metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

METRO VANCOUVER REGIONAL DISTRICT
WATER COMMITTEE

REGULAR MEETING

Wednesday, April 6, 2022
9:15 am
Meeting conducted electronically pursuant to the Procedure Bylaw
28th Floor Boardroom, 4515 Central Boulevard, Burnaby, British Columbia
Webstream available at http://www.metrovancouver.org

A G E N D A[1]

1. ADOPTION OF THE AGENDA

1.1 April 6, 2022 Regular Meeting Agenda
That the Water Committee adopt the agenda for its regular meeting scheduled for April 6, 2022 as circulated.

2. ADOPTION OF THE MINUTES *pg. 4*

2.1 March 2, 2022 Regular Meeting Minutes
That the Water Committee adopt the minutes of its regular meeting held March 2, 2022 as circulated.

3. DELEGATIONS

4. INVITED PRESENTATIONS

5. REPORTS FROM COMMITTEE OR STAFF

5.1 Regional Public Works Mutual Aid Agreement for Major Emergencies *pg. 9*
That the GVWD Board authorize the Board Chair and Chief Administrative Officer to sign the new Regional Public Works Mutual Aid Agreement.

5.2 GVWD 2021 Water Quality Annual Report *pg. 42*
That the GVWD Board receive for information the report dated March 8, 2022, titled "GVWD 2021 Water Quality Annual Report".

[1] *Note: Recommendation is shown under each item, where applicable.*

5.3 GVWD Water Supply System 2021 Annual Update *pg. 103*

That the Water Committee receive for information the report dated March 28, 2022, titled "GVWD Water Supply System 2021 Annual Update".

5.4 Environmental Policy for the Greater Vancouver Water District *pg. 129*

That the GVWD Board approve the Environmental Policy for the Greater Vancouver Water District and related document, Environmental Performance Goals, as presented in the report dated March 7, 2022, titled "Environmental Policy for the Greater Vancouver Water District".

5.5 Engagement Plan and Proposed Rates for Water DCC Program Implementation *pg. 138*

That the GVWD Board:

a) direct staff to proceed with engagement on the proposed implementation of a water DCC program as described in the report dated March 3, 2022, titled "Engagement Plan and Proposed Rates for Water DCC Program Implementation"; and

b) direct staff to proceed with engagement on the proposed implementation of the water DCC program with rates determined using a 90% assist factor.

5.6 GVWD Capital Program Expenditure Update to December 31, 2021 *pg. 144*

That the Water Committee receive for information the report dated March 7, 2022, titled "GVWD Capital Program Expenditure Update to December 31, 2021".

5.7 2021 Contribution Agreement Annual Reports - Seymour Salmonid Society and Coquitlam River Watershed Roundtable *pg. 155*

That the Water Committee receive for information the report dated March 1, 2022, titled "2021 Contribution Agreement Annual Reports - Seymour Salmonid Society and Coquitlam River Watershed Roundtable".

5.8 Drinking Water Conservation Program Update *pg. 218*

That the Water Committee receive for information the report dated March 11, 2022, titled "Drinking Water Conservation Program Update".

5.9 2022 Lawn Watering Communications and We Love Water Campaign Update *pg. 223*

That the GVWD Board receive for information the report dated March 22, 2022, titled "2022 Lawn Watering Communications and We Love Water Campaign Update".

5.10 Water Supply Update for Summer 2022 *pg. 233*

That the Water Committee receive for information the report dated March 28, 2022, titled "Water Supply Update for Summer 2022".

5.11 GVWD Flow Meter Upgrade Program – Progress Report *pg. 237*

That the Water Committee receive for information the report dated March 22, 2022 titled "GVWD Flow Meter Upgrade Program – Progress Report".

5.12 Project Delivery Capital Portfolio Update *pg. 240*

That the Water Committee receive for information the report dated March 23, 2022 titled "Project Delivery Capital Portfolio Update".

5.13 Manager's Report *pg. 243*

That the Water Committee receive for information the report dated March 22, 2022, titled "Manager's Report".

6. INFORMATION ITEMS

7. OTHER BUSINESS

8. BUSINESS ARISING FROM DELEGATIONS

9. RESOLUTION TO CLOSE MEETING

10. ADJOURNMENT/CONCLUSION

That the Water Committee adjourn/conclude its regular meeting of April 6, 2022.

Membership:

Brodie, Malcolm (C) – Richmond
Elford, Doug (VC) – Surrey
Asmundson, Brent – Coquitlam
Baird, Ken – Tsawwassen First Nation
Bell, Don – North Vancouver City
Bligh, Rebecca – Vancouver
Dingwall, Bill – Pitt Meadows
Guichon, Alicia – Delta
Keithley, Joe – Burnaby
Martin, Gayle – Langley City
Ross, Jamie – Belcarra
Svendsen, Ryan – Maple Ridge
Vagramov, Rob – Port Moody

METRO VANCOUVER REGIONAL DISTRICT
WATER COMMITTEE

Minutes of the Regular Meeting of the Metro Vancouver Regional District (MVRD) Water Committee held at 9:01 a.m. on Wednesday, March 2, 2022 in the 28th Floor Boardroom, 4515 Central Boulevard, Burnaby, British Columbia.

MEMBERS PRESENT:
Chair, Mayor Malcolm Brodie*, Richmond
Vice Chair, Councillor Doug Elford*, Surrey
Councillor Brent Asmundson*, Coquitlam
Councillor Don Bell*, North Vancouver City
Councillor Rebecca Bligh*, Vancouver (arrived at 9:02 a.m.)
Mayor Bill Dingwall, Pitt Meadows (arrived at 9:07 a.m.)
Councillor Alicia Guichon*, Delta
Councillor Joe Keithley*, Burnaby
Councillor Gayle Martin*, Langley City
Mayor Jamie Ross*, Belcarra
Councillor Ryan Svendsen*, Maple Ridge
Mayor Rob Vagramov, Port Moody

MEMBERS ABSENT:
Chief Ken Baird, Tsawwassen

STAFF PRESENT:
Marilyn Towill, General Manager, Water Services
Natalia Melnikov, Legislative Services Coordinator, Board and Information Services

1. ADOPTION OF THE AGENDA

1.1 March 2, 2022 Regular Meeting Agenda

It was MOVED and SECONDED
That the Water Committee adopt the agenda for its regular meeting scheduled for March 2, 2022 as circulated.

CARRIED

9:02 a.m. Councillor Bligh arrived at the meeting.

*denotes electronic meeting participation as authorized by Section 3.6.2 of the *Procedure Bylaw*

2. ADOPTION OF THE MINUTES

2.1 January 12, 2022 Regular Meeting Minutes

It was MOVED and SECONDED
That the Water Committee adopt the minutes of its regular meeting held January 12, 2022 as circulated.

CARRIED

3. DELEGATIONS

No items presented.

4. INVITED PRESENTATIONS

No items presented.

5. REPORTS FROM COMMITTEE OR STAFF

5.1 2022 Water Sustainability Innovation Fund Applications

Report dated February 14, 2022, from Lucas Pitts, Director, Policy, Planning and Analysis, presenting the Water Committee with the six approved Water Services projects.

Members were provided with an overview of the 2022 Water Sustainability Innovation Fund applications for the six approved Water Services projects, including 10-year salmon enhancement action plan, hydrological models for the Capilano and Seymour Watersheds, digital transformation of the water system planning and analysis, feasibility study for transmission system energy use optimization, new technology for the determination of E.coli in recreational water, and regional equity and affordability of drinking water in the region.

9:07 a.m. Mayor Dingwall arrived at the meeting.

Presentation material titled "Water Sustainability Innovation Fund Applications" is retained with the March 2, 2022 Water Committee agenda.

It was MOVED and SECONDED
That the Water Committee receive for information, the report dated February 14, 2022, titled "2022 Water Sustainability Innovation Fund Applications" and the list of the 2022 Water Services Sustainability Innovation Fund projects.

CARRIED

5.2 Award of Contract Resulting from Tender No. 21-001: Construction of Fleetwood Reservoir Phase 1

Report dated February 1, 2022, from Roy Moulder, Director, Procurement, Procurement and Real Estate Services, and Goran Oljaca, Director, Engineering and Construction, Water Services, advising the Water Committee of the results of Tender No. 21-001: Construction – Fleetwood Reservoir Phase 1 and recommending award of the contract in the amount of $30,959,650.00 (exclusive of taxes) to Kenaidan Contracting Ltd.

It was MOVED and SECONDED

That the GVWD Board:

a) approve the award of a contract in the amount of $30,959,650.00 (exclusive of taxes) to Kenaidan Contracting Ltd. resulting from Tender No. 21-001: Construction - Fleetwood Reservoir Phase 1, subject to final review by the Commissioner; and
b) authorize the Commissioner and the Corporate Officer to execute the required documentation once the Commissioner is satisfied that the award should proceed.

CARRIED

5.3 Port Mann Corridor Upgrades – Completion Report

Report dated February 2, 2022, from Joel Melanson, Division Manager, Engineering and Construction, and Ross Richardson, Lead Senior Engineer, Engineering and Construction, Water Services, informing the Water Committee of the completion of the Port Mann water supply corridor upgrade program and providing an update on how these projects contribute to meeting the key strategic directions set out in *The Board Strategic Plan 2019 to 2022*.

It was MOVED and SECONDED

That the Water Committee receive for information the report, dated February 2, 2022, titled "Port Mann Corridor Upgrades – Completion Report".

CARRIED

5.4 GVWD Electrical Energy Use, Generation and Management

Report dated February 10, 2022, from Arezoo Heidarian, Lead Senior Engineer, and Terry Hui, Division Manager, Technical Support Services, Water Services, providing the Water Committee with information on the water utility's electrical energy usage, generation, and energy management projects.

Members were provided with an overview of the water utility's electrical energy usage and costs savings from energy generation at four water facilities and various energy management projects.

Request of Staff
Staff were requested to provide information on the cost of equipment, upgrades, and process improvements, as well as return on investment compared to the associated energy savings.

It was MOVED and SECONDED
That the Water Committee receive for information the report dated February 10, 2022 titled "GVWD Electrical Energy Use, Generation and Management".

CARRIED

5.5 Manager's Report
Report dated February 14, 2022, from Marilyn Towill, General Manager, Water Services, providing the Water Committee with an update on the Water Development Cost Charges and a copy of the revised Water Committee 2022 Meeting Schedule and Work Plan.

Discussion ensued regarding the impact of the Development Cost Charges (DCC) on affordable housing, the grace period for new and in-stream applications, and the need for further discussion on the assist factor.

It was MOVED and SECONDED
That the Water Committee receive for information the report dated February 14, 2022, titled "Manager's Report".

CARRIED

6. INFORMATION ITEMS
No items presented.

7. OTHER BUSINESS
No items presented.

8. BUSINESS ARISING FROM DELEGATIONS
No items presented.

9. RESOLUTION TO CLOSE MEETING
No items presented.

10. ADJOURNMENT/CONCLUSION

It was MOVED and SECONDED
That the Water Committee conclude its regular meeting of March 2, 2022.

CARRIED
(Time: 9:31 a.m.)

_____ _____

Natalia Melnikov,
Legislative Services Coordinator

Malcolm Brodie, Chair

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metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

To: Water Committee

From: Peter Navratil, General Manager, Liquid Waste Services
Brant Arnold-Smith, Program Manager, Security & Emergency Management

Date: March 11, 2022 Meeting Date: April 6, 2022

Subject: **Regional Public Works Mutual Aid Agreement**

RECOMMENDATION
That the GVWD Board authorize the Board Chair and Chief Administrative Officer to sign the new Regional Public Works Mutual Aid Agreement.

EXECUTIVE SUMMARY
A major emergency or other serious incident affecting one or more Local Authorities or Regional Authorities is more and more likely to affect the Metro Vancouver region given the impacts of climate change and the ever present seismic risk. The current GVRD Public Works Mutual Aid Agreement dated February 8, 2000 requires modernizing as several jurisdictions, such as Anmore, Belcarra, Bowen Island, Tsawwassen First Nation, Lions Bay, UBC/UEL, MVRD, GVS&DD and GVWD are not party to the agreement, and would like to be included. The new Regional Public Works Mutual Aid Agreement improves on the agreement from 2000 and is intended to set the terms and conditions for sharing resources, during a coordinated and supportive response.

The new Agreement has undergone extensive consultation through a number of municipal advisory committees, most notably, the Regional Administrators Advisory Committee, who unanimously endorsed the final version of the agreement. Over the next 6 months, Boards and Councils around the region will be given the opportunity to sign the agreement. Once completed, the February 8, 2000 agreement will be repealed.

Staff recommend that the GVWD become a signatory.

PURPOSE
The new Regional Public Works Mutual Aid Agreement's (Attachment 1) purpose is to allow for mutual support, aid and assistance to be provided by members to ensure that Public Works are maintained in the event of an emergency or other serious incident. Local Authorities are required under the *Local Authority Emergency Management Regulation* to identify the procedures by which emergency resources, including, without limitation, personnel, equipment and facilities, may be obtained from sources within or outside of the jurisdictional area for which the Local Authority has responsibility.

Resources are intended to be available in the event of a major emergency of such magnitude that it is likely to be beyond the capability of a single Local Authority or Regional Authority and requires the combined resources of several or all the Local Authorities and Regional Authorities in the Agreement.

This Agreement shall not supplant, without mutual consent, existing agreements between the Parties for the exchange or provision of resources on a reimbursable, exchange, or other basis.

BACKGROUND

The current GVRD Public Works Mutual Aid Agreement signed February 8, 2000 (Attachment 2) excludes a number of jurisdictions who would now like to participate. The recent events of the pandemic and extreme flooding in the fall of 2021, along with the ever present seismic risks in the region have highlighted the benefits of mutual aid.

The proposed new Agreement modernizes terms, improves indemnification clauses and opens the Agreement up to all Metro Vancouver members including the MVRD, GVWD and GVS&DD.

AGREEMENT PRINCIPLES

The Regional Public Works Mutual Agreement is designed following these principles:

- Voluntary support based on each jurisdiction's situation
- Call your neighbours first
- Responders take direction from Requestors
- Costs will be based on Responders "rates of the day" with a 10% overhead allowance added
- All parties are expected to maintain sufficient insurance
- Provision included for Joinder Agreements

ADVISORY COMMITTEE ENGAGEMENT

Since the fall of 2021, staff have engaged with several advisory committees (each committee multiple times) including the Regional Emergency Planners Committee (REPC), the Regional Engineers Advisory Committee (REAC) and the Regional Administrators Advisory Committee (RAAC) to obtain their feedback and input on the proposed new Agreement.

Most of the advisory committees' comments focused on whether the agreement maintains 'task eligibility' with the Province, definitions within the agreement, whether or not to include overhead on costs and finally indemnification.

All of the comments have been taken into account and reviewed by in-house and external legal advice.

In the final briefing to RAAC, they voted unanimously to endorse the agreement.

LEGAL IMPLICATIONS

The local government Councils and Board of the Metro Vancouver Regional District (with respect to Electoral Area A) are "local authorities" within the meaning of the *Emergency Program Act*, [RSBC 1996] Chapter 111. Local Authorities are required under the *Local Authority Emergency Management Regulation* [B.C. Reg. 380/95] to identify the procedures by which emergency resources, including, without limitation, personnel, equipment and facilities may be obtained from sources within or outside of the jurisdictional area for which the Local Authority has responsibility.

The *Local Authority Emergency Management Regulation* [BC Reg. 380/95], states a Local Authority may enter into mutual aid agreements for resources and subsequent cost recovery outside of the jurisdictional area for which the Local Authority has responsibility.

The *Local Government Act* [RSBC 2015, Chapter 1], a board of a regional district has the statutory authority to enter into mutual aid agreements with a Local Authority.

The *Greater Vancouver Sewerage and Drainage District Act* [SBC 1956, Chapter 59] and the *Greater Vancouver Water District Act* [SBC 1924, Chapter 22], the GVS&DD and the GVWD, respectively, have the statutory authority to enter into mutual aid agreements with Local Authorities.

The *University Endowment Land Act* [RSBC 1996 Ch. 469], the Minister of Municipal Affairs has the authority to enter into agreements respecting the administration of the University Endowment Land.

ALTERNATIVES

1. That the GVWD Board authorize the Board Chair and Chief Administrative Officer to sign the new Regional Public Works Mutual Aid Agreement.

2. That the GVWD Board receive for information the report dated March 11, 2022 titled "Regional Public Works Mutual Aid Agreement" and provide alternate direction to staff.

FINANCIAL IMPLICATIONS

There are no additional financial implications associated with the agreement or its ongoing maintenance. This was accomplished by using each jurisdiction's 'rates of the day' as a way to avoid annual updates to lists for labour, material and equipment rates. A key objective was to develop a simple, and easy to apply agreement that could be activated efficiently by any signatory.

CONCLUSION

Staff recommend Alternative 1, that the GVWD Board sign as a signatory to the new Regional Public Works Mutual Aid Agreement. The Agreement will allow for a coordinated and supportive response during a major emergency or other serious incident affecting one or more Local Authorities or Regional Authorities within the Metro Vancouver region.

Attachments

1. Regional Public Works Mutual Aid Agreement
2. GVRD Public Works Mutual Aid Agreement signed February 8, 2000

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REGIONAL PUBLIC WORKS MUTUAL AID AGREEMENT

This Agreement is made as of the ____ day of _____ 2022,

AMONG:

1) **Village of Anmore**
2) **Village of Belcarra**
3) **Bowen Island Municipality**
4) **City of Burnaby**
5) **City of Coquitlam**
6) **City of Delta**
7) **City of Langley**
8) **Township of Langley**
9) **Village of Lions Bay**
10) **City of Maple Ridge**
11) **City of New Westminster**
12) **City of North Vancouver**
13) **District of North Vancouver**
14) **City of Pitt Meadows**
15) **City of Port Coquitlam**
16) **City of Port Moody**
17) **City of Richmond**
18) **City of Surrey**
19) **Tsawwassen First Nation**
20) **City of Vancouver**
21) **District of West Vancouver**
22) **City of White Rock**
23) **Metro Vancouver Regional District (as to Electoral Area A)**
24) **Greater Vancouver Sewerage and Drainage District**
25) **Greater Vancouver Water District**
26) **Her Majesty the Queen in Right of the Province of British Columbia, as represented by the Minister of Municipal Affairs (as to the University Endowment Land)**
27) **University of British Columbia**

WHEREAS:

A. Capitalized terms used in these recitals and this Agreement have the meanings ascribed to them in Section 1.0;

B. The local government councils and board of the Metro Vancouver Regional District (with respect to Electoral Area A) are "local authorities" within the meaning of the *Emergency Program Act*, [RSBC 1996] Chapter 111;

C. Local Authorities are required under the *Local Authority Emergency Management Regulation* [B.C. Reg. 380/95] to identify the procedures by which emergency resources, including personnel, equipment and facilities may be obtained from sources within or outside of the jurisdictional area

for which the Local Authority has responsibility;

D. A Major Emergency affecting one or more Local Authorities or Regional Authorities is likely to affect the Metro Vancouver region as a whole and as such, the Parties agree that it is in the best interests for the Parties to implement a coordinated and supportive response;

E. Pursuant to the *Local Authority Emergency Management Regulation* [BC Reg. 380/95], a Local Authority may enter into mutual aid agreements for Resources and subsequent cost recovery outside of the jurisdictional area for which the Local Authority has responsibility;

F. Pursuant to the *Local Government Act* [RSBC 2015, Chapter 1], a board of a regional district has the statutory authority to enter into mutual aid agreements with a Local Authority;

G. Pursuant to the *Greater Vancouver Sewerage and Drainage District Act* [SBC 1956, Chapter 59] and the *Greater Vancouver Water District Act* [SBC 1924, Chapter 22], the GVS&DD and the GVWD, respectively, have the statutory authority to enter into mutual aid agreements with Local Authorities;

H. Pursuant to the *University Endowment Land Act* [RSBC 1996 Ch. 469], the Minister of Municipal Affairs has the authority to enter into agreements respecting the administration of the University Endowment Land;

I. Pursuant to the *University Act* [RSBC 1996 Ch. 468], the Board of Governors of the University of British Columbia has the authority to enter into agreements on behalf of the university; and

J. The Parties desire to enter into this Agreement for the purposes of providing for mutual support, aid and assistance to, among other things, ensure that Public Works are maintained in the event of a Major Emergency.

NOW THEREFORE in consideration of the premises and of the sum of $10.00 and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, each of the above signing Parties hereto covenant and agree with each other as follows:

1.0 Definitions

In this Agreement, unless something in the subject matter or context is inconsistent therewith, the capitalized terms herein will have the meanings set out below:

(a) "**Agreement**" means this agreement and includes all recitals and schedules to this agreement;

(b) "**Authorized Representative**" means the representative of the Local Authority or Regional Authority authorized by the municipal council, regional board, Minister of Municipal Affairs or Board of Governors of the University of British Columbia, as applicable, to coordinate, allocate, and prioritize assistance under the terms of this Agreement.

(c) "**Computer System**" means any computer, hardware, software, communications system, electronic device, server, cloud, or microcontroller, including similar system or any configuration of the aforementioned and including any associated input, output, data

storage device, networking equipment or back up facility.

(d) "**Cyber Attack**" means an attempt to disrupt, disable, destroy or maliciously control a Computer System and includes, without limitation, an attempt to destroy the integrity of data or to steal controlled information.

(e) "**Disaster**" means a calamity that:

(i) is caused by accident, fire, explosion or technical failure or by the forces of nature; and

(ii) has resulted in serious harm to the health, safety or welfare of people, or in widespread damage to property.

(f) "**Effective Date**" has the meaning given in Section 9.1;

(g) "**Emergency**" means a present or imminent event or circumstance that:

(i) is caused by accident, fire, explosion, pandemic, technical failure or the forces of nature; and

(ii) requires prompt coordination of action or special regulation of persons or property to protect the health, safety or welfare of a person or to limit damage to property.

(h) "**GVS&DD**" means the Greater Vancouver Sewerage and Drainage District;

(i) "**GVWD**" means the Greater Vancouver Water District;

(j) "**Joinder Agreement**" means an agreement substantially in the form attached hereto as Schedule "A", pursuant to which a New Party agrees to join and be bound by the terms of this Agreement;

(k) "**Local Authority**" means:

(i) for a municipality, the municipal council; and

(ii) for an electoral area in a regional district, the board of the regional district;

and for the purposes of this Agreement includes the following parties who are not are "local authorities" within the meaning of the *Emergency Program Act*, [RSBC 1996] Chapter 111:

(iii) for the University Endowment Lands, the Minister of Municipal Affairs; and

(iv) for the University of British Columbia, its Board of Governors.

(l) "**Major Emergency**" means an Emergency, Disaster or Other Serious Incident that involves one or more Local Authorities or Regional Authorities and requires resources beyond the capability of one or more of the Local Authorities or Regional Authorities

involved.

(m) "**New Party**" has the meaning given in Section 9.3 below.

(n) "**Other Serious Incident**" means any sudden, unexpected, or unintended incident, other than a Disaster or Emergency, and including a Cyber Attack, for which a Local Authority or Regional Authority may require assistance to protect the health, safety or welfare of a person or to limit damage to Public Works or other property.

(o) "**Parties**" means those parties who have signed this Agreement or a Joinder Agreement, and "Party" means any one of them.

(p) "**Public Works**" means any work or property under the management or control of the Local Authority or Regional Authority, including but not limited drinking water, wastewater waste management services, transportation systems and networks and Computer Systems.

(q) "**Regional Authority**" means the Board of the GVS&DD or the Board of the GVWD.

(r) "**Requesting Authority**" means a Requesting Local Authority or Requesting Regional Authority, as the case may be.

(s) "**Requesting Authority's Personnel**" includes any elected officials, officers, employees or affiliated volunteers of a Requesting Authority.

(t) "**Requesting Local Authority**" means a Local Authority under a Major Emergency situation that has, pursuant to this Agreement, requested assistance from another Local Authority or Regional Authority.

(u) "**Requesting Regional Authority**" means a Regional Authority under a Major Emergency situation that has, pursuant to this Agreement, requested assistance from another Local Authority or Regional Authority.

(v) "**Resources**" means a Local Authority's personnel, equipment, facilities, services and materials that are available or potentially available for utilization to ensure that Public Works are maintained.

(w) "**Responding Authority**" means a Responding Local Authority or Responding Regional Authority, as the case may be.

(x) "**Responding Authority's Personnel**" includes any elected officials, officers, employees or affiliated volunteers of a Responding Authority.

(y) "**Responding Local Authority**" means a Local Authority that provides Resources to a Requesting Authority that has, pursuant to this Agreement, requested assistance to confront a Major Emergency.

(z) "**Responding Regional Authority**" means a Regional Authority that provides Resources to a Requesting Authority that has, pursuant to this Agreement, requested assistance to

confront a Major Emergency.

(aa) "**Standby Expenses**" means compensation paid or owing to an employee not scheduled for normal work but who is required to be immediately available for call-in work.

2.0 Intent of the Agreement

2.1 This Agreement is intended to guide the sharing of Resources amongst Local Authorities and Regional Authorities when assistance has been requested during Major Emergency situations for which the sharing of Resources is required.

2.2 Resources are intended to be available in the event of a Major Emergency of such magnitude that it is, or is likely to be, beyond the capability of a single Local Authority or Regional Authority and requires the combined Resources of several or all of the Local Authorities and Regional Authorities to this Agreement.

3.0 Scope of the Agreement

3.1 Except as set out in Section 12.1 below, this Agreement shall not supplant, without mutual consent, existing agreements between the Parties for the exchange or provision of Resources on a reimbursable, exchange, or other basis.

3.2 Any activation of this Agreement under Section 4.0 will clearly state that the request for Resources is being made under this Agreement.

4.0 Activation

4.1 In the event of a Major Emergency, the Authorized Representative designated by the Requesting Authority may activate this Agreement by making a request for Resources to the Authorized Representative of one or more Parties to this Agreement.

4.2 If the Requesting Authority is a Local Authority, such Requesting Local Authority shall first request Resources from their bordering Local Authorities, before requesting Resources from more distant Local Authorities or from Regional Authorities.

4.3 If the Requesting Authority is a Regional Authority, the Requesting Regional Authority shall first request Resources from those Local Authorities adjacent to the location of the Major Emergency before requesting Resources from more distant Local Authorities.

4.4 Sections 4.2 and 4.3 shall not restrict a Requesting Authority from accepting the first available Resources from any Local Authority.

5.0 Resource Requests and Inventory

5.1 Each Party agrees that, in the event of a Major Emergency, it will, upon receipt of a written request from a Requesting Party, furnish such Resources as are available, provided that doing so would not unreasonably diminish the capacity of the Responding Authority to provide any required Resources to its own jurisdictional area. For certainty, the extent of the assistance given will be at the discretion of the Authorized Representative of the Responding Authority, having regard to

its own local needs and situation at the time.

5.2 The start date of the provision of Resources will be the date agreed to in writing by both the Requesting Authority and Responding Authority. The termination date for the provision of Resources will be determined by the Responding Authority and shall not exceed the end time of the Major Emergency, as agreed by the Responding Authority and Requesting Authority.

5.3 During a Major Emergency, all personnel from a Responding Authority shall report to and work under the direction of the Party within whose jurisdiction the Major Emergency is occurring, in cooperation with the Requesting Authority and any other Responding Authorities.

5.4 Each Party should maintain an inventory of Resources that may be made available in the event of a Major Emergency and share that inventory with its neighbouring Local Authorities and Regional Authorities.

5.5 If a request for Resources is made pursuant to this Agreement, the Requesting Party will, as necessary, make available to the Responding Authority:

(a) maps of its jurisdiction indicating the nearest and most suitable roads to enable responders to get to an emergency as quickly as possible, together with locations of water supplies and access thereto;

(b) applicable operating guidelines and communications protocols;

(c) a copy of the Requesting Authority's emergency plan; and

(d) names and contact information for the Requesting Authority's key personnel.

6.0 Reimbursement

6.1 The Requesting Authority will reimburse the Responding Authority for any actual costs incurred providing any Resources requested under this Agreement, plus a sum equal to 10% of those costs and expenses on account of the Responding Authority's overhead.

6.2 Without limiting the generality of Section 6.1, a Requesting Authority shall pay to the Responding Authority:

(a) Regular Time – Salaries, wages and other regular time employment expenses (including benefits and statutory deductions) of employees or affiliated volunteers, at the current prevailing rates of the Responding Authority.

(b) Overtime and Standby Expenses – Overtime employment expenses and Standby Expenses of employees or affiliated volunteers, at the current prevailing rates of the Responding Authority. There is no compensation for banked time of employees.

(c) Supplies and Materials – Value of supplies or other materials which are not returnable to the Responding Authority. All charges will be at current market rates or at rates otherwise agreed to. Supplies or materials may be replaced with like supplies or materials, if agreed to by the Responding Authority.

(d) Equipment – Compensation for the use of equipment, vehicles, computers, or other hardware owned outright by the Responding Authority. Equipment reimbursement rates shall be at a rate agreed to by the Requesting Authority and Responding Authority for vehicles or other equipment. If a rate cannot be agreed, the rate will at the British Columbia standard for equipment reimbursement, as represented by the Blue Book – BC Equipment Rental Rate Guide. The Requesting Authority shall be responsible for the operating costs of equipment provided, including costs of repairs required as a result of the Requesting Authority's use, while in its possession. For certainty, a Requesting Authority is not responsible for the costs of equipment repairs that would have been undertaken by the Responding Authority as a matter of routine repair or maintenance.

(e) Facilities – Compensation for the use of Responding Authority facilities. Reimbursement rates will be at the prevailing rate on the day the facility is rented, leased or otherwise made available to the Requesting Authority.

6.3 The Requesting Authority's obligation to reimburse the Responding Authority pursuant to this Agreement is irrespective of the Requesting Authority's entitlement to compensation or funding received from Emergency Management BC or any other funding agencies. Accordingly, the Requesting Authority will be responsible for any shortfall in any amounts payable by the Requesting Authority pursuant to this Agreement and any cost recovery by the Requesting Authority from Emergency Management BC or other funding agency.

6.4 The Requesting Authority shall be responsible for any loss or damage to Resources used in the response and shall pay any expense incurred in the operation and maintenance thereof, as well as any expense incurred in the provision of a service or other expense in answering the request for assistance from the Requesting Authority. An itemized claim for loss and damage to the Responding Authority's equipment at the response scene shall be filed within thirty (30) days of such loss or damage occurring.

6.5 All Resources noted in Subsections 6.2(d) and (e) provided to a Requesting Authority shall be returned in the same condition as when such Resources were delivered to the Requesting Authority. These Resources shall be deemed to be provided in good working order, unless otherwise noted by the Responding Authority at the time of delivery.

6.6 The Requesting Authority will arrange for and pay for all costs associated with any necessary repairs or restoration of Resources prior to returning such Resources to the Responding Authority. For certainty, a Requesting Authority is not responsible for the costs of repairs or restoration that would have been undertaken by the Responding Authority as a matter of routine repair or maintenance.

6.7 The Responding Authority will invoice the Requesting Authority detailing all costs incurred in providing Resources under this Agreement, including all overhead amounts referred to in Section 6.1. Payment of such invoices by the Requesting Authority is due in full sixty (60) days from the date of invoice, unless alternate arrangements have been made between the Requesting Authority and Responding Authority or the invoice is in dispute, as contemplated in Section 6.9.

6.8 Payment by the Requesting Authority will be by cheque mailed to the Responding Authority's address, as detailed in the invoice, or if the Responding Authority and Requesting Authority mutually agree, payment may be transferred electronically to the Responding Authorities' bank

account, as stipulated by the Responding Authority.

6.9 If a dispute ensues with respect to an invoice issued by a Responding Authority pursuant to Section 6.7, the Parties to the dispute will use best efforts to resolve the dispute as soon as possible in accordance with the dispute resolution process provided in Section 10.0.

6.10 The Parties acknowledge and agree that they are each individually responsible for staying apprised of the financial guidelines and eligibility requirements of Emergency Management BC and any other funding agencies related to potential cost recovery that may be available from such agencies in respect of any Resources provided under this Agreement.

7.0 Insurance, Liability and Indemnity

7.1 The Parties agree to obtain and maintain sufficient insurance to meet any obligations or liabilities that may arise in connection with this Agreement. Notwithstanding the foregoing, the Parties acknowledge and agrees that they each may self-insure part or all of the risks, subject always to equivalent terms and conditions as though such policies were obtained from licensed commercial insurers.

7.2 Any required insurance coverage pursuant to this Agreement will be arranged prior to the acceptance of the request for Resources under this Agreement.

7.3 When rendering aid outside their jurisdictional area, all personnel and affiliated volunteers will retain the same powers, duties, rights, privileges and immunities, including any coverage under the *Worker's Compensation Act* that they receive when they are on duty in their home jurisdiction.

7.4 A Requesting Authority shall pay to the Responding Authority:

(a) the Workers' Compensation, death or disability benefits or any other form of compensation (including judgements, damages, costs, penalties and expenses) which the Responding Authority is legally obligated to pay to one of its employees or affiliated volunteers or the family or beneficiaries of such employees or volunteers by reason of the death or injury to an employee or volunteer while working on a Major Emergency on behalf of the Requesting Authority; and

(b) all legal fees and disbursements incurred by the Responding Authority to defend any demands, claims, suits or actions arising from, related to or caused by any death or injury to an employee or volunteer while working on a Major Emergency on behalf of the Requesting Authority.

7.5 The Requesting Authority shall in no way be deemed liable or responsible for the personal property of Responding Authority Personnel which may be lost, stolen, or damaged while performing their duties in responding under the terms of this Agreement.

7.6 No Party to this Agreement shall be liable in damages to another Party, nor to the owner of property within the geographic jurisdiction of the Requesting Authority or another Party for failing to respond to a request for assistance under this Agreement or for failing to render adequate assistance.

