 tonnes of GHG emissions in the community to-date.

The City has continued to secure commitments that new developments in potential DEU service areas will be "District Energy Ready" through rezoning, development and building permit processes. This means that new developments in appropriate potential service areas are built with in-building mechanical systems that are compatible with district energy connection for space heating and domestic water heating.

LIEC is continuing to work with Corix on the City Centre DEU due diligence process as per the executed MOU. This work includes the development and analysis of long term DEU servicing strategies for the City Centre area. Staff are expecting to report to Council on the outcomes of this due diligence process in 2019.

As the City Centre DEU due diligence process has advanced, staff saw the opportunity to secure a customer base for the immediate implementation of GHG emissions reduction through the rezoning and/or OCP amendment application process. Seven development applicants have committed to construct and transfer energy plants to the City or LIEC through either of these

[1] Assumed that all energy was provided for heating. The business-as-usual (BAU) assumed that 40% of the building heating load would be provided from electricity and the remaining 60% would be from gas make-up air units.

processes, so that LIEC can provide immediate service to these customers. The commitment for these developments to construct and transfer energy plants to the City or LIEC was subject to adoption of a DEU service area bylaw pertaining to these sites. LIEC and City staff subsequently developed the CCDEU Bylaw to secure commitments from the first five developments, which Council adopted in September 2018. Council amended the CCDEU Bylaw to include the Richmond Centre Mall development in October 2018 and the Polygon Fiorella development in February 2019.

The development rezoning application (RZ 15-704980) was granted third reading at the Public Hearing held on February 19, 2018. The applicant is actively working to fulfill the rezoning considerations and prepare the associated Development Permit for the project for the City's Development Permit Panel's consideration.

Analysis

City Centre District Energy Utility Service Area Expansion

The six storey hotel building is estimated to consist of approximately 56,575ft ^{2} of hotel space.

Expanding the City Centre District Energy Utility service area to include a development of this type results in the following direct benefits:

- Immediate connectivity opportunity with the future low-carbon district energy system resulting in reduction of GHG emissions compared to business as usual;
- Expansion of LIEC's customer base under a positive stand-alone business case while the City Centre strategy develops;
- Increasing community's energy resiliency; and
- Providing financial and environmental stability to customers, mitigating potential volatility in energy costs.

The rezoning considerations for this development include a requirement for a legal agreement that, if the City elects, would require the developer to transfer ownership of the development's centralized energy plant to the City or LIEC at no cost to the City or LIEC, so that LIEC can provide immediate service to the customer. City and LIEC staff have met with the developer's representative to obtain their commitment to transfer the energy plant in accordance with the legal agreement, and are continuing discussions to establish specific requirements associated with the plant. Rezoning considerations were applied to this development prior to establishment of requirements for a low-carbon energy plant and as such, the language did not require the centralized energy plant to be low-carbon. However, LIEC ownership of a conventional energy plant still carries significant benefits as LIEC can connect this building immediately to the future low-carbon district energy system or potentially implement on-site low-carbon technology at a later stage.

This development rezoning application also includes a single lot at 8960 Douglas Street which is proposed to consist of a single storey building with approximately 1,733 ft^2 of commercial space. Due to the small scale of this commercial building, a DEU requirement is not being sought for.

Due to the anticipated energy loads of the hotel development, LIEC staff have conducted a business case analysis for owning and operating this development's energy plant using the same rate structure that was applied for business case analysis of the other developments under the CCDEU Bylaw service area. Consistent with Council objectives, staff have used a rate that is competitive with the conventional energy costs for providing the same level of service. The rate structure and actual rate to customers will be refined once the costs have been confirmed through the design and engineering phase for the first developments within the CCDEU Bylaw service area.

The LIEC Board of Directors has reviewed this opportunity and recommends expanding the City Centre District Energy Utility service area to include the hotel development located at 8871, 8891, 8911, 8931, 8951, and 8971 Douglas Street.

Financial Impact

None.

The centralized energy system will be designed and constructed by developers at their cost. Costs incurred by LIEC for engineering support and operations and maintenance will be funded from the existing and future LIEC capital and operating budgets. All LIEC costs will be recovered from customers' fees.

Conclusion

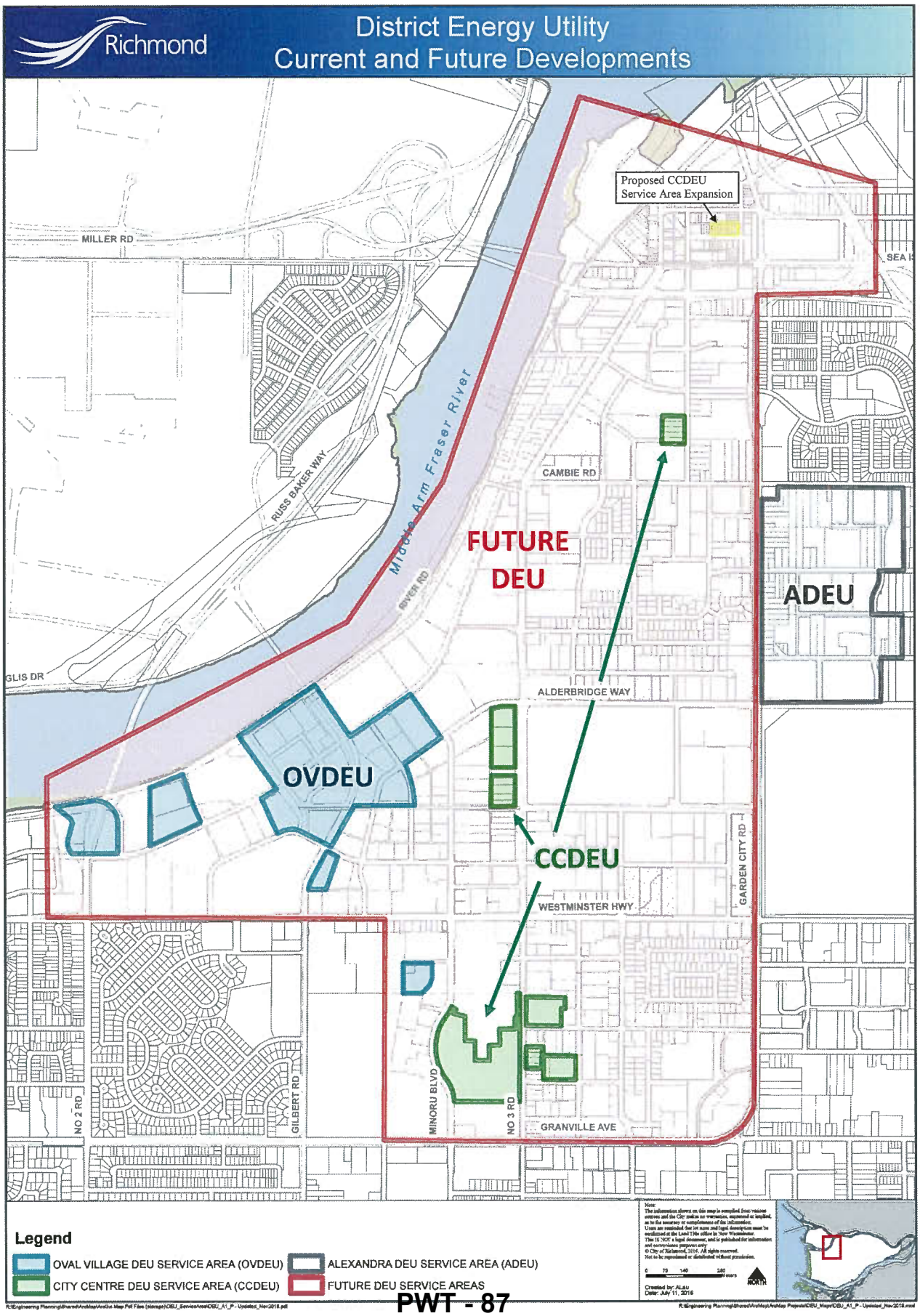
Expanding the service area for the City Centre District Energy Utility Bylaw No. 9895 as proposed will allow for immediate expansion of LIEC's customer base and in turn immediate connectivity opportunity to future low-carbon district energy systems in Richmond's City Centre area. The project will increase the community's energy resiliency by taking advantage of the district energy system's ability to utilize different fuel sources and future fuel switching capability of the technology.

Peter Russell, MCIP RPP
Senior Manager, Sustainability and District Energy
(604-276-4130)

PRcd

Att. 1: Map of Current and Future District Energy Utility Areas in Richmond

Attachment 1 – Map of Current and Future District Energy Utility Areas in Richmond



City of Richmond

Bylaw 10012

City Centre District Energy Utility Bylaw No. 9895 Amendment Bylaw No. 10012

The Council of the City of Richmond enacts as follows:

1. The **City Centre District Energy Utility Bylaw No. 9895** is further amended:

   (a) by deleting Schedule A (Boundaries of Service Area) in its entirety and replacing with a new Schedule A attached as Schedule A to this Amendment Bylaw; and

   (b) by deleting Schedule E (Energy Generation Plant Designated Properties) in its entirety and replacing with a new Schedule E attached as Schedule B to this Amendment Bylaw.

2. This Bylaw is cited as "**City Centre District Energy Utility Bylaw No. 9895, Amendment Bylaw No. 10012**".

FIRST READING	
SECOND READING	
THIRD READING	
ADOPTED	

CITY OF RICHMOND
APPROVED for content by originating dept.
APPROVED for legality by Solicitor
BRB

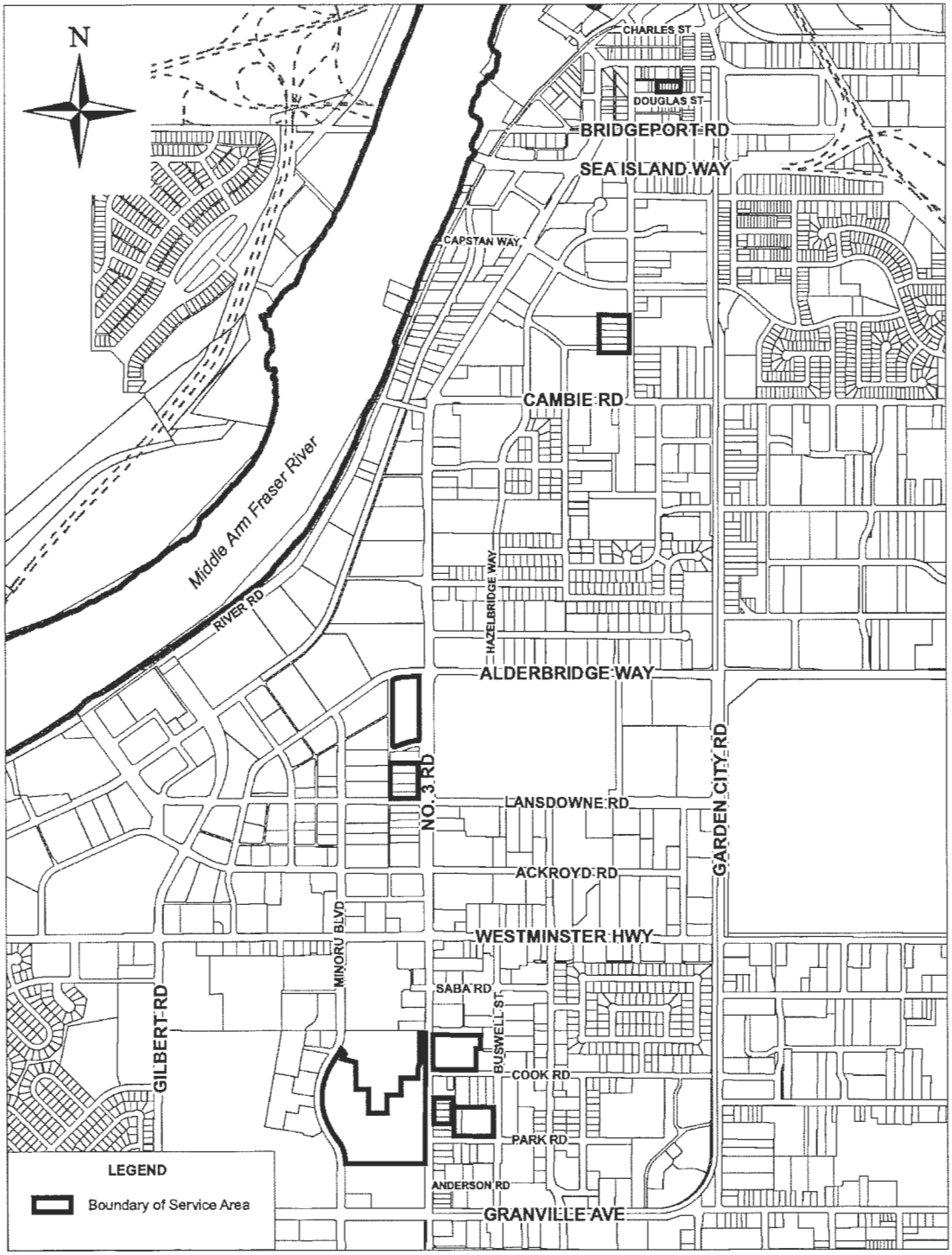
MAYOR

CORPORATE OFFICER

Schedule A to Amendment Bylaw No. 10012

SCHEDULE A to BYLAW NO. 9895

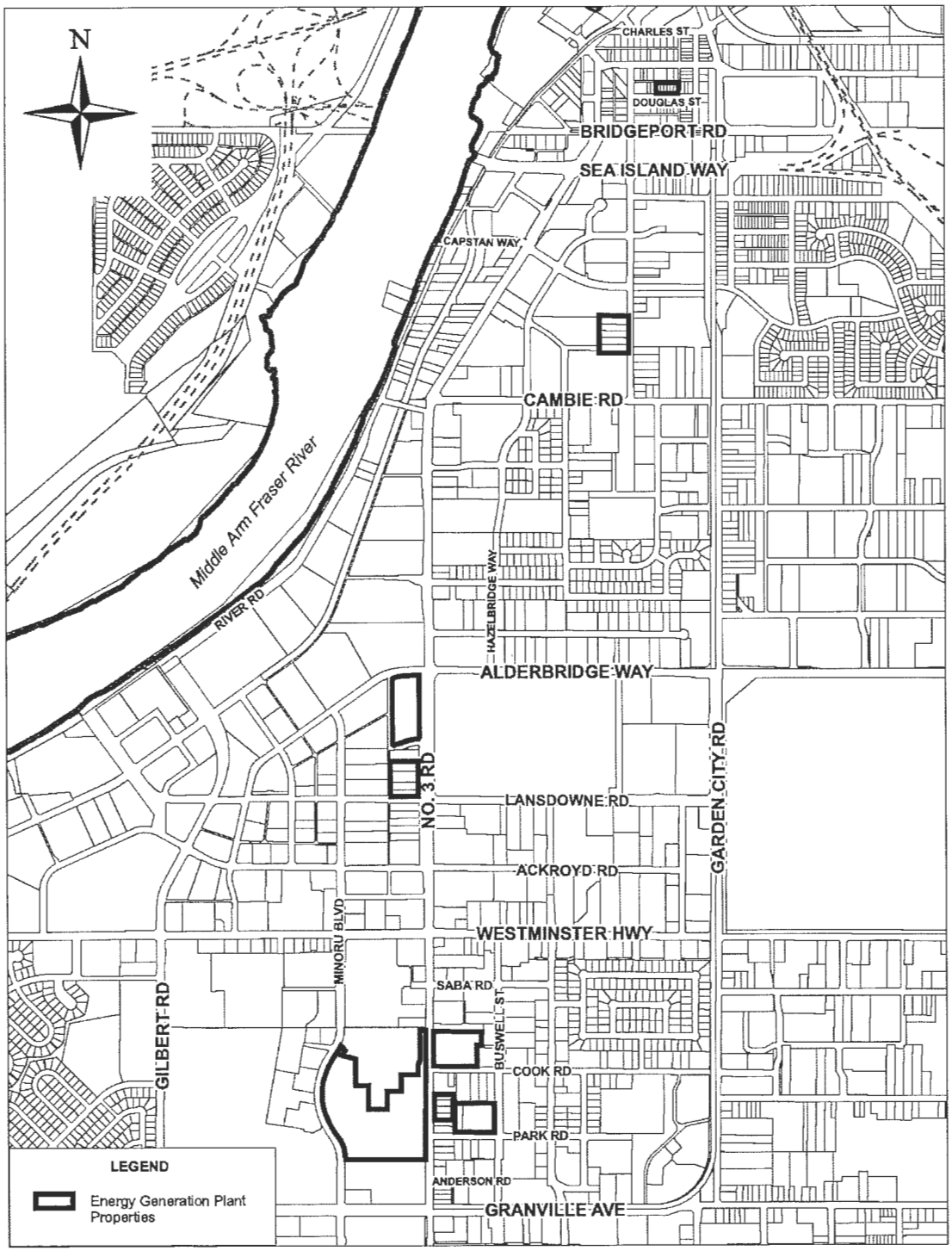
Boundaries of Service Area



Schedule B to Amendment Bylaw No. 10012

SCHEDULE E to BYLAW NO. 9895

Energy Generation Plant Designated Properties



City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	May 6, 2019
From:	Tom Stewart, AScT. Director, Public Works Operations	**File:**	10-6000-00/Vol 01
Re:	**2018 Annual Water Quality Report**		

Staff Recommendation

That the staff report titled "2018 Annual Water Quality Report" dated May 6, 2019 from the Director, Public Works, be endorsed and made available to the community through the City's website and through various communication tools including social media and as part of community outreach activities.

Tom Stewart, AScT.
Director, Public Works Operations
(604-233-3301)

Att. 2

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

Staff Report

Origin

In 2001, the Province of British Columbia enacted the Drinking Water Protection Act, which provided the Minister of Health with the authority to implement and enforce standards for water supply systems in British Columbia. In May 2003, regulations to be implemented under the Drinking Water Protection Act were adopted by the legislature as the Drinking Water Protection Regulation. These Acts were updated on April 29, 2014 under Bill 18 – 2014: the Water Sustainability Act.

This report presents the City's 2018 Annual Water Quality Report, which enables the City to meet its obligations for public reporting to comply with applicable requirements in accordance with these regulations. A summary of the 2018 Annual Water Quality Report is presented as Attachment 1, with the full report included as Attachment 2.

Analysis

The Drinking Water Protection Regulation requires water purveyors in BC to possess an operating permit, which confirms the Drinking Water Officer for the area has approved the water supply. The Drinking Water Officer is given the authority to monitor water purveyors to ensure they are providing safe drinking water through compliance with the British Columbia Drinking Water Protection Regulation, and any other conditions of the operating permit.

Under the Regulation, the City of Richmond is required to:

- Develop and maintain a process to notify the Medical Health Officer and the Drinking Water Officer of situations or conditions that render or could render the water unfit to drink;
- Implement and maintain a plan for collecting, shipping and analyzing water samples in compliance with the direction set by the Drinking Water Officer; and
- Implement and maintain a plan for reporting monitoring results to the Drinking Water Officer and to water users.

Richmond thrives on its ability to provide water to residents and businesses, and to Richmond Fire-Rescue in the event of a fire. To ensure a consistent supply, the capital watermain replacement program is a proactive approach to avoiding breaks and has proven to be a reliable and valuable tool in water distribution management. In 2018, Public Works staff attended to 23 watermain breaks, a slight increase from the 19 watermain breaks in 2017 and a significant decrease from the 38 watermain breaks in 2016. Repairs for a single watermain break can amount to $100,000 plus damages to private properties and service disruptions to businesses and residents. As such, a proactive replacement and maintenance program is essential to minimizing costs and ensuring minimal to no disruptions in water quality and supply.

Highlights of the 2018 Annual Water Quality Report include:

- Richmond residents enjoyed high-quality, reliable drinking water.
- 2,057 water samples were collected to ensure water quality and each passed with outstanding results.
- Test results confirm high quality water and demonstrate continuous improvement.

- 35.5M cubic metres of water were purchased from Metro Vancouver in 2018 compared to 35.3M cubic metres in 2017.
- Richmond's tap water stations are used in many community events providing potable water to the public and promoting tap water usage.
- The educational program Project WET, where students learn about water conservation, water quality and water distribution, represents the partnership between Richmond School Board and Public Works.

These and many other initiatives are detailed in the attached "2018 Annual Water Quality Report".

Proposed Communication

Subject to Council's approval, the "2018 Annual Water Quality Report" will be posted on the City's website and made available through various communication tools including social media channels and as part of community outreach activities.

Financial Impact

None.

Conclusion

The 2018 Annual Water Quality Report outlines the methods in which the City manages its water system to ensure compliance with applicable provincial requirements under the Drinking Water Protection Act. In 2018, the City's water quality met and exceeded the required standards to ensure residents enjoyed high quality, reliable and safe drinking water.

This report has been reviewed and endorsed by the Medical Health Officer of Vancouver Coastal Health Authority as part of the City's reporting obligations.

Bryan Shepherd
Manager, Waterworks
(604-233-3334)

BS:nk

Att. 1: 2018 Annual Water Quality Report Summary
2: 2018 Annual Water Quality Report

City of Richmond

2018 Annual Water Quality Report Summary

In 2018, Richmond residents enjoyed high-quality and reliable drinking water. Water Services staff collected 2,057 water samples from 40 sampling sites to ensure excellent water quality.

Richmond is dedicated to promoting the value of municipal tap water, maximizing opportunities for use of tap water in municipal facilities and developing strategies for making tap water the "water of choice" in our community.

Taking a sample

Testing a sample

Project WET

Flushing

How does Richmond provide high-quality tap water?

- By testing all 40 water quality sites on a regular basis.
- By continuous preventative maintenance and monitoring.
- By providing the water system with the highest degree of care to ensure that it's an inhospitable environment for any harmful bacteria or toxins.
- By proactive watermain replacement and maintenance projects.

Multi-Barrier Approach

Richmond recognizes that in order to provide the highest quality water, several methods must be used to ensure its superiority – hence the "Multi-Barrier Approach".

The "Multi-Barrier Approach" includes:

- disinfection of the water at the source;
- water quality monitoring capabilities at seven pressure reducing valve (PRV) stations;
- weekly microbiological testing;
- system operators that are certified by the Environmental Operators Certification Program of BC;
- maintenance practices that are of the highest standard.

Heterotrophic Plate Count (HPC)

- The HPC count indicates the presence of nutrients that could facilitate the growth of harmful bacteria such as E. coli.
- By reducing the HPC levels, the possibility of bacteriological re-growth is essentially reduced.
- The minimal positive chlorine residual in our water also disinfects and eliminates harmful substances within our distribution system.

2018 Results

- Provided 35.5 million m^3 of the highest quality drinking water to over 222,945 Richmond residents.
- Conducted 2,057 microbiological tests from 40 test locations.
- Maintained 12 pressure reducing valve (PRV) stations.
- Maintained 4,973 fire hydrants to ensure water is available during an emergency.
- Repaired 23 watermain breaks without compromising the integrity of the water distribution system while maintaining positive pressure.
- Discovered and repaired 43 non-visible underground leaks through Richmond's leak detection program using noise loggers measuring sound frequencies in the targeted pipe allowing any leaks to be heard and recorded.
- Hosted over 250 students and teachers from Richmond elementary schools as part of the annual educational program: Project WET.
- Repaired 185 service connections.
- Installed 5,360 m of new watermain.
- Installed 403 water services for new developments.

Summary

Richmond residents will continue to enjoy fresh, high-quality drinking water. It is without a doubt that the City of Richmond consistently excels at providing tap water of excellent quality and reliability.

Richmond

City of Richmond

2018 Annual Water Quality Report

Richmond

Richmond is dedicated to promoting the value of municipal tap water, maximizing opportunities for use of tap water in municipal facilities and developing strategies for making tap water the "water of choice" in our community.

Contents

Executive Summary

The purpose of this report is to fulfill the requirements set out in the British Columbia Drinking Water Protection Act (BCDWPA) by giving an overview of the water distribution system, describing the maintenance conducted, detailing some of the unique features of the system and providing the results of Richmond's water quality testing program.

Test results confirm high-quality water and demonstrate continuous improvement. Richmond's water system is provided with the highest degree of care to ensure that it's an inhospitable environment for any harmful bacteria or toxins. Also, utility funding contributes to proactive watermain replacement and maintenance projects that will ensure the overall health of the system well into the future.

In 2018, the City of Richmond's Water Services staff undertook the following:

- provided 35.5 million m^3 of the highest quality drinking water to over 222,945 Richmond residents;
- conducted 2,057 microbiological tests from 40 test locations;
- maintained 12 pressure reducing valve (PRV) stations;
- maintained 4,973 fire hydrants to ensure water is available during an emergency;
- repaired 23 watermain breaks without compromising the integrity of the water distribution system while maintaining positive pressure;
- discovered and repaired 43 non-visible underground leaks through Richmond's leak detection program using noise loggers measuring sound frequencies in the targeted pipe allowing any leaks to be heard and recorded;
- hosted over 250 students and teachers from Richmond elementary schools as part of the annual educational program: Project WET;
- repaired 185 service connections;
- installed 5,360 m of new watermain;
- installed 403 water services for new developments.

The City of Richmond's Water Services section takes its role as a water purveyor very seriously and is proud to be the guardian of such a precious resource.

Introduction

In 2002, the City of Richmond implemented a Drinking Water Quality Monitoring Program. This program was developed with input from the Vancouver Coastal Health Authority and is in accordance with the British Columbia Drinking Water Protection Act (BCDWPA), the Water Quality Monitoring and Reporting Plan for Metro Vancouver and member municipalities and the Guidelines for Canadian Drinking Water Quality (GCDWQ).

The Vancouver Coastal Health Authority requires the City of Richmond to provide the Annual Drinking Water Quality Report so that Richmond can maintain its operating permit. Richmond's Medical Health Officer reviews the report and upon request, the report is made public. It provides important information concerning Richmond's water distribution system and water quality.

The conditions set out in the British Columbia Drinking Water Protection Act (BCDWPA) require that all water systems in BC be classified as a Level I through IV facility. Richmond's system is classified as a Level III facility so all staff are responsible for possessing a valid Level I to Level III Equipment Operators Certification Program (EOCP) certificate. To obtain and maintain a level of certification, staff successfully complete the annual training. This is done to ensure that staff are able to respond appropriately and immediately to problems prior to becoming a risk to health or property.

As a water purveyor, Richmond complies with provincial legislation, including the British Columbia Drinking Water Protection Act (BCDWPA), and the British Columbia Drinking Water Protection Regulations (BCDWPR). Information is also compared to the federal Guidelines for Canadian Drinking Water Quality (GCDWQ). Under these various pieces of legislation the City of Richmond is required to:

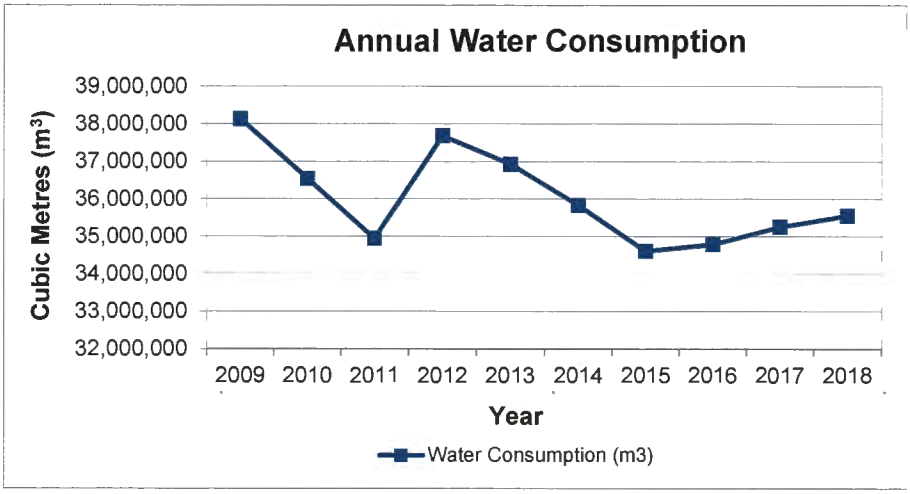
- develop a process to notify the Medical Health Officer of any condition that could render unsafe drinking water;
- implement a sampling program that adequately represents all areas within the City;
- meet the requirements of the British Columbia Drinking Water Protection Act (BCDWPA), and ensure test results are immediately available to the Medical Health Officer;
- receive an annual construction permit for the construction, installation and extension of the water distribution system;
- ensure that the City's water distribution system is classified under the criteria for the Environmental Operators Certification Program (EOCP) and that Water Services staff are certified to the same level as the distribution system;
- produce an annual public report detailing the results of the City's water quality monitoring program.

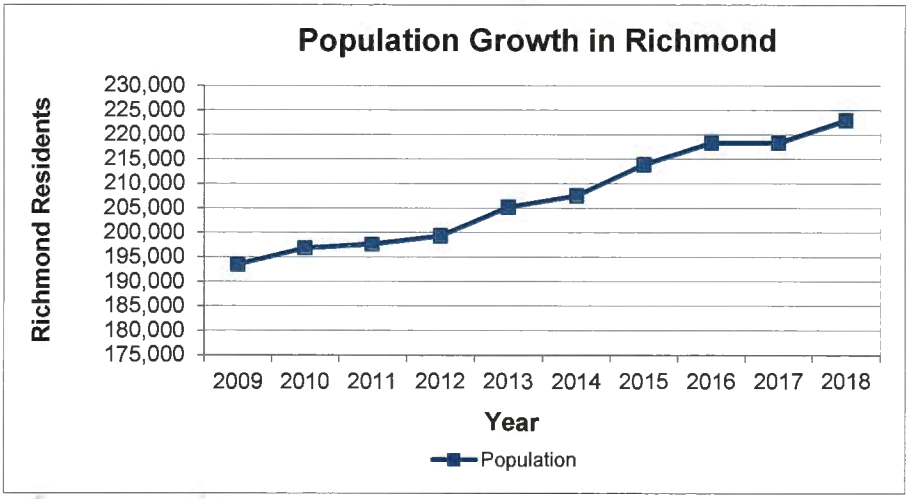
Each day, Metro Vancouver residents use enough water to fill BC Place. The average amount of water consumed daily in Metro Vancouver is 1 billion litres.

Water regulations are in effect from May 1 – October 15. They help manage demand for drinking water during the summer, periods of water shortages, and in emergencies.

Metro Vancouver Water District

In 2018, the City of Richmond purchased 35.5 million m^3 of drinking water from the Metro Vancouver Water District.





Three watersheds supply regional water: Capilano Reservoir, Seymour Reservoir, and Coquitlam Reservoir. The Capilano and Seymour Reservoirs supply two thirds of the water for the region. The Coquitlam Reservoir supplies the remaining third. Richmond receives the majority of its water from the Capilano and Seymour reservoir.

Water from these reservoirs can be directed through a series of transmission watermains to any city or municipality within the Metro Vancouver region. Source water is provided directly from the watersheds by Metro Vancouver and is tested for a number of microbiological, chemical, and physical parameters. There are two drinking water treatment facilities, Seymour-Capilano Filtration Plant (SCFP) and Coquitlam Water Treatment Plant (CWTP). The SCFP is the largest filtration plant in Canada and has the capacity to filter up to 1.8 billion litres of water per day. Water is carried from the Capilano watershed to the SCFP by two underground tunnels over 7 km long and 3.8 m in diameter. The CWTP has the capacity to treat 380 million litres of water per day.

PWT - 102

Metro Vancouver Watersheds

Run full loads in the dishwasher. The average cycle uses 23 litres of water, down from older models at 38 litres. A half-full dishwasher uses the same amount of water as a full one.

An average garden hose delivers around 45 litres of water each minute. Install a shut-off nozzle on your hose so it runs only when in use.

PWT - 103

An hour a week of sprinkling or rain is all you need for a healthy lawn. Too much water will drown its roots and encourage weeds.

Shell Road and Bird Road PRV

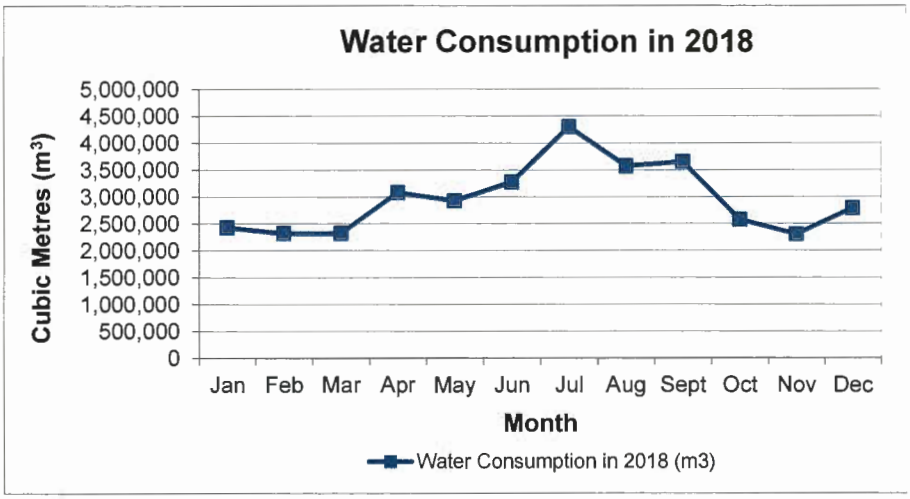
Water used in the kitchen for rinsing and cooking can be used again to water house plants.

Water Distribution System Overview

The City of Richmond's water distribution system begins at 12 separate connection points along Metro Vancouver's transmission mains. At each connection point there is a City owned pressure reducing valve (PRV) chamber. The City's responsibility for water quality begins at this chamber and ends at the residential or commercial property line.

Table 1 – Overview of Richmond's Water Distribution Network

Water Assets	2018
Hydrants	4,973
Valves	14,576
PRV chambers (active)	12
Watermains (City)	646 km
Service connections	35,040



PWT - 104

Pressure Reducing Valves (PRV)

The Water Services section maintains 12 pressure reducing valve (PRV) stations throughout Richmond. PRV stations decrease the pressure of Metro Vancouver's water feed to one that is manageable for Richmond's water distribution system. The stations are connected to a supervisory control and data acquisition (SCADA) system that provides information to the Works Yard such as water pressure, quality and volume. This allows for certified Water Services staff to react to problems quickly and effectively 24 hours a day, seven days a week.

Table 1 indicates the monthly water consumption in Richmond. It is estimated that most municipalities in North America lose anywhere from 12% to 15% of their potable water to undiscovered, underground leakage. The Water Loss Management Program allows City Engineering and Water Services staff to determine the total amount of water consumed through normal operational programs and practices such as single-family residential, multi-family residential and commercial metering programs. While combining these programs with watermain flushing, parks and median irrigation, and Richmond Fire Rescue water usage, it is reasonable to assume that the unidentified portion of the annual water consumption is attributed to water loss within the distribution system.

Data acquisition inside the PRV

Service Renewals

This program aims to prevent breaks and leaks by continuously upgrading and replacing older water services from the watermain to the property line. This preventative maintenance construction occurs throughout the year and requires minimal restoration.

Check for leaks in your garden hose. Small leaks or a loose coupling can quickly add up to a lot of wasted water.

PRV inspection

Taking a sample inside the PRV

Dual-flush toilets give the option of a water-saving half flush. We use about 270 litres of water and about one quarter of indoor water use is from flushing the toilet.

Water Quality Monitoring

In 2018, the City of Richmond collected samples on a weekly basis at 40 dedicated sampling sites. These sites are strategically located throughout the City to give a good representation of the City's water quality across the distribution network. In 2018, 2,057 water samples were collected by Water Services staff and sent for analysis at Metro Vancouver laboratories. These sample results were reviewed by the Vancouver and Richmond Coastal Health Authority to ensure the drinking water met the standards outlined in the British Columbia Drinking Water Protection Regulations (BCDWPR).

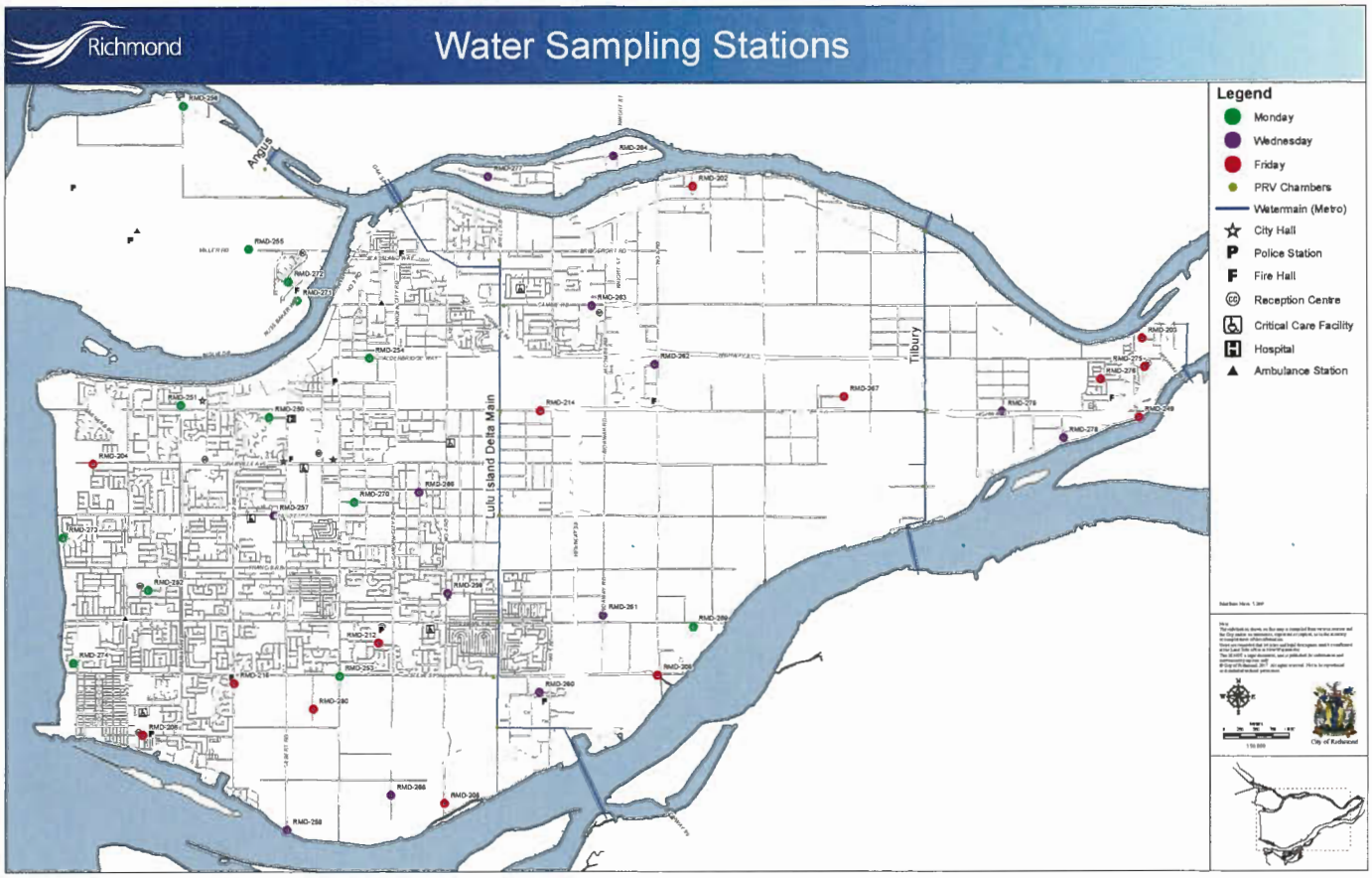
Sample station

Table 2 – Number of Annual Samples

Year	Annual Samples
2010	1,649
2011	1,936
2012	1,957
2013	1,997
2014	1,993
2015	2,027
2016	2,040
2017	2,065
2018	2,057

Taking a sample

PWT - 106



Bacteriological Tests

The City of Richmond and Metro Vancouver conduct bacteriological tests for total coliform, fecal coliform and heterotrophic plate counts (HPC). The presence of these organisms in drinking water indicates that the water may be contaminated and may contain potentially harmful bacteria, viruses or parasites.

Defrost food overnight in the fridge instead of thawing it under running water that ends up down the drain.

Multi-Barrier Approach

Richmond recognizes that in order to provide the highest quality water, several methods must be used to ensure its superiority.

The "Multi-Barrier Approach" includes:

- disinfection of the water at the source;
- water quality monitoring capabilities at six PRV sites;
- weekly microbiological testing at 40 sites throughout Richmond;
- system operators are certified by Environmental Operators Certification Program (EOCP) of BC;
- maintenance practices that are of the highest standard.

Leave grass clippings on your lawn after mowing. Leaving clippings to decompose reduces evaporation, allowing you to water your lawn less.

Regular maintenance on sampling site

Samples for lab analysis

Total Coliforms

Total coliform bacteria reproduce in water, soil or digestive systems of animals. The presence of total coliforms indicates water may have been contaminated and that the disinfection process is inadequate. In distribution systems where more than 10 samples are collected in a given sampling period, as is the case in Richmond, no consecutive samples from the same site or no more than 10% of samples should show the presence of total coliform bacteria.

Testing for total coliforms should be carried out in all drinking water systems. The number, frequency and location of samples for total coliform testing will vary according to the type and size of the system and jurisdictional requirements.

Provincial standards state that no sample can contain more than 10 total coliforms per 100 ml, and that 90% of samples in a 30-day period must have zero coliform organisms.

Fecal Coliforms

Fecal coliforms are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter water bodies from human and animal waste. They are key indicators of sewerage contamination. Due to diseases and parasites, which are spread through sewerage, provincial standards state there can be no detectable fecal coliforms per 100 ml sample.

2018 Results

In 2018, 2,057 water samples were collected by City staff and analyzed by Metro Vancouver laboratory staff. All final results met drinking water requirements for fecal and total coliforms. The City of Richmond was in compliance with British Columbia Drinking Water Protection Regulations (BCDWPR) for bacteria in 2018.

Heterotrophic Plate Count

Heterotrophic plate counts (HPC) tests measure aerobic heterotrophic bacteria. This test indicates the presence of nutrients that could facilitate the growth of harmful bacteria such as E. coli, and determines changes in water quality during treatment and distribution. HPC tests indicate the onset of bacterial re-growth within the distribution system commonly due to stagnant water contained in dead end and low flow watermains. By reducing the HPC levels, the possibility of bacteriological re-growth is essentially reduced because the pipes are an inhospitable environment for bacteria to grow. The minimal amount of positive chlorine residual in our water also disinfects and eliminates harmful substances within our distribution system. In 2018, none of the 2,057 water samples exceeded regulated levels for HPC's at >500 CFU/mls. In fact, only two of the 2,057 water samples exceeded 100 CFU/mls.

Flushing

As part of a five-year program, Water Services successfully executed the annual flushing program. This important maintenance practice ensuring high-quality tap water by moving water through the pipes and eliminating stagnant water at dead-ends. By doing so, the pipes are cleared and the risk of high HPC levels which lead to bacteria re-growth is significantly reduced.

Failed samples

The standard response to a failed water sample is:

- re-sample at the site;
- flush the watermain extensively;
- re-sample;
- the watermain is then isolated to one feed until test results confirm compliance with the British Columbia Drinking Water Protection Regulations (BCDWPR).

Testing the sample

Watering between 4 AM and 9 AM complies with sprinkling regulations, and reduces the amount of water lost to wind and evaporation.

Staff flushing

Don't let the water run when washing dishes. Fill one basin with water for washing and another for rinsing.

According to Metro Vancouver, the average person uses 270 litres of water per day.

Toilets 24%
Faucets 20%
Shower 20%
Clothes washers 16%
Leaks 13%
Baths 3%
Other 3%
Dishwashers 2%

Physical Parameters

Water in Richmond's distribution system is tested for the physical parameters of turbidity and temperature at the same time as bacteriological testing. Information is also collected on the taste and odour of Richmond's water by actively tracking water quality complaints.

Turbidity

Metro Vancouver is responsible for the quality of Richmond's source water. Turbidity is a measure of water clarity and cloudiness. Turbidity is measured in Nephelometric Turbidity Units (NTU). The guideline allows for turbidity levels up to 5 NTUs providing that source water protection, monitoring, and water treatment requirements are met including increased levels of residual chlorine. Turbidity is a concern because increased turbidity compromises the drinking water disinfection process. In 2018, the highest level of turbidity was one sample measured at 4.4 NTU. Only 31 samples out of 2,057 had turbidity levels of more than 1 NTU.

In general, sites with elevated turbidity are located in sections of the distribution network where there is low demand on the water system or where dead-end watermains exist. The increase may be attributed to sediment disturbance in the distribution system. During the year, when sampling indicates a turbidity level greater than >5 NTU's, affected watermains in the test area are flushed, and re-tested until a satisfactory result is obtained.

Temperature

High temperatures in the distribution system can affect the residual level of chlorine and can contribute to bacterial re-growth. Typically, the temperature of drinking water in the distribution system rises during summer months. Although there were no customer complaints regarding Richmond's water temperature, samples exceeded the aesthetic guideline of 15 °C 223 times out of 2,057; only five temperatures exceeded 20 °C. The majority of these elevated temperatures were recorded during the summer months.

Taste and Odour

Taste and odour are only monitored in response to customer complaints. Records indicate that seven complaints were received regarding taste and five complaints were received regarding odour in 2018. These complaints generally relate to high levels of residual chlorine in that part of the system at that particular time. Residents who complained about taste or odour problems were advised to flush their internal system. If the problem was not resolved, Water Services staff were dispatched to the location until a satisfactory result was obtained and verified through laboratory analysis.

Chemical Parameters

The City of Richmond, in partnership with Metro Vancouver, tests for the following chemical parameters: chlorine residual, trihalomethanes (THM), haloacetic acids (HAA), and pH. Periodic testing is also performed to determine heavy metals levels in the water system.

Free Chlorine Residual

Chlorine residual is a measurement of the disinfecting agent remaining in the distribution system at the point of delivery to the customer. Ensuring proper levels of chlorine in the distribution system is essential in protecting Richmond's water supply from bacteriological contamination or re-growth. In recent years, the City has made great progress in improving chlorine residuals by implementing various flushing programs.

Disinfection By-Products

Disinfection by-products are potentially harmful compounds produced by the reaction of a water disinfectant (such as chlorine or ozone) with naturally occurring organic matter in water. Two common chlorination by-products are Trihalomethanes (THMs) and Haloacetic Acids (HAAs). In drinking water, THMs can enter the human body via multiple routes of exposure. These include ingestion by consuming water and inhalation and skin absorption from showering and bathing. Under the Guidelines for Canadian Drinking Water Quality (GCDWQ), the maximum acceptable concentration (IMAC) for THMs is 100 parts per billion (ppb). The 100 ppb level for THMs is based on an annual average of samples taken quarterly. High levels on a particular day are not of concern unless they are consistently high over a period of time. Typically, THM levels will be highest in the summer and lowest in the winter months. Likewise, under the GCDWD, the maximum acceptable concentration (IMAC) for HAAs is 0.08 mg/L. In 2018, the City utilized the Metro Vancouver laboratory to perform quarterly tests for HAA's and THM's. These were carried out at representative sampling sites in accordance with a joint Metro Vancouver/ Richmond monitoring plan. In 2018, all results were within acceptable levels as defined in the GCDWQ. (Appendix 5)

The pH Value

The measurement of acidity is known as pH. A pH below 7.0 is considered acidic, above 7.0 is considered basic, with 7.0 being neutral. It is recognized that acidic water will accelerate the corrosion of metal pipes, often causing blue-green staining in household fixtures.

The Seymour-Capilano filtration plant includes pH adjustment and corrosion control in its treatment processes. It is expected that the pH of drinking water will rise in the coming years as the filtration plant reaches its full potential. This will extend the lifespan of water plumbing systems and enhance water quality.

Metals

The City's water quality program also includes testing for metals, such as copper, iron, lead, and zinc. All results were within or below GCDWQ limits for 2018. Complete test results are included in Appendix 6.

Choose plants that love dry heat. Embrace the dry heat by planting tomatoes, basil, beans, melon, eggplant and more in your garden.

Testing the chlorine residual at the PVR

Shorten your shower by two minutes. Reducing your shower by two minutes can save 460 litres of water in one month.

A family of four washes about 300 loads of laundry per year. Run full loads of laundry. A full load uses less water than two half loads.

Set a timer as a reminder to turn off your sprinkler.

Mobile Emergency Response Unit

Water Services staff are trained to operate the water treatment trailer for use during a major emergency where Richmond's water is contaminated. The treatment trailer is capable of producing 55,000 litres of potable water per day from non-potable sources such as the Fraser River. It is maintained and continuously tested by Water Services staff to ensure that the water is safe to serve Richmond residents in an emergency situation.

Rear view of the unit

Educating students at Project WET

Public Notification

At the direction of the Medical Health Officer, water quality advisories will be issued to the general public if necessary. Similarly, the notification will be issued to the general public for any work being done that will affect the quality of their drinking water. An example is included in Appendix 7.

Table 3 – Agency Notification for Situations Drinking Water Safety

Situation	Notifying Agency	Agency Notified	Time Frame For Notification
Fecal positive sample	City of Richmond Metro Vancouver Lab	City of Richmond / Medical Health Officer	Immediate
Chemical/biological contamination	City of Richmond Metro Vancouver Lab	City of Richmond / Medical Health Officer	Immediate
Turbidity > 5 NTU	City of Richmond Metro Vancouver Control Centre Metro Vancouver Lab	City of Richmond / Medical Health Officer	Immediate
Disinfection failure primary or secondary disinfection	City of Richmond Metro Vancouver Control Centre Metro Vancouver Lab	City of Richmond / Medical Health Officer	Immediate, where BC DWPR or GCDWQ guidelines may not be met
Loss of pressure due to high demand	City of Richmond Metro Vancouver Control Centre	Medical Health Officer City of Richmond Metro Vancouver Control Centre	Immediate
Watermain break where the pressure drops below 20 psi	City of Richmond Metro Vancouver Control Centre	Medical Health Officer City of Richmond	Immediate

Use a broom instead of a hose. Sweep driveways, decks, patios and sidewalks with a broom instead of using a hose. That 15-minute job could use 675 litres of water.

Instead of running the tap until the water cools, keep a pitcher of cold drinking water on standby in the fridge.

Residential water meter

Water meter maintenance

Water Conservation Programs

Water Conservation Program

The City of Richmond continues to succeed in reducing annual water consumption despite a growing population. Since 2012, population has grown by approximately 11% (10% in 2017) and overall water consumption has decreased by 6% (7% in 2017). This equates to a total annual savings of over $1,490,000. This can be explained by corporate and community wide initiatives including water metering, pressure management, the toilet rebate program, the clothes washer rebate program and the City's leak reduction program.

Reduction of water system pressure in lower demand periods such as the winter season extends water infrastructure service life and also reduces system water loss.

The leak reduction program identifies single-family properties with continuous leaks and educates the homeowner about the leak and significantly reduces overall private property leakage.

Universal Single-Family Water Meter Program

The universal single-family water meter program was completed in 2017. Advanced notification was provided to flat rate customers prior to meter installation. Water meters are a fair and equitable way of charging residents for water and will reduce the overall water consumption throughout the City.

Multi-Family Water Meter Program

The volunteer multi-family water meter program allows residents to pay for the actual amount of water they use, rather than being billed on the flat-rate system. To date, 146 multi-family complexes have been completed, comprising of 9,119 dwelling units. Multi-family meter installs began in 2018 and carried over to 2019 for completion.

Pressure Management Program

The City of Richmond reduces water pressure by 10 PSI between October and May, causing the system pressure to change from 90 PSI to 80 PSI. The purpose of this practice is to reduce the volume of leakage and extend the life of our water infrastructure. A decrease in nighttime flows and private leaks has been observed. Richmond is actively pursuing automated pressure management, where fluctuation would happen on a more regular basis through pilot systems on our pressure reducing valve (PRV) stations, which could recognize demand periods. Each one of Richmond's 12 PRV stations is turned down until the operating pressure is reached. In 2017, the City introduced a new and successful timer-based pressure management program which lowered the pressure from 90 PSI to 80 PSI in the summer months from 1:00 to 5:00 a.m. This program will further reduce leakage volume and extend the life of the water infrastructure.

Toilet Rebate Program

The City of Richmond's Toilet Rebate Program provides a utility account rebate of $100.00 to homeowners who install a low-flush toilet. Single and multi-family homeowners are eligible to apply for a lifetime maximum of two rebates per property. Industrial, commercial and other non-residential properties are not eligible at this time. The purpose of the toilet rebate program is to encourage homeowners to replace high volume toilets with low-flush toilets to conserve water and to reduce costs. Homeowners enjoy a reduction in their utility bill while contributing to a sustainable water conservation initiative. In 2018, there were 728 rebates submitted.

Clothes Washer Rebate Program

Through a partnership program with BC Hydro, residents could receive a rebate of up to $100, equally cost shared between BC Hydro and the City of Richmond for the replacement of an inefficient clothes washer with a new high efficiency one. The bi-annual rebate program encourages homeowners to conserve water and energy. In 2018, 914 clothes washer rebates were issued to Richmond residents.

Rain Barrels

Rain barrels are excellent outdoor water-saving devices that collect and store rainwater from rooftops for lawn and garden use. Rain water is a great water source for lawns, plants and gardens. For water metered households, using rainwater will reduce the amount of tap water used for your garden therefore decreasing the utility bill.

Rain barrels are available for purchase at the City's Recycling Depot by Richmond residents only. Installation instructions are included. In 2018, 118 rain barrels were sold; a slight decline from the 153 rain barrels sold in 2017.

SYSTERN rain barrel features:

- unique shape and neutral color suitable for any home and garden;
- 208 litre (55 gallon) capacity;
- mosquito mesh keeps out bugs and leaves;
- BPA free;
- made from recycled content;
- UV stabilizer is added to resist deterioration from sunlight;
- overflow hose can be linked to another SYSTERN or can be directed away from the house.

Metro Vancouver Water Restrictions

Due to dry and hot weather, continued high water demand and declining reservoir levels, Metro Vancouver imposed stage one water sprinkling restrictions from May 1 until October 15. All Public Works sections and Parks Operations were involved in collecting and using recycled water for Richmond's parks, plants, street sweeping and vactor operation.

Vegetables love the warm water stored in rain barrels, and you'll save treated drinking water.

Rain barrel

Put leaves and bark mulch around shrubs and trees to hold in moisture. Mulch can preserve moisture by reducing soil temperature and slowing evaporation.

Water distribution station at Project WET

Meter Shop station at Project WET

Portable drinking fountain

Water Education Programs

Project WET

Project WET is an interactive elementary school water education program aimed at teaching students about the importance of water, environmental programs, sewerage and drainage. Largely targeted for Richmond students in grades four through seven, this program is designed to educate students on the importance of water quality and supply.

The acronym "WET" stands for "Water Education Team". Touring from station to station, the objective is to promote higher-level thinking skills while learning about the fundamentals of water. In 2018, over 250 students and teachers participated in the program.

During the tour to the Works Yard, students can expect to learn many exciting areas of water and drainage systems such as:

- Richmond's water distribution system and how water reaches the taps;
- water sampling and water quality testing;
- importance of fire hydrants and how they work;
- portable drinking fountains and Richmond's high-quality tap water;
- water conservation and what students can do to help;
- uses of watermains, automatic flushing units, valves and meters;
- inspection camera technology;
- sewerage and drainage pipes and systems;
- importance of keeping toxic materials out of ditches and storm sewers;
- pump stations and how they work;
- recycling and other environmentally sustainable practices;
- how our dykes help to keep our island afloat;
- Richmond's emergency water treatment trailer.

Tap Water Initiative

In 2010, Metro Vancouver initiated its tap water campaign. The intent of this initiative is to encourage tap water consumption by the public and highlight public drinking fountains so that the public can refill water bottles or simply get a drink of water. On April 14, 2009, Mayor Malcom Brodie endorsed this campaign indicating that the City of Richmond is dedicated to promoting the value of municipal tap water, maximizing opportunities for use of tap water in municipal facilities and developing strategies for making tap water the "water of choice".

To support this initiative, Richmond's Water Services section is proud to maintain several portable drinking fountains that are used at numerous community events to provide the public with potable tap water and to promote tap water usage as an alternative to bottled water consumption. Samples are tested upon installation ensuring good quality water for the public to enjoy. In 2018, Water Services' portable drinking fountains were installed at 43 community events in Richmond.

The 28 water fountains found on Richmond's dikes and in parks are maintained by Water Services. They are tested and inspected ensuring accessible and high-quality drinking water. They must be turned off in winter months to prevent freezing and costly damage. They are turned on in the spring for the public to enjoy. An auto-flushing unit was installed on one of the longer pipes, to a fountain, to turn over the water and maintain an accurate chlorine residual.

Position your sprinkler so that it is only watering your lawn and plants, not driveways or sidewalks.

Public Works Open House

The Water Services section plays a large role in the annual Public Works Open House that takes place in May. This is an opportunity for staff to show residents some of the critical services that are provided such as maintaining our infrastructure. Likewise, staff showcase the work that is done on a daily basis to ensure the safety and health of the community. This event draws attention to the importance of public works in community life.

Public Works Open House

"H2Whoa!" Theatrical Presentation by DreamRider Productions

"H2Whoa!" teaches students in grades K-7 all about the water cycle, sources of water pollution and water conservation. The focus is on positive actions and educating family and friends about the use of water, the need to protect it and its importance to everyday living. In 2018, ten Richmond elementary schools and over 3,200 teachers and students had the opportunity to view this theatrical presentation.

Public Works Open House

Conclusion

In 2018, Richmond residents enjoyed high-quality drinking water. From the protected watersheds to the local taps, both Metro Vancouver and the City of Richmond focus immensely on safe and high-quality drinking water.

Test results confirm high-quality water and demonstrate continuous improvement. Richmond's water system is provided with the highest degree of care to ensure that it's an inhospitable environment for any harmful bacteria or toxins. The City of Richmond's Water Services section takes its role as a water purveyor very seriously and is proud to be the guardian of such a precious resource.

Water Services staff continue to employ best management practices in the operation and maintenance of the water system. Certified by the Equipment Operators Certification Program (EOCP), staff meet all requirements of the British Columbia Drinking Water Protection Act (BCDWPA) and are well equipped to operate and maintain all aspects of the water system from source to property line

The City appreciates the good working relationship with Vancouver Coastal Health Authority and acknowledges them as important partners in maintaining high quality drinking water throughout the City of Richmond.

Sincerely,

Bryan Shepherd
Manager, Water Services
City of Richmond
604-233-3334
bshepherd@richmond.ca

Appendices

APPENDIX 1: REFERENCES

APPENDIX 2: WATER SAMPLING SITES

APPENDIX 3: 2018 WATER QUALITY RESULTS

APPENDIX 4: 2018 THM AND HAA TEST RESULTS

APPENDIX 5: 2018 HEAVY METAL AND VINYL CHLORIDE TESTING RESULTS

APPENDIX 6: SAMPLE DRINKING WATER QUALITY ADVISORY

APPENDIX 7: SPECIFIC EMERGENCY RESPONSE PLANS

APPENDIX 1: REFERENCES

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APPENDIX 2: WATER SAMPLING SITES

	SAMPLING STATION NUMBER	WATER SAMPLING SITES
MONDAY	RMD-250	6071 Azure Road
	RMD-251	5951McCallan Road
	RMD-252	9751 Pendleton Road
	RMD-253	11051 No 3 Road
	RMD-254	5300 No. 3 Road
	RMD-255	6000 Blk. Miller Road
	RMD-256	1000 Blk. McDonald Road
	RMD-269	14951 Triangle Road
	RMD-270	8200 Jones Road
	RMD-271	3800 Cessna Drive
	RMD-272	751 Catalina Crescent
	RMD-273	Opp. 8331 Fairfax Place
	RMD-274	10920 Springwood Court
WEDNESDAY	RMD-257	6640 Blundell Road
	RMD-258	7000 Blk. Dyke Road
	RMD-259	10020 Amethyst Avenue
	RMD-260	11111 Horseshoe Way
	RMD-261	9911 Sidaway Road
	RMD-262	13799 Commerce Pkwy
	RMD-263	12560 Cambie Road
	RMD-264	13100 Mitchell Road
	RMD-266	9380 General Currie Road
	RMD-268	13800 No. 3 Road
	RMD-277	Opp. 11280 Twigg Place
	RMD-278	6651 Fraserwood Place
	RMD-279	Opp. 20371 Westminster Highway
FRIDAY	RMD-202	1500 Valemont Way
	RMD-203	23260 Westminster Highway
	RMD-204	3180 Granville Avenue
	RMD-205	13851 Steveston Highway
	RMD-206	4251 Moncton Street
	RMD-208	13200 No. 4 Road
	RMD-212	Opposite 8600 Ryan Road
	RMD-214	11720 Westminster Highway
	RMD-216	11080 No. 2 Road
	RMD-267	17240 Fedoruk Road
	RMD-249	23000 Block Dyke Road
	RMD-275	5180 Smith Crescent
	RMD-276	22271 Cochrane Drive
	RMD-280	11500 McKenzie Road

APPENDIX 3: 2018 WATER QUALITY RESULTS

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-251	Grab	5951McCallan Rd.	2-Jan-18	0.75	<1	<2	3	<1	0.13
RMD-273	Grab	Opp. 8331 Fairfax Place	2-Jan-18	0.78	<1	<2	4	<1	0.19
RMD-252	Grab	9751 Pendleton Rd.	2-Jan-18	0.8	<1	<2	4	<1	0.1
RMD-274	Grab	10920 Springwood Court	2-Jan-18	0.83	<1	<2	5	<1	0.12
RMD-253	Grab	11051 No 3 Rd.	2-Jan-18	0.87	<1	2	3	<1	0.07
RMD-269	Grab	14951 Triangle Rd.	2-Jan-18	0.72	<1	<2	6	<1	0.27
RMD-270	Grab	8200 Jones Rd.	2-Jan-18	0.9	<1	<2	4	<1	0.09
RMD-254	Grab	5300 No. 3 Rd.	2-Jan-18	0.81	<1	<2	4	<1	0.09
RMD-256	Grab	1000 Blk. McDonald Rd.	2-Jan-18	0.52	<1	2	5	<1	0.48
RMD-255	Grab	6000 Blk. Miller Rd.	2-Jan-18	0.95	<1	<2	3	<1	0.15
RMD-271	Grab	3800 Cessna Drive	2-Jan-18	0.72	<1	<2	5	<1	0.19
RMD-272	Grab	751 Catalina Cres.	2-Jan-18	0.89	<1	<2	4	<1	0.15
RMD-250	Grab	6071 Azure Rd.	2-Jan-18	0.81	<1	<2	4	<1	0.13
RMD-263	Grab	12560 Cambie Rd.	3-Jan-18	0.76	<1	<2	5	<1	0.09
RMD-277	Grab	Opp. 11280 Twigg Place	3-Jan-18	0.85	<1	<2	5	<1	0.1
RMD-264	Grab	13100 Mitchell Rd.	3-Jan-18	0.83	<1	<2	6	<1	0.15
RMD-262	Grab	13799 Commerce Pkwy.	3-Jan-18	0.64	<1	<2	5	<1	0.09
RMD-278	Grab	6651 Fraserwood Place	3-Jan-18	0.67	<1	4	5	<1	0.08
RMD-279	Grab	Opp. 20371 Westminster Hwy.	3-Jan-18	0.58	<1	4	5	<1	0.1
RMD-261	Grab	9911 Sidaway Rd.	3-Jan-18	0.87	<1	<2	5	<1	0.08
RMD-260	Grab	11111 Horseshoe Way	3-Jan-18	0.84	<1	<2	5	<1	0.09
RMD-259	Grab	10020 Amethyst Ave.	3-Jan-18	0.8	<1	<2	5	<1	0.27
RMD-266	Grab	9380 General Currie Rd.	3-Jan-18	0.81	<1	<2	5	<1	0.09
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	3-Jan-18	0.8	<1	<2	6	<1	0.09
RMD-258	Grab	7000 Blk. Dyke Rd.	3-Jan-18	0.88	<1	<2	5	<1	0.1
RMD-257	Grab	6640 Blundell Rd.	3-Jan-18	0.75	<1	<2	5	<1	0.09
RMD-204	Grab	3180 Granville Ave.	4-Jan-18	0.71	<1	<2	4	<1	0.09
RMD-206	Grab	4251 Moncton St.	4-Jan-18	0.87	<1	<2	5	<1	0.08
RMD-216	Grab	11080 No. 2 Rd.	4-Jan-18	0.93	<1	<2	4	<1	0.1
RMD-280	Grab	11500 McKenzie Rd.	4-Jan-18	0.66	<1	<2	6	<1	0.11
RMD-212	Grab	Opp. 8600 Ryan Rd.	4-Jan-18	0.96	<1	<2	4	<1	0.13
RMD-208	Grab	13200 No. 4 Rd.	4-Jan-18	0.86	<1	<2	5	<1	0.1
RMD-205	Grab	13851 Steveston Hwy.	4-Jan-18	0.73	<1	<2	3	<1	0.08
RMD-202	Grab	1500 Valemont Way	4-Jan-18	0.77	<1	<2	4	<1	0.08
RMD-214	Grab	11720 Westminster Hwy.	4-Jan-18	1.12	<1	<2	4	<1	0.09
RMD-267	Grab	17240 Fedoruk	4-Jan-18	0.69	<1	2	5	<1	0.12
RMD-249	Grab	23000 Blk. Dyke Rd.	4-Jan-18	0.67	<1	<2	5	<1	0.11
RMD-276	Grab	22271 Cochrane Drive	4-Jan-18	0.64	<1	<2	4	<1	0.09

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-275	Grab	5180 Smith Cres.	4-Jan-18	0.58	<1	<2	5	<1	0.18
RMD-203	Grab	23260 Westminster Hwy.	4-Jan-18	0.74	<1	2	3	<1	0.09
RMD-251	Grab	5951McCallan Rd.	8-Jan-18	0.7	<1	<2	3	<1	0.13
RMD-273	Grab	Opp. 8331 Fairfax Place	8-Jan-18	0.68	<1	2	4	<1	0.12
RMD-252	Grab	9751 Pendleton Rd.	8-Jan-18	0.64	<1	ontamina	4	<1	0.11
RMD-274	Grab	10920 Springwood Court	8-Jan-18	0.73	<1	<2	4	<1	0.16
RMD-253	Grab	11051 No 3 Rd.	8-Jan-18	0.65	<1	<2	4	<1	0.19
RMD-269	Grab	14951 Triangle Rd.	8-Jan-18	0.56	<1	<2	4	<1	0.12
RMD-270	Grab	8200 Jones Rd.	8-Jan-18	0.8	<1	2	4	<1	0.15
RMD-256	Grab	1000 Blk. McDonald Rd.	8-Jan-18	0.61	<1	<2	4	<1	0.18
RMD-255	Grab	6000 Blk. Miller Rd.	8-Jan-18	0.88	<1	<2	4	<1	0.24
RMD-271	Grab	3800 Cessna Drive	8-Jan-18	0.78	<1	<2	4	<1	0.12
RMD-272	Grab	751 Catalina Cres.	8-Jan-18	0.69	<1	<2	4	<1	0.14
RMD-250	Grab	6071 Azure Rd.	8-Jan-18	0.72	<1	<2	3	<1	0.77
RMD-263	Grab	12560 Cambie Rd.	10-Jan-18	0.88	<1	<2	3	<1	0.66
RMD-264	Grab	13100 Mitchell Rd.	10-Jan-18	0.9	<1	<2	4	<1	0.99
RMD-277	Grab	Opp. 11280 Twigg Place	10-Jan-18	0.91	<1	<2	5	<1	0.2
RMD-262	Grab	13799 Commerce Pkwy.	10-Jan-18	0.87	<1	<2	3	<1	0.33
RMD-278	Grab	6651 Fraserwood Place	10-Jan-18	0.76	<1	<2	5	<1	0.12
RMD-279	Grab	Opp. 20371 Westminster Hwy.	10-Jan-18	0.77	<1	<2	3	<1	0.12
RMD-261	Grab	9911 Sidaway Rd.	10-Jan-18	0.87	<1	<2	4	<1	0.16
RMD-260	Grab	11111 Horseshoe Way	10-Jan-18	0.89	<1	<2	3	<1	0.14
RMD-259	Grab	10020 Amethyst Ave.	10-Jan-18	0.76	<1	<2	4	<1	0.39
RMD-266	Grab	9380 General Currie Rd.	10-Jan-18	0.78	<1	<2	4	<1	0.2
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	10-Jan-18	0.75	<1	<2	4	<1	0.27
RMD-258	Grab	7000 Blk. Dyke Rd.	10-Jan-18	0.9	<1	<2	4	<1	0.24
RMD-257	Grab	6640 Blundell Rd.	10-Jan-18	0.69	<1	<2	4	<1	0.23
RMD-204	Grab	3180 Granville Ave.	12-Jan-18	0.76	<1	2	5	<1	0.13
RMD-206	Grab	4251 Moncton St.	12-Jan-18	0.87	<1	2	5	<1	0.12
RMD-216	Grab	11080 No. 2 Rd.	12-Jan-18	0.84	<1	<2	5	<1	0.15
RMD-280	Grab	11500 McKenzie Rd.	12-Jan-18	0.85	<1	<2	7	<1	0.19
RMD-212	Grab	Opp. 8600 Ryan Rd.	12-Jan-18	0.79	<1	<2	7	<1	0.15
RMD-208	Grab	13200 No. 4 Rd.	12-Jan-18	0.78	<1	<2	7	<1	0.14
RMD-205	Grab	13851 Steveston Hwy.	12-Jan-18	0.74	<1	<2	5	<1	0.17
RMD-202	Grab	1500 Valemont Way	12-Jan-18	0.83	<1	<2	4	<1	0.19
RMD-214	Grab	11720 Westminster Hwy.	12-Jan-18	0.91	<1	<2	4	<1	0.13
RMD-267	Grab	17240 Fedoruk	12-Jan-18	0.7	<1	<2	5	<1	0.1
RMD-249	Grab	23000 Blk. Dyke Rd.	12-Jan-18	0.66	<1	<2	5	<1	0.3
RMD-275	Grab	5180 Smith Cres.	12-Jan-18	0.71	<1	<2	5	<1	0.13
RMD-276	Grab	22271 Cochrane Drive	12-Jan-18	0.76	<1	<2	5	<1	0.17

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-203	Grab	23260 Westminster Hwy.	12-Jan-18	0.74	<1	2	5	<1	0.15
RMD-251	Grab	5951McCallan Rd.	15-Jan-18	0.76	<1	<2	5	<1	0.13
RMD-273	Grab	Opp. 8331 Fairfax Place	15-Jan-18	0.84	<1	<2	8	<1	0.26
RMD-252	Grab	9751 Pendleton Rd.	15-Jan-18	0.78	<1	<2	7	<1	0.11
RMD-274	Grab	10920 Springwood Court	15-Jan-18	0.91	<1	<2	8	<1	0.14
RMD-253	Grab	11051 No 3 Rd.	15-Jan-18	0.9	<1	<2	6	<1	0.13
RMD-269	Grab	14951 Triangle Rd.	15-Jan-18	0.73	<1	<2	8	<1	0.15
RMD-270	Grab	8200 Jones Rd.	15-Jan-18	0.86	<1	<2	7	<1	0.18
RMD-254	Grab	5300 No. 3 Rd.	15-Jan-18	0.82	<1	<2	6	<1	0.15
RMD-256	Grab	1000 Blk. McDonald Rd.	15-Jan-18	0.64	<1	<2	7	<1	0.33
RMD-255	Grab	6000 Blk. Miller Rd.	15-Jan-18	0.95	<1	<2	6	<1	0.28
RMD-271	Grab	3800 Cessna Drive	15-Jan-18	0.9	<1	<2	6	<1	0.15
RMD-272	Grab	751 Catalina Cres.	15-Jan-18	0.85	<1	2	5	<1	0.14
RMD-250	Grab	6071 Azure Rd.	15-Jan-18	0.87	<1	<2	7	<1	0.15
RMD-263	Grab	12560 Cambie Rd.	17-Jan-18	0.82	<1	<2	4	<1	0.22
RMD-264	Grab	13100 Mitchell Rd.	17-Jan-18	0.85	<1	<2	5	<1	0.1
RMD-277	Grab	Opp. 11280 Twigg Place	17-Jan-18	0.97	<1	<2	4	<1	0.19
RMD-262	Grab	13799 Commerce Pkwy.	17-Jan-18	0.83	<1	<2	4	<1	0.14
RMD-278	Grab	6651 Fraserwood Place	17-Jan-18	0.76	<1	2	6	<1	0.1
RMD-279	Grab	Opp. 20371 Westminster Hwy.	17-Jan-18	0.83	<1	<2	4	<1	0.12
RMD-261	Grab	9911 Sidaway Rd.	17-Jan-18	0.74	<1	<2	4	<1	0.1
RMD-260	Grab	11111 Horseshoe Way	17-Jan-18	0.99	<1	<2	3	<1	0.1
RMD-259	Grab	10020 Amethyst Ave.	17-Jan-18	0.94	<1	<2	4	<1	0.37
RMD-266	Grab	9380 General Currie Rd.	17-Jan-18	0.92	<1	<2	5	<1	0.1
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	17-Jan-18	0.91	<1	<2	4	<1	0.17
RMD-258	Grab	7000 Blk. Dyke Rd.	17-Jan-18	0.92	<1	<2	4	<1	0.11
RMD-257	Grab	6640 Blundell Rd.	17-Jan-18	0.87	<1	2	3	<1	0.1
RMD-204	Grab	3180 Granville Ave.	18-Jan-18	0.79	<1	<2	8	<1	0.12
RMD-206	Grab	4251 Moncton St.	18-Jan-18	0.84	<1	2	5	<1	0.09
RMD-216	Grab	11080 No. 2 Rd.	18-Jan-18	0.92	<1	<2	7	<1	0.12
RMD-280	Grab	11500 McKenzie Rd.	18-Jan-18	0.61	<1	<2	9	<1	0.14
RMD-212	Grab	Opp. 8600 Ryan Rd.	18-Jan-18	0.84	<1	<2	9	<1	0.1
RMD-208	Grab	13200 No. 4 Rd.	18-Jan-18	0.86	<1	2	6	<1	0.1
RMD-205	Grab	13851 Steveston Hwy.	18-Jan-18	0.71	<1	<2	7	<1	0.11
RMD-202	Grab	1500 Valemont Way	18-Jan-18	0.73	<1	<2	6	<1	0.1
RMD-214	Grab	11720 Westminster Hwy.	18-Jan-18	0.87	<1	<2	6	<1	0.13
RMD-267	Grab	17240 Fedoruk	18-Jan-18	0.69	<1	<2	6	<1	0.1
RMD-249	Grab	23000 Blk. Dyke Rd.	18-Jan-18	0.78	<1	2	6	<1	0.1
RMD-276	Grab	22271 Cochrane Drive	18-Jan-18	0.76	<1	<2	6	<1	0.16
RMD-275	Grab	5180 Smith Cres.	18-Jan-18	1.3	<1	<2	6	<1	0.14

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-203	Grab	23260 Westminster Hwy.	18-Jan-18	0.55	<1	<2	7	<1	0.17
RMD-251	Grab	5951McCallan Rd.	22-Jan-18	0.75	<1	<2	7	<1	0.09
RMD-273	Grab	Opp. 8331 Fairfax Place	22-Jan-18	0.74	<1	<2	7	<1	0.21
RMD-252	Grab	9751 Pendleton Rd.	22-Jan-18	0.72	<1	<2	7	<1	0.11
RMD-274	Grab	10920 Springwood Court	22-Jan-18	0.8	<1	2	7	<1	0.14
RMD-253	Grab	11051 No 3 Rd.	22-Jan-18	0.78	<1	<2	7	<1	0.09
RMD-269	Grab	14951 Triangle Rd.	22-Jan-18	0.6	<1	2	8	<1	0.13
RMD-270	Grab	8200 Jones Rd.	22-Jan-18	0.77	<1	<2	8	<1	0.11
RMD-254	Grab	5300 No. 3 Rd.	22-Jan-18	0.69	<1	<2	7	<1	0.12
RMD-256	Grab	1000 Blk. McDonald Rd.	22-Jan-18	0.6	<1	<2	8	<1	0.12
RMD-255	Grab	6000 Blk. Miller Rd.	22-Jan-18	0.95	<1	<2	5	<1	0.23
RMD-271	Grab	3800 Cessna Drive	22-Jan-18	0.8	<1	<2	7	<1	0.19
RMD-272	Grab	751 Catalina Cres.	22-Jan-18	0.95	<1	<2	7	<1	0.15
RMD-250	Grab	6071 Azure Rd.	22-Jan-18	0.74	<1	<2	7	<1	0.11
RMD-263	Grab	12560 Cambie Rd.	24-Jan-18	0.82	<1	<2	5	<1	0.18
RMD-264	Grab	13100 Mitchell Rd.	24-Jan-18	0.88	<1	<2	5	<1	0.17
RMD-277	Grab	Opp. 11280 Twigg Place	24-Jan-18	0.85	<1	<2	4	<1	0.15
RMD-262	Grab	13799 Commerce Pkwy.	24-Jan-18	0.77	<1	<2	4	<1	0.13
RMD-278	Grab	6651 Fraserwood Place	24-Jan-18	0.53	<1	<2	6	<1	0.14
RMD-279	Grab	Opp. 20371 Westminster Hwy.	24-Jan-18	0.72	<1	<2	5	<1	0.13
RMD-261	Grab	9911 Sidaway Rd.	24-Jan-18	0.83	<1	<2	4	<1	0.11
RMD-260	Grab	11111 Horseshoe Way	24-Jan-18	0.89	<1	<2	4	<1	0.11
RMD-259	Grab	10020 Amethyst Ave.	24-Jan-18	0.81	<1	<2	6	<1	0.37
RMD-266	Grab	9380 General Currie Rd.	24-Jan-18	0.99	<1	<2	6	<1	0.15
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	24-Jan-18	0.82	<1	<2	5	<1	0.2
RMD-258	Grab	7000 Blk. Dyke Rd.	24-Jan-18	0.94	<1	<2	5	<1	0.13
RMD-257	Grab	6640 Blundell Rd.	24-Jan-18	0.78	<1	<2	6	<1	0.16
RMD-204	Grab	3180 Granville Ave.	26-Jan-18	0.74	<1	<2	9	<1	0.1
RMD-206	Grab	4251 Moncton St.	26-Jan-18	0.82	<1	<2	6	<1	0.11
RMD-216	Grab	11080 No. 2 Rd.	26-Jan-18	0.86	<1	<2	6	<1	0.12
RMD-280	Grab	11500 McKenzie Rd.	26-Jan-18	0.83	<1	<2	6	<1	0.09
RMD-212	Grab	Opp. 8600 Ryan Rd.	26-Jan-18	0.76	<1	<2	5	<1	0.1
RMD-208	Grab	13200 No. 4 Rd.	26-Jan-18	0.74	<1	<2	5	<1	0.1
RMD-205	Grab	13851 Steveston Hwy.	26-Jan-18	0.75	<1	<2	6	<1	0.12
RMD-202	Grab	1500 Valemont Way	26-Jan-18	0.71	<1	<2	5	<1	0.08
RMD-214	Grab	11720 Westminster Hwy.	26-Jan-18	0.91	<1	<2	6	<1	0.08
RMD-267	Grab	17240 Fedoruk	26-Jan-18	0.67	<1	2	6	<1	0.12
RMD-249	Grab	23000 Blk. Dyke Rd.	26-Jan-18	0.6	<1	<2	5	<1	0.1
RMD-276	Grab	22271 Cochrane Drive	26-Jan-18	0.66	<1	<2	6	<1	0.09
RMD-275	Grab	5180 Smith Cres.	26-Jan-18	0.6	<1	<2	6	<1	0.11

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-203	Grab	23260 Westminster Hwy.	26-Jan-18	0.81	<1	<2	5	<1	0.09
RMD-251	Grab	5951McCallan Rd.	29-Jan-18	0.87	<1	<2	7	<1	0.13
RMD-273	Grab	Opp. 8331 Fairfax Place	29-Jan-18	0.78	<1	<2	8	<1	0.14
RMD-252	Grab	9751 Pendleton Rd.	29-Jan-18	0.72	<1	<2	7	<1	0.1
RMD-274	Grab	10920 Springwood Court	29-Jan-18	0.9	<1	<2	7	<1	0.09
RMD-253	Grab	11051 No 3 Rd.	29-Jan-18	0.85	<1	<2	6	<1	0.13
RMD-269	Grab	14951 Triangle Rd.	29-Jan-18	0.67	<1	<2	7	<1	0.14
RMD-270	Grab	8200 Jones Rd.	29-Jan-18	0.87	<1	<2	7	<1	0.13
RMD-254	Grab	5300 No. 3 Rd.	29-Jan-18	0.81	<1	<2	7	<1	0.12
RMD-256	Grab	1000 Blk. McDonald Rd.	29-Jan-18	0.61	<1	<2	8	<1	0.18
RMD-255	Grab	6000 Blk. Miller Rd.	29-Jan-18	0.87	<1	<2	6	<1	0.28
RMD-271	Grab	3800 Cessna Drive	29-Jan-18	0.91	<1	<2	8	<1	0.13
RMD-272	Grab	751 Catalina Cres.	29-Jan-18	0.86	<1	2	8	<1	0.13
RMD-250	Grab	6071 Azure Rd.	29-Jan-18	0.71	<1	<2	8	<1	0.11
RMD-263	Grab	12560 Cambie Rd.	31-Jan-18	0.83	<1	<2	6	<1	0.12
RMD-264	Grab	13100 Mitchell Rd.	31-Jan-18	0.94	<1	<2	6	<1	0.1
RMD-277	Grab	Opp. 11280 Twigg Place	31-Jan-18	0.99	<1	<2	6	<1	0.21
RMD-262	Grab	13799 Commerce Pkwy.	31-Jan-18	0.63	<1	2	6	<1	0.1
RMD-278	Grab	6651 Fraserwood Place	31-Jan-18	0.69	<1	<2	8	<1	0.13
RMD-261	Grab	9911 Sidaway Rd.	31-Jan-18	0.66	<1	<2	7	<1	0.17
RMD-260	Grab	11111 Horseshoe Way	31-Jan-18	1.01	<1	<2	6	<1	0.14
RMD-259	Grab	10020 Amethyst Ave.	31-Jan-18	0.73	<1	<2	8	<1	0.62
RMD-266	Grab	9380 General Currie Rd.	31-Jan-18	1	<1	<2	6	<1	0.17
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	31-Jan-18	1.04	<1	<2	6	<1	3.4
RMD-258	Grab	7000 Blk. Dyke Rd.	31-Jan-18	0.88	<1	<2	6	<1	0.67
RMD-257	Grab	6640 Blundell Rd.	31-Jan-18	0.84	<1	<2	6	<1	0.09
RMD-204	Grab	3180 Granville Ave.	1-Feb-18	0.76	<1	<2	7	<1	0.13
RMD-206	Grab	4251 Moncton St.	1-Feb-18	0.92	<1	<2	7	<1	0.19
RMD-216	Grab	11080 No. 2 Rd.	1-Feb-18	0.87	<1	<2	6	<1	0.1
RMD-280	Grab	11500 McKenzie Rd.	1-Feb-18	0.79	<1	<2	8	<1	0.14
RMD-212	Grab	Opp. 8600 Ryan Rd.	1-Feb-18	0.82	<1	2	6	<1	0.1
RMD-208	Grab	13200 No. 4 Rd.	1-Feb-18	0.83	<1	<2	6	<1	0.18
RMD-205	Grab	13851 Steveston Hwy.	1-Feb-18	0.7	<1	<2	7	<1	0.14
RMD-202	Grab	1500 Valemont Way	1-Feb-18	0.73	<1	<2	6	<1	0.48
RMD-214	Grab	11720 Westminster Hwy.	1-Feb-18	0.95	<1	<2	6	<1	0.15
RMD-267	Grab	17240 Fedoruk	1-Feb-18	0.66	<1	<2	6	<1	0.14
RMD-249	Grab	23000 Blk. Dyke Rd.	1-Feb-18	0.65	<1	<2	6	<1	0.19
RMD-276	Grab	22271 Cochrane Drive	1-Feb-18	0.67	<1	<2	7	<1	0.13
RMD-275	Grab	5180 Smith Cres.	1-Feb-18	0.62	<1	<2	6	<1	0.13
RMD-203	Grab	23260 Westminster Hwy.	1-Feb-18	0.67	<1	<2	7	<1	0.12

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	1-Feb-18	0.68	<1	<2	5	<1	0.1
RMD-251	Grab	5951McCallan Rd.	5-Feb-18	1.05	<1	2	5	<1	0.12
RMD-273	Grab	Opp. 8331 Fairfax Place	5-Feb-18	0.98	<1	<2	7	<1	0.12
RMD-252	Grab	9751 Pendleton Rd.	5-Feb-18	0.79	<1	<2	6	<1	0.13
RMD-274	Grab	10920 Springwood Court	5-Feb-18	0.88	<1	<2	7	<1	0.13
RMD-253	Grab	11051 No 3 Rd.	5-Feb-18	1.07	<1	<2	5	<1	0.11
RMD-269	Grab	14951 Triangle Rd.	5-Feb-18	0.78	<1	<2	7	<1	0.12
RMD-270	Grab	8200 Jones Rd.	5-Feb-18	0.88	<1	4	6	<1	0.15
RMD-254	Grab	5300 No. 3 Rd.	5-Feb-18	0.77	<1	2	7	<1	0.12
RMD-256	Grab	1000 Blk. McDonald Rd.	5-Feb-18	0.77	<1	<2	7	<1	0.13
RMD-255	Grab	6000 Blk. Miller Rd.	5-Feb-18	0.89	<1	<2	6	<1	0.58
RMD-271	Grab	3800 Cessna Drive	5-Feb-18	0.72	<1	<2	6	<1	0.1
RMD-272	Grab	751 Catalina Cres.	5-Feb-18	0.82	<1	<2	6	<1	0.37
RMD-250	Grab	6071 Azure Rd.	5-Feb-18	0.89	<1	<2	6	<1	0.1
RMD-257	Grab	6640 Blundell Rd.	7-Feb-18	0.67	<1	<2	4	<1	0.14
RMD-266	Grab	9380 General Currie Rd.	7-Feb-18	0.67	<1	<2	3.5	<1	0.19
RMD-263	Grab	12560 Cambie Rd.	7-Feb-18	0.64	<1	<2	4	<1	0.14
RMD-277	Grab	Opp. 11280 Twigg Place	7-Feb-18	0.66	<1	<2	4	<1	0.18
RMD-264	Grab	13100 Mitchell Rd.	7-Feb-18	0.65	<1	<2	5	<1	0.24
RMD-262	Grab	13799 Commerce Pkwy.	7-Feb-18	0.67	<1	<2	4	<1	0.13
RMD-278	Grab	6651 Fraserwood Place	7-Feb-18	0.65	<1	<2	4.5	<1	0.12
RMD-279	Grab	Opp. 20371 Westminster Hwy.	7-Feb-18	0.66	<1	<2	4	<1	0.17
RMD-261	Grab	9911 Sidaway Rd.	7-Feb-18	0.65	<1	<2	4	<1	0.13
RMD-260	Grab	11111 Horseshoe Way	7-Feb-18	0.7	<1	<2	3	<1	0.14
RMD-259	Grab	10020 Amethyst Ave.	7-Feb-18	0.62	<1	<2	5	<1	0.33
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	7-Feb-18	0.69	<1	<2	4	<1	0.16
RMD-258	Grab	7000 Blk. Dyke Rd.	7-Feb-18	0.64	<1	<2	4.5	<1	0.29
RMD-204	Grab	3180 Granville Ave.	9-Feb-18	0.72	<1	<2	4	<1	0.15
RMD-206	Grab	4251 Moncton St.	9-Feb-18	0.6	<1	<2	5	<1	0.19
RMD-216	Grab	11080 No. 2 Rd.	9-Feb-18	0.79	<1	2	4	<1	0.2
RMD-280	Grab	11500 McKenzie Rd.	9-Feb-18	0.81	<1	<2	5	<1	0.15
RMD-212	Grab	Opp. 8600 Ryan Rd.	9-Feb-18	1	<1	<2	5	<1	0.21
RMD-208	Grab	13200 No. 4 Rd.	9-Feb-18	0.87	<1	<2	4	<1	0.19
RMD-205	Grab	13851 Steveston Hwy.	9-Feb-18	0.63	<1	2	5	<1	0.08
RMD-202	Grab	1500 Valemont Way	9-Feb-18	0.73	<1	<2	4	<1	0.13
RMD-214	Grab	11720 Westminster Hwy.	9-Feb-18	0.8	<1	2	4	<1	0.15
RMD-267	Grab	17240 Fedoruk	9-Feb-18	0.7	<1	<2	6	<1	0.13
RMD-249	Grab	23000 Blk. Dyke Rd.	9-Feb-18	0.66	<1	<2	4	<1	0.09
RMD-276	Grab	22271 Cochrane Drive	9-Feb-18	0.68	<1	<2	5	<1	0.09
RMD-275	Grab	5180 Smith Cres.	9-Feb-18	0.67	<1	<2	7	<1	0.08

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-203	Grab	23260 Westminster Hwy.	9-Feb-18	0.77	<1	<2	5	<1	0.11
RMD-251	Grab	5951McCallan Rd.	13-Feb-18	0.84	<1	<2	5	<1	0.11
RMD-273	Grab	Opp. 8331 Fairfax Place	13-Feb-18	0.77	<1	20	7	<1	0.1
RMD-252	Grab	9751 Pendleton Rd.	13-Feb-18	0.73	<1	<2	7	<1	0.1
RMD-274	Grab	10920 Springwood Court	13-Feb-18	0.76	<1	<2	7	<1	0.1
RMD-253	Grab	11051 No 3 Rd.	13-Feb-18	0.85	<1	<2	5	<1	0.12
RMD-269	Grab	14951 Triangle Rd.	13-Feb-18	0.58	<1	<2	5	<1	0.12
RMD-270	Grab	8200 Jones Rd.	13-Feb-18	0.73	<1	<2	6	<1	0.1
RMD-254	Grab	5300 No. 3 Rd.	13-Feb-18	0.72	<1	<2	6	<1	0.12
RMD-256	Grab	1000 Blk. McDonald Rd.	13-Feb-18	0.54	<1	<2	7	<1	0.26
RMD-255	Grab	6000 Blk. Miller Rd.	13-Feb-18	0.94	<1	<2	5	<1	0.24
RMD-271	Grab	3800 Cessna Drive	13-Feb-18	0.89	<1	<2	7	<1	0.16
RMD-272	Grab	751 Catalina Cres.	13-Feb-18	1.04	<1	<2	5	<1	0.15
RMD-250	Grab	6071 Azure Rd.	13-Feb-18	0.81	<1	<2	5	<1	0.1
RMD-263	Grab	12560 Cambie Rd.	14-Feb-18	0.84	<1	<2	5	<1	0.2
RMD-264	Grab	13100 Mitchell Rd.	14-Feb-18	1.01	<1	<2	4	<1	0.13
RMD-277	Grab	Opp. 11280 Twigg Place	14-Feb-18	0.91	<1	<2	4	<1	0.2
RMD-262	Grab	13799 Commerce Pkwy.	14-Feb-18	0.61	<1	<2	5	<1	0.18
RMD-278	Grab	6651 Fraserwood Place	14-Feb-18	0.64	<1	<2	6	<1	0.2
RMD-279	Grab	Opp. 20371 Westminster Hwy.	14-Feb-18	0.79	<1	<2	5	<1	0.15
RMD-261	Grab	9911 Sidaway Rd.	14-Feb-18	0.69	<1	<2	4	<1	0.29
RMD-260	Grab	11111 Horseshoe Way	14-Feb-18	0.85	<1	<2	4	<1	0.17
RMD-259	Grab	10020 Amethyst Ave.	14-Feb-18	0.72	<1	<2	5	<1	0.5
RMD-266	Grab	9380 General Currie Rd.	14-Feb-18	0.82	<1	<2	4	<1	0.19
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	14-Feb-18	0.94	<1	<2	5	<1	0.11
RMD-258	Grab	7000 Blk. Dyke Rd.	14-Feb-18	0.77	<1	<2	4	<1	0.14
RMD-257	Grab	6640 Blundell Rd.	14-Feb-18	0.73	<1	<2	3	<1	0.16
RMD-204	Grab	3180 Granville Ave.	15-Feb-18	0.89	<1	2	3	<1	0.12
RMD-206	Grab	4251 Moncton St.	15-Feb-18	0.75	<1	<2	3	<1	0.17
RMD-216	Grab	11080 No. 2 Rd.	15-Feb-18	0.75	<1	<2	3	<1	0.2
RMD-280	Grab	11500 McKenzie Rd.	15-Feb-18	0.67	<1	<2	5	<1	0.19
RMD-212	Grab	Opp. 8600 Ryan Rd.	15-Feb-18	0.75	<1	<2	3	<1	0.11
RMD-208	Grab	13200 No. 4 Rd.	15-Feb-18	0.82	<1	<2	3	<1	0.14
RMD-205	Grab	13851 Steveston Hwy.	15-Feb-18	0.62	<1	<2	3	<1	0.1
RMD-202	Grab	1500 Valemont Way	15-Feb-18	0.68	<1	<2	1	<1	0.1
RMD-214	Grab	11720 Westminster Hwy.	15-Feb-18	0.62	<1	<2	2	<1	0.12
RMD-267	Grab	17240 Fedoruk	15-Feb-18	0.55	<1	<2	4	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	15-Feb-18	0.62	<1	<2	3	<1	0.21
RMD-276	Grab	22271 Cochrane Drive	15-Feb-18	0.62	<1	2	4	<1	0.24
RMD-275	Grab	5180 Smith Cres.	15-Feb-18	0.55	<1	<2	4	<1	0.12

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-203	Grab	23260 Westminster Hwy.	15-Feb-18	0.64	<1	<2	3	<1	0.14
RMD-251	Grab	5951McCallan Rd.	19-Feb-18	0.61	<1	<2	3	<1	0.11
RMD-273	Grab	Opp. 8331 Fairfax Place	19-Feb-18	0.6	<1	<2	3	<1	0.17
RMD-252	Grab	9751 Pendleton Rd.	19-Feb-18	0.64	<1	<2	4	<1	0.15
RMD-274	Grab	10920 Springwood Court	19-Feb-18	0.62	<1	<2	5	<1	0.17
RMD-253	Grab	11051 No 3 Rd.	19-Feb-18	0.83	<1	<2	3	<1	0.21
RMD-269	Grab	14951 Triangle Rd.	19-Feb-18	0.72	<1	<2	4	<1	0.2
RMD-270	Grab	8200 Jones Rd.	19-Feb-18	0.77	<1	<2	4	<1	0.23
RMD-254	Grab	5300 No. 3 Rd.	19-Feb-18	0.81	<1	<2	4	<1	0.22
RMD-256	Grab	1000 Blk. McDonald Rd.	19-Feb-18	0.59	<1	<2	4	<1	0.36
RMD-255	Grab	6000 Blk. Miller Rd.	19-Feb-18	0.87	<1	<2	4	<1	0.48
RMD-271	Grab	3800 Cessna Drive	19-Feb-18	0.78	<1	<2	3	<1	0.23
RMD-272	Grab	751 Catalina Cres.	19-Feb-18	0.86	<1	<2	3	<1	0.11
RMD-250	Grab	6071 Azure Rd.	19-Feb-18	0.73	<1	<2	5	<1	0.25
RMD-263	Grab	12560 Cambie Rd.	21-Feb-18	0.83	<1	<2	5	<1	0.15
RMD-277	Grab	Opp. 11280 Twigg Place	21-Feb-18	0.9	<1	<2	6	<1	0.14
RMD-264	Grab	13100 Mitchell Rd.	21-Feb-18	0.9	<1	<2	5	<1	0.11
RMD-262	Grab	13799 Commerce Pkwy.	21-Feb-18	0.69	<1	<2	5	<1	0.1
RMD-278	Grab	6651 Fraserwood Place	21-Feb-18	0.71	<1	<2	5	<1	0.13
RMD-279	Grab	Opp. 20371 Westminster Hwy.	21-Feb-18	0.66	<1	<2	6	<1	0.1
RMD-261	Grab	9911 Sidaway Rd.	21-Feb-18	0.7	<1	2	5	<1	0.15
RMD-260	Grab	11111 Horseshoe Way	21-Feb-18	0.9	<1	<2	5	<1	0.1
RMD-259	Grab	10020 Amethyst Ave.	21-Feb-18	0.73	<1	<2	7	<1	0.13
RMD-266	Grab	9380 General Currie Rd.	21-Feb-18	0.87	<1	<2	6	<1	0.12
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	21-Feb-18	0.82	<1	<2	6	<1	0.13
RMD-258	Grab	7000 Blk. Dyke Rd.	21-Feb-18	0.83	<1	<2	6	<1	0.12
RMD-257	Grab	6640 Blundell Rd.	21-Feb-18	0.84	<1	<2	6	<1	0.1
RMD-204	Grab	3180 Granville Ave.	23-Feb-18	0.63	<1	<2	5	<1	0.13
RMD-206	Grab	4251 Moncton St.	23-Feb-18	0.83	<1	<2	5	<1	0.15
RMD-214	Grab	11720 Westminster Hwy.	23-Feb-18	0.91	<1	<2	4	<1	0.1
RMD-216	Grab	11080 No. 2 Rd.	23-Feb-18	0.92	<1	<2	5	<1	0.15
RMD-202	Grab	1500 Valemont Way	23-Feb-18	0.98	<1	<2	3	<1	0.16
RMD-280	Grab	11500 McKenzie Rd.	23-Feb-18	0.91	<1	<2	6	<1	0.14
RMD-212	Grab	Opp. 8600 Ryan Rd.	23-Feb-18	0.88	<1	<2	5	<1	0.13
RMD-267	Grab	17240 Fedoruk	23-Feb-18	0.7	<1	<2	4	<1	0.14
RMD-208	Grab	13200 No. 4 Rd.	23-Feb-18	0.9	<1	2	5	<1	0.1
RMD-249	Grab	23000 Blk. Dyke Rd.	23-Feb-18	0.66	<1	<2	4	<1	0.12
RMD-205	Grab	13851 Steveston Hwy.	23-Feb-18	0.84	<1	<2	5	<1	0.14
RMD-276	Grab	22271 Cochrane Drive	23-Feb-18	0.74	<1	<2	4	<1	0.12
RMD-275	Grab	5180 Smith Cres.	23-Feb-18	0.69	<1	<2	4	<1	0.12