7.7 When Resources are provided by a Responding Authority to a Requesting Authority pursuant to this Agreement, the Requesting Authority shall release, indemnify and save harmless the Responding Authority and the Responding Authority's Personnel from and against all liabilities, claims, losses, suits, actions, judgments, demands, debts, accounts, damages, costs, penalties and expenses (including all legal fees and disbursements) which may be made against the Responding Authority, or which the Responding Authority may suffer or incur, arising from, related to or caused by:

(a) the provision of Resources by the Responding Authority to the Requesting Authority under this Agreement;

(b) the breach, violation, contravention or non-performance by the Requesting Authority of any of its obligations, agreements, covenants, conditions, representations, warranties or any other term of this Agreement; or

(c) the negligence or misconduct of the Requesting Authority's Personnel acting in the course of their duties pursuant to this Agreement,

except where such liabilities, claims, losses, suits, actions, judgments, demands, debts, accounts, damages, costs, penalties and expenses (including all legal fees and disbursements) result from the negligence or misconduct of the Responding Authority's Personnel under this Agreement. The indemnities contemplated in this Section 7.7 will survive the termination or expiration of this Agreement or a Party's withdrawal from the Agreement pursuant to Section 9.2.

7.8 Subject to Section 7.7 above, the Responding Authority will not be liable or responsible in any way for all liabilities, claims, losses, suits, actions, judgments, demands, debts, accounts, damages, costs, penalties and expenses (including all legal fees and disbursements) which may be made against the Requesting Authority, or which the Requesting Authority may suffer or incur, including any personal injury that may be sustained by the Requesting Authority's Personnel, or by any other person, or for any loss or damage or injury to, property belonging to or in the possession of the Requesting Authority or the Requesting Authority's Personnel or any other person, including any equipment, materials, supplies, motor or other vehicles, arising from, related to or caused by the provision of Resources by the Responding Authority to the Requesting Authority under this Agreement, unless such liabilities, claims, losses, suits, actions, judgments, demands, debts, accounts, damages, injuries, costs, penalties and expenses (including all legal fees and disbursements) result from the negligence or misconduct of the Responding Authority or the Responding Authority's Personnel while acting in the course of their duties pursuant to this Agreement.

8.0 Modification and Review

8.1 This Agreement may only be amended upon the written consent of all signing Parties.

8.2 This Agreement may be reviewed by the Parties:

(a) every five years, starting from the Effective Date, to ensure that it remains up to date and relevant for all Parties; or

(b) any time upon the written request of any Party.

8.3 The master copy of this Agreement, together with any Joinder Agreements, will be held by the Metro Vancouver Regional District and will be made available electronically to all Parties upon request.

9.0 Effective Date, Term and Addition of Parties

9.1 This Agreement shall come into effect as soon as it has been executed by two Parties (the "**Effective Date**").

9.2 Any one of the Parties hereto may withdraw from this Agreement by giving not less than thirty (30) days prior written notice to the other Parties, following which the Agreement shall continue in force between the remaining Parties.

9.3 A Governmental Authority may be added as a new party (a "**New Party**") to this Agreement if such New Party executes and delivers to the Metro Vancouver Regional District a Joinder Agreement substantially in the form of Schedule "A" attached hereto. "**Governmental Authority**" means any federal, provincial, regional, municipal, local or other government, governmental or public department, authority, commission, council, board, bureau or agency.

10.0 Dispute Resolution

10.1 In the event of any dispute or material disagreement among two or more Parties regarding the interpretation or application of any provision of this Agreement, the Parties agree that:

(a) the Parties, through their Authorized Representatives, will, in good faith, make all reasonable efforts to resolve the dispute by negotiation, during which time each Party will disclose to the other Party all relevant information relating to the dispute;

(b) if the dispute remains unresolved, the Parties will meet with a qualified mediator in a timely manner and attempt, in good faith, to further negotiate a resolution of such dispute; and

(c) if the mediator cannot resolve the dispute within 48 hours, then the dispute will, unless otherwise agreed by the Parties, either:

(i) be resolved in accordance with Division 3 of Part 9 of the *Community Charter*, [SBC 2003] Chapter 26; or

(ii) for any dispute involving a Party to which Division 3 of Part 9 of the *Community Charter*, [SBC 2003] Chapter 26 does not apply, be submitted to final and binding arbitration by a sole arbitrator appointed pursuant to the *Arbitration Act* (British Columbia).

11.0 Approvals

11.1 The Parties signify their approval of this Agreement by the signatures of their respective authorized representatives below.

12.0 General Provisions

12.1 **Schedules.** Schedule "A" is attached to and forms part of this Agreement.

12.2 **Interpretation**.

(a) The words "include", "includes" and "including" as used in this Agreement shall be deemed to be followed by the phrase ", without limitation,".

(b) The captions and headings contained in this Agreement are for convenience only and do not define or in any way limit or enlarge the scope or intent of any provision of this Agreement.

12.3 **Survival of Obligations.** All of the obligations of the Parties which expressly or by their nature survive termination or expiration of this Agreement, will continue in full force and effect subsequent to and notwithstanding such termination or expiration and until they are satisfied or by their nature expire.

12.4 **Amendment.** No amendment of this Agreement will be binding unless made in writing and executed by each of the Parties hereto.

12.5 **Entire Agreement.** This Agreement constitutes the entire agreement amongst the Parties with respect to the subject matter hereof and for certainty this Agreement supersedes the "Mutual Aid Agreement for Public Works Assistance" that was prepared by the Metro Vancouver Regional Engineers Advisory Committee in 2000 and entered into by participating Local Authorities.

12.6 **Governing Law.** This Agreement and any dispute arising out of or in connection with this Agreement will be governed exclusively in accordance with the laws of British Columbia and the laws of Canada applicable in British Columbia which will be deemed to be the proper law of this Agreement.

12.7 **Severability.** Each provision of this Agreement is intended to be severable and if any provision is determined by a court of competent jurisdiction to be illegal or invalid or unenforceable for any reason whatsoever, such provision shall be severed from this Agreement and will not affect the legality or enforceability of the remainder of any other provision of this Agreement.

12.8 **Time of Essence.** Time shall be of the essence of this Agreement.

12.9 **No Derogation.** The Parties acknowledge and agree that nothing contained or implied in this Agreement will be construed as limiting or prejudicing the rights and powers of any Party in the exercise of their respective functions pursuant to the *Local Government Act*, the *Community Charter,* the *Vancouver Charter* and the *Emergency Program Act*, as the case may be, or any other right or power under any public or private statutes, bylaws, orders or regulations, all of which may be fully exercised as if this Agreement had not been entered into.

12.10 **Assignment.** This Agreement shall not be assignable.

12.11 **Counterparts.** This Agreement may be executed in counterparts and returned by email with a PDF attachment, each of which when executed and delivered shall constitute an original and all of which together shall constitute one and the same Agreement.

IN WITNESS WHEREOF this Agreement has been executed and delivered by the Parties as of the day and year first above written.

Village of Anmore

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Village of Belcarra

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Bowen Island Municipality

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Burnaby

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Coquitlam

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Delta

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Langley

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Township of Langley

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Village of Lions Bay

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Maple Ridge

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of New Westminster

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of North Vancouver

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

District of North Vancouver

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Pitt Meadows

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Port Coquitlam

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Port Moody

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Richmond

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Surrey

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Tsawwassen First Nation

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of Vancouver

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

District of West Vancouver

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

City of White Rock

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Metro Vancouver Regional District

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Greater Vancouver Sewer and Drainage District

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Greater Vancouver Water District

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Her Majesty the Queen in Right of the Province of British Columbia, as represented by the Minister of Municipal Affairs

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

University of British Columbia

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

SCHEDULE "A"

JOINDER AGREEMENT

This Joinder Agreement is made as of the ____ day of _____.

Pursuant to and in accordance with Section 9.3 of the Regional Mutual Agreement for Major Emergencies made as of the ___ day of _____ (the "**Mutual Aid Agreement**") [*insert name of new party joining the Agreement*] hereby acknowledges and agrees that [*insert name of new party joining the Agreement*] has received and reviewed a complete copy of the Mutual Aid Agreement and shall be fully bound by, and subject to, all of the terms and conditions of the Mutual Aid Agreement as though it were an original party thereto.

[insert name of new party]

Per: _____
Authorized Signatory

Per: _____
Authorized Signatory

Appendix A

WHEREAS the Parties desire to enter into an Agreement whereby Public Works resources can be deployed to assist any Party during an emergency.

NOW THEREFORE THIS AGREEMENT WITNESSES THAT, in consideration of the mutual covenants and agreements herein contained and subject to the terms and conditions hereinafter set out, the Parties agree as follows:

1. In this Agreement, unless the context otherwise requires,

    a) "**emergency**" means any present or imminent calamity or sudden or violent disturbance that in the opinion of the City Engineer cannot be brought under control by the use of the available local resources and that requires prompt co-ordination of action or special regulation of persons or property to protect the health, safety or welfare of people, or to limit property damage;

    b) "**emergency resources**" means all persons, services, equipment and materials held by, or directly available to, the Public Works Services of a Party;

    c) "**City Engineer**" means, for each Party, the senior municipal employee responsible for the Public Works Services of that Party or his delegate.

2. The procedure to be followed in requesting and rendering aid under this Agreement shall be governed by the following principles, namely:

    a) A City Engineer will attempt to fully utilize the emergency resources of his bordering Parties before requesting emergency resources from more distance Parties except where special equipment is not available from the bordering Parties.

    b) Where a City Engineer determines that an emergency exists, he shall request emergency resources from the appropriate Party.

    c) A City Engineer who receives a request for emergency resources from another Party may determine the extent of and duration for which the emergency resource are available and thereupon such emergency resources, if any are available, shall be dispatched and utilized to control the emergency; but nothing in this Agreement shall be construed to require a City Engineer to dispatch emergency resources.

    d) The Person in Charge of emergency resources sent to assist in an emergency shall remain in charge of those resources and control and direct those resources in co-operation with the requesting City Engineer.

3. The Parties agree to consult on a regular basis through their City Engineer on the best ways to achieve the optimum deployment of emergency resources to control emergencies.

4. When a Party provides emergency resources:

a) the Party providing emergency resources may, within sixty days after so doing, render to the Party that requested emergency resources a correct account of the cost of the service.

b) the Party that requested emergency resources shall pay the account within thirty days after receiving it.

c) Payment for emergency services would be on a cost recovery basis without overhead or profit.

5. Any Party may terminate its rights and responsibilities under this Agreement by giving to the City Clerk of the other Parties, thirty days notice in writing of its intention to do so.

6. This Agreement is not intended to interfere with or supersede any existing written agreements between the parties.

7. Subject to paragraph 8, each party to this Agreement covenants and agrees that it will not initiate legal action or third party proceedings against any other party to this Agreement, based on provision or failure to provide emergency resources. In any action arising from the provision or failure to provide emergency resources, the municipality where the incident requiring emergency resources occurred, shall (a) defend the action on behalf of itself and any other parties to this Agreement who are defendants in the action, and (b) indemnify and save harmless the other parties for liabilities which may result.

8 Any claims as between the Parties to this Agreement arising out of gross or willful negligence in the provision or failure to provide emergency resources or any dispute arising respecting a Party's rights or obligations shall be referred to and finally resolved by arbitration under the rules of the British Columbia International Commercial Arbitration Centre and shall be administered in accordance with its "Procedures for Cases under the BCIAC Rules". Provided the arbitrator in this procedure is satisfied that the dispute arises from gross or willful negligence, the arbitrator has jurisdiction to provide relief against the indemnity in paragraph 7 and may allocate responsibility among the Parties in whatever manner the arbitrator deems appropriate.

For the purpose of Sections 7 and 8, "Party" includes any employee, contractor or volunteer of the Party.

9. Notices or other communications under this Agreement shall be sufficiently given if delivered to a City Engineer personally or left at the City Engineer's office or mailed to the following:

(List of Participating Agencies will be entered here as resolutions are received from Municipal Councils.)

IN WITNESS WHEREOF the Parties hereto have caused to be affixed their seals attested by the signatures of their respective officers duly authorized for such purpose.

The Corporate Seal of the Corporation of

CITY OF RICHMOND

Authorized signing Officers

Mayor
GREG HALSEY-BRANDT

City Clerk J. RICHARD McKENNA

The Corporate Seal of the Corporation of

CITY OF WHITE ROCK

Authorized signing Officers

Mayor
HARDY K. STAUB
MAYOR

Clerk
DIANE A. MIDDLER
CITY CLERK

The Corporate Seal of the Corporation of

CITY OF NEW WESTMINSTER

Authorized signing Officers

Mayor
CALVIN DONNELLY
ACTING MAYOR

Clerk
SUSAN BROWN
CITY CLERK

135090 / 0040-00

The Corporate Seal of the Corporation of

THE TOWNSHIP OF LANGLEY

Authorized signing Officers

Mayor Clerk

The Corporate Seal of the Corporation of

CITY OF VANCOUVER

Authorized signing Officers

Mayor Clerk

The Corporate Seal of the Corporation of

DISTRICT OF PITT MEADOWS

Authorized signing Officers

Mayor Clerk

The Corporate Seal of the Corporation of

City of Port Coquitlam

Authorized signing Officers

Acting Mayor - R.H. TALBOT Clerk SUSAN RAUH, CMC, CITY CLERK

The Corporate Seal of the Corporation of

THE DISTRICT OF WEST VANCOUVER

Authorized signing Officers

Mayor Clerk

The Corporate Seal of the Corporation of

THE CITY OF BURNABY

Authorized signing Officers

Mayor Clerk DEBBIE R. COMIS
City Clerk - Authorized Signatory

Public Works Mutual Aid Agreement
Lower Mainland Municipalities

The Corporate Seal of the Corporation of

The City of Coquitlam

Authorized signing Officers

Mayor

A/D/Clerk

The Corporate Seal of the Corporation of

the City of Coquitlam

Authorized signing Officers

Mayor

A/D/Clerk

The Corporate Seal of the Corporation of

the City of Coquitlam

Authorized signing Officers

Mayor

A/D/Clerk

The Corporate Seal of the ~~Corporation of~~

CITY OF LANGLEY

Authorized signing Officers

Mayor

Clerk

The Corporate Seal of the Corporation of

DISTRICT OF NORTH VANCOUVER

Authorized signing Officers

Mayor Don Bell

Clerk Agnes Hilsen

The Corporate Seal of the Corporation of

City of Port Moody

Authorized signing Officers

Mayor

Clerk

The Corporate Seal of the Corporation of

CITY OF NORTH VANCOUVER

Authorized signing Officers

Mayor
Barbara A. Sharp - Mayor

Clerk
Bruce Hawkshaw - Clerk

The Corporate Seal of the Corporation of

DISTRICT OF MAPLE RIDGE

Authorized signing Officers

Mayor
KATHLEEN J. MORSE
MAYOR

Clerk
TERENCE E. FRYER
MUNICIPAL CLERK

The Corporate Seal of the Corporation of

Delta

Authorized signing Officers

Mayor
Lois E. Jackson

Clerk
Gil Mervyn
04/02/30.

The Corporate Seal of the Corporation of

City of Surrey

Authorized signing Officers

Mayor Clerk January 18, 2004

The Corporate Seal of the Corporation of

Authorized signing Officers

Mayor Clerk

The Corporate Seal of the Corporation of

Authorized signing Officers

Mayor Clerk

To: Water Committee

From: Larry Chow, Program Manager, Interagency Projects and Quality Control, Water Services

Date: March 8, 2022 Meeting Date: April 6, 2022

Subject: **GVWD 2021 Water Quality Annual Report**

RECOMMENDATION

That the GVWD Board receive for information the report dated March 8, 2022, titled "GVWD 2021 Water Quality Annual Report".

EXECUTIVE SUMMARY

The Greater Vancouver Water District (GVWD) 2021 Water Quality Annual Report is required, under the provincial *Drinking Water Protection Regulation* (DWPR), and is also a requirement of the *Drinking Water Management Plan* (DWMP). The annual report summarizes water quality analysis conducted on samples collected from the GVWD source reservoirs, in-system reservoirs and transmission system.

The annual report outlines how Metro Vancouver's water quality monitoring program continues to fulfill its role in confirming that the multiple protection barriers for drinking water, including watershed protection, water treatment and the ongoing operation of the water system, continue to ensure excellent water quality for the region.

In 2021, the water quality of the treated water was excellent. All water quality parameters analyzed met or exceeded water quality standards and the *Guidelines for Canadian Drinking Water Quality* (GCDWQ).

PURPOSE

To provide the Board with a summary of the GVWD 2021 Water Quality Annual Report.

BACKGROUND

Each year Metro Vancouver is required, under the provincial DWPR, to produce an annual report on drinking water quality. The annual report is also a requirement of Metro Vancouver's DWMP. The annual report provides the key results and findings associated with Metro Vancouver's program of continuous monitoring and assessment of drinking water quality in the region. The annual report also provides an assessment of drinking water quality relative to the existing drinking water standards and guidelines and highlights any unusual occurrences. Monitoring results for member jurisdictions are also discussed in the annual report, where relevant.

In accordance with Section 11 of the DWPR, the annual report will be sent to the Chief Medical Health Officers of the Vancouver Coastal and Fraser Health Authorities.

metrovancouver

Greater Vancouver Water District

2021 Water Quality Annual Report

Volume 1 of 2

March 2022

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(under separate cover)

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EXECUTIVE SUMMARY

Source Water Quality

- In 2021, the turbidity levels of the delivered water met the requirements of the Guidelines for Canadian Drinking Water Quality (GCDWQ).
- The Capilano supply was in service for the entire year. Heavy rainfall events in November resulted in Capilano source water turbidity peaking just over 21 Nephelometric Turbidity Unit (NTU). Even with the higher turbidity, the delivered filtered Capilano water was less than 0.30 NTU as measured by online instruments for the entire year.
- The Seymour supply was in service for the entire year. Heavy rainfall events in November resulted in Seymour source water turbidity peaking at 11 NTU. The delivered filtered Seymour water was less than 0.30 NTU as measured by online instruments for the entire year.
- The Coquitlam supply was in service for the entire year. The unfiltered Coquitlam source water was greater than 1 NTU for 22 days in 2021 and did not exceed 5 NTU throughout the year in accordance with GVWD's Permit to Operate.
- The microbiological quality of the three source waters was excellent in 2021. The levels of bacteria and protozoa detected were low and indicative of high quality source water.
- Coquitlam source water quality met the bacteriological requirements for avoiding filtration outlined in the turbidity section of the GCDWQ.
- Results of the analyses of the source water for herbicides, pesticides, volatile organic compounds and radionuclides were all found to be below the recommended limits for these substances as listed in the GCDWQ.

Water Treatment

- The Seymour Capilano Filtration Plant (SCFP) performance, as measured by the quality of the delivered water, was excellent in 2021. The daily average turbidity of water leaving the clearwells to enter the Greater Vancouver Water District (GVWD) transmission system was an average of 0.15 NTU in 2021.
- Turbidity levels for Individual Filter Effluent (IFE) met the turbidity requirements of the GCDWQ.
- Filtration consistently removed iron, colour and organics from the Capilano and Seymour source water.
- Levels of total aluminum in filtered water were consistently below the GCDWQ operational guideline value of 0.2 mg/L for direct filtration plants using aluminum-based coagulants. The maximum value for 2021 was 0.03 mg/L.
- There were no outages of ultraviolet treatment at the SCFP and the Coquitlam Water Treatment Plant (CWTP).
- The SCFP and CWTP operated the full year using sodium hypochlorite for chlorination.
- The secondary disinfection stations boosted chlorine when required.

Transmission/Distribution System Water Quality

- Bacteriological water quality was excellent in the GVWD transmission mains and in-system storage reservoirs.
- Of the approximate 6,600 samples collected from the regional system for testing in 2021, none were positive for *E. coli*. The detection of an *E. coli* triggers a protocol which involves immediate notification to health and member jurisdiction officials, re-sampling, and a thorough investigation into the possible causes.
- Bacteriological water quality was excellent in the distribution systems of the member jurisdictions. Of the approximate 20,800 samples collected from member jurisdictions for

testing in 2021, a high percentage (99.8%) were free of total coliforms, and one sample tested positive for *E. coli*.

- The running average levels of the Trihalomethane (THM) group of chlorine disinfection by-products detected in the delivered water in the GVWD and member jurisdiction systems were below the Maximum Acceptable Concentration (MAC) in the GCDWQ of 100 µg/L (0.1 mg/L). The running average levels for the Haloacetic Acid (HAA) group of chlorine disinfection by-products were below the GCDWQ Maximum Acceptable Concentration (MAC) of 80 µg/L (0.08 mg/L).

ACRONYMS

ACU	Apparent Color Unit
AO	Aesthetic Objective (characteristics such as taste, colour, appearance, temperature that are not health related)
BCDWPR	*British Columbia Drinking Water Protection Regulation*
BHT	Break Head Tank
BTEX	Benzene, Ethylbenzene, Toluene, Xylene
CALA	Canadian Association for Laboratory Accreditation
CRWPS	Capilano Raw Water Pump Station
CFE	Combined Filter Effluent
CFU	Colony Forming Units
CO_2	Carbon Dioxide
CTD	Conductivity, Temperature, Depth
CWTP	Coquitlam Water Treatment Plant
DS	Distribution System
DBP	Disinfection By-product
DOC	Dissolved Organic Carbon
DWTP	*Drinking Water Treatment Program*
DWTO	*Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia*
E. coli	*Escherichia coli*
ERF	Energy Recovery Facility
EPA	Environmental Protection Agency (USA)
ESWTR	*Enhanced Surface Water Treatment Rule* (USA)
GCDWQ	*Guidelines for Canadian Drinking Water Quality*
GVWD	Greater Vancouver Water District
HAA	Haloacetic Acid
HPC	Heterotrophic Plate Count
IFE	Individual Filter Effluent
MAC	Maximum Acceptable Concentration
MCL	Maximum Contaminant Level
MDA	Minimum Detectable Activity
MDL	Method Detection Limit
mg/L	Milligram per litre (0.001 g/L)
µg/L	Microgram per litre (0.000001 g/L)
mL	Milliliter
MF	Membrane Filtration
mJ/cm^2	Millijoule per centimeter squared
MPN	Most Probable Number
N/A	Not Available
NTU	Nephelometric Turbidity Unit
PAH	Polycyclic Aromatic Hydrocarbons
PFOA	Perfluorooactanoic Acid
PFOS	Perfluorooctane Sulfonate
pH	Measure of acidity or basicity of water; pH 7 is neutral

ppb	Parts per Billion (Equivalent of microgram per litre)
ppm	Parts per Million (Equivalent of microgram per litre)
RCW	Recycled Clarified Water
RWT	Raw Water Tunnel
SCADA	Supervisory Control and Data Acquisition
SCFP	Seymour Capilano Filtration Plant
TS	Transmission System
$THAA_5$	Total $Haloacetic_5$ Acids
THM	Trihalomethane
TOC	Total Organic Carbon
TTHM	Total Trihalomethane
TWT	Treated Water Tunnel
UV_{254}	Ultraviolet Absorbance at 254 nm
WHO	World Health Organization
WQMRP	*Water Quality Monitoring and Reporting Plan for Metro Vancouver (GVWD) and Local Government Members*

WATER SAMPLING AND TESTING PROGRAM

Water Type	Parameter	Frequency
Untreated, Source Water	Total coliform and *E. coli*	Daily
	Turbidity	Daily
	Giardia and *Cryptosporidium*	Monthly at Capilano and Coquitlam
	Ammonia, colour, iron, organic carbon, pH	Weekly
	Alkalinity, chloride, calcium, hardness, magnesium, manganese, nitrate, potassium, phosphate, sulphate	Monthly
	Aluminum, copper, sodium, total and suspended solids	Bi-monthly
	Trihalomethanes, haloacetic acids	Quarterly
	Antimony, arsenic, barium, boron, cadmium, cyanide, chromium, lead, mercury, nickel, phenols, selenium, silver, zinc	Semi-annually
	Pesticides and herbicides	Annually
	PAHs, BTEXs	Annually
	VOC	Annually
	Radioisotopes	Annually
Treated water	Total coliform and *E. coli*	Daily
	Turbidity	Daily
	Temperature	Daily
	Ammonia, colour, iron, organic carbon, pH, aluminum at SCFP	Weekly
	Aluminum, copper, sodium, total and suspended solids	Bi-Monthly
	Trihalomethanes, haloacetic acids	Quarterly at selected sites
	Antimony, arsenic, barium, boron, cadmium, cyanide, chromium, lead, mercury, nickel, phenols, selenium, silver, zinc	Semi-annually
GVWD Water Mains	Total coliform and *E. coli*	Weekly per site
	Heterotrophic plate count	Weekly per site
	Free chlorine	Weekly per site
	Trihalomethanes, haloacetic acids, pH	Quarterly at selected sites
	PAHs, BTEXs	Semi-annually at selected sites
GVWD Reservoirs	Total coliform and *E. coli*	Weekly per site
	Heterotrophic plate count	Weekly per site
	Free chlorine	Weekly per site
Member Jurisdiction Distribution Systems	Total coliform and *E. coli*	Weekly per site
	Heterotrophic plate count	Weekly per site
	Free chlorine	Weekly per site
	Turbidity	Weekly per site
	Trihalomethanes, haloacetic acids, pH	Quarterly at selected sites

1.0 SOURCE WATER QUALITY

The first barrier in place to protect the quality of drinking water supply is the protection of the Water Supply Area to ensure the best quality source water. Source water monitoring provides ongoing confirmation that the barrier is effective, identifies seasonal changes and provides the monitoring information necessary to adjust the level of water treatment that is in place. Regular monitoring of the water sources is also a requirement of the *Water Quality Monitoring and Reporting Plan for Metro Vancouver (GVWD) and Local Government Members (WQMRP)*.

1.1. Bacteriological Quality of the Source Water

The bacteriological quality of the source water is an important indicator of the degree of contamination, and the treatment required to ensure a safe water supply. *The Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia* (DWTO) Section 4.3 states *"The number of E. coli in raw water does not exceed 20/100 mL (or if E. coli data are not available less than 100/100 mL of total coliform) in at least 90% of the weekly samples from the previous six months. Treatment target for all water systems is to contain no detectable E. coli or fecal coliform per 100 mL."*

Table 1 summarizes *E. coli* data for all three GVWD water supply sources. The levels of *E. coli* for all three sources were below the 10% limit in the provincial turbidity guideline.

	Percent of samples (daily) in a six month period ending on the last day of the month named where *E. coli* greater than 20/100 mL		
Month	**Capilano**	**Seymour**	**Coquitlam**
Jan	4.4%	8.7%	3.8%
Feb	4.4%	9.1%	3.9%
Mar	1.1%	5.1%	0.6%
Apr	0.0%	0.0%	0.0%
May	0.0%	0.0%	0.0%
Jun	0.0%	0.0%	0.0%
Jul	0.0%	0.0%	0.0%
Aug	0.0%	0.0%	0.0%
Sep	3.8%	4.4%	3.3%
Oct	3.8%	7.6%	3.8%
Nov	3.8%	7.7%	3.8%
Dec	3.8%	7.7%	3.8%

Table 1: Percent of Samples in Six Continual Months with E. coli/100 mL Exceeding 20

Figure 1 shows the results of the analysis of the source water from 2017 to 2021 at all three intakes compared to the limits for source water bacterial levels in the DWTO. As in previous years, all three sources met the limit of not more than 10% exceeding 20 *E. coli*/100 mL. Also, as in previous years, samples collected at the intakes in the fall and winter had the highest *E. coli* levels. Typically, *E. coli* can be traced back to high flow levels at the main tributaries of the supply lakes and a first flush phenomenon after a period of dry weather.

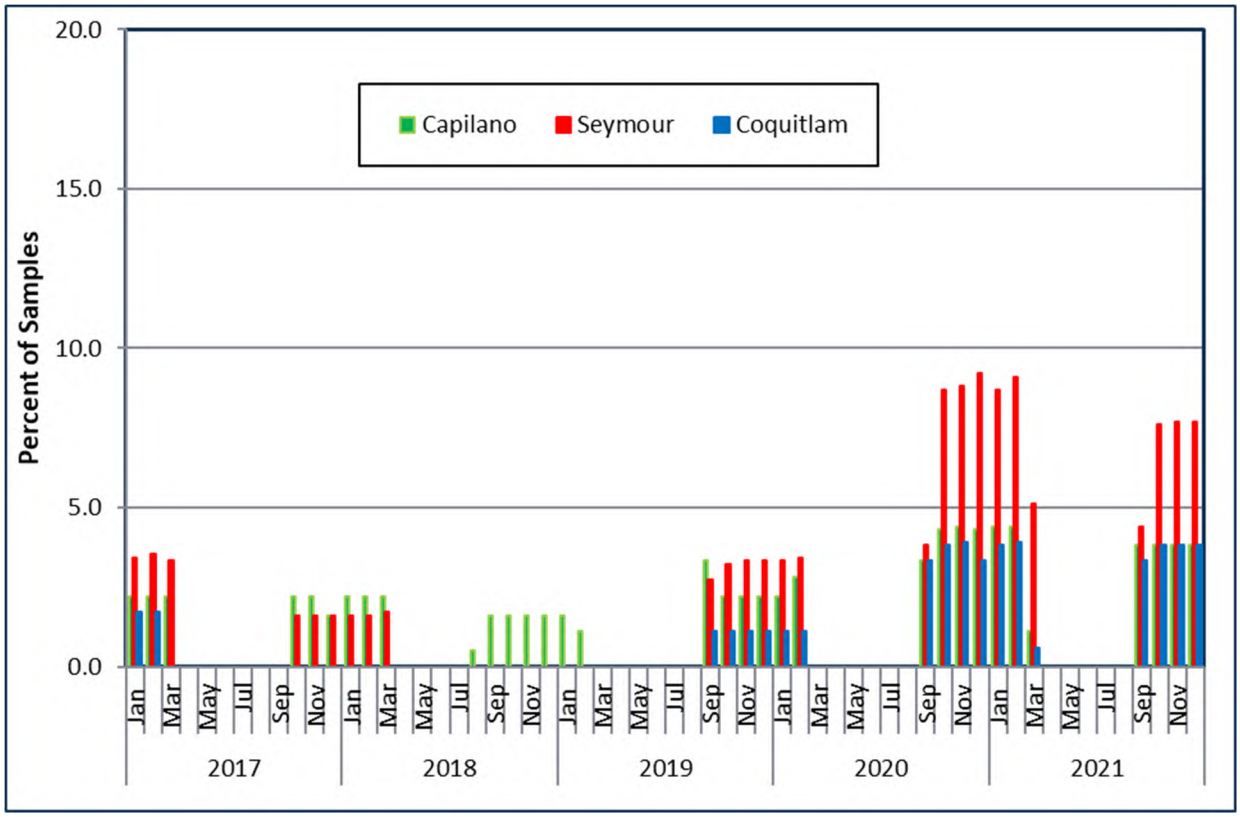


Figure 1: Percent of Samples Exceeding 20 E. coli/100 mL at all Three Sources (2017 to 2021)

Note: Metro Vancouver has protected Water Supply Areas and therefore the source of *E. coli* is most likely originating from endemic animals in the Water Supply Areas.

1.2. Source Water Monitoring for *Giardia* and *Cryptosporidium*

Unfiltered surface water supplies have the potential of containing the protozoan pathogens *Giardia* and *Cryptosporidium*. Outbreaks of *Giardiasis* occurred in a number of locations in BC and Washington State in the late 1980s, and Metro Vancouver has been monitoring raw water for *Giardia* since 1987. Since 1992, Metro Vancouver has participated in a program with the BC Centre of Disease Control Enhanced Water Testing Laboratory, to gather more information about the number and nature of cysts found in the GVWD water supplies. The program involves collecting samples from the Capilano and Coquitlam supplies upstream of disinfection.

At the SCFP, monitoring for *Giardia* and *Cryptosporidium* has focused on the recycled water returning to the head of the plant and this monitoring has confirmed that the procedures in place effectively control the levels of *Giardia* and *Cryptosporidium* in the recycled wash water from the filters.

The results of the 2021 testing program are contained in the "Metro Vancouver Detection of Waterborne *Cryptosporidium* and *Giardia* January - December, 2021 Annual Report", which was prepared by the BC Public Health Microbiology & Reference Laboratories, Environmental Microbiology, and can be found in Appendix D. Three of twelve (25%) samples collected at Capilano and three of the twelve (25%) collected at Coquitlam were positive for *Giardia* (Table 2).

Seymour samples are all process control samples and not Seymour source water (shown as N/A in the table).

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Capilano	75	50	18	18	50	58	33	33	33	25
Seymour	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Coquitlam	50	23	8	0	17	67	8	25	25	25

Table 2: Percent of Samples Positive for Giardia

Zero of twelve (0%) samples collected at Capilano were positive for *Cryptosporidium*, and zero of twelve (0%) were positive at Coquitlam (Table 3). Seymour samples are all process control samples and not Seymour source water (shown as N/A in the table).

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Capilano	16	9	9	9	25	17	8	0	0	0
Seymour	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Coquitlam	8	9	0	0	0	0	0	0	0	0

Table 3: Percent of Samples Positive of Cryptosporidium

Year to year fluctuations are demonstrated for *Giardia* and *Cryptosporidium* and there has always been considerable variation in the results.

1.3. Turbidity

As shown in Figure 2, GVWD water sources have been susceptible to turbidity upsets due to high runoff from storms which can cause slides and stream scouring in the Water Supply Areas, or from re-suspension of sediment from the edges of the lakes during periods of low water levels. The DWTO allows a utility to be exempt from filtration if the turbidity does not exceed specific water quality parameters requirements and provided that a number of other provisions, including source water protection and two forms of water treatment requirements, are in place. Historically the turbidity levels on both the Capilano and Seymour sources would not meet these criteria, therefore plans were developed and implemented to filter both supplies.

Filtration of 100% of the Seymour supply began in December 2009, and filtration and distribution of the Capilano supply through the Twin Tunnels connecting the Capilano and Seymour source supplies commenced in February 2015. Both the raw and treated water tunnels were fully operational in April 2015.

Section 4.4 of the DWTO (Version 1.1, November 2012) contains the following provision for filtration exemption:

"For nonfiltered surface water to be acceptable as a drinking water source supply, average daily turbidity levels should be established through sampling at equal intervals (at least every four hours) immediately before the disinfectant is applied. Turbidity levels of around 1.0 NTU but not exceeding 5.0 NTU for more than two days in a 12-month period should be demonstrated in the absence of filtration. In addition, source water turbidity also should not show evidence of harbouring microbiological contaminants in excess of the exemption criteria."

Capilano and Seymour water is filtered so these source water criteria don't apply to the delivered water. Coquitlam, which is unfiltered, was in service for all of 2021 in accordance with the DWTO.