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-203	Grab	23260 Westminster Hwy.	23-Feb-18	0.78	<1	<2	5	<1	0.13
RMD-251	Grab	5951McCallan Rd.	26-Feb-18	0.86	<1	<2	5	<1	0.24
RMD-273	Grab	Opp. 8331 Fairfax Place	26-Feb-18	0.76	<1	<2	6	<1	0.16
RMD-252	Grab	9751 Pendleton Rd.	26-Feb-18	0.76	<1	<2	6	<1	0.13
RMD-274	Grab	10920 Springwood Court	26-Feb-18	0.85	<1	<2	6	<1	0.15
RMD-253	Grab	11051 No 3 Rd.	26-Feb-18	0.86	<1	2	5	<1	0.15
RMD-269	Grab	14951 Triangle Rd.	26-Feb-18	0.87	<1	<2	4	<1	0.14
RMD-270	Grab	8200 Jones Rd.	26-Feb-18	0.85	<1	<2	6	<1	0.22
RMD-254	Grab	5300 No. 3 Rd.	26-Feb-18	0.87	<1	<2	5	<1	0.16
RMD-256	Grab	1000 Blk. McDonald Rd.	26-Feb-18	0.69	<1	<2	6	<1	0.26
RMD-255	Grab	6000 Blk. Miller Rd.	26-Feb-18	0.89	<1	<2	4	<1	0.84
RMD-271	Grab	3800 Cessna Drive	26-Feb-18	0.88	<1	2	6	<1	0.12
RMD-272	Grab	751 Catalina Cres.	26-Feb-18	0.93	<1	2	5	<1	0.15
RMD-250	Grab	6071 Azure Rd.	26-Feb-18	0.87	<1	<2	6	<1	0.13
RMD-263	Grab	12560 Cambie Rd.	28-Feb-18	0.94	<1	<2	5	<1	0.14
RMD-277	Grab	Opp. 11280 Twigg Place	28-Feb-18	0.93	<1	<2	5	<1	0.22
RMD-264	Grab	13100 Mitchell Rd.	28-Feb-18	0.85	<1	<2	5	<1	0.17
RMD-262	Grab	13799 Commerce Pkwy.	28-Feb-18	0.79	<1	<2	5	<1	0.14
RMD-278	Grab	6651 Fraserwood Place	28-Feb-18	0.84	<1	<2	5	<1	0.2
RMD-279	Grab	Opp. 20371 Westminster Hwy.	28-Feb-18	0.84	<1	<2	5	<1	0.18
RMD-261	Grab	9911 Sidaway Rd.	28-Feb-18	0.87	<1	<2	5	<1	0.25
RMD-260	Grab	11111 Horseshoe Way	28-Feb-18	0.79	<1	<2	5	<1	0.16
RMD-259	Grab	10020 Amethyst Ave.	28-Feb-18	0.88	<1	<2	6	<1	0.6
RMD-266	Grab	9380 General Currie Rd.	28-Feb-18	0.9	<1	<2	5	<1	0.14
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	28-Feb-18	0.84	<1	<2	5	<1	0.11
RMD-258	Grab	7000 Blk. Dyke Rd.	28-Feb-18	0.82	<1	<2	5	<1	0.2
RMD-257	Grab	6640 Blundell Rd.	28-Feb-18	0.83	<1	<2	5	<1	0.27
RMD-204	Grab	3180 Granville Ave.	1-Mar-18	1	<1	2	5	<1	0.15
RMD-206	Grab	4251 Moncton St.	1-Mar-18	0.78	<1	<2	5	<1	0.16
RMD-216	Grab	11080 No. 2 Rd.	1-Mar-18	0.93	<1	<2	5	<1	0.12
RMD-280	Grab	11500 McKenzie Rd.	1-Mar-18	0.77	<1	2	6	<1	0.18
RMD-212	Grab	Opp. 8600 Ryan Rd.	1-Mar-18	0.85	<1	<2	4	<1	0.16
RMD-208	Grab	13200 No. 4 Rd.	1-Mar-18	0.94	<1	<2	5	<1	0.12
RMD-205	Grab	13851 Steveston Hwy.	1-Mar-18	0.99	<1	<2	5	<1	0.1
RMD-202	Grab	1500 Valemont Way	1-Mar-18	0.88	<1	<2	4	<1	0.15
RMD-214	Grab	11720 Westminster Hwy.	1-Mar-18	0.73	<1	<2	5	<1	0.13
RMD-267	Grab	17240 Fedoruk	1-Mar-18	0.87	<1	<2	6	<1	0.13
RMD-249	Grab	23000 Blk. Dyke Rd.	1-Mar-18	0.95	<1	2	6	<1	0.1
RMD-276	Grab	22271 Cochrane Drive	1-Mar-18	0.79	<1	<2	5	<1	0.12
RMD-275	Grab	5180 Smith Cres.	1-Mar-18	0.76	<1	<2	6	<1	0.16

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-203	Grab	23260 Westminster Hwy.	1-Mar-18	0.82	<1	<2	4	<1	0.13
RMD-251	Grab	5951McCallan Rd.	5-Mar-18	0.72	<1	<2	5	<1	0.22
RMD-273	Grab	Opp. 8331 Fairfax Place	5-Mar-18	0.65	<1	<2	6	<1	0.17
RMD-252	Grab	9751 Pendleton Rd.	5-Mar-18	0.81	<1	<2	6	<1	0.18
RMD-274	Grab	10920 Springwood Court	5-Mar-18	0.84	<1	<2	7	<1	0.1
RMD-253	Grab	11051 No 3 Rd.	5-Mar-18	0.69	<1	<2	5	<1	0.2
RMD-269	Grab	14951 Triangle Rd.	5-Mar-18	0.6	<1	<2	6	<1	0.13
RMD-270	Grab	8200 Jones Rd.	5-Mar-18	0.8	<1	2	6	<1	0.14
RMD-254	Grab	5300 No. 3 Rd.	5-Mar-18	0.71	<1	<2	5	<1	0.16
RMD-256	Grab	1000 Blk. McDonald Rd.	5-Mar-18	0.64	<1	2	7	<1	0.25
RMD-255	Grab	6000 Blk. Miller Rd.	5-Mar-18	1.06	<1	<2	6	<1	0.31
RMD-271	Grab	3800 Cessna Drive	5-Mar-18	0.93	<1	<2	7	<1	0.21
RMD-272	Grab	751 Catalina Cres.	5-Mar-18	0.99	<1	<2	6	<1	0.18
RMD-250	Grab	6071 Azure Rd.	5-Mar-18	0.85	<1	<2	5	<1	0.17
RMD-257	Grab	6640 Blundell Rd.	7-Mar-18	0.73	<1	<2	3	<1	0.17
RMD-258	Grab	7000 Blk. Dyke Rd.	7-Mar-18	0.88	<1	<2	3	<1	0.09
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	7-Mar-18	0.79	<1	<2	3	<1	0.12
RMD-260	Grab	11111 Horseshoe Way	7-Mar-18	0.78	<1	<2	2	<1	0.12
RMD-259	Grab	10020 Amethyst Ave.	7-Mar-18	0.78	<1	<2	3	<1	0.26
RMD-266	Grab	9380 General Currie Rd.	7-Mar-18	0.95	<1	<2	3	<1	0.12
RMD-261	Grab	9911 Sidaway Rd.	7-Mar-18	0.82	<1	<2	4	<1	0.14
RMD-263	Grab	12560 Cambie Rd.	7-Mar-18	0.91	<1	<2	4	<1	0.09
RMD-262	Grab	13799 Commerce Pkwy.	7-Mar-18	0.8	<1	<2	4	<1	0.15
RMD-264	Grab	13100 Mitchell Rd.	7-Mar-18	0.81	<1	<2	4	<1	0.24
RMD-277	Grab	Opp. 11280 Twigg Place	7-Mar-18	0.88	<1	2	4	<1	0.13
RMD-279	Grab	Opp. 20371 Westminster Hwy.	7-Mar-18	0.78	<1	<2	4	<1	0.11
RMD-278	Grab	6651 Fraserwood Place	7-Mar-18	0.74	<1	<2	4	<1	0.09
RMD-204	Grab	3180 Granville Ave.	9-Mar-18	0.87	<1	<2	6	<1	0.1
RMD-206	Grab	4251 Moncton St.	9-Mar-18	1.19	<1	2	5	<1	0.13
RMD-216	Grab	11080 No. 2 Rd.	9-Mar-18	0.84	<1	<2	5	<1	0.12
RMD-280	Grab	11500 McKenzie Rd.	9-Mar-18	0.83	<1	<2	5	<1	0.1
RMD-212	Grab	Opp. 8600 Ryan Rd.	9-Mar-18	0.83	<1	<2	6	<1	0.09
RMD-208	Grab	13200 No. 4 Rd.	9-Mar-18	0.81	<1	<2	5	<1	0.09
RMD-205	Grab	13851 Steveston Hwy.	9-Mar-18	0.8	<1	<2	5	<1	0.1
RMD-202	Grab	1500 Valemont Way	9-Mar-18	0.82	<1	<2	4	<1	0.08
RMD-214	Grab	11720 Westminster Hwy.	9-Mar-18	0.85	<1	<2	4	<1	0.09
RMD-267	Grab	17240 Fedoruk	9-Mar-18	0.8	<1	<2	4	<1	0.09
RMD-249	Grab	23000 Blk. Dyke Rd.	9-Mar-18	0.74	<1	<2	4	<1	0.11
RMD-276	Grab	22271 Cochrane Drive	9-Mar-18	0.8	<1	2	4	<1	0.08
RMD-275	Grab	5180 Smith Cres.	9-Mar-18	0.75	<1	<2	4	<1	0.11

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-203	Grab	23260 Westminster Hwy.	9-Mar-18	0.67	<1	<2	5	<1	0.11
RMD-251	Grab	5951McCallan Rd.	12-Mar-18	0.73	<1	<2	3	<1	0.08
RMD-273	Grab	Opp. 8331 Fairfax Place	12-Mar-18	0.82	<1	<2	7	<1	0.14
RMD-252	Grab	9751 Pendleton Rd.	12-Mar-18	0.81	<1	<2	5	<1	0.1
RMD-274	Grab	10920 Springwood Court	12-Mar-18	0.79	<1	<2	6	<1	0.09
RMD-253	Grab	11051 No 3 Rd.	12-Mar-18	0.74	<1	<2	4	<1	0.09
RMD-269	Grab	14951 Triangle Rd.	12-Mar-18	0.76	<1	<2	4	<1	0.12
RMD-270	Grab	8200 Jones Rd.	12-Mar-18	0.77	<1	<2	5	<1	0.1
RMD-254	Grab	5300 No. 3 Rd.	12-Mar-18	0.94	<1	<2	4	<1	0.1
RMD-256	Grab	1000 Blk. McDonald Rd.	12-Mar-18	0.66	<1	<2	5	<1	0.23
RMD-255	Grab	6000 Blk. Miller Rd.	12-Mar-18	0.95	<1	4	4	<1	0.28
RMD-271	Grab	3800 Cessna Drive	12-Mar-18	0.87	<1	<2	5	<1	0.13
RMD-272	Grab	751 Catalina Cres.	12-Mar-18	1.01	<1	<2	5	<1	0.1
RMD-250	Grab	6071 Azure Rd.	12-Mar-18	0.83	<1	<2	4	<1	0.12
RMD-204	Grab	3180 Granville Ave.	15-Mar-18	1.04	<1	<2	5	<1	0.08
RMD-206	Grab	4251 Moncton St.	15-Mar-18	1.03	<1	<2	4	<1	0.08
RMD-216	Grab	11080 No. 2 Rd.	15-Mar-18	0.97	<1	<2	4	<1	0.09
RMD-280	Grab	11500 McKenzie Rd.	15-Mar-18	0.58	<1	<2	6	<1	0.12
RMD-212	Grab	Opp. 8600 Ryan Rd.	15-Mar-18	0.75	<1	2	4	<1	0.08
RMD-208	Grab	13200 No. 4 Rd.	15-Mar-18	0.71	<1	<2	5	<1	0.09
RMD-205	Grab	13851 Steveston Hwy.	15-Mar-18	0.84	<1	<2	5	<1	0.09
RMD-202	Grab	1500 Valemont Way	15-Mar-18	0.89	<1	<2	3	<1	0.09
RMD-214	Grab	11720 Westminster Hwy.	15-Mar-18	1.07	<1	<2	4	<1	0.08
RMD-267	Grab	17240 Fedoruk	15-Mar-18	0.67	<1	<2	5	<1	0.09
RMD-249	Grab	23000 Blk. Dyke Rd.	15-Mar-18	0.58	<1	<2	5	<1	0.09
RMD-276	Grab	22271 Cochrane Drive	15-Mar-18	0.67	<1	<2	5	<1	0.09
RMD-275	Grab	5180 Smith Cres.	15-Mar-18	0.62	<1	<2	5	<1	0.08
RMD-203	Grab	23260 Westminster Hwy.	15-Mar-18	0.66	<1	<2	4	<1	0.09
RMD-251	Grab	5951McCallan Rd.	19-Mar-18	0.99	<1	<2	7	<1	0.17
RMD-273	Grab	Opp. 8331 Fairfax Place	19-Mar-18	0.74	<1	<2	10	<1	0.21
RMD-252	Grab	9751 Pendleton Rd.	19-Mar-18	0.78	<1	<2	6	<1	0.19
RMD-274	Grab	10920 Springwood Court	19-Mar-18	0.92	<1	<2	7	<1	0.09
RMD-253	Grab	11051 No 3 Rd.	19-Mar-18	0.84	<1	<2	7	<1	0.13
RMD-269	Grab	14951 Triangle Rd.	19-Mar-18	0.69	<1	<2	8	<1	0.18
RMD-270	Grab	8200 Jones Rd.	19-Mar-18	0.81	<1	<2	7	<1	0.1
RMD-254	Grab	5300 No. 3 Rd.	19-Mar-18	0.71	<1	<2	7	<1	0.13
RMD-256	Grab	1000 Blk. McDonald Rd.	19-Mar-18	0.63	<1	<2	8	<1	0.5
RMD-255	Grab	6000 Blk. Miller Rd.	19-Mar-18	0.97	<1	<2	7	<1	0.24
RMD-271	Grab	3800 Cessna Drive	19-Mar-18	0.83	<1	<2	8	<1	0.1
RMD-272	Grab	751 Catalina Cres.	19-Mar-18	0.96	<1	<2	7	<1	0.26

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-250	Grab	6071 Azure Rd.	19-Mar-18	0.78	<1	<2	6	<1	0.35
RMD-263	Grab	12560 Cambie Rd.	21-Mar-18	0.8	<1	2	6	<1	0.19
RMD-264	Grab	13100 Mitchell Rd.	21-Mar-18	0.83	<1	<2	6	<1	0.13
RMD-277	Grab	Opp. 11280 Twigg Place	21-Mar-18	0.87	<1	<2	6	<1	0.17
RMD-262	Grab	13799 Commerce Pkwy.	21-Mar-18	0.79	<1	<2	6	<1	0.14
RMD-278	Grab	6651 Fraserwood Place	21-Mar-18	0.67	<1	<2	7	<1	0.23
RMD-279	Grab	Opp. 20371 Westminster Hwy.	21-Mar-18	0.73	<1	<2	5	<1	0.16
RMD-261	Grab	9911 Sidaway Rd.	21-Mar-18	0.76	<1	<2	6	<1	0.14
RMD-260	Grab	11111 Horseshoe Way	21-Mar-18	0.71	<1	2	6	<1	0.21
RMD-259	Grab	10020 Amethyst Ave.	21-Mar-18	0.82	<1	2	6	<1	1
RMD-266	Grab	9380 General Currie Rd.	21-Mar-18	0.81	<1	<2	6	<1	0.12
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	21-Mar-18	0.76	<1	<2	6	<1	0.13
RMD-258	Grab	7000 Blk. Dyke Rd.	21-Mar-18	0.95	<1	<2	6	<1	0.15
RMD-257	Grab	6640 Blundell Rd.	21-Mar-18	0.73	<1	<2	6	<1	0.15
RMD-204	Grab	3180 Granville Ave.	23-Mar-18	0.76	<1	<2	6	<1	0.2
RMD-206	Grab	4251 Moncton St.	23-Mar-18	0.77	<1	<2	6	<1	0.15
RMD-216	Grab	11080 No. 2 Rd.	23-Mar-18	0.88	<1	2	5	<1	0.14
RMD-280	Grab	11500 McKenzie Rd.	23-Mar-18	0.84	<1	<2	6	<1	0.23
RMD-212	Grab	Opp. 8600 Ryan Rd.	23-Mar-18	0.81	<1	<2	6	<1	0.17
RMD-208	Grab	13200 No. 4 Rd.	23-Mar-18	0.83	<1	<2	6	<1	0.2
RMD-205	Grab	13851 Steveston Hwy.	23-Mar-18	0.76	<1	2	6	<1	0.16
RMD-202	Grab	1500 Valemont Way	23-Mar-18	0.71	<1	10	6	<1	0.18
RMD-214	Grab	11720 Westminster Hwy.	23-Mar-18	0.96	<1	<2	6	<1	0.17
RMD-267	Grab	17240 Fedoruk	23-Mar-18	0.75	<1	<2	6	<1	0.2
RMD-249	Grab	23000 Blk. Dyke Rd.	23-Mar-18	0.75	<1	<2	6	<1	0.14
RMD-276	Grab	22271 Cochrane Drive	23-Mar-18	0.77	<1	<2	6	<1	0.17
RMD-275	Grab	5180 Smith Cres.	23-Mar-18	0.75	<1	<2	6	<1	0.15
RMD-203	Grab	23260 Westminster Hwy.	23-Mar-18	0.84	<1	<2	6	<1	0.15
RMD-251	Grab	5951McCallan Rd.	26-Mar-18	0.97	<1	<2	7	<1	0.08
RMD-273	Grab	Opp. 8331 Fairfax Place	26-Mar-18	0.79	<1	<2	7	<1	0.11
RMD-252	Grab	9751 Pendleton Rd.	26-Mar-18	0.71	<1	<2	8	<1	0.09
RMD-274	Grab	10920 Springwood Court	26-Mar-18	0.9	<1	<2	8	<1	0.09
RMD-253	Grab	11051 No 3 Rd.	26-Mar-18	0.89	<1	<2	8	<1	0.19
RMD-269	Grab	14951 Triangle Rd.	26-Mar-18	0.91	<1	<2	8	<1	0.1
RMD-270	Grab	8200 Jones Rd.	26-Mar-18	0.95	<1	<2	8	<1	0.1
RMD-254	Grab	5300 No. 3 Rd.	26-Mar-18	0.88	<1	<2	8	<1	0.08
RMD-256	Grab	1000 Blk. McDonald Rd.	26-Mar-18	0.39	<1	<2	9	<1	0.48
RMD-255	Grab	6000 Blk. Miller Rd.	26-Mar-18	1.04	<1	<2	6	<1	0.18
RMD-271	Grab	3800 Cessna Drive	26-Mar-18	0.93	<1	<2	7	<1	0.12
RMD-272	Grab	751 Catalina Cres.	26-Mar-18	0.96	<1	<2	7	<1	0.1

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-250	Grab	6071 Azure Rd.	26-Mar-18	0.91	<1	4	7	<1	0.1
RMD-257	Grab	6640 Blundell Rd.	27-Mar-18	0.85	<1	<2	6	<1	0.1
RMD-258	Grab	7000 Blk. Dyke Rd.	27-Mar-18	0.89	<1	<2	7	<1	0.08
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	27-Mar-18	0.61	<1	2	7	<1	0.1
RMD-260	Grab	11111 Horseshoe Way	27-Mar-18	0.78	<1	<2	6	<1	0.08
RMD-259	Grab	10020 Amethyst Ave.	27-Mar-18	0.86	<1	<2	7	<1	0.47
RMD-266	Grab	9380 General Currie Rd.	27-Mar-18	0.77	<1	<2	6	<1	0.13
RMD-261	Grab	9911 Sidaway Rd.	27-Mar-18	0.66	<1	<2	6	<1	0.11
RMD-263	Grab	12560 Cambie Rd.	27-Mar-18	0.78	<1	<2	6	<1	0.15
RMD-264	Grab	13100 Mitchell Rd.	27-Mar-18	0.85	<1	<2	7	<1	0.16
RMD-277	Grab	Opp. 11280 Twigg Place	27-Mar-18	0.84	<1	<2	8	<1	0.14
RMD-262	Grab	13799 Commerce Pkwy.	27-Mar-18	0.8	<1	<2	7	<1	0.14
RMD-278	Grab	6651 Fraserwood Place	27-Mar-18	0.83	<1	<2	7	<1	0.1
RMD-279	Grab	Opp. 20371 Westminster Hwy.	27-Mar-18	0.78	<1	<2	7	<1	0.1
RMD-204	Grab	3180 Granville Ave.	28-Mar-18	0.79	<1	6	8	<1	0.09
RMD-206	Grab	4251 Moncton St.	28-Mar-18	0.86	<1	<2	7	<1	0.09
RMD-216	Grab	11080 No. 2 Rd.	28-Mar-18	0.83	<1	<2	6	<1	0.09
RMD-280	Grab	11500 McKenzie Rd.	28-Mar-18	0.84	<1	<2	7	<1	0.12
RMD-212	Grab	Opp. 8600 Ryan Rd.	28-Mar-18	0.81	<1	<2	7	<1	0.12
RMD-208	Grab	13200 No. 4 Rd.	28-Mar-18	0.83	<1	<2	7	<1	0.1
RMD-205	Grab	13851 Steveston Hwy.	28-Mar-18	0.79	<1	4	6	<1	0.08
RMD-202	Grab	1500 Valemont Way	28-Mar-18	0.91	<1	<2	5	<1	0.15
RMD-214	Grab	11720 Westminster Hwy.	28-Mar-18	0.95	<1	<2	5	<1	0.12
RMD-267	Grab	17240 Fedoruk	28-Mar-18	0.74	<1	<2	7	<1	0.12
RMD-249	Grab	23000 Blk. Dyke Rd.	28-Mar-18	0.76	<1	2	7	<1	0.09
RMD-276	Grab	22271 Cochrane Drive	28-Mar-18	0.88	<1	2	6	<1	0.09
RMD-275	Grab	5180 Smith Cres.	28-Mar-18	0.72	<1	2	7	<1	0.12
RMD-203	Grab	23260 Westminster Hwy.	28-Mar-18	0.7	<1	<2	8	<1	0.1
RMD-251	Grab	5951McCallan Rd.	3-Apr-18	0.75	<1	<2	6	<1	0.11
RMD-273	Grab	Opp. 8331 Fairfax Place	3-Apr-18	0.69	<1	<2	10	<1	0.12
RMD-252	Grab	9751 Pendleton Rd.	3-Apr-18	0.7	<1	<2	6	<1	0.12
RMD-274	Grab	10920 Springwood Court	3-Apr-18	0.82	<1	<2	7	<1	0.12
RMD-253	Grab	11051 No 3 Rd.	3-Apr-18	0.76	<1	<2	5	<1	0.13
RMD-269	Grab	14951 Triangle Rd.	3-Apr-18	0.76	<1	<2	6	<1	0.11
RMD-270	Grab	8200 Jones Rd.	3-Apr-18	0.74	<1	<2	8	<1	0.13
RMD-254	Grab	5300 No. 3 Rd.	3-Apr-18	0.72	<1	<2	8	<1	0.16
RMD-256	Grab	1000 Blk. McDonald Rd.	3-Apr-18	0.59	<1	<2	8	<1	0.84
RMD-255	Grab	6000 Blk. Miller Rd.	3-Apr-18	0.81	<1	<2	6	<1	0.14
RMD-271	Grab	3800 Cessna Drive	3-Apr-18	0.91	<1	<2	9	<1	0.17
RMD-272	Grab	751 Catalina Cres.	3-Apr-18	0.88	<1	<2	7	<1	0.13

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-250	Grab	6071 Azure Rd.	3-Apr-18	0.75	<1	<2	6	<1	0.11
RMD-263	Grab	12560 Cambie Rd.	4-Apr-18	0.54	<1	<2	5	<1	0.13
RMD-264	Grab	13100 Mitchell Rd.	4-Apr-18	0.73	<1	<2	5	<1	0.12
RMD-277	Grab	Opp. 11280 Twigg Place	4-Apr-18	0.7	<1	<2	7	<1	0.14
RMD-262	Grab	13799 Commerce Pkwy.	4-Apr-18	0.78	<1	<2	6	<1	0.1
RMD-278	Grab	6651 Fraserwood Place	4-Apr-18	0.75	<1	<2	5	<1	0.12
RMD-279	Grab	Opp. 20371 Westminster Hwy.	4-Apr-18	0.82	<1	<2	5	<1	0.1
RMD-261	Grab	9911 Sidaway Rd.	4-Apr-18	0.72	<1	<2	5	<1	1.3
RMD-260	Grab	11111 Horseshoe Way	4-Apr-18	0.68	<1	<2	5	<1	0.11
RMD-259	Grab	10020 Amethyst Ave.	4-Apr-18	0.8	<1	<2	7	<1	0.51
RMD-266	Grab	9380 General Currie Rd.	4-Apr-18	1.02	<1	<2	5	<1	0.14
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	4-Apr-18	0.72	<1	<2	5	<1	0.13
RMD-258	Grab	7000 Blk. Dyke Rd.	4-Apr-18	0.77	<1	<2	6	<1	0.16
RMD-257	Grab	6640 Blundell Rd.	4-Apr-18	0.72	<1	<2	5	<1	0.1
RMD-204	Grab	3180 Granville Ave.	6-Apr-18	0.89	<1	2	7	<1	0.11
RMD-206	Grab	4251 Moncton St.	6-Apr-18	0.85	<1	<2	6	<1	0.13
RMD-216	Grab	11080 No. 2 Rd.	6-Apr-18	0.86	<1	<2	6	<1	0.23
RMD-280	Grab	11500 McKenzie Rd.	6-Apr-18	0.86	<1	<2	7	<1	0.11
RMD-212	Grab	Opp. 8600 Ryan Rd.	6-Apr-18	0.8	<1	<2	6	<1	0.13
RMD-208	Grab	13200 No. 4 Rd.	6-Apr-18	0.81	<1	<2	7	<1	0.11
RMD-205	Grab	13851 Steveston Hwy.	6-Apr-18	0.76	<1	8	5	<1	0.13
RMD-202	Grab	1500 Valemont Way	6-Apr-18	0.63	<1	<2	6	<1	0.11
RMD-214	Grab	11720 Westminster Hwy.	6-Apr-18	0.82	<1	<2	6	<1	0.13
RMD-267	Grab	17240 Fedoruk	6-Apr-18	0.72	<1	<2	7	<1	0.12
RMD-249	Grab	23000 Blk. Dyke Rd.	6-Apr-18	0.66	<1	<2	7	<1	0.11
RMD-276	Grab	22271 Cochrane Drive	6-Apr-18	0.68	<1	<2	6	<1	0.11
RMD-275	Grab	5180 Smith Cres.	6-Apr-18	0.58	<1	<2	7	<1	0.09
RMD-203	Grab	23260 Westminster Hwy.	6-Apr-18	0.73	<1	<2	6	<1	0.12
RMD-251	Grab	5951McCallan Rd.	9-Apr-18	0.83	<1	<2	7	<1	0.14
RMD-273	Grab	Opp. 8331 Fairfax Place	9-Apr-18	0.77	<1	<2	10	<1	0.1
RMD-252	Grab	9751 Pendleton Rd.	9-Apr-18	0.7	<1	<2	8	<1	0.13
RMD-274	Grab	10920 Springwood Court	9-Apr-18	0.82	<1	2	9	<1	0.14
RMD-253	Grab	11051 No 3 Rd.	9-Apr-18	0.8	<1	<2	9	<1	0.18
RMD-269	Grab	14951 Triangle Rd.	9-Apr-18	0.82	<1	<2	9	<1	0.13
RMD-270	Grab	8200 Jones Rd.	9-Apr-18	0.78	<1	<2	9	<1	0.1
RMD-254	Grab	5300 No. 3 Rd.	9-Apr-18	0.67	<1	<2	9	<1	0.22
RMD-256	Grab	1000 Blk. McDonald Rd.	9-Apr-18	0.53	<1	<2	9	<1	0.59
RMD-255	Grab	6000 Blk. Miller Rd.	9-Apr-18	0.92	<1	<2	7	<1	0.17
RMD-271	Grab	3800 Cessna Drive	9-Apr-18	0.83	<1	<2	8	<1	0.15
RMD-272	Grab	751 Catalina Cres.	9-Apr-18	0.91	<1	<2	9	<1	0.17

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-250	Grab	6071 Azure Rd.	9-Apr-18	0.79	<1	<2	8	<1	0.14
RMD-263	Grab	12560 Cambie Rd.	11-Apr-18	0.79	<1	<2	7	<1	0.11
RMD-277	Grab	Opp. 11280 Twigg Place	11-Apr-18	0.84	<1	<2	8	<1	0.12
RMD-264	Grab	13100 Mitchell Rd.	11-Apr-18	0.8	<1	<2	7	<1	0.13
RMD-262	Grab	13799 Commerce Pkwy.	11-Apr-18	0.74	<1	<2	7	<1	0.13
RMD-278	Grab	6651 Fraserwood Place	11-Apr-18	0.64	<1	2	7	<1	0.08
RMD-279	Grab	Opp. 20371 Westminster Hwy.	11-Apr-18	0.85	<1	<2	7	<1	0.13
RMD-261	Grab	9911 Sidaway Rd.	11-Apr-18	0.83	<1	2	7	<1	0.13
RMD-260	Grab	11111 Horseshoe Way	11-Apr-18	0.84	<1	<2	7	<1	0.11
RMD-259	Grab	10020 Amethyst Ave.	11-Apr-18	0.75	<1	2	8	<1	1.6
RMD-266	Grab	9380 General Currie Rd.	11-Apr-18	0.79	<1	<2	7	<1	0.11
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	11-Apr-18	0.8	<1	<2	7	<1	0.13
RMD-258	Grab	7000 Blk. Dyke Rd.	11-Apr-18	0.68	<1	<2	8	<1	0.1
RMD-257	Grab	6640 Blundell Rd.	11-Apr-18	0.72	<1	<2	7	<1	0.09
RMD-204	Grab	3180 Granville Ave.	12-Apr-18	0.86	<1	<2	8	<1	0.12
RMD-206	Grab	4251 Moncton St.	12-Apr-18	0.78	<1	<2	8	<1	0.13
RMD-216	Grab	11080 No. 2 Rd.	12-Apr-18	0.9	<1	<2	8	<1	0.11
RMD-280	Grab	11500 McKenzie Rd.	12-Apr-18	0.68	<1	<2	9	<1	0.14
RMD-212	Grab	Opp. 8600 Ryan Rd.	12-Apr-18	0.87	<1	<2	8	<1	0.12
RMD-208	Grab	13200 No. 4 Rd.	12-Apr-18	0.92	<1	<2	9	<1	0.11
RMD-205	Grab	13851 Steveston Hwy.	12-Apr-18	0.78	<1	<2	8	<1	0.11
RMD-202	Grab	1500 Valemont Way	12-Apr-18	0.76	<1	<2	7	<1	0.12
RMD-214	Grab	11720 Westminster Hwy.	12-Apr-18	0.78	<1	<2	8	<1	0.1
RMD-267	Grab	17240 Fedoruk	12-Apr-18	0.75	<1	<2	8	<1	0.13
RMD-249	Grab	23000 Blk. Dyke Rd.	12-Apr-18	0.74	<1	<2	8	<1	0.13
RMD-276	Grab	22271 Cochrane Drive	12-Apr-18	0.76	<1	<2	8	<1	0.14
RMD-275	Grab	5180 Smith Cres.	12-Apr-18	0.71	<1	<2	8	<1	0.13
RMD-203	Grab	23260 Westminster Hwy.	12-Apr-18	0.75	<1	<2	8	<1	0.13
RMD-251	Grab	5951McCallan Rd.	16-Apr-18	0.85	<1	<2	8	<1	0.11
RMD-273	Grab	Opp. 8331 Fairfax Place	16-Apr-18	0.72	<1	<2	10	<1	0.11
RMD-252	Grab	9751 Pendleton Rd.	16-Apr-18	0.77	<1	<2	9	<1	0.13
RMD-274	Grab	10920 Springwood Court	16-Apr-18	0.89	<1	<2	8	<1	0.11
RMD-253	Grab	11051 No 3 Rd.	16-Apr-18	0.91	<1	<2	9	<1	0.1
RMD-269	Grab	14951 Triangle Rd.	16-Apr-18	0.66	<1	2	9	<1	0.21
RMD-270	Grab	8200 Jones Rd.	16-Apr-18	0.84	<1	<2	9	<1	0.11
RMD-254	Grab	5300 No. 3 Rd.	16-Apr-18	0.64	<1	<2	9	<1	0.11
RMD-256	Grab	1000 Blk. McDonald Rd.	16-Apr-18	0.53	<1	<2	9	<1	0.93
RMD-255	Grab	6000 Blk. Miller Rd.	16-Apr-18	1.02	<1	<2	8	<1	0.19
RMD-271	Grab	3800 Cessna Drive	16-Apr-18	0.93	<1	<2	9	<1	0.11
RMD-272	Grab	751 Catalina Cres.	16-Apr-18	0.76	<1	ontamina	8	<1	0.17

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-250	Grab	6071 Azure Rd.	16-Apr-18	0.78	<1	<2	8	<1	0.1
RMD-263	Grab	12560 Cambie Rd.	18-Apr-18	0.84	<1	<2	7	<1	0.18
RMD-277	Grab	Opp. 11280 Twigg Place	18-Apr-18	0.89	<1	<2	8	<1	0.97
RMD-264	Grab	13100 Mitchell Rd.	18-Apr-18	0.89	<1	<2	8	<1	0.24
RMD-262	Grab	13799 Commerce Pkwy.	18-Apr-18	0.72	<1	<2	8	<1	0.13
RMD-278	Grab	6651 Fraserwood Place	18-Apr-18	0.73	<1	<2	8	<1	0.19
RMD-279	Grab	Opp. 20371 Westminster Hwy.	18-Apr-18	0.73	<1	<2	8	<1	0.14
RMD-261	Grab	9911 Sidaway Rd.	18-Apr-18	0.69	<1	<2	8	<1	0.16
RMD-260	Grab	11111 Horseshoe Way	18-Apr-18	0.88	<1	<2	8	<1	0.11
RMD-259	Grab	10020 Amethyst Ave.	18-Apr-18	0.6	<1	<2	8	<1	0.38
RMD-266	Grab	9380 General Currie Rd.	18-Apr-18	0.87	<1	<2	8	<1	0.21
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	18-Apr-18	0.82	<1	<2	8	<1	0.36
RMD-258	Grab	7000 Blk. Dyke Rd.	18-Apr-18	0.79	<1	<2	8	<1	0.1
RMD-257	Grab	6640 Blundell Rd.	18-Apr-18	0.78	<1	<2	8	<1	0.13
RMD-206	Grab	4251 Moncton St.	20-Apr-18	0.81	<1	2	8	<1	0.09
RMD-216	Grab	11080 No. 2 Rd.	20-Apr-18	0.87	<1	<2	9	<1	0.1
RMD-280	Grab	11500 McKenzie Rd.	20-Apr-18	0.8	<1	<2	9	<1	0.11
RMD-212	Grab	Opp. 8600 Ryan Rd.	20-Apr-18	0.69	<1	<2	9	<1	0.16
RMD-208	Grab	13200 No. 4 Rd.	20-Apr-18	0.74	<1	<2	9	<1	0.15
RMD-205	Grab	13851 Steveston Hwy.	20-Apr-18	0.79	<1	<2	7	<1	0.4
RMD-202	Grab	1500 Valemont Way	20-Apr-18	0.78	<1	<2	7	<1	0.18
RMD-214	Grab	11720 Westminster Hwy.	20-Apr-18	0.86	<1	<2	8	<1	0.1
RMD-267	Grab	17240 Fedoruk	20-Apr-18	0.71	<1	<2	7	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	20-Apr-18	0.7	<1	<2	8	<1	0.4
RMD-276	Grab	22271 Cochrane Drive	20-Apr-18	0.74	<1	<2	9	<1	0.3
RMD-275	Grab	5180 Smith Cres.	20-Apr-18	0.7	<1	<2	9	<1	0.4
RMD-251	Grab	5951McCallan Rd.	23-Apr-18	0.72	<1	<2	8	<1	0.36
RMD-273	Grab	Opp. 8331 Fairfax Place	23-Apr-18	0.76	<1	2	12	<1	0.33
RMD-252	Grab	9751 Pendleton Rd.	23-Apr-18	0.64	<1	<2	9	<1	0.37
RMD-274	Grab	10920 Springwood Court	23-Apr-18	0.79	<1	<2	11	<1	0.19
RMD-253	Grab	11051 No 3 Rd.	23-Apr-18	0.72	<1	2	9	<1	0.39
RMD-269	Grab	14951 Triangle Rd.	23-Apr-18	0.71	<1	<2	9	<1	0.18
RMD-270	Grab	8200 Jones Rd.	23-Apr-18	0.8	<1	2	10	<1	0.19
RMD-254	Grab	5300 No. 3 Rd.	23-Apr-18	0.79	<1	<2	9	<1	0.57
RMD-256	Grab	1000 Blk. McDonald Rd.	23-Apr-18	0.56	<1	<2	10	<1	0.75
RMD-255	Grab	6000 Blk. Miller Rd.	23-Apr-18	0.72	<1	<2	7	<1	0.65
RMD-271	Grab	3800 Cessna Drive	23-Apr-18	0.61	<1	<2	9	<1	0.28
RMD-272	Grab	751 Catalina Cres.	23-Apr-18	0.69	<1	<2	9	<1	0.19
RMD-250	Grab	6071 Azure Rd.	23-Apr-18	0.75	<1	<2	9	<1	0.18
RMD-263	Grab	12560 Cambie Rd.	25-Apr-18	0.86	<1	2	8	<1	0.18

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	25-Apr-18	0.82	<1	<2	8	<1	0.22
RMD-277	Grab	Opp. 11280 Twigg Place	25-Apr-18	0.81	<1	2	9	<1	0.16
RMD-262	Grab	13799 Commerce Pkwy.	25-Apr-18	0.67	<1	<2	8	<1	0.14
RMD-278	Grab	6651 Fraserwood Place	25-Apr-18	0.66	<1	<2	9	<1	0.2
RMD-279	Grab	Opp. 20371 Westminster Hwy.	25-Apr-18	0.77	<1	<2	8	<1	0.15
RMD-261	Grab	9911 Sidaway Rd.	25-Apr-18	0.74	<1	<2	8	<1	0.11
RMD-260	Grab	11111 Horseshoe Way	25-Apr-18	0.89	<1	<2	7	<1	0.1
RMD-259	Grab	10020 Amethyst Ave.	25-Apr-18	0.77	<1	2	8	<1	0.24
RMD-266	Grab	9380 General Currie Rd.	25-Apr-18	0.96	<1	<2	7	<1	0.12
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	25-Apr-18	0.77	<1	<2	8	<1	0.12
RMD-258	Grab	7000 Blk. Dyke Rd.	25-Apr-18	0.82	<1	4	8	<1	0.17
RMD-257	Grab	6640 Blundell Rd.	25-Apr-18	0.6	<1	<2	8	<1	0.29
RMD-204	Grab	3180 Granville Ave.	26-Apr-18	0.78	<1	<2	9	<1	0.12
RMD-206	Grab	4251 Moncton St.	26-Apr-18	0.71	<1	<2	8	<1	0.3
RMD-216	Grab	11080 No. 2 Rd.	26-Apr-18	0.7	<1	<2	8	<1	0.13
RMD-280	Grab	11500 McKenzie Rd.	26-Apr-18	0.73	<1	<2	10	<1	0.26
RMD-212	Grab	Opp. 8600 Ryan Rd.	26-Apr-18	0.77	<1	2	8	<1	0.13
RMD-208	Grab	13200 No. 4 Rd.	26-Apr-18	0.79	<1	<2	9	<1	0.12
RMD-205	Grab	13851 Steveston Hwy.	26-Apr-18	0.69	<1	<2	9	<1	0.15
RMD-202	Grab	1500 Valemont Way	26-Apr-18	0.7	<1	<2	9	<1	0.11
RMD-214	Grab	11720 Westminster Hwy.	26-Apr-18	0.83	<1	<2	9	<1	0.11
RMD-267	Grab	17240 Fedoruk	26-Apr-18	0.66	<1	<2	9	<1	0.13
RMD-249	Grab	23000 Blk. Dyke Rd.	26-Apr-18	0.7	<1	2	9	<1	0.17
RMD-275	Grab	5180 Smith Cres.	26-Apr-18	0.75	<1	<2	10	<1	0.13
RMD-276	Grab	22271 Cochrane Drive	26-Apr-18	0.76	<1	<2	9	<1	0.12
RMD-203	Grab	23260 Westminster Hwy.	26-Apr-18	0.71	<1	<2	9	<1	0.12
RMD-251	Grab	5951McCallan Rd.	30-Apr-18	0.72	<1	<2	8	<1	0.28
RMD-273	Grab	Opp. 8331 Fairfax Place	30-Apr-18	0.76	<1	<2	15	<1	0.14
RMD-252	Grab	9751 Pendleton Rd.	30-Apr-18	0.78	<1	2	9	<1	0.14
RMD-274	Grab	10920 Springwood Court	30-Apr-18	0.78	<1	2	11	<1	0.1
RMD-253	Grab	11051 No 3 Rd.	30-Apr-18	0.71	<1	<2	9	<1	0.1
RMD-269	Grab	14951 Triangle Rd.	30-Apr-18	0.77	<1	6	8	<1	0.13
RMD-270	Grab	8200 Jones Rd.	30-Apr-18	0.43	<1	<2	10	<1	0.13
RMD-254	Grab	5300 No. 3 Rd.	30-Apr-18	0.7	<1	<2	9	<1	0.19
RMD-256	Grab	1000 Blk. McDonald Rd.	30-Apr-18	0.56	<1	<2	10	<1	0.47
RMD-255	Grab	6000 Blk. Miller Rd.	30-Apr-18	0.72	<1	<2	8	<1	0.36
RMD-271	Grab	3800 Cessna Drive	30-Apr-18	0.72	<1	<2	9	<1	0.1
RMD-272	Grab	751 Catalina Cres.	30-Apr-18	0.74	<1	<2	9	<1	0.13
RMD-250	Grab	6071 Azure Rd.	30-Apr-18	0.88	<1	<2	9	<1	0.31
RMD-263	Grab	12560 Cambie Rd.	2-May-18	0.84	<1	<2	9	<1	0.12

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	2-May-18	0.94	<1	2	10	<1	0.12
RMD-277	Grab	Opp. 11280 Twigg Place	2-May-18	0.81	<1	<2	11	<1	0.25
RMD-262	Grab	13799 Commerce Pkwy.	2-May-18	0.92	<1	<2	10	<1	0.12
RMD-278	Grab	6651 Fraserwood Place	2-May-18	0.52	<1	<2	10	<1	0.14
RMD-279	Grab	Opp. 20371 Westminster Hwy.	2-May-18	0.8	<1	<2	10	<1	0.13
RMD-261	Grab	9911 Sidaway Rd.	2-May-18	0.89	<1	<2	10	<1	0.13
RMD-260	Grab	11111 Horseshoe Way	2-May-18	0.77	<1	<2	9	<1	0.11
RMD-259	Grab	10020 Amethyst Ave.	2-May-18	0.81	<1	<2	9	<1	0.13
RMD-266	Grab	9380 General Currie Rd.	2-May-18	0.96	<1	<2	9	<1	0.15
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	2-May-18	0.86	<1	<2	10	<1	0.11
RMD-258	Grab	7000 Blk. Dyke Rd.	2-May-18	1	<1	2	11	<1	0.12
RMD-257	Grab	6640 Blundell Rd.	2-May-18	1.06	<1	2	9	<1	0.13
RMD-204	Grab	3180 Granville Ave.	4-May-18	0.78	<1	<2	11	<1	0.13
RMD-206	Grab	4251 Moncton St.	4-May-18	0.73	<1	<2	8	<1	0.1
RMD-216	Grab	11080 No. 2 Rd.	4-May-18	0.8	<1	<2	10	<1	0.09
RMD-280	Grab	11500 McKenzie Rd.	4-May-18	0.79	<1	<2	11	<1	0.09
RMD-212	Grab	Opp. 8600 Ryan Rd.	4-May-18	0.79	<1	<2	10	<1	0.1
RMD-208	Grab	13200 No. 4 Rd.	4-May-18	0.79	<1	2	9	<1	0.1
RMD-205	Grab	13851 Steveston Hwy.	4-May-18	0.93	<1	<2	9	<1	0.19
RMD-202	Grab	1500 Valemont Way	4-May-18	0.81	<1	2	9	<1	0.29
RMD-214	Grab	11720 Westminster Hwy.	4-May-18	0.79	<1	<2	8	<1	0.1
RMD-267	Grab	17240 Fedoruk	4-May-18	0.81	<1	<2	11	<1	0.13
RMD-249	Grab	23000 Blk. Dyke Rd.	4-May-18	0.73	<1	<2	11	<1	0.11
RMD-276	Grab	22271 Cochrane Drive	4-May-18	0.81	<1	<2	9	<1	0.22
RMD-275	Grab	5180 Smith Cres.	4-May-18	0.71	<1	<2	11	<1	0.11
RMD-203	Grab	23260 Westminster Hwy.	4-May-18	0.83	<1	<2	9	<1	0.15
RMD-251	Grab	5951McCallan Rd.	7-May-18	0.65	<1	2	10	<1	0.11
RMD-273	Grab	Opp. 8331 Fairfax Place	7-May-18	0.69	<1	oor sprea	15	<1	0.09
RMD-252	Grab	9751 Pendleton Rd.	7-May-18	0.72	<1	2	10	<1	0.12
RMD-274	Grab	10920 Springwood Court	7-May-18	0.76	<1	<2	13	<1	0.14
RMD-253	Grab	11051 No 3 Rd.	7-May-18	0.83	<1	<2	9	<1	0.14
RMD-269	Grab	14951 Triangle Rd.	7-May-18	0.78	<1	2	10	<1	0.2
RMD-270	Grab	8200 Jones Rd.	7-May-18	0.71	<1	<2	10	<1	0.11
RMD-254	Grab	5300 No. 3 Rd.	7-May-18	0.75	<1	2	10	<1	0.12
RMD-256	Grab	1000 Blk. McDonald Rd.	7-May-18	0.66	<1	<2	11	<1	0.14
RMD-255	Grab	6000 Blk. Miller Rd.	7-May-18	0.82	<1	<2	9	<1	2.5
RMD-271	Grab	3800 Cessna Drive	7-May-18	0.79	<1	<2	13	<1	0.1
RMD-272	Grab	751 Catalina Cres.	7-May-18	0.75	<1	<2	10	<1	0.11
RMD-250	Grab	6071 Azure Rd.	7-May-18	0.73	<1	<2	9	<1	0.19
RMD-263	Grab	12560 Cambie Rd.	9-May-18	0.71	<1	<2	11	<1	0.14