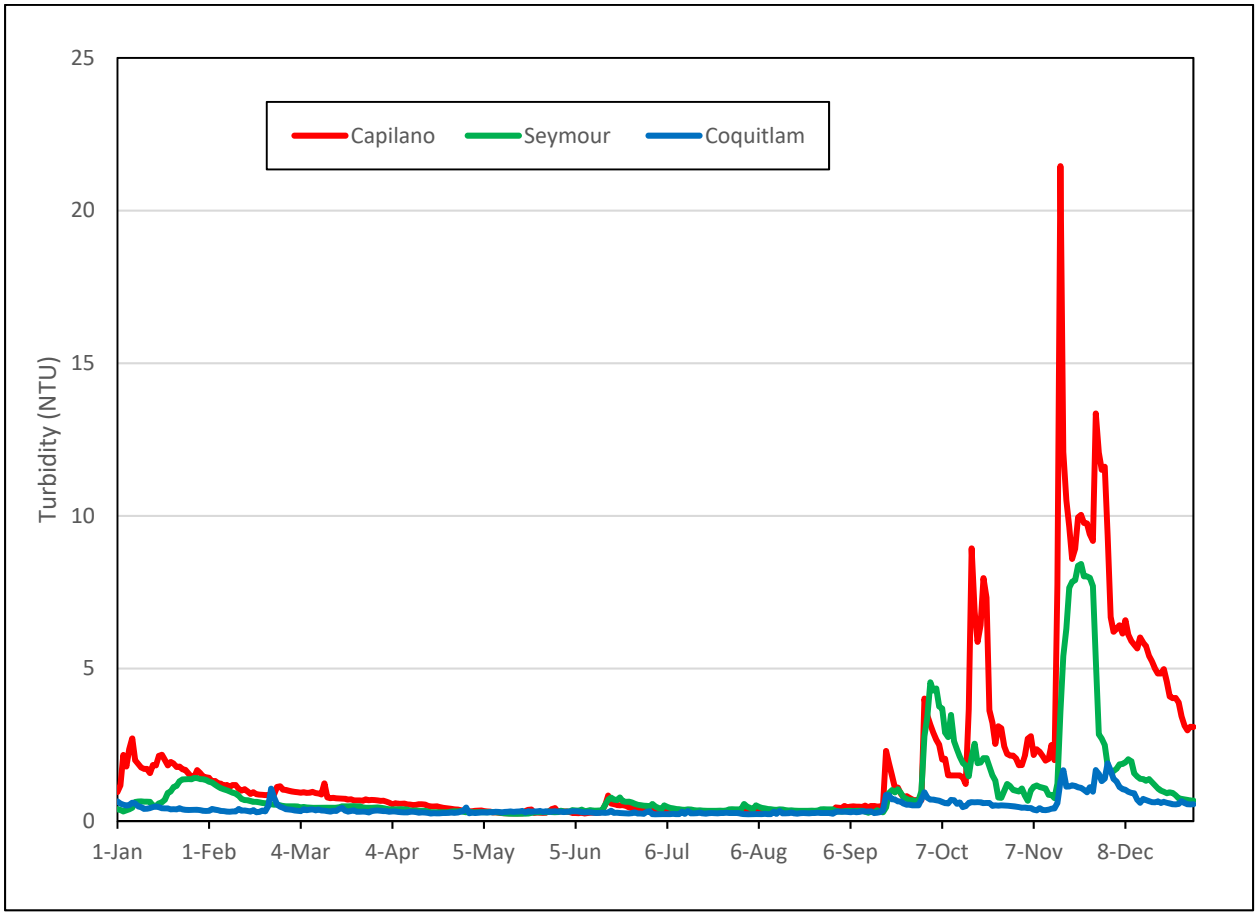


Figure 2: Average Daily Turbidity of Source Water (From In-line Readings)

1.4. Chemistry

1.4.1. Chemical and Physical Characteristics of Source Water

The chemical and physical characteristics of the GVWD source water are summarized in Appendix A of this report; detailed analytical results are provided in Volume II. The results from the chemical and physical analyses of the source water in 2021 were similar to those for other years.

1.4.2. Herbicides, Pesticides, Volatile Organic Compounds, Radioactivity and Uranium

Analyses of the source water for a variety of organic compounds, including all of the compounds with an specified MAC in the *Guidelines for Canadian Drinking Water Quality* (GCDWQ), is carried out on an annual basis in accordance with the WQMRP. The results are contained in Appendix B of this report and in Volume II. No parameters were detected above the applicable GCDWQ health based limits.

1.4.3. PFOS and PFAS

The GCDWQ have added the parameters of Perfluorooctane Sulfonate (PFOS) and Perfluorooactanoic Acid (PFAS) for testing of the source and treated waters. The results are in Appendix B of this report and in Volume II. None of the chemicals in these categories were detected. Common sources of these synthetic chemicals are from consumer products and fire-fighting foam for their water and oil repellant properties.

1.4.4. Limnology

The Reservoir Water Quality Monitoring Program started in 2014 collects limnology data (physical, chemical and biological parameters) for the Capilano, Seymour and Coquitlam Reservoirs. Reservoir monitoring information is important in proactively managing the supply reservoirs as water quality could be impacted by environmental variability and climate change. This program assists in ensuring that variation and trends in reservoir quality are scientifically tracked over time.

Water sampling of the source reservoirs and inflow rivers is conducted between April and November each year. Biological productivity that can influence water quality is the highest during this time of year, making it an important time for sampling and measurements. Monthly sampling of the source water is conducted by staff and sample analysis undertaken by accredited labs. More frequent water quality measurements are compiled by arrays of scientific instruments in each reservoir.

Metro Vancouver employs the services of a limnology consultant to review the annual program data, interpret physical, chemical, and biological conditions and examine long term trends. Results in 2021, as in previous years, confirmed the three reservoirs are ultra-oligotrophic (see Appendix C), which means they have low levels of available nutrients and low levels of biological production. A single value called the Trophic State Index (TSI) is used to infer time course change in water quality based on the amount of algal biomass in the water column of each reservoir. TSI values have remained consistently low since measurements began (see Appendix C), which shows low biological production. The ultra-oligotrophic classification and low TSI values are highly desirable for source drinking water supply and shows that the GVWD Water Supply Areas and reservoirs continue to supply high quality water.

There is worldwide interest in blue green algae (also known as cyanobacteria) in water reservoirs. These algae can produce toxins that are collectively known as microcystins. A common cyanobacterium in GVWD reservoirs is called Merismopedia spp., which is thought to produce these microcystins. Despite the presence of cyanobacteria, the concentration of microcystins in GVWD reservoirs remains well below levels known to affect human health and are far below the GCDWQ. This desirable condition is due to the ultra-oligotrophic status of the reservoirs. Metro Vancouver continues to monitor cyanobacteria, including Merismopedia species as well as processes in the reservoirs that control the growth of cyanobacteria and other algae. These data are routinely used to help predict changes to water quality over time related to climatic and environmental change and aid in making proactive decisions about ongoing reservoir management strategies.

2.0 QUALITY CONTROL ASSESSMENT OF WATER TREATMENT

Water treatment is the second barrier (after source water protection) relied on to assure the quality of the water supply.

Completion of the Twin Tunnels Project in 2015 successfully concluded GVWD's regional long-range water treatment enhancement plans which spanned more than ten years. Each tunnel is 3.8 metres in diameter, 7.1 kilometres long, and 160 to 640 meters below ground level, running beneath Grouse Mountain and Mount Fromme. The water from the Raw Water Tunnel (RWT) is filtered and treated alongside the Seymour source water at the Seymour Capilano Filtration Plant (SCFP). Both treated sources enter the Clearwell at the SCFP for further treatment before the blended water is distributed to the region. Blended treated water returns to Capilano through the Treated Water Tunnel (TWT) and provides high quality drinking water to the Capilano area while the remainder is distributed through the Seymour system.

2.1. Seymour Capilano Filtration Plant

The SCFP is a chemically assisted direct filtration plant which uses poly aluminum chloride as a coagulant with polymers to improve particle removal. These substances help aggregate particles to form visible floc. The flocculated particles are removed by passing this water through a filter medium of anthracite and sand. The result is the production of filtered water which is then exposed to ultraviolet light as the water exits each filter. The final processes are the addition of sodium hypochlorite (chlorine) and hydrated lime before the water enters the Clearwells. The West and East Clearwells are large water storage reservoirs that store and allow controlled passage of water with mixing (or blending) of the injected chlorine and hydrated lime. The Clearwells provide sufficient retention (or contact time) with chlorine to provide any further disinfection required after filtration and ultraviolet light treatment. Carbon dioxide (CO_2) in solution is added to trim pH once the desired alkalinity is reached. After the Clearwells, the finished water enters the transmission system at the Seymour Treated Water Valve Chamber. The SCFP has been operational since December 2009 and the quality of the water produced has been excellent.

2.1.1. Filtration

As a result of filtration treatment of the Capilano and Seymour water sources, there have been a number of changes to the characteristics of the delivered water. Some of these changes are visible, and some are not. The most obvious visible change in the water is the decrease in colour and increase in clarity. There is a total loss of brown hue that can sometimes characterize Capilano and Seymour waters before filtration. This improvement in colour is a result of removal of the naturally occurring parameters that cause the brown hue by the filtration process. Suspended particles in water that cause light to scatter (turbidity) are also removed. The end product is water that is very clear. Due to the purity of the water, it may have a slight bluish tinge.

Figure 3 compares the apparent colour of SCFP filtered water and Capilano and Seymour source waters for 2021. During the fall rainfall events, the apparent colour of the Seymour source water feeding the SCFP had a reading over 25 ACU. After the removal of the organic material through filtration, the colour of the filtered water delivered to the public was never greater than 3 ACU.

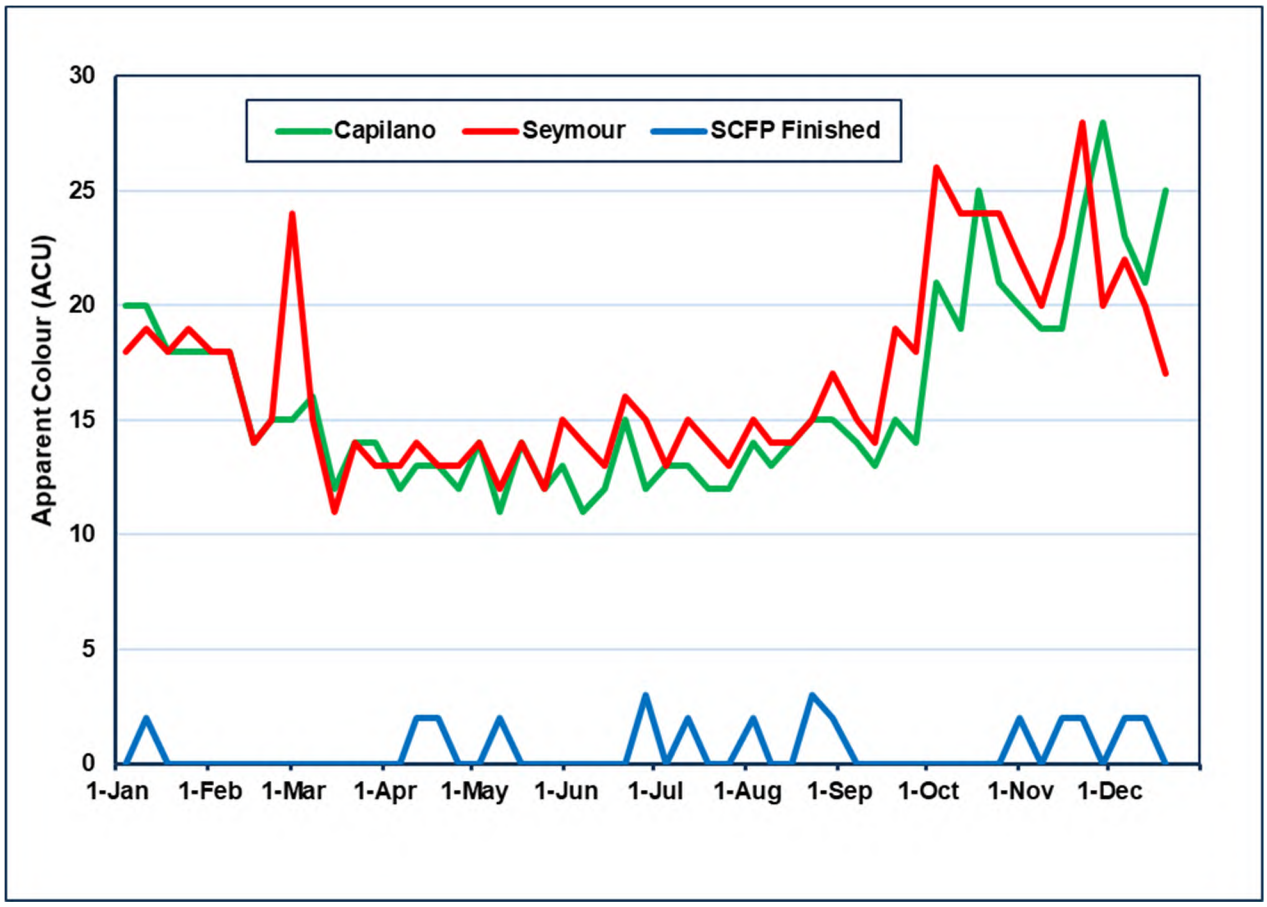


Figure 3: Apparent Colour Levels Before and After Filtration

Figure 4 compares turbidity of the two source waters that feed the SCFP to the turbidity level of the finished water. The Seymour source experienced an average daily turbidity greater than 1 NTU for 106 days. The Capilano source exceeded 1 NTU on 127 days. Since both sources were filtered at the SCFP, the maximum average daily turbidity of the delivered water was 0.22 NTU and the average was 0.15 NTU.

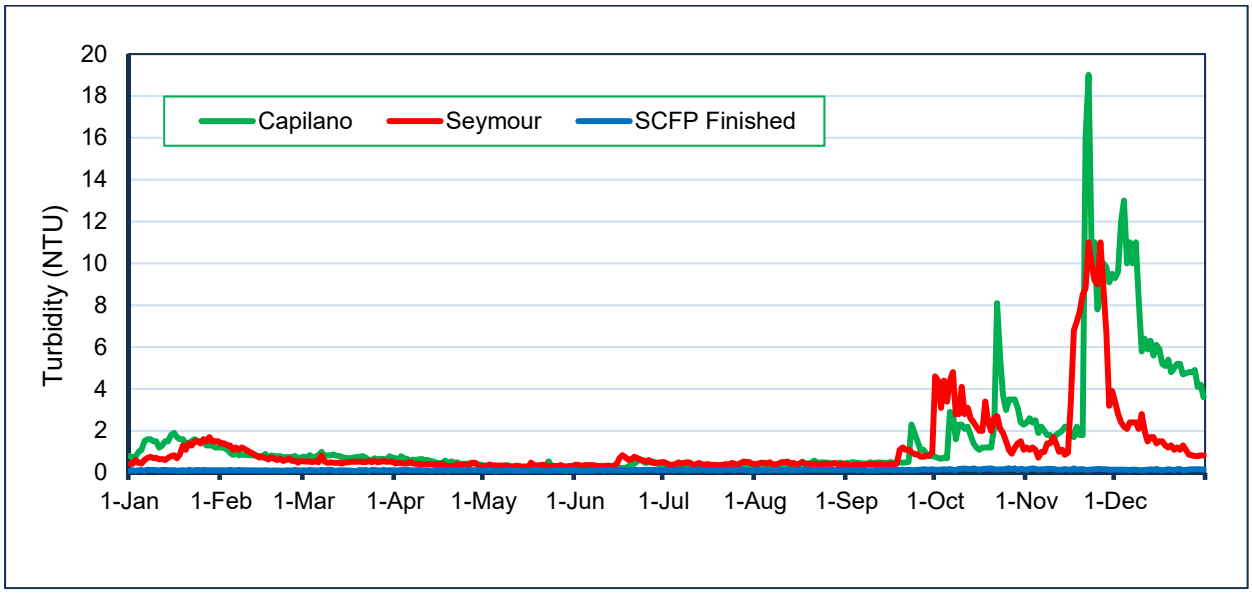


Figure 4: Average Daily Turbidity Levels Before and After Filtration

Removal of turbidity in the source water improves the aesthetic qualities of the water, but it also has the benefit of removing certain types of pathogenic microorganisms that may be present. At a minimum, properly run direct filtration plants such as the SCFP will remove up to 2.5 log (two log is a 99% reduction) of *Giardia* and *Cryptosporidium* plus 1 log of viruses. To ensure this removal, it is critical that the performance of each filter determined by the turbidity of its effluent is monitored on a continuous basis.

The GCDWQ (2020) states: "*For conventional and direct filtration, less than or equal to 0.3 nephelometric turbidity units (NTU) in at least 95% of measurements either per filter cycle or per month and never to exceed 1.0 NTU.*"

Ideally the turbidity from each filter would never exceed 0.1 NTU; however, there are rare occurrences of turbidity readings that exceed this ideal level. The turbidity performance of all 24 filters is measured by examining the percent of time that the turbidity of each Individual Filter Effluent (IFE) met the turbidity guidelines of not greater than 1.0 NTU and at least 95% of time less than 0.3 NTU. This is summarized in Table 4. In 2021, there were no incidents where the IFE was greater than 1.0 NTU and the few incidences of filter turbidity readings that were greater than 0.3 NTU, were well within the 95% limit.

Month	Occurrence of IFE Turbidity greater than 1.0 NTU (None Allowed)	Percent of Time IFE Turbidity was less than 0.3 NTU (Minimum 95% Required)
January	0	100%
February	0	100%
March	0	99.99%
April	0	99.99%
May	0	100%
June	0	99.99%
July	0	100%
August	0	100%
September	0	100%
October	0	100%
November	0	100%
December	0	99.99%

Table 4: Monthly Filter Effluent Turbidity Summary

Under normal operating conditions the average turbidity of the filtered water at SCFP was 0.15 NTU.

All water that flows through the filters immediately passes through the ultraviolet units. The intensity of the ultraviolet lamps automatically increases when there is an increase in turbidity of the water exiting each filter. After ultraviolet treatment, the water is chlorinated as it enters the clearwell, where more than one hour of contact time is provided.

2.1.2. Ultraviolet Treatment

The effluent from each filter is treated with ultraviolet light as the water exits the filter. Ultraviolet treatment is effective in altering the DNA structure of *Giardia* and *Cryptosporidium.* thus rendering cysts and oocysts, respectively, of these parasites non-infectious. Other disinfectants, especially chlorine, are ineffective against *Cryptosporidium* oocysts at reasonable dosages. In the unlikely event of a breakthrough of *Cryptosporidium* oocysts, especially at the end of a filter run, ultraviolet light is present to render any parasites that may be present as non-infectious. Oocysts are not able to proliferate inside the intestines of human hosts to cause illness after a sufficient dose of ultraviolet light. The target dosage for ultraviolet light is to achieve 2-Log (99%) *Giardia* and *Cryptosporidium* inactivation is 21 mJ/cm^2.

Under normal operating conditions, two rows of lamps operating at 75% power provide sufficient ultraviolet light to meet the dosage requirement for 2-log reduction of *Giardia* and *Cryptosporidium*

Table 5 summarizes the performance of the SCFP ultraviolet system in 2021.

Month	Percent of Monthly Volume ≥ 2-log of *Giardia* and *Cryptosporidium* Inactivation (95% of monthly volume required)
January	99.83%
February	99.92%
March	99.87%
April	99.95%
May	99.95%
June	99.95%
July	99.93%
August	99.86%
September	99.94%
October	99.88%
November	99.92%
December	99.93%

Table 5: Percent of Volume Meeting Ultraviolet Dosage Requirements at SCFP

2.1.3. Chlorination

Chlorination is used for disinfection at the source as well as at secondary disinfection stations to minimize bacterial regrowth in the GVWD transmission and member jurisdiction distribution systems. Chlorination provides 4-log virus inactivation with liquid sodium hypochlorite.

2.2. Coquitlam Water Treatment Plant

The Coquitlam Water Treatment Plant (CWTP) uses ozonation, ultraviolet treatment, soda ash and chlorination to treat water from the Coquitlam source.

Ozonation provides pre-treatment and helps remove micro-organisms from the water, reduces disinfection by-products and improves water clarity, which increases the efficiency of the subsequent ultraviolet process. Ozonation provides an additional 4-log virus inactivation to chlorination. Soda ash is then added for pH and alkalinity adjustment for corrosion control, followed by chlorination.

2.2.1. Ultraviolet Treatment

Ultraviolet treatment (operational since 2014) provides for primary disinfection, and achieves 3-log inactivation of chlorine-resistant micro-organisms for *Giardia* and *Cryptosporidium*. The water is directed into 8 ultraviolet units, each containing 40 ultraviolet lamps encased in protective sleeves. Ultraviolet light emitted from the lamps passes through the water. The US Environmental Protection Agency (USEPA) requires that the ultraviolet disinfection process results in target *Giardia* and *Cryptosporidium* inactivation in at least 95% of the treated water volume on a monthly basis, which is summarized in Table 6. The USEPA standard is used because there is no Canadian standard.

Month	Percent of Monthly Volume ≥ 3-log *Giardia* and *Cryptosporidium* Inactivation (Minimum 95% Required)
January	99.86%
February	99.87%
March	99.88%
April	99.84%
May	99.87%
June	99.83%
July	99.91%
August	99.90%
September	99.90%
October	99.85%
November	99.88%
December	99.90%

Table 6: Percent of Volume Meeting Ultraviolet Dosage Requirements at CWTP

2.2.2. Chlorination

Chlorination is used for disinfection at the source as well as at secondary disinfection stations to minimize bacterial regrowth in the GVWD transmission and member jurisdiction distribution systems. Chlorination provides 4-log virus inactivation with liquid sodium hypochlorite, which replaced the compressed chlorine gas system in 2017. Table 7 summarizes the performance of all the Coquitlam disinfection systems in 2021.

Facility	Performance	Discussion
Ozonation	Operated 99.7% of time	Acts as a pre-treatment, enhancing the removal of organics and increasing the UV Transmittance making Ultraviolet treatment more effective. Ozone outages were due to electrical or instrument maintenance, ozone outage test, or ozone generator faults.
Ultraviolet	No loss of ultraviolet in 2021. 99.87 % of volume was treated to ultraviolet specifications	UV performance met USEPA requirements. (95% of monthly volume required).
Chlorination	100% of water was chlorinated	This facility uses chlorine as a secondary disinfectant except during an outage of the ultraviolet system when it is used for primary disinfection.

Table 7: Performance of Coquitlam Disinfection Facilities

2.3. Secondary Disinfection

There are 8 secondary disinfection stations operated by Metro Vancouver. The purpose of these stations is to increase the chlorine residual in the water transmission and distribution systems to meet a target residual based on a number of factors, including source water turbidity, the amount of bacterial regrowth detected in member jurisdiction distribution system samples and the chlorine demand in the water. The rate of chlorine decay is lower in the areas receiving filtered water from the SCFP and consequently, lower chlorine dosage levels are required to maintain desired chlorine residual levels. The target chlorine dose leaving the secondary facilities receiving SCFP water is 0.8 mg/L. These facilities frequently have an incoming chlorine residual high enough that boosting is not required. The target chlorine dose leaving the secondary facilities receiving CWTP water ranges from 1.20 to 1.50 mg/L.

Table 8 summarizes the performance of the secondary disinfection facilities in 2021.

Facility	Branch Main	Average Free Chlorine (mg/L)	Range of Free Chlorine (mg/L)	Discussion
Clayton	Whalley/Clayton	1.21	1.02 – 1.54	Supplied by Coquitlam water. Station was shut down for one day to replace existing connection to City of Surrey.
	Jericho/Clayton	1.23	0.95 – 1.61	
Chilco/Alberni	Capilano No. 4 and No.5	0.74	0.61 – 0.83	Supplied by SCFP water. Station was out of service periodically throughout the year due to power outages and water main isolations.
Pitt River	Haney Main No.2	1.23	0.88 – 1.52	Supplied by Coquitlam water. Station was out of service periodically throughout the year due to power issues and piping breaks.
	Haney Main No.3	1.23	1.01 – 1.53	
Newton	Surrey Hickleton Main	0.99	0.38 – 1.34	Primarily supplied by SCFP water. Power loss for a few hours caused both metering pumps to fault.
Kersland	Capilano No. 4 and No.5	0.89	0.67 – 1.10	Supplied by SCFP water. The Sodium Hypochlorite Solution injection piping was replaced in May. Station was off for 2 weeks.
Central Park	South Burnaby Main No.1	0.77	0.70 – 1.04	Primarily supplied by SCFP water. Station was off for 2 days in March for main repairs.
	South Burnaby Main No.2	0.90	0.65 – 1.39	
Cape Horn	Coquitlam Main No.2	1.24	0.93 – 1.53	Supplied by Coquitlam water. Station was out of service for 1.5 hours after a loss of power in March. Main No. 2 was dosed using Main No. 3 system after a break in piping. Repairs made and systems returned to normal after 2 days.
	Coquitlam Main No.3	1.24	0.79 – 1.51	
Vancouver Heights	Boundary Road Main No. 5	0.84	0.69 – 1.19	Supplied by SCFP water. No operational issues.

Table 8: Performance of Secondary Disinfection Facilities

2.4. Corrosion Control

Metro Vancouver's Corrosion Control Program began in the 1990s and involves several steps to reduce pipe corrosion. As part of the current Corrosion Control Program: Copper Pipes Protection initiative, further changes in pH and alkalinity were made in June 2021 to help reduce pipe corrosion through the addition of natural minerals.

The untreated water from all three sources had a pH lower than the limit of the GCDWQ of pH 7.0.

In the SCFP process, filtered water is dosed with hydrated lime (calcium bicarbonate) to raise its pH and alkalinity before it enters the clearwells. To achieve the desired alkalinity, the resultant pH is trimmed using CO_2 to bring it down to target levels

At the Coquitlam source, the commissioning of the CO_2 system at the CWTP began in 2019 and was fully operational in 2021. The CO_2 system with the addition of soda ash allows the GVWD to meet new target pH and alkalinity values across the entire system. Similar to the SCFP, the CO_2 system is used to trim the resultant pH to desired target levels.

The average pH of the treated water leaving Seymour Capilano and Coquitlam Water Treatment Plants was 8.2 and 8.1, respectively, during 2021.

Performance of the corrosion control facilities is summarized in Table 9.

Facility	Performance	Discussion
SCFP Corrosion Control	pH ranged from 7.4 – 8.9	The annual average pH was 8.2 and was continually monitored with online instrumentation. The pH target changed from 7.7 to 8.4 in June 2021 to enhance corrosion control.
CWTP Corrosion Control	pH ranged from 6.7 – 9.4	The annual average pH was 8.1. On a couple of occasions in January the pH was <7.0 for a short period due to a soda ash equipment fault. In April and December, the pH was > 9 for a short period. In April it was due to complications with the carbon dioxide dosing. In December it was related to a failure with the soda ash system.

Table 9: Performance of Corrosion Control Facilities

The chemical and physical characteristics of the GVWD treated water are summarized in Appendix A of this report and detailed analytical results are provided in Volume II.

3.0 TRANSMISSION/DISTRIBUTION SYSTEM WATER QUALITY

Schedule A of the *BC Drinking Water Protection Regulation* (BCDWPR) contains standards for the bacteriological quality of potable water in the Province. There are three components of this standard that apply to large utilities such as GVWD and its member jursidictions. These are:

Part 1: No sample should be positive for *E. coli*.

Part 2: Not more than 10% of the samples in a 30-day period should be positive for total coliform bacteria when more than 1 sample is collected.

Part 3: No sample should contain more than 10 total coliform bacteria per 100 mL.

The BCDWPR does not contain any water standards other than the three limits for *E. coli* and total coliform bacteria. Information on the significance of the detection of these organisms can be found in the GCDWQ – Supporting Documents, specifically:

"E. coli is a member of the total coliform group of bacteria and is the only member that is found exclusively in the faeces of humans and other animals. Its presence in water indicates not only recent faecal contamination of the water but also the possible presence of intestinal disease-causing bacteria, viruses and protozoa."

"The presence of total coliform bacteria in water in the distribution system (but not in water leaving the treatment plant) indicates that the distribution system may be vulnerable to contamination or may simply be experiencing bacterial regrowth."

To summarize, the detection of an *E. coli* bacteria in a sample of treated water is an indication of a potentially serious risk. The detection of total coliform bacteria may indicate intrusion into the system, or it may indicate that these bacteria are growing in the distribution system itself (regrowth).

The number of *E. coli* detected in both GVWD and member jurisdiction drinking water samples is typically very low. Out of more than 26,000 samples collected from GVWD and member jurisdiction systems analyzed in 2021, one sample was positive for *E. coli*. The detection of a positive *E. coli* sample triggers a protocol which involves immediate notification to health and member jurisdiction officials, re-sampling, and a thorough investigation into the possible causes.

In the GVWD transmission system, only 11 out of the approximately 6,600 samples collected, tested positive for total coliforms. Only 30 of the approximately 20,000 samples collected from the member jurisdiction distribution systems tested positive for total coliforms in 2021. The majority of the coliforms (67%) in the member jurisdiction systems appeared in the warmer water months of June through October.

The most likely source of these organisms can be attributed to bacterial regrowth. It should be emphasized that 99.8% of the samples in 2021 had no coliforms present, which is a good indicator of effective water treatment and good transmission and distribution system water quality.

3.1. Microbiological Water Quality in the GVWD System

3.1.1. GVWD Water Mains

Water quality in GVWD water mains is monitored from the point leaving the source and throughout the transmission system. In 2021, there were approximately 4,400 samples collected and tested for the presence of indicator bacteria. The percentage of samples from the GVWD water mains that were positive for total coliform bacteria was very low, well below the 10% standard. Of the approximately 4,400 samples processed, only 9 samples tested positive for total coliforms and no samples were positive for *E. coli* bacteria. The compliance of monitoring results from GVWD water mains with the criteria in the BCDWPR is shown in Figure 5.

There were another 540 samples collected from stations where only chlorine residuals are measured. In addition, there are inline stations collecting data every 10-minutes after chlorination at each source, but these samples are not included in the calculations for compliance monitoring.

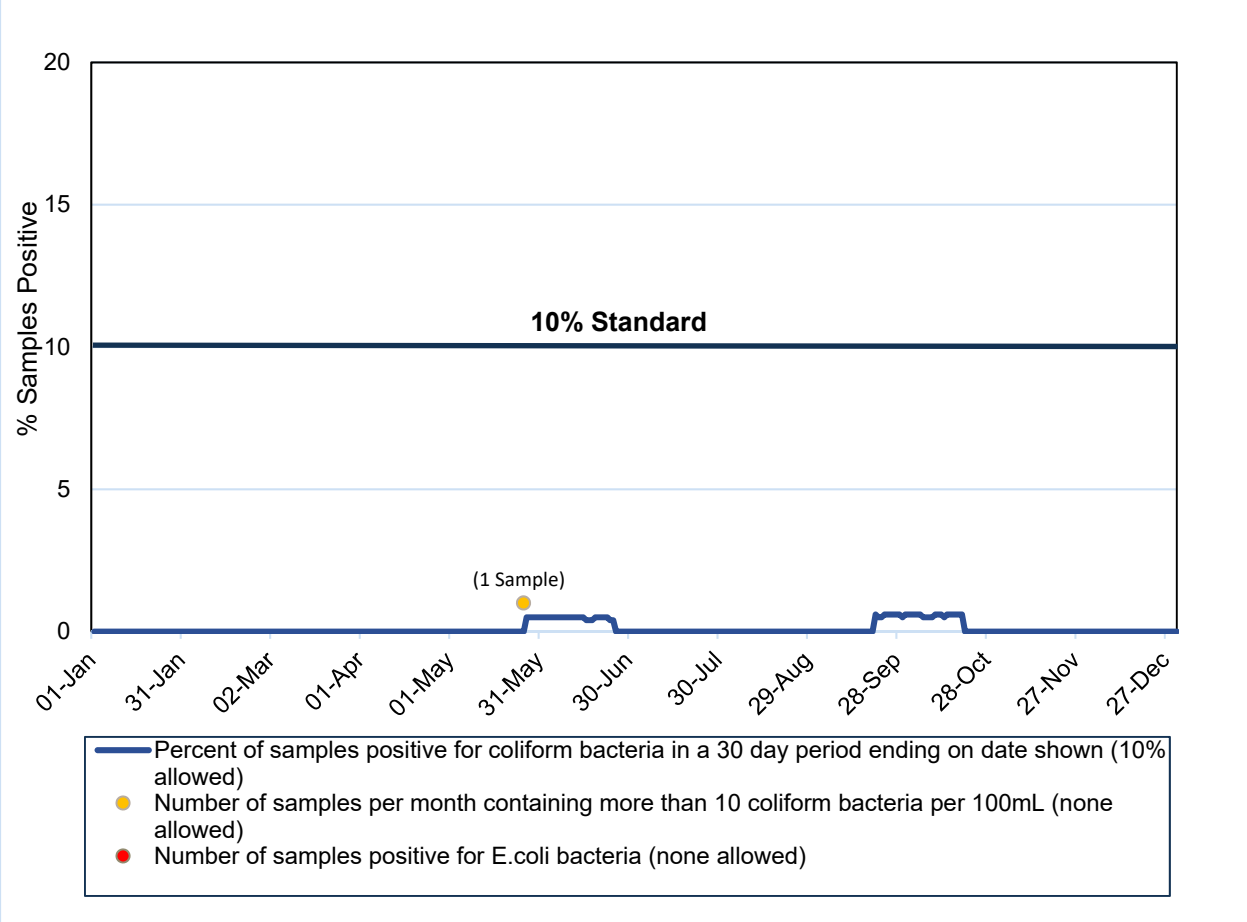


Figure 5: Bacteriological Quality of Water in GVWD Water Mains

3.1.2. GVWD Reservoirs

In 2021, over 2,200 samples were collected from 21 reservoirs and tanks that are located throughout the GVWD water system. Only 2 samples were positive for total coliforms. No sample from a reservoir was positive for *E. coli*.

The compliance of 2021 monitoring results from GVWD reservoirs with the criteria in the BCDWPR is shown in Figure 6.