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-277	Grab	Opp. 11280 Twigg Place	9-May-18	0.72	<1	<2	10	<1	0.13
RMD-264	Grab	13100 Mitchell Rd.	9-May-18	0.76	<1	<2	9	<1	0.09
RMD-262	Grab	13799 Commerce Pkwy.	9-May-18	0.71	<1	<2	10	<1	0.1
RMD-278	Grab	6651 Fraserwood Place	9-May-18	0.72	<1	<2	10	<1	0.21
RMD-279	Grab	Opp. 20371 Westminster Hwy.	9-May-18	0.75	<1	<2	9	<1	0.14
RMD-261	Grab	9911 Sidaway Rd.	9-May-18	0.69	<1	<2	10	<1	0.1
RMD-260	Grab	11111 Horseshoe Way	9-May-18	0.71	<1	2	9	<1	0.1
RMD-259	Grab	10020 Amethyst Ave.	9-May-18	0.69	<1	<2	12	<1	0.17
RMD-266	Grab	9380 General Currie Rd.	9-May-18	0.69	<1	<2	10	<1	0.11
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	9-May-18	0.73	<1	<2	10	<1	0.09
RMD-258	Grab	7000 Blk. Dyke Rd.	9-May-18	0.74	<1	<2	10	<1	0.14
RMD-257	Grab	6640 Blundell Rd.	9-May-18	0.72	<1	<2	10	<1	0.1
RMD-204	Grab	3180 Granville Ave.	10-May-18	0.68	<1	<2	11	<1	0.1
RMD-206	Grab	4251 Moncton St.	10-May-18	0.76	<1	<2	9	<1	0.13
RMD-216	Grab	11080 No. 2 Rd.	10-May-18	0.81	<1	2	9	<1	0.15
RMD-280	Grab	11500 McKenzie Rd.	10-May-18	0.6	<1	4	12	<1	0.18
RMD-212	Grab	Opp. 8600 Ryan Rd.	10-May-18	0.85	<1	<2	9	<1	0.12
RMD-208	Grab	13200 No. 4 Rd.	10-May-18	0.91	<1	<2	9	<1	0.11
RMD-205	Grab	13851 Steveston Hwy.	10-May-18	0.7	<1	<2	9	<1	0.1
RMD-202	Grab	1500 Valemont Way	10-May-18	0.72	<1	<2	9	<1	0.12
RMD-214	Grab	11720 Westminster Hwy.	10-May-18	0.89	<1	<2	9	<1	0.16
RMD-267	Grab	17240 Fedoruk	10-May-18	0.71	<1	<2	11	<1	0.1
RMD-249	Grab	23000 Blk. Dyke Rd.	10-May-18	0.65	<1	<2	10	<1	0.14
RMD-276	Grab	22271 Cochrane Drive	10-May-18	0.72	<1	<2	9	<1	0.1
RMD-275	Grab	5180 Smith Cres.	10-May-18	0.62	<1	<2	9	<1	0.29
RMD-203	Grab	23260 Westminster Hwy.	10-May-18	0.69	<1	<2	9	<1	0.08
RMD-251	Grab	5951McCallan Rd.	14-May-18	0.79	<1	<2	10	<1	0.1
RMD-273	Grab	Opp. 8331 Fairfax Place	14-May-18	0.63	<1	<2	15	<1	0.11
RMD-252	Grab	9751 Pendleton Rd.	14-May-18	0.87	<1	<2	11	<1	0.11
RMD-274	Grab	10920 Springwood Court	14-May-18	0.86	<1	<2	11	<1	0.16
RMD-253	Grab	11051 No 3 Rd.	14-May-18	0.68	<1	<2	11	<1	0.11
RMD-269	Grab	14951 Triangle Rd.	14-May-18	0.79	<1	<2	10	<1	0.18
RMD-270	Grab	8200 Jones Rd.	14-May-18	0.95	<1	<2	11	<1	0.13
RMD-254	Grab	5300 No. 3 Rd.	14-May-18	0.82	<1	<2	10	<1	0.15
RMD-256	Grab	1000 Blk. McDonald Rd.	14-May-18	0.59	<1	<2	12	<1	0.26
RMD-255	Grab	6000 Blk. Miller Rd.	14-May-18	0.8	<1	<2	10	<1	1.6
RMD-271	Grab	3800 Cessna Drive	14-May-18	0.92	<1	<2	10	<1	0.17
RMD-272	Grab	751 Catalina Cres.	14-May-18	0.78	<1	<2	10	<1	0.11
RMD-250	Grab	6071 Azure Rd.	14-May-18	0.81	<1	2	10	<1	0.1
RMD-263	Grab	12560 Cambie Rd.	14-May-18	0.74	<1	<2	9	<1	0.12

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	16-May-18	0.77	<1	<2	9	<1	0.14
RMD-277	Grab	Opp. 11280 Twigg Place	16-May-18	0.76	<1	<2	10	<1	0.15
RMD-262	Grab	13799 Commerce Pkwy.	16-May-18	0.71	<1	<2	10	<1	0.17
RMD-278	Grab	6651 Fraserwood Place	16-May-18	0.75	<1	<2	11	<1	0.39
RMD-279	Grab	Opp. 20371 Westminster Hwy.	16-May-18	0.96	<1	<2	9	<1	0.37
RMD-261	Grab	9911 Sidaway Rd.	16-May-18	0.68	<1	<2	10	<1	0.25
RMD-260	Grab	11111 Horseshoe Way	16-May-18	0.79	<1	<2	9	<1	0.15
RMD-259	Grab	10020 Amethyst Ave.	16-May-18	0.63	<1	<2	10	<1	0.4
RMD-266	Grab	9380 General Currie Rd.	16-May-18	0.85	<1	<2	10	<1	0.11
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	16-May-18	0.79	<1	<2	11	<1	0.16
RMD-258	Grab	7000 Blk. Dyke Rd.	16-May-18	0.68	<1	<2	10	<1	0.14
RMD-257	Grab	6640 Blundell Rd.	16-May-18	0.76	<1	<2	10	<1	0.12
RMD-204	Grab	3180 Granville Ave.	18-May-18	0.79	<1	<2	11	<1	0.18
RMD-206	Grab	4251 Moncton St.	18-May-18	0.7	<1	<2	10	<1	0.15
RMD-216	Grab	11080 No. 2 Rd.	18-May-18	0.73	<1	<2	10	<1	0.17
RMD-280	Grab	11500 McKenzie Rd.	18-May-18	0.66	<1	<2	12	<1	0.19
RMD-212	Grab	Opp. 8600 Ryan Rd.	18-May-18	0.74	<1	<2	10	<1	0.2
RMD-208	Grab	13200 No. 4 Rd.	18-May-18	0.73	<1	2	11	<1	0.23
RMD-205	Grab	13851 Steveston Hwy.	18-May-18	0.7	<1	<2	10	<1	0.38
RMD-202	Grab	1500 Valemont Way	18-May-18	0.73	<1	<2	9	<1	0.49
RMD-214	Grab	11720 Westminster Hwy.	18-May-18	0.8	<1	2	9	<1	0.16
RMD-267	Grab	17240 Fedoruk	18-May-18	0.69	<1	<2	13	<1	0.14
RMD-249	Grab	23000 Blk. Dyke Rd.	18-May-18	0.65	<1	2	11	<1	0.23
RMD-276	Grab	22271 Cochrane Drive	18-May-18	0.59	<1	<2	11	<1	0.29
RMD-275	Grab	5180 Smith Cres.	18-May-18	0.5	<1	<2	11	<1	0.35
RMD-203	Grab	23260 Westminster Hwy.	18-May-18	0.54	<1	<2	10	<1	0.45
RMD-251	Grab	5951McCallan Rd.	22-May-18	0.87	<1	2	10	<1	0.11
RMD-273	Grab	Opp. 8331 Fairfax Place	22-May-18	0.69	<1	<2	12	<1	0.1
RMD-252	Grab	9751 Pendleton Rd.	22-May-18	0.79	<1	<2	11	<1	0.08
RMD-274	Grab	10920 Springwood Court	22-May-18	0.77	<1	<2	13	<1	0.1
RMD-253	Grab	11051 No 3 Rd.	22-May-18	0.8	<1	2	12	<1	0.09
RMD-269	Grab	14951 Triangle Rd.	22-May-18	0.78	<1	<2	10	<1	0.1
RMD-254	Grab	5300 No. 3 Rd.	22-May-18	0.88	<1	<2	11	<1	0.13
RMD-270	Grab	8200 Jones Rd.	22-May-18	0.8	<1	<2	12	<1	0.09
RMD-256	Grab	1000 Blk. McDonald Rd.	22-May-18	0.57	<1	<2	12	<1	1.2
RMD-255	Grab	6000 Blk. Miller Rd.	22-May-18	0.83	<1	<2	11	<1	0.77
RMD-271	Grab	3800 Cessna Drive	22-May-18	0.64	<1	<2	13	<1	0.1
RMD-272	Grab	751 Catalina Cres.	22-May-18	0.83	<1	<2	10	<1	0.1
RMD-250	Grab	6071 Azure Rd.	22-May-18	0.83	<1	<2	12	<1	0.1
RMD-263	Grab	12560 Cambie Rd.	23-May-18	0.74	<1	<2	10	<1	0.2

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	23-May-18	0.6	<1	<2	10	<1	0.18
RMD-277	Grab	Opp. 11280 Twigg Place	23-May-18	0.69	<1	<2	11	<1	0.24
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	23-May-18	0.63	<1	<2	10	<1	0.18
RMD-262	Grab	13799 Commerce Pkwy.	23-May-18	0.75	<1	<2	10	<1	0.18
RMD-278	Grab	6651 Fraserwood Place	23-May-18	0.7	<1	<2	10	<1	0.16
RMD-279	Grab	Opp. 20371 Westminster Hwy.	23-May-18	0.68	<1	<2	10	<1	0.17
RMD-261	Grab	9911 Sidaway Rd.	23-May-18	0.75	<1	<2	10	<1	0.21
RMD-260	Grab	11111 Horseshoe Way	23-May-18	0.68	<1	<2	10	<1	0.19
RMD-259	Grab	10020 Amethyst Ave.	23-May-18	0.65	<1	<2	10	<1	0.28
RMD-266	Grab	9380 General Currie Rd.	23-May-18	0.73	<1	<2	10	<1	0.16
RMD-258	Grab	7000 Blk. Dyke Rd.	23-May-18	0.67	<1	<2	10	<1	0.17
RMD-257	Grab	6640 Blundell Rd.	23-May-18	0.7	<1	<2	11	<1	0.16
RMD-204	Grab	3180 Granville Ave.	24-May-18	0.72	<1	<2	12	<1	0.22
RMD-206	Grab	4251 Moncton St.	24-May-18	0.7	<1	<2	11	<1	0.27
RMD-216	Grab	11080 No. 2 Rd.	24-May-18	0.77	<1	<2	10	<1	0.24
RMD-280	Grab	11500 McKenzie Rd.	24-May-18	0.57	<1	<2	13	<1	0.15
RMD-212	Grab	Opp. 8600 Ryan Rd.	24-May-18	0.76	<1	<2	10	<1	0.2
RMD-208	Grab	13200 No. 4 Rd.	24-May-18	0.82	<1	<2	9	<1	0.21
RMD-205	Grab	13851 Steveston Hwy.	24-May-18	0.77	<1	2	10	<1	0.19
RMD-202	Grab	1500 Valemont Way	24-May-18	0.74	<1	<2	10	<1	0.23
RMD-214	Grab	11720 Westminster Hwy.	24-May-18	0.75	<1	<2	10	<1	0.2
RMD-267	Grab	17240 Fedoruk	24-May-18	0.75	<1	<2	12	<1	0.16
RMD-249	Grab	23000 Blk. Dyke Rd.	24-May-18	0.76	<1	<2	10	<1	0.18
RMD-276	Grab	22271 Cochrane Drive	24-May-18	0.76	<1	<2	11	<1	0.23
RMD-275	Grab	5180 Smith Cres.	24-May-18	0.77	<1	<2	11	<1	0.2
RMD-203	Grab	23260 Westminster Hwy.	24-May-18	0.66	<1	<2	10	<1	0.2
RMD-251	Grab	5951McCallan Rd.	28-May-18	0.82	<1	<2	10	<1	0.27
RMD-273	Grab	Opp. 8331 Fairfax Place	28-May-18	0.78	<1	<2	19	<1	0.27
RMD-252	Grab	9751 Pendleton Rd.	28-May-18	0.71	<1	<2	12	<1	0.21
RMD-274	Grab	10920 Springwood Court	28-May-18	0.79	<1	<2	15	<1	0.24
RMD-253	Grab	11051 No 3 Rd.	28-May-18	0.83	<1	<2	11	<1	0.26
RMD-269	Grab	14951 Triangle Rd.	28-May-18	0.72	<1	<2	11	<1	0.2
RMD-270	Grab	8200 Jones Rd.	28-May-18	0.8	<1	2	11	<1	0.36
RMD-254	Grab	5300 No. 3 Rd.	28-May-18	0.8	<1	<2	10	<1	0.49
RMD-256	Grab	1000 Blk. McDonald Rd.	28-May-18	0.67	<1	<2	13	<1	0.67
RMD-255	Grab	6000 Blk. Miller Rd.	28-May-18	0.82	<1	<2	10	<1	1.6
RMD-271	Grab	3800 Cessna Drive	28-May-18	0.85	<1	<2	12	<1	0.4
RMD-272	Grab	751 Catalina Cres.	28-May-18	0.82	<1	<2	10	<1	0.27
RMD-250	Grab	6071 Azure Rd.	28-May-18	0.78	<1	<2	11	<1	0.23
RMD-263	Grab	12560 Cambie Rd.	28-May-18	0.74	<1	2	10	<1	0.16

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	30-May-18	0.82	<1	<2	10	<1	0.23
RMD-277	Grab	Opp. 11280 Twigg Place	30-May-18	0.9	<1	<2	11	<1	0.2
RMD-262	Grab	13799 Commerce Pkwy.	30-May-18	0.79	<1	<2	11	<1	0.11
RMD-278	Grab	6651 Fraserwood Place	30-May-18	0.76	<1	<2	10	<1	0.15
RMD-279	Grab	Opp. 20371 Westminster Hwy.	30-May-18	0.59	<1	18	11	<1	0.16
RMD-261	Grab	9911 Sidaway Rd.	30-May-18	0.77	<1	<2	10	<1	0.21
RMD-260	Grab	11111 Horseshoe Way	30-May-18	0.76	<1	<2	10	<1	0.18
RMD-259	Grab	10020 Amethyst Ave.	30-May-18	0.75	<1	2	12	<1	2
RMD-266	Grab	9380 General Currie Rd.	30-May-18	0.82	<1	<2	11	<1	0.17
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	30-May-18	0.77	<1	<2	12	<1	0.13
RMD-258	Grab	7000 Blk. Dyke Rd.	30-May-18	0.79	<1	<2	11	<1	0.15
RMD-257	Grab	6640 Blundell Rd.	30-May-18	0.78	<1	<2	10	<1	0.14
RMD-204	Grab	3180 Granville Ave.	1-Jun-18	0.79	<1	<2	11	<1	0.12
RMD-216	Grab	11080 No. 2 Rd.	1-Jun-18	0.77	<1	<2	10	<1	0.12
RMD-206	Grab	4251 Moncton St.	1-Jun-18	0.74	<1	<2	11	<1	0.12
RMD-280	Grab	11500 McKenzie Rd.	1-Jun-18	0.8	<1	<2	12	<1	0.11
RMD-212	Grab	Opp. 8600 Ryan Rd.	1-Jun-18	0.73	<1	<2	11	<1	0.14
RMD-208	Grab	13200 No. 4 Rd.	1-Jun-18	0.71	<1	<2	10	<1	0.13
RMD-205	Grab	13851 Steveston Hwy.	1-Jun-18	0.72	<1	2	10	<1	0.15
RMD-202	Grab	1500 Valemont Way	1-Jun-18	0.68	<1	<2	9	<1	0.08
RMD-214	Grab	11720 Westminster Hwy.	1-Jun-18	0.79	<1	<2	9	<1	0.16
RMD-267	Grab	17240 Fedoruk	1-Jun-18	0.6	<1	<2	12	<1	0.11
RMD-249	Grab	23000 Blk. Dyke Rd.	1-Jun-18	0.61	<1	6	11	<1	0.15
RMD-276	Grab	22271 Cochrane Drive	1-Jun-18	0.71	<1	76	10	<1	0.13
RMD-275	Grab	5180 Smith Cres.	1-Jun-18	0.63	<1	<2	11	<1	0.09
RMD-203	Grab	23260 Westminster Hwy.	1-Jun-18	0.67	<1	4	9	<1	0.1
RMD-251	Grab	5951McCallan Rd.	4-Jun-18	0.78	<1	<2	11	<1	0.1
RMD-273	Grab	Opp. 8331 Fairfax Place	4-Jun-18	0.67	<1	<2	18	<1	0.1
RMD-252	Grab	9751 Pendleton Rd.	4-Jun-18	0.67	<1	<2	14	<1	0.09
RMD-274	Grab	10920 Springwood Court	4-Jun-18	0.73	<1	2	14	<1	0.08
RMD-253	Grab	11051 No 3 Rd.	4-Jun-18	0.7	<1	<2	13	<1	0.08
RMD-269	Grab	14951 Triangle Rd.	4-Jun-18	0.75	<1	<2	13	<1	0.09
RMD-270	Grab	8200 Jones Rd.	4-Jun-18	0.73	<1	<2	13	<1	0.1
RMD-254	Grab	5300 No. 3 Rd.	4-Jun-18	0.68	<1	<2	13	<1	0.1
RMD-256	Grab	1000 Blk. McDonald Rd.	4-Jun-18	0.66	<1	2	14	<1	1.1
RMD-255	Grab	6000 Blk. Miller Rd.	4-Jun-18	0.82	<1	2	10	<1	2.9
RMD-271	Grab	3800 Cessna Drive	4-Jun-18	0.66	<1	<2	13	<1	0.08
RMD-272	Grab	751 Catalina Cres.	4-Jun-18	0.88	<1	<2	10	<1	0.1
RMD-250	Grab	6071 Azure Rd.	4-Jun-18	0.74	<1	2	13	<1	0.16
RMD-263	Grab	12560 Cambie Rd.	4-Jun-18	0.64	<1	<2	9	<1	0.19

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	6-Jun-18	0.61	<1	<2	10	<1	0.25
RMD-277	Grab	Opp. 11280 Twigg Place	6-Jun-18	0.69	<1	<2	10	<1	0.25
RMD-262	Grab	13799 Commerce Pkwy.	6-Jun-18	0.73	<1	<2	10	<1	0.21
RMD-278	Grab	6651 Fraserwood Place	6-Jun-18	0.66	<1	<2	11	<1	0.16
RMD-279	Grab	Opp. 20371 Westminster Hwy.	6-Jun-18	0.72	<1	<2	10	<1	0.15
RMD-261	Grab	9911 Sidaway Rd.	6-Jun-18	0.7	<1	<2	11	<1	0.19
RMD-260	Grab	11111 Horseshoe Way	6-Jun-18	0.71	<1	<2	11	<1	0.28
RMD-259	Grab	10020 Amethyst Ave.	6-Jun-18	0.65	<1	4	13	<1	1.4
RMD-266	Grab	9380 General Currie Rd.	6-Jun-18	0.71	<1	<2	10	<1	0.22
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	6-Jun-18	0.66	<1	<2	11	<1	0.18
RMD-258	Grab	7000 Blk. Dyke Rd.	6-Jun-18	0.75	<1	2	10	<1	0.21
RMD-257	Grab	6640 Blundell Rd.	6-Jun-18	0.71	<1	<2	10	<1	0.17
RMD-204	Grab	3180 Granville Ave.	7-Jun-18	0.67	<1	<2	12	<1	0.26
RMD-206	Grab	4251 Moncton St.	7-Jun-18	0.72	<1	2	11	<1	0.23
RMD-216	Grab	11080 No. 2 Rd.	7-Jun-18	0.75	<1	<2	10	<1	0.24
RMD-280	Grab	11500 McKenzie Rd.	7-Jun-18	0.62	<1	2	14	<1	0.16
RMD-212	Grab	Opp. 8600 Ryan Rd.	7-Jun-18	0.73	<1	2	11	<1	0.22
RMD-208	Grab	13200 No. 4 Rd.	7-Jun-18	0.74	<1	<2	10	<1	0.21
RMD-205	Grab	13851 Steveston Hwy.	7-Jun-18	0.79	<1	<2	10	<1	0.2
RMD-202	Grab	1500 Valemont Way	7-Jun-18	0.74	<1	<2	10	<1	0.21
RMD-214	Grab	11720 Westminster Hwy.	7-Jun-18	0.82	<1	<2	10	<1	0.15
RMD-267	Grab	17240 Fedoruk	7-Jun-18	0.73	<1	<2	12	<1	0.16
RMD-249	Grab	23000 Blk. Dyke Rd.	7-Jun-18	0.75	<1	<2	11	<1	0.12
RMD-276	Grab	22271 Cochrane Drive	7-Jun-18	0.75	<1	<2	11	<1	0.23
RMD-275	Grab	5180 Smith Cres.	7-Jun-18	0.64	<1	<2	12	<1	0.15
RMD-203	Grab	23260 Westminster Hwy.	7-Jun-18	0.7	<1	<2	10	<1	0.4
RMD-251	Grab	5951McCallan Rd.	11-Jun-18	0.78	<1	<2	9	<1	0.13
RMD-273	Grab	Opp. 8331 Fairfax Place	11-Jun-18	0.61	<1	<2	17	<1	0.12
RMD-252	Grab	9751 Pendleton Rd.	11-Jun-18	0.71	<1	<2	11	<1	0.1
RMD-274	Grab	10920 Springwood Court	11-Jun-18	0.7	<1	2	13	<1	0.12
RMD-253	Grab	11051 No 3 Rd.	11-Jun-18	0.72	<1	<2	10	<1	0.15
RMD-269	Grab	14951 Triangle Rd.	11-Jun-18	0.7	<1	<2	11	<1	0.09
RMD-270	Grab	8200 Jones Rd.	11-Jun-18	0.83	<1	<2	11	<1	0.16
RMD-254	Grab	5300 No. 3 Rd.	11-Jun-18	0.78	<1	<2	10	<1	0.12
RMD-256	Grab	1000 Blk. McDonald Rd.	11-Jun-18	0.62	<1	2	12	<1	0.72
RMD-255	Grab	6000 Blk. Miller Rd.	11-Jun-18	0.83	<1	<2	9	<1	0.46
RMD-271	Grab	3800 Cessna Drive	11-Jun-18	0.84	<1	<2	11	<1	0.15
RMD-272	Grab	751 Catalina Cres.	11-Jun-18	0.92	<1	2	10	<1	0.13
RMD-250	Grab	6071 Azure Rd.	11-Jun-18	0.8	<1	<2	10	<1	0.15
RMD-263	Grab	12560 Cambie Rd.	11-Jun-18	0.71	<1	<2	12	<1	0.12

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	13-Jun-18	0.68	<1	<2	13	<1	0.1
RMD-277	Grab	Opp. 11280 Twigg Place	13-Jun-18	0.81	<1	<2	12	<1	0.22
RMD-262	Grab	13799 Commerce Pkwy.	13-Jun-18	0.74	<1	<2	12	<1	0.11
RMD-278	Grab	6651 Fraserwood Place	13-Jun-18	0.73	<1	2	11	<1	0.11
RMD-279	Grab	Opp. 20371 Westminster Hwy.	13-Jun-18	0.76	<1	<2	11	<1	0.17
RMD-261	Grab	9911 Sidaway Rd.	13-Jun-18	0.72	<1	<2	12	<1	0.09
RMD-260	Grab	11111 Horseshoe Way	13-Jun-18	0.8	<1	<2	10	<1	0.09
RMD-259	Grab	10020 Amethyst Ave.	13-Jun-18	0.72	<1	2	13	<1	0.83
RMD-266	Grab	9380 General Currie Rd.	13-Jun-18	0.81	<1	<2	10	<1	0.11
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	13-Jun-18	0.55	<1	<2	12	<1	0.28
RMD-258	Grab	7000 Blk. Dyke Rd.	13-Jun-18	0.78	<1	22	12	<1	0.16
RMD-257	Grab	6640 Blundell Rd.	13-Jun-18	0.79	<1	<2	11	<1	0.11
RMD-204	Grab	3180 Granville Ave.	15-Jun-18	0.75	<1	<2	12	<1	0.12
RMD-206	Grab	4251 Moncton St.	15-Jun-18	0.72	<1	<2	11	<1	0.13
RMD-216	Grab	11080 No. 2 Rd.	15-Jun-18	0.77	<1	<2	10	<1	0.12
RMD-280	Grab	11500 McKenzie Rd.	15-Jun-18	0.74	<1	<2	13	<1	0.12
RMD-212	Grab	Opp. 8600 Ryan Rd.	15-Jun-18	0.78	<1	<2	11	<1	0.16
RMD-208	Grab	13200 No. 4 Rd.	15-Jun-18	0.66	<1	<2	10	<1	0.14
RMD-205	Grab	13851 Steveston Hwy.	15-Jun-18	0.79	<1	<2	11	<1	0.13
RMD-202	Grab	1500 Valemont Way	15-Jun-18	0.64	<1	<2	11	<1	0.14
RMD-214	Grab	11720 Westminster Hwy.	15-Jun-18	0.72	<1	<2	10	<1	0.11
RMD-267	Grab	17240 Fedoruk	15-Jun-18	0.7	<1	<2	12	<1	0.11
RMD-249	Grab	23000 Blk. Dyke Rd.	15-Jun-18	0.79	<1	2	11	<1	0.13
RMD-276	Grab	22271 Cochrane Drive	15-Jun-18	0.76	<1	<2	11	<1	0.12
RMD-275	Grab	5180 Smith Cres.	15-Jun-18	0.84	<1	<2	12	<1	0.1
RMD-203	Grab	23260 Westminster Hwy.	15-Jun-18	0.84	<1	<2	11	<1	0.13
RMD-251	Grab	5951McCallan Rd.	18-Jun-18	1.03	<1	2	11	<1	0.21
RMD-273	Grab	Opp. 8331 Fairfax Place	18-Jun-18	0.53	<1	<2	19	<1	0.15
RMD-252	Grab	9751 Pendleton Rd.	18-Jun-18	0.69	<1	<2	13	<1	0.11
RMD-274	Grab	10920 Springwood Court	18-Jun-18	0.75	<1	<2	15	<1	0.15
RMD-253	Grab	11051 No 3 Rd.	18-Jun-18	0.78	<1	2	12	<1	0.12
RMD-269	Grab	14951 Triangle Rd.	18-Jun-18	0.77	<1	<2	12	<1	0.16
RMD-270	Grab	8200 Jones Rd.	18-Jun-18	0.78	<1	<2	13	<1	0.18
RMD-254	Grab	5300 No. 3 Rd.	18-Jun-18	0.83	<1	<2	13	<1	0.13
RMD-256	Grab	1000 Blk. McDonald Rd.	18-Jun-18	0.43	<1	<2	13	<1	0.57
RMD-255	Grab	6000 Blk. Miller Rd.	18-Jun-18	0.9	<1	<2	10	<1	0.69
RMD-271	Grab	3800 Cessna Drive	18-Jun-18	0.86	<1	<2	11	<1	0.19
RMD-272	Grab	751 Catalina Cres.	18-Jun-18	0.89	<1	<2	11	<1	0.19
RMD-250	Grab	6071 Azure Rd.	18-Jun-18	0.71	<1	<2	11	<1	0.14
RMD-263	Grab	12560 Cambie Rd.	18-Jun-18	0.73	<1	<2	11	<1	0.32

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	20-Jun-18	0.74	<1	<2	13	<1	0.51
RMD-277	Grab	Opp. 11280 Twigg Place	20-Jun-18	0.82	<1	<2	13	<1	0.34
RMD-262	Grab	13799 Commerce Pkwy.	20-Jun-18	0.79	<1	<2	13	<1	0.23
RMD-278	Grab	6651 Fraserwood Place	20-Jun-18	0.77	<1	<2	13	<1	0.33
RMD-279	Grab	Opp. 20371 Westminster Hwy.	20-Jun-18	0.83	<1	<2	12	<1	0.24
RMD-261	Grab	9911 Sidaway Rd.	20-Jun-18	0.73	<1	<2	12	<1	0.38
RMD-260	Grab	11111 Horseshoe Way	20-Jun-18	0.78	<1	2	11	<1	0.35
RMD-259	Grab	10020 Amethyst Ave.	20-Jun-18	0.79	<1	<2	12	<1	2.2
RMD-266	Grab	9380 General Currie Rd.	20-Jun-18	0.82	<1	<2	12	<1	1.3
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	20-Jun-18	0.8	<1	<2	12	<1	0.37
RMD-258	Grab	7000 Blk. Dyke Rd.	20-Jun-18	0.78	<1	<2	12	<1	0.31
RMD-257	Grab	6640 Blundell Rd.	20-Jun-18	0.84	<1	<2	12	<1	0.41
RMD-204	Grab	3180 Granville Ave.	21-Jun-18	0.78	<1	4	11	<1	0.41
RMD-206	Grab	4251 Moncton St.	21-Jun-18	0.72	<1	<2	11	<1	0.5
RMD-216	Grab	11080 No. 2 Rd.	21-Jun-18	0.77	<1	<2	11	<1	0.39
RMD-280	Grab	11500 McKenzie Rd.	21-Jun-18	0.63	<1	<2	15	<1	0.26
RMD-212	Grab	Opp. 8600 Ryan Rd.	21-Jun-18	0.74	<1	<2	12	<1	0.41
RMD-208	Grab	13200 No. 4 Rd.	21-Jun-18	0.88	<1	<2	11	<1	0.35
RMD-205	Grab	13851 Steveston Hwy.	21-Jun-18	0.73	<1	<2	11	<1	0.23
RMD-202	Grab	1500 Valemont Way	21-Jun-18	0.79	<1	<2	11	<1	0.19
RMD-214	Grab	11720 Westminster Hwy.	21-Jun-18	0.8	<1	<2	11	<1	0.42
RMD-267	Grab	17240 Fedoruk	21-Jun-18	0.68	<1	<2	13	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	21-Jun-18	0.7	<1	34	13	<1	0.19
RMD-276	Grab	22271 Cochrane Drive	21-Jun-18	0.71	<1	<2	12	<1	0.16
RMD-275	Grab	5180 Smith Cres.	21-Jun-18	0.69	<1	<2	12	<1	0.2
RMD-203	Grab	23260 Westminster Hwy.	21-Jun-18	0.74	<1	<2	12	<1	0.18
RMD-251	Grab	5951McCallan Rd.	25-Jun-18	0.78	<1	<2	13	<1	0.1
RMD-273	Grab	Opp. 8331 Fairfax Place	25-Jun-18	0.57	<1	<2	19	<1	0.13
RMD-252	Grab	9751 Pendleton Rd.	25-Jun-18	0.71	<1	<2	14	<1	0.09
RMD-274	Grab	10920 Springwood Court	25-Jun-18	0.65	<1	<2	16	<1	0.18
RMD-253	Grab	11051 No 3 Rd.	25-Jun-18	0.69	<1	<2	14	<1	0.12
RMD-269	Grab	14951 Triangle Rd.	25-Jun-18	0.71	<1	<2	11	<1	0.12
RMD-270	Grab	8200 Jones Rd.	25-Jun-18	0.75	<1	<2	12	<1	0.12
RMD-254	Grab	5300 No. 3 Rd.	25-Jun-18	0.79	<1	<2	14	<1	0.22
RMD-256	Grab	1000 Blk. McDonald Rd.	25-Jun-18	0.57	<1	<2	14	<1	0.75
RMD-255	Grab	6000 Blk. Miller Rd.	25-Jun-18	0.71	<1	34	13	<1	0.32
RMD-271	Grab	3800 Cessna Drive	25-Jun-18	0.79	<1	2	12	<1	0.09
RMD-272	Grab	751 Catalina Cres.	25-Jun-18	0.78	<1	<2	12	<1	0.1
RMD-250	Grab	6071 Azure Rd.	25-Jun-18	0.84	<1	2	13	<1	0.1
RMD-263	Grab	12560 Cambie Rd.	25-Jun-18	0.84	<1	<2	11	<1	0.13

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	27-Jun-18	0.6	<1	2	14	<1	0.14
RMD-277	Grab	Opp. 11280 Twigg Place	27-Jun-18	0.7	<1	<2	13	<1	0.2
RMD-262	Grab	13799 Commerce Pkwy.	27-Jun-18	0.68	<1	<2	14	<1	0.16
RMD-278	Grab	6651 Fraserwood Place	27-Jun-18	0.71	<1	<2	13	<1	0.13
RMD-279	Grab	Opp. 20371 Westminster Hwy.	27-Jun-18	0.57	<1	<2	11	<1	0.17
RMD-261	Grab	9911 Sidaway Rd.	27-Jun-18	0.71	<1	<2	13	<1	0.15
RMD-260	Grab	11111 Horseshoe Way	27-Jun-18	0.79	<1	<2	13	<1	0.18
RMD-259	Grab	10020 Amethyst Ave.	27-Jun-18	0.89	<1	<2	12	<1	0.68
RMD-266	Grab	9380 General Currie Rd.	27-Jun-18	0.82	<1	<2	13	<1	0.21
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	27-Jun-18	0.72	<1	<2	12	<1	0.15
RMD-258	Grab	7000 Blk. Dyke Rd.	27-Jun-18	0.86	<1	2	13	<1	0.11
RMD-257	Grab	6640 Blundell Rd.	27-Jun-18	0.87	<1	<2	12	<1	0.16
RMD-204	Grab	3180 Granville Ave.	29-Jun-18	0.81	<1	<2	12	<1	0.32
RMD-206	Grab	4251 Moncton St.	29-Jun-18	0.79	<1	<2	10	<1	0.35
RMD-216	Grab	11080 No. 2 Rd.	29-Jun-18	0.89	<1	<2	10	<1	0.22
RMD-280	Grab	11500 McKenzie Rd.	29-Jun-18	0.79	<1	<2	14	<1	0.19
RMD-212	Grab	Opp. 8600 Ryan Rd.	29-Jun-18	0.88	<1	<2	10	<1	0.18
RMD-208	Grab	13200 No. 4 Rd.	29-Jun-18	0.95	<1	<2	11	<1	0.39
RMD-205	Grab	13851 Steveston Hwy.	29-Jun-18	0.52	<1	<2	11	<1	0.3
RMD-202	Grab	1500 Valemont Way	29-Jun-18	0.7	<1	<2	11	<1	0.31
RMD-214	Grab	11720 Westminster Hwy.	29-Jun-18	0.88	<1	<2	11	<1	0.42
RMD-267	Grab	17240 Fedoruk	29-Jun-18	0.66	<1	<2	13	<1	0.32
RMD-249	Grab	23000 Blk. Dyke Rd.	29-Jun-18	0.72	<1	4	13	<1	0.34
RMD-276	Grab	22271 Cochrane Drive	29-Jun-18	0.68	<1	<2	12	<1	0.2
RMD-275	Grab	5180 Smith Cres.	29-Jun-18	0.65	<1	<2	12	<1	0.18
RMD-203	Grab	23260 Westminster Hwy.	29-Jun-18	0.71	<1	<2	11	<1	0.16
RMD-251	Grab	5951McCallan Rd.	3-Jul-18	0.88	<1	<2	11	<1	0.19
RMD-273	Grab	Opp. 8331 Fairfax Place	3-Jul-18	0.73	<1	<2	19	<1	0.21
RMD-252	Grab	9751 Pendleton Rd.	3-Jul-18	0.73	<1	4	14	<1	0.16
RMD-274	Grab	10920 Springwood Court	3-Jul-18	0.81	<1	<2	14	<1	0.21
RMD-253	Grab	11051 No 3 Rd.	3-Jul-18	0.87	<1	<2	11	<1	0.23
RMD-269	Grab	14951 Triangle Rd.	3-Jul-18	0.7	<1	<2	11	<1	0.13
RMD-270	Grab	8200 Jones Rd.	3-Jul-18	0.87	<1	<2	14	<1	0.11
RMD-254	Grab	5300 No. 3 Rd.	3-Jul-18	0.93	<1	<2	13	<1	0.18
RMD-256	Grab	1000 Blk. McDonald Rd.	3-Jul-18	0.65	<1	<2	15	<1	0.43
RMD-255	Grab	6000 Blk. Miller Rd.	3-Jul-18	0.88	<1	<2	11	<1	0.43
RMD-271	Grab	3800 Cessna Drive	3-Jul-18	0.76	<1	2	14	<1	0.12
RMD-272	Grab	751 Catalina Cres.	3-Jul-18	0.91	<1	<2	11	<1	0.14
RMD-250	Grab	6071 Azure Rd.	3-Jul-18	0.74	<1	<2	13	<1	0.14
RMD-263	Grab	12560 Cambie Rd.	4-Jul-18	0.79	<1	<2	11	<1	0.26

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-264	Grab	13100 Mitchell Rd.	4-Jul-18	0.69	<1	2	13	<1	0.22
RMD-277	Grab	Opp. 11280 Twigg Place	4-Jul-18	0.73	<1	<2	13	<1	0.19
RMD-262	Grab	13799 Commerce Pkwy.	4-Jul-18	0.72	<1	2	12	<1	0.22
RMD-278	Grab	6651 Fraserwood Place	4-Jul-18	0.74	<1	<2	12	<1	0.22
RMD-279	Grab	Opp. 20371 Westminster Hwy.	4-Jul-18	0.76	<1	<2	11	<1	0.27
RMD-261	Grab	9911 Sidaway Rd.	4-Jul-18	0.78	<1	<2	11	<1	0.26
RMD-260	Grab	11111 Horseshoe Way	4-Jul-18	0.82	<1	<2	11	<1	0.19
RMD-259	Grab	10020 Amethyst Ave.	4-Jul-18	0.72	<1	<2	14	<1	0.89
RMD-266	Grab	9380 General Currie Rd.	4-Jul-18	0.72	<1	<2	11	<1	0.18
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	4-Jul-18	0.67	<1	<2	14	<1	0.28
RMD-258	Grab	7000 Blk. Dyke Rd.	4-Jul-18	0.68	<1	<2	13	<1	0.16
RMD-257	Grab	6640 Blundell Rd.	4-Jul-18	0.82	<1	<2	12	<1	0.2
RMD-206	Grab	4251 Moncton St.	5-Jul-18	0.73	<1	<2	12	<1	0.38
RMD-216	Grab	11080 No. 2 Rd.	5-Jul-18	0.84	<1	<2	13	<1	0.28
RMD-280	Grab	11500 McKenzie Rd.	5-Jul-18	0.59	<1	4	18	<1	0.19
RMD-212	Grab	Opp. 8600 Ryan Rd.	5-Jul-18	0.93	<1	4	12	<1	0.3
RMD-208	Grab	13200 No. 4 Rd.	5-Jul-18	0.98	<1	<2	14	<1	0.34
RMD-205	Grab	13851 Steveston Hwy.	5-Jul-18	0.78	<1	<2	13	<1	0.23
RMD-202	Grab	1500 Valemont Way	5-Jul-18	0.8	<1	<2	11	<1	0.23
RMD-214	Grab	11720 Westminster Hwy.	5-Jul-18	0.92	<1	<2	12	<1	0.26
RMD-267	Grab	17240 Fedoruk	5-Jul-18	0.68	<1	2	15	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	5-Jul-18	0.67	<1	8	13	<1	0.2
RMD-275	Grab	5180 Smith Cres.	5-Jul-18	0.57	<1	<2	14	<1	0.25
RMD-251	Grab	5951McCallan Rd.	9-Jul-18	0.77	<1	<2	11	<1	0.1
RMD-273	Grab	Opp. 8331 Fairfax Place	9-Jul-18	0.62	<1	<2	20	<1	0.11
RMD-252	Grab	9751 Pendleton Rd.	9-Jul-18	0.7	<1	<2	14	<1	0.13
RMD-274	Grab	10920 Springwood Court	9-Jul-18	0.76	<1	2	13	<1	0.21
RMD-253	Grab	11051 No 3 Rd.	9-Jul-18	0.77	<1	<2	13	<1	0.15
RMD-269	Grab	14951 Triangle Rd.	9-Jul-18	0.69	<1	<2	11	<1	0.11
RMD-270	Grab	8200 Jones Rd.	9-Jul-18	0.74	<1	2	13	<1	0.12
RMD-254	Grab	5300 No. 3 Rd.	9-Jul-18	0.65	<1	<2	13	<1	0.19
RMD-256	Grab	1000 Blk. McDonald Rd.	9-Jul-18	0.61	<1	<2	14	<1	0.45
RMD-255	Grab	6000 Blk. Miller Rd.	9-Jul-18	0.72	<1	<2	11	<1	0.33
RMD-271	Grab	3800 Cessna Drive	9-Jul-18	0.69	<1	<2	13	<1	0.35
RMD-272	Grab	751 Catalina Cres.	9-Jul-18	0.81	<1	<2	13	<1	0.15
RMD-250	Grab	6071 Azure Rd.	9-Jul-18	0.73	<1	2	12	<1	0.14
RMD-263	Grab	12560 Cambie Rd.	11-Jul-18	0.86	<1	<2	11	<1	0.15
RMD-264	Grab	13100 Mitchell Rd.	11-Jul-18	0.68	<1	2	13	<1	0.15
RMD-277	Grab	Opp. 11280 Twigg Place	11-Jul-18	0.69	<1	4	12	<1	0.14
RMD-262	Grab	13799 Commerce Pkwy.	11-Jul-18	0.72	<1	<2	11	<1	0.12

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-278	Grab	6651 Fraserwood Place	11-Jul-18	0.7	<1	<2	11	<1	0.35
RMD-279	Grab	Opp. 20371 Westminster Hwy.	11-Jul-18	0.75	<1	<2	10	<1	0.33
RMD-261	Grab	9911 Sidaway Rd.	11-Jul-18	0.75	<1	<2	11	<1	0.24
RMD-260	Grab	11111 Horseshoe Way	11-Jul-18	0.72	<1	<2	11	<1	0.22
RMD-259	Grab	10020 Amethyst Ave.	11-Jul-18	0.68	<1	4	12	<1	0.79
RMD-266	Grab	9380 General Currie Rd.	11-Jul-18	0.76	<1	<2	10	<1	0.19
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	11-Jul-18	0.73	<1	<2	11	<1	0.17
RMD-258	Grab	7000 Blk. Dyke Rd.	11-Jul-18	0.72	<1	8	12	<1	0.11
RMD-257	Grab	6640 Blundell Rd.	11-Jul-18	0.78	<1	<2	11	<1	0.21
RMD-204	Grab	3180 Granville Ave.	13-Jul-18	0.63	<1	2	15	<1	0.21
RMD-206	Grab	4251 Moncton St.	13-Jul-18	0.73	<1	<2	12	<1	0.24
RMD-216	Grab	11080 No. 2 Rd.	13-Jul-18	0.67	<1	2	10	<1	0.15
RMD-280	Grab	11500 McKenzie Rd.	13-Jul-18	0.76	<1	<2	14	<1	0.13
RMD-212	Grab	Opp. 8600 Ryan Rd.	13-Jul-18	0.67	<1	oor sprea	12	<1	0.13
RMD-208	Grab	13200 No. 4 Rd.	13-Jul-18	0.77	<1	<2	12	<1	0.12
RMD-205	Grab	13851 Steveston Hwy.	13-Jul-18	0.67	<1	2	11	<1	0.21
RMD-202	Grab	1500 Valemont Way	13-Jul-18	0.75	<1	<2	11	<1	0.14
RMD-214	Grab	11720 Westminster Hwy.	13-Jul-18	0.75	<1	2	10	<1	0.14
RMD-267	Grab	17240 Fedoruk	13-Jul-18	0.71	<1	<2	13	<1	0.13
RMD-249	Grab	23000 Blk. Dyke Rd.	13-Jul-18	0.68	<1	2	12	<1	0.14
RMD-276	Grab	22271 Cochrane Drive	13-Jul-18	0.71	<1	<2	12	<1	0.12
RMD-275	Grab	5180 Smith Cres.	13-Jul-18	0.69	<1	2	13	<1	0.12
RMD-203	Grab	23260 Westminster Hwy.	13-Jul-18	0.72	<1	2	11	<1	0.12
RMD-251	Grab	5951McCallan Rd.	16-Jul-18	0.89	<1	<2	12	<1	0.2
RMD-273	Grab	Opp. 8331 Fairfax Place	16-Jul-18	0.58	<1	4	21	<1	0.29
RMD-252	Grab	9751 Pendleton Rd.	16-Jul-18	0.72	<1	2	15	<1	0.23
RMD-274	Grab	10920 Springwood Court	16-Jul-18	0.71	<1	<2	17	<1	0.3
RMD-253	Grab	11051 No 3 Rd.	16-Jul-18	0.74	<1	2	15	<1	0.3
RMD-269	Grab	14951 Triangle Rd.	16-Jul-18	0.75	<1	<2	13	<1	0.2
RMD-270	Grab	8200 Jones Rd.	16-Jul-18	0.81	<1	<2	15	<1	0.33
RMD-254	Grab	5300 No. 3 Rd.	16-Jul-18	0.79	<1	<2	14	<1	0.25
RMD-256	Grab	1000 Blk. McDonald Rd.	16-Jul-18	0.62	<1	<2	15	<1	0.7
RMD-255	Grab	6000 Blk. Miller Rd.	16-Jul-18	0.89	<1	<2	11	<1	0.46
RMD-271	Grab	3800 Cessna Drive	16-Jul-18	0.91	<1	<2	14	<1	0.35
RMD-272	Grab	751 Catalina Cres.	16-Jul-18	0.91	<1	<2	12	<1	0.28
RMD-250	Grab	6071 Azure Rd.	16-Jul-18	0.78	<1	<2	14	<1	0.11
RMD-263	Grab	12560 Cambie Rd.	18-Jul-18	0.92	<1	<2	11	<1	0.33
RMD-264	Grab	13100 Mitchell Rd.	18-Jul-18	0.78	<1	2	13	<1	0.23
RMD-277	Grab	Opp. 11280 Twigg Place	18-Jul-18	0.91	<1	<2	12	<1	0.18
RMD-262	Grab	13799 Commerce Pkwy.	18-Jul-18	0.77	<1	<2	13	<1	0.22

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-278	Grab	6651 Fraserwood Place	18-Jul-18	0.71	<1	2	13	<1	0.19
RMD-279	Grab	Opp. 20371 Westminster Hwy.	18-Jul-18	0.75	<1	<2	11	<1	0.17
RMD-261	Grab	9911 Sidaway Rd.	18-Jul-18	0.73	<1	<2	12	<1	0.14
RMD-260	Grab	11111 Horseshoe Way	18-Jul-18	0.78	<1	<2	13	<1	0.67
RMD-259	Grab	10020 Amethyst Ave.	18-Jul-18	0.75	<1	<2	14	<1	0.67
RMD-266	Grab	9380 General Currie Rd.	18-Jul-18	0.79	<1	<2	13	<1	0.35
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	18-Jul-18	0.76	<1	4	14	<1	0.19
RMD-258	Grab	7000 Blk. Dyke Rd.	18-Jul-18	0.76	<1	2	13	<1	0.13
RMD-257	Grab	6640 Blundell Rd.	18-Jul-18	0.82	<1	<2	12	<1	0.38
RMD-204	Grab	3180 Granville Ave.	19-Jul-18	0.67	<1	<2	14	<1	0.33
RMD-206	Grab	4251 Moncton St.	19-Jul-18	0.72	<1	<2	13	<1	0.29
RMD-216	Grab	11080 No. 2 Rd.	19-Jul-18	0.82	<1	<2	12	<1	0.32
RMD-280	Grab	11500 McKenzie Rd.	19-Jul-18	0.7	<1	<2	16	<1	0.3
RMD-212	Grab	Opp. 8600 Ryan Rd.	19-Jul-18	0.72	<1	2	12	<1	0.23
RMD-208	Grab	13200 No. 4 Rd.	19-Jul-18	0.63	<1	<2	13	<1	0.23
RMD-205	Grab	13851 Steveston Hwy.	19-Jul-18	0.68	<1	2	14	<1	0.22
RMD-202	Grab	1500 Valemont Way	19-Jul-18	0.89	<1	<2	14	<1	0.14
RMD-214	Grab	11720 Westminster Hwy.	19-Jul-18	0.71	<1	2	12	<1	0.18
RMD-267	Grab	17240 Fedoruk	19-Jul-18	0.71	<1	<2	17	<1	0.17
RMD-249	Grab	23000 Blk. Dyke Rd.	19-Jul-18	0.56	<1	12	15	<1	0.19
RMD-276	Grab	22271 Cochrane Drive	19-Jul-18	0.97	<1	<2	16	<1	0.21
RMD-275	Grab	5180 Smith Cres.	19-Jul-18	0.79	<1	<2	17	<1	0.14
RMD-203	Grab	23260 Westminster Hwy.	19-Jul-18	0.52	<1	<2	13	<1	0.15
RMD-251	Grab	5951McCallan Rd.	23-Jul-18	0.77	<1	<2	14	<1	0.2
RMD-273	Grab	Opp. 8331 Fairfax Place	23-Jul-18	0.73	<1	4	22	<1	0.19
RMD-252	Grab	9751 Pendleton Rd.	23-Jul-18	0.7	<1	<2	14	<1	0.16
RMD-274	Grab	10920 Springwood Court	23-Jul-18	0.74	<1	<2	17	<1	0.43
RMD-253	Grab	11051 No 3 Rd.	23-Jul-18	0.84	<1	<2	13	<1	0.17
RMD-269	Grab	14951 Triangle Rd.	23-Jul-18	0.78	<1	<2	15	<1	0.15
RMD-270	Grab	8200 Jones Rd.	23-Jul-18	0.77	<1	<2	16	<1	0.17
RMD-254	Grab	5300 No. 3 Rd.	23-Jul-18	0.81	<1	<2	14	<1	0.21
RMD-256	Grab	1000 Blk. McDonald Rd.	23-Jul-18	0.6	<1	<2	14	<1	0.93
RMD-255	Grab	6000 Blk. Miller Rd.	23-Jul-18	0.85	<1	2	13	<1	0.39
RMD-271	Grab	3800 Cessna Drive	23-Jul-18	0.91	<1	<2	14	<1	0.2
RMD-272	Grab	751 Catalina Cres.	23-Jul-18	0.83	<1	<2	13	<1	0.16
RMD-250	Grab	6071 Azure Rd.	23-Jul-18	0.79	<1	<2	14	<1	0.2
RMD-263	Grab	12560 Cambie Rd.	25-Jul-18	0.92	<1	<2	12	<1	0.38
RMD-264	Grab	13100 Mitchell Rd.	25-Jul-18	0.55	<1	6	14	<1	0.83
RMD-277	Grab	Opp. 11280 Twigg Place	25-Jul-18	0.76	<1	<2	14	<1	0.5
RMD-262	Grab	13799 Commerce Pkwy.	25-Jul-18	0.77	<1	<2	14	<1	0.32

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-278	Grab	6651 Fraserwood Place	25-Jul-18	0.69	<1	<2	15	<1	0.21
RMD-279	Grab	Opp. 20371 Westminster Hwy.	25-Jul-18	0.87	<1	<2	14	<1	0.11
RMD-261	Grab	9911 Sidaway Rd.	25-Jul-18	0.62	<1	2	15	<1	0.14
RMD-260	Grab	11111 Horseshoe Way	25-Jul-18	0.7	<1	<2	13	<1	0.16
RMD-259	Grab	10020 Amethyst Ave.	25-Jul-18	0.74	<1	<2	16	<1	0.87
RMD-266	Grab	9380 General Currie Rd.	25-Jul-18	0.81	<1	<2	13	<1	0.22
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	25-Jul-18	0.75	<1	<2	15	<1	0.21
RMD-258	Grab	7000 Blk. Dyke Rd.	25-Jul-18	0.78	<1	12	13	<1	0.18
RMD-257	Grab	6640 Blundell Rd.	25-Jul-18	0.8	<1	<2	14	<1	0.14
RMD-204	Grab	3180 Granville Ave.	27-Jul-18	0.76	<1	<2	15	<1	0.11
RMD-206	Grab	4251 Moncton St.	27-Jul-18	0.78	<1	<2	13	<1	0.38
RMD-216	Grab	11080 No. 2 Rd.	27-Jul-18	0.78	<1	<2	13	<1	0.14
RMD-280	Grab	11500 McKenzie Rd.	27-Jul-18	1.05	<1	<2	16	<1	0.12
RMD-212	Grab	Opp. 8600 Ryan Rd.	27-Jul-18	0.84	<1	<2	13	<1	0.19
RMD-208	Grab	13200 No. 4 Rd.	27-Jul-18	0.8	<1	<2	12	<1	0.15
RMD-205	Grab	13851 Steveston Hwy.	27-Jul-18	0.98	<1	<2	13	<1	0.29
RMD-202	Grab	1500 Valemont Way	27-Jul-18	0.8	<1	<2	12	<1	0.21
RMD-214	Grab	11720 Westminster Hwy.	27-Jul-18	0.78	<1	2	13	<1	0.18
RMD-267	Grab	17240 Fedoruk	27-Jul-18	0.77	<1	<2	15	<1	0.19
RMD-249	Grab	23000 Blk. Dyke Rd.	27-Jul-18	0.8	<1	4	16	<1	0.13
RMD-276	Grab	22271 Cochrane Drive	27-Jul-18	0.73	<1	<2	14	<1	0.17
RMD-275	Grab	5180 Smith Cres.	27-Jul-18	0.83	<1	<2	15	<1	0.2
RMD-203	Grab	23260 Westminster Hwy.	27-Jul-18	0.78	<1	2	13	<1	0.29
RMD-251	Grab	5951McCallan Rd.	30-Jul-18	0.73	<1	<2	14	<1	0.14
RMD-273	Grab	Opp. 8331 Fairfax Place	30-Jul-18	0.67	<1	14	20	<1	0.25
RMD-252	Grab	9751 Pendleton Rd.	30-Jul-18	0.62	<1	<2	16	<1	0.26
RMD-274	Grab	10920 Springwood Court	30-Jul-18	0.66	<1	12	16	<1	0.23
RMD-253	Grab	11051 No 3 Rd.	30-Jul-18	0.72	<1	2	13	<1	0.19
RMD-269	Grab	14951 Triangle Rd.	30-Jul-18	1.02	<1	4	14	<1	0.23
RMD-270	Grab	8200 Jones Rd.	30-Jul-18	0.7	<1	<2	16	<1	0.14
RMD-254	Grab	5300 No. 3 Rd.	30-Jul-18	0.72	<1	2	15	<1	0.26
RMD-255	Grab	6000 Blk. Miller Rd.	30-Jul-18	0.93	<1	<2	13	<1	0.72
RMD-256	Grab	1000 Blk. McDonald Rd.	30-Jul-18	0.66	<1	<2	16	<1	0.69
RMD-271	Grab	3800 Cessna Drive	30-Jul-18	0.89	<1	<2	14	<1	0.15
RMD-272	Grab	751 Catalina Cres.	30-Jul-18	0.76	<1	<2	14	<1	0.17
RMD-250	Grab	6071 Azure Rd.	30-Jul-18	0.66	<1	10	15	<1	0.18
RMD-263	Grab	12560 Cambie Rd.	1-Aug-18	0.79	<1	<2	12	<1	0.14
RMD-264	Grab	13100 Mitchell Rd.	1-Aug-18	0.76	<1	<2	14	<1	0.2
RMD-277	Grab	Opp. 11280 Twigg Place	1-Aug-18	0.72	<1	<2	14	<1	0.3
RMD-262	Grab	13799 Commerce Pkwy.	1-Aug-18	0.71	<1	<2	13	<1	0.18

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-278	Grab	6651 Fraserwood Place	1-Aug-18	0.74	<1	<2	14	<1	0.16
RMD-279	Grab	Opp. 20371 Westminster Hwy.	1-Aug-18	0.77	<1	<2	14	<1	0.2
RMD-261	Grab	9911 Sidaway Rd.	1-Aug-18	0.59	<1	<2	14	<1	0.14
RMD-260	Grab	11111 Horseshoe Way	1-Aug-18	0.68	<1	2	14	<1	0.12
RMD-259	Grab	10020 Amethyst Ave.	1-Aug-18	0.62	<1	14	16	<1	0.62
RMD-266	Grab	9380 General Currie Rd.	1-Aug-18	0.65	<1	58	15	<1	0.55
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	1-Aug-18	0.65	<1	<2	16	<1	0.15
RMD-258	Grab	7000 Blk. Dyke Rd.	1-Aug-18	0.62	<1	24	15	<1	0.15
RMD-257	Grab	6640 Blundell Rd.	1-Aug-18	0.71	<1	<2	14	<1	0.15
RMD-204	Grab	3180 Granville Ave.	2-Aug-18	0.72	<1	2	15	<1	0.34
RMD-206	Grab	4251 Moncton St.	2-Aug-18	0.74	<1	2	13	<1	0.78
RMD-216	Grab	11080 No. 2 Rd.	2-Aug-18	0.83	<1	<2	13	<1	0.13
RMD-280	Grab	11500 McKenzie Rd.	2-Aug-18	0.4	<1	<2	17	<1	0.19
RMD-212	Grab	Opp. 8600 Ryan Rd.	2-Aug-18	0.84	<1	<2	14	<1	0.17
RMD-208	Grab	13200 No. 4 Rd.	2-Aug-18	0.93	<1	<2	13	<1	0.13
RMD-205	Grab	13851 Steveston Hwy.	2-Aug-18	0.73	<1	<2	13	<1	0.15
RMD-202	Grab	1500 Valemont Way	2-Aug-18	0.71	<1	<2	13	<1	0.13
RMD-214	Grab	11720 Westminster Hwy.	2-Aug-18	0.88	<1	<2	13	<1	0.28
RMD-267	Grab	17240 Fedoruk	2-Aug-18	0.64	<1	<2	14	<1	0.14
RMD-249	Grab	23000 Blk. Dyke Rd.	2-Aug-18	0.61	<1	<2	17	<1	0.18
RMD-276	Grab	22271 Cochrane Drive	2-Aug-18	0.6	<1	<2	15	<1	0.15
RMD-275	Grab	5180 Smith Cres.	2-Aug-18	0.69	<1	<2	14	<1	0.16
RMD-203	Grab	23260 Westminster Hwy.	2-Aug-18	0.79	<1	<2	14	<1	0.15
RMD-251	Grab	5951McCallan Rd.	7-Aug-18	0.77	<1	<2	14	<1	0.22
RMD-273	Grab	Opp. 8331 Fairfax Place	7-Aug-18	0.64	<1	2	21	<1	0.16
RMD-252	Grab	9751 Pendleton Rd.	7-Aug-18	0.63	<1	<2	15	<1	3.2
RMD-274	Grab	10920 Springwood Court	7-Aug-18	0.72	<1	<2	18	<1	0.25
RMD-253	Grab	11051 No 3 Rd.	7-Aug-18	0.74	<1	4	14	<1	0.21
RMD-269	Grab	14951 Triangle Rd.	7-Aug-18	0.8	<1	<2	14	<1	0.25
RMD-270	Grab	8200 Jones Rd.	7-Aug-18	0.78	<1	<2	14	<1	0.2
RMD-254	Grab	5300 No. 3 Rd.	7-Aug-18	0.75	<1	2	15	<1	0.21
RMD-256	Grab	1000 Blk. McDonald Rd.	7-Aug-18	0.67	<1	<2	17	<1	4.4
RMD-255	Grab	6000 Blk. Miller Rd.	7-Aug-18	0.89	<1	<2	14	<1	0.62
RMD-271	Grab	3800 Cessna Drive	7-Aug-18	0.73	<1	<2	16	<1	0.2
RMD-272	Grab	751 Catalina Cres.	7-Aug-18	0.81	<1	<2	14	<1	0.2
RMD-250	Grab	6071 Azure Rd.	7-Aug-18	0.79	<1	<2	15	<1	0.13
RMD-263	Grab	12560 Cambie Rd.	8-Aug-18	0.84	<1	<2	13	<1	0.14
RMD-264	Grab	13100 Mitchell Rd.	8-Aug-18	0.85	<1	<2	15	<1	0.27
RMD-277	Grab	Opp. 11280 Twigg Place	8-Aug-18	0.89	<1	<2	14	<1	0.23
RMD-262	Grab	13799 Commerce Pkwy.	8-Aug-18	0.81	<1	<2	13	<1	0.15

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-278	Grab	6651 Fraserwood Place	8-Aug-18	0.76	<1	4	14	<1	0.4
RMD-279	Grab	Opp. 20371 Westminster Hwy.	8-Aug-18	0.69	<1	ontamina	14	<1	0.2
RMD-261	Grab	9911 Sidaway Rd.	8-Aug-18	0.74	<1	<2	15	<1	0.12
RMD-260	Grab	11111 Horseshoe Way	8-Aug-18	0.83	<1	<2	14	<1	0.14
RMD-259	Grab	10020 Amethyst Ave.	8-Aug-18	0.77	<1	90	17	<1	1.1
RMD-266	Grab	9380 General Currie Rd.	8-Aug-18	0.83	<1	<2	13	<1	0.11
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	8-Aug-18	0.81	<1	<2	13	<1	0.15
RMD-258	Grab	7000 Blk. Dyke Rd.	8-Aug-18	0.82	<1	6	16	<1	0.12
RMD-257	Grab	6640 Blundell Rd.	8-Aug-18	0.83	<1	<2	14	<1	0.14
RMD-204	Grab	3180 Granville Ave.	10-Aug-18	0.7	<1	<2	14	<1	0.13
RMD-206	Grab	4251 Moncton St.	10-Aug-18	0.75	<1	2	14	<1	0.27
RMD-216	Grab	11080 No. 2 Rd.	10-Aug-18	0.84	<1	<2	14	<1	0.14
RMD-280	Grab	11500 McKenzie Rd.	10-Aug-18	0.81	<1	8	16	<1	0.13
RMD-212	Grab	Opp. 8600 Ryan Rd.	10-Aug-18	0.83	<1	4	14	<1	0.19
RMD-208	Grab	13200 No. 4 Rd.	10-Aug-18	0.8	<1	2	14	<1	0.15
RMD-205	Grab	13851 Steveston Hwy.	10-Aug-18	0.87	<1	4	14	<1	0.26
RMD-202	Grab	1500 Valemont Way	10-Aug-18	0.84	<1	2	14	<1	0.28
RMD-214	Grab	11720 Westminster Hwy.	10-Aug-18	0.84	<1	<2	14	<1	0.18
RMD-267	Grab	17240 Fedoruk	10-Aug-18	0.9	<1	<2	15	<1	0.25
RMD-249	Grab	23000 Blk. Dyke Rd.	10-Aug-18	0.81	<1	4	15	<1	0.22
RMD-276	Grab	22271 Cochrane Drive	10-Aug-18	0.86	<1	28	14	<1	0.19
RMD-275	Grab	5180 Smith Cres.	10-Aug-18	0.79	<1	<2	14	<1	0.27
RMD-203	Grab	23260 Westminster Hwy.	10-Aug-18	0.74	<1	<2	14	<1	0.17
RMD-251	Grab	5951McCallan Rd.	13-Aug-18	0.68	<1	<2	15	<1	0.21
RMD-273	Grab	Opp. 8331 Fairfax Place	13-Aug-18	0.66	<1	<2	23	<1	0.11
RMD-252	Grab	9751 Pendleton Rd.	13-Aug-18	0.71	<1	<2	12	<1	0.2
RMD-274	Grab	10920 Springwood Court	13-Aug-18	0.63	<1	<2	18	<1	0.17
RMD-253	Grab	11051 No 3 Rd.	13-Aug-18	0.48	<1	2	14	<1	0.19
RMD-269	Grab	14951 Triangle Rd.	13-Aug-18	0.75	<1	<2	15	<1	0.18
RMD-270	Grab	8200 Jones Rd.	13-Aug-18	0.77	<1	<2	14	<1	0.15
RMD-254	Grab	5300 No. 3 Rd.	13-Aug-18	0.74	<1	<2	15	<1	0.12
RMD-256	Grab	1000 Blk. McDonald Rd.	13-Aug-18	0.38	<1	<2	17	<1	0.61
RMD-255	Grab	6000 Blk. Miller Rd.	13-Aug-18	0.68	<1	<2	14	<1	0.54
RMD-271	Grab	3800 Cessna Drive	13-Aug-18	0.71	<1	<2	16	<1	0.18
RMD-272	Grab	751 Catalina Cres.	13-Aug-18	0.73	<1	<2	15	<1	0.46
RMD-250	Grab	6071 Azure Rd.	13-Aug-18	0.78	<1	2	16	<1	0.1
RMD-263	Grab	12560 Cambie Rd.	15-Aug-18	0.7	<1	<2	14	<1	0.16
RMD-264	Grab	13100 Mitchell Rd.	15-Aug-18	0.75	<1	2	15	<1	0.19
RMD-277	Grab	Opp. 11280 Twigg Place	15-Aug-18	0.73	<1	<2	15	<1	0.22
RMD-262	Grab	13799 Commerce Pkwy.	15-Aug-18	0.71	<1	<2	15	<1	0.17

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-278	Grab	6651 Fraserwood Place	15-Aug-18	0.68	<1	2	16	<1	0.19
RMD-279	Grab	Opp. 20371 Westminster Hwy.	15-Aug-18	0.73	<1	<2	15	<1	0.19
RMD-261	Grab	9911 Sidaway Rd.	15-Aug-18	0.74	<1	2	14	<1	0.16
RMD-260	Grab	11111 Horseshoe Way	15-Aug-18	0.81	<1	<2	15	<1	0.18
RMD-259	Grab	10020 Amethyst Ave.	15-Aug-18	0.75	<1	10	14	<1	0.52
RMD-266	Grab	9380 General Currie Rd.	15-Aug-18	0.87	<1	<2	15	<1	0.22
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	15-Aug-18	0.82	<1	2	15	<1	0.16
RMD-258	Grab	7000 Blk. Dyke Rd.	15-Aug-18	0.82	<1	26	16	<1	0.13
RMD-257	Grab	6640 Blundell Rd.	15-Aug-18	0.81	<1	<2	15	<1	0.11
RMD-204	Grab	3180 Granville Ave.	16-Aug-18	0.76	<1	2	17	<1	0.2
RMD-206	Grab	4251 Moncton St.	16-Aug-18	0.8	<1	<2	15	<1	0.22
RMD-216	Grab	11080 No. 2 Rd.	16-Aug-18	0.78	<1	<2	15	<1	0.21
RMD-280	Grab	11500 McKenzie Rd.	16-Aug-18	0.5	<1	2	18	<1	0.13
RMD-212	Grab	Opp. 8600 Ryan Rd.	16-Aug-18	0.79	<1	<2	16	<1	0.22
RMD-208	Grab	13200 No. 4 Rd.	16-Aug-18	0.9	<1	<2	15	<1	0.19
RMD-205	Grab	13851 Steveston Hwy.	16-Aug-18	0.75	<1	4	16	<1	0.15
RMD-202	Grab	1500 Valemont Way	16-Aug-18	0.67	<1	<2	16	<1	0.13
RMD-267	Grab	17240 Fedoruk	16-Aug-18	0.7	<1	<2	18	<1	0.13
RMD-249	Grab	23000 Blk. Dyke Rd.	16-Aug-18	0.64	<1	<2	17	<1	0.13
RMD-276	Grab	22271 Cochrane Drive	16-Aug-18	0.66	<1	<2	17	<1	0.11
RMD-275	Grab	5180 Smith Cres.	16-Aug-18	0.67	<1	<2	17	<1	0.13
RMD-203	Grab	23260 Westminster Hwy.	16-Aug-18	0.71	<1	<2	16	<1	0.12
RMD-251	Grab	5951McCallan Rd.	20-Aug-18	0.82	<1	<2	14	<1	0.12
RMD-273	Grab	Opp. 8331 Fairfax Place	20-Aug-18	0.78	<1	90	21	<1	0.15
RMD-252	Grab	9751 Pendleton Rd.	20-Aug-18	0.73	<1	2	17	<1	0.12
RMD-274	Grab	10920 Springwood Court	20-Aug-18	0.74	<1	4	19	<1	0.14
RMD-253	Grab	11051 No 3 Rd.	20-Aug-18	0.92	<1	2	15	<1	0.13
RMD-269	Grab	14951 Triangle Rd.	20-Aug-18	0.76	<1	2	16	<1	0.15
RMD-270	Grab	8200 Jones Rd.	20-Aug-18	0.8	<1	12	17	<1	0.14
RMD-254	Grab	5300 No. 3 Rd.	20-Aug-18	0.82	<1	2	17	<1	0.11
RMD-256	Grab	1000 Blk. McDonald Rd.	20-Aug-18	0.61	<1	12	19	<1	1.1
RMD-255	Grab	6000 Blk. Miller Rd.	20-Aug-18	0.67	<1	14	16	<1	0.68
RMD-272	Grab	751 Catalina Cres.	20-Aug-18	0.7	<1	<2	16	<1	0.13
RMD-271	Grab	3800 Cessna Drive	20-Aug-18	0.81	<1	<2	18	<1	0.13
RMD-250	Grab	6071 Azure Rd.	20-Aug-18	0.86	<1	<2	17	<1	0.18
RMD-263	Grab	12560 Cambie Rd.	22-Aug-18	0.68	<1	<2	16	<1	0.35
RMD-264	Grab	13100 Mitchell Rd.	22-Aug-18	0.74	<1	2	16	<1	0.27
RMD-277	Grab	Opp. 11280 Twigg Place	22-Aug-18	0.67	<1	<2	16	<1	0.32
RMD-262	Grab	13799 Commerce Pkwy.	22-Aug-18	0.67	<1	<2	16	<1	0.16
RMD-278	Grab	6651 Fraserwood Place	22-Aug-18	0.73	<1	4	16	<1	0.2

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	22-Aug-18	0.69	<1	<2	16	<1	0.27
RMD-261	Grab	9911 Sidaway Rd.	22-Aug-18	0.61	<1	<2	16	<1	0.27
RMD-260	Grab	11111 Horseshoe Way	22-Aug-18	0.68	<1	2	15	<1	0.28
RMD-259	Grab	10020 Amethyst Ave.	22-Aug-18	0.62	<1	8	17	<1	0.89
RMD-266	Grab	9380 General Currie Rd.	22-Aug-18	0.71	<1	<2	15	<1	0.3
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	22-Aug-18	0.66	<1	<2	15	<1	0.2
RMD-258	Grab	7000 Blk. Dyke Rd.	22-Aug-18	0.74	<1	16	17	<1	0.27
RMD-257	Grab	6640 Blundell Rd.	22-Aug-18	0.66	<1	<2	15	<1	0.21
RMD-204	Grab	3180 Granville Ave.	24-Aug-18	0.64	<1	<2	14	<1	0.12
RMD-206	Grab	4251 Moncton St.	24-Aug-18	0.8	<1	2	16	<1	0.25
RMD-216	Grab	11080 No. 2 Rd.	24-Aug-18	0.78	<1	2	16	<1	0.14
RMD-280	Grab	11500 McKenzie Rd.	24-Aug-18	0.76	<1	2	17	<1	0.16
RMD-212	Grab	Opp. 8600 Ryan Rd.	24-Aug-18	0.79	<1	<2	15	<1	0.12
RMD-208	Grab	13200 No. 4 Rd.	24-Aug-18	0.83	<1	8	15	<1	0.14
RMD-205	Grab	13851 Steveston Hwy.	24-Aug-18	0.83	<1	2	15	<1	0.27
RMD-202	Grab	1500 Valemont Way	24-Aug-18	0.84	<1	<2	15	<1	0.16
RMD-214	Grab	11720 Westminster Hwy.	24-Aug-18	0.8	<1	<2	15	<1	0.2
RMD-267	Grab	17240 Fedoruk	24-Aug-18	0.84	<1	<2	18	<1	0.17
RMD-249	Grab	23000 Blk. Dyke Rd.	24-Aug-18	0.8	<1	8	15	<1	0.24
RMD-276	Grab	22271 Cochrane Drive	24-Aug-18	0.79	<1	14	15	<1	0.25
RMD-275	Grab	5180 Smith Cres.	24-Aug-18	0.76	<1	<2	16	<1	0.2
RMD-203	Grab	23260 Westminster Hwy.	24-Aug-18	0.83	<1	<2	16	<1	0.27
RMD-251	Grab	5951McCallan Rd.	27-Aug-18	0.87	<1	<2	16	<1	0.2
RMD-273	Grab	Opp. 8331 Fairfax Place	27-Aug-18	0.73	<1	12	20	<1	1.4
RMD-252	Grab	9751 Pendleton Rd.	27-Aug-18	0.79	<1	<2	18	<1	0.16
RMD-274	Grab	10920 Springwood Court	27-Aug-18	0.87	<1	26	18	<1	0.32
RMD-253	Grab	11051 No 3 Rd.	27-Aug-18	0.8	<1	<2	17	<1	0.34
RMD-269	Grab	14951 Triangle Rd.	27-Aug-18	1.02	<1	<2	14	<1	0.33
RMD-270	Grab	8200 Jones Rd.	27-Aug-18	0.84	<1	8	14	<1	0.17
RMD-254	Grab	5300 No. 3 Rd.	27-Aug-18	0.83	<1	<2	17	<1	0.14
RMD-256	Grab	1000 Blk. McDonald Rd.	27-Aug-18	0.58	<1	<2	18	<1	1.8
RMD-255	Grab	6000 Blk. Miller Rd.	27-Aug-18	0.87	<1	<2	15	<1	0.57
RMD-272	Grab	751 Catalina Cres.	27-Aug-18	0.88	<1	<2	16	<1	0.14
RMD-271	Grab	3800 Cessna Drive	27-Aug-18	0.85	<1	<2	16	<1	0.14
RMD-250	Grab	6071 Azure Rd.	27-Aug-18	0.83	<1	2	17	<1	0.3
RMD-263	Grab	12560 Cambie Rd.	29-Aug-18	0.82	<1	<2	16	<1	0.18
RMD-264	Grab	13100 Mitchell Rd.	29-Aug-18	0.61	<1	2	17	<1	0.12
RMD-277	Grab	Opp. 11280 Twigg Place	29-Aug-18	0.85	<1	<2	13	<1	0.22
RMD-262	Grab	13799 Commerce Pkwy.	29-Aug-18	0.85	<1	<2	16	<1	0.22
RMD-278	Grab	6651 Fraserwood Place	29-Aug-18	0.71	<1	4	15	<1	0.18

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	29-Aug-18	1.02	<1	<2	16	<1	0.23
RMD-261	Grab	9911 Sidaway Rd.	29-Aug-18	0.86	<1	<2	17	<1	0.3
RMD-260	Grab	11111 Horseshoe Way	29-Aug-18	0.89	<1	2	16	<1	0.15
RMD-259	Grab	10020 Amethyst Ave.	29-Aug-18	0.8	<1	46	18	<1	1
RMD-266	Grab	9380 General Currie Rd.	29-Aug-18	0.87	<1	<2	16	<1	0.18
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	29-Aug-18	0.77	<1	<2	16	<1	0.15
RMD-258	Grab	7000 Blk. Dyke Rd.	29-Aug-18	0.8	<1	32	17	<1	0.19
RMD-257	Grab	6640 Blundell Rd.	29-Aug-18	0.86	<1	<2	15	<1	0.12
RMD-204	Grab	3180 Granville Ave.	30-Aug-18	0.82	<1	<2	18	<1	0.36
RMD-206	Grab	4251 Moncton St.	30-Aug-18	0.8	<1	<2	18	<1	0.32
RMD-216	Grab	11080 No. 2 Rd.	30-Aug-18	0.84	<1	<2	17	<1	0.39
RMD-280	Grab	11500 McKenzie Rd.	30-Aug-18	0.46	<1	2	17	<1	0.25
RMD-212	Grab	Opp. 8600 Ryan Rd.	30-Aug-18	0.81	<1	6	16	<1	0.3
RMD-208	Grab	13200 No. 4 Rd.	30-Aug-18	0.8	<1	<2	16	<1	0.22
RMD-205	Grab	13851 Steveston Hwy.	30-Aug-18	0.81	<1	8	16	<1	0.18
RMD-202	Grab	1500 Valemont Way	30-Aug-18	0.73	<1	<2	16	<1	0.16
RMD-214	Grab	11720 Westminster Hwy.	30-Aug-18	0.84	<1	<2	15	<1	0.21
RMD-267	Grab	17240 Fedoruk	30-Aug-18	0.74	<1	<2	18	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	30-Aug-18	0.81	<1	4	17	<1	0.16
RMD-276	Grab	22271 Cochrane Drive	30-Aug-18	0.76	<1	6	17	<1	0.17
RMD-275	Grab	5180 Smith Cres.	30-Aug-18	0.67	<1	<2	18	<1	0.19
RMD-203	Grab	23260 Westminster Hwy.	30-Aug-18	0.74	<1	4	17	<1	0.21
RMD-251	Grab	5951McCallan Rd.	4-Sep-18	0.78	<1	<2	15	<1	0.11
RMD-273	Grab	Opp. 8331 Fairfax Place	4-Sep-18	0.72	<1	12	20	<1	0.15
RMD-252	Grab	9751 Pendleton Rd.	4-Sep-18	0.75	<1	<2	17	<1	0.17
RMD-274	Grab	10920 Springwood Court	4-Sep-18	0.78	<1	24	17	<1	0.2
RMD-253	Grab	11051 No 3 Rd.	4-Sep-18	0.79	<1	<2	17	<1	0.12
RMD-269	Grab	14951 Triangle Rd.	4-Sep-18	0.86	<1	<2	17	<1	0.25
RMD-270	Grab	8200 Jones Rd.	4-Sep-18	0.77	<1	8	16	<1	0.14
RMD-254	Grab	5300 No. 3 Rd.	4-Sep-18	0.8	<1	<2	16	<1	0.14
RMD-256	Grab	1000 Blk. McDonald Rd.	4-Sep-18	0.52	<1	2	19	<1	0.98
RMD-255	Grab	6000 Blk. Miller Rd.	4-Sep-18	0.9	<1	<2	15	<1	0.29
RMD-271	Grab	3800 Cessna Drive	4-Sep-18	0.75	<1	<2	15	<1	0.16
RMD-272	Grab	751 Catalina Cres.	4-Sep-18	0.9	<1	<2	16	<1	0.15
RMD-250	Grab	6071 Azure Rd.	4-Sep-18	0.76	<1	<2	16	<1	0.12
RMD-263	Grab	12560 Cambie Rd.	5-Sep-18	0.85	<1	<2	16	<1	0.34
RMD-264	Grab	13100 Mitchell Rd.	5-Sep-18	0.69	<1	<2	17	<1	0.22
RMD-277	Grab	Opp. 11280 Twigg Place	5-Sep-18	0.84	<1	<2	17	<1	0.54
RMD-262	Grab	13799 Commerce Pkwy.	5-Sep-18	0.92	<1	<2	16	<1	0.26
RMD-278	Grab	6651 Fraserwood Place	5-Sep-18	0.79	<1	8	16	<1	0.38

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	5-Sep-18	0.86	<1	<2	16	<1	0.31
RMD-261	Grab	9911 Sidaway Rd.	5-Sep-18	0.71	<1	<2	17	<1	0.62
RMD-260	Grab	11111 Horseshoe Way	5-Sep-18	0.81	<1	<2	17	<1	0.19
RMD-259	Grab	10020 Amethyst Ave.	5-Sep-18	0.74	<1	160	18	<1	2.2
RMD-266	Grab	9380 General Currie Rd.	5-Sep-18	0.84	<1	<2	16	<1	0.17
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	5-Sep-18	0.74	<1	<2	17	<1	0.19
RMD-258	Grab	7000 Blk. Dyke Rd.	5-Sep-18	0.8	<1	4	17	<1	0.18
RMD-257	Grab	6640 Blundell Rd.	5-Sep-18	0.84	<1	2	16	<1	0.29
RMD-204	Grab	3180 Granville Ave.	7-Sep-18	0.78	<1	<2	17	<1	0.11
RMD-206	Grab	4251 Moncton St.	7-Sep-18	0.79	<1	6	16	<1	0.38
RMD-216	Grab	11080 No. 2 Rd.	7-Sep-18	0.79	<1	<2	17	<1	0.12
RMD-280	Grab	11500 McKenzie Rd.	7-Sep-18	0.69	<1	4	17	<1	0.12
RMD-212	Grab	Opp. 8600 Ryan Rd.	7-Sep-18	0.88	<1	<2	17	<1	0.13
RMD-208	Grab	13200 No. 4 Rd.	7-Sep-18	0.85	<1	<2	16	<1	0.17
RMD-205	Grab	13851 Steveston Hwy.	7-Sep-18	0.98	<1	2	16	<1	0.31
RMD-202	Grab	1500 Valemont Way	7-Sep-18	1.03	<1	<2	16	<1	0.21
RMD-214	Grab	11720 Westminster Hwy.	7-Sep-18	0.75	<1	<2	16	<1	0.12
RMD-267	Grab	17240 Fedoruk	7-Sep-18	0.92	<1	<2	17	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	7-Sep-18	1	<1	26	17	<1	1
RMD-276	Grab	22271 Cochrane Drive	7-Sep-18	0.93	<1	<2	17	<1	0.22
RMD-275	Grab	5180 Smith Cres.	7-Sep-18	1.09	<1	<2	18	<1	0.17
RMD-203	Grab	23260 Westminster Hwy.	7-Sep-18	0.97	<1	<2	17	<1	0.26
RMD-251	Grab	5951McCallan Rd.	10-Sep-18	0.78	<1	<2	16	<1	0.12
RMD-273	Grab	Opp. 8331 Fairfax Place	10-Sep-18	0.62	<1	<2	20	<1	0.1
RMD-252	Grab	9751 Pendleton Rd.	10-Sep-18	0.63	<1	<2	16	<1	0.14
RMD-274	Grab	10920 Springwood Court	10-Sep-18	0.62	<1	8	17	<1	0.18
RMD-253	Grab	11051 No 3 Rd.	10-Sep-18	0.62	<1	<2	17	<1	0.1
RMD-269	Grab	14951 Triangle Rd.	10-Sep-18	0.91	<1	<2	17	<1	0.16
RMD-270	Grab	8200 Jones Rd.	10-Sep-18	0.65	<1	<2	18	<1	0.15
RMD-254	Grab	5300 No. 3 Rd.	10-Sep-18	0.76	<1	<2	17	<1	0.1
RMD-256	Grab	1000 Blk. McDonald Rd.	10-Sep-18	0.61	<1	<2	17	<1	1.7
RMD-255	Grab	6000 Blk. Miller Rd.	10-Sep-18	0.79	<1	4	15	<1	0.14
RMD-271	Grab	3800 Cessna Drive	10-Sep-18	0.74	<1	<2	17	<1	0.11
RMD-272	Grab	751 Catalina Cres.	10-Sep-18	0.86	<1	<2	16	<1	0.13
RMD-250	Grab	6071 Azure Rd.	10-Sep-18	0.7	<1	4	17	<1	0.13
RMD-263	Grab	12560 Cambie Rd.	12-Sep-18	0.87	<1	<2	17	<1	0.16
RMD-264	Grab	13100 Mitchell Rd.	12-Sep-18	0.68	<1	4	17	<1	0.22
RMD-277	Grab	Opp. 11280 Twigg Place	12-Sep-18	0.86	<1	2	17	<1	0.26
RMD-262	Grab	13799 Commerce Pkwy.	12-Sep-18	0.77	<1	<2	18	<1	0.23
RMD-278	Grab	6651 Fraserwood Place	12-Sep-18	0.86	<1	8	16	<1	0.19

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	12-Sep-18	1.02	<1	<2	17	<1	0.22
RMD-261	Grab	9911 Sidaway Rd.	12-Sep-18	0.81	<1	2	16	<1	0.25
RMD-260	Grab	11111 Horseshoe Way	12-Sep-18	0.88	<1	4	17	<1	0.3
RMD-259	Grab	10020 Amethyst Ave.	12-Sep-18	0.94		300	18		3.6
RMD-266	Grab	9380 General Currie Rd.	12-Sep-18	0.82	<1	<2	16	<1	0.15
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	12-Sep-18	0.72	<1	<2	17	<1	0.26
RMD-258	Grab	7000 Blk. Dyke Rd.	12-Sep-18	0.71	<1	12	17	<1	0.1
RMD-257	Grab	6640 Blundell Rd.	12-Sep-18	0.83	<1	<2	15	<1	0.13
RMD-204	Grab	3180 Granville Ave.	13-Sep-18	0.76	<1	2	18	<1	0.13
RMD-206	Grab	4251 Moncton St.	13-Sep-18	0.72	<1	<2	17	<1	1.1
RMD-216	Grab	11080 No. 2 Rd.	13-Sep-18	0.78	<1	<2	17	<1	0.18
RMD-280	Grab	11500 McKenzie Rd.	13-Sep-18	0.67	<1	4	18	<1	0.23
RMD-212	Grab	Opp. 8600 Ryan Rd.	13-Sep-18	0.87	<1	2	17	<1	0.31
RMD-208	Grab	13200 No. 4 Rd.	13-Sep-18	0.85	<1	4	16	<1	0.19
RMD-205	Grab	13851 Steveston Hwy.	13-Sep-18	0.78	<1	10	17	<1	0.23
RMD-202	Grab	1500 Valemont Way	13-Sep-18	0.65	<1	<2	16	<1	0.18
RMD-214	Grab	11720 Westminster Hwy.	13-Sep-18	0.61	<1	<2	16	<1	0.23
RMD-267	Grab	17240 Fedoruk	13-Sep-18	0.82	<1	<2	18	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	13-Sep-18	0.86	<1	2	17	<1	0.2
RMD-276	Grab	22271 Cochrane Drive	13-Sep-18	0.77	<1	<2	18	<1	0.25
RMD-275	Grab	5180 Smith Cres.	13-Sep-18	0.79	<1	<2	18	<1	0.24
RMD-203	Grab	23260 Westminster Hwy.	13-Sep-18	0.72	<1	<2	16	<1	0.17
RMD-251	Grab	5951McCallan Rd.	17-Sep-18	0.73	<1	<2	15	<1	0.22
RMD-273	Grab	Opp. 8331 Fairfax Place	17-Sep-18	0.65	<1	<2	18	<1	0.21
RMD-252	Grab	9751 Pendleton Rd.	17-Sep-18	0.47	<1	<2	16	<1	0.2
RMD-274	Grab	10920 Springwood Court	17-Sep-18	0.68	<1	<2	16	<1	0.25
RMD-253	Grab	11051 No 3 Rd.	17-Sep-18	0.7	<1	<2	16	<1	0.23
RMD-269	Grab	14951 Triangle Rd.	17-Sep-18	0.68	<1	<2	16	<1	0.24
RMD-270	Grab	8200 Jones Rd.	17-Sep-18	0.71	<1	2	16	<1	0.22
RMD-254	Grab	5300 No. 3 Rd.	17-Sep-18	0.75	<1	<2	16	<1	0.21
RMD-256	Grab	1000 Blk. McDonald Rd.	17-Sep-18	0.56	<1	4	16	<1	2
RMD-255	Grab	6000 Blk. Miller Rd.	17-Sep-18	0.82	<1	<2	15	<1	0.23
RMD-271	Grab	3800 Cessna Drive	17-Sep-18	0.8	<1	<2	15	<1	0.17
RMD-272	Grab	751 Catalina Cres.	17-Sep-18	0.83	<1	2	15	<1	0.21
RMD-250	Grab	6071 Azure Rd.	17-Sep-18	0.76	<1	<2	16	<1	0.21
RMD-263	Grab	12560 Cambie Rd.	19-Sep-18	0.73	<1	<2	15	<1	0.17
RMD-264	Grab	13100 Mitchell Rd.	19-Sep-18	0.76	<1	<2	16	<1	0.49
RMD-277	Grab	Opp. 11280 Twigg Place	19-Sep-18	0.83	<1	<2	16	<1	1.5
RMD-262	Grab	13799 Commerce Pkwy.	19-Sep-18	0.73	<1	<2	15	<1	0.21
RMD-278	Grab	6651 Fraserwood Place	19-Sep-18	0.75	<1	2	16	<1	0.54

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	19-Sep-18	0.93	<1	<2	15	<1	0.25
RMD-261	Grab	9911 Sidaway Rd.	19-Sep-18	0.75	<1	<2	15	<1	0.25
RMD-260	Grab	11111 Horseshoe Way	19-Sep-18	0.76	<1	<2	15	<1	0.14
RMD-259	Grab	10020 Amethyst Ave.	19-Sep-18	0.73	<1	<2	16	<1	0.12
RMD-266	Grab	9380 General Currie Rd.	19-Sep-18	0.77	<1	<2	15	<1	0.12
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	19-Sep-18	0.72	<1	<2	15	<1	0.51
RMD-258	Grab	7000 Blk. Dyke Rd.	19-Sep-18	0.73	<1	8	16	<1	0.74
RMD-257	Grab	6640 Blundell Rd.	19-Sep-18	0.71	<1	<2	16	<1	0.18
RMD-204	Grab	3180 Granville Ave.	21-Sep-18	0.57	<1	<2	16	<1	0.19
RMD-206	Grab	4251 Moncton St.	21-Sep-18	0.71	<1	2	15	<1	0.19
RMD-216	Grab	11080 No. 2 Rd.	21-Sep-18	0.53	<1	<2	15	<1	0.17
RMD-280	Grab	11500 McKenzie Rd.	21-Sep-18	0.58	<1	<2	16	<1	0.14
RMD-212	Grab	Opp. 8600 Ryan Rd.	21-Sep-18	0.62	<1	2	15	<1	0.21
RMD-208	Grab	13200 No. 4 Rd.	21-Sep-18	0.64	<1	<2	15	<1	0.2
RMD-205	Grab	13851 Steveston Hwy.	21-Sep-18	0.97	<1	<2	15	<1	0.39
RMD-202	Grab	1500 Valemont Way	21-Sep-18	0.92	<1	<2	14	<1	0.3
RMD-214	Grab	11720 Westminster Hwy.	21-Sep-18	0.66	<1	<2	14	<1	0.2
RMD-267	Grab	17240 Fedoruk	21-Sep-18	0.86	<1	4	15	<1	0.4
RMD-249	Grab	23000 Blk. Dyke Rd.	21-Sep-18	1.02	<1	4	15	<1	0.67
RMD-276	Grab	22271 Cochrane Drive	21-Sep-18	1	<1	<2	15	<1	0.41
RMD-275	Grab	5180 Smith Cres.	21-Sep-18	0.91	<1	<2	15	<1	2.3
RMD-203	Grab	23260 Westminster Hwy.	21-Sep-18	0.94	<1	<2	14	<1	0.36
RMD-251	Grab	5951McCallan Rd.	24-Sep-18	0.72	<1	2	16	<1	0.17
RMD-273	Grab	Opp. 8331 Fairfax Place	24-Sep-18	0.6	<1	2	18	<1	0.15
RMD-252	Grab	9751 Pendleton Rd.	24-Sep-18	0.64	<1	<2	15	<1	0.34
RMD-274	Grab	10920 Springwood Court	24-Sep-18	0.58	<1	6	17	<1	0.22
RMD-253	Grab	11051 No 3 Rd.	24-Sep-18	0.53	<1	<2	14	<1	0.25
RMD-269	Grab	14951 Triangle Rd.	24-Sep-18	0.58	<1	<2	14	<1	0.17
RMD-270	Grab	8200 Jones Rd.	24-Sep-18	0.67	<1	6	15	<1	0.21
RMD-254	Grab	5300 No. 3 Rd.	24-Sep-18	0.72	<1	2	14	<1	0.22
RMD-256	Grab	1000 Blk. McDonald Rd.	24-Sep-18	0.49	<1	4	16	<1	0.67
RMD-255	Grab	6000 Blk. Miller Rd.	24-Sep-18	0.69	<1	4	14	<1	0.78
RMD-271	Grab	3800 Cessna Drive	24-Sep-18	0.69	<1	2	14	<1	0.28
RMD-272	Grab	751 Catalina Cres.	24-Sep-18	0.68	<1	<2	13	<1	0.21
RMD-250	Grab	6071 Azure Rd.	24-Sep-18	0.73	<1	2	13	<1	0.21
RMD-263	Grab	12560 Cambie Rd.	26-Sep-18	0.71	<1	<2	14	<1	0.21
RMD-264	Grab	13100 Mitchell Rd.	26-Sep-18	0.62	<1	<2	15	<1	0.19
RMD-277	Grab	Opp. 11280 Twigg Place	26-Sep-18	0.65	<1	<2	15	<1	0.2
RMD-262	Grab	13799 Commerce Pkwy.	26-Sep-18	0.68	<1	6	15	<1	0.18
RMD-278	Grab	6651 Fraserwood Place	26-Sep-18	0.8	<1	<2	15	<1	0.18

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	26-Sep-18	0.86	<1	<2	15	<1	0.25
RMD-261	Grab	9911 Sidaway Rd.	26-Sep-18	0.79	<1	<2	15	<1	0.21
RMD-260	Grab	11111 Horseshoe Way	26-Sep-18	0.81	<1	<2	15	<1	0.21
RMD-259	Grab	10020 Amethyst Ave.	26-Sep-18	0.65	<1	<2	15	<1	0.19
RMD-266	Grab	9380 General Currie Rd.	26-Sep-18	0.74	<1	<2	14	<1	0.19
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	26-Sep-18	0.72	<1	2	15	<1	3.2
RMD-258	Grab	7000 Blk. Dyke Rd.	26-Sep-18	0.78	<1	6	15	<1	3.9
RMD-257	Grab	6640 Blundell Rd.	26-Sep-18	0.68	<1	<2	15	<1	0.13
RMD-204	Grab	3180 Granville Ave.	27-Sep-18	0.61	<1	6	17	<1	0.22
RMD-206	Grab	4251 Moncton St.	27-Sep-18	0.68	<1	<2	17	<1	0.49
RMD-216	Grab	11080 No. 2 Rd.	27-Sep-18	0.63	<1	2	17	<1	0.22
RMD-280	Grab	11500 McKenzie Rd.	27-Sep-18	0.39	<1	2	16	<1	0.15
RMD-212	Grab	Opp. 8600 Ryan Rd.	27-Sep-18	0.68	<1	2	15	<1	0.17
RMD-208	Grab	13200 No. 4 Rd.	27-Sep-18	0.61	<1	2	16	<1	0.14
RMD-205	Grab	13851 Steveston Hwy.	27-Sep-18	0.82	<1	4	14	<1	0.22
RMD-202	Grab	1500 Valemont Way	27-Sep-18	0.85	<1	<2	12	<1	0.21
RMD-214	Grab	11720 Westminster Hwy.	27-Sep-18	0.74	<1	2	14	<1	0.14
RMD-267	Grab	17240 Fedoruk	27-Sep-18	0.76	<1	<2	18	<1	0.17
RMD-249	Grab	23000 Blk. Dyke Rd.	27-Sep-18	0.58	<1	<2	16	<1	0.19
RMD-276	Grab	22271 Cochrane Drive	27-Sep-18	0.73	<1	<2	13	<1	0.21
RMD-275	Grab	5180 Smith Cres.	27-Sep-18	0.67	<1	<2	14	<1	0.25
RMD-203	Grab	23260 Westminster Hwy.	27-Sep-18	0.78	<1	<2	14	<1	0.21
RMD-251	Grab	5951McCallan Rd.	1-Oct-18	0.59	<1	<2	14	<1	0.54
RMD-273	Grab	Opp. 8331 Fairfax Place	1-Oct-18	0.71	<1	4	17	<1	0.32
RMD-252	Grab	9751 Pendleton Rd.	1-Oct-18	0.6	<1	<2	14	<1	0.27
RMD-274	Grab	10920 Springwood Court	1-Oct-18	0.73	<1	<2	15	<1	0.37
RMD-253	Grab	11051 No 3 Rd.	1-Oct-18	0.69	<1	<2	13	<1	0.44
RMD-269	Grab	14951 Triangle Rd.	1-Oct-18	0.72	<1	<2	14	<1	0.47
RMD-270	Grab	8200 Jones Rd.	1-Oct-18	0.73	<1	2	16	<1	0.61
RMD-254	Grab	5300 No. 3 Rd.	1-Oct-18	0.71	<1	<2	16	<1	0.48
RMD-256	Grab	1000 Blk. McDonald Rd.	1-Oct-18	0.56	<1	12	16	<1	0.69
RMD-255	Grab	6000 Blk. Miller Rd.	1-Oct-18	0.88	<1	2	14	<1	0.58
RMD-271	Grab	3800 Cessna Drive	1-Oct-18	0.81	<1	<2	15	<1	0.43
RMD-272	Grab	751 Catalina Cres.	1-Oct-18	0.85	<1	<2	14	<1	0.41
RMD-250	Grab	6071 Azure Rd.	1-Oct-18	0.64	<1	<2	14	<1	0.37
RMD-263	Grab	12560 Cambie Rd.	3-Oct-18	0.81	<1	<2	16	<1	0.13
RMD-264	Grab	13100 Mitchell Rd.	3-Oct-18	0.63	<1	<2	15	<1	0.12
RMD-277	Grab	Opp. 11280 Twigg Place	3-Oct-18	0.77	<1	<2	12	<1	0.16
RMD-262	Grab	13799 Commerce Pkwy.	3-Oct-18	0.79	<1	<2	12	<1	0.15
RMD-278	Grab	6651 Fraserwood Place	3-Oct-18	0.7	<1	<2	13	<1	0.18