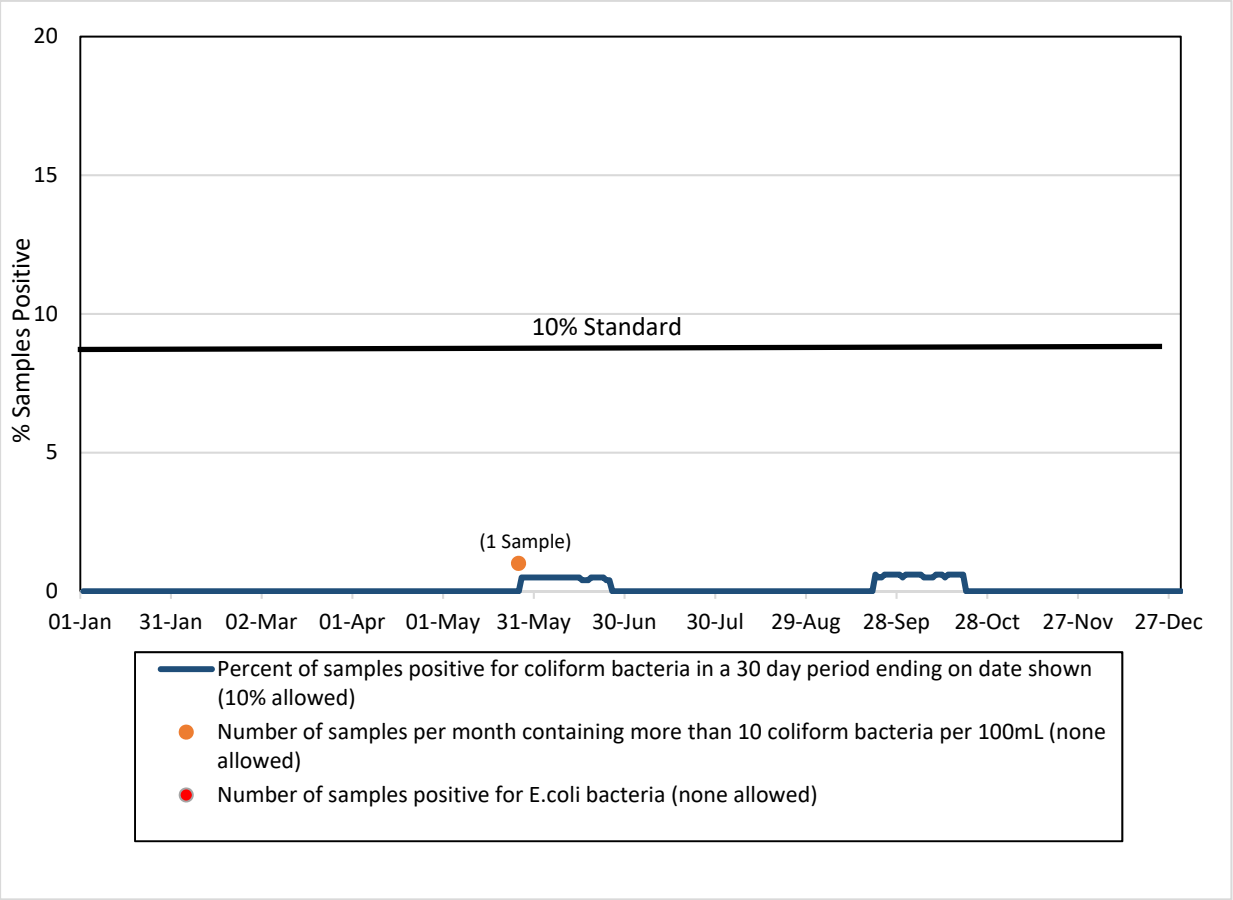


Figure 6: Bacteriological Quality of Water in GVWD Reservoirs

Reservoir water quality is optimized by the use of secondary disinfection coupled with an active reservoir exercising program that includes a minimum of weekly monitoring of chlorine residuals and bacteriology results, which can result in changes to filling levels, if necessary.

In 2021, the first of two cells of the new Jericho Reservoir was commissioned and placed into service on August 30. The reservoir will service the growing needs of the Township of Langley. The second cell is expected to be commissioned in 2022. Total storage at this facility will be 20 million litres.

Table 10 provides an overview of the status of the GVWD reservoirs from 2018 to 2021. During certain times of the year, it is not possible to cycle reservoirs as much as would be desired due to operational constraints. Despite these constraints, water quality as determined by coliform bacteria was satisfactory in all reservoirs.

Reservoir (Capacity in Million Litres)	Average Free Chlorine (mg/L)				Discussion
	2018	2019	2020	2021	
Burnaby Mountain Reservoir (13.2)	0.49	0.53	0.57	0.53	Inspection by divers for conditions in April. Remained in operation.
Burnaby Tank (2.3)	0.54	0.58	0.60	0.57	No operational issues
Cape Horn Reservoir (40.0)	0.78	0.61	0.78	0.71	No operational issues
Central Park Reservoir (35.0)	0.53	0.51	0.66	0.54	No operational issues
Clayton Reservoir (21.6)	1.1	1.02	1.08	1.1	Cell 1 was out of service January 1 to May 10. Cell 2 removed from service October 12 to maintain water quality due to seasonal low demand.
Glenmore Tanks (1.0)	0.66	0.68	0.77	0.73	No operational issues
Grandview Reservoir (13.5)	0.71	0.73	0.80	0.85	No operational issues
Greenwood Reservoir (8.8)	0.66	0.68	0.75	0.70	No operational issues
Hellings Tank (4.3)	0.47	0.48	0.54	0.56	No operational issues
Jericho Reservoir (20.0)	NA	NA	NA	1.10	New reservoir. Cell 1 was disinfected and was in operation starting on August 30.
Kennedy Reservoir (16.3)	0.56	0.52	0.58	0.65	No operational issues
Kersland Reservoir (73.7)	0.55	0.55	0.66	0.65	Reservoir No.1 removed from service in October for upgrades until Spring 2022. No Operational issues with other cell.
Little Mountain Reservoir (171.0)	0.64	0.67	0.72	0.69	No operational issues
Maple Ridge Reservoir (20.0)	0.53	0.52	0.44	0.46	No operational issues
Newton Reservoir (32.0)	0.45	0.46	0.55	0.44	No operational issues
Pebble Hill Reservoir (42.2)	0.63	0.60	0.66	0.54	Cell 1 was out of service January 1 to July 12. Cell 1 was out of service October 17 to maintain water quality due to seasonal low demand and for seismic upgrade work. No Operational issues with other cells.
Prospect Reservoir (4.4)	0.64	0.66	0.76	0.73	No operational issues
Sasamat Reservoir (26.0)	0.54	0.54	0.65	0.62	No operational issues
Sunnyside Reservoir (22.7)	0.58	0.47	0.73	0.85	Cell 1 was investigated by divers in March. Cell 2 was cleaned, inspected, and disinfected in November.
Vancouver Heights Reservoir (43.0)	0.66	0.75	0.82	0.78	The reservoir was cleaned by divers in February while remaining in service.
Westburnco Reservoir (73.0)	0.58	0.58	0.64	0.60	No operational issues
Whalley Reservoir (33.4)	0.60	0.59	0.73	0.71	No operational issues

Table 10: Status of GVWD Reservoirs (2018-2021)

3.2. Microbiological Water Quality in Member Jurisdiction Systems

For samples collected from member jurisdiction systems, the percent positive per month for total coliform bacteria from 2018-2021 is shown in Figure 7.

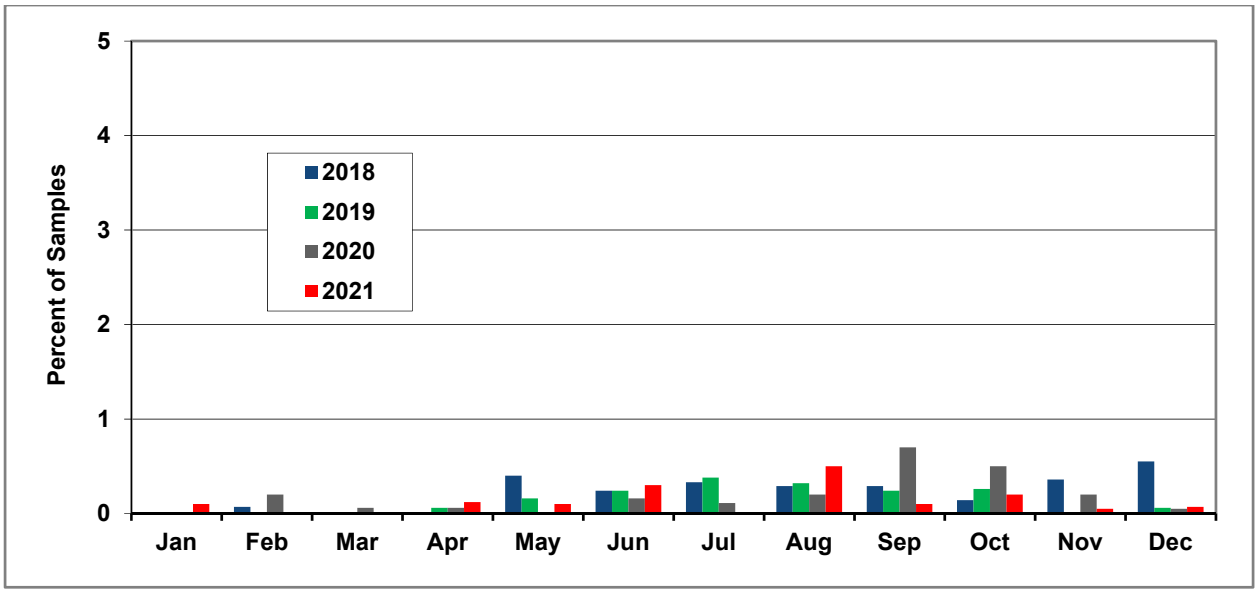


Figure 7: Percent of Samples per Month Positive for Total Coliform Bacteria (2018 to 2021)

The percentage of samples positive for total coliform bacteria in 2021 remained relatively similar as compared to 2020.

Schedule A of the BCDWPR contains standards for the bacteriological quality of potable water in the Province. There are three components of this standard that apply to local governments:

Part 1: No sample should be positive for *E. coli.*

Part 2: Not more than 10% of the samples in a 30-day period should be positive for total coliform bacteria when more than 1 sample is collected.

Part 3: No sample should contain more than 10 total coliform bacteria per 100 mL.

For samples from member jurisdiction systems, this requirement was met in 2021 with the following exceptions:

- One sample in January contained more than 10 total coliform bacteria.
- One sample in June contained more than 10 total coliform bacteria.
- One sample in October was positive for *E. coli.*

Table 11 shows the compliance with the bacteriological standards (3 parts) in the BCDWPR for samples taken within the distribution systems of the 20 member jurisdictions that are supplied with GVWD water.

Month	Number that met Part 1	Number that met Part 2	Number that met Part 3	Number that met all requirements
January	20	20	19	19
February	20	20	20	20
March	20	20	20	20
April	20	20	20	20
May	20	20	20	20
June	20	20	19	19
July	20	20	20	20
August	20	20	20	20
September	20	20	20	20
October	19	20	20	19
November	20	20	20	20
December	20	20	20	20

Table 11: Member Jurisdiction Water Quality Compared to the Provincial Bacteriological Standards

3.3. Disinfection By-Products in the Transmission/Distribution Systems

As the treated water moves through the GVWD Transmission system and into the member jurisdiction distribution system's infrastructure of pipes and reservoirs, changes in water quality occur. This is mainly due to the reaction between the chlorine in the water (added during primary and secondary disinfection) and naturally occurring organic matter in the water.

One of the most significant changes is the production of chlorinated disinfection by-products (DBPs). DBPs is a term used to describe a group of organic and inorganic compounds formed during water disinfection.

Reactions between dissolved natural organic matter and chlorine can lead to the formation of a variety of halogenated DBPs. There are two major groups of chlorinated DBPs: Total Trihalomethanes (TTHMs) and Total Haloacetic Acids ($THAA_5$). Factors that affect DBP formation include: amount of chlorine added to water, reaction time, concentration and characteristics of dissolved organic materials (precursors), water temperature, and water pH. In general, DBPs continue to form as long as chlorine and reactive DBP precursors are present in the water.

The Maximum Acceptable Concentration (MAC) in the GCDWQ for TTHMs is a locational yearly running average of 100 ppb (0.1 mg/L) based on quarterly samples. A comparison of TTHM levels in the GVWD and member jurisdiction systems in 2021 is shown in Figure 8. All THM results from GVWD water mains and member jurisdiction systems were below the MAC of 100 ppb.

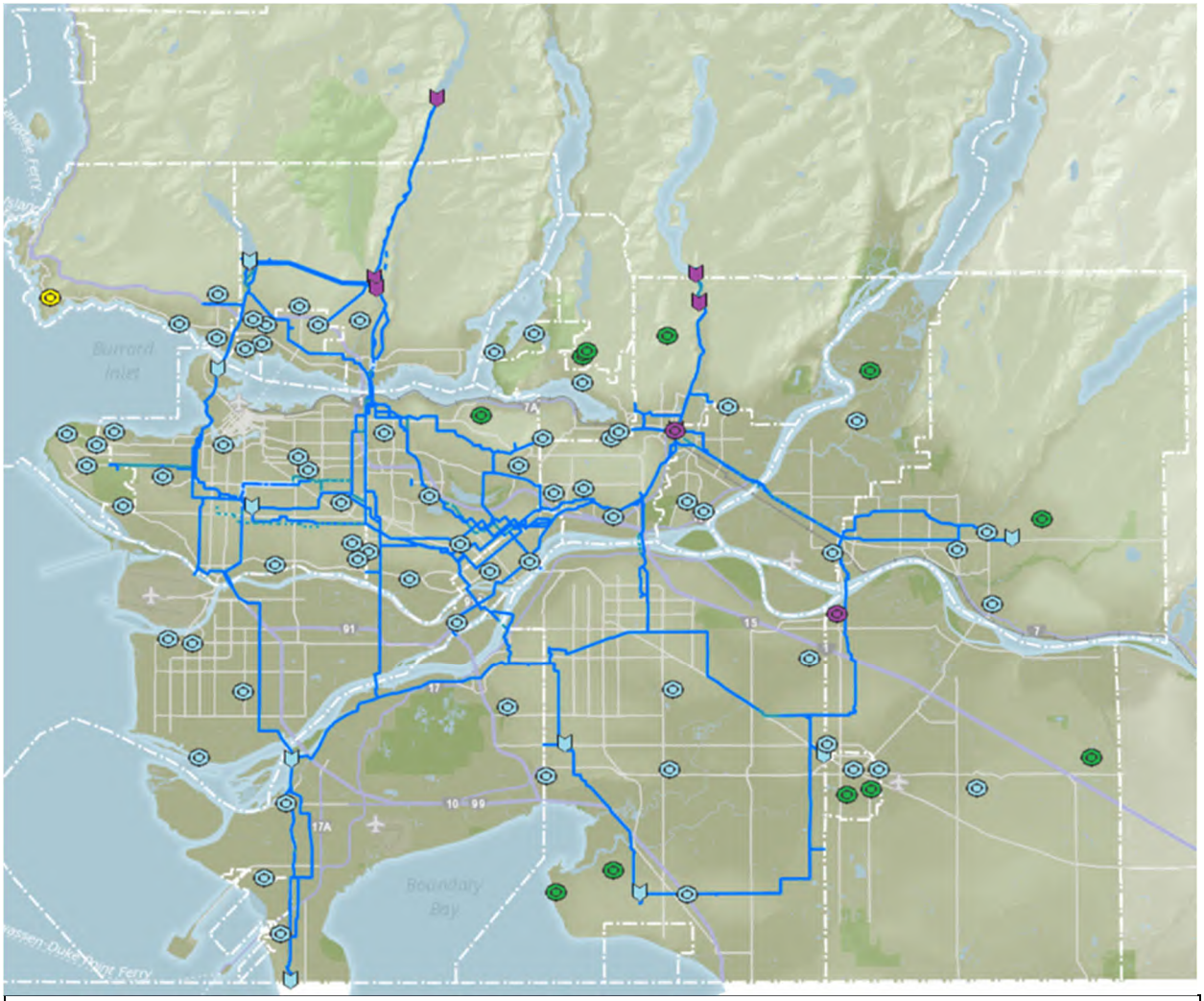
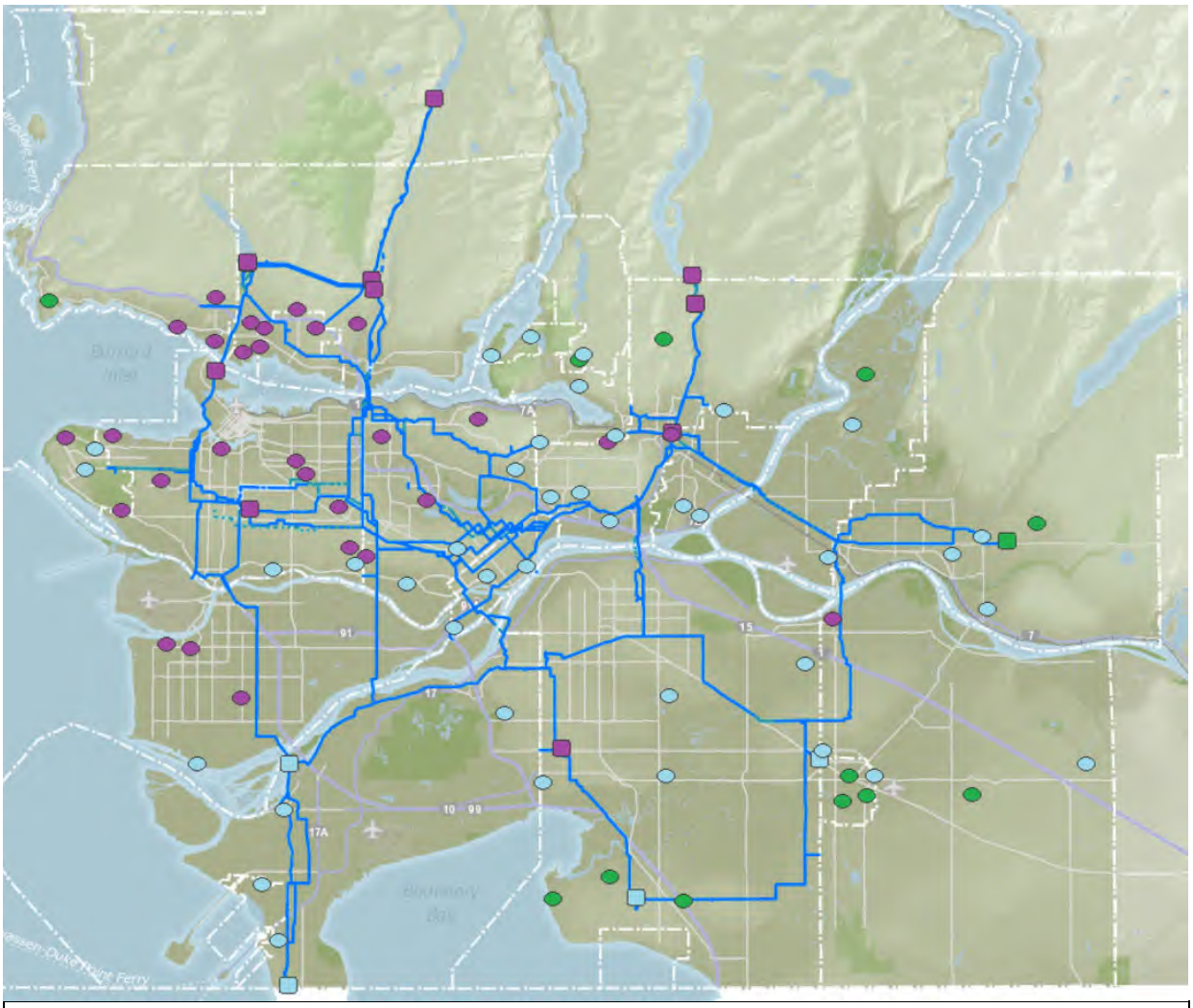


Figure 8: Average Total Trihalomethane Levels

The other group of disinfection by-products of interest is the Total Haloacetic Acid ($THAA_5$) group. Comparison of $THAA_5$ in the GVWD and member jurisdiction systems in 2021 is shown in Figure 9. In 2021, all HAA results from GVWD water mains and member jurisdiction systems were below the MAC of 80 ppb.



2021 Average GVWD THAA = 22 ppb
2021 Average Member Jurisdictions THAA = 26 ppb

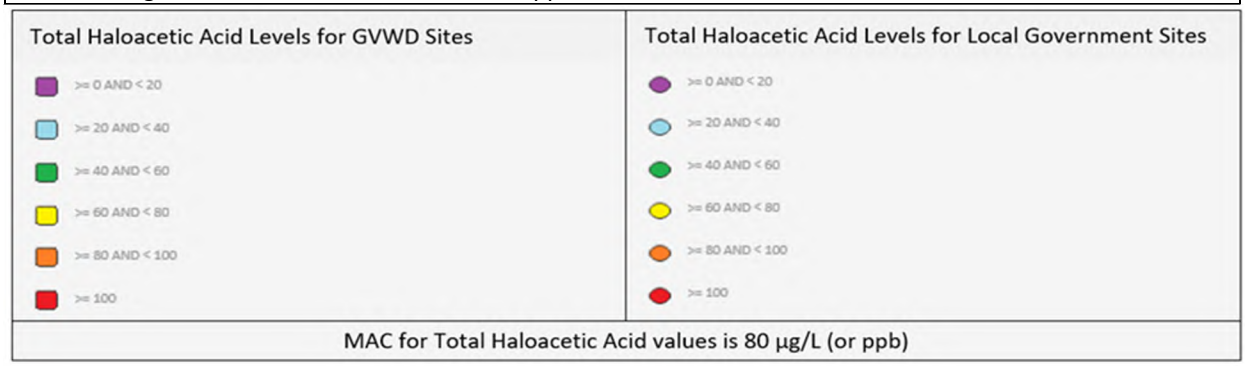


Figure 9: Average Total Haloacetic Acid Levels

4.0 QUALITY CONTROL/QUALITY ASSURANCE

In 1994, as required by a new BC Ministry of Health program, the bacteriology section of the GVWD Laboratory received approval from the Provincial Medical Health Officer to perform bacteriological analysis of potable water as required in the BCDWPR. An ongoing requirement of this approval is successful participation in the provincial Clinical Microbiology Proficiency Testing Program, or its equivalent. Representatives of the Approval Committee for Bacteriology Laboratories have carried out an inspection of the GVWD Laboratory facilities at the Lake City Operations Centre in February 2019 as part of the process leading up to approval of the laboratory by the Provincial Health Officer. The next inspection is scheduled for 2022.

In addition to the approval process discussed above, the GVWD Laboratory is accredited by the Canadian Association for Laboratory Accreditation (CALA) for the analysis of parameters for which the laboratory has requested certification. The GVWD Laboratory has been inspected by representatives from CALA bi-annually since 1995.

Accreditation for the laboratory from the Standards Council of Canada was first received early in 1996 and continued until the middle of 2005, when accreditation was granted by CALA directly.

The most recent on-site audit took place in September 2021, and CALA is expected to issue accreditation approval in Spring 2022. The next CALA inspection will take place in the fall of 2023.

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APPENDIX A — CHEMICAL AND PHYSICAL ANALYSIS SUMMARIES

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

Physical and Chemical Analysis of Water Supply

2021 – Capilano Water System

Parameter	Untreated	Treated		Canadian Guideline		
	Average	Average	Range	Days Exceeded	Limit	Reason Established
Alkalinity as CaCO3 (mg/L)	2.8	16	9.0-25		none	
Aluminum Dissolved (µg/L)	76	34	19-63		none	
Aluminum Total (µg/L)	164	35	19-81		none	
Antimony Total (µg/L)	<0.5	<0.5	<0.5	0	6	Health
Arsenic Total (µg/L)	<0.5	<0.5	<0.5	0	10	Health
Barium Total (µg/L)	2.9	2.5	1.8-2.9	0	1000	Health
Boron Total (µg/L)	<10	<10	<10	0	5000	Health
Bromate (mg/L)	<0.01	<0.01	<0.01	0	0.1	Health
Bromide (mg/L)	<0.01	<0.01	<0.01		none	
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	0	5	Health
Calcium Total (µg/L)	1140	6210	3980-9320		none	
Carbon Organic - Dissolved (mg/L)	1.8	0.7	0.5-1.0		none	
Carbon Organic - Total (mg/L)	1.8	0.7	0.5-1.0		none	
Chlorate (mg/L)	<0.01	0.03	0.02-0.04	0	1	Health
Chloride (mg/L)	<0.5	2.4	2.0-3.1	0	=250	Aesthetic
Chromium Total (µg/L)	<0.1	<0.05	<0.05	0	50	Health
Cobalt Total (µg/L)	<0.5	<0.5	<0.5		none	
Color - Apparent (ACU)	16	<2	<2-3		none	
Color - True (TCU)	11	<1	<1-2	0	=15	Aesthetic
Conductivity (µmhos/cm)	10	41	30-55		none	
Copper Total (µg/L)	2.1	<0.5	<0.5	0	=1000	Aesthetic
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	0	0.2	Health
Fluoride (mg/L)	<0.05	<0.05	<0.05	0	1.5	Health
Hardness as CaCO3 (mg/L)	3.5	16.6	10.5-24.3		none	
Iron Dissolved (µg/L)	34	<5	<5-5		none	
Iron Total (µg/L)	121	<6	<5-13	0	=300	Aesthetic
Lead Total (µg/L)	<0.5	<0.5	<0.5	0	5	Health
Magnesium Total (µg/L)	166	185	147-241		none	
Manganese Dissolved (µg/L)	3.9	1.6	0.7-3.3		none	
Manganese Total (µg/L)	5.4	3.6	1.4-7.0	0	=50	Aesthetic
Mercury Total (µg/L)	<0.05	<0.05	<0.05	0	1	Health
Molybdenum Total (µg/L)	<0.5	<0.5	<0.5		none	
Nickel Total (µg/L)	<0.5	<0.5	<0.5		none	
Nitrogen - Ammonia as N (mg/L)	<0.02	<0.02	<0.02		none	
Nitrogen - Nitrate as N (mg/L)	0.07	0.06	0.04-0.10	0	45	Health
Nitrogen - Nitrite as N (mg/L)	<0.01	<0.01	<0.01	0	1	Health
pH (pH units)	6.5	7.7	7.4-8.2	0	7.0 to 10.5	Aesthetic
Phenol (mg/L)	<0.005	<0.005	<0.005		none	
Phosphorus Dissolved (µg/L)	<10	<10	<10		none	
Phosphorus Total (µg/L)	<10	<10	<10		none	
Potassium Total (µg/L)	150	150	124-169		none	
Residue Total (mg/L)	15	28	21-37		none	
Residue Total Dissolved (mg/L)	10	30	20-40	0	=500	Aesthetic
Residue Total Fixed (mg/L)	9	22	15-31		none	
Residue Total Volatile (mg/L)	6	6	4-9		none	
Selenium Total (µg/L)	<0.5	<0.5	<0.5	0	50	Health
Silica as SiO2 (mg/L)	3.2	3.2	2.3-3.8		none	
Silver Total (µg/L)	<0.5	<0.5	<0.5		none	
Sodium Total (µg/L)	564	1570	1420-1760	0	=200000	Aesthetic
Sulphate (mg/L)	<0.6	1.0	0.7-1.3	0	=500	Aesthetic
Turbidity (NTU)	1.7	0.13	0.06-0.24		none	
Turbidity IFE (NTU)	-	-	-	-	-	-
UV Absorbance 254 nm (Abs/cm)	0.073	0.011	0.007-0.017		none	
Zinc Total (µg/L)	<3	<3	<3	0	=5000	Aesthetic

These figures are averaged values from a number of laboratory analyses done throughout the year. Where the range is a single value no variation was measured for the samples analyzed. Average values containing one or more results below the detection limit are preceded with "<" symbol. Minimum range values than "<" denotes not detectable with the technique used for determination. Methods and terms are based on those of the most current on-line version of "Standard Methods for the Examination of Water and Waste Water". Untreated water is from the intake prior to the raw water tunnel, treated water is from a single site in the GVWD distribution system after the treated water tunnel and before the breakhead tank. Guidelines are taken from the most current Guidelines for Canadian Drinking Water Quality summary table updated in September 2020. Capilano Source was operational for 365 days in 2021.
[1]Treated turbidity guideline and the number of exceedances applies to Individual Filter Effluent readings; measured in events and not days.

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

Physical and Chemical Analysis of Water Supply

2021 – Seymour Water System

Parameter	Untreated	Treated		Canadian Guideline		
	Average	Average	Range	Days Exceeded	Limit	Reason Established
Alkalinity as CaCO3 (mg/L)	3.3	16	8.3-24		none	
Aluminum Dissolved (µg/L)	69	34	19-63		none	
Aluminum Total (µg/L)	130	35	20-76		none	
Antimony Total (µg/L)	<0.5	<0.5	<0.5	0	6	Health
Arsenic Total (µg/L)	<0.5	<0.5	<0.5	0	10	Health
Barium Total (µg/L)	3.1	2.5	2.0-2.9	0	1000	Health
Boron Total (µg/L)	<10	<10	<10	0	5000	Health
Bromate (mg/L)	<0.01	<0.01	<0.01	0	0.1	Health
Bromide (mg/L)	<0.01	<0.01	<0.01		none	
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	0	5	Health
Calcium Total (µg/L)	1550	6320	3980-9180		none	
Carbon Organic - Dissolved (mg/L)	1.6	0.7	0.5-1.0		none	
Carbon Organic - Total (mg/L)	1.7	0.7	0.5-1.0		none	
Chlorate (mg/L)	<0.01	0.03	0.02-0.04	0	1	Health
Chloride (mg/L)	<0.5	2.4	2.0-3.1	0	=250	Aesthetic
Chromium Total (µg/L)	<0.07	<0.05	<0.05	0	50	Health
Cobalt Total (µg/L)	<0.5	<0.5	<0.5		none	
Color - Apparent (ACU)	17	<2	<2-3		none	
Color - True (TCU)	11	<1	<1-1	0	=15	Aesthetic
Conductivity (µmhos/cm)	12	41	29-55		none	
Copper Total (µg/L)	29.4	<0.6	<0.5-1.1	0	=1000	Aesthetic
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	0	0.2	Health
Fluoride (mg/L)	<0.05	<0.05	<0.05	0	1.5	Health
Hardness as CaCO3 (mg/L)	4.5	16.7	10.6-23.9		none	
Iron Dissolved (µg/L)	63	<6	<5-29		none	
Iron Total (µg/L)	162	<8	<5-29	0	=300	Aesthetic
Lead Total (µg/L)	<0.5	<0.5	<0.5	0	5	Health
Magnesium Total (µg/L)	154	186	148-238		none	
Manganese Dissolved (µg/L)	4.2	3.0	1.9-4.6		none	
Manganese Total (µg/L)	6.2	4.0	2.2-6.2	0	=50	Aesthetic
Mercury Total (µg/L)	<0.05	<0.05	<0.05	0	1	Health
Molybdenum Total (µg/L)	<0.5	<0.5	<0.5		none	
Nickel Total (µg/L)	<0.5	<0.5	<0.5		none	
Nitrogen - Ammonia as N (mg/L)	<0.02	<0.02	<0.02		none	
Nitrogen - Nitrate as N (mg/L)	0.06	0.06	0.03-0.10	0	45	Health
Nitrogen - Nitrite as N (mg/L)	<0.01	<0.01	<0.01	0	1	Health
pH (pH units)	6.5	7.7	7.3-8.1	0	7.0 to 10.5	Aesthetic
Phenol (mg/L)	<0.005	<0.005	<0.005		none	
Phosphorus Dissolved (µg/L)	<10	<10	<10		none	
Phosphorus Total (µg/L)	<10	<10	<10		none	
Potassium Total (µg/L)	150	142	123-169		none	
Residue Total (mg/L)	16	28	22-37		none	
Residue Total Dissolved (mg/L)	10	30	20-40	0	=500	Aesthetic
Residue Total Fixed (mg/L)	9	21	12-32		none	
Residue Total Volatile (mg/L)	7	7	5-11		none	
Selenium Total (µg/L)	<0.5	<0.5	<0.5	0	50	Health
Silica as SiO2 (mg/L)	3.1	3.1	2.3-3.8		none	
Silver Total (µg/L)	<0.5	<0.5	<0.5		none	
Sodium Total (µg/L)	534	1550	1400-1720	0	=200000	Aesthetic
Sulphate (mg/L)	1.1	1.0	0.7-1.3	0	=500	Aesthetic
Turbidity (NTU)	1.1	0.13	0.06-0.21		none	
Turbidity IFE (NTU)	-	-	-	-	-	-
UV Absorbance 254 nm (Abs/cm)	0.070	0.011	0.008-0.017		none	
Zinc Total (µg/L)	<4	<3	<3	0	=5000	Aesthetic

These figures are averaged values from a number of laboratory analyses done throughout the year. Where the range is a single value no variation was measured for the samples analyzed. Average values containing one or more results below the detection limit are preceded with "<" symbol. Minimum range values than "<" denotes not detectable with the technique used for determination. Methods and terms are based on those of the most current on-line version of "Standard Methods for the Examination of Water and Waste Water". Untreated water is from a sample site prior to coagulation, treated water is from a sample site downstream of the SCFP clearwell. Guidelines are taken from the most current Guidelines for Canadian Drinking Water Quality summary table updated in September 2020. Seymour Source was operational for 365 days in 2021.

[1]Treated turbidity guideline and the number of exceedances applies to Individual Filter Effluent readings; measured in events and not days.