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	3-Oct-18	0.69	<1	<2	13	<1	0.19
RMD-261	Grab	9911 Sidaway Rd.	3-Oct-18	0.66	<1	<2	12	<1	0.13
RMD-260	Grab	11111 Horseshoe Way	3-Oct-18	0.72	<1	<2	14	<1	0.2
RMD-259	Grab	10020 Amethyst Ave.	3-Oct-18	0.68	<1	<2	14	<1	0.13
RMD-266	Grab	9380 General Currie Rd.	3-Oct-18	0.73	<1	<2	13	<1	0.14
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	3-Oct-18	0.74	<1	<2	13	<1	0.11
RMD-258	Grab	7000 Blk. Dyke Rd.	3-Oct-18	0.65	<1	<2	13	<1	0.12
RMD-257	Grab	6640 Blundell Rd.	3-Oct-18	0.73	<1	<2	14	<1	0.16
RMD-204	Grab	3180 Granville Ave.	5-Oct-18	0.94	<1	<2	14	<1	0.26
RMD-206	Grab	4251 Moncton St.	5-Oct-18	0.66	<1	<2	14	<1	0.37
RMD-216	Grab	11080 No. 2 Rd.	5-Oct-18	0.69	<1	<2	14	<1	0.3
RMD-280	Grab	11500 McKenzie Rd.	5-Oct-18	0.63	<1	36	14	<1	0.16
RMD-212	Grab	Opp. 8600 Ryan Rd.	5-Oct-18	0.7	<1	26	14	<1	0.26
RMD-208	Grab	13200 No. 4 Rd.	5-Oct-18	0.74	<1	<2	14	<1	0.16
RMD-205	Grab	13851 Steveston Hwy.	5-Oct-18	0.69	<1	<2	14	<1	0.26
RMD-202	Grab	1500 Valemont Way	5-Oct-18	0.75	<1	<2	13	<1	0.24
RMD-214	Grab	11720 Westminster Hwy.	5-Oct-18	0.8	<1	<2	13	<1	0.23
RMD-267	Grab	17240 Fedoruk	5-Oct-18	0.63	<1	2	14	<1	0.31
RMD-249	Grab	23000 Blk. Dyke Rd.	5-Oct-18	0.72	<1	<2	14	<1	0.41
RMD-276	Grab	22271 Cochrane Drive	5-Oct-18	0.76	<1	2	14	<1	0.24
RMD-275	Grab	5180 Smith Cres.	5-Oct-18	0.65	<1	<2	15	<1	0.34
RMD-203	Grab	23260 Westminster Hwy.	5-Oct-18	0.66	<1	2	14	<1	0.21
RMD-251	Grab	5951McCallan Rd.	9-Oct-18	0.6	<1	<2	12	<1	0.3
RMD-273	Grab	Opp. 8331 Fairfax Place	9-Oct-18	0.73	<1	6	16	<1	0.2
RMD-252	Grab	9751 Pendleton Rd.	9-Oct-18	0.64	<1	<2	13	<1	0.35
RMD-274	Grab	10920 Springwood Court	9-Oct-18	0.61	<1	<2	15	<1	0.19
RMD-253	Grab	11051 No 3 Rd.	9-Oct-18	0.83	<1	<2	12	<1	0.35
RMD-269	Grab	14951 Triangle Rd.	9-Oct-18	0.46	<1	<2	15	<1	0.18
RMD-270	Grab	8200 Jones Rd.	9-Oct-18	0.73	<1	<2	12	<1	0.52
RMD-254	Grab	5300 No. 3 Rd.	9-Oct-18	0.71	<1	<2	13	<1	0.3
RMD-256	Grab	1000 Blk. McDonald Rd.	9-Oct-18	0.42	<1	2	14	<1	0.57
RMD-255	Grab	6000 Blk. Miller Rd.	9-Oct-18	0.84	<1	2	12	<1	0.51
RMD-271	Grab	3800 Cessna Drive	9-Oct-18	0.76	<1	<2	13	<1	0.44
RMD-272	Grab	751 Catalina Cres.	9-Oct-18	0.78	<1	<2	14	<1	0.58
RMD-250	Grab	6071 Azure Rd.	9-Oct-18	0.64	<1	2	13	<1	0.3
RMD-263	Grab	12560 Cambie Rd.	10-Oct-18	0.82	<1	<2	13	<1	0.26
RMD-264	Grab	13100 Mitchell Rd.	10-Oct-18	0.74	<1	<2	14	<1	0.36
RMD-277	Grab	Opp. 11280 Twigg Place	10-Oct-18	0.93	<1	<2	14	<1	0.23
RMD-262	Grab	13799 Commerce Pkwy.	10-Oct-18	0.63	<1	<2	14	<1	0.15
RMD-278	Grab	6651 Fraserwood Place	10-Oct-18	0.52	<1	<2	13	<1	0.15

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-279	Grab	Opp. 20371 Westminster Hwy.	10-Oct-18	0.6	<1	<2	13	<1	0.19
RMD-261	Grab	9911 Sidaway Rd.	10-Oct-18	0.75	<1	<2	13	<1	0.72
RMD-259	Grab	10020 Amethyst Ave.	10-Oct-18	0.85	<1	<2	14	<1	0.17
RMD-266	Grab	9380 General Currie Rd.	10-Oct-18	0.75	<1	<2	14	<1	0.28
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	10-Oct-18	0.75	<1	<2	14	<1	0.2
RMD-258	Grab	7000 Blk. Dyke Rd.	10-Oct-18	0.7	<1	4	14	<1	0.13
RMD-257	Grab	6640 Blundell Rd.	10-Oct-18	0.75	<1	<2	13	<1	0.24
RMD-204	Grab	3180 Granville Ave.	11-Oct-18	1.01	<1	4	12	<1	0.32
RMD-206	Grab	4251 Moncton St.	11-Oct-18	0.78	<1	<2	11	<1	0.23
RMD-216	Grab	11080 No. 2 Rd.	11-Oct-18	0.8	<1	<2	12	<1	0.25
RMD-280	Grab	11500 McKenzie Rd.	11-Oct-18	0.63	<1	<2	14	<1	0.14
RMD-212	Grab	Opp. 8600 Ryan Rd.	11-Oct-18	0.82	<1	<2	12	<1	0.32
RMD-208	Grab	13200 No. 4 Rd.	11-Oct-18	0.79	<1	<2	13	<1	0.24
RMD-205	Grab	13851 Steveston Hwy.	11-Oct-18	0.69	<1	<2	13	<1	0.28
RMD-202	Grab	1500 Valemont Way	11-Oct-18	0.59	<1	<2	12	<1	0.35
RMD-214	Grab	11720 Westminster Hwy.	11-Oct-18	0.74	<1	<2	13	<1	0.21
RMD-267	Grab	17240 Fedoruk	11-Oct-18	0.52	<1	<2	14	<1	0.33
RMD-249	Grab	23000 Blk. Dyke Rd.	11-Oct-18	0.57	<1	6	13	<1	0.27
RMD-276	Grab	22271 Cochrane Drive	11-Oct-18	0.56	<1	<2	13	<1	0.83
RMD-275	Grab	5180 Smith Cres.	11-Oct-18	0.49	<1	2	14	<1	0.67
RMD-203	Grab	23260 Westminster Hwy.	11-Oct-18	0.52	<1	<2	13	<1	0.58
RMD-251	Grab	5951McCallan Rd.	15-Oct-18	0.71	<1	<2	13	<1	0.38
RMD-273	Grab	Opp. 8331 Fairfax Place	15-Oct-18	0.66	<1	2	16	<1	0.21
RMD-252	Grab	9751 Pendleton Rd.	15-Oct-18	0.64	<1	2	14	<1	0.24
RMD-274	Grab	10920 Springwood Court	15-Oct-18	0.63	<1	6	15	<1	0.15
RMD-253	Grab	11051 No 3 Rd.	15-Oct-18	0.63	<1	2	13	<1	0.12
RMD-269	Grab	14951 Triangle Rd.	15-Oct-18	0.46	<1	<2	15	<1	0.4
RMD-270	Grab	8200 Jones Rd.	15-Oct-18	0.71	<1	<2	14	<1	0.3
RMD-254	Grab	5300 No. 3 Rd.	15-Oct-18	0.71	<1	<2	13	<1	0.36
RMD-256	Grab	1000 Blk. McDonald Rd.	15-Oct-18	0.52	<1	16	15	<1	1.2
RMD-255	Grab	6000 Blk. Miller Rd.	15-Oct-18	0.73	<1	2	13	<1	0.63
RMD-271	Grab	3800 Cessna Drive	15-Oct-18	0.82	<1	<2	14	<1	0.34
RMD-272	Grab	751 Catalina Cres.	15-Oct-18	0.75	<1	<2	13	<1	0.26
RMD-250	Grab	6071 Azure Rd.	15-Oct-18	0.77	<1	8	14	<1	0.31
RMD-263	Grab	12560 Cambie Rd.	17-Oct-18	0.62	<1	<2	13	<1	0.14
RMD-264	Grab	13100 Mitchell Rd.	17-Oct-18	0.7	<1	<2	13	<1	0.12
RMD-277	Grab	Opp. 11280 Twigg Place	17-Oct-18	0.67	<1	<2	14	<1	0.16
RMD-262	Grab	13799 Commerce Pkwy.	17-Oct-18	0.56	<1	<2	13	<1	0.09
RMD-278	Grab	6651 Fraserwood Place	17-Oct-18	0.55	<1	<2	14	<1	0.12
RMD-279	Grab	Opp. 20371 Westminster Hwy.	17-Oct-18	0.51	<1	<2	12	<1	0.1

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-261	Grab	9911 Sidaway Rd.	17-Oct-18	0.57	<1	<2	13	<1	0.11
RMD-259	Grab	10020 Amethyst Ave.	17-Oct-18	0.54	<1	<2	12	<1	0.11
RMD-266	Grab	9380 General Currie Rd.	17-Oct-18	0.86	<1	<2	13	<1	0.19
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	17-Oct-18	0.57	<1	4	14	<1	0.16
RMD-258	Grab	7000 Blk. Dyke Rd.	17-Oct-18	0.63	<1	4	13	<1	0.1
RMD-257	Grab	6640 Blundell Rd.	17-Oct-18	0.66	<1	<2	13	<1	0.12
RMD-204	Grab	3180 Granville Ave.	19-Oct-18	0.86	<1	2	13	<1	0.12
RMD-206	Grab	4251 Moncton St.	19-Oct-18	0.65	<1	<2	12	<1	0.25
RMD-216	Grab	11080 No. 2 Rd.	19-Oct-18	0.54	<1	<2	13	<1	0.11
RMD-280	Grab	11500 McKenzie Rd.	19-Oct-18	0.52	<1	2	13	<1	0.11
RMD-212	Grab	Opp. 8600 Ryan Rd.	19-Oct-18	0.72	<1	<2	14	<1	0.12
RMD-208	Grab	13200 No. 4 Rd.	19-Oct-18	0.68	<1	<2	14	<1	0.12
RMD-205	Grab	13851 Steveston Hwy.	19-Oct-18	0.67	<1	4	13	<1	0.13
RMD-202	Grab	1500 Valemont Way	19-Oct-18	0.49	<1	<2	12	<1	0.14
RMD-214	Grab	11720 Westminster Hwy.	19-Oct-18	0.7	<1	<2	12	<1	0.15
RMD-267	Grab	17240 Fedoruk	19-Oct-18	0.54	<1	<2	13	<1	0.14
RMD-249	Grab	23000 Blk. Dyke Rd.	19-Oct-18	0.62	<1	<2	13	<1	0.14
RMD-276	Grab	22271 Cochrane Drive	19-Oct-18	0.6	<1	2	13	<1	0.11
RMD-275	Grab	5180 Smith Cres.	19-Oct-18	0.6	<1	<2	15	<1	0.23
RMD-203	Grab	23260 Westminster Hwy.	19-Oct-18	0.54	<1	8	13	<1	0.13
RMD-251	Grab	5951McCallan Rd.	22-Oct-18	0.79	<1	<2	12	<1	0.35
RMD-273	Grab	Opp. 8331 Fairfax Place	22-Oct-18	0.69	<1	<2	14	<1	0.1
RMD-252	Grab	9751 Pendleton Rd.	22-Oct-18	0.74	<1	<2	13	<1	0.1
RMD-274	Grab	10920 Springwood Court	22-Oct-18	0.77	<1	<2	13	<1	0.18
RMD-253	Grab	11051 No 3 Rd.	22-Oct-18	0.71	<1	<2	13	<1	0.13
RMD-269	Grab	14951 Triangle Rd.	22-Oct-18	0.6	<1	<2	14	<1	0.11
RMD-270	Grab	8200 Jones Rd.	22-Oct-18	0.73	<1	2	13	<1	0.11
RMD-254	Grab	5300 No. 3 Rd.	22-Oct-18	0.75	<1	<2	13	<1	0.23
RMD-255	Grab	6000 Blk. Miller Rd.	22-Oct-18	0.86	<1	6	12	<1	0.19
RMD-256	Grab	1000 Blk. McDonald Rd.	22-Oct-18	0.51	<1	4	14	<1	0.96
RMD-271	Grab	3800 Cessna Drive	22-Oct-18	0.82	<1	<2	13	<1	0.12
RMD-272	Grab	751 Catalina Cres.	22-Oct-18	0.84	<1	2	12	<1	0.11
RMD-250	Grab	6071 Azure Rd.	22-Oct-18	0.81	<1	<2	13	<1	0.1
RMD-263	Grab	12560 Cambie Rd.	24-Oct-18	0.81	<1	<2	12	<1	0.11
RMD-264	Grab	13100 Mitchell Rd.	24-Oct-18	0.63	<1	2	12	<1	0.1
RMD-277	Grab	Opp. 11280 Twigg Place	24-Oct-18	0.82	<1	100	13	<1	0.11
RMD-262	Grab	13799 Commerce Pkwy.	24-Oct-18	0.67	<1	<2	13	<1	0.11
RMD-278	Grab	6651 Fraserwood Place	24-Oct-18	0.54	<1	<2	13	<1	0.1
RMD-279	Grab	Opp. 20371 Westminster Hwy.	24-Oct-18	0.62	<1	<2	12	<1	0.11
RMD-261	Grab	9911 Sidaway Rd.	24-Oct-18	0.7	<1	20	13	<1	0.11

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-260	Grab	11111 Horseshoe Way	24-Oct-18	0.73	<1	<2	13	<1	0.15
RMD-259	Grab	10020 Amethyst Ave.	24-Oct-18	0.7	<1	<2	13	<1	0.12
RMD-266	Grab	9380 General Currie Rd.	24-Oct-18	0.73	<1	<2	13	<1	0.09
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	24-Oct-18	0.81	<1	<2	13	<1	0.53
RMD-258	Grab	7000 Blk. Dyke Rd.	24-Oct-18	0.72	<1	<2	13	<1	0.11
RMD-257	Grab	6640 Blundell Rd.	24-Oct-18	0.8	<1	2	13	<1	0.11
RMD-204	Grab	3180 Granville Ave.	25-Oct-18	0.83	<1	4	13	<1	0.12
RMD-206	Grab	4251 Moncton St.	25-Oct-18	0.6	<1	<2	12	<1	0.33
RMD-267	Grab	17240 Fedoruk	25-Oct-18	0.58	<1	<2	13	<1	0.14
RMD-216	Grab	11080 No. 2 Rd.	25-Oct-18	0.77	<1	<2	13	<1	0.1
RMD-276	Grab	22271 Cochrane Drive	25-Oct-18	0.55	<1	2	13	<1	0.18
RMD-275	Grab	5180 Smith Cres.	25-Oct-18	0.58	<1	<2	13	<1	0.1
RMD-280	Grab	11500 McKenzie Rd.	25-Oct-18	0.48	<1	2	14	<1	0.15
RMD-203	Grab	23260 Westminster Hwy.	25-Oct-18	0.58	<1	<2	13	<1	0.13
RMD-212	Grab	Opp. 8600 Ryan Rd.	25-Oct-18	0.7	<1	<2	13	<1	0.11
RMD-249	Grab	23000 Blk. Dyke Rd.	25-Oct-18	0.63	<1	<2	13	<1	0.11
RMD-208	Grab	13200 No. 4 Rd.	25-Oct-18	0.74	<1	2	13	<1	0.1
RMD-205	Grab	13851 Steveston Hwy.	25-Oct-18	0.57	<1	<2	12	<1	0.11
RMD-202	Grab	1500 Valemont Way	25-Oct-18	0.6	<1	<2	13	<1	0.09
RMD-214	Grab	11720 Westminster Hwy.	25-Oct-18	0.81	<1	<2	13	<1	0.13
RMD-251	Grab	5951McCallan Rd.	29-Oct-18	0.85	<1	<2	12	<1	0.15
RMD-273	Grab	Opp. 8331 Fairfax Place	29-Oct-18	0.67	<1	<2	14	<1	0.14
RMD-252	Grab	9751 Pendleton Rd.	29-Oct-18	0.72	<1	<2	12	<1	0.11
RMD-274	Grab	10920 Springwood Court	29-Oct-18	0.77	<1	<2	12	<1	0.11
RMD-253	Grab	11051 No 3 Rd.	29-Oct-18	0.68	<1	<2	12	<1	0.16
RMD-269	Grab	14951 Triangle Rd.	29-Oct-18	0.58	<1	2	12	<1	0.1
RMD-270	Grab	8200 Jones Rd.	29-Oct-18	0.72	<1	<2	12	<1	0.13
RMD-254	Grab	5300 No. 3 Rd.	29-Oct-18	0.87	<1	<2	11	<1	0.18
RMD-256	Grab	1000 Blk. McDonald Rd.	29-Oct-18	0.58	<1	<2	12	<1	0.48
RMD-255	Grab	6000 Blk. Miller Rd.	29-Oct-18	0.97	<1	<2	11	<1	0.37
RMD-271	Grab	3800 Cessna Drive	29-Oct-18	0.93	<1	<2	12	<1	0.14
RMD-272	Grab	751 Catalina Cres.	29-Oct-18	0.91	<1	<2	12	<1	0.28
RMD-250	Grab	6071 Azure Rd.	29-Oct-18	0.86	<1	<2	12	<1	0.22
RMD-263	Grab	12560 Cambie Rd.	31-Oct-18	0.75	<1	<2	12	<1	0.14
RMD-264	Grab	13100 Mitchell Rd.	31-Oct-18	0.59	<1	4	10	<1	0.34
RMD-277	Grab	Opp. 11280 Twigg Place	31-Oct-18	0.82	<1	<2	11	<1	0.15
RMD-262	Grab	13799 Commerce Pkwy.	31-Oct-18	0.63	<1	10	11	<1	0.24
RMD-278	Grab	6651 Fraserwood Place	31-Oct-18	0.68	<1	2	11	<1	0.15
RMD-279	Grab	Opp. 20371 Westminster Hwy.	31-Oct-18	0.66	<1	<2	10	<1	0.14
RMD-261	Grab	9911 Sidaway Rd.	31-Oct-18	0.59	<1	2	12	<1	0.14

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-260	Grab	11111 Horseshoe Way	31-Oct-18	0.76	<1	<2	12	<1	0.14
RMD-259	Grab	10020 Amethyst Ave.	31-Oct-18	0.76	<1	<2	11	<1	0.15
RMD-266	Grab	9380 General Currie Rd.	31-Oct-18	0.72	<1	<2	11	<1	0.12
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	31-Oct-18	0.83	<1	4	13	<1	0.16
RMD-258	Grab	7000 Blk. Dyke Rd.	31-Oct-18	0.76	<1	<2	12	<1	0.12
RMD-257	Grab	6640 Blundell Rd.	31-Oct-18	0.73	<1	<2	10	<1	0.13
RMD-204	Grab	3180 Granville Ave.	2-Nov-18	0.74	<1	<2	12	<1	0.18
RMD-206	Grab	4251 Moncton St.	2-Nov-18	0.71	<1	<2	12	<1	0.29
RMD-216	Grab	11080 No. 2 Rd.	2-Nov-18	0.8	<1	<2	12	<1	0.18
RMD-280	Grab	11500 McKenzie Rd.	2-Nov-18	0.7	<1	<2	13	<1	0.13
RMD-212	Grab	Opp. 8600 Ryan Rd.	2-Nov-18	0.75	<1	<2	13	<1	0.18
RMD-208	Grab	13200 No. 4 Rd.	2-Nov-18	0.79	<1	2	13	<1	0.13
RMD-205	Grab	13851 Steveston Hwy.	2-Nov-18	0.71	<1	<2	13	<1	0.18
RMD-202	Grab	1500 Valemont Way	2-Nov-18	0.72	<1	<2	12	<1	0.22
RMD-214	Grab	11720 Westminster Hwy.	2-Nov-18	0.81	<1	<2	13	<1	0.17
RMD-267	Grab	17240 Fedoruk	2-Nov-18	0.65	<1	<2	14	<1	0.12
RMD-249	Grab	23000 Blk. Dyke Rd.	2-Nov-18	0.69	<1	<2	13	<1	0.18
RMD-276	Grab	22271 Cochrane Drive	2-Nov-18	0.71	<1	<2	14	<1	0.19
RMD-275	Grab	5180 Smith Cres.	2-Nov-18	0.63	<1	<2	13	<1	0.16
RMD-203	Grab	23260 Westminster Hwy.	2-Nov-18	0.67	<1	<2	12	<1	0.18
RMD-251	Grab	5951McCallan Rd.	5-Nov-18	0.86	<1	<2	10	<1	0.17
RMD-273	Grab	Opp. 8331 Fairfax Place	5-Nov-18	0.68	<1	<2	12	<1	0.19
RMD-252	Grab	9751 Pendleton Rd.	5-Nov-18	0.55	<1	<2	11	<1	0.12
RMD-274	Grab	10920 Springwood Court	5-Nov-18	0.71	<1	<2	12	<1	0.18
RMD-253	Grab	11051 No 3 Rd.	5-Nov-18	0.69	<1	<2	11	<1	0.17
RMD-269	Grab	14951 Triangle Rd.	5-Nov-18	0.59	<1	<2	11	<1	0.53
RMD-270	Grab	8200 Jones Rd.	5-Nov-18	0.65	<1	<2	11	<1	0.23
RMD-254	Grab	5300 No. 3 Rd.	5-Nov-18	0.75	<1	<2	11	<1	0.27
RMD-256	Grab	1000 Blk. McDonald Rd.	5-Nov-18	0.53	<1	<2	11	<1	1.5
RMD-255	Grab	6000 Blk. Miller Rd.	5-Nov-18	0.8	<1	2	10	<1	0.25
RMD-271	Grab	3800 Cessna Drive	5-Nov-18	0.84	<1	<2	11	<1	0.15
RMD-272	Grab	751 Catalina Cres.	5-Nov-18	0.87	<1	2	11	<1	0.28
RMD-250	Grab	6071 Azure Rd.	5-Nov-18	0.76	<1	<2	11	<1	0.16
RMD-263	Grab	12560 Cambie Rd.	7-Nov-18	0.72	<1	<2	10	<1	0.23
RMD-264	Grab	13100 Mitchell Rd.	7-Nov-18	0.79	<1	<2	10	<1	0.27
RMD-277	Grab	Opp. 11280 Twigg Place	7-Nov-18	0.77	<1	<2	10	<1	0.26
RMD-262	Grab	13799 Commerce Pkwy.	7-Nov-18	0.7	<1	4	10	<1	0.18
RMD-278	Grab	6651 Fraserwood Place	7-Nov-18	0.64	<1	2	10	<1	0.36
RMD-279	Grab	Opp. 20371 Westminster Hwy.	7-Nov-18	0.68	<1	<2	10	<1	0.18
RMD-261	Grab	9911 Sidaway Rd.	7-Nov-18	0.67	<1	<2	10	<1	0.22

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-260	Grab	11111 Horseshoe Way	7-Nov-18	0.87	<1	<2	10	<1	0.17
RMD-259	Grab	10020 Amethyst Ave.	7-Nov-18	0.8	<1	6	10	<1	0.15
RMD-266	Grab	9380 General Currie Rd.	7-Nov-18	0.71	<1	2	10	<1	0.17
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	7-Nov-18	0.81	<1	<2	10	<1	0.13
RMD-258	Grab	7000 Blk. Dyke Rd.	7-Nov-18	0.84	<1	8	10	<1	0.22
RMD-257	Grab	6640 Blundell Rd.	7-Nov-18	0.75	<1	<2	10	<1	0.43
RMD-204	Grab	3180 Granville Ave.	8-Nov-18	0.61	<1	<2	11	<1	0.22
RMD-206	Grab	4251 Moncton St.	8-Nov-18	0.63	<1	<2	11	<1	0.19
RMD-216	Grab	11080 No. 2 Rd.	8-Nov-18	0.78	<1	12	10	<1	0.14
RMD-280	Grab	11500 McKenzie Rd.	8-Nov-18	0.5	<1	2	11	<1	0.13
RMD-212	Grab	Opp. 8600 Ryan Rd.	8-Nov-18	0.76	<1	<2	10	<1	0.19
RMD-208	Grab	13200 No. 4 Rd.	8-Nov-18	0.65	<1	<2	12	<1	0.14
RMD-205	Grab	13851 Steveston Hwy.	8-Nov-18	0.71	<1	<2	10	<1	0.17
RMD-202	Grab	1500 Valemont Way	8-Nov-18	0.7	<1	<2	11	<1	0.2
RMD-214	Grab	11720 Westminster Hwy.	8-Nov-18	0.64	<1	<2	9	<1	0.18
RMD-267	Grab	17240 Fedoruk	8-Nov-18	0.63	<1	<2	10	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	8-Nov-18	0.71	<1	<2	10	<1	0.17
RMD-276	Grab	22271 Cochrane Drive	8-Nov-18	0.69	<1	<2	11	<1	0.17
RMD-275	Grab	5180 Smith Cres.	8-Nov-18	0.64	<1	<2	11	<1	0.14
RMD-203	Grab	23260 Westminster Hwy.	8-Nov-18	0.61	<1	<2	10	<1	0.21
RMD-251	Grab	5951McCallan Rd.	13-Nov-18	0.87	<1	<2	9	<1	0.15
RMD-273	Grab	Opp. 8331 Fairfax Place	13-Nov-18	0.65	<1	<2	12	<1	0.13
RMD-252	Grab	9751 Pendleton Rd.	13-Nov-18	0.64	<1	<2	12	<1	0.11
RMD-274	Grab	10920 Springwood Court	13-Nov-18	0.72	<1	<2	12	<1	0.13
RMD-253	Grab	11051 No 3 Rd.	13-Nov-18	0.73	<1	<2	11	<1	0.11
RMD-269	Grab	14951 Triangle Rd.	13-Nov-18	0.57	<1	<2	11	<1	0.13
RMD-270	Grab	8200 Jones Rd.	13-Nov-18	0.7	<1	<2	10	<1	0.12
RMD-254	Grab	5300 No. 3 Rd.	13-Nov-18	0.77	<1	<2	10	<1	0.11
RMD-255	Grab	6000 Blk. Miller Rd.	13-Nov-18	0.84	<1	<2	9	<1	0.32
RMD-256	Grab	1000 Blk. McDonald Rd.	13-Nov-18	0.5	<1	<2	10	<1	0.68
RMD-272	Grab	751 Catalina Cres.	13-Nov-18	0.87	<1	<2	9	<1	0.14
RMD-271	Grab	3800 Cessna Drive	13-Nov-18	0.68	<1	<2	12	<1	0.14
RMD-250	Grab	6071 Azure Rd.	13-Nov-18	0.84	<1	2	10	<1	0.14
RMD-263	Grab	12560 Cambie Rd.	14-Nov-18	0.79	<1	<2	10	<1	0.23
RMD-264	Grab	13100 Mitchell Rd.	14-Nov-18	0.78	<1	2	10	<1	0.28
RMD-277	Grab	Opp. 11280 Twigg Place	14-Nov-18	0.85	<1	<2	10	<1	0.27
RMD-278	Grab	6651 Fraserwood Place	14-Nov-18	0.58	<1	<2	11	<1	0.17
RMD-279	Grab	Opp. 20371 Westminster Hwy.	14-Nov-18	0.68	<1	<2	9	<1	0.17
RMD-261	Grab	9911 Sidaway Rd.	14-Nov-18	0.74	<1	<2	10	<1	0.17
RMD-260	Grab	11111 Horseshoe Way	14-Nov-18	0.79	<1	2	10	<1	0.21

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-259	Grab	10020 Amethyst Ave.	14-Nov-18	0.78	<1	<2	11	<1	0.18
RMD-266	Grab	9380 General Currie Rd.	14-Nov-18	0.77	<1	<2	10	<1	0.16
RMD-262	Grab	13799 Commerce Pkwy.	14-Nov-18	0.75	<1	<2	9	<1	0.26
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	14-Nov-18	0.81	<1	<2	10	<1	0.2
RMD-258	Grab	7000 Blk. Dyke Rd.	14-Nov-18	0.87	<1	<2	9	<1	0.23
RMD-257	Grab	6640 Blundell Rd.	14-Nov-18	0.81	<1	2	9	<1	0.42
RMD-204	Grab	3180 Granville Ave.	16-Nov-18	0.73	<1	<2	10	<1	0.1
RMD-206	Grab	4251 Moncton St.	16-Nov-18	0.71	<1	<2	10	<1	0.14
RMD-216	Grab	11080 No. 2 Rd.	16-Nov-18	0.76	<1	<2	9	<1	0.17
RMD-280	Grab	11500 McKenzie Rd.	16-Nov-18	0.74	<1	<2	10	<1	0.16
RMD-212	Grab	Opp. 8600 Ryan Rd.	16-Nov-18	0.8	<1	<2	9	<1	0.13
RMD-208	Grab	13200 No. 4 Rd.	16-Nov-18	0.8	<1	<2	9	<1	0.12
RMD-205	Grab	13851 Steveston Hwy.	16-Nov-18	0.63	<1	<2	10	<1	0.1
RMD-202	Grab	1500 Valemont Way	16-Nov-18	0.7	<1	<2	10	<1	0.14
RMD-214	Grab	11720 Westminster Hwy.	16-Nov-18	0.78	<1	<2	9	<1	0.1
RMD-267	Grab	17240 Fedoruk	16-Nov-18	0.62	<1	<2	10	<1	0.09
RMD-249	Grab	23000 Blk. Dyke Rd.	16-Nov-18	0.66	<1	2	9	<1	0.18
RMD-276	Grab	22271 Cochrane Drive	16-Nov-18	0.62	<1	2	10	<1	0.14
RMD-275	Grab	5180 Smith Cres.	16-Nov-18	0.63	<1	<2	10	<1	0.14
RMD-203	Grab	23260 Westminster Hwy.	16-Nov-18	0.6	<1	<2	10	<1	0.13
RMD-251	Grab	5951McCallan Rd.	19-Nov-18	0.95	<1	<2	8	<1	0.14
RMD-273	Grab	Opp. 8331 Fairfax Place	19-Nov-18	0.71	<1	2	11	<1	0.15
RMD-252	Grab	9751 Pendleton Rd.	19-Nov-18	0.76	<1	<2	10	<1	0.36
RMD-274	Grab	10920 Springwood Court	19-Nov-18	0.72	<1	<2	10	<1	0.1
RMD-253	Grab	11051 No 3 Rd.	19-Nov-18	0.82	<1	<2	10	<1	0.13
RMD-269	Grab	14951 Triangle Rd.	19-Nov-18	0.73	<1	<2	11	<1	0.14
RMD-270	Grab	8200 Jones Rd.	19-Nov-18	0.95	<1	2	9	<1	0.16
RMD-254	Grab	5300 No. 3 Rd.	19-Nov-18	0.88	<1	6	9	<1	0.34
RMD-256	Grab	1000 Blk. McDonald Rd.	19-Nov-18	0.66	<1	<2	10	<1	0.57
RMD-255	Grab	6000 Blk. Miller Rd.	19-Nov-18	1.04	<1	<2	9	<1	0.31
RMD-271	Grab	3800 Cessna Drive	19-Nov-18	0.96	<1	<2	10	<1	0.34
RMD-272	Grab	751 Catalina Cres.	19-Nov-18	1.03	<1	<2	9	<1	0.15
RMD-250	Grab	6071 Azure Rd.	19-Nov-18	0.94	<1	<2	10	<1	0.15
RMD-263	Grab	12560 Cambie Rd.	21-Nov-18	0.81	<1	<2	8	<1	0.18
RMD-264	Grab	13100 Mitchell Rd.	21-Nov-18	0.78	<1	<2	8	<1	0.15
RMD-277	Grab	Opp. 11280 Twigg Place	21-Nov-18	0.99	<1	<2	8	<1	0.16
RMD-262	Grab	13799 Commerce Pkwy.	21-Nov-18	0.71	<1	<2	9	<1	0.22
RMD-278	Grab	6651 Fraserwood Place	21-Nov-18	0.65	<1	<2	9	<1	0.16
RMD-279	Grab	Opp. 20371 Westminster Hwy.	21-Nov-18	0.69	<1	2	9	<1	0.09
RMD-261	Grab	9911 Sidaway Rd.	21-Nov-18	0.77	<1	[N/A mc	9	<1	0.23

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-260	Grab	11111 Horseshoe Way	21-Nov-18	1.13	<1	<2	8	<1	0.14
RMD-259	Grab	10020 Amethyst Ave.	21-Nov-18	0.83	<1	<2	9	<1	0.14
RMD-266	Grab	9380 General Currie Rd.	21-Nov-18	0.91	<1	<2	8	<1	0.1
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	21-Nov-18	0.78	<1	<2	9	<1	0.17
RMD-258	Grab	7000 Blk. Dyke Rd.	21-Nov-18	0.8	<1	<2	9	<1	0.1
RMD-257	Grab	6640 Blundell Rd.	21-Nov-18	0.7	<1	<2	8	<1	0.12
RMD-204	Grab	3180 Granville Ave.	22-Nov-18	0.88	<1	<2	10	<1	0.18
RMD-206	Grab	4251 Moncton St.	22-Nov-18	0.79	<1	<2	9	<1	0.11
RMD-216	Grab	11080 No. 2 Rd.	22-Nov-18	0.87	<1	<2	8	<1	0.11
RMD-280	Grab	11500 McKenzie Rd.	22-Nov-18	0.54	<1	2	9	<1	0.14
RMD-212	Grab	Opp. 8600 Ryan Rd.	22-Nov-18	0.91	<1	<2	8	<1	0.14
RMD-208	Grab	13200 No. 4 Rd.	22-Nov-18	0.8	<1	2	8	<1	0.14
RMD-205	Grab	13851 Steveston Hwy.	22-Nov-18	0.67	<1	<2	8	<1	0.11
RMD-202	Grab	1500 Valemont Way	22-Nov-18	0.63	<1	<2	9	<1	0.12
RMD-214	Grab	11720 Westminster Hwy.	22-Nov-18	1	<1	20	7	<1	0.13
RMD-267	Grab	17240 Fedoruk	22-Nov-18	0.63	<1	8	10	<1	0.12
RMD-249	Grab	23000 Blk. Dyke Rd.	22-Nov-18	0.67	<1	<2	10	<1	0.12
RMD-276	Grab	22271 Cochrane Drive	22-Nov-18	0.59	<1	<2	9	<1	0.15
RMD-275	Grab	5180 Smith Cres.	22-Nov-18	0.55	<1	<2	10	<1	0.13
RMD-203	Grab	23260 Westminster Hwy.	22-Nov-18	0.59	<1	<2	9	<1	0.11
RMD-251	Grab	5951McCallan Rd.	26-Nov-18	0.99	<1	18	8	<1	0.24
RMD-273	Grab	Opp. 8331 Fairfax Place	26-Nov-18	0.75	<1	2	10	<1	0.16
RMD-252	Grab	9751 Pendleton Rd.	26-Nov-18	0.74	<1	<2	10	<1	0.21
RMD-274	Grab	10920 Springwood Court	26-Nov-18	0.78	<1	2	10	<1	0.17
RMD-253	Grab	11051 No 3 Rd.	26-Nov-18	0.77	<1	<2	10	<1	0.15
RMD-269	Grab	14951 Triangle Rd.	26-Nov-18	0.65	<1	<2	10	<1	0.11
RMD-270	Grab	8200 Jones Rd.	26-Nov-18	0.81	<1	<2	10	<1	0.2
RMD-254	Grab	5300 No. 3 Rd.	26-Nov-18	0.86	<1	<2	10	<1	0.18
RMD-256	Grab	1000 Blk. McDonald Rd.	26-Nov-18	0.54	<1	<2	10	<1	0.39
RMD-255	Grab	6000 Blk. Miller Rd.	26-Nov-18	0.86	<1	8	9	<1	0.26
RMD-272	Grab	751 Catalina Cres.	26-Nov-18	0.93	<1	<2	10	<1	0.15
RMD-271	Grab	3800 Cessna Drive	26-Nov-18	0.95	<1	<2	10	<1	0.16
RMD-250	Grab	6071 Azure Rd.	26-Nov-18	1	<1	<2	9	<1	0.32
RMD-263	Grab	12560 Cambie Rd.	28-Nov-18	0.83	<1	<2	9	<1	0.11
RMD-264	Grab	13100 Mitchell Rd.	28-Nov-18	0.91	<1	2	9	<1	0.13
RMD-277	Grab	Opp. 11280 Twigg Place	28-Nov-18	1.08	<1	<2	9	<1	0.14
RMD-262	Grab	13799 Commerce Pkwy.	28-Nov-18	0.73	<1	<2	8	<1	0.1
RMD-278	Grab	6651 Fraserwood Place	28-Nov-18	0.74	<1	10	9	<1	0.11
RMD-279	Grab	Opp. 20371 Westminster Hwy.	28-Nov-18	0.82	<1	<2	8	<1	0.09
RMD-261	Grab	9911 Sidaway Rd.	28-Nov-18	0.9	<1	<2	9	<1	0.1

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-260	Grab	11111 Horseshoe Way	28-Nov-18	0.91	<1	4	9	<1	0.11
RMD-259	Grab	10020 Amethyst Ave.	28-Nov-18	0.96	<1	6	8	<1	0.12
RMD-266	Grab	9380 General Currie Rd.	28-Nov-18	0.92	<1	2	8	<1	0.11
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	28-Nov-18	0.97	<1	<2	9	<1	0.13
RMD-258	Grab	7000 Blk. Dyke Rd.	28-Nov-18	0.95	<1	<2	9	<1	0.12
RMD-257	Grab	6640 Blundell Rd.	28-Nov-18	1.05	<1	<2	9	<1	0.12
RMD-204	Grab	3180 Granville Ave.	30-Nov-18	0.97	<1	<2	8	<1	0.11
RMD-206	Grab	4251 Moncton St.	30-Nov-18	0.69	<1	<2	8	<1	0.12
RMD-216	Grab	11080 No. 2 Rd.	30-Nov-18	1.01	<1	<2	8	<1	0.11
RMD-280	Grab	11500 McKenzie Rd.	30-Nov-18	0.76	<1	<2	9	<1	0.1
RMD-212	Grab	Opp. 8600 Ryan Rd.	30-Nov-18	1	<1	<2	8	<1	0.11
RMD-208	Grab	13200 No. 4 Rd.	30-Nov-18	1.16	<1	<2	8	<1	0.12
RMD-205	Grab	13851 Steveston Hwy.	30-Nov-18	0.85	<1	<2	8	<1	0.13
RMD-202	Grab	1500 Valemont Way	30-Nov-18	0.65	<1	<2	7	<1	0.13
RMD-214	Grab	11720 Westminster Hwy.	30-Nov-18	0.8	<1	<2	7	<1	0.13
RMD-267	Grab	17240 Fedoruk	30-Nov-18	0.58	<1	2	8	<1	0.09
RMD-249	Grab	23000 Blk. Dyke Rd.	30-Nov-18	0.64	<1	<2	7	<1	0.12
RMD-276	Grab	22271 Cochrane Drive	30-Nov-18	0.61	<1	<2	7	<1	0.1
RMD-275	Grab	5180 Smith Cres.	30-Nov-18	0.66	<1	<2	8	<1	0.09
RMD-203	Grab	23260 Westminster Hwy.	30-Nov-18	0.67	<1	2	8	<1	0.12
RMD-251	Grab	5951McCallan Rd.	3-Dec-18	0.77	<1	<2	7	1	0.11
RMD-273	Grab	Opp. 8331 Fairfax Place	3-Dec-18	0.91	<1	<2	8	<1	0.16
RMD-252	Grab	9751 Pendleton Rd.	3-Dec-18	0.73	<1	<2	9	<1	0.12
RMD-274	Grab	10920 Springwood Court	3-Dec-18	0.87	<1	<2	9	<1	0.1
RMD-253	Grab	11051 No 3 Rd.	3-Dec-18	0.91	<1	<2	9	<1	0.12
RMD-270	Grab	8200 Jones Rd.	3-Dec-18	0.76	<1	<2	8	<1	0.18
RMD-250	Grab	6071 Azure Rd.	3-Dec-18	0.78	<1	<2	8	<1	0.1
RMD-254	Grab	5300 No. 3 Rd.	3-Dec-18	0.76	<1	<2	9	<1	0.18
RMD-256	Grab	1000 Blk. McDonald Rd.	3-Dec-18	0.48	<1	<2	9	<1	0.69
RMD-255	Grab	6000 Blk. Miller Rd.	3-Dec-18	0.96	<1	2	7	<1	0.29
RMD-272	Grab	751 Catalina Cres.	3-Dec-18	0.96	<1	6	7	<1	0.19
RMD-271	Grab	3800 Cessna Drive	3-Dec-18	0.96	<1	<2	8	<1	0.1
RMD-269	Grab	14951 Triangle Rd.	3-Dec-18	0.54	<1	<2	10	<1	0.22
RMD-263	Grab	12560 Cambie Rd.	5-Dec-18	0.74	<1	<2	6	<1	0.21
RMD-264	Grab	13100 Mitchell Rd.	5-Dec-18	0.87	<1	<2	5	<1	0.21
RMD-277	Grab	Opp. 11280 Twigg Place	5-Dec-18	0.91	<1	2	7	<1	0.23
RMD-262	Grab	13799 Commerce Pkwy.	5-Dec-18	0.75	<1	2	7	<1	0.2
RMD-278	Grab	6651 Fraserwood Place	5-Dec-18	0.66	<1	<2	7	<1	0.12
RMD-279	Grab	Opp. 20371 Westminster Hwy.	5-Dec-18	0.66	<1	4	6	<1	0.16
RMD-261	Grab	9911 Sidaway Rd.	5-Dec-18	0.95	<1	<2	7	<1	0.35

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-260	Grab	11111 Horseshoe Way	5-Dec-18	0.89	<1	<2	7	<1	0.18
RMD-259	Grab	10020 Amethyst Ave.	5-Dec-18	0.84	<1	<2	7	<1	0.24
RMD-266	Grab	9380 General Currie Rd.	5-Dec-18	0.83	<1	<2	6	<1	0.19
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	5-Dec-18	0.76	<1	<2	7	<1	0.18
RMD-258	Grab	7000 Blk. Dyke Rd.	5-Dec-18	0.84	<1	<2	7	<1	0.2
RMD-257	Grab	6640 Blundell Rd.	5-Dec-18	0.86	<1	<2	7	<1	0.22
RMD-205	Grab	13851 Steveston Hwy.	6-Dec-18	0.74	<1	<2	8	<1	0.23
RMD-202	Grab	1500 Valemont Way	6-Dec-18	0.71	<1	<2	7	<1	0.27
RMD-203	Grab	23260 Westminster Hwy.	6-Dec-18	0.64	<1	<2	7	<1	0.26
RMD-275	Grab	5180 Smith Cres.	6-Dec-18	0.7	<1	<2	8	<1	0.21
RMD-276	Grab	22271 Cochrane Drive	6-Dec-18	0.73	<1	2	6	<1	0.18
RMD-249	Grab	23000 Blk. Dyke Rd.	6-Dec-18	0.67	<1	<2	8	<1	0.27
RMD-267	Grab	17240 Fedoruk	6-Dec-18	0.67	<1	<2	8	<1	0.2
RMD-214	Grab	11720 Westminster Hwy.	6-Dec-18	0.95	<1	<2	7	<1	0.17
RMD-206	Grab	4251 Moncton St.	6-Dec-18	0.76	<1	<2	7	<1	0.23
RMD-204	Grab	3180 Granville Ave.	6-Dec-18	0.72	<1	2	7	<1	0.27
RMD-280	Grab	11500 McKenzie Rd.	6-Dec-18	0.56	<1	<2	9	<1	0.22
RMD-212	Grab	Opp. 8600 Ryan Rd.	6-Dec-18	0.88	<1	6	7	<1	0.19
RMD-208	Grab	13200 No. 4 Rd.	6-Dec-18	0.82	<1	<2	8	<1	0.22
RMD-251	Grab	5951McCallan Rd.	10-Dec-18	0.91	<1	2	8	<1	0.18
RMD-273	Grab	Opp. 8331 Fairfax Place	10-Dec-18	0.84	<1	<2	8	<1	0.15
RMD-252	Grab	9751 Pendleton Rd.	10-Dec-18	0.75	<1	<2	9	<1	0.15
RMD-274	Grab	10920 Springwood Court	10-Dec-18	0.96	<1	<2	9	<1	0.13
RMD-253	Grab	11051 No 3 Rd.	10-Dec-18	0.79	<1	<2	8	<1	0.12
RMD-269	Grab	14951 Triangle Rd.	10-Dec-18	0.74	<1	<2	9	<1	0.12
RMD-270	Grab	8200 Jones Rd.	10-Dec-18	1	<1	<2	8	<1	0.15
RMD-254	Grab	5300 No. 3 Rd.	10-Dec-18	0.89	<1	<2	8	<1	0.14
RMD-256	Grab	1000 Blk. McDonald Rd.	10-Dec-18	0.61	<1	<2	8	<1	0.24
RMD-255	Grab	6000 Blk. Miller Rd.	10-Dec-18	1	<1	2	7	<1	0.29
RMD-271	Grab	3800 Cessna Drive	10-Dec-18	1.03	<1	<2	8	<1	0.14
RMD-272	Grab	751 Catalina Cres.	10-Dec-18	0.98	<1	<2	8	<1	0.16
RMD-250	Grab	6071 Azure Rd.	10-Dec-18	0.93	<1	<2	8	<1	0.16
RMD-257	Grab	6640 Blundell Rd.	12-Dec-18	0.78	<1	<2	6	<1	0.1
RMD-258	Grab	7000 Blk. Dyke Rd.	12-Dec-18	0.78	<1	<2	6	<1	0.58
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	12-Dec-18	0.85	<1	<2	6	<1	0.25
RMD-260	Grab	11111 Horseshoe Way	12-Dec-18	0.84	<1	<2	7	<1	0.15
RMD-259	Grab	10020 Amethyst Ave.	12-Dec-18	0.95	<1	<2	7	<1	0.11
RMD-266	Grab	9380 General Currie Rd.	12-Dec-18	0.99	<1	<2	6	<1	0.11
RMD-261	Grab	9911 Sidaway Rd.	12-Dec-18	0.88	<1	<2	6	<1	0.11
RMD-262	Grab	13799 Commerce Pkwy.	12-Dec-18	0.87	<1	<2	6	<1	0.16

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-263	Grab	12560 Cambie Rd.	12-Dec-18	0.95	<1	<2	7	<1	0.12
RMD-264	Grab	13100 Mitchell Rd.	12-Dec-18	1	<1	<2	7	<1	0.14
RMD-277	Grab	Opp. 11280 Twigg Place	12-Dec-18	1.05	<1	<2	7	<1	0.14
RMD-278	Grab	6651 Fraserwood Place	12-Dec-18	0.75	<1	<2	8	<1	0.12
RMD-279	Grab	Opp. 20371 Westminster Hwy.	12-Dec-18	0.92	<1	<2	7	<1	0.15
RMD-204	Grab	3180 Granville Ave.	13-Dec-18	0.82	<1	2	6	<1	0.32
RMD-206	Grab	4251 Moncton St.	13-Dec-18	0.78	<1	<2	7	<1	0.37
RMD-216	Grab	11080 No. 2 Rd.	13-Dec-18	0.78	<1	<2	7	<1	0.35
RMD-280	Grab	11500 McKenzie Rd.	13-Dec-18	0.67	<1	<2	7	<1	0.39
RMD-212	Grab	Opp. 8600 Ryan Rd.	13-Dec-18	0.85	<1	<2	7	<1	0.3
RMD-208	Grab	13200 No. 4 Rd.	13-Dec-18	0.79	<1	<2	7	<1	0.26
RMD-205	Grab	13851 Steveston Hwy.	13-Dec-18	0.8	<1	<2	6	<1	0.27
RMD-202	Grab	1500 Valemont Way	13-Dec-18	0.7	<1	<2	6	<1	0.33
RMD-214	Grab	11720 Westminster Hwy.	13-Dec-18	0.88	<1	<2	6	<1	0.22
RMD-267	Grab	17240 Fedoruk	13-Dec-18	0.7	<1	<2	7	<1	0.38
RMD-249	Grab	23000 Blk. Dyke Rd.	13-Dec-18	0.64	<1	<2	7	<1	0.32
RMD-276	Grab	22271 Cochrane Drive	13-Dec-18	0.77	<1	<2	6	<1	0.3
RMD-275	Grab	5180 Smith Cres.	13-Dec-18	0.76	<1	<2	6	<1	1.1
RMD-203	Grab	23260 Westminster Hwy.	13-Dec-18	0.75	<1	<2	6	<1	0.38
RMD-251	Grab	5951McCallan Rd.	17-Dec-18	0.96	<1	NA	6	<1	0.15
RMD-273	Grab	Opp. 8331 Fairfax Place	17-Dec-18	0.51	<1	NA	8	<1	0.18
RMD-252	Grab	9751 Pendleton Rd.	17-Dec-18	0.73	<1	NA	7	<1	0.14
RMD-274	Grab	10920 Springwood Court	17-Dec-18	0.6	<1	NA	7	<1	0.16
RMD-253	Grab	11051 No 3 Rd.	17-Dec-18	0.74	<1	NA	6	<1	0.11
RMD-269	Grab	14951 Triangle Rd.	17-Dec-18	0.73	<1	NA	8	<1	0.13
RMD-270	Grab	8200 Jones Rd.	17-Dec-18	0.85	<1	NA	7	<1	0.42
RMD-254	Grab	5300 No. 3 Rd.	17-Dec-18	0.69	<1	NA	7	<1	0.11
RMD-256	Grab	1000 Blk. McDonald Rd.	17-Dec-18	0.62	<1	NA	7	<1	0.45
RMD-255	Grab	6000 Blk. Miller Rd.	17-Dec-18	0.79	<1	NA	6	<1	0.4
RMD-271	Grab	3800 Cessna Drive	17-Dec-18	0.84	<1	NA	8	<1	0.18
RMD-272	Grab	751 Catalina Cres.	17-Dec-18	0.87	<1	NA	6	<1	0.12
RMD-250	Grab	6071 Azure Rd.	17-Dec-18	0.81	<1	NA	7	<1	0.16
RMD-263	Grab	12560 Cambie Rd.	19-Dec-18	0.68	<1	NA	6	<1	0.15
RMD-264	Grab	13100 Mitchell Rd.	19-Dec-18	0.88	<1	NA	6	<1	0.15
RMD-277	Grab	Opp. 11280 Twigg Place	19-Dec-18	0.92	<1	NA	7	<1	0.1
RMD-262	Grab	13799 Commerce Pkwy.	19-Dec-18	0.78	<1	NA	6	<1	0.1
RMD-278	Grab	6651 Fraserwood Place	19-Dec-18	0.78	<1	NA	7	<1	0.09
RMD-279	Grab	Opp. 20371 Westminster Hwy.	19-Dec-18	0.73	<1	NA	5	<1	0.1
RMD-261	Grab	9911 Sidaway Rd.	19-Dec-18	0.73	<1	NA	6	<1	0.15
RMD-260	Grab	11111 Horseshoe Way	19-Dec-18	0.9	<1	NA	6	<1	0.13

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-259	Grab	10020 Amethyst Ave.	19-Dec-18	0.79	<1	NA	7	<1	0.12
RMD-266	Grab	9380 General Currie Rd.	19-Dec-18	0.77	<1	NA	5	<1	0.16
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	19-Dec-18	0.79	<1	NA	6	<1	0.09
RMD-258	Grab	7000 Blk. Dyke Rd.	19-Dec-18	0.82	<1	NA	7	<1	0.14
RMD-257	Grab	6640 Blundell Rd.	19-Dec-18	0.89	<1	NA	6	<1	0.1
RMD-204	Grab	3180 Granville Ave.	20-Dec-18	0.79	<1	NA	7	<1	0.12
RMD-206	Grab	4251 Moncton St.	20-Dec-18	0.74	<1	NA	6	<1	0.09
RMD-216	Grab	11080 No. 2 Rd.	20-Dec-18	0.81	<1	NA	6	<1	0.13
RMD-280	Grab	11500 McKenzie Rd.	20-Dec-18	0.61	<1	NA	8	<1	0.15
RMD-212	Grab	Opp. 8600 Ryan Rd.	20-Dec-18	0.8	<1	NA	7	<1	0.13
RMD-208	Grab	13200 No. 4 Rd.	20-Dec-18	0.77	<1	NA	7	<1	0.09
RMD-205	Grab	13851 Steveston Hwy.	20-Dec-18	0.78	<1	NA	6	<1	0.11
RMD-202	Grab	1500 Valemont Way	20-Dec-18	0.75	<1	NA	5	<1	0.14
RMD-214	Grab	11720 Westminster Hwy.	20-Dec-18	0.96	<1	NA	6	<1	0.13
RMD-267	Grab	17240 Fedoruk	20-Dec-18	0.64	<1	NA	6	<1	0.13
RMD-249	Grab	23000 Blk. Dyke Rd.	20-Dec-18	0.68	<1	NA	6	<1	0.1
RMD-276	Grab	22271 Cochrane Drive	20-Dec-18	0.65	<1	NA	6	<1	0.15
RMD-275	Grab	5180 Smith Cres.	20-Dec-18	0.63	<1	NA	7	<1	0.11
RMD-203	Grab	23260 Westminster Hwy.	20-Dec-18	0.67	<1	NA	6	<1	0.14
RMD-256	Grab	1000 Blk. McDonald Rd.	27-Dec-18	0.8	<1	NA	5	<1	0.22
RMD-255	Grab	6000 Blk. Miller Rd.	27-Dec-18	0.98	<1	NA	6	<1	0.39
RMD-257	Grab	6640 Blundell Rd.	27-Dec-18	0.85	<1	NA	6	<1	0.18
RMD-258	Grab	7000 Blk. Dyke Rd.	27-Dec-18	0.85	<1	NA	5	<1	0.16
RMD-271	Grab	3800 Cessna Drive	27-Dec-18	0.83	<1	NA	6	<1	0.5
RMD-268	Grab	13800 No. 3 Rd. (off Garden City)	27-Dec-18	0.74	<1	NA	7	<1	0.13
RMD-272	Grab	751 Catalina Cres.	27-Dec-18	0.89	<1	NA	6	<1	0.09
RMD-250	Grab	6071 Azure Rd.	27-Dec-18	0.82	<1	NA	4	<1	0.09
RMD-259	Grab	10020 Amethyst Ave.	27-Dec-18	0.86	<1	NA	7	<1	0.13
RMD-251	Grab	5951McCallan Rd.	27-Dec-18	0.66	<1	NA	6	<1	0.1
RMD-266	Grab	9380 General Currie Rd.	27-Dec-18	1	<1	NA	6	<1	0.16
RMD-260	Grab	11111 Horseshoe Way	27-Dec-18	0.86	<1	NA	6	<1	0.14
RMD-273	Grab	Opp. 8331 Fairfax Place	27-Dec-18	0.91	<1	NA	5	<1	0.12
RMD-252	Grab	9751 Pendleton Rd.	27-Dec-18	0.65	<1	NA	6	<1	0.09
RMD-261	Grab	9911 Sidaway Rd.	27-Dec-18	0.83	<1	NA	7	<1	0.13
RMD-262	Grab	13799 Commerce Pkwy.	27-Dec-18	0.87	<1	NA	5	<1	0.13
RMD-274	Grab	10920 Springwood Court	27-Dec-18	0.61	<1	NA	5	<1	0.08
RMD-253	Grab	11051 No 3 Rd.	27-Dec-18	0.73	<1	NA	6	<1	0.1
RMD-263	Grab	12560 Cambie Rd.	27-Dec-18	0.85	<1	NA	6	<1	0.2
RMD-264	Grab	13100 Mitchell Rd.	27-Dec-18	0.62	<1	NA	7	<1	0.16
RMD-269	Grab	14951 Triangle Rd.	27-Dec-18	0.77	<1	NA	6	<1	0.08

Sample Name	Sample Type	Sample Reported Name	Sampled Date	Chlorine Free (mg/L)	Ecoli (CFU/100mLs)	HPC (CFU/mL)	Temperature (°C)	Total Coliform (CFU/100mLs)	Turbidity (NTU)
RMD-277	Grab	Opp. 11280 Twigg Place	27-Dec-18	0.85	<1	NA	6	<1	0.13
RMD-270	Grab	8200 Jones Rd.	27-Dec-18	0.72	<1	NA	5	<1	0.11
RMD-278	Grab	6651 Fraserwood Place	27-Dec-18	0.85	<1	NA	7	<1	0.11
RMD-254	Grab	5300 No. 3 Rd.	27-Dec-18	0.64	<1	NA	5	<1	0.11
RMD-279	Grab	Opp. 20371 Westminster Hwy.	27-Dec-18	0.79	<1	NA	8	<1	0.12
RMD-204	Grab	3180 Granville Ave.	28-Dec-18	0.73	<1	NA	5	<1	0.14
RMD-206	Grab	4251 Moncton St.	28-Dec-18	0.73	<1	NA	5	<1	0.12
RMD-216	Grab	11080 No. 2 Rd.	28-Dec-18	0.78	<1	NA	6	<1	0.12
RMD-280	Grab	11500 McKenzie Rd.	28-Dec-18	0.67	<1	NA	7	<1	0.15
RMD-212	Grab	Opp. 8600 Ryan Rd.	28-Dec-18	0.79	<1	NA	6	<1	0.16
RMD-208	Grab	13200 No. 4 Rd.	28-Dec-18	0.86	<1	NA	6	<1	0.11
RMD-205	Grab	13851 Steveston Hwy.	28-Dec-18	0.87	<1	NA	6	<1	0.15
RMD-202	Grab	1500 Valemont Way	28-Dec-18	0.74	<1	NA	5	<1	0.13
RMD-214	Grab	11720 Westminster Hwy.	28-Dec-18	0.87	<1	NA	5	<1	0.14
RMD-267	Grab	17240 Fedoruk	28-Dec-18	0.69	<1	NA	6	<1	0.15
RMD-249	Grab	23000 Blk. Dyke Rd.	28-Dec-18	0.77	<1	NA	6	<1	0.15
RMD-276	Grab	22271 Cochrane Drive	28-Dec-18	0.77	<1	NA	6	<1	0.14
RMD-275	Grab	5180 Smith Cres.	28-Dec-18	0.76	<1	NA	7	1	0.26
RMD-203	Grab	23260 Westminster Hwy.	28-Dec-18	0.75	<1	NA	7	<1	0.13

APPENDIX 4: 2018 THM AND HAA TEST RESULTS

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-250	2016/10/19	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27.3	
RMD-250	2017/03/06	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	17.9	
RMD-250	2017/05/15	<1	<1	<1	19	21		<0.5	10	<1	<2	11.6	23.6	
RMD-250	2017/08/23	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	16.9	**21**
RMD-250	2017/11/29	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21.4	**20**

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-250	2018/02/15	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18.4	**20**
RMD-250	2018/05/30	<1	<1	<1	22	22	**22**	<0.5	7	<1	<2	5.6	14.3	**18**
RMD-251	2016/10/19	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26.2	
RMD-251	2017/03/06	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	19.9	
RMD-251	2017/05/15	<1	<1	<1	19	21		<0.5	10	<1	<2	10.8	23.3	
RMD-251	2017/08/23	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	2017/11/29	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	14.7	**18**

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-251	2018/02/15	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	18.8	**18**
RMD-251	2018/05/30	<1	<1	<1	22	22	**22**	<0.5	4	<1	<2	3.5	9.1	**15**
RMD-258	2016/10/19	1	<1	<1	24	26		<0.5	11	<1	7	17	35.7	
RMD-258	2017/03/06	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	2017/05/15	<1	<1	<1	17	18		<0.5	11	<1	<2	11.1	24.3	
RMD-258	2017/08/23	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	19.7	**25**
RMD-258	2017/11/29	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-258	2018/02/15	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	22.6	**22**
RMD-258	2018/05/30	<1	<1	<1	22	22	**24**	<0.5	7	<1	<2	5.5	14.9	**20**
RMD-259	2016/10/19	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36.4	
RMD-259	2017/03/06	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	19.8	
RMD-259	2017/05/15	<1	<1	<1	21	23		<0.5	11	<1	<2	10.7	23.8	
RMD-259	2017/08/23	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	18.9	**25**
RMD-259	2017/11/29	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	26.7	**22**

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guileline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guileline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-259	2018/02/15	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	20.6	**23**
RMD-259	2018/05/30	<1	<1	<1	25	25	**26**	<0.5	8	<1	<2	7.4	18	**21**
RMD-250	6-Mar-17	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	17.9	
RMD-250	15-May-17	<1	<1	<1	19	21		<0.5	10	<1	<2	11.6	23.6	
RMD-250	23-Aug-17	<1	<1	<1	21	21		<0.5	9	<1	<2	6.5	16.9	
RMD-250	29-Nov-17	<1	<1	<1	24	25	22	<0.5	10	<1	<2	10.6	21.4	20
RMD-250	15-Feb-18	<1	<1	<1	20	21	22	<0.5	8	<1	<2	8.7	18.4	20

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-250	30-May-18	<1	<1	<1	22	22	22	<0.5	7	<1	<2	5.6	14.3	18
RMD-250	8-Aug-18	<1	<1	<1	18	18	22	<0.5	6	<1	<2	5.2	12.2	17
RMD-251	6-Mar-17	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	19.9	
RMD-251	15-May-17	<1	<1	<1	19	21		<0.5	10	<1	<2	10.8	23.3	
RMD-251	23-Aug-17	<1	<1	<1	21	21		<0.5	10	<1	<2	5.9	16	
RMD-251	29-Nov-17	<1	<1	<1	25	26	22	<0.5	8	<1	<2	5.7	14.7	18
RMD-251	15-Feb-18	<1	<1	<1	19	20	22	<0.5	8	<1	<2	8.3	18.8	18

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-251	30-May-18	<1	<1	<1	22	22	22	<0.5	4	<1	<2	3.5	9.1	15
RMD-251	8-Aug-18	<1	<1	<1	16	16	21	<0.5	6	<1	<2	4.8	11.7	14
RMD-258	6-Mar-17	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-17	<1	<1	<1	17	18		<0.5	11	<1	<2	11.1	24.3	
RMD-258	23-Aug-17	<1	<1	<1	25	25		<0.5	11	<1	<2	7.7	19.7	
RMD-258	29-Nov-17	<1	<1	<1	25	25	22	<0.5	11	<1	<2	9.7	22	21
RMD-258	15-Feb-18	<1	<1	<1	22	23	23	<0.5	9	<1	<2	10.8	22.6	22

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	<1	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	11	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	<1	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-258	30-May-18	<1	<1	<1	22	22	24	<0.5	7	<1	<2	5.5	14.9	20
RMD-258	8-Aug-18	<1	<1	<1	22	22	23	<0.5	8	<1	<2	6.7	15.8	19
RMD-259	6-Mar-17	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	19.8	
RMD-259	15-May-17	<1	<1	<1	21	23		<0.5	11	<1	<2	10.7	23.8	
RMD-259	23-Aug-17	<1	<1	<1	26	26		<0.5	11	<1	<2	7.3	18.9	
RMD-259	29-Nov-17	<1	<1	<1	28	29	25	<0.5	11	<1	<2	13.8	26.7	22
RMD-259	15-Feb-18	<1	<1	<1	22	23	25	<0.5	9	<1	<2	9.7	20.6	23

Sample	Date Sampled	THM (ppb)						HAA (ppb)						
		Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100 ppb)	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80 ppb)
RMD-250	31-Aug-2016	1	<1	<1	21	24		<0.5	9	<1	4	7.3	21	
RMD-250	19-Oct-2016	<1	<1	<1	24	26		<0.5	9	<1	5	12.7	27	
RMD-250	6-Mar-2017	<1	<1	<1	17	19		<0.5	7	<1	<2	9.7	18	
RMD-250	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	11.6	24	**22**
RMD-250	23-Aug-2017	<1	<1	<1	21	21	**22**	<0.5	9	<1	<2	6.5	17	**21**
RMD-250	29-Nov-2017	<1	<1	<1	24	25	**22**	<0.5	10	<1	<2	10.6	21	**20**
RMD-250	15-Feb-2018	<1	<1	<1	20	21	**22**	<0.5	8	<1	<2	8.7	18	**20**
RMD-251	31-Aug-2016	1	<1	<1	26	28		<0.5	9	<1	3	7	20	
RMD-251	19-Oct-2016	<1	<1	<1	23	25		<0.5	9	<1	6	10.9	26	
RMD-251	6-Mar-2017	<1	<1	<1	17	18		<0.5	7	<1	<2	10.7	20	
RMD-251	15-May-2017	<1	<1	<1	19	21	**23**	<0.5	10	<1	<2	10.8	23	**22**
RMD-251	23-Aug-2017	<1	<1	<1	21	21	**21**	<0.5	10	<1	<2	5.9	16	**21**
RMD-251	29-Nov-2017	<1	<1	<1	25	26	**22**	<0.5	8	<1	<2	5.7	15	**18**
RMD-251	15-Feb-2018	<1	<1	<1	19	20	**22**	<0.5	8	<1	<2	8.3	19	**18**
RMD-258	31-Aug-2016	1	<1	<1	26	28		<0.5	10	<1	4	7.9	23	
RMD-258	19-Oct-2016	1	<1	<1	24	26		<0.5	11	<1	7	17	36	
RMD-258	6-Mar-2017	<1	<1	<1	18	20		<0.5	7	<1	<2	10.5	19	
RMD-258	15-May-2017	<1	<1	<1	17	18	**23**	<0.5	11	<1	<2	11.1	24	**25**
RMD-258	23-Aug-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	7.7	20	**25**
	29-Nov-2017	<1	<1	<1	25	25	**22**	<0.5	11	<1	<2	9.7	22	**21**
RMD-258	15-Feb-2018	<1	<1	<1	22	23	**23**	<0.5	9	<1	<2	10.8	23	**22**
RMD-259	31-Aug-2016	2	<1	<1	29	32		<0.5	12	<1	5	10.1	28	
RMD-259	19-Oct-2016	1	<1	**<1**	27	29		<0.5	12	<1	7	17.2	36	
RMD-259	6-Mar-2017	<1	<1	<1	18	20		<0.5	8	<1	<2	10.5	20	
RMD-259	15-May-2017	<1	<1	<1	21	23	**26**	<0.5	11	<1	<2	10.7	24	**27**
RMD-259	23-Aug-2017	<1	<1	<1	26	26	**25**	<0.5	11	<1	<2	7.3	19	**25**
RMD-259	29-Nov-2017	<1	<1	<1	28	29	**25**	<0.5	**11**	<1	<2	13.8	27	**22**
RMD-259	15-Feb-2018	**<1**	<1	<1	22	23	**25**	<0.5	9	<1	<2	9.7	21	**23**
RMD-259	30-May-18	<1	<1	<1	25	25	26	<0.5	8	<1	<2	7.4	18	21
RMD-259	8-Aug-18	<1	<1	<1	24	25	26	<0.5	9	<1	<2	7.7	19.2	21

PWT - 182

Sample	Sample Reported Name	Date Sampled	THM (ppb)					HAA (ppb)						Extras
			Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	Total Trihalomethanes	Dibromoacetic Acid	Dichloroacetic Acid	Monobromoacetic Acid	Monochloroacetic Acid	Trichloroacetic Acid	Total Haloacetic Acid	pH units pH
RMD-250	6071 Azure Rd.	15-Feb-2018	<1	<1	<1	20	21	<0.5	8	<1	<2	8.7	18.4	
RMD-251	5951McCallan Rd.	15-Feb-2018	<1	<1	<1	19	20	<0.5	8	<1	<2	8.3	18.8	
RMD-258	7000 Blk. Dyke Rd.	15-Feb-2018	<1	<1	<1	22	23	<0.5	9	<1	<2	10.8	22.6	
RMD-259	10020 Amethyst Ave.	15-Feb-2018	<1	<1	<1	22	23	<0.5	9	<1	<2	9.7	20.6	7.3
RMD-250	6071 Azure Rd.	2018-05-30 16:00	<1	<1	<1	22	22	<0.5	7	<1	<2	5.6	14.3	
RMD-251	5951McCallan Rd.	2018-05-30 16:15	<1	<1	<1	22	22	<0.5	4	<1	<2	3.5	9.1	
RMD-258	7000 Blk. Dyke Rd.	2018-05-30 03:30	<1	<1	<1	22	22	<0.5	7	<1	<2	5.5	14.9	
RMD-259	10020 Amethyst Ave.	2018-05-30 14:40	<1	<1	<1	25	25	<0.5	8	<1	<2	7.4	18	7.5
RMD-250	6071 Azure Rd.	2018-08-08 16:00	<1	<1	<1	18	**18**	<0.5	6	<1	<2	5.2	**12.2**	
RMD-251	5951McCallan Rd.	2018-08-08 16:15	<1	<1	<1	16	**16**	<0.5	6	<1	<2	4.8	**11.7**	
RMD-258	7000 Blk. Dyke Rd.	2018-08-08 15:30	<1	<1	<1	22	**22**	<0.5	8	<1	<2	6.7	**15.8**	
RMD-259	10020 Amethyst Ave.	2018-08-08 14:40	<1	<1	<1	24	**25**	<0.5	9	<1	<2	7.7	**19.2**	7.5

PWT - 183

APPENDIX 5: 2018 HEAVY METAL AND VINYL CHLORIDE TESTING RESULTS

Metal		RMD-250	RMD-257	RMD-263
	Sample Description	6071 Azure Rd.	6640 Blundell Rd.	12560 Cambie Rd.
	Sample Date	2018/06/13 15:40	2018/06/13 15:50	2018/06/13 12:30
	Sample Type	GRAB	GRAB	GRAB
Aluminum Total	µg/L	25	26	26
Antimony Total	µg/L	<0.5	<0.5	<0.5
Arsenic Total	µg/L	<0.5	<0.5	<0.5
Barium Total	µg/L	2.5	2.6	2.5
Boron Total	µg/L	<10	<10	<10
Cadmium Total	µg/L	<0.2	<0.2	<0.2
Calcium Total	µg/L	4570	4700	4670
Chromium Total	µg/L	<0.05	<0.05	<0.05
Cobalt Total	µg/L	<0.5	<0.5	<0.5
Copper Total	µg/L	2.8	4.4	1.3
Iron Total	µg/L	<5	<5	<5
Lead Total	µg/L	0.5	<0.5	<0.5
Magnesium Total	µg/L	147	150	150
Manganese Total	µg/L	1.8	2.0	2.1
Mercury Total	µg/L	<0.05	<0.05	<0.05
Molybdenum Total	µg/L	<0.5	<0.5	<0.5
Nickel Total	µg/L	<0.5	<0.5	<0.5
Potassium Total	µg/L	132	136	136
Selenium Total	µg/L	<0.5	<0.5	<0.5
Silver Total	µg/L	<0.5	<0.5	<0.5
Sodium Total	µg/L	1400	1470	1450
Zinc Total	µg/L	<3.0	3.3	<3.0

Vinyl Chloride Testing Results

Sample Site Number	Sample Reported Name	Sampled date	Vinyl Chloride (mg/L)
RMD-205	13851 Steveston Hwy.	21-Jun-18	<0.00040
RMD-206	4251 Moncton St.	21-Jun-18	<0.00040
RMD-253	11051 No 3 Rd.	21-Jun-18	<0.00040
RMD-256	1000 Blk. McDonald Rd.	21-Jun-18	<0.00040
RMD-263	12560 Cambie Rd.	21-Jun-18	<0.00040
RMD-205	13851 Steveston Hwy.	26-Nov-18	<0.00040
RMD-206	4251 Moncton St.	26-Nov-18	<0.00040
RMD-253	11051 No 3 Rd.	26-Nov-18	<0.00040
RMD-256	1000 Blk. McDonald Rd.	26-Nov-18	<0.00040
RMD-263	12560 Cambie Rd.	26-Nov-18	<0.00040

Metal Limits

Parameter	Canadian Guideline Limit	Reason Guideline Established
Aluminium Total (µg/L)	200	Aesthetic
Antimony Total (µg/L)	6	Health
Arsenic Total (µg/L)	10	Health
Barium Total (µg/L)	1000	Health
Boron Total (µg/L)	5000	Health
Cadmium Total (µg/L)	5	Health
Calcium Total (µg/L)	none	
Chromium Total (µg/L)	50	Health
Cobalt Total (µg/L)	none	
Copper Total (µg/L)	≤1000	Aesthetic
Iron Total (µg/L)	≤ 300	Aesthetic
Lead Total (µg/L)	10	Health
Magnesium Total (µg/L)	none	
Manganese Total (µg/L)	≤ 50	Aesthetic
Mercury Total (µg/L)	1.0	Health
Molybdenum Total (µg/L)	none	
Nickel Total (µg/L)	none	
Potassium Total (µg/L)	none	
Selenium Total (µg/L)	50	Health
Silver Total (µg/L)	none	
Sodium Total (µg/L)	≤ 200,000	Aesthetic
Zinc Total (µg/L)	≤ 5000	Aesthetic

*Checked January 2018

APPENDIX 6: SAMPLE DRINKING WATER QUALITY ADVISORY

CITY OF RICHMOND ANNUAL WATERMAIN FLUSHING NOTIFICATION

On Monday, February 20, the Water Services section will begin the annual watermain flushing program. To minimize disruptions, this work will be conducted from Monday to Thursday, 8:00 p.m. to 6:30 a.m. The program will continue for up to six weeks.

Flushing watermains is required to maintain water quality. Your water will not be turned off; however, during this time you may experience water pressure fluctuation or discolouration. This is not a health concern and should only last for a short time. It is recommended that you run the cold water until the discolouration clears.

If you have any questions, please contact 604-270-8721. For more information on Richmond's high-quality tap water and other water education programs, visit: **www.richmond.ca/water**.

APPENDIX 7: SPECIFIC EMERGENCY RESPONSE PLANS

Positive Response for Fecal or E. Coli

If a water sample tests positive for fecal coliform, the following response plan will occur:

- the municipality's water quality personnel and the Medical Health Officer will be notified by the Metro Vancouver laboratory;
- interim samples from the site will be examined. Interim samples are samples in the period between when the fecal positive sample was taken, and when it was determined to be fecal positive;
- arrangements will be made for the immediate collection of a repeat sample including, where possible, samples from upstream and downstream of the fecal positive sample;
- the chlorine residual for the sample noted on the sampler's Water Sample Data Sheet will be reviewed to determine if a localized loss of disinfectant occurred;
- all water utility personnel will be contacted to determine if there was any loss of pressure, or other unusual events, that may have led to contaminants entering the system;
- the need for a boil-water advisory will be evaluated by the City and the Medical Health Officer. If a boil-water advisory is deemed necessary, the municipality will carry out various means to inform the public. Metro Vancouver will be informed of this public advisory;
- the City, in consultation with the Medical Health Officer, will determine the need and extent for a boil-water advisory;
- the Metro Vancouver laboratory will initiate procedures to identify species of the fecal positive organism with standard biochemical tests;
- the Medical Health Officer will be contacted with the repeat sample results and the results of the species identification on the fecal positive sample when these tests are complete.

In the event of possible E. Coli or fecal coliform contamination, all steps to ensure public health and safety will be taken including banning water usage if necessary.

Chemical or Biological Contamination Response

In the event of chemical or biological contamination, in source waters or the City's distribution system, the following actions will be taken by both, the City of Richmond and Metro Vancouver:

- immediately notify Vancouver Coastal Health;
- identify the chemical and any public health risk factors associated with its presence in potable water;
- isolate the contaminated zone area and determine the level of contamination;
- issue a public advisory in consultation with the Medical Health Officer.

In the event of possible biological or chemical contamination, all steps to safety will be taken to ensure public health including banning water usage if necessary.

Turbidity Response

Turbidity (cloudy water) occurs during periods of heavy rain at and surrounding Metro Vancouver water sources. The City of Richmond, in conjunction with Vancouver Coastal Health, has developed a turbidity response plan, which considers the City's responsibility for due diligence without unreasonably constraining the water utility's ability to operate the system.

During turbidity events of >1 NTU the staff will:

- begin a rigorous sampling program for microbiological activity and residual chlorine;
- monitor the City's supervisory control and data acquisition (SCADA) system with updates sent to Vancouver Coastal Health on a predetermined schedule;
- issue a public communication in consultation with the regional Health Authority;
- if necessary, issue a boil-water advisory to residents receiving turbid water.

Response to Interruption of Primary and/or Secondary Disinfection

Upon notification by Metro Vancouver Operations that an interruption in disinfection has occurred:

- staff will monitor residual levels of chlorine at strategic locations in the Metro Vancouver supply area;
- the City's SCADA system will be monitored with updates sent to Vancouver Coastal Health on a predetermined schedule, as set by the health authority;
- in cases where chlorine residual is less than 0.2 ppm, City crews will flush the affected area until an acceptable level is achieved;
- these actions will continue until disinfection is resumed and adequate levels of residual chlorine have been reached in the distribution system.

Response to Loss of Pressure Due to High Demand

In the event of a pressure loss due to high demand:

- City staff will attempt to rectify the problem as soon as possible using various demands management techniques and by supplementing supply to problem areas;
- Metro Vancouver and the Medical Health Officer will be notified of any water quality issues;
- City staff will perform chlorine residual tests at various locations to determine if adequate disinfectant is present in the distribution;
- all water quality complaints from the public will be thoroughly investigated due to the potential for water contamination during low water pressure.

Response to Watermain Breaks with Suspected Contamination

All watermain breaks where chemical or microbiological contamination of the system is suspected will be immediately reported to the Medical Health Officer. The municipality will isolate the contaminated section from the rest of the distribution system. Once the watermain has been repaired, chlorine residual testing will be conducted at various locations affected by the main break. If low chlorine residuals are found, necessary actions to increase the levels of free chlorine will be carried out. If bacterial contamination is suspected, water samples will be analyzed and appropriate action taken.

City of Richmond
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City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	May 17, 2019
From:	Milton Chan, P.Eng. Acting Director, Engineering	**File:**	10-6060-04-01/2019-Vol 01
Re:	**Steveston Island Flood Protection Update**		

Staff Recommendation

That the staff report titled "Steveston Island Flood Protection Update", dated May 17, 2019 from the Acting Director, Engineering, be received for information.

Milton Chan, P.Eng.
Acting Director, Engineering
(604-276-4377)

Att. 1

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Real Estate Services	☑	
Parks Services	☑	
Roads & Construction	☑	
Sustainability	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** CJ	**APPROVED BY CAO**

Staff Report

Background

This report provides an update to Council on the status of dike planning along the dike alignment that utilizes Steveston Island.

It is projected that sea levels will rise approximately 1.0m and the City will subside by 0.2m by the year 2100. To maintain a high level of flood protection for the City, Richmond's flood protection system needs to be proactively planned and improved.

At the April 22, 2013 Regular Council Meeting, Council endorsed the work plan contained in the staff report titled "Dike Master Plan – Phase 1 Report". The Dike Master Plan Phase 1 report assessed and recommended flood protection measures for the west dike south of Williams Road and the south dike from Garry Point Park to No. 2 Road. Phase 1 identified a new dike on Steveston Island with structures and gates to enclose Steveston Harbour as the recommended long-term solution for flood protection in the Steveston area. The west dike portion of the Phase 1 assessment was recommended to maintain its current alignment with raising of the dike to a 4.7m dike crest elevation.

Subsequently, staff pursued the recommendations from Phase 1 to further develop the Steveston Island dike concept per the Council endorsed work plan (Attachment 1). In 2017, the City was awarded $1.2 million through the National Disaster Mitigation Program to complete the Steveston Island Flood Risk Investigation, which includes geotechnical testing, sea gate concept evaluation, and updates to the Phase 1 report. The findings from this investigation are outlined in this staff report.

Analysis

Project Site – Steveston

From a small fishing village, Steveston rapidly expanded in the early 1900's as workers came for jobs in the booming fishing industry. Today, Steveston is home to a vibrant community with famous historical buildings, rich cultural history, and an operating port with over 500 commercial fishing vessels. Harbour facilities are located at two distinct sites – the Gulf site and the Paramount site – managed by the Steveston Harbour Authority.

The current perimeter dike alignment runs through Steveston Village. Raising the dike on the current alignment would have major impacts to the existing properties, businesses, and infrastructure in the Steveston area. The Steveston Island dike alignment avoids many of these impacts. The proposed alignment also better supports future dike upgrades, provides more protection for the harbour, and is consistent with long term improvement plans from the Steveston Harbour Authority.

Figure 1 shows the general layout of the Steveston Island dike. The planned work area is primarily contained on Steveston Island and the Fraser River riverbed. This alignment ties into the existing dike at the eastern edge of Garry Point Park and at Dyke Road just east of London Heritage Farm.

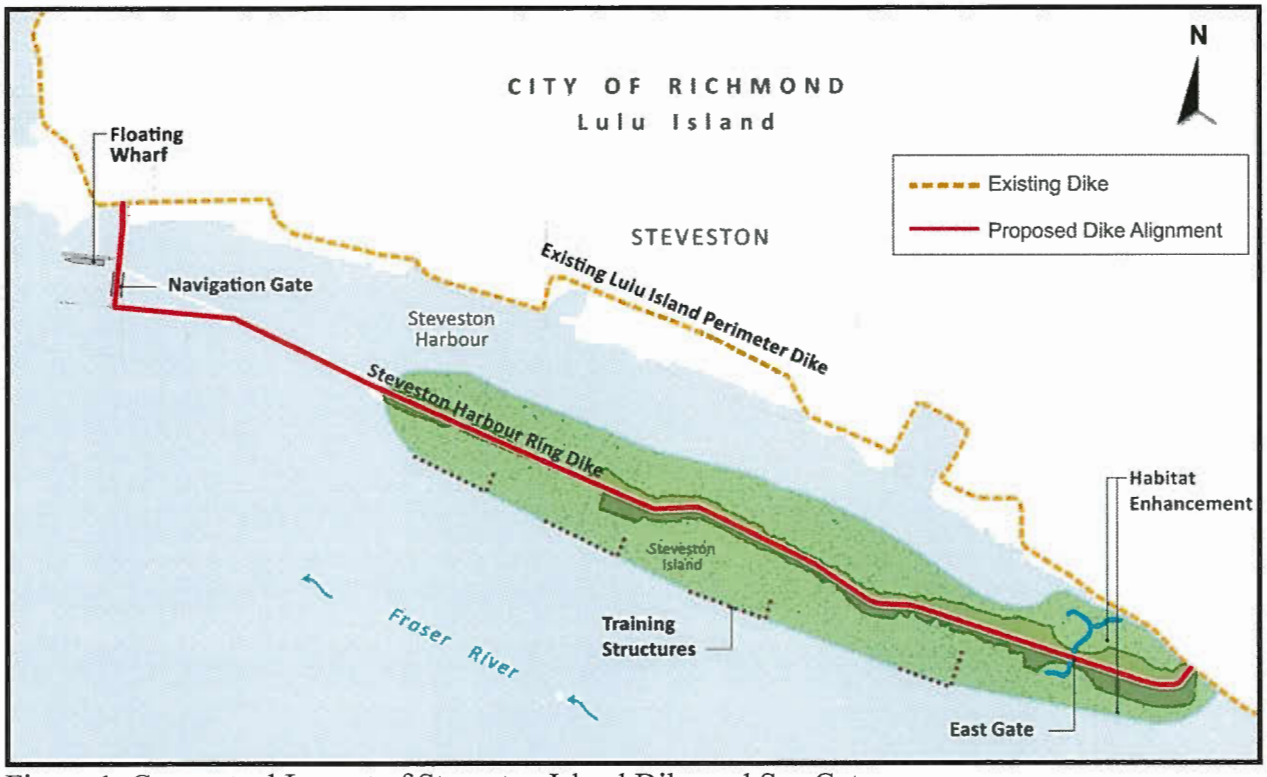

Figure 1. Conceptual Layout of Steveston Island Dike and Sea Gate

Flood Risk Assessment

With its location in the Fraser River, the primary flood risks for Steveston are related to climate change-induced sea level rise, storm surge, and post-seismic tidal events. Spring snowmelt freshets have a more significant effect on Lulu Island east of Nelson Road. Using the Provincially-adopted sea level rise guidelines, the City is preparing for 1.0m of sea level rise by year 2100 and 2.0m by year 2200. Storm surge, wind effects, and subsidence are further considerations for risk evaluation and are addressed as a part of the City's Flood Protection Management Strategy and Dike Master Plans.

As recommended in Phase 1, implementing the Steveston Island dike and sea gate would provide relief from sea level rise and storm surge effects for Steveston. This would allow gradual improvements and land raising in Steveston, which could be phased with development to minimize disruption to the existing businesses, heritage and infrastructure.

The proposed Steveston Island dike and sea gate concept will be designed to meet the Provincial flood elevation guidelines and the BC Building Code where applicable.

Steveston Island Dike and Sea Gate Concept

The Steveston Island dike and sea gate concept is based on the recommended dike alignment from Dike Master Plan Phase 1, endorsed by Council. Staff have completed geotechnical investigations, expert consultation, stakeholder engagements, and concept review to develop the recommended concept plan. The primary objectives of the Steveston Island dike concept are:

- Flood Safety – decrease the risk of flooding in Steveston (and the rest of Richmond) from extreme ocean tide and storm surge water levels, with consideration for sea level rise;

- Harbour Operations – provide safe harbour and expanded moorage for the fishing fleet while improving traffic flow in and out of the harbour;

- Environment – protect and enhance important riparian and aquatic habitat while maintaining or improving water quality within the harbour; and

- Parks / Public Amenities / Events – provide opportunities for public education on flood protection and encourage meaningful engagement between the public and natural habitat.

The Steveston Island dike and sea gate concept can be considered in three primary components: the Navigation Sea Gate (West), Steveston Island earth-filled dike and sheet pile wall, and the East Gate. Each component of the concept contributes toward the objectives listed above and are outlined in this report.

Navigation Sea Gate (West)

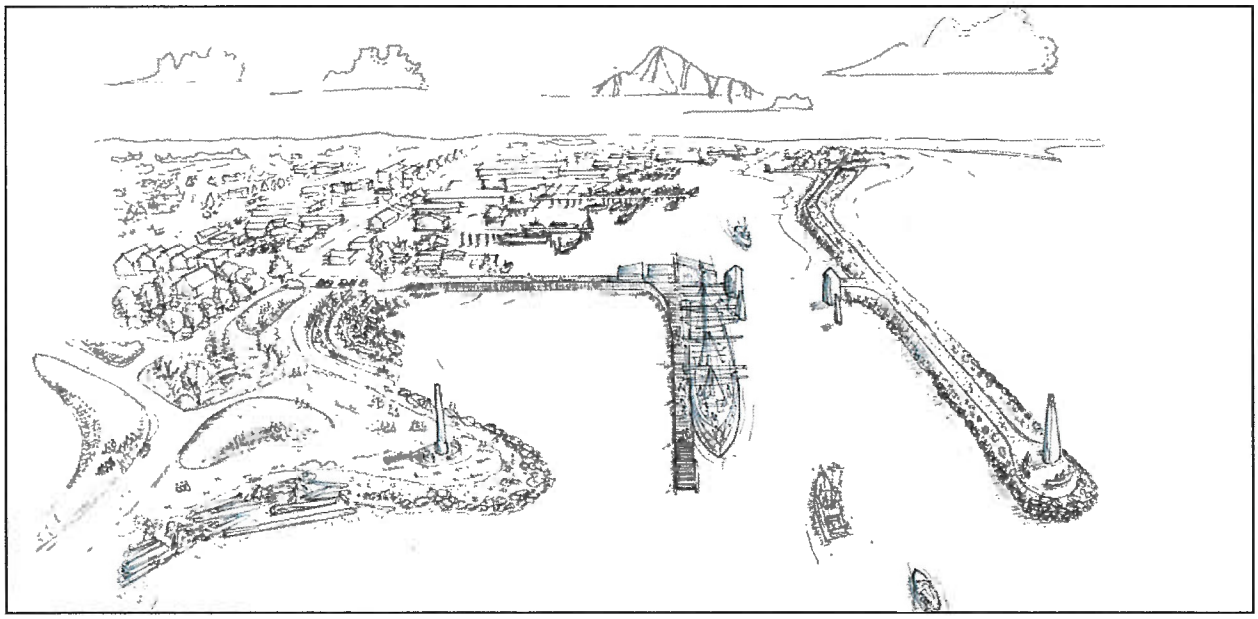

Figure 2. Artistic Perspective of the Navigation Sea Gate (Looking East)

The Navigation Sea Gate concept was developed based on an assessment of current conditions, economic value and stakeholder requirements from groups including the Steveston Harbour Authority, the Port of Vancouver and Fisheries and Oceans Canada. The proposed type of gate for the Navigation Sea Gate is a horizontal axis sector gate, as shown in Figures 3 and 4. Level of protection from storm surge and high tide events would be determined during detailed design. Figure 3 shows the closed Navigation Sea Gate with an upper gate elevation of 5.5m to accommodate for anticipated sea level rise beyond the year 2100.

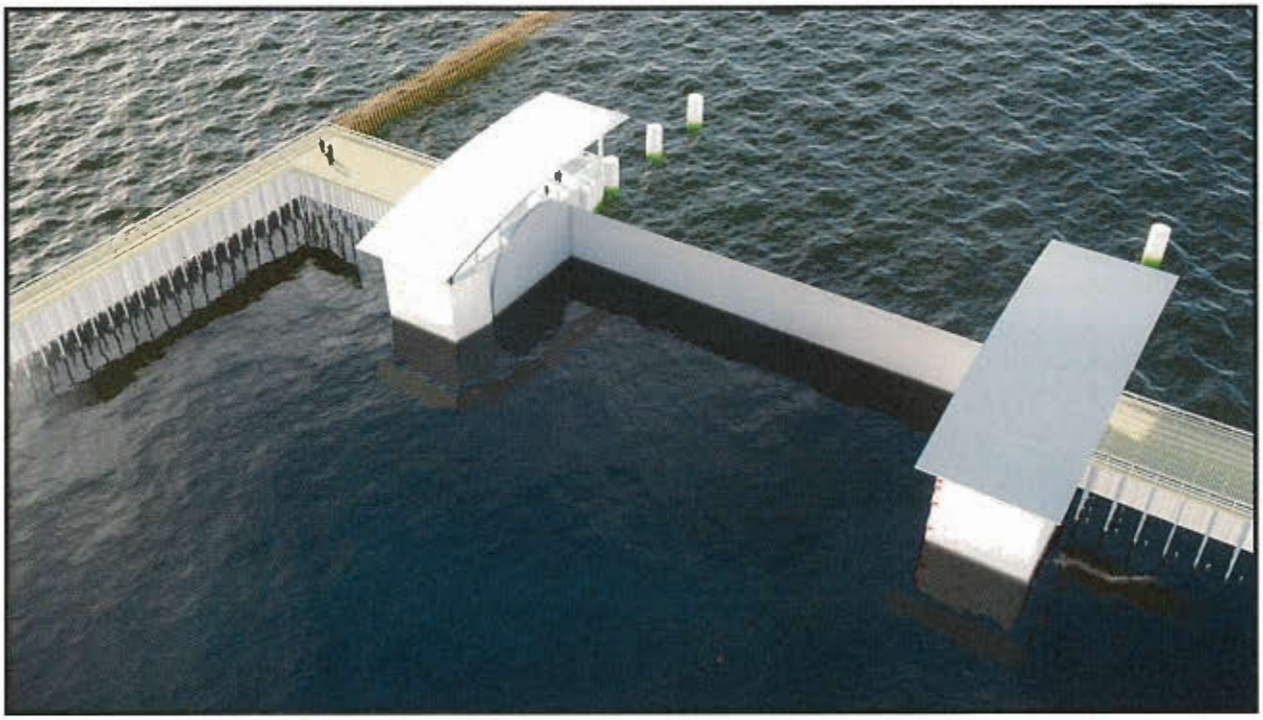

Figure 3. Closed Horizontal Axis Sector Gate (Looking West) Rendering

Similar gates have been used in applications such as the Thames Barrier in London, England.

Advantages of this type of gate include:

- No overhead structure to limit clearance for taller vessels;
- Can provide full draft within harbour at the gate entrance;
- Gate sits within a robust and rigid structure that can resist differential movement during an earthquake;
- Operated using a relatively simple single action hydraulic piston;
- Major components can be accessed without underwater equipment if necessary;
- Gate operation is not usually impacted by sedimentation; and
- Gate can be fully rotated out of the water for more extensive maintenance and inspection.

The structure consists of a steel gate attached to a circular section which is rotated vertically to close and down flat horizontally when the gate is opened. The gate opening would be approximately 50m wide to allow for two-lane ship traffic (or single-lane for the largest vessel, a dredger, that uses the channel) to access the harbour.

A causeway would extend from the existing Lulu Island perimeter dike in Garry Point Park to the north side of the gate structure. The causeway would provide pedestrian and vehicular traffic access to the sea gate, and could be raised in the future to accommodate further sea level rise.

Figure 4. Open Navigation Sea Gate Rendering (Looking East)

Steveston Island Earth-Filled Dike and Sheet Pile Wall

The earth-filled dike along the Steveston Island alignment is proposed to have a trapezoidal cross-section, similar to a conventional dike, and be resilient to seismic activity and seepage due to shallower side slopes and a wide dike core. Dredged material from the Fraser River could be used to construct the earth dike, providing greater economic viability, local sourcing of materials, and the potential for habitat enhancement. Dredged material could potentially be acquired through partnerships with agencies such as the Port of Vancouver.

A sheet pile wall would be used to connect the earth-filled dike to the navigation sea gate. A narrow footprint would be required to limit impact to navigation and river habitat. The sheet pile wall would generally follow the alignment of the existing Steveston Harbour breakwater and could be designed to allow pedestrian access.

Once land use rights-of-way are established, the next step of the recommended approach is to complete the design of the earth dike and east gate in coordination with the Steveston Harbour Authority and the Port of Vancouver. It may take several years to accumulate the required material so it is recommended that this work commence in advance of the other project phases.

East Gate

The East Gate provides flushing and fish access which is beneficial for maintaining the health of the aquatic ecosystem in Steveston Harbour. For flood protection, the proposed concept is a stop-log type system with upper pedestrian and vehicle crossing that can be closed during high tide or storm surge events. The East Gate and related earthworks would be completed in the early phases of the project as they provide sediment control and construction access to Steveston Island.

Figure 8. Open East Gate Rendering (Looking North)

Environmental Considerations and Public Programming

Preliminary design concepts for the Steveston Island Dike and Sea Gate Concept will affect the intertidal sand and mudflats in the area. Staff have identified potential enhancement opportunities within the project that may help to offset any construction-related impacts and support the environmental permitting process. Staff will continue to assess these opportunities through detailed assessment and work internally to secure all environmental permitting requirements based on the final design.

Public programming has not been evaluated in detail. Coordination with the City's Parks department, stakeholders and the public will further inform the layout and desired amenities on Steveston Island. The current concept includes optimized space for public events, trails, and viewpoints. The 2022 Parks and Open Space Strategy as well as the 2009 Waterfront Strategy will be used as guides during all parts of the project.

Estimated Project Costs

The high-level estimated cost of the Steveston Island dike and sea gate project, excluding programming and public art, is approximately $170 million to be incurred progressively in established project phases. The estimated cost to raise the dike in Steveston along the existing alignment through the village is similar, but would result in major disruptions to existing properties, commercial and heritage buildings, and infrastructure in Steveston. It would also potentially impact the character of the existing waterfront area.