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

Physical and Chemical Analysis of Water Supply

2021 – Coquitlam Water System

Parameter	Untreated	Treated		Canadian Guideline		
	Average	Average	Range	Days Exceeded	Limit	Reason Established
Alkalinity as CaCO3 (mg/L)	1.9	16	7.1-23		none	
Aluminum Dissolved (µg/L)	68	70	61-85		none	
Aluminum Total (µg/L)	94	94	77-141		none	
Antimony Total (µg/L)	<0.5	<0.5	<0.5	0	6	Health
Arsenic Total (µg/L)	<0.5	<0.5	<0.5	0	10	Health
Barium Total (µg/L)	2.2	2.2	1.9-2.4	0	1000	Health
Boron Total (µg/L)	<10	<10	<10	0	5000	Health
Bromate (mg/L)	<0.01	<0.01	<0.01	0	0.1	Health
Bromide (mg/L)	<0.01	<0.01	<0.01		none	
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	0	5	Health
Calcium Total (µg/L)	836	836	752-899		none	
Carbon Organic - Dissolved (mg/L)	1.6	1.5	1.2-2.0		none	
Carbon Organic - Total (mg/L)	1.7	1.5	1.2-2.0		none	
Chlorate (mg/L)	<0.01	0.06	0.03-0.10	0	1	Health
Chloride (mg/L)	<0.5	2.2	1.8-2.7	0	=250	Aesthetic
Chromium Total (µg/L)	<0.05	<0.05	<0.05-0.06	0	50	Health
Cobalt Total (µg/L)	<0.5	<0.5	<0.5		none	
Color - Apparent (ACU)	13	<2	<2-3		none	
Color - True (TCU)	9	<1	<1-1	0	=15	Aesthetic
Conductivity (µmhos/cm)	8	37	24-50		none	
Copper Total (µg/L)	4.7	<0.5	<0.5-0.6	0	=1000	Aesthetic
Cyanide Total (mg/L)	<0.02	<0.02	<0.02	0	0.2	Health
Fluoride (mg/L)	<0.05	<0.05	<0.05	0	1.5	Health
Hardness as CaCO3 (mg/L)	2.5	2.5	2.3-2.6		none	
Iron Dissolved (µg/L)	22	24	12-64		none	
Iron Total (µg/L)	57	58	31-150	0	=300	Aesthetic
Lead Total (µg/L)	<0.5	<0.5	<0.5	0	5	Health
Magnesium Total (µg/L)	97	98	86-110		none	
Manganese Dissolved (µg/L)	4.2	2.6	1.5-4.2		none	
Manganese Total (µg/L)	4.5	3.8	2.0-7.4	0	=50	Aesthetic
Mercury Total (µg/L)	<0.05	<0.05	<0.05	0	1	Health
Molybdenum Total (µg/L)	<0.5	<0.5	<0.5		none	
Nickel Total (µg/L)	<0.5	<0.5	<0.5		none	
Nitrogen - Ammonia as N (mg/L)	<0.02	<0.02	<0.02		none	
Nitrogen - Nitrate as N (mg/L)	0.07	0.08	0.04-0.10	0	45	Health
Nitrogen - Nitrite as N (mg/L)	<0.01	<0.01	<0.01	0	1	Health
pH (pH units)	6.3	7.9	7.1-8.7	0	7.0 to 10.5	Aesthetic
Phenol (mg/L)	<0.005	<0.005	<0.005		none	
Phosphorus Dissolved (µg/L)	<10	<10	<10		none	
Phosphorus Total (µg/L)	<10	<10	<10		none	
Potassium Total (µg/L)	108	109	106-112		none	
Residue Total (mg/L)	12	30	21-36		none	
Residue Total Dissolved (mg/L)	10	30	20-40	0	=500	Aesthetic
Residue Total Fixed (mg/L)	6	20	12-26		none	
Residue Total Volatile (mg/L)	6	10	7-13		none	
Selenium Total (µg/L)	<0.5	<0.5	<0.5	0	50	Health
Silica as SiO2 (mg/L)	2.5	2.5	2.2-2.8		none	
Silver Total (µg/L)	<0.5	<0.5	<0.5		none	
Sodium Total (µg/L)	462	8010	5110-10600	0	=200000	Aesthetic
Sulphate (mg/L)	<0.5	<0.6	<0.5-0.7	0	=500	Aesthetic
Turbidity (NTU)	0.50	0.43	0.18-1.9		none	
UV 254 - Apparent (Abs/cm)	0.071	0.023	0.015-0.060		none	
UV Absorbance 254 nm (Abs/cm)	0.065	0.019	0.013-0.022		none	
Zinc Total (µg/L)	<3	<3	<3	0	=5000	Aesthetic

These figures are averaged values from a number of laboratory analyses done throughout the year. Where the range is a single value no variation was measured for the samples analyzed. Average values containing one or more results below the detection limit are preceded with "<" symbol. Minimum range values than "<" denotes not detectable with the technique used for determination. Methods and terms are based on those of the most current on-line version of "Standard Methods for the Examination of Water and Waste Water". Untreated water is from the intake prior to treatment, treated water is from a single site in the GVWD distribution system downstream of CWTP. Guidelines are taken from the most current Guidelines for Canadian Drinking Water Quality summary table updated in September 2020. Recommended turbidity guidelines applies to finished treated water from an un-filtered source. Coquitlam source was operational for 365 days in 2021.

APPENDIX B — ANALYSIS OF WATER FOR ORGANIC/INORGANIC COMPONENTS AND RADIONUCLIDES

Analysis of Source Waters for Herbicides, Pesticides, Volatile Organic Compounds and Uranium

Parameter	Units	Date Sampled	MAC	AO	Capilano	Seymour	Coquitlam
Atrazine	µg/L	06/23/21	5		<1.0	<1.0	<1.0
Azinphos-Methyl	µg/L	06/23/21	20		<1.0	<1.0	<1.0
benzene	µg/L	09/24/21	5		<0.50	<0.50	<0.50
Benzo(a)pyrene	µg/L	12/07/21	0.04		<0.0050	<0.0050	<0.0050
Bromoxynil	µg/L	06/23/21	5		<0.50	<0.50	<0.50
Carbaryl	µg/L	06/23/21	90		<5.0	<5.0	<5.0
Carbofuran	µg/L	06/23/21	90		<5.0	<5.0	<5.0
Carbon tetrachloride	µg/L	09/24/21	2		<0.50	<0.50	<0.50
Chlorpyrifos (Dursban)	µg/L	06/23/21	90		<2.0	<2.0	<2.0
Cyanobacterial toxins-Microcystin-LR	µg/L	April – Nov 2021	1.5		<0.20	<0.20	<0.20
Diazinon	µg/L	06/23/21	20		<2.0	<2.0	<2.0
Dicamba	µg/L	06/23/21	120		<0.50	<0.50	<0.50
Dichlorobenzene, 1,2-	µg/L	09/24/21	200	≤ 3	<0.50	<0.50	<0.50
Dichlorobenzene, 1,4-	µg/L	09/24/21	5	≤ 1	<0.50	<0.50	<0.50
Dichloroethane, 1,2-	µg/L	09/24/21	5		<0.50	<0.50	<0.50
Dichloroethylene, 1,1-	µg/L	09/24/21	14		<0.50	<0.50	<0.50
Dichloromethane	µg/L	09/24/21	50		<1.0	<1.0	<1.0
Dichlorophenol, 2,4-	µg/L	06/23/21	900	≤ 0.3	<0.10	<0.10	<0.10
Dichlorophenoxyacetic acid,2,4-(2,4-D)	µg/L	06/23/21	100		<0.50	<0.50	<0.50
Diclofop-methyl	µg/L	06/23/21	9		<0.90	<0.90	<0.90
Dimethoate	µg/L	06/23/21	20		<2.0	<2.0	<2.0
Diquat	µg/L	06/23/21	70		<7.0	<7.0	<7.0
Diuron	µg/L	06/23/21	150		<10	<10	<10
Ethylbenzene	µg/L	09/24/21	140	≤ 1.6	<0.50	<0.50	<0.50
Glyphosate	µg/L	06/23/21	280		<10	<10	<10
Malathion	µg/L	06/23/21	190		<2.0	<2.0	<2.0
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	µg/L	06/23/21	100		<0.50	<0.50	<0.50
Methyl-tert-butyl ether [MTBE]	µg/L	09/24/21	None	≤ 15	<0.50	<0.50	<0.50
Metolachlor	µg/L	06/23/21	50		<5.0	<5.0	<5.0
Metribuzin (Sencor)	µg/L	06/23/21	80		<5.0	<5.0	<5.0
Monochlorobenzene	µg/L	09/24/21	80	≤ 30	<0.50	<0.50	<0.50
N-Nitrosodimethylamine (NDMA)	ng/L	06/23/21	0.04		<1.9	<1.9	<2.0
Nitrilotriacetic acid (NTA)	mg/L	06/23/21	400		<0.050	<0.050	<0.050
Paraquat	µg/L	06/23/21	10		<1.0	<1.0	<1.0

Analysis of Source Waters for Herbicides, Pesticides, Volatile Organic Compounds and Uranium Con't

Parameter	Units	Date Sampled	MAC	AO	Capilano	Seymour	Coquitlam
Pentachlorophenol	µg/L	06/23/21	60		<0.10	<0.10	<0.10
Phorate	µg/L	06/23/21	2		<1.0	<1.0	<1.0
Picloram	µg/L	06/23/21	190		<0.50	<0.50	<0.50
Simazine	µg/L	06/23/21	10		<2.0	<2.0	<2.0
Terbufos	µg/L	06/23/21	1		<1.0	<1.0	<1.0
tetrachloroethylene	µg/L	09/24/21	10		<0.50	<0.50	<0.50
Tetrachlorophenol, 2,3,4,6-	µg/L	06/23/21	100	≤ 1	<0.10	<0.10	<0.10
Toluene	µg/L	09/24/21	60	24	<0.40	<0.40	<0.40
Trichloroethylene	µg/L	09/24/21	5		<0.50	<0.50	<0.50
Trichlorophenol, 2,4,6-	µg/L	06/23/21	5	≤ 2	<0.10	<0.10	<0.10
Trifluralin	µg/L	06/23/21	45		<5.0	<5.0	<5.0
Uranium (Total)	µg/L	06/21/21	20		0.0323	0.0230	0.0460
Vinyl chloride	µg/L	09/24/21	2		<0.40	<0.40	<0.40
Xylenes, total	µg/L	09/24/21	90	≤ 20	<0.50	<0.50	<0.50

Monitoring of Selected GVWD Water Mains for BTEXs

Parameters	Units	MAC	AO	Maple Ridge Main at Reservoir		Barnston Island Main at Willoughby PS		Jericho-Clayton Main		South Burnaby Main #2	
				10-Dec	18-May	17-May	7-Dec	19-May	10-Dec	18-May	7-Dec
Benzene	ppb	5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethyl Benzene	ppb	140	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	ppb	60	24	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Xylene Total	ppb	90	20	1	<1	<1	1	1	1	<1	1

Analysis of Source Water for PAH's

Parameters	Units	Capilano		Seymour		Coquitlam	
		19-May	07-Dec	07-Dec	17-May	19-May	07-Dec
acenaphthene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
acridine	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	µg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	µg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 2-	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
naphthalene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
phenanthrene	µg/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pyrene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

Analysis of Selected GVWD Mains for PAHs

Parameters	Units	Coquitlam Main #2	Westburnco Reservoir		Barnston Island		Queensborough		Whalley Kennedy Link Main		Haney Main #2		36th Ave Main
		19-May	9-Dec	18-May	7-Dec	18-May	9-Dec	19-May	9-Dec	19-May	9-Dec	17-May	7-Dec
acenaphthene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
acridine	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(a)pyrene	µg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0076	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010
dibenz(a,h)anthracene	µg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
fluorene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 2-	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
naphthalene	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
phenanthrene	µg/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
pyrene	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
quinoline	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

[1]Benzo(a)pyrene is the only PAH compound that has guideline limit. Maximum Acceptable Concentration of Benzo(a)pyrene is 0.04µg/L

Monitoring of Source Waters for PFOS and PFOA

Parameter	Sampling Date	Units	MAC	Capilano	Seymour	Coquitlam
PFOS	07/30/2021	µg/L	600	<0.010	<0.010	<0.010
PFOA	07/30/2021	µg/L	200	<0.010	<0.010	<0.010

Parameter	Sampling Date	Units	Capilano	Seymour	Coquitlam
PFBA	07/30/2021	µg/L	<0.10	<0.10	<0.10
PFPeA	07/30/2021	µg/L	<0.10	<0.10	<0.10
PFHxA	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFHpA	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFOA	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFNA	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFDA	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFUnA	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFDoA	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFTrDA	07/30/2021	µg/L	<0.0250	<0.0250	<0.0250
PFTeDA	07/30/2021	µg/L	<0.025	<0.025	<0.025
PFBS	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFPeS	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFHxS	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFHpS	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFOS	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFNS	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFDS	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFDoS	07/30/2021	µg/L	<0.010	<0.010	<0.010
4:2 FTS	07/30/2021	µg/L	<0.010	<0.010	<0.010
6:2 FTS	07/30/2021	µg/L	<0.010	<0.010	<0.010
8:2 FTS	07/30/2021	µg/L	<0.010	<0.010	<0.010
PFOSA	07/30/2021	µg/L	<0.010	<0.010	<0.010
N-MeFOSA	07/30/2021	µg/L	<0.025	<0.025	<0.025
N-EtFOSA	07/30/2021	µg/L	<0.025	<0.025	<0.025
MeFOSAA	07/30/2021	µg/L	<0.010	<0.010	<0.010
EtFOSAA	07/30/2021	µg/L	<0.010	<0.010	<0.010
N-MeFOSE	07/30/2021	µg/L	<0.030	<0.030	<0.030
N-EtFOSE	07/30/2021	µg/L	<0.030	<0.030	<0.030
HFPO-DA	07/30/2021	µg/L	<0.20	<0.20	<0.20
ADONA	07/30/2021	µg/L	<0.010	<0.010	<0.010
9Cl-PF3ONS	07/30/2021	µg/L	<0.020	<0.020	<0.020
11Cl-PF3OUdS	07/30/2021	µg/L	<0.020	<0.020	<0.020

Analysis of Source Water for Radioactivity

Radioactivity	Units	Date Sampled	MAC[1]	Capilano	Seymour	Coquitlam
				Activity	Activity	Activity
Cesium-134	Bq/L	09/22/21	7	<0.33	<0.37	<0.42
Cesium-137	Bq/L	09/22/21	10	<0.37	<0.35	<0.34
Cobalt-60	Bq/L	09/22/21	2	<0.36	<0.45	<0.45
Gross Alpha	Bq/L	09/22/21	<0.5	<0.05	<0.045	<0.056
Gross Beta	Bq/L	09/22/21	<1.0	<0.097	<0.097	<0.093
Iodine-131	Bq/L	09/22/21	6	<1	<1.1	<0.97
Lead-210	Bq/L	09/22/21	0.2	<0.019	<0.019	<0.02
Radium 226	Bq/L	09/22/21	0.5	<0.0061	<0.0081	<0.0066
Radon-222	Bq/L	11/22/21	None	<4	<3.9	<3.9
Strontium-90	Bq/L	09/22/21	5	<0.0095	<0.01	<0.011
Tritium	Bq/L	09/22/21	7000	<12	<12	<12
Cesium-134	Bq/L	09/22/21	7	<0.33	<0.37	<0.42

APPENDIX C — ANALYSIS OF SOURCE WATERS FOR THE RESERVOIR MONITORING PROGRAM

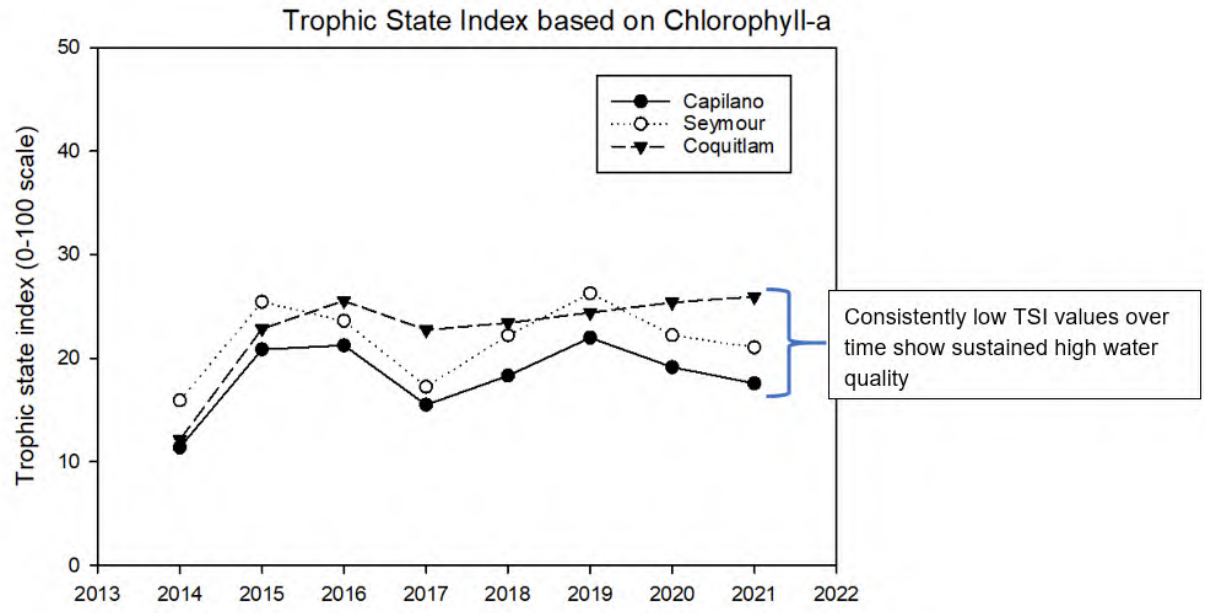
Comparison of Water Quality in GVWD Water Supply Sources to Standard Water Quality Classifications

Chemical measurement[2]	Average value[3]					Status of Reservoirs
	Ultra-oligotrophic status defined in the scientific literature[1]	Oligotrophic status defined in the scientific literature[1]	Capilano Reservoir 2014 – 2021 (2021 only in brackets)	Seymour Reservoir 2014 – 2021 (2021 only in brackets)	Coquitlam Reservoir 2014 – 2021 (2021 only in brackets)	
Total phosphorus (parts per billion)	5	8.0	3.0 (4.0)	3.0 (4.0)	3.0 (4.0)	Ultraoligotrophic (very high water quality)
Total Nitrogen (parts per billion)	250	661	125 (117)	124 (96)	129 (131)	Ultraoligotrophic (very high water quality)
Phytoplankton biomass (parts per billion of chlorophyll-a)	0.5	1.7	0.41 (0.36)	0.55 (0.46)	0.54 (0.68)	Ultraoligotrophic (very high water quality)

[1]e.g. Wetzel, R.G. 2001 River Ecosystems. 3rd edition. Academic Press. New York.
Ultraoligotrophic means very low nutrient content and very low biological production: very high water quality
Oligotrophic means low nutrient content and low biological production (low risk of algal blooms): high water quality
[2]Chemical measurements are defined as follows:

- Phosphorus and nitrogen are nutrients that primarily control the growth of algae, including cyanobacteria.
- Phytoplankton biomass includes cells of all algae and cyanobacteria species in a reservoir.

[3]Values are averages from all water depths during April through November of all years. Values in brackets are average values only from 2021.



APPENDIX D — REPORT TO METRO VANCOUVER ON *CRYPTOSPORIDIUM* AND *GIARDIA* STUDY

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Metro Vancouver
Detection of Waterborne *Cryptosporidium* and *Giardia*

January - December, 2021
Annual Report

January 2022

Dr. Natalie Prystajecky, Program Head
Christine Tchao, Team Lead
Tracy Chan, Technical Coordinator
Daisy Yu, Technical Coordinator

Environmental Microbiology
BCCDC Public Health Laboratory
Provincial Health Services Authority

Metro Vancouver
Detection of Waterborne *Cryptosporidium and Giardia*
January - December, 2021 Annual Report

Purpose

To detect and quantify *Cryptosporidium* oocysts and *Giardia* cysts from Metro Vancouver reservoirs, Capilano and Coquitlam, as well as from the Recycled Clarified Water (RCW) from Seymour-Capilano Filtration Plant (SCFP).

Introduction

Cryptosporidium and *Giardia* species are parasites that infect the intestinal tracts of a wide range of warm-blooded animals. In humans, infection with *Cryptosporidium* species or *Giardia lamblia* can cause gastroenteritis. Since *Cryptosporidium* oocysts and *Giardia* cysts are resistant to chlorination, they are of great concern for drinking water purveyors (1-3). On behalf of Metro Vancouver, the Environmental Microbiology Laboratory at BCCDC Public Health Laboratory (BCCDC PHL) examined the source water of Capilano and Coquitlam reservoirs, as well as Recycled Clarified Water (RCW) at the Seymour-Capilano Filtration Plant (SCFP) for the presence of *Cryptosporidium* oocysts and *Giardia* cysts. All sample collection, testing, analysis and reporting occurred on a monthly basis using a validated method.

Methods

The Environmental Microbiology Laboratory at BCCDC PHL follows the United States Environmental Protection Agency (USEPA) Method 1623.1: *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA (4) for the detection of oocysts and cysts in water. As stated by Method 1623.1, the performance is based on the method applicable for the quantification of *Cryptosporidium* and *Giardia* in aqueous matrices. It requires the filtration of a large volume of water and immunomagnetic separation (IMS) to concentrate and purify the oocysts and cysts from sample material captured. After the IMS purification, immunofluorescence microscopy was performed to identify and enumerate oocysts and cysts. 4'-6-diamidino-2-phenylindole staining (DAPI) and differential interference contrast microscopy (DIC) are used to confirm internal structures of the cysts and oocysts.

Raw water samples were collected by the Metro Vancouver staff at specific sampling sites at the reservoirs and filtration plants on the scheduled date each month. A desired volume of samples were filtered in the field using Pall Life Science Envirochek HV filters. After collection and filtration, the Envirochek HV filters were transported to the Environmental Microbiology Laboratory at BCCDC PHL, where they were processed and analysed within 96 hours. Positive and negative controls were included for the entire process to assess the performance of the method. Matrix spike testing was also performed at scheduled collection periods, annually for baseline assessment.

Results & Discussions

In 2021, 36 sample filters (excluding matrix spikes) were examined in total. These include:

- 12 Envirochek HV filters from Capilano reservoir
- 12 Envirochek HV filters from Coquitlam reservoir
- 12 Envirochek HV filters from SCFP-RCW

Table 1 and Figures 1-3 show the summary of all results. Detailed results per collection site can be found in Tables A1-A3 in Appendix A.

	Capilano Reservoir		Coquitlam Reservoir		Seymour Capilano Filtration Plant – Recycled Clarified Water	
# of Filters Tested	12		12		12	
Average volume (L) Filtered per Month	50		50		770.9	
Average Detection Limit (oo)cysts per 100 L	<2.0		<2.0		0.31	
	Cryptosporidium	**Giardia**	**Cryptosporidium**	**Giardia**	**Cryptosporidium**	**Giardia**
# Positive Filters	0	3	0	3	0	0
% Positive Filters	0%	25%	0%	25%	0%	0%
Max Count (oo)cysts per 100 L	0	2	0	4	0	0

Table 1. Metro Vancouver Filter Result Summary in 2021

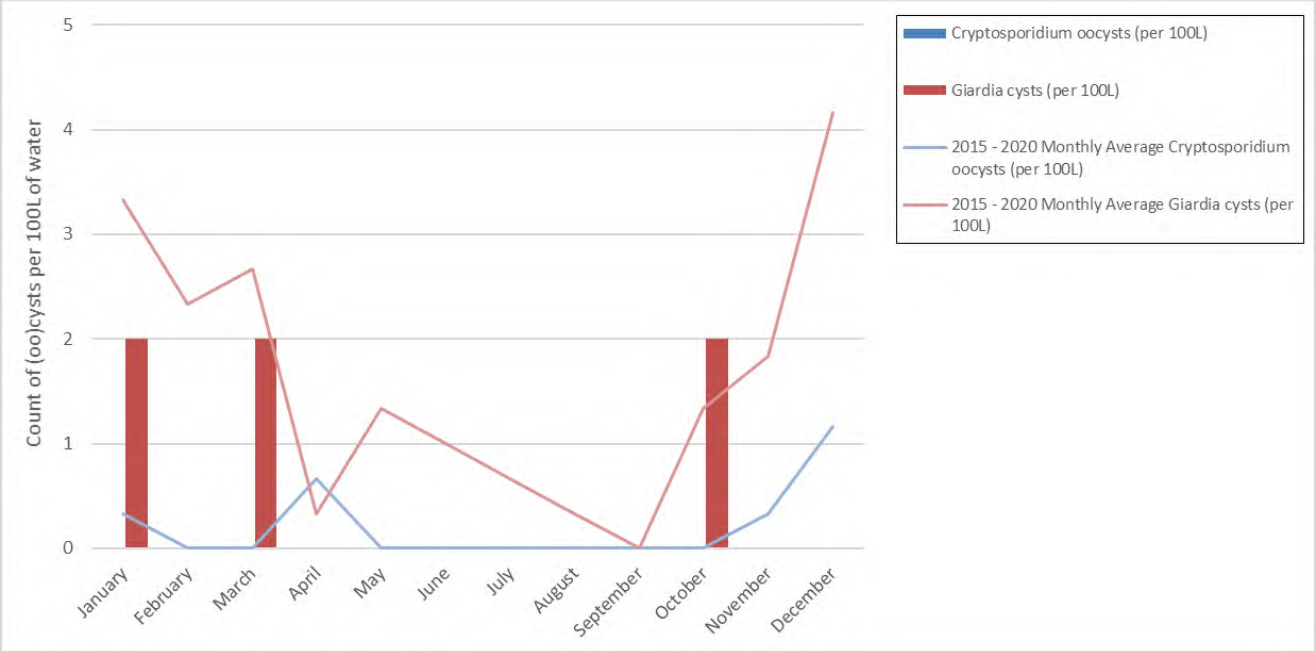

Figure 1. Capilano Reservoir *Cryptosporidium* Oocysts and *Giardia* Cysts Counts per 100 Litres of Raw Water in 2021

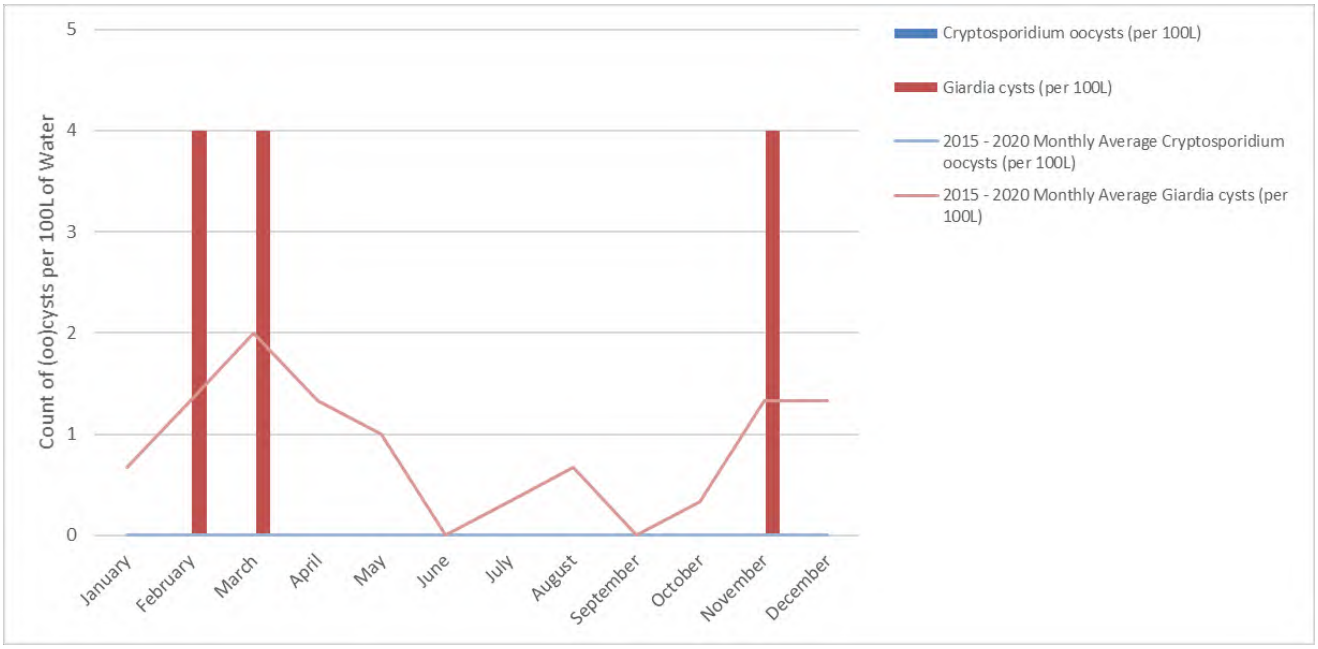

Figure 2: Coquitlam Reservoir *Cryptosporidium* Oocysts and *Giardia* Cysts Counts per 100 Litres of Raw Water in 2021

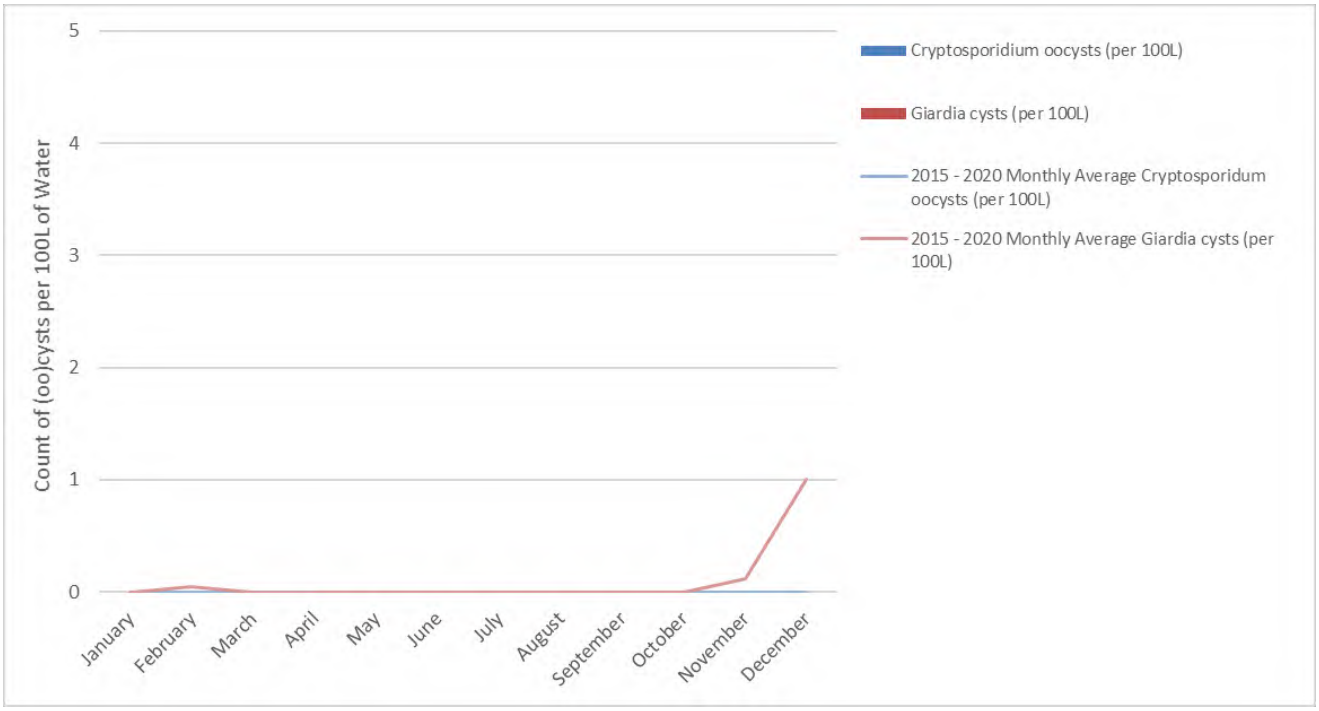

Figure 3: Seymour Capilano Filtration Plant - Recycled Clarified Water *Cryptosporidium* Oocysts and *Giardia* Cysts Counts per 100 Litres of Raw Water in 2021

Overall, similar trends were observed for both *Cryptosporidium* and *Giardia* in 2021, in comparison to historical data in 2015-2020.

DAPI staining is used as part of the confirmation of the internal structure of *Cryptosporidium* oocysts and *Giardia* cysts. DIC microscopy is used primarily for *Cryptosporidium* oocyst and *Giardia* cyst confirmation but it can also serve as an indicator of oocysts/cysts cytoplasm and cell wall integrity. While no median body (or axoneme) was observed for all *Giardia* cysts detected, the cytoplasm was observed indicating that the cysts were not empty and could be viable.

Summary of morphological results are listed in Tables 2 and 3. Detailed results for staining by IFA, DAPI and internal morphology, as determined through DIC microscopy, for every identified cyst and oocyst were recorded in Tables A4-A9 in Appendix A.

Site	Count	DAPI -	DAPI +		DIC		
		Light blue internal staining, no distinct nuclei, green rim	Intense blue internal staining	Nuclei stained sky blue	Empty oocysts	Oocysts with amorphous structure	Oocysts with internal structure, sporozoites
Capilano	0	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Coquitlam	0	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
SCFP-RCW	0	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%

Table 2. 2021 Summary of morphological results for *Cryptosporidium* oocysts observed under fluorescence microscope

Site	Count	DAPI -	DAPI +		DIC				
		Light blue internal staining, no distinct nuclei, green rim	Intense blue internal staining	Nuclei stained sky blue	Empty cysts	Cysts with amorphous structure	Cysts with internal structure		
							Nuclei	Median Body	Axoneme
Capilano	3	1 33.3%	0 0.0%	2 66.7%	0 0.0%	3 100.0%	0 0.0%	0 0.0%	0 0.0%
Coquitlam	6	6 100.0%	0 0.0%	0 0.0%	0 0.0%	6 100.0%	0 0.0%	0 0.0%	0 0.0%
SCFP-RCW	0	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%

Table 3: 2021 Summary of morphological results for *Giardia* cysts observed under fluorescence microscope

DAPI staining is used as an indicator of nuclei integrity by staining the DNA. It can also approximate oocysts/cysts integrity; the absence of nuclei is indicative of an aged, damaged or non-infective cell. A number of oocysts and cysts observed across all sites had no visible nuclei indicating that they were aged and likely subjected to environmental degradation (Table 4). However, they were likely in previous infective state.

Number of Nuclei per (oo)cyst	0*	1	2	3	4	Total # of (oo)cysts
Cryptosporidium oocysts						
Capilano	0	0	0	0	0	**0**
Coquitlam	0	0	0	0	0	**0**
SCFP-RCW	0	0	0	0	0	**0**
Giardia cysts						
Capilano	1	0	1	0	1	**3**
Coquitlam	6	0	0	0	0	**6**
SCFP-RCW	0	0	0	0	0	**0**

Table 4: 2021 Number of nuclei in each *Cryptosporidium* oocysts and *Giardia* cysts. *DAPI negative or only intense blue internal staining.

Due to the variations of water chemistry and organic matters between geographical area and temporally within each sampling sites, a matrix spike is performed annually to provide recovery rate estimation from each site. The results of the matrix spike recovery (2007-2021) are compiled in Table 5. Matrix recovery rates fluctuate from year-to-year, even within each site. This variation is not uncommon for the test and has been noted in USEPA's Method 1623.1.

Matrix testing in 2021 was completed in both summer and winter on two separate sampling events at each site. 50L were filtered from each site and the percentage recovery for *Cryptosporidium* oocysts and *Giardia* cysts and were noted in Table 5.

Year	Capilano		Coquitlam		SCFP - Recycled Clarified Water	
	Cryptosporidium % Recovery	Giardia % Recovery	Cryptosporidium % Recovery	Giardia % Recovery	Cryptosporidium % Recovery	Giardia % Recovery
2007	27.6%	37.4%	28.0%	54.0%	Not collected	Not collected
2008	25.0%	55.0%	28.0%	39.0%	Not collected	Not collected
2009	10.0%	40.0%	16.0%	37.0%	Not collected	Not collected
2010	28.0%	43.0%	26.0%	49.0%	17.0%	13.0%
2011	27.0%	44.0%	22.0%	47.0%	1.0%	0.0%
2012	38.4%	76.5%	35.0%	49.0%	7.0%	13.7%
2013	22.4%	59.4%	16.3%	64.4%	6.1%	14.9%
2014	Not collected	Not collected	55.0%	39.4%	18.0%	14.1%
2015	26.3%	40.4%	2.0%	60.6%	9.1%	26.5%
2016	35.4%	47.5%	22.2%	50.5%	9.1%	14.0%
2017	20.2%	38.4%	22.2%	21.2%	0.0%	2.0%
2018	43.4%	75.8%	17.1%	59.6%	1.0%	11.1%
2019	0.0%	43.0%	1.0%	55.0%	0.0%	4.1%
2020	5.1%	37.4%	8.1%	59.8%	0.0%	4.0%
2021 Summer	2.0%	53.0%	0.0%	35.0%	5.1%	38.0%
2021 Winter	11.1%	52.0%	15.2%	80.0%	0.0%	8.0%

Table 5: Matrix Results from 2007 - 2021

Summary

In brief, we reported:

1. Overall, a steady positivity rate was observed across all sites for both *Cryptosporidium* oocysts and *Giardia* cysts.

2. *Cryptosporidium* oocysts were not detected in Capilano reservoir, Coquitlam reservoir and SCFP-RCW.

3. *Giardia* cysts were detected in filters from Capilano and Coquitlam but not from SCFP-RCW. 25% of all filters received from Capilano were positive for *Giardia*, and 25% of all filters received from Coquitlam were positive for *Giardia*, and there were no *Giardia* cysts detected for SCFP-RCW.

4. The highest concentration of *Giardia* cysts detected in 2021 was from Coquitlam reservoir in February, March, and November (4 cysts per 100 L).

5. Most of the *Giardia* cysts detected showed evidence of environmental degradation.

6. Matrix recovery for *Cryptosporidium* oocyst continued to be low, which is consistent with previous years. The additional matrix collection in the summer did not confirm suspected seasonality variabilities for this year. Further summer matrix collections are recommended to continue this investigation.

These *semi-quantitative* data (reported oocyst and cyst levels) should be interpreted in the context of, and with the understanding that the current standard laboratory method, USEPA Method 1623.1, used for detecting and analysing parasites in water matrices has its limitations, with variable recovery rates depending on the water matrix and environmental conditions.

Acknowledgements

The BCCDC Public Health Laboratory thanks Metro Vancouver for their ongoing support of this program and other related projects. In particular, the assistance of Larry Chow, Vila Goh, Eileen Butler, and Melody Sato of the Metro Vancouver, Water Quality Department are greatly appreciated.

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Appendix A

Lab #	Site Sampled	Month	Date Sampled	Volume filtered (L)	Detection Limit (per 100L)	Cryptosporidum oocysts (per 100L)	Giardia cysts (per 100L)	2015 - 2020 Monthly Average	
								Cryptosporidum oocysts (per 100L)	Giardia cysts (per 100L)
8150	Capilano Reservoir	January	January 17, 2021	50	<2.0	0	2	0.3	3.3
8155	Capilano Reservoir	February	February 21, 2021	50	<2.0	0	0	0.0	2.3
8160	Capilano Reservoir	March	March 14, 2021	50	<2.0	0	2	0.0	2.7
8165	Capilano Reservoir	April	April 18, 2021	50	<2.0	0	0	0.7	0.3
8173	Capilano Reservoir	May	May 16, 2021	50	<2.0	0	0	0.0	1.3
8178	Capilano Reservoir	June	June 20, 2021	50	<2.0	0	0	0.0	1.0
8185	Capilano Reservoir	July	July 18, 2021	50	<2.0	0	0	0.0	0.7
8191	Capilano Reservoir	August	August 15, 2021	50	<2.0	0	0	0.0	0.3
8196	Capilano Reservoir	September	September 19, 2021	50	<2.0	0	0	0.0	0.0
8201	Capilano Reservoir	October	October 3, 2021	50	<2.0	0	2	0.0	1.3
8211	Capilano Reservoir	November	November 14, 2021	50	<2.0	0	0	0.3	1.8
8218	Capilano Reservoir	December	December 12, 2021	50	<2.0	0	0	1.2	4.2
			2021 Average	50	<2.0	0	0.5		

Table A1. Capilano Reservoir Monthly Filter Results in 2021

Lab #	Site Sampled	Month	Date Sampled	Volume filtered (L)	Detection Limit (per 100L)	Cryptosporidum oocysts (per 100L)	Giardia cysts (per 100L)	2015 - 2020 Monthly Average	
								Cryptosporidum oocysts (per 100L)	Giardia cysts (per 100L)
8151	Coquitlam Reservoir	January	January 17, 2021	50	<2.0	0	0	0.0	0.7
8156	Coquitlam Reservoir	February	February 21, 2021	50	<2.0	0	4	0.0	1.3
8161	Coquitlam Reservoir	March	March 14, 2021	50	<2.0	0	4	0.0	2.0
8166	Coquitlam Reservoir	April	April 18, 2021	50	<2.0	0	0	0.0	1.3
8174	Coquitlam Reservoir	May	May 16, 2021	50	<2.0	0	0	0.0	1.0
8179	Coquitlam Reservoir	June	June 20, 2021	50	<2.0	0	0	0.0	0.0
8186	Coquitlam Reservoir	July	July 18, 2021	50	<2.0	0	0	0.0	0.3
8192	Coquitlam Reservoir	August	August 15, 2021	50	<2.0	0	0	0.0	0.7
8197	Coquitlam Reservoir	September	September 19, 2021	50	<2.0	0	0	0.0	0.0
8202	Coquitlam Reservoir	October	October 3, 2021	50	<2.0	0	0	0.0	0.3
8212	Coquitlam Reservoir	November	November 14, 2021	50	<2.0	0	4	0.0	1.3
8219	Coquitlam Reservoir	December	December 12, 2021	50	<2.0	0	0	0.0	1.3
			2021 Average	50	<2.0	0	1		

Table A2. Coquitlam Reservoir Monthly Filter Results in 2021

Lab #	Site Sampled	Month	Date Sampled	Volume filtered (L)	Detection Limit (per 100L)	Cryptosporidum oocysts (per 100L)	Giardia cysts (per 100L)	2015 - 2020 Monthly Average	
								Cryptosporidum oocysts (per 100L)	Giardia cysts (per 100L)
8152	SCFP - Recycled Clarified Water	January	January 19, 2021	3793.2	<0.03	0	0	0.0	0.0
8157	SCFP - Recycled Clarified Water	February	February 23, 2021	254.5	<0.39	0	0	0.0	0.1
8162	SCFP - Recycled Clarified Water	March	March 16, 2021	426	<0.23	0	0	0.0	0.0
8167	SCFP - Recycled Clarified Water	April	April 20, 2021	244.9	<0.41	0	0	0.0	0.0
8175	SCFP - Recycled Clarified Water	May	May 18, 2021	201.3	<0.497	0	0	0.0	0.0
8180	SCFP - Recycled Clarified Water	June	June 22, 2021	252.7	<0.396	0	0	0.0	0.0
8187	SCFP - Recycled Clarified Water	July	July 20, 2021	297.3	<0.336	0	0	0.0	0.0
8193	SCFP - Recycled Clarified Water	August	August 17, 2021	1716.8	<0.058	0	0	0.0	0.0
8198	SCFP - Recycled Clarified Water	September	September 21, 2021	296.5	<0.337	0	0	0.0	0.0
8203	SCFP - Recycled Clarified Water	October	October 5, 2021	1318	<0.076	0	0	0.0	0.0
8213	SCFP - Recycled Clarified Water	November	November 16, 2021	187	<0.53	0	0	0.0	0.1
8220	SCFP - Recycled Clarified Water	December	December 14, 2021	263	<0.380	0	0	0.0	1.0
			2021 Average	770.9	0.31	0	0		

Table A3. Seymour Capilano Filtration Plant - Recycled Clarified Water (SCFP-RCW) Monthly Filter Results in 2021

			Giardia										
			Giardia			DAPI -	DAPI +		DIC				
Lab #	Site name	Date sampled	Object located by FA	Shape (oval or round)	Size L x W (µm)	Light blue internal staining, no distinct nuclei, green rim	Intense blue internal staining	Number of nuclei stained sky blue	Empty cysts	Cysts with amorphous structure	Number of nuclei	Median Body	Axoneme
8150	Capilano Reservoir	January 17, 2021	1	Oval	12x9			4		P			
8155	Capilano Reservoir	February 21, 2021	0										
8160	Capilano Reservoir	March 14, 2021	1	Oval	13x9	P				P			
8165	Capilano Reservoir	April 18, 2021	0										
8173	Capilano Reservoir	May 16, 2021	0										
8178	Capilano Reservoir	June 20, 2021	0										
8185	Capilano Reservoir	July 18, 2021	0										
8191	Capilano Reservoir	August 15, 2021	0										
8196	Capilano Reservoir	September 19, 2021	0										
8201	Capilano Reservoir	October 3, 2021	#1	Oval	12x5			2		P			
8211	Capilano Reservoir	November 14, 2021	0										
8218	Capilano Reservoir	December 12, 2021	0										

Table A4. Capilano Reservoir Slide Examination Results - *Giardia* 2021 (P = present)

			Giardia										
			Giardia			DAPI -	DAPI +		DIC				
Lab #	Site name	Date sampled	Object located by FA	Shape (oval or round)	Size L x W (µm)	Light blue internal staining, no distinct nuclei, green rim	Intense blue internal staining	Number of nuclei stained sky blue	Empty cysts	Cysts with amorphous structure	Number of nuclei	Median Body	Axoneme
8151	Coquitlam Reservoir	January 17, 2021	0										
8156	Coquitlam Reservoir	February 21, 2021	1	Oval	13x9	P				P			
8156	Coquitlam Reservoir	February 21, 2021	2	Oval	15x10	P				P			
8161	Coquitlam Reservoir	March 14, 2021	1	Oval	13X7	P				P			
8161	Coquitlam Reservoir	March 14, 2021	2	Oval	10X5	P				P			
8166	Coquitlam Reservoir	April 18, 2021	0										
8174	Coquitlam Reservoir	May 16, 2021	0										
8179	Coquitlam Reservoir	June 20, 2021	0										
8186	Coquitlam Reservoir	July 18, 2021	0										
8192	Coquitlam Reservoir	August 15, 2021	0										
8197	Coquitlam Reservoir	September 19, 2021	0										
8202	Coquitlam Reservoir	October 3, 2021	0										
8212	Coquitlam Reservoir	November 14, 2021	#1	Oval	15x9	P				P			
8212	Coquitlam Reservoir	November 14, 2021	#2	Oval	10x7	P				P			
8219	Coquitlam Reservoir	December 12, 2021	0										

Table A5. Coquitlam Reservoir Slide Examination Results - *Giardia* 2021 (P = present)

			Giardia										
			Giardia			DAPI -	DAPI +		DIC				
Lab #	Site name	Date sampled	Object located by FA	Shape (oval or round)	Size L x W (µm)	Light blue internal staining, no distinct nuclei, green rim	Intense blue internal staining	Number of nuclei stained sky blue	Empty cysts	Cysts with amorphous structure	Number of nuclei	Median Body	Axoneme
8152	SCFP - Recycled Clarified Water	January 19, 2021	0										
8162	SCFP - Recycled Clarified Water	March 16, 2021	0										
8167	SCFP - Recycled Clarified Water	April 20, 2021	0										
8175	SCFP - Recycled Clarified Water	May 18, 2021	0										
8180	SCFP - Recycled Clarified Water	June 22, 2021	0										
8187	SCFP - Recycled Clarified Water	July 20, 2021	0										
8193	SCFP - Recycled Clarified Water	August 17, 2021	0										
8198	SCFP - Recycled Clarified Water	September 21, 2021	0										
8203	SCFP - Recycled Clarified Water	October 5, 2021	0										
8213	SCFP - Recycled Clarified Water	November 16, 2021	0										
8220	SCFP - Recycled Clarified Water	December 14, 2021	0										

Table A6. Seymour Capilano Filtration Plant – Recycled Clarified Water Slide Examination Results - *Giardia* 2021

			Cryptosporidium								
			Cryptosporidium			DAPI -	DAPI +		DIC		
Lab #	Site name	Date sampled	Object located by FA	Shape (oval or round)	Size L x W (µm)	Light blue internal staining, no distinct nuclei, green rim	Intense blue internal staining	Number of nuclei stained sky blue	Empty oocysts	Oocysts with amorphous structure	Oocysts with internal structure, Number of sporozoites
8150	Capilano Reservoir	January 17, 2021	0								
8155	Capilano Reservoir	February 21, 2021	0								
8160	Capilano Reservoir	March 14, 2021	0								
8165	Capilano Reservoir	April 18, 2021	0								
8173	Capilano Reservoir	May 16, 2021	0								
8178	Capilano Reservoir	June 20, 2021	0								
8185	Capilano Reservoir	July 18, 2021	0								
8191	Capilano Reservoir	August 15, 2021	0								
8196	Capilano Reservoir	September 19, 2021	0								
8201	Capilano Reservoir	October 3, 2021	0								
8211	Capilano Reservoir	November 14, 2021	0								
8218	Capilano Reservoir	December 12, 2021	0								

Table A7. Capilano Reservoir Slide Examination Results - *Cryptosporidium* 2021

			Cryptosporidium			DAPI -	DAPI +		DIC		
Lab #	Site name	Date sampled	Object located by FA	Shape (oval or round)	Size L x W (µm)	Light blue internal staining, no distinct nuclei, green rim	Intense blue internal staining	Number of nuclei stained sky blue	Empty oocysts	Oocysts with amorphous structure	Oocysts with internal structure, Number of sporozoites
8151	Coquitlam Reservoir	January 17, 2021	0								
8156	Coquitlam Reservoir	February 21, 2021	0								
8161	Coquitlam Reservoir	March 14, 2021	0								
8166	Coquitlam Reservoir	April 18, 2021	0								
8174	Coquitlam Reservoir	May 16, 2021	0								
8179	Coquitlam Reservoir	June 20, 2021	0								
8186	Coquitlam Reservoir	July 18, 2021	0								
8192	Coquitlam Reservoir	August 15, 2021	0								
8197	Coquitlam Reservoir	September 19, 2021	0								
8202	Coquitlam Reservoir	October 3, 2021	0								
8212	Coquitlam Reservoir	November 14, 2021	0								
8219	Coquitlam Reservoir	December 12, 2021	0								

Table A8. Coquitlam Reservoir Slide Examination Results - *Cryptosporidium* 2021

			Cryptosporidium								
			Cryptosporidium			DAPI -	DAPI +		DIC		
Lab #	Site name	Date sampled	Object located by FA	Shape (oval or round)	Size L x W (µm)	Light blue internal staining, no distinct nuclei, green rim	Intense blue internal staining	Number of nuclei stained sky blue	Empty oocysts	Oocysts with amorphous structure	Oocysts with internal structure, Number of sporozoites
8152	SCFP - Recycled Clarified Water	January 19, 2021	0								
8157	SCFP - Recycled Clarified Water	February 23, 2021	0								
8162	SCFP - Recycled Clarified Water	March 16, 2021	0								
8167	SCFP - Recycled Clarified Water	April 20, 2021	0								
8175	SCFP - Recycled Clarified Water	May 18, 2021	0								
8180	SCFP - Recycled Clarified Water	June 22, 2021	0								
8187	SCFP - Recycled Clarified Water	July 20, 2021	0								
8193	SCFP - Recycled Clarified Water	August 17, 2021	0								
8198	SCFP - Recycled Clarified Water	September 21, 2021	0								
8203	SCFP - Recycled Clarified Water	October 5, 2021	0								
8213	SCFP - Recycled Clarified Water	November 16, 2021	0								
8220	SCFP - Recycled Clarified Water	December 14, 2021	0								

Table A9. Seymour Capilano Filtration Plant – Recycled Clarified Water Slide Examination Results - *Cryptosporidium* 2021

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

Additionally, the annual report will be made accessible to the public through public libraries in the region, including Metro Vancouver's Library and Information Centre, and will be posted on Metro Vancouver's website.

This report is being brought forward at this time to enable Metro Vancouver, and its member jurisdictions, to meet the reporting timeline stipulated in the DWPR.

WATER QUALITY/TREATMENT HIGHLIGHTS

A summary of the main items relevant to water quality during 2021 are as follows:

1. Source Water Quality

- In 2021, the turbidity levels of the delivered water met the requirements of the GCDWQ.
- The Capilano reservoir was in service for the entire year. Heavy rainfall events late in the year resulted in Capilano source water turbidity peaking just over 21 Nephelometric Turbidity Units (NTU). Even with the higher turbidity, the delivered filtered Capilano water was less than 0.30 NTU stipulated in the GCDWQ for the entire year.
- The Seymour reservoir was in service for the entire year. Heavy rainfall events late in the year resulted in the Seymour source water turbidity peaking at 11 NTU. The delivered filtered Seymour water was less than 0.30 NTU stipulated in the GCDWQ for the entire year.
- The Coquitlam reservoir was in service for the entire year. The turbidity of the unfiltered Coquitlam source water was greater than 1 NTU for 22 days and did not exceed 5 NTU throughout the year in accordance with GVWD's Permit to Operate.
- The microbiological quality of the three source reservoirs was excellent in 2021. All three sources met the bacteriological requirements stipulated in the GCDWQ.
- Results of the analyses of the source water for herbicides, pesticides, volatile organic compounds and radionuclides were all found to be below the recommended limits for these substances as stipulated in the GCDWQ.
- Reservoir limnology sampling occurred from June through November 2021 and confirmed little to no change in biological productivity levels and chemical parameters from previous years. All three reservoirs remain in an ultra-oligotrophic state and are providing excellent quality source water.

2. Water Treatment

- The Seymour Capilano Twin Tunnels enabled the Capilano source water to be treated at the Seymour Capilano Filtration Plant (SCFP) and subsequently returned to the Capilano transmission system throughout the entire year.
- The SCFP provided continuous filtration performance, producing excellent delivered water quality in 2021, specifically:
    - The daily average turbidity of the water leaving the clearwells and entering the GVWD transmission system was less than 0.30 NTU;
    - Turbidity levels for individual filters met the turbidity requirements of the GCDWQ;
    - Filtration consistently removed iron, colour and organics from Capilano and Seymour source waters;

  - Levels of total aluminum in filtered water were consistently below the GCDWQ operational guideline value of 0.2 mg/L for direct filtration plants using aluminum-based coagulants. The maximum value was 0.03 mg/L;
  - pH and alkalinity levels were 8.2 and 17 mg/L as $CaCO_3$, respectively, and met the GCDWQ; and
  - The targeted level of chlorine disinfection was 0.80 mg/L.
- The Coquitlam Water Treatment Plant (CWTP) uses ultraviolet light treatment as the primary disinfectant, along with ozone pre-treatment and chlorine disinfection for water originating from the unfiltered Coquitlam source. Plant performance was excellent, specifically:
  - Ultraviolet light treatment consistently and effectively inactivated pathogens at a very high percentage (99.8%);
  - The average turbidity of the water leaving the plant and entering the GVWD transmission system was on average 0.30 NTU;
  - pH and alkalinity levels were 8.1 and 17 mg/L as $CaCO_3$, respectively, and met the GCDWQ; and
  - The targeted level of chlorine disinfection ranged from 1.3 to 1.5 mg/L.
- The eight secondary disinfection stations within the transmission system boosted chlorine levels where necessary and as required. All stations use sodium hypochlorite as a disinfectant and the targeted level of chlorine disinfection ranged from 0.80 to 1.5 mg/L.

3. Transmission and Distribution System Water Quality

- Bacteriological water quality in the GVWD transmission mains and in-system storage reservoirs was excellent in 2021. Of the approximately 6,600 regional samples collected for testing in 2021, none were positive for *E. coli*.
- Bacteriological water quality in the distribution systems of the member jurisdictions was excellent in 2021. Of the approximately 20,800 member jurisdiction samples collected for testing in 2021, a high percentage (99.8%) were free of total coliforms, and one sample tested positive for *E. coli*.
- The running average levels of the trihalomethane group of chlorine disinfection by-products detected in the delivered water in the GVWD and local jurisdiction systems were below the Maximum Acceptable Concentration (MAC) specified in the GCDWQ. The running average levels for the haloacetic acid group of chlorine disinfection by-products in the GVWD system were also below the MAC.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

Water quality analyses included in the annual report is incorporated within the annual operating budget of the Interagency Projects and Quality Control Division's Drinking Water Quality Control Program.

CONCLUSION

As outlined by the GVWD 2021 Water Quality Annual Report, Metro Vancouver's water quality monitoring program continues to fulfill its role in confirming that the multiple protection barriers for

drinking water, including watershed protection, water treatment and the ongoing operation of the water system, are effective at ensuring excellent water quality for the region. This monitoring is essential in assessing performance of treatment technologies to ensure compliance with current standards and potential treatment upgrade requirements for the future.

The drinking water provided by the GVWD to its member jurisdictions met or exceeded all applicable water quality regulations, operating permits, and guidelines in 2021.

Attachment
"Greater Vancouver Regional District 2021 Water Quality Annual Report, Volume 1", dated March, 2022 *(50038933)*

48984498

To: Water Committee

From: Lucas Pitts, Director, Policy, Planning and Analysis, Water Services

Date: March 28, 2022 Meeting Date: April 6, 2022

Subject: **GVWD Water Supply System 2021 Annual Update**

RECOMMENDATION

That the Water Committee receive for information the report dated March 28, 2022, titled "GVWD Water Supply System 2021 Annual Update".

EXECUTIVE SUMMARY

The *Greater Vancouver Water District - Water Supply System 2021 Annual Update* report summarizes key initiatives undertaken by Metro Vancouver in 2021, including water conservation, risk management, capital projects to accommodate regional growth, and responding to emergencies affecting the drinking water system. The 2021 update is the first edition of this annual report, which will be issued annually hereafter.

This report was prepared following guidance from the Ministry of Health (the Ministry) found in their draft Guidance for Water User Communication, which was shared with the Greater Vancouver Water District (GVWD) in October of 2021 for review and comment. The report meets the communication requirements stipulated in the *Drinking Water Protection Act* and *Regulation*.

PURPOSE

To provide the Water Committee with an overview of the *GVWD Water Supply System 2021 Annual Update*.

BACKGROUND

As a Water Supplier regulated under BC's *Drinking Water Protect Act* and *Drinking Water Protection Regulation*, the GVWD must communicate with water users on various topics defined in the legislation. To create a standardized document for meeting the legislated communication requirements, the Ministry of Health is developing the *Guidance for Water User Communications,* which is currently in draft format. Through the *GVWD Water Supply System 2021 Annual Update*, the GVWD seeks to build public awareness and involvement in the drinking water program, identified as one of the six components of the *Multi-Barrier Approach to Safe Drinking Water* by Health Canada.

The guidance document was provided to the GVWD for review and comment in October of 2021. To remain at the forefront of regulatory requirements and best practices and to stay aligned with the Ministry's initiatives, the GVWD has endeavoured to undertake the *GVWD Water Supply System 2021 Annual Update* report as recommended by the Ministry. Given that the guidance is still in draft, there may be changes to this report in the subsequent year's editions. This report is being brought forward at this time to align with the publication of *GVWD Water Supply System 2021 Annual Update* report, which the Ministry similarly requires.

GVWD Water Supply System 2021 Annual Update Report Summary

The *GVWD Water Supply System 2021 Annual Update* report summarizes initiatives undertaken by the GVWD in 2021. The report provides a general overview of the GVWD's drinking water system, including a description of the three sources, two treatment plants, and an overview of the regional transmission system to provide context to the work that GVWD undertook in 2021.

The key initiatives that are reported are summarized as follows:

- The analysis of over 38,000 water samples by the drinking water quality program. The results of which can be found in the 2021 Annual Water Quality Control Report;
- Mitigating risk for the drinking water system including long-term water supply infrastructure planning through the consideration of filtration pre-treatment, intake location and treatment designs for the Coquitlam Water Supply, and the Regional Water Supply System Lifeline Study: Seismic Vulnerability Assessment;
- Tracking, monitoring and analysis of drinking water demand. The highest peak day consumption in the summer of 2021 was 1.8 billion litres/day, which was recorded on Sunday, June 27, 2021;
- Undertaking the *We Love Water* campaign, promoted to increase awareness of the GVWD's drinking water system and the need for residential water conservation;
- Finalizing the Quality Management System for Drinking Water Operational Plan (QMSDW), which forms the foundation for specific prioritized actions to safeguard drinking water and to aid in the strategic decision-making, planning, and resource allocation, while focusing on continuous improvement;
- The continued system maintenance on the Little Mountain Reservoir was completed this year as well as the protective coating of equipment at the Capilano Energy Recovery Facility; and
- The spending for capital projects focused on growth, resilience, maintenance and opportunity upgrades.

Additionally, a summary of the Emergency Response and Contingency Plan is provided per Section 13 (4) of the *Drinking Water Protection Regulation*.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

This is an information report. No financial implications are presented.

CONCLUSION

By completing the *GVWD Water Supply System 2021 Annual Update* report, GVWD aligns with the Ministry of Health's direction and new initiatives. The report provides transparent and proactive communication with water users and promotes public involvement and awareness of the drinking water system, one of the six elements of Health Canada's *Multi-Barrier Approach to Safe Drinking Water*.

Attachment

GVWD Water Supply System 2021 Annual Update *(49557167)*

49467620

metrovancouver


Capilano Reservoir

Great Vancouver Water District – Water Supply System 2021 Annual Update

March 2022

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EXECUTIVE SUMMARY

The *Greater Vancouver Water District Water Supply System 2021 Annual Update* report summarizes key initiatives undertaken by Metro Vancouver in 2021, including water conservation, risk management, capital projects to accommodate regional growth, and responding to emergencies affecting the drinking water system. The 2021 Update is the first edition of this annual report, which will be issued annually hereafter. This report was prepared following guidance from the Ministry of Health (the Ministry) found in their draft *Guidance for Water User Communication*.

Report Background

The purpose of the report is to meet the communication requirements stipulated in the provincial *Drinking Water Protection Act* and *Drinking Water Protection Regulation*. As a Water Supplier regulated under the *Drinking Water Protect Act* and *Drinking Water Protection Regulation*, Metro Vancouver, also known as the Greater Vancouver Water District, must communicate with water users on topics defined in the legislation.

The Ministry has developed the draft *Guidance for Water User Communications* to create a standardized approach to meeting the legislated communication requirements. The Ministry provided the draft guidance document to Metro Vancouver for review and comment in October 2021. To remain at the forefront of regulatory requirements and best practices and aligned with the Ministry's initiatives, Metro Vancouver has undertaken the *Greater Vancouver Water District - Water Supply System 2021 Annual Update* in a manner consistent with the recommendations in the Ministry's draft guidance. Given that the guidance is still in draft, there may be changes to the format of this report in the future year's versions.

By completing the *Greater Vancouver Water District - Water Supply System 2021 Annual Update* report, Metro Vancouver aligns with the Ministry's direction and new initiatives. This report provides transparent and proactive communication with water users and promotes public involvement and awareness of the drinking water system, which is one of the six elements of Health Canada's *Multi-Barrier Approach to Safe Drinking Water*.

Report Summary

Metro Vancouver sources the region's drinking water from three protected watersheds, Coquitlam, Seymour and Capilano. The water is then treated at one of two water treatment plants and distributed throughout the region via 520 km of transmission mains, pump stations and reservoirs. This water is tested throughout all of the processes to guarantee high-quality drinking water is being distributed to member jurisdictions. To ensure consistent and reliable high-quality water, Metro Vancouver maintains, upgrades and builds infrastructure to meet current and future needs. This includes seismic upgrades, reservoir cleaning, and building new infrastructure to meet the growth needs of the region. Community engagement is undertaken to increase awareness about the need for residential water conservation.

Key initiatives undertaken by Metro Vancouver in 2021, included the following:

- Water Quality Sampling Program, involving:
  - The analysis of over 38,000 water samples through the drinking water quality program. The results of which can be found in the 2021 Annual Water Quality Control; and
  - The adjustment of the finished water's pH to 8.3 and alkalinity to 20 mg/L as $CaCO_3$ to reduce the corrosiveness of the water and improve the stability of the water in the distribution system.
- Water System Risk Mitigation, involving:
  - Mitigating risk for the drinking water system including long-term water supply infrastructure planning through the consideration of filtration pre-treatment, intake location and treatment designs for the Coquitlam Water Supply, and the Regional Water Supply System Lifeline Study: Seismic Vulnerability Assessment.
- Water Conservation, involving:
  - Tracking, monitoring and analysis of drinking water demand. The highest peak day consumption in the summer of 2021 was 1.80 billion litres/day, which was recorded on Sunday, June 27, 2021; and
  - Undertaking the *We Love Water* campaign, promoted to increase awareness of Metro Vancouver's drinking water system and the need for residential water conservation.
- Financial Planning, involving:
  - Total water sales of $320 million with differential water rates intended to incentivize drinking water conservation efforts and reduce long-term pressure on the capital budget.
- Water System Management involving:
  - Finalizing the Quality Management System for Drinking Water Operational Plan (QMSDW), which forms the foundation for specific prioritized actions to safeguard drinking water and to aid in the strategic decision-making, planning, and resource allocation, while focusing on continuous improvement;
  - Annual maintenance projects including the isolation, draining, and cleaning of six in-system reservoirs to maintain water quality throughout the distribution system and the completion of 3,875 preventative maintenance work orders;
  - Finalizing the Port Mann Corridor Upgrades with the commissioning of the fourth leg, the Whalley Main, connecting the Whalley Reservoir to 148th Street; and
  - Commissioning the Jericho Reservoir, the 27th in-system reservoir that will be used to continue to supply water to the Township of Langley, and the City of Surrey.
- Emergency Response, involving:
  - Responding to two natural storm events that resulted in dam discharge flows that exceeded the minimum flood levels selected for the initiation of the Seymour Falls Dam Emergency Response Plan, however there were no hazardous conditions, no persons placed in danger and no impacts to the delivery of drinking water.
  - Continuing to respond to the changing COVID-19 situation and adjusting control measures following the Guidance of the Provincial Health Officer.

ACRONYMS

BC	British Columbia
BL	Billion Litres
CWTP	Coquitlam Water Treatment Plant
DBPs	Disinfection By-Products
DCC	Development Cost Charges
DWCP	Drinking Water Conservation Plan
ERCP	Emergency Response and Contingency Plan
GVWD	Greater Vancouver Water District
ML	Million Litres
MLD	Million Litres per Day
NBCC	National Building Code of Canada
QMSDW	Quality Management System for Drinking Water Operational Plan
SCFP	Seymour Capilano Filtration Plant
SFD	Seymour Falls Dam
UV	Ultraviolet

1.0 INTRODUCTION

1.1. Purpose

As a Water Supplier regulated under BC's *Drinking Water Protect Act* and *Drinking Water Protection Regulation,* Metro Vancouver is required to communicate with water users on various topics defined in the legislation. The *Greater Vancouver Water District Water Supply System 2021 Annual Update* is recommended by the Ministry of Health to meet the *Drinking Protection Act* and *Regulation*'s public communication requirements. This report was prepared following guidance from the Ministry of Health found in their draft *Guidance for Water User Communication*.

The purpose of the *Greater Vancouver Water District - Water Supply System 2021 Annual Update* is to proactively communicate with member jurisdictions and the public by providing an annual update on the water supply system. Through the *Greater Vancouver Water District - Water Supply System 2021 Annual Update*, Metro Vancouver seeks to build public awareness and involvement in the drinking water program, which has been identified as one of the components of the *Multi-Barrier Approach to Safe Drinking Water* by Health Canada.

1.2. Greater Vancouver Water District

Under the legal entity of the *Greater Vancouver Water District* (GVWD), Metro Vancouver provides drinking water to the region. The GVWD was created and constituted under the provincial statute, the *Greater Vancouver Water District Act*, to supply drinking water to the Metro Vancouver region. The GVWD is governed by an Administration Board (the Board) consisting of representatives from the member jurisdictions of the GVWD. The Board appoints a Commissioner (the GVWD Commissioner) who provides management and oversight of the activities of the GVWD.

GVWD and its member jurisdictions work together to provide clean, safe drinking water to the region. The GVWD membership consists of 18 municipalities, one Electoral Area, and one Treaty First Nation. The GVWD working together with its members, plans for and delivers regional-scale drinking water services to approximately 2.7 million people. The following are the member jurisdictions that are supplied water from the GVWD.

Table 1: GVWD Member Jurisdictions

Village of Anmore	Electoral Area A	City of North Vancouver	City of Richmond
Village of Belcarra	City of Langley	District of North Vancouver	City of Surrey
City of Burnaby	Township of Langley	City of Pitt Meadows	Tsawwassen First Nation
City of Coquitlam	City of Maple Ridge	City of Port Coquitlam	City of Vancouver
City of Delta	City of New Westminster	City of Port Moody	District of West Vancouver

The Metro Vancouver is responsible for:

- managing and protecting the water supply areas;
- treating the water at the source and throughout the Metro Vancouver network;
- transmission of drinking water to local water distribution networks;
- monitoring, testing, and reporting on Metro Vancouver water quality; and
- planning for Metro Vancouver water system's sustainability.