The currently estimated costs are significantly higher than the preliminary $55 million estimated in 2013. The main reasons for the increased estimate are increased seismic mitigation and regulatory requirements, along with significant increases in construction costs due to market conditions. As the design progresses and market conditions continue to evolve, the cost estimates will be further refined.

Next Steps

Per the Council endorsed work plan, staff will complete further assessments to negotiate land use and rights-of-way on Steveston Island, continue design work in preparation for concept implementation, and work with key stakeholders to establish strategic partnerships that can be leveraged to reduce construction costs and seek funding from senior government.

The Steveston Island dike and sea gate project is a long-term initiative and has a multi-decade timeline for implementation. Advance planning and proactive engagement of stakeholders allows the City to strategically implement this upgrade through grants and partnerships, and accelerate the construction schedule should funding opportunities or changes in climate change science arise.

Financial Impact

None.

Capital projects will be brought forward for Council consideration as part of the Capital Budget process. Staff will also continue to pursue funding from senior government to support the City's dike raising efforts.

Conclusion

Staff have completed concept assessments with the assistance of experts in geology, climate change, and flood protection. The design concept outlined in this staff report includes a navigation sea gate, sheet pile and island earth-filled dike, and a stop-log access gate as core components. Staff are continuing to implement the work plan from Dike Master Plan Phase 1.

Jason Ho, P.Eng.
Manager, Engineering Planning
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Christopher Chan, BASc, EIT
Project Manager, Engineering Planning
(604-204-8516)

JH: cc

Att. 1: Dike Master Plan Phase 1 Work Plan (Southern West Dike and Steveston Dike)

Dike Master Plan Phase 1 Work Plan (Southern West Dike and Steveston Dike)

a. Secure the land and rights to construct the Steveston Island Dike. This includes:

   i. Apply to the Ministry of Forests Lands and Natural Resource Operations for an Investigative License to identify land management jurisdictions and to permit geotechnical or other investigations. This may require a new survey to confirm boundaries and jurisdiction.

   ii. Request for the Ministry to liaise with Federal Government Agencies (e.g. Port Metro Vancouver, Department of Fisheries and Oceans/Small Craft Harbours, and Public Works Canada) to process a Statutory Right of Way application.

   iii. Liaise with First Nations group prior to Ministry investigations and associated consultations.

b. Complete preliminary designs and related investigations to assist with securing the land and obtaining regulatory approvals. Work is expected to include:

   i. A preliminary design that establishes the extent of land required for earth fill and related structures.

   ii. A geotechnical investigation that defines the extent of soil improvements required, and therefore the extent of the land required.

   iii. An environmental investigation to determine the impact and potential habitat improvements associated with creating additional intertidal and marsh areas along the proposed alignment. Approvals will be required from external agencies (e.g. DFO, MoE, PMV etc.).

   iv. A hydraulic study to assess the impact on sedimentation patterns and water quality.

c. Coordinate the design and construction of the Steveston Island dike with compatible Steveston Harbour Authority (SHA), City Parks, and Port Metro Vancouver (PMV) plans, including:

   i. Coordinate with the Steveston Community Fishing Harbour development plan which includes narrowing the entrances to the harbour at both ends.

   ii. Coordinate with Parks plans to create a sheltered space for the marine oriented public events like the Tall Ships Festival, and other improvements to the park and trail network.

   iii. Work with PMV who are seeking environmental compensation and land reclamation opportunities similar to the intertidal habitat that may be created with the Steveston Island dike.

iv. Seek opportunities to coordinate fill activities with adjacent PMV dredging operations.

v. Support PMV improvements to the Albion dike and other Roberts Bank structures and habitat creation that result in improved breakwater effects for Steveston.

d. Once the Steveston Island Dike alignment is secured, revise the dike standard behind the Steveston Island Dike to a consistent but relaxed standard that is more compatible with the surrounding property accesses. A 4.1m dike crest elevation is suggested as a starting point for discussion. This would be the current designated flood level of 2.9m plus a 1.2m allowance for sea level rise.

e. Continue to plan for construction of the Southern West Dike to a 4.7m crest elevation.

f. Develop a two dimensional wave and storm surge model for the Sturgeon Bank, to arrive at wave run-up estimates to confirm optimum barrier island configurations.

g. Confirm constructability of the barrier islands using dredge sand.

h. If justified by observed sea level rise, proceed with design and construction of offshore wave dissipation structures to minimize required onshore crest level increases.

City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	May 17, 2019
From:	Milton Chan, P.Eng. Acting Director, Engineering	**File:**	10-6060-04-01/2019-Vol 01
Re:	**Flood Protection Management Strategy 2019 – Final Report**		

Staff Recommendation

That the "Flood Protection Management Strategy 2019" attached to the staff report titled, "Flood Protection Management Strategy 2019 – Final Report", dated May 17, 2019 from the Acting Director, Engineering, be endorsed.

Milton Chan, P.Eng.
Acting Director, Engineering
(604-276-4377)

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:** CJ	**APPROVED BY CAO**

Staff Report

Origin

The 2008 – 2031 Richmond Flood Protection Strategy (2008 Strategy) is the City's guiding framework for continual upgrades and improvement to the City's flood protection system. 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.

Staff have developed the Flood Protection Management Strategy 2019 (Strategy) to update the 2008 Strategy with new information on flood hazard management in the City.

At the Regular Council Meeting on March 26, 2019, Council adopted the following motion:

> *"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."*

This report summarizes the results of the public and key stakeholder engagement.

Analysis

Richmond is recognized as a leading dike authority in British Columbia. A key component of the City's successful Flood Protection Program is the Flood Protection Management Strategy which provides high-level guidance for flood risk management in the City. As sea level rise science evolves and the population and economic investment in Richmond continue to increase, the City's priorities and management of flood risk need to be reviewed to incorporate best practices and current science.

The Strategy includes an Implementation Program that outlines short and long -term strategies for policy planning, infrastructure upgrades, and other areas related to flood risk mitigation. The recommended actions are summarized in Table 1 below:

Table 1. Summary of Implementation Program

Category	Action
Program Management – the overall management of the flood protection program	• Ensure that the flood protection program is supported with technical investigations, environmental monitoring, funding, and staffing • Recognize habitat impact and enhancement opportunities with nature-based solutions
Structural Flood Protection – area-specific upgrades to flood protection infrastructure	• Complete dike master planning, establish a world-class flood protection standard and continue to upgrade the perimeter dike • Adopt a seismic dike design standard that is suitable

	for Richmond and accepted by the Province • Research and implement secondary dikes where opportunistic • Review, rehabilitate, and upgrade the City's internal drainage system
Policy and Non-Structural Flood Protection – plans, legislation, and bylaws including the Official Community Plan 2041, *Local Government Act*, and Floodplain Designation and Protection Bylaw No. 8204	• Update policies with current strategies and flood protection science • Manage the dike corridor to prioritize long-term flood protection with area-specific strategies • Update the dike operations and maintenance manual with dike master plans and best practices
Emergency Preparedness – flood response planning and preparedness through the Emergency Management Office and interagency partnerships	• Continue with an integrated emergency management planning approach both internally and with partner agencies • Work with transportation authorities to upgrade post-disaster routes for emergency evacuation • Update plans for emergency flood response and recovery

A complete list of the recommended actions are located in the attached report under Part 2: The Implementation Program.

Public Engagement

In April 2019, the Strategy was presented to the public through two open houses, an information session at the Dyke Trail Dog Park, and the Capital Projects Open House. These public sessions engaged over 100 residents, and over 500 people visited the "LetsTalkRichmond.ca" web page.

Based on feedback, the public indicated:

- Strong support for raising the perimeter dike and accelerating work on flood protection system components such as drainage pump stations and stormwater canals;
- Strong support to continue funding relationships with senior government and other sources to advance flood protection;
- Support for increasing the diking and drainage utility funding to accelerate investment in flood protection;
- Support for further research into sustainable flood protection solutions;
- Support for advancing flood protection through superdike developments and land raising;
- Requests for more interactive maps, figures, and summaries related to flood protection for public access, visuals to highlight current and future levels of protection in the City, construction timelines, and cost;

- Requests for more public information related to flood protection including environmental impacts from land raising and soil fill placement, development contributions, and stormwater management;

- Requests to review funding levels and prioritization for flood protection; and

- Request for more public information related to City efforts to reduce climate change impacts, the City's resilience to rising temperatures, and seismic activity.

Where appropriate, comments and suggestions were incorporated into the Strategy to improve usability and provide clarifications. This feedback informs next steps for stakeholder communication and flood protection planning in the City.

Key External Stakeholder Engagement

The following key external stakeholders were engaged:

- 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 (MFLNRORD)
- 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

Stakeholders that returned comments were generally supportive of the findings and overall approach in the Strategy. Stakeholders indicated:

- Suggestions for a summary of the Dike Master Plans and Floodplain Designation and Protection Bylaw No. 8204 to be included in the Strategy;

- Suggestions for additional detail in the regional engagement and relationships section of the report; and
- Support and additional resources for consultation related to flood protection planning and projects.

Key stakeholder input was incorporated into the Strategy where appropriate and informs future interagency engagement.

Next Steps

Staff will have ongoing engagement with key stakeholders and the public on climate change, flood protection, and area-specific considerations through the use of social media, open houses, presentations, and other platforms. In addition, key actions from the Strategy's Implementation Program will be advanced to improve the City's overall resilience to flooding.

Financial Impact

None.

Project costs will be presented for Council consideration as individual initiatives and programs through the annual budgeting process.

Conclusion

The Flood Protection Management Strategy, which is the City's guiding framework for continual upgrades and improvement to the City's flood protection system, has been updated to reflect new information on sea level rise and flood hazard management in the City. Public and key stakeholder engagement has been completed and feedback has been incorporated into the Strategy where appropriate.

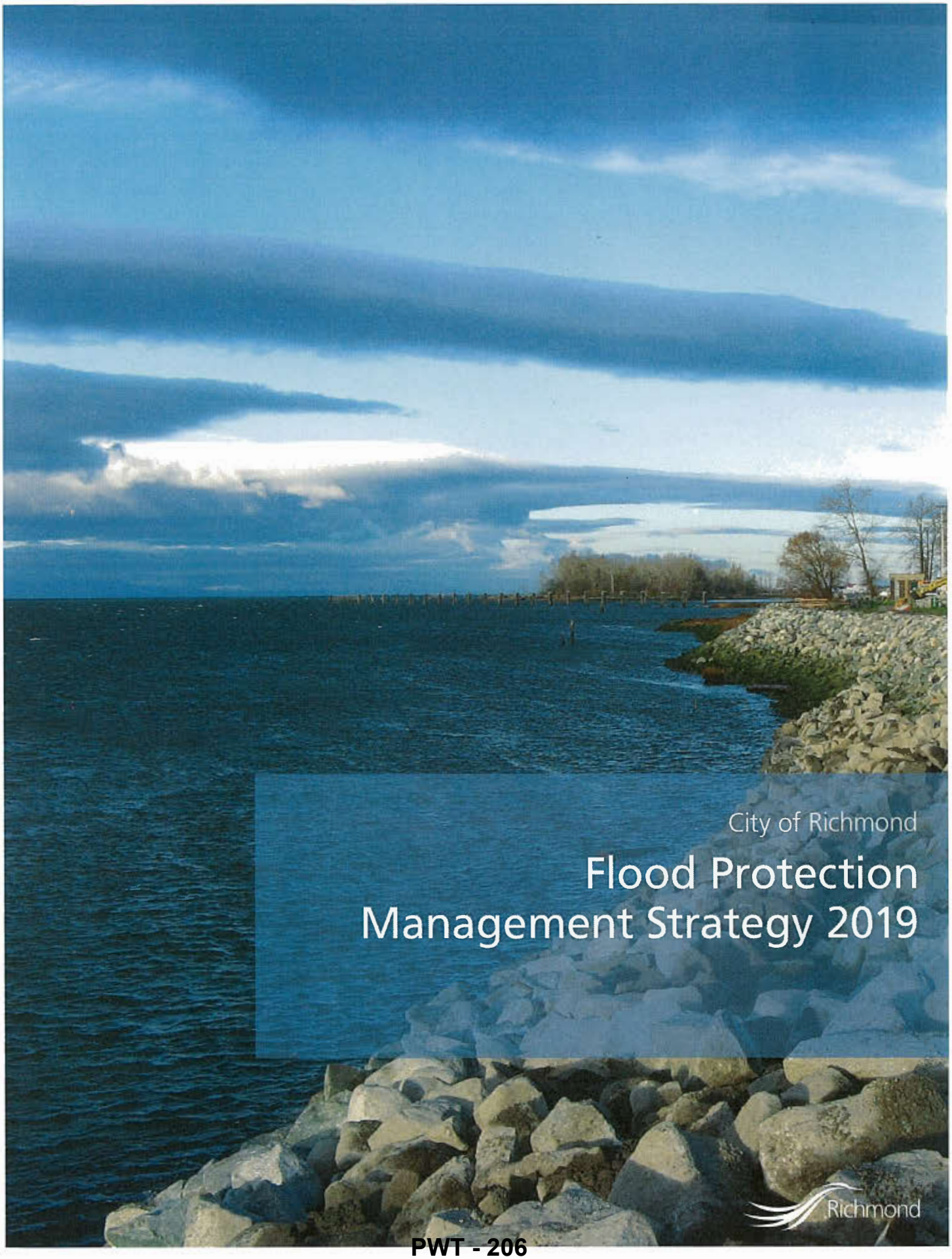
Staff recommend that the Flood Protection Management Strategy 2019 be used as the primary guidance document for flood protection management in the City, replacing the 2008 Strategy.

Jason Ho, P.Eng.
Manager, Engineering Planning
(604-244-1281)

Christopher Chan, EIT
Project Manager, Engineering Planning
(604-204-8516)

JH:cc

Att. 1: Flood Protection Management Strategy 2019



City of Richmond

Flood Protection Management Strategy 2019

Richmond

Table of Contents

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 Flood Protection Management Strategy 2019 (Strategy) updates the 2008 Strategy with current science and provides the next steps to establish a world-class flood protection system for the City of Richmond.

The proposed Implementation Program objectives from the 2008 Strategy have been substantially achieved as shown below:

Table 1: 2008–2031 Flood Protection Strategy Implementation Program – Planning Actions

Actions	Results
Examine and pursue senior government cost sharing to implement the Flood Protection Strategy (Engineering; Public Works; Finance).	Successfully secured over $30 million in senior government grants for implementation of the Flood Protection Strategy. ***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.

Actions	Results
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***

Actions	Results
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 actions have been completed and are shown in Table 2.

Table 2: 2008–2031 Flood Protection Strategy Implementation Program – Bylaws Actions

Actions	Results
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 diking actions and their current status from the 2008–2031 Flood Protection Strategy are listed in Table 3.

Table 3: 2008–2031 Flood Protection Strategy Implementation Program – Diking Actions

Actions	Results
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***

Actions	Results
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 actions and current statuses 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 Actions

Actions	Results
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***

Notable projects and milestones from the Flood Protection Program are presented in a timeline format in Appendix 2.

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. The review and update of the 2008 Strategy has resulted in the Flood Protection Management Strategy 2019.

Part 1: The Flood Protection Management Strategy 2019

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;
- complement 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.

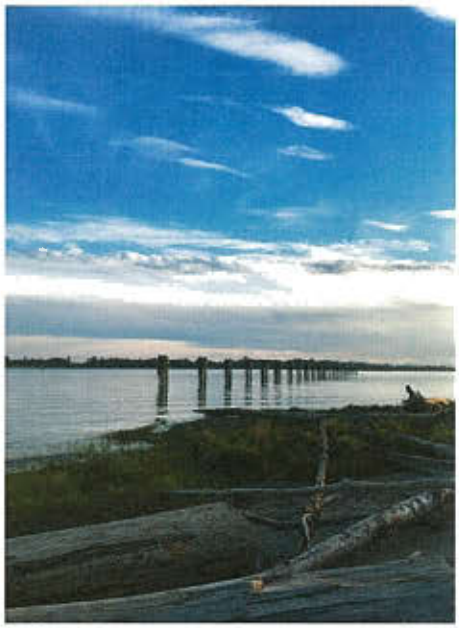
In locations where the City does not have the jurisdictional authority, such as the Port of Vancouver lands in Richmond, lands held or controlled by either the Federal or Provincial Governments (e.g., most of Sea Island), the City's Strategy encourages interagency cooperation to address mutual flood 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 2019 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, the Integrated Rainwater Resource Management Strategy (IRRMS), 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 pump 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.

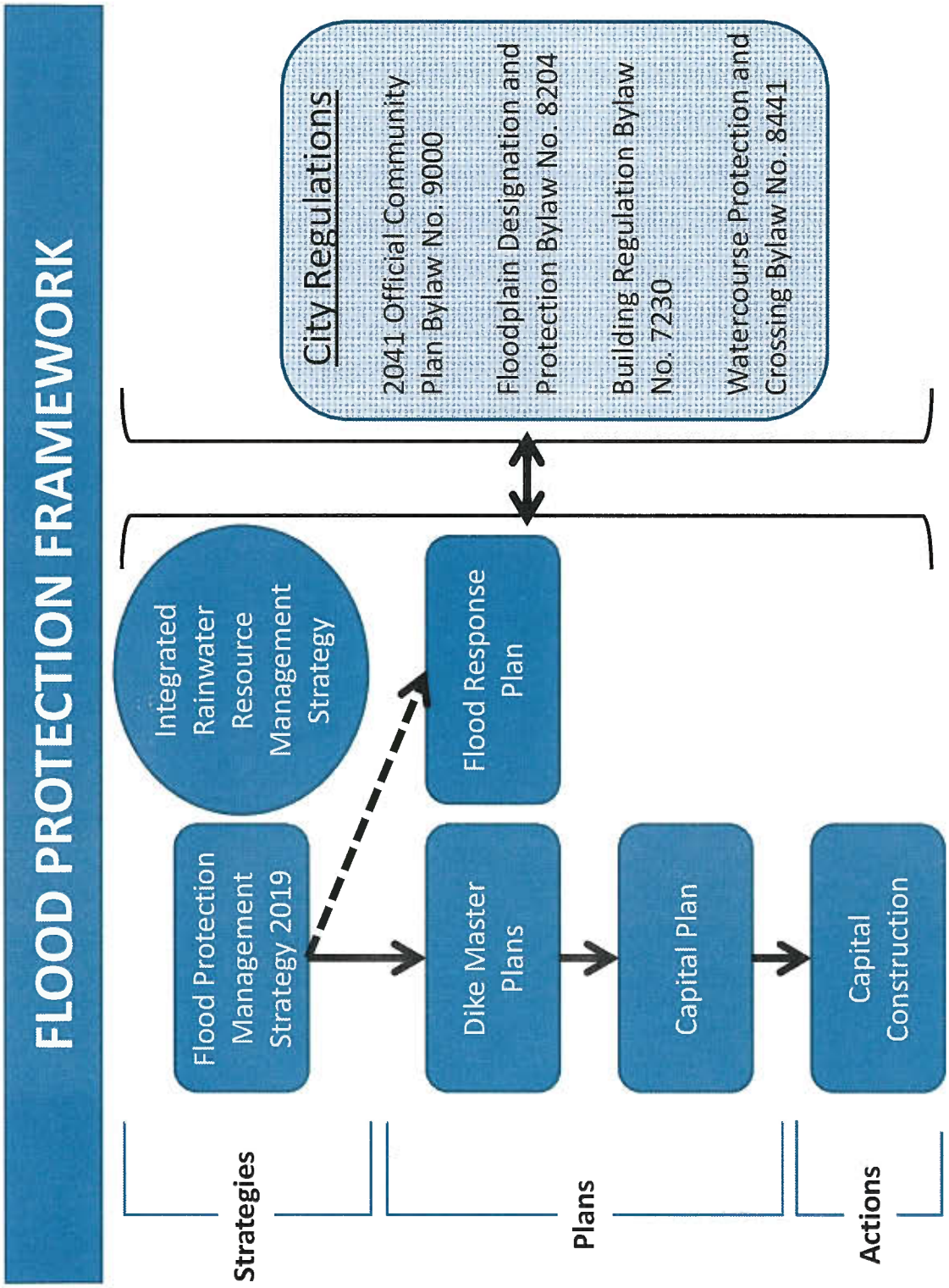
3. The City has the authority, through the *Local Government Act*, to designate a floodplain and to set construction requirements for development, subject to Provincial policies and standards (e.g., the Provincial Flood Hazard Area Land Use Management Guidelines);

- 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 Development Applications (i.e., Rezonings, Development Permits). Council 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.

Figure 1 – Flood Protection Framework



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 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 (MFLNRORD)

- MFLNRORD, 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 not 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. MFLNRORD 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 2010, the City was awarded $3.9 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 $440,000 for flood protection planning.
- Ongoing Provincial funding is encouraged.

8. Emergency Management BC (EMBC) Emergency Preparedness and Recovery

- The Province operates EMBC which coordinates aspects such as:
  - emergency preparedness training and funding;
  - disaster response coordination; and
  - recovery funding and assistance.
- EMBC will respond to emergency calls from local governments and emergency personnel. Ongoing EMBC assistance is encouraged.

9. Provincial (MFLNRORD) 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, $8.6 million was awarded to Richmond through the Federal and Provincially funded Flood Protection Program;
  - in 2014, $2 million was awarded to Richmond through the Federal and Provincially funded BC Building Canada Fund;
  - in 2017, the City of Richmond was awarded $1.1 million for flood protection planning through the National Disaster Mitigation Program;
  - in 2019, the City of Richmond was awarded $13.8 million for flood protection infrastructure upgrades through the Disaster Mitigation and Adaptation Fund; and
  - in 2019, the City of Richmond participated in the national Smart Cities Challenge for the opportunity to win $10 million.
- 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.

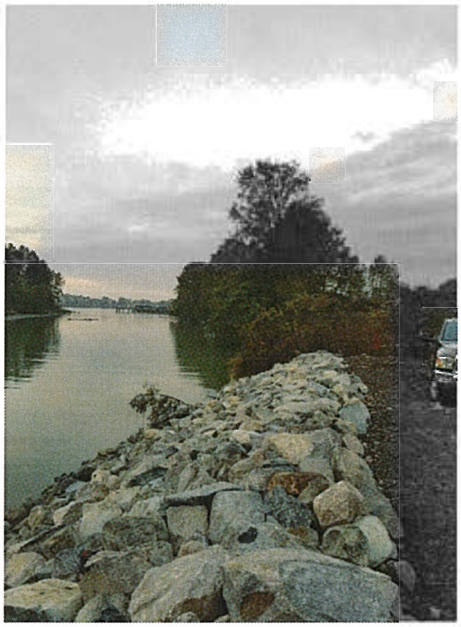
Phase 2, initiated in 2017, is expected to include the following components:

- 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 pump 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.

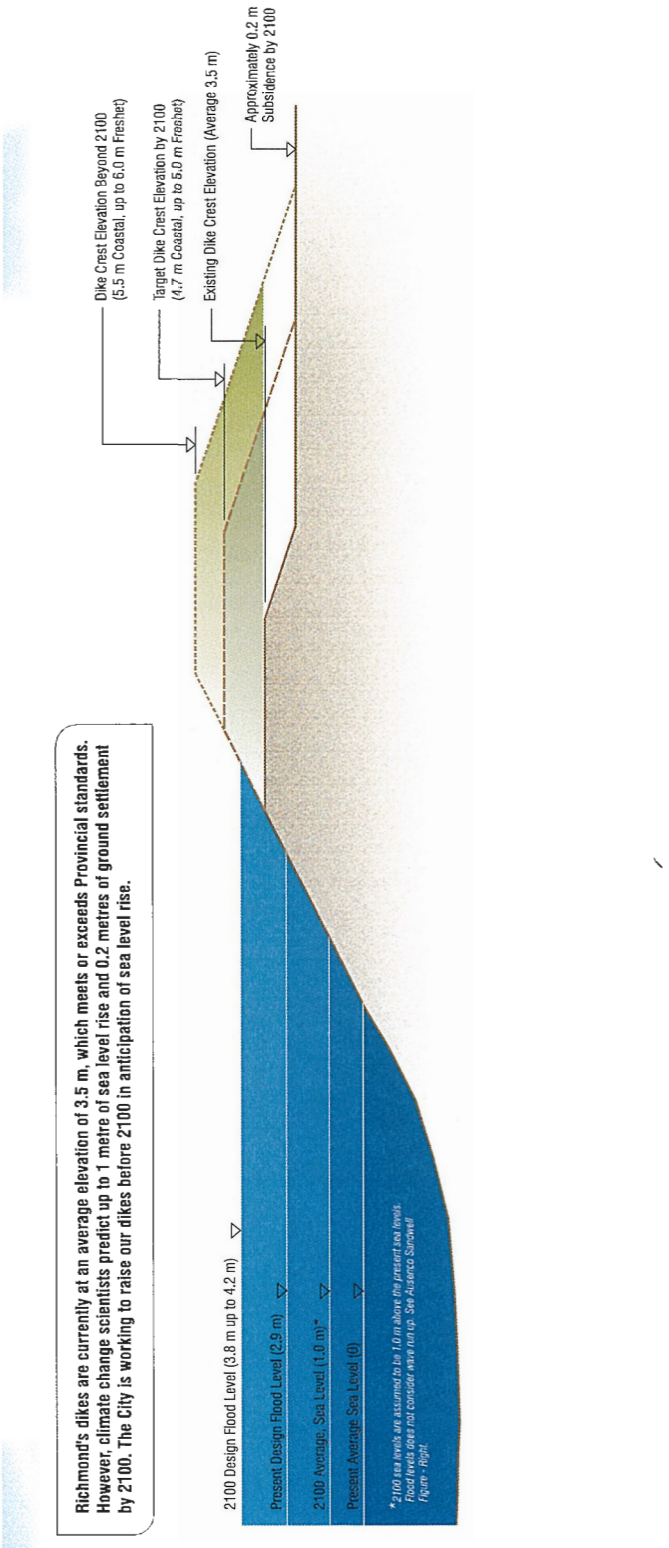
New Dike Crest Elevation Standard

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.

Figure 2 – Design Flood Levels and Dike Crest Elevations



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 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 Management Plan: Under the EMO's guidance, the City has established an Emergency Management 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.
- 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:

- next steps related to flood protection; and
- continuing strategies for the City.

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.
	Investigate nature-based, sustainable solutions for flood risk mitigation through participation in regional research initiatives and identification of innovative technology.
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 Dike Master Plan Phase 1 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) while considering implications on urban design and accessibility. 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 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.
	Evaluate the Boundary Road secondary dike concept 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 area-specific strategies along the dike corridor that may include Development Permit Areas which would be coordinated with Richmond's 2041 Official Community Plan, the Waterfront Strategy, and the Ecological Network Management Strategy. The purpose would be to ensure that all activity in these areas give priority to long-term flood protection objectives.
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 sufficient budgeting for the 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 land use changes and development.
	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 locations are 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 recommended in Dike Master Plan Phase 5).
Emergency Management	Continue with an integrated emergency management planning approach both internally and with other agencies the City will rely on during emergency events.
	Continue to work with transportation authorities with the objective of optimizing major transportation routes 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 composed of 17 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, intense rainfall, 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.

Integrated Rainwater Resource Management Strategy

In 2016, Richmond's City Council endorsed the Integrated Rainwater Resource Management Strategy (IRRMS) which provides high-level strategies to address Richmond's unique water management needs. The purpose of the IRRMS is to protect and enhance the City's stormwater conveyance infrastructure and ecological assets under higher intensity rainfall events, and considers rainwater as a resource to be utilized.

The Flood Protection Management Strategy 2019 and the Integrated Rainwater Resource Management Strategy considers future development, water management, and sustainable solutions as key components for achieving the City's goals for a safe and well-managed community. The strategies are compatible and can be used together to encourage management of water resources that are conducive to the ecological network, stormwater storage, and flood protection.

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:

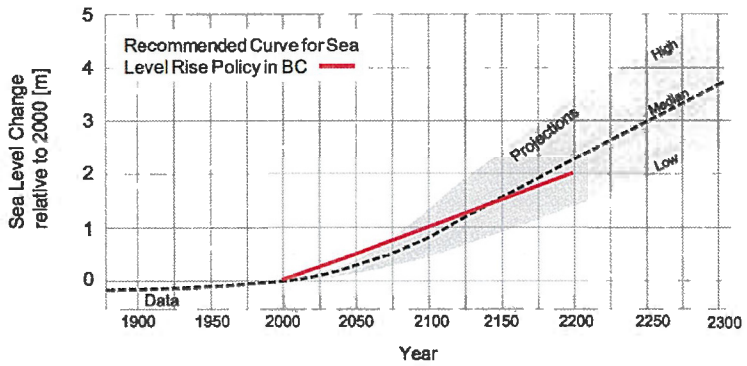
- an extreme high water condition in the river or tidal sea;
- a lowering of the dike crest; or
- an increase in the level of the Fraser River exceeding the dike crest, by extreme freshet discharges in the Fraser River.

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

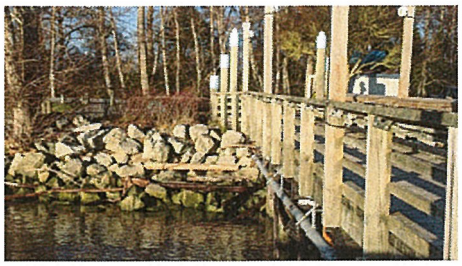
Sea level rise projections currently referenced by the Province is shown on Figure 3 and flood levels including projected sea level rise on Figure 4. The recommended linear projection will allow municipalities to overbuild their dikes in advance of the median projection. The City of Richmond has adopted 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.

Figure 3: 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

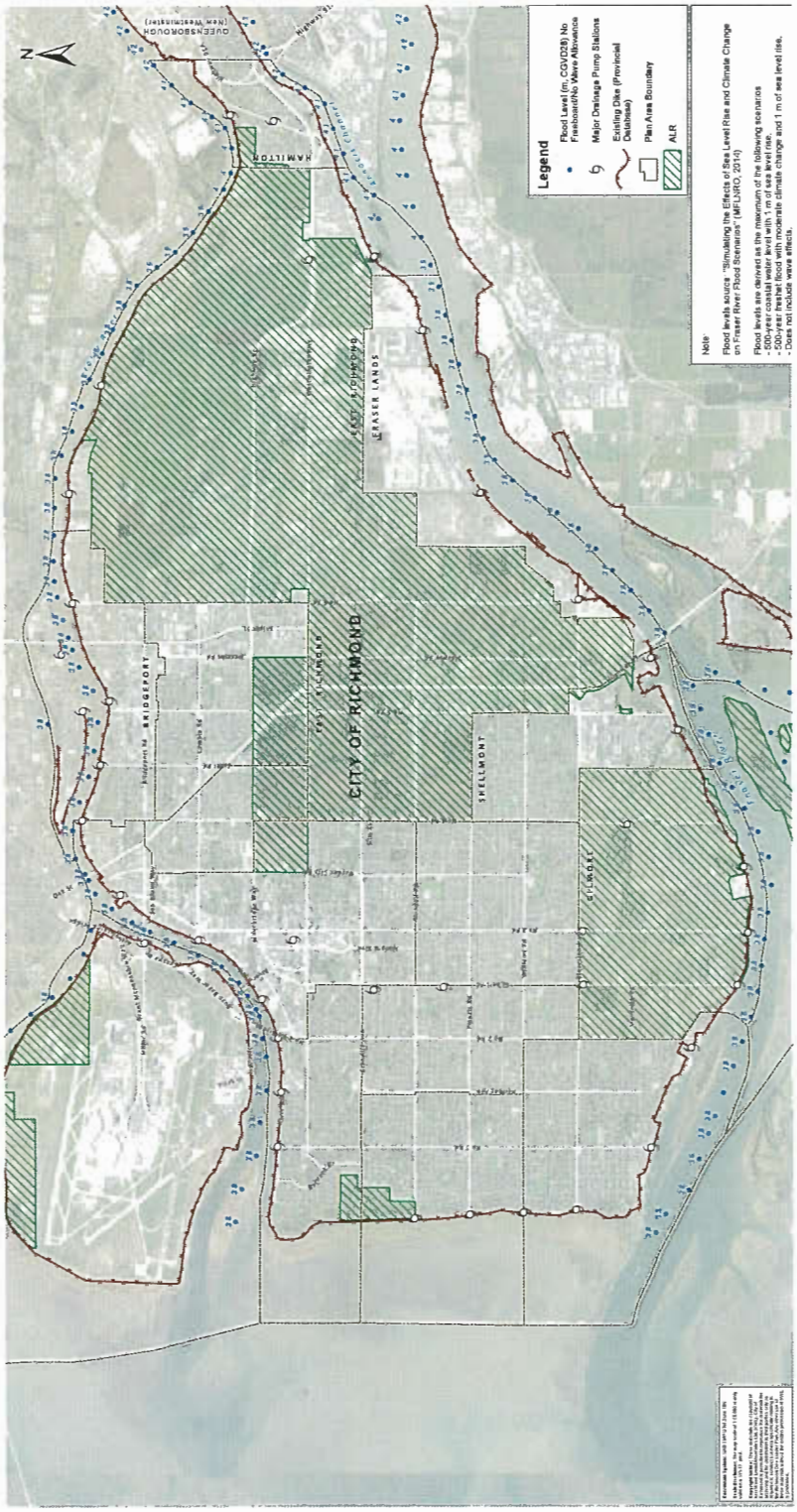
Wind setup is a local increase in water depth near the shoreline caused by the shear force of wind blowing over the water surface towards the land. The magnitude of wind setup depends on the available wind fetch and water depth, and will be greatest where there are extensive areas of shallower water. Sturgeon Bank is an example of an area that could contribute to wind setup along the western shoreline of the city.

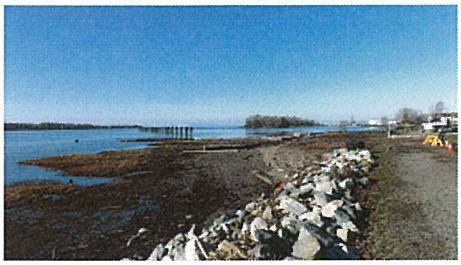
Because of its local nature, a "typical" value for wind setup cannot be defined for Richmond. Where applicable, site-specific values must be determined and added to the still-water coastal flood level. A case study of the West Dike in the 2011 Sea Dike Guidelines (Ausenco Sandwell, 2011a) includes a 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.

Figure 4 – Fraser River Flood Elevations





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 5. 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 6) 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 5: Bylaw No. 8204 Schedule B – Flood Construction Levels

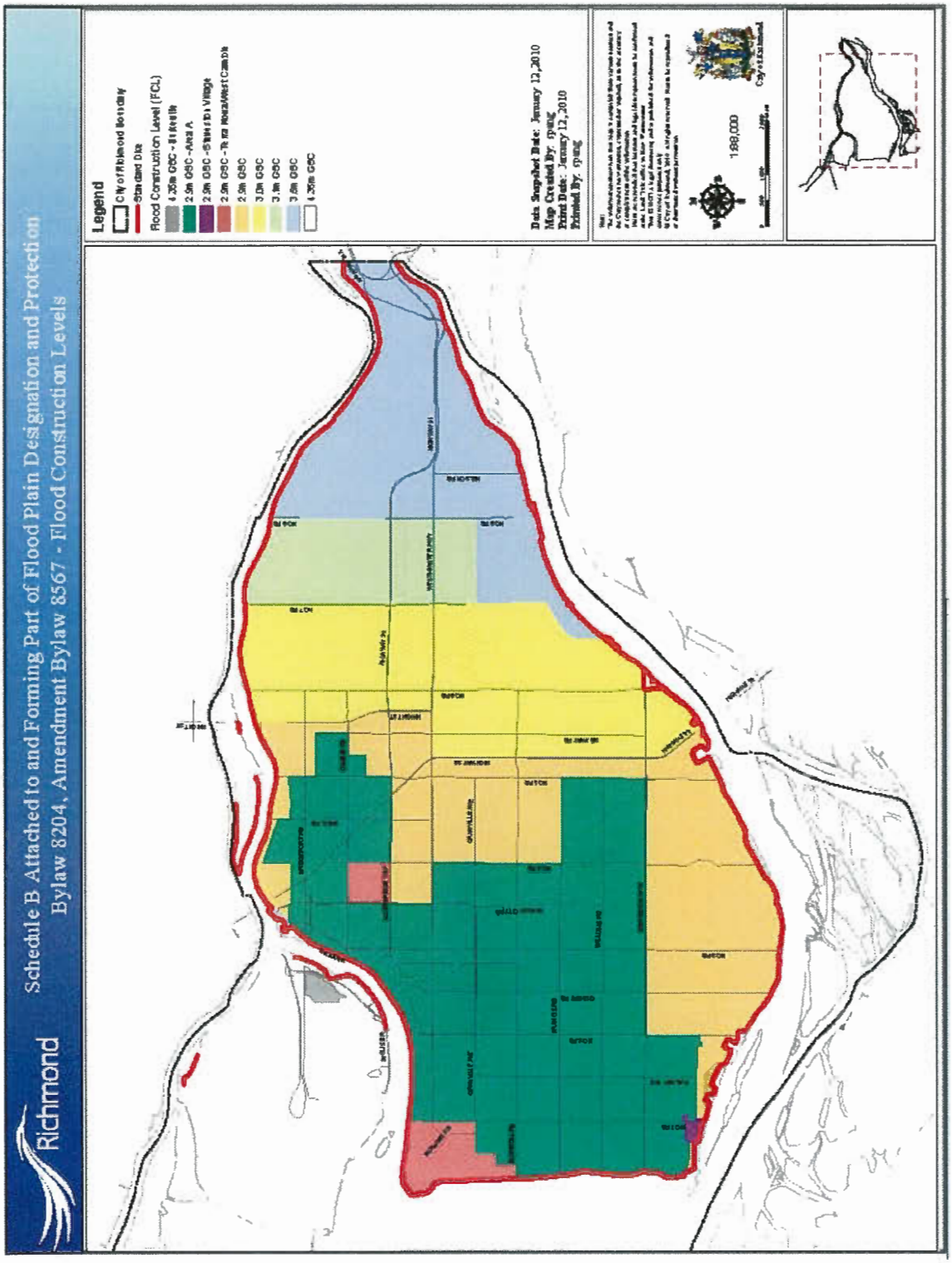
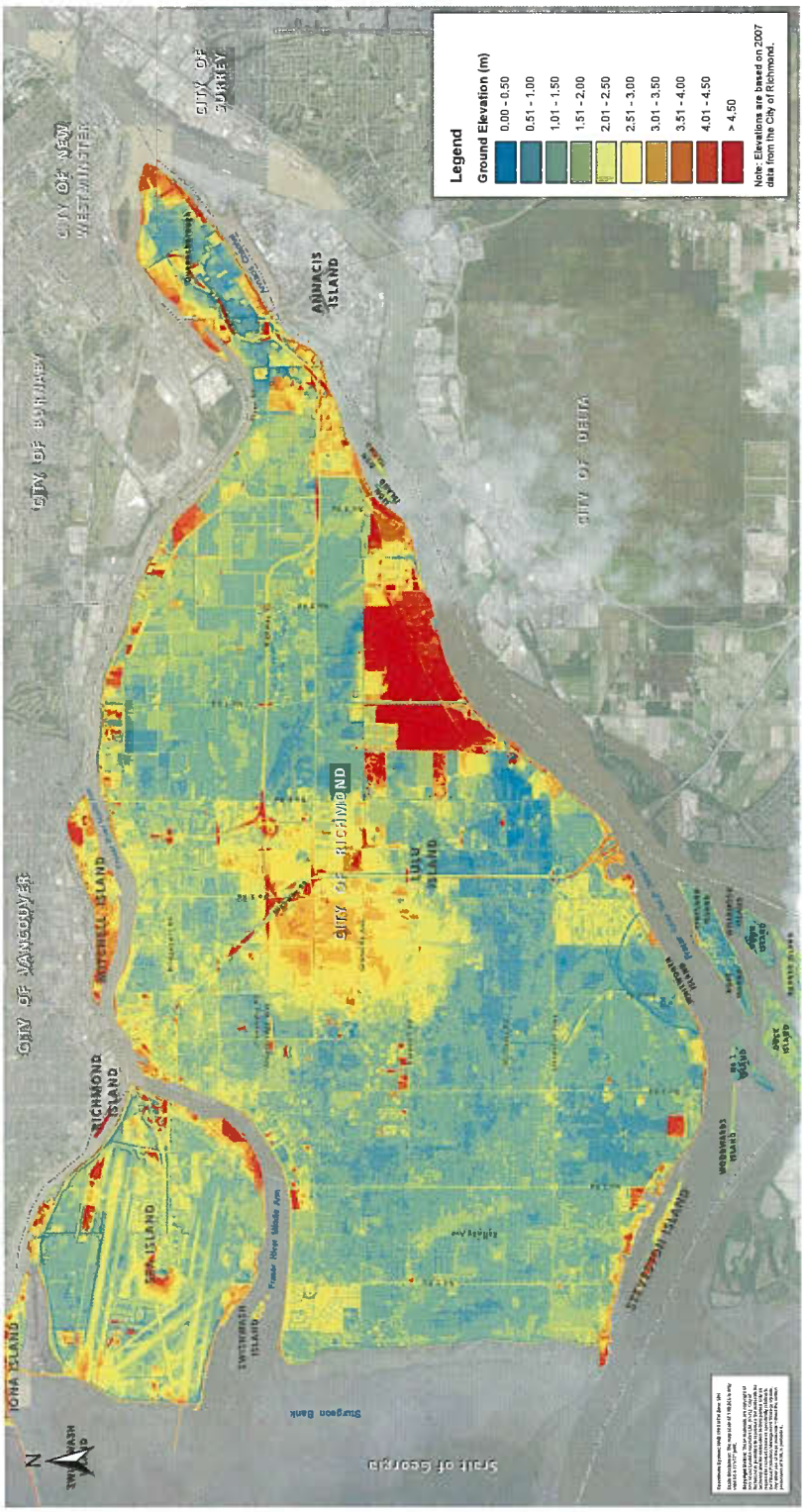
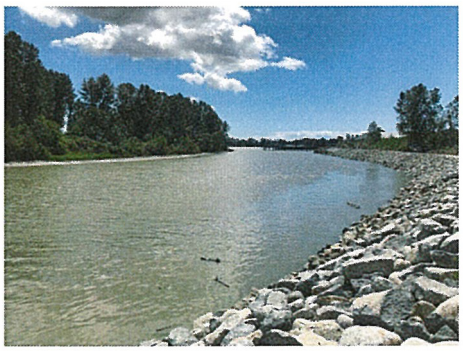


Figure 6: City of Richmond Elevation Map (2016)





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% (allocation varies annually with Program priorities) of the funding is applied to dike upgrading, at least 60 years 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 risks 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 additional tools 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 Integrated Rainwater Resource Management Strategy (2018), 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 Management Strategy.

Appendix 2: Flood Protection Program Timeline

CITY OF RICHMOND **FLOOD PROTECTION MANAGEMENT STRATEGY**

Flood Protection Bylaw Amendments | Flood Protection Master Planning | Municipal Flood Protection Construction | Development Dike Construction

2000
Council approve the concept of establishing a Drainage and Dikin[illegible] and adopt a Drainage Improvement Reserve Fund

2000
Peace Arch Drainage Pump Station rebuild is completed

2002
A multi year project begins to hydraulically model West Richmond's drainage system and prioritise system improvements

2002
A drainage utility is established to provide a dedicated funding source for drainage improvements

2002
Gilbert Road North Drainage Pump Station rehab is completed

November 2003
The Drainage Pump Station Condition Assessment is completed

2002
Tipping Road South Drainage Pump Station rebuild is completed

2003
No 1 Road South Drainage Pump Station rebuild is completed

October 2005
The Tsunami Hazard at the Fraser River Delta Study is completed. No tsunami was found to impact Richmond in the last 4000 years (since geological records began)

2006
A dike utility is implemented to provide a dedicated funding source for dike improvements

June 2006
Council adopt East Richmond Agricultural Water Supply Study 2006

July 2006
Council adopt the 2006-2031 Flood Protection Management Strategy

2006
Duck Island Drainage Pump Station rehab is complete

2007
Francis Road West Drainage Pump Station is complete

June 2008
The 2008-2031 Flood Protection Management Stategy replaces the 2006 Strategy

2008
The Flood Plain Designation and Protection Bylaw No. 8204 is enacted which outlines building, landfill and set back strategies for flood protection

2008
Richmond Olympic Oval superdike construction

2008
Comstock Road Drainage Pump Station rehab is complete

April 2009
The Mid Island Dike Study concludes that it is more cost effective to upgrade Lulu Island's perimeter dike than to build a mid island dike

2010
Gilbert Road South Drainage Pump Station rehab is complete

2010
Cambie Road West Drainage Pump Station rebuild is complete

2010
City receives $3.9 million grant from senior government for pump station upgrades

2011
Drainage Modelling is updated to support Bylaw 9000, The 2041 Official Community Plan

2011
No 4 Road North Drainage Pump Station rebuild is complete

2013
Oris "Parc Riviera Phase 1" superdike construction

April 2013
Council adopt Dike Master Plan - Phase 1 Report that includes endorsement of Steveston Island as the preferred long term dike solution in Steveston

2013
Williams Road Drainage Pump Station rebuild is complete

2013
Onni (Steveston) "Imperial Landing" superdike construction

October 2013
Council adopt Ageing Infrastructure Planning- 2013 Update Report

2014
Council adopt East Richmond Agricultural Water Supply Study Update 2013

2014
No. 1 Road North Drainage Pump Station rebuild complete

July 2015
Council adopt Ageing Infrastructure Planning- 2015 Update Report

2014
City receives $2.04 million grant from Emergency Management BC towards Bath Slough Drainage Pump Station Upgrade

2015
Bath Slough Drainage Pump Station rebuild is complete

PWT - 253

Richmond

CITY OF RICHMOND **FLOOD PROTECTION MANAGEMENT STRATEGY**

Flood Protection Bylaw Amendments | Flood Protection Master Planning | Municipal Flood Protection Construction | Development Dike Construction

2016
City receives $16.6 million grant from the Province of British Columbia towards $28 million pumpstation and dike upgrades

2017
City receives NDMP grant funding to complete Flood Mitigation Strategy Update in the amount of $500,000 ($250,000 Federal, $250,000 Provincial) which includes Dike Master Plan Phase 3, Flood Protection Management Strategy Update and the Pump Station Condition Assessment

2017
City receives UBCM grant funding to complete Dike Master Plan Phase 5 in the amount of $150,000

April 2018
Council adopt Dike Master Plan Phase 2

2018
Aspac "River Green" (east of Oval) superdike construction

2018
No. 2 Road North Drainage Pump Station rebuild is complete

April 2019
City receives $1.0 million grant from Emergency Management BC towards Steveston Highway – No. 3 Road Drainage Pump Station Upgrade

PWT - 254

(timeline cont'd)

2016
Aspac (west of Oval) superdike construction

2017
Oris "Kawaki" superdike construction

July 2017
Council adopt Ageing Utility and Road Infrastructure Planning – 2017 Update report

2017
City receives NDMP grant funding to complete Steveston Island Flood Mitigation Planning in the amount of $1,215,000 (Federal $810,000, Provincial $405,000, City of Richmond $405,000)

2017
Mitchell Island development superdike construction

2018
Britannia Flood Protection Improvements is complete

April 2018
Council adopt the Integrated Rainwater Resource Management Strategy

2018
Oris "Parc Riviera Phase 2" superdike construction

March 2019
Council adopt Dike Master Plan Phases 3 & 5

March 2019
Drainage Pump Station Condition Assessment is completed

April 2019
City receives $13.8 million grant from the Disaster Mitigation and Adaptation Fund for flood protection and infrastructure upgrades

FUTURE PROJECTS

2019
Flood Protection Management Strategy 2019

2019
Steveston Highway – No. 3 Road Drainage Pump Station Upgrade

Winter 2019
Horseshoe Slough Drainage Pump Station

Winter 2020
Shell Road North Drainage Pump Station

Winter 2020
No. 3 Road to Finn Slough Dike Upgrade

Spring 2021
No. 2 Road South Drainage Pump Station

2019
Dike Master Plan Phase 4

Winter 2019
Gilbert to No.3 Road Dike Upgrade

Winter 2019
Burkeville Drainage Upgrades Phase 1

Winter 2020
No. 7 Road South Drainage Pump Station

Winter 2020
No. 9 Road South Dike Upgrade

Richmond

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