Once the water leaves Metro Vancouver's transmission system and enters into the local distribution mains, the water is the responsibility of the member jurisdiction.

2.0 DRINKING WATER SYSTEM OVERVIEW

Metro Vancouver's drinking water originates from rain and snowmelt stored in three protected reservoirs: Capilano, Seymour and Coquitlam. Three alpine lakes, Loch Lomond, Burwell Lake, and Palisade Lake, provide additional water storage. To control the storage in the reservoirs, Metro Vancouver operates and maintains the Cleveland, Seymour Falls, and alpine lake dams, while the Coquitlam Dam is owned and operated by BC Hydro. Water is collected, stored and distributed to local jurisdictions through a network of dams, treatment plants, water mains, pumping stations, and in-system storage reservoirs located throughout the region. The entire water system, including the water supply areas, encompasses a total land area of 2,860 square kilometres. Figure 1 provides an overview of the Metro Vancouver water supply system.

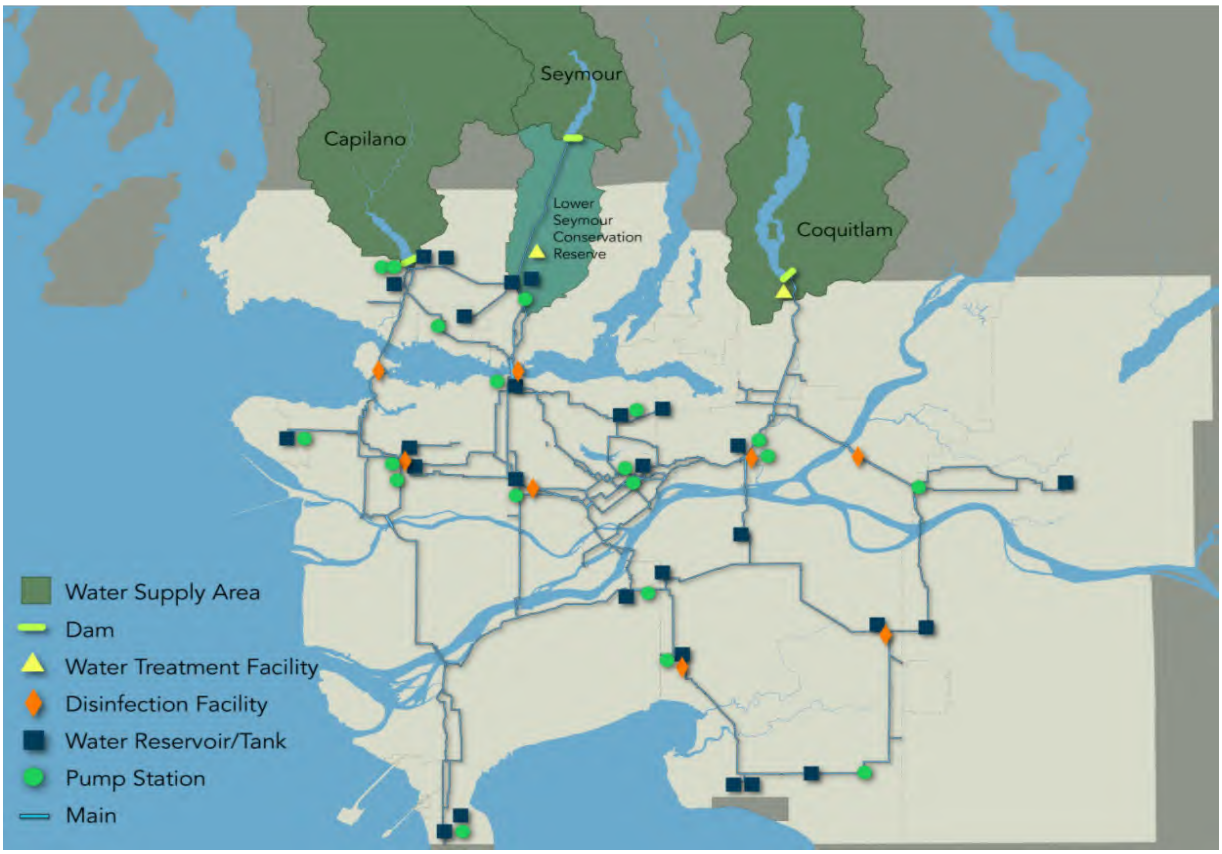

Figure 1: Metro Vancouver Drinking Water System Overview

2.1. Source Water

Metro Vancouver's water supply areas are approximately 60,000 hectares of protected lands north of the metropolitan area. The three water supply areas (drainages, catchments) are, in order from east to west, Coquitlam (20,461 hectares), Seymour (12,375 hectares), and Capilano (19,535 hectares). In addition, there are off-catchment lands of the Lower Seymour Conservation Reserve, which are a total of 5,600 hectares in area. Access to these lands is controlled and limited through the *Watershed Access Policy*. Protecting the water supply areas by restricting access is a fundamental component of the multiple barrier approach to safe drinking water, as outlined by Health Canada.

The Capilano Water Supply Area is 19,535 ha in area and the most western of Metro Vancouver's water supply areas. The Cleveland Dam is located on the Capilano River to store drinking water for the region; it is a concrete dam that was built in 1954. The Capilano Water Supply Area has one alpine lake, Palisade Lake, which provides an additional 10 BL of storage.

The Seymour Water Supply Area is 12,375 ha and is located north of the District of North Vancouver. The Seymour Falls Dam and the reservoir created behind it is the highest of three sources of supply for the water system. The Seymour Falls Dam was built in 1961 to replace a dam that was built in 1927. Also within the Seymour Water Supply Area are two alpine lakes, Burwell Lake and Loch

Lomond Lake. Burwell Lake provides 12,000 ML of storage, and Loch Lomond Lake provides 7,000 ML of storage. The dams for these lakes are opened during high-demand periods in the summer.

Metro Vancouver's most eastern water supply is Coquitlam Reservoir. Coquitlam Reservoir is owned by the Province and managed by BC Hydro for power generation. Metro Vancouver is licenced by the Province to use 451,000 ML per year from Coquitlam Reservoir. Additional water is purchased from BC Hydro annually. In 2021 Metro Vancouver purchased an additional nomination of 84,500 ML.

2.2. Water Treatment Facilities

As Metro Vancouver's source water is surface water, Metro Vancouver is required by the Ministry to treat the water to meet the *Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia.* Metro Vancouver's water is treated at two water treatment plants, either the Seymour Capilano Filtration Plant (SCFP) or the Coquitlam Water Treatment Plant (CWTP).

2.2.1. Seymour Capilano Filtration Plant

The Capilano and Seymour reservoir's water is treated at the Seymour Capilano Filtration Plant (SCFP). An underground tunnel transports water over 7 km from the Capilano Reservoir to SCFP so that water from both Seymour and Capilano can be treated at one facility.

The primary drinking water treatment processes at the Seymour Capilano Filtration Plant are filtration and ultraviolet (UV) disinfection. Filtration treats drinking water by removing particulates, organic matter, and micro-organisms. An added benefit of filtration is that less chlorine is required to maintain water quality in the transmission and distribution systems. Treatment after filtration includes UV disinfection, which works by inactivating micro-organisms in the source water. Following the UV, sodium hypochlorite (chlorination) is added for disinfection, and then the pH and alkalinity are adjusted using a combination of lime (calcium hydroxide) and carbon dioxide before the water enters the transmission system. Figure 2 describes the individual treatment processes. SCFP in 2021 treated a maximum day demand of 1,049 ML and an average of 670 ML per day; the plant is designed to treat up to 1,800 ML per day.

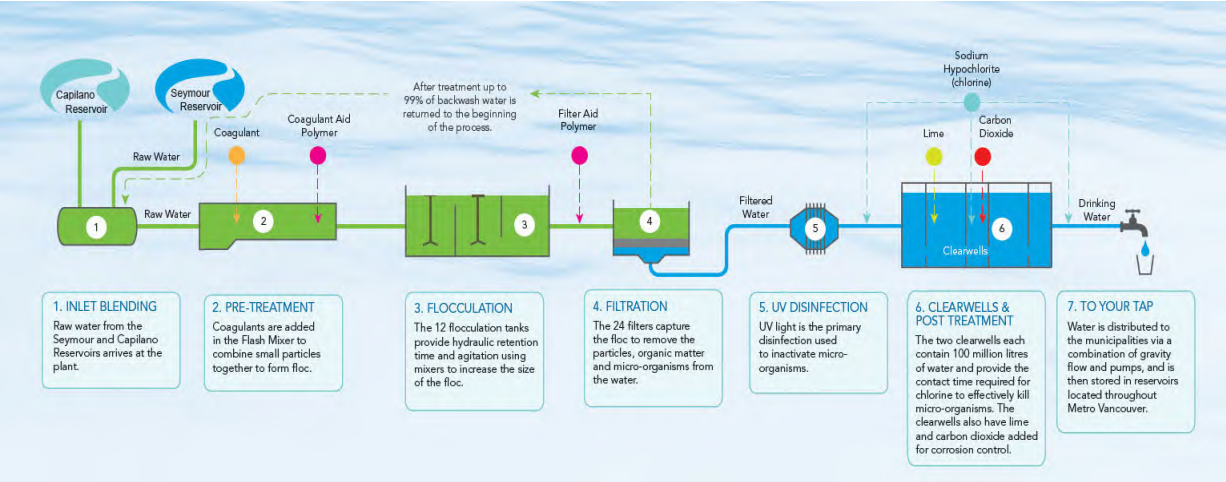

Figure 1: SCFP Treatment Processes

2.2.2. Coquitlam Water Treatment Plant

The Coquitlam Water Treatment Plant (CWTP) is located north of the City of Coquitlam and treats water from the Coquitlam Reservoir. In 2021 CWTP treated an average of 401 MLD and a maximum of 868 MLD; the plant is designed to treat a maximum of 1,200 MLD.

The Coquitlam Water Supply Area is of different geology than the Seymour and Capilano Water Supply Areas, and the water is typically less turbid even during heavy rain events, and as such, this system relies on different forms of treatment. At CWTP, ozone is used as a pre-treatment to help break down the organics and reduce the production of disinfection by-products (DBPs). The primary treatment is UV disinfection followed by sodium hypochlorite (chlorination) for disinfection. The pH and alkalinity are adjusted using a combination of soda ash (sodium carbonate) and carbon dioxide before it enters the transmission system. The following Figure 3 shows the process flow diagram for CWTP.

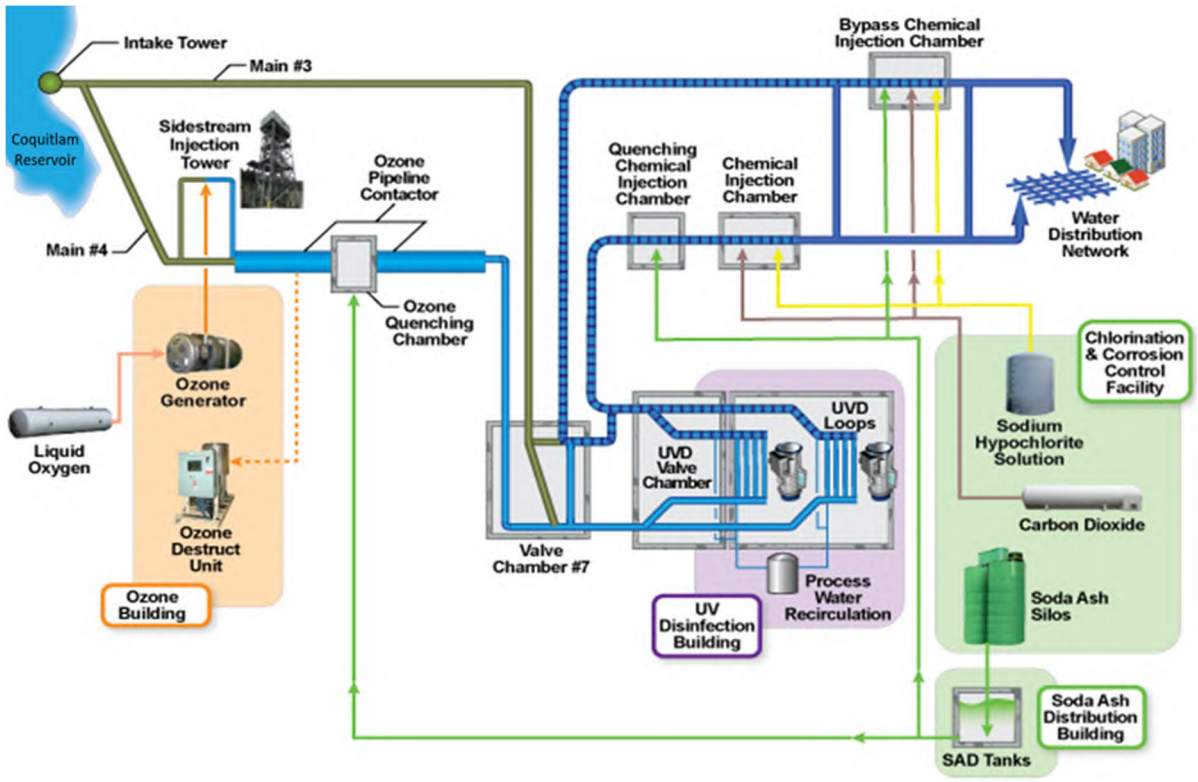

Figure 2: Coquitlam Water Treatment Plant Process Overview

2.3. Transmission System

Metro Vancouver supplies approximately one billion litres of drinking water each day (rising to over 1.5 billion litres in the summer) to member jurisdictions through a network of 19 pump stations, 27 in-system storage reservoirs, eight secondary disinfection facilities, and over 520 km of transmission water mains ranging from 350 mm to 3 m in diameter. Thousands of kilometres of additional municipal distribution mains deliver water to the consumer's tap.

Water transmission from the Capilano and Seymour sources across the Burrard Inlet is achieved via the First Narrows and Second Narrows marine crossings. The Coquitlam supply is conveyed south without crossing major waterways. From these points, the conveyance of water is predominantly in a north to south direction, with interconnecting east-west transmission mains and pump stations.

The geography of the region provides, in large part, for conveyance supported by gravity, for much of the region when demands are relatively low. However, when demand is higher during the summer months or if portions of the system are out of service for construction or maintenance work, pumping is required at many locations as gravity flow capacity alone is insufficient.

3.0 WATER QUALITY SAMPLING PROGRAM

Metro Vancouver conducts daily tests on the drinking water—analyzing around 38,000 water samples each year. Results are public and found in annual Water Quality Control reports on the Metro Vancouver Website. The *2021 Annual Water Quality Control* report will be available in April 2022. This Water Quality Control report provides a summary the water quality analysis results for source, treated and distributed water in 2021.

As part of Metro Vancouver's corrosion control program, the alkalinity and pH levels were adjusted on June 7, 2021 at both SCFP and CWTP. The treatment systems have been running reliably and steadily at a pH of 8.3, which is within Health Canada's Guidelines for Canadian Drinking Water Quality range of a pH of 7 to 10.5. To help improve the stability of the target pH level in the water transmission and distribution pipes, the alkalinity target was doubled to about 20 mg/L (expressed as calcium carbonate).

4.0 WATER SYSTEM RISK MITIGATION

Metro Vancouver follows the *Quality Management System for Drinking Water Operational Plan* (QMSDW), which was finalized in 2021. A formal internal audit is completed through this process, including risk assessment outcomes and implementation of critical control measures. Risk Assessment is a fundamental part of the QMSDW process. It forms the foundation for building a set of specific prioritized actions to safeguard drinking water and to aid in strategic decision-making, planning, and resource allocation. The analysis includes identifying, assessing, controlling, and mitigating the risks of the hazardous events that may occur in Metro Vancouver's drinking water system.

4.1. Water Supply Area Risks

Climate change is a significant source of risk for the Metro Vancouver water supply areas. With climate change, it is anticipated that significant precipitation events will occur more frequently, with higher intensity and less snow accumulation; this may result in landslides of higher frequency and magnitude in our water supply areas. Increased turbidity and other climate change risks have been considered in long-term water supply infrastructure planning by considering filtration pre-treatment, intake location and treatment designs. Metro Vancouver is fortunate to have three independent and well-protected water supply areas, which is an added measure of resiliency, particularly during the wet season when two of the three sources can currently meet regional water demand. Additional mitigation measures such as upgrading reservoir debris booms, monitoring wildfire risks and replacing stream-road crossings are underway.

4.2. Treatment System Risks

The current treatment for the Coquitlam system does not include filtration. Although the current water quality in Coquitlam Reservoir is very good, turbidity events do happen, and more frequent significant events are expected to occur in the future due to climate change.

Turbidity is just one water quality parameter among other parameters that would require filtration of the Coquitlam source water in the future. Filtration is beneficial for turbidity removal and removes a portion of naturally occurring organics. Organics reduction has several benefits, including reducing the amount of chlorination required to maintain adequate residual levels in the transmission and distribution systems. Reduced chlorination also reduces the levels of DBPs, which are health-regulated parameters under the federal Guidelines for Canadian Drinking Water Quality.

Metro Vancouver is in the process of planning for a new filtration plant for the Coquitlam source water. Filtration provides resiliency and risk mitigation against changing future regulations and emerging contaminants. The past decision to filter the Capilano and Seymour sources was predicated on similar considerations.

4.3. Transmission System Risks

In 2021 Metro Vancouver prepared the "Regional Water Supply System Lifeline Study: Seismic Vulnerability Assessment", which updates the previous Lifeline Study completed in 1993. The 2021 study investigated Metro Vancouver's water mains' seismic vulnerabilities and all other facilities, excluding dams. This report evaluated the water mains and facilities for earthquakes with a 1:2,475-year and 1: 10,000-year return period, respectively, per Metro Vancouver's Seismic Design Criteria and draft 2020 National Building Code of Canada (NBCC) requirements. This study recommends additional site-specific assessments and structural analysis for facilities to improve the predictions of seismic damage. The study also provides recommendations on other seismic resiliency measures.

4.4. Evolving Guidelines

In Canada, drinking water guidelines are developed by Health Canada's Water and Air Quality Bureau. BC's Ministry of Health is responsible for selecting and implementing the guidelines. As new guidelines are developed and implemented, Metro Vancouver proactively reviews the water supply system and ensures that the system is capable of meeting the latest guidelines or identifies if treatment system or other upgrades are required.

5.0 WATER USE AND CONSERVATION

5.1. Water Availability and Use Trends

The Metro Vancouver region experienced a higher than average snowpack in early 2021. Record high temperatures in the second half of June contributed to a faster than normal snowmelt, resulting in reservoir drawdown starting in early July. The source reservoirs were proactively managed to capture the incoming streamflow to ensure Seymour and Capilano Reservoirs reached their respective targeted full pool elevations before June 1, 2021, and July 1, 2021.

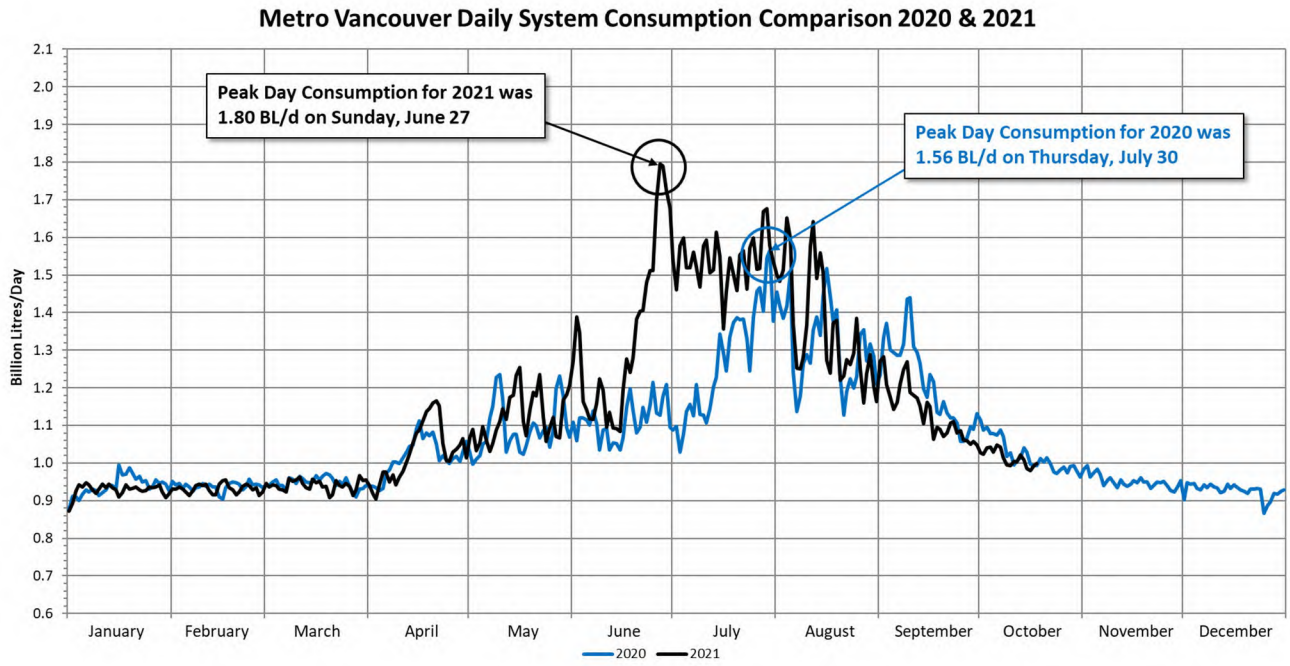

Figure 3: 2020 and 2021 Daily Water Consumption

As shown in Figure 4, the highest peak day consumption in summer 2021 of 1.80 billion litres/day was recorded on Sunday, June 27, 2021. An extreme heatwave affected the lower mainland from late June through mid-July and peaked on June 28 – 29, 2021. The above normal water use was sustained during this period. The 2021 peak day consumption was observed a few weeks earlier than recorded in previous years.

Between 1994 and 2021, Metro Vancouver's service population has grown by 940,000 people, at an annual growth rate of approximately 1.97%. Despite the population growth, average daily water demand has remained relatively constant over the past 28 years, as shown in Figure 5. Thus, per capita water use has been declining over the past 28 years, as shown in Figure 6, which is often attributed to more efficient plumbing fixtures, increasing public awareness about water conservation and increasingly stringent lawn watering. For similar reasons, most communities across Canada have seen comparable declines in per capita water use.

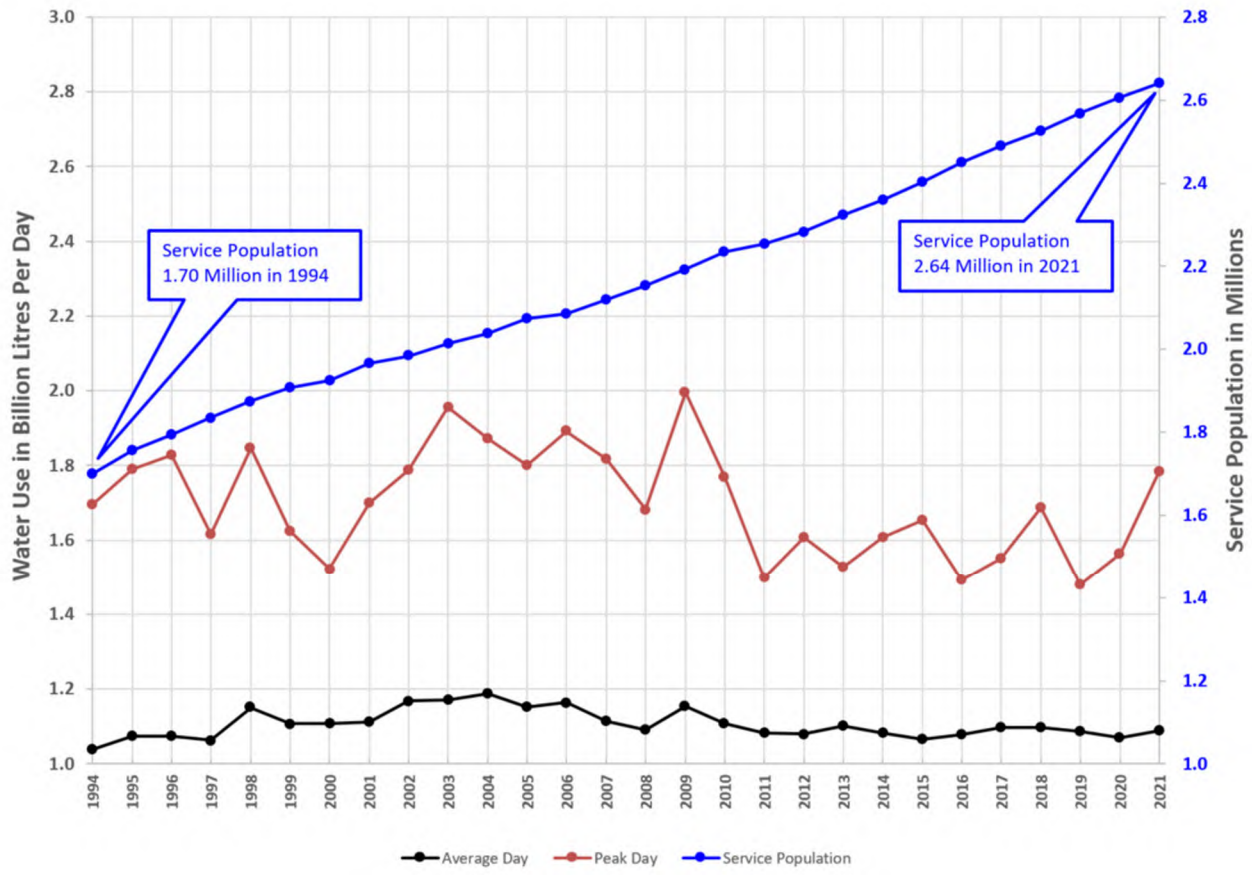

Figure 4: Regional Population and Water Use from 1994 to 2021

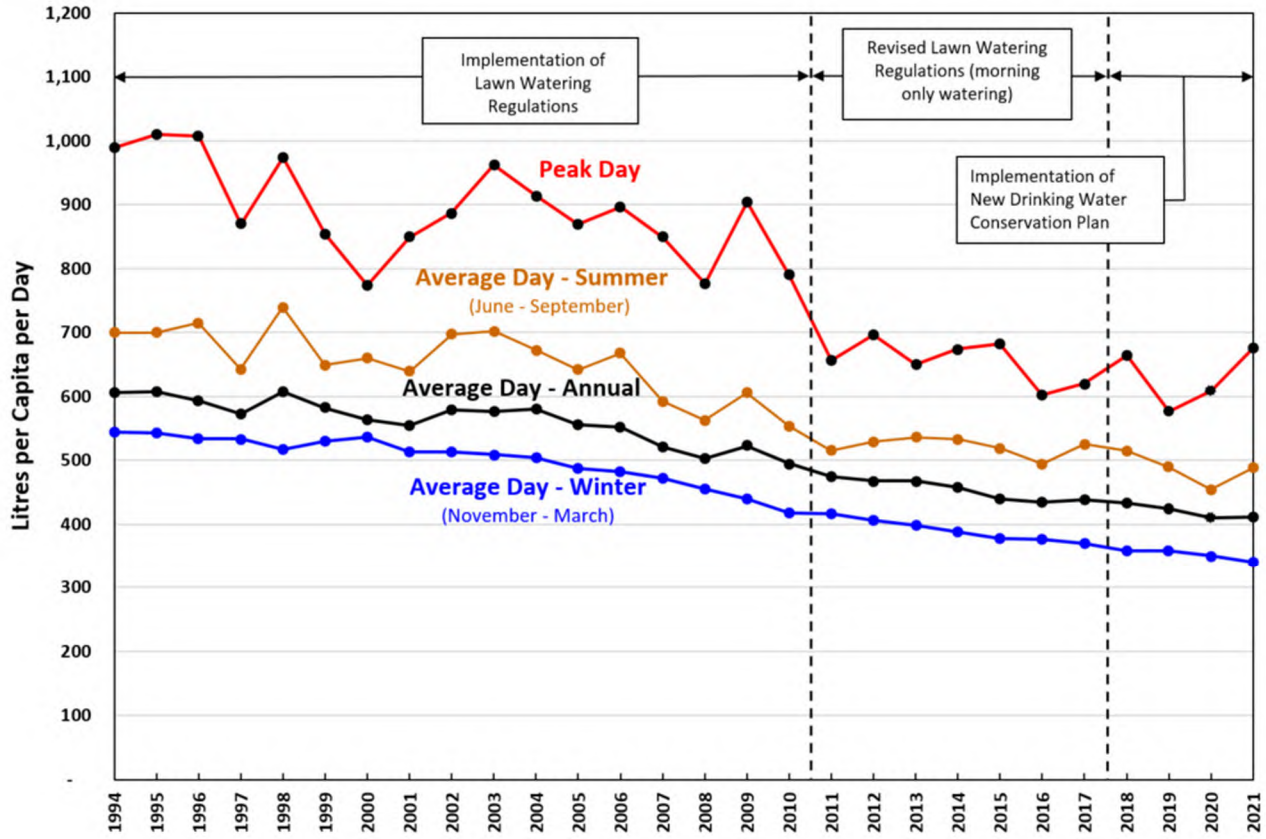

Figure 5: Regional Per Capita Water Use from 1994 to 2021

5.2. Water Conservation Measures

Metro Vancouver undertakes several communications initiatives annually to ensure water resources are used efficiently throughout the region. Key initiatives in 2021 included the communication of the region-wide watering regulations and the communications campaign – *We Love Water* – to increase awareness of Metro Vancouver's water system and the need for residential water conservation. The promotional strategy for both initiatives included a broad reach through television, radio, print, and outdoor advertising and targeted and weather-triggered digital tactics, in total, broadcast and digital promotions delivered over 36.6 million impressions with 35% more web visits than in 2020, including 9,479 visits to Metro Vancouver's Lawn Watering Regulation web page and over 599,000 social media views.

Despite the campaign's reach, water use was at a record high in 2021 during the ongoing hot and dry weather. In 2022 Metro Vancouver will update water conservation communications to reflect the changes to the Drinking Water Conservation Plan (DWCP).

Figure 6: Example of 2021 Lawn Water Regulations Public Communications

To help reduce seasonal demands, Metro Vancouver updated the DWCP, reducing the allowable residential and non-residential lawn watering days from two days per week to one day per week during Stage 1. Changes to Stage 2 include a ban on residential and non-residential lawn watering. Member jurisdictions will be responsible for their respective bylaw amendments for implementation in 2022.

The water supply system performed without significant stresses over the 2021 summer season. Water conservation will continue to be an important factor in determining future system needs. Sustained reductions in per capita water use over the coming years could potentially defer the significant capital investments required to meet the needs of a growing region.

6.0 FINANCIAL PLANNING

The 2021 total water sales revenues of approximately $320 million, with higher summer rates of $0.9546/m^3 for June through September and the lower rate of $0.7119/m^3 applying for the rest of the year (equating to an overall average water rate of $0.8110/m^3). The differential rates are intended to incentivize conservation efforts in the region and reduce long-term pressures on the capital budget.

7.0 WATER SYSTEM MANAGEMENT

7.1. Asset Management Program

Metro Vancouver's Asset Management Program ensures that assets are managed in a manner that minimizes asset failure risks and impacts to customers and optimizes the lifecycle value of assets to meet asset performance targets consistently, and enables evidence-based decision-making to provide quality services continuously. In 2019, the Board approved the *Asset Management for Water Services* policy. This policy establishes asset management principles and framework to balance asset performance, risk, and cost to deliver Metro Vancouver water services.

7.2. Operations and Maintenance Program

Through the Asset Management Program, the repairs and improvements required for the drinking water system are identified. These repairs and improvements are undertaken either as annual maintenance projects or one-time minor capital projects. Annual maintenance is an essential component of the long-range plan and addresses the need for replacement or refurbishment of existing infrastructure to ensure that it continues to perform as required to meet service objectives.

Metro Vancouver undertakes system maintenance daily to ensure the existing equipment and facilities are in a good state of repair and to know when additional maintenance or replacement is needed.

Multi-year maintenance projects that are underway, include the following:

Annual Reservoir Cleaning – Metro Vancouver's in-system water storage reservoirs are periodically isolated and drained for interior cleaning, inspection, and repair or upgrade construction. Cleaning is conducted either through draining and using high-pressure water spray or using divers to remove sediment from the interior. In 2021, six reservoirs were isolated, drained and cleaned, and one reservoir was cleaned by divers.

Water Meter Upgrade Program – There are over 200 water meters located at the points of connection to the member jurisdiction's systems. The Water Meter Upgrade Program started in 2018, it involves installing seven new water meters, and replacing 30 existing water meters. In 2021, two new water meters were installed, one water meter was replaced and the design for the installation or replacement was progressed on nine of the other water meters.

Capilano Energy Recovery Facility Corrosion Mitigation – The coating on some of the piping, valves, and other various equipment inside the Capilano Energy Recovery Facility's Machine Hall room was recently replaced to mitigate surface corrosion. This work involved cleaning and removing any existing corrosion, repassivation of stainless steel surfaces, and applying a corrosion prevention coating.

Valve Replacement Program – Metro Vancouver is continually reviewing the water transmission system to ensure valve chambers are in good working order through condition assessments and isolation tests. A number of air valves were assessed and replaced in 2021. A 2021 minor capital project was used to plan the refurbishment of a valve chamber south of the Second Narrows Crossing. The Capital Program is also used to replace valves identified during assessments such as the First Narrows Crossing valve replacement. A more formalized valve maintenance program is currently being developed to improve system operations and budgeting.

Condition Assessments – Condition assessments follow the Asset Management for Water Services Policy, and improve understanding of the system's health and resiliency and can lead to asset repair and replacement projects. In 2021 Metro Vancouver completed condition assessments of three

critical aerial crossings, two sections of a submerged crossing, isolation valve chambers for three aerial crossings, and 12 other chambers in the water system.

Mechanical, Instrumentation, and Electrical Maintenance – In 2021, the maintenance team performed 3,875 preventative maintenance work orders. Examples of maintenance work includes eight pump re-builds at various pump stations; and program troubleshooting for instrumentation at Newton Pump Station.

7.3. Capital Program

The Water Services capital budget for 2021 includes 118 active projects with an estimated investment value of $2.36 billion over 2021-2025. These projects ensure the overall water system is being upgraded to meet service levels as well as applicable changing or new regulations. Capital investments addressing population growth are the largest component of the budget, representing slightly more than 51% of spending in the next 5-years.

In 2021 many major projects reached significant milestones, including the following key projects:

Douglas Road Main No. 2 – This new water main will replace the existing Douglas Road Main No. 1 between North Burnaby and New Westminster built in the 1940s. Construction of the 15-kilometre-long, 1,500 mm diameter water main began in 2007, and several project phases have already been completed and are in service. The two remaining sections are the Vancouver Heights Section, for which construction was completed in early 2021 and commissioning in the fall of 2021, and the Still Creek Section, which commenced construction in the summer of 2021. The Still Creek Section is the final phase of the project. When complete, it will ensure the continued delivery of clean, safe drinking water to the cities of Burnaby and New Westminster.

Second Narrows Water Supply Tunnel – In October of 2021, the tunnel excavation was completed for the Second Narrows Water Supply Tunnel, an important infrastructure project that will improve the seismic resiliency of the region's drinking water system. Now that the 5.8 m diameter tunnel is complete, three large diameter steel water mains will be installed and connected to the existing water system with new valve chambers. This project is one of several new regional water supply tunnel projects that are being constructed to meet current seismic standards and increase supply capacity.

Fleetwood Reservoir and Water Main – Work is underway on a new reservoir and water main in Surrey that will help Metro Vancouver meet the demands of the growing communities south of the Fraser River for clean, safe drinking water. The water main will connect the new reservoir to the regional drinking water system. The reservoir will be located in Meagan Anne MacDougall Park, and construction, which is expected to last about two years, will start in early 2022. The reservoir will be able to hold 13.6 million litres of water.

First Narrows Crossing North Shaft Valve Chamber – The valve chamber for the north shaft of the First Narrows Crossing houses underground pipe connections and large valves that control water flow

from the Capilano Transmission Main on the north shore to a tunnel carrying water under Burrard Inlet. The Capilano Transmission Mains No. 4 and 5 isolation valves were replaced, and both mains returned to service in 2021.

Little Mountain Reservoir – The upgrades for the Little Mountain Reservoir, located in Queen Elizabeth Park, included roof repairs, concrete sealing, and joint replacement. The work involved close collaboration with the Vancouver Parks Board and was completed in summer 2021. This work ensures that water quality is maintained throughout the lifespan of the reservoir.

CWTP Ozone Control System – Water from the Coquitlam Reservoir is pre-treated with ozone before it enters the Coquitlam UV Disinfection Plant. The three ozone generator reactors and their power supply units were originally installed in 1999. The power supply units are currently being replaced and, upon completion, will increase the ozone production capacity of the ozone generator reactor.

In 2021 there were also projects that were finalized and commissioned, bringing new infrastructure into the water transmission system, including the following:

Whalley Main – The Whalley Main was the fourth and final leg of the Port Mann Corridor Upgrades project. This project reached substantial completion in 2021 with final connections made in the fall of 2021 and was put into service in December of 2021. The Port Mann Corridor Upgrades project connects Metro Vancouver's water supply to the communities south of the Fraser River. The Whalley Main consists of approximately 2,000 meters of 1,500 mm diameter water main on 148th Street between Whalley Reservoir and 95A Avenue in the City of Surrey. The new water main is required to meet growth south of the Fraser River and twins a portion of the existing Whalley-Clayton Main, which connects the Whalley Reservoir to the Whalley-Kennedy Main.

Jericho Reservoir Cell #1 - In 2021, the Jericho Reservoir Cell #1 was connected to the drinking water system and became Metro Vancouver's twenty-seventh in-system storage reservoir. The Jericho Reservoir is a key component of Metro Vancouver's supply to the Township of Langley, and the City of Surrey. Located in the Township of Langley, the reservoir is being constructed in two phases and will have a total combined storage volume of 39.1 ML. Phase 1 is comprised of two cells with a combined total storage volume of 20.6 ML, Cell #1 was completed and was put into service in 2021. The second cell is anticipated to be brought online in 2022. The second phase of the reservoir is being planned for 2040.

8.0 EMERGENCY RESPONSE SUMMARY

8.1. Emergency Response and Contingency Plan Summary

The Emergency Response and Contingency Plan (ERCP) covers all aspects of the Metro Vancouver Emergency Management structure. Together with the Corporate Emergency Management Plan, Emergency Management Standard, business continuity plans, and Emergency Response Plans, all activities related to emergencies that may affect water supply are addressed. This Plan is intended to meet all requirements of the *Drinking Water Protection Act* and *Regulatio*n for an *Emergency Response and Contingency Plan*. Similarly, this summary of the ERCP is intended to meet the *Drinking Water Protection Regulation* Section 13 (4), which requires water suppliers to make public a summary of the ERCP to the water users.

Water system operations and emergency management are shared responsibilities between Metro Vancouver and its member jurisdictions. The overall purpose of this Plan is to provide general guidance to Metro Vancouver in preparing for, responding to, and recovering from an emergency situation. Emergencies considered include, but may not be limited to, earthquakes, floods, wildland & interface fire, and severe weather. The Plan defines Water Services' roles and responsibilities during incidents, emergencies and disasters.

Ultimately, Metro Vancouver will endeavour to maintain the continuity of drinking water delivery to our member jurisdictions. In an emergency, Metro Vancouver's priorities are: (1) Deliver drinking water whenever possible to members for consumption and/or firefighting. (2) Protect the integrity of water in its system for public health, (sourced from Metro Vancouver's Water Services Emergency Management Plan V13).

In meeting these priorities, Metro Vancouver subscribes to the following Response Objectives, in order of priority they are as follows:

1. Ensure the safety and health of all responders and Metro Vancouver staff;
2. Save Lives;
3. Reduce Suffering;
4. Protect the Public;
5. Protect Critical Infrastructure;
6. Protect Property;
7. Protect the Environment; and
8. Reduce Social and Economic Losses.

8.2. Emergency Recovery

There were two natural storm events in 2021 that resulted in high flow releases from Seymour Falls Dam (SFD), on September 30 and November 15. Both events resulted in dam discharge flows that exceeded the minimum flood levels selected for the initiation of the Seymour Falls Dam Emergency Response Plan, and resulted in notification of external partners as listed in the plan. From staff

discussions with external partners, neither natural storm event resulted in hazardous conditions or persons placed in imminent danger. Similarly, there were no impacts on the delivery of drinking water to the member jurisdictions.

Additionally, Metro Vancouver continues to monitor the changing COVID-19 situation and periodically adjusts control measures following the guidance of the Provincial Health Officer to maintain the health and safety of staff. Access to drinking water facilities is being restricted to essential personnel only and all public tours are canceled until further notice. There have been some schedule impacts to the capital projects. However, there have been no negative impacts on the delivery of drinking water to the member jurisdictions.


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To: Water Committee

From: Heidi Walsh, Director, Watersheds & Environment, Water Services
Kirstie Rendall, Supervisor, Environment, Water Services

Date: March 7, 2022 Meeting Date: April 6, 2022

Subject: **Environmental Policy for the Greater Vancouver Water District**

RECOMMENDATION

That the GVWD Board approve the *Environmental Policy for the Greater Vancouver Water District* and related document, *Environmental Performance Goals,* as presented in the report dated March 7, 2022, titled "Environmental Policy for the Greater Vancouver Water District".

EXECUTIVE SUMMARY

The Greater Vancouver Water District (GVWD) is developing an Environmental Management System (EMS) based on ISO 14001:2015. A key aspect to its success is the development and adoption of an environmental policy within the defined scope of the EMS. The proposed new *Environmental Policy for the Greater Vancouver Water District* Board policy, and related document, *Environmental Performance Goals* are presented for Committee and Board consideration in this report.

Establishment of the *Environmental Policy for the GVWD* formalizes the utility's commitment to achieving excellence in environmental performance, provides a framework for further development of the EMS, and supports progress to obtaining certification to ISO 14001 in 2023/24. The GVWD has been working in conjunction with the Greater Vancouver Sewerage & Drainage District (GVS&DD) to develop EMS components beneficial to both utilities. The GVS&DD will also be bringing forward a similar environmental policy for Liquid Waste Services at its next Board meeting.

PURPOSE

To seek the GVWD Board's approval of the attached *Environmental Policy for the Greater Vancouver Water District* and *Environmental Performance Goals*.

BACKGROUND

Development of the proposed *Environmental Policy for the Greater Vancouver Water District* and related document, *Environmental Performance Goals* (hereafter referred to collectively as the *Environmental Policy*) is a requirement of ISO certification and requires Water Committee review and the GVWD Board approval. The GVWD Environmental Management System (EMS) has been under development for three years and is now in a position to formalize the *Environmental Policy* through support of the Board in pursuit of ISO certification.

ENVIRONMENTAL MANAGEMENT SYSTEM

An Environmental Management System (EMS) is an organized and systematic way of managing an organization's operations to identify environmental risk, minimize adverse environmental impacts, conserve resources, prevent pollution, and ensure regulatory compliance. An EMS serves as a

proactive tool to improve environmental performance with a focus on due diligence and continual improvement. Due diligence involves taking proactive steps to ensure that regulatory standards are met and that adverse environmental impacts do not occur. Similar to a health and safety management system, an organization's EMS is audited on a regular basis to identify gaps and areas for improvement.

Staff have been working collaboratively with GVS&DD staff, to develop Environmental Management Systems for the utilities that conform to ISO 14001:2015. The GVWD intends to pursue certification to the international standard in 2023/24. Leadership and commitment from the GVWD Board and active support from the senior management team for the EMS are critical to its success. Taking a systemized approach to managing the utility's environmental risk areas will enhance the GVWD's environmental performance, help reach corporate climate change goals, streamline existing processes, ensure regulatory compliance is maintained, improve due diligence, and reduce the potential for litigation.

Environmental Policy

ISO 14001 lays out the components required in order to develop a robust EMS and attain certification. The standard emphasizes the need to establish, implement, and maintain an environmental policy. This policy must:

- Be appropriate to the purpose and context of the organization, including the nature, scale, and environmental impacts of its activities, products, and services;
- Provide a framework for setting environmental objectives;
- Include a commitment to protection of the environment, including pollution prevention;
- Include a commitment to fulfil the organization's compliance obligations; and
- Include a commitment to continual improvement of the EMS to enhance environmental performance.

The *Environmental Policy* will signal to the Board, employees, and the public that the GVWD is serious about managing environmental risks and is committed to providing the resources to implement the EMS. It supports inclusion of environmental regulatory criteria and risk-based decision-making into business processes. The GVWD's *Environmental Policy* will serve to broaden environmental awareness and promote a proactive risk management mindset, while demonstrating to staff that there is management support for environmental risk reduction initiatives and providing staff with clear environmental performance expectations as defined by policy outcomes and related goals.

The *Environmental Policy* commits the GVWD to implement and maintain an Environmental Management System based on ISO 14001, in order to systematically and proactively identify, prioritize, and manage environmental risks. To achieve this, the GVWD will:

- Determine its significant environmental risks (COMPLETE);
- Set performance objectives and metrics (COMPLETE);
- Develop plans, programs, procedures, protocols, and practices (UNDERWAY);
- Use knowledge of environmental risk to inform asset management and capital infrastructure planning (FUTURE GOAL);
- Increase staff awareness and empower them to generate solutions (UNDERWAY); and
- Review and report on progress and performance improvement (FUTURE GOAL).

Environmental Performance Goals
The *Environmental Performance Goals* will provide the framework for setting performance objectives and identifying performance metrics in the following categories:

- Drinking water supply, treatment, and transmission;
- Ecological health and function;
- Air emissions, energy use, and climate change; and
- Infrastructure and operations – resources, materials, and waste management.

The GVWD's *Environmental Performance Goals* are written as a 'related document' to the *Environmental Policy* to allow for periodic updates. Many of the goals listed reflect commitments made in existing Metro Vancouver regional plans. These goals will form the basis of environmental performance objectives to be developed by the utility for each significant risk area.

Next Steps
ISO 14001 requires that this policy be available to the public. Following Board approval, Metro Vancouver will develop an external-facing Environmental Policy fact sheet/summary sheet for public consumption and use.

ALTERNATIVES

1. That the GVWD Board approve the *Environmental Policy for the Greater Vancouver Water District* and related document, *Environmental Performance Goals* as presented in the report dated March 7, 2022, titled "Environmental Policy for the Greater Vancouver Water District".
2. That the GVWD Board receive for information the report dated March 7, 2022, titled "Environmental Policy for the Greater Vancouver Water District", and provide alternate direction to staff.

FINANCIAL IMPLICATIONS
Consulting costs for EMS development are currently $125,000 per year and anticipated to continue through 2024. These cost are within the Watersheds & Environment operational budget. Following development, the EMS will move into an audit, maintenance, and continual improvement phase with costs anticipated to be of comparable value. While not readily quantifiable, improvements to the GVWD's environmental practices are expected to result in reduced regulatory and financial risk over the long term.

CONCLUSION
There is currently no GVWD Board policy supporting the utility's environmental practices. Water Services staff are developing an Environmental Management System that conforms to ISO 14001 and are working toward certification to the standard. ISO 14001 requires an organization to establish, implement, and maintain an environmental policy within the defined scope of its EMS.

The proposed *Environmental Policy* is intended to solidify and formalize the utility's commitments to environmental protection. It commits the GVWD to implement and maintain an EMS that conforms to ISO 14001, to systematically and proactively identify, prioritize, and manage environmental risks related to the utility's infrastructure and operations to achieve desired outcomes. The *Environmental*

Policy includes performance goals set to achieve improvements in environmental performance in key areas of environmental protection. Once established, this policy will provide a framework for further development of the EMS and support the utility's progress to obtaining certification to ISO 14001 in 2023/24.

Attachments

1. Environmental Policy for the Greater Vancouver Water District *(47472144)*
2. Environmental Performance Goals *(47471440)*

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BOARD

ENVIRONMENTAL POLICY FOR THE GREATER VANCOUVER WATER DISTRICT (GVWD)

Effective Date: TBD

Approved By: GVWD Board

Policy No. XX-XXX

PURPOSE

This Policy commits the Greater Vancouver Water District (GVWD) to implement and maintain an Environmental Management System (EMS) conforming to ISO 14001, to systematically and proactively identify, prioritize, and manage environmental risks related to the utility's infrastructure and operations to achieve the following outcomes:

- Protect the environment
- Reduce pollutants and greenhouse gases, prevent waste, and conserve natural ecosystems
- Reliably fulfill compliance obligations
- Continually improve decision-making to mitigate risks and improve environmental performance

Achievement of these outcomes will be assessed through continual monitoring and measurement of performance information and data, based on the *GVWD Environmental Performance Goals*.

POLICY

The Greater Vancouver Water District's strategic commitments to the environment are set out in the *Board Strategic Plan*, *Ecological Health Framework*, *Climate 2050 Strategic Framework, Drinking Water Management Plan* and other existing corporate documents. GVWD commits to integrating environmental principles and performance objectives into all decision-making processes to enhance the environmental performance of the utility. This will be accomplished by developing strategies to identify and mitigate potential adverse environmental impacts, protect and enhance the natural environment, prevent pollution, reduce waste generation and improve its management, optimize energy use, and proactively continue to adapt GVWD's infrastructure and operations to climate change.

Environmental Commitments

GVWD commits to the following, with respect to land management and the development, operations, and maintenance of the utility's infrastructure:

- Protect the environment
- Prevent pollution
- Stay abreast of regulatory changes, meet regulatory and other compliance obligations, demonstrate due diligence, and respond to legislative change
- Continually improve GVWD's EMS as a mechanism to improve environmental performance in the areas outlined in the *GVWD Environmental Performance Goals,* namely:
    - Drinking Water Supply, Treatment, and Transmission

- Ecological Health and Function
- Air Emissions, Energy Use, and Climate Change
- Water Infrastructure and Operations – Resources, Materials, and Waste Management

Environmental Management System

An Environmental Management System provides the framework for fulfilling compliance obligations, demonstrating due diligence, and tracking environmental performance. It is a risk-based, systematic, and iterative approach to planning, doing, reviewing, and taking preventative and corrective action.

As part of this approach GVWD will:

- Develop and implement an EMS conforming to ISO 14001
- Determine and document significant environmental risks and related compliance obligations
- Set, prioritize, and annually review performance objectives for all significant environmental risk areas considering practicality, feasibility, efficiency, stakeholder impacts, and affordability
- Develop, implement, and continually improve operational and maintenance plans, programs, procedures, protocols, and practices, along with training and communications, to enhance performance in the significant environmental risk areas
- Incorporate knowledge of potential impacts of identified environmental risks into asset management and capital infrastructure planning
- Provide environmental performance information to staff, and empower them to generate solutions that deliver desirable outcomes
- Regularly report on and review progress in meeting the environmental performance objectives by:
    - Defining and monitoring metrics for the *GVWD Environmental Performance Goals*, based on the performance objectives established for the significant environmental risk areas
    - Performing audits of the Environmental Management System or any of its programs

Communication

GVWD will ensure the Environmental Policy is communicated to all persons governing or working for or on behalf of the utility.

This Environmental Policy is publicly available.

Application

This policy covers all activities GVWD controls or influences.

Related Document

GVWD Environmental Performance Goals

Environmental Performance Goals

Environmental Policy for Greater Vancouver Water District

The majority of the following environmental performance goals for the Greater Vancouver Water District (GVWD) align with existing Metro Vancouver applicable plans and policies, that are subject to periodic updates. Any corresponding changes to this document, when required to maintain alignment, will be reviewed by the Water Services Directors and approved by the General Manager.

Goal
Drinking Water Supply, Treatment, and Transmission
a) Protect, conserve, and support the restoration of fish populations in watershed areas affected by GVWD's activities.
b) Promote region-wide water conservation through public education and influence member jurisdictions in areas of regulatory enforcement of water use restrictions.
c) Restore disturbed areas and deactivate watershed roads that are no longer required.
d) Promote water reclamation at wastewater treatment plants and evaluate alternatives to using drinking water for other specific purposes.
e) Reduce the adverse environmental impacts of GVWD's infrastructure and building design and construction, while enhancing social and environmental benefits in a fiscally responsible manner.
Ecological Health and Function
a) Protect, restore, or enhance habitat to improve ecological resilience.
b) Exercise extraordinary care with ecosystems that contain species which are vulnerable or endangered or are critical to living systems.
c) Incorporate the social, economic, cultural, and environmental value provided by ecosystem services into decision making.
d) Control and prevent the spread of invasive species by following invasive species best management practices.
Air Emissions, Energy Use, and Climate Change
a) Conduct activities to contribute to healthy, clean, and clear air for current and future generations.
b) Advance corporate carbon neutrality in support of becoming a carbon neutral region by 2050 and to achieve interim regional targets.
c) Reduce energy consumption, switch to renewable energy, maximize energy recovery, sequester and remove carbon, and continually improve energy efficiency performance.

Environmental Performance Goals

Environmental Policy for Greater Vancouver Water District

Goal
d) Achieve long-term resilience of the regional drinking water system to natural hazards and other significant disruptions through a continual process of climate change adaptation.
Water Infrastructure and Operations – Resources, Materials, and Waste Management
a) Continually improve environmental management practices for procurement, delivery, storage, and handling, and efficient use of resources and materials.
b) Plan and control operations to prevent harmful impacts associated with GVWD activities and substances entering the environment, including water containing sediments, drinking water, disinfection wastewater, fuels, oils, and other hazardous chemicals or wastes.
c) Continually improve waste management practices to reduce the generation of waste, increase the reuse and recycling of waste, and increase the recovery of materials and energy from remaining waste. Dispose of residual waste products in a cost-effective manner that minimizes environmental impacts.

Reviewed by:

Heidi Walsh, Director Water Services, *Watersheds & Environment*	Date
Lucas Pitts, Director Water Services, *Policy, Planning & Analysis*	Date
Goran Oljaca, Director Water Services, *Engineering & Construction*	Date
Andrew de Boer, Acting Director Water Services, *Operations & Maintenance*	Date

Inder Singh, Director Water Services, *Interagency Projects & Quality Control*	Date
Daniel Roberge, Director Water Services, *Shared & Support Services*	Date

Approval:

Marilyn Towill, General Manager Water Services	Date

To: Water Committee

From: Joe Sass, Director, Financial Planning & Operations / Deputy CFO

Date: March 3, 2022 Meeting Date: April 6, 2022

Subject: **Engagement Plan and Proposed Rates for Water DCC Program Implementation**

RECOMMENDATION

That the GVWD Board:

a) direct staff to proceed with engagement on the proposed implementation of a water DCC program as described in the report dated March 3, 2022, titled "Engagement Plan and Proposed Rates for Water DCC Program Implementation"; and

b) direct staff to proceed with engagement on the proposed implementation of the water DCC program with rates determined using a 90% assist factor.

EXECUTIVE SUMMARY

For the last several years, Metro Vancouver staff have worked with the Province under the understanding that The *Greater Vancouver Water District Act* did not allow Metro Vancouver to have Development Cost Charges (DCCs) as a funding mechanism for its water function. As staff have worked to move forward the legislative changes, an evolved interpretation by the Province on our legislative environment was proposed to allow GVWD to collect DCC's under the Local Government Act. This approach will allow us to move forward sooner than having to wait for a legislative change, thus meeting the direction set out in the current *Board Strategic Plan*.

With growth projects comprising 54% of the long-term water capital program, getting a growth driven revenue stream in place as soon as possible is critical.

Work to date has included initial engagement, industry capacity analysis, and rate modelling resulting in a set of draft DCC *rates in principle* for consultation. Initial rates were brought forward to the Committee in July of 2021, and were not endorsed to move forward for consultation alongside the liquid waste DCC rate update, which is now completed. With clarity emerging on the legislative environment and the path to implementation of the DCC program, this report is being brought back for consideration.

Following Board endorsement of the rates in principle and approval of the engagement plan in this report, there will be further engagement with relevant levels of government, First Nations, stakeholders, and the public, before finalizing the proposal and seeking Board and Provincial approval.

PURPOSE

To receive feedback and authorization for further engagement on the proposed implementation of a water Development Cost Charge (DCC) program, and the proposed engagement plan.

BACKGROUND

DCCs are a mechanism to fund the cost of infrastructure expansion required for new development in addition to other revenue sources. While Metro Vancouver has operated a liquid waste DCC program of the Greater Vancouver Sewerage and Drainage District (GVS&DD) since 1997, there has never been a water DCC program in place, as the Greater Vancouver Water District (GVWD) Act does not allow for the collection of DCC's. However, given new staff looking at historical interpretations at the province, a different approach to legislative authority is possible. The concept of Metro Vancouver funding the growth portion of its regional water infrastructure through DCCs has been encouraged by most members for several years, and in the *2019-22 Board Strategic Plan* (Reference 1), the Metro Vancouver Board committed to pursuing the adoption of water DCCs. With growth projects comprising 54% of the long-term water capital program, ensuring a diverse and robust revenue model is critical.

WATER DCC PROGRAM IMPLEMENTATION PROCESS

The DCC program implementation process has been driven by a DCC Steering Committee of representatives of the Metro Vancouver finance, liquid waste, and water departments. This Steering Committee is simultaneously overseeing both this implementation of a water DCC program as well as an update to the liquid waste DCC program. The Steering Committee's work has included:

- **Engagement.** Developing and implementing approaches to information sharing and engagement with members, the Province, First Nations, relevant industry stakeholders, and the public, as described in detail in a subsequent section.
- **Industry capacity analysis.** The procurement of a report on the development industry's capacity to absorb a new water DCC.
- **Rate modelling.** The modelling of DCC rates necessary to support growth projects, with consideration of variables including planning horizon, application of interest costs, assist factor, and methodology.
- **Preparing *rates in principle*.** Development of proposed *rates in principle*, following consideration of engagement to date, industry capacity analysis, and rate modelling; these rates are being brought forward for Board endorsement for use in further engagements with relevant parties.

WATER DCC FRAMEWORK

The framework of the water DCC program has been designed to align with the liquid waste DCC framework in most respects, including the following factors:

- **Land use categories.** DCCs are to be based on four separate land use categories: single-family dwelling, townhouse, apartment, and non-residential.
- **Units for charging DCCs.** Residential developments will be charged per unit/dwelling, while a DCC for a non-residential development will be charged per square foot.
- **Assist factor.** The assist factor is the portion of the growth project that is to be funded from water sales to GVWD members rather than DCCs. Increasing the assist factor shifts more of the cost of system expansion (growth) from DCCs to water sales.

There is one significant point of difference between the proposed water DCC framework and the existing liquid waste DCC framework:

- **Sub-regional areas.** The liquid waste DCC program is separated into four sewerage areas: Vancouver, Lulu Island West, North Shore, and Fraser. Each sewerage area has its own unique fee

structure based on its development requirements. The water DCC program will operate at the regional level, with one fee structure.

Given this framework, rates are then calculated based on growth projections, projected costs of growth projects, projected interest rates, and assist factors, among other variables.

One key lesson learned in past engagement on the liquid waste DCC program shows that regular reviews of the DCC program, and in particular the rates, is helpful to members and other stakeholders to ensure that increases can be more predictable and easier to absorb. This practice will be built into the management of the water DCC program.

PROPOSED WATER DCC RATES AND ASSIST FACTOR

A set of proposed DCC rates in principle was brought forward in July 2021 for consideration by the Water Committee. At that time the Water Committee did not endorse the rates proposed, and staff were instructed to reconsider the proposed rates as the large assist factor did not adhere with the direction for growth in the region to pay for required growth in the water system. The rates proposed had been calculated to include:

- Interest on project costs
- A 90% assist factor; this is recommended to ensure that DCC rates are within the capacity of industry's current ability to pay
- A 30-year planning horizon

The proposed water DCC rate options in principle are outlined below:

Option 1: If directed to consult on the rates at a 1% assist factor, thus achieving the overarching objective by the water committee in one year, the proposed rates would be as follows:

Single-Family	Townhouse	Apartment	Non-Residential
$13,249 / unit	$11,278 / unit	$8,436 / unit	$6.71/ ft^2 of floor area

Option 2: If directed to consult on the rates at a 50% assist factor, which is a compromise between the staff recommendation of 90% assist factor and the 1% noted above:

Single-Family	Townhouse	Apartment	Non-Residential
$6,692 / unit	$5,696 / unit	$4,261 / unit	$3.39 / ft^2 of floor area

Option 3: Consistent with the consultant report received on the available room for Metro Vancouver's DCC updates, the staff recommendation is to proceed with consultation at a 90% assist factor. Note that this would be the introductory rate and staff would work to reduce this assist factor over time, as the market would allow, to ultimately reach a 1% assist factor:

Single-Family	Townhouse	Apartment	Non-Residential
$1,338 / unit	$1,139 / unit	$852 / unit	$0.68 / ft^2 of floor area

While staff certainly appreciate and agree with the desire for growth to pay for growth, it is our belief, supported by the industry capacity analysis conducted, that the impact of these rates is greater than would be absorbable by the development community without impact to the market overall. As such, staff's recommendation remains at implementing the DCC program with a 90% assist factor, with a plan to reduce this assist factor systematically over time.

As per the provisions set out in S. 568(2) of the *Local Government Act*, existing permit applications that are in stream at the time the new rates come into effect will not be charged the new DCC rates as long as the permit is issued within one year, and any new permit applications received after the bylaw approval will be subject to the new DCC.

ENGAGEMENT PROCESS

Engagement to date has been undertaken jointly on this project to implement the new water DCC program, as well as on the update to the liquid waste DCC program. Since Q2 of 2021, due to feedback and direction from the Water Committee, consultation on the liquid waste DCC's took place but did not include the water rates. Since that time staff have been working with the Province on the legislative environment while conducting robust consultations on liquid waste rates. Now that clarity around the legislative environment has emerged, and that consultations for liquid waste rates have completed, staff are planning to conduct the water rate consultations in the near term.

The consultation process to date has involved:

- Q4 2020: Letters to members, the University Endowment Lands, and First Nations, outlining the DCC projects and inviting initial comments. Preliminary discussions with the Province.
- Q4 2020: Initial contact with industry groups, with feedback showing that discussions would be more appropriate once draft rates were developed.
- Q1 2021: Development of a dedicated webpage (Reference 2) and FAQ document (Reference 3) on metrovancouver.org to provide information on both DCC projects. Initiation of a DCC email address and a DCC mailing list on metrovancouver.org to allow for convenient channels of communication.
- Q2 2021: Presentations to the Regional Engineers Advisory Committee (REAC), Regional Administrative Advisory Committee (RAAC), and Regional Finance Advisory Committee (RFAC), with discussions indicating substantial support from members for both water and liquid waste programs. Direct follow up with each of the region's First Nations.

Feedback on the rates thus far has been supportive. REAC expressed a desire for higher rates (via reduced assist factor), while RAAC articulated more caution, recognizing the impact of rate increases both to the market, as well as to their own municipal DCCs. RFAC focused primarily on how to move toward a model where growth is contributing to more of the costs, as well as how Metro Vancouver, TransLink, and members can collaborate in the future on DCCs. Perhaps not surprisingly, Metro Vancouver received renewed calls for annual incremental increases, much like the *Community Charter* regulation (*Development Cost Charge Amendment Bylaw Approval Exemption Regulation*) that exempts a DCC Bylaw from the approval requirements in the *Local Government Act* once each year for up to four years as long as increases do not exceed the Vancouver Consumer Price Index.

With this report, the proposed rates in principle will be reviewed with the Metro Vancouver Water Committee, and with the GVWD Board prior to broader engagement with relevant levels of government, First Nations, industry stakeholders, and the public over the next three months. The next steps in the engagement process will include:

- Continued discussions with the Province on passing the necessary legislation to implement the water DCC program, and on the liquid waste DCC program update
- Continued discussions with First Nations
- Ongoing updates to the dedicated DCC webpage and FAQ document
- A series of online forums and one in-person forum with specific invitations sent out to Metro Vancouver members, members of the development community (including the Urban Development Institute, the Greater Vancouver Home Builders Association, boards of trade and chambers of commerce in the region), and promoted to industry through industry associations and to the public through the metrovancouver.org website and relevant Metro Vancouver mailing lists
- Reports to the Metro Vancouver Water Committee, and the GVWD Board, to provide findings of the engagement process and recommendations for moving forward with the implementation of a water DCC program
- Submission of the draft bylaw and report to the Province

ALTERNATIVES

1. That the GVWD Board:
   a) direct staff to proceed with engagement on the proposed implementation of a water DCC program as described in the report dated March 3, 2022, titled "Engagement Plan and Proposed Rates for Water DCC Program Implementation"; and
   b) direct staff to proceed with engagement on the proposed implementation of the water DCC program with rates determined using a 90% assist factor.

2. That the GVWD Board:
   a) direct staff to proceed with engagement on the proposed implementation of a water DCC program as described in the report dated March 3, 2022, titled "Engagement Plan and Proposed Rates for Water DCC Program Implementation"; and
   b) direct staff to proceed with engagement on the proposed implementation of the water DCC program with rates determined using a 50% assist factor.

3. That the GVWD Board:
   a) direct staff to proceed with engagement on the proposed implementation of a water DCC program as described in the report dated March 3, 2022, titled "Engagement Plan and Proposed Rates for Water DCC Program Implementation"; and
   b) direct staff to proceed with engagement on the proposed implementation of the water DCC program with rates determined using a 1% assist factor.

4. That the GVWD Board provide alternate direction to staff regarding the proposed water DCC framework, using alternate rates and assist factor, and/or the engagement plan as described in the report dated March 3, 2022, titled "Engagement Plan and Proposed Rates for Water DCC Program Implementation".

FINANCIAL IMPLICATIONS

The cost of the engagement process will be funded through the existing water function budget. With successful implementation of the water DCC program, the projected impacts will be built into the financial plan through the budget process.

OTHER IMPLICATIONS

While DCCs are an important tool for local governments to use in funding infrastructure driven by growth, it is important to consider the cumulative impact that they have on developers' abilities to pay for sites, which can in turn have effects on the real estate market including reduced supply and price increases. The proposed draft DCC rates in principle have been prepared with consideration given to industry's capacity for increased costs.

CONCLUSION

Following up on a commitment to pursue the adoption of a water DCC program in the current *Board Strategic Plan*, an internal cross-departmental DCC Steering Committee is recommending the implementation of a DCC framework for the water function that closely aligns with the existing liquid waste DCC framework, but with fees set out at the regional level rather than at a sub-regional level. Draft DCC rates in principle contained in this report have been developed based on initial engagement, industry capacity analysis, and rate modelling.

The engagement plan in this report to discuss the rates in principle with relevant levels of government, First Nations, stakeholders, and the public, will be central to finalizing the proposed DCC framework and draft DCC rates, before seeking Board approval to request that the Inspector of Municipalities approve the rates.

To advance the implementation of an important funding mechanism for growth-driven projects as the region experiences an increasing need for system expansion and increasing costs of infrastructure, staff recommend Alternative 1.

REFERENCES

1. Metro Vancouver Board Strategic Plan 2019-2022
2. Development Cost Charges webpage
3. FAQ Document

46289921

To: Water Committee

From: Goran Oljaca, Director, Engineering and Construction, Water Services

Date: March 7, 2022 Meeting Date: April 6, 2022

Subject: **GVWD Capital Program Expenditure Update to December 31, 2021**

RECOMMENDATION

That the Water Committee receive for information the report dated March 7, 2022, titled "GVWD Capital Program Expenditure Update to December 31, 2021".

EXECUTIVE SUMMARY

The capital expenditure reporting process as approved by the Board provides for regular status reports on capital expenditures three times per year. This is the year-end report for 2021 which includes both the overall capital program for the water utility with a multi-year view of capital projects and the actual capital spending for the 2021 fiscal year in comparison to the annual budget. In 2021 the annual capital expenditures for GVWD were $214.9 million to date compared to an annual capital budget of $431.3 million. This shortfall is primarily due to project delays related to the timing of tenders, construction delays and issues relating to COVID-19.

Forecasted expenditures for the current water utility capital program remain within the approved budgets through to completion.

PURPOSE

To report on the status of the GVWD capital program and financial performance for the 2021 fiscal year ending December 31, 2021.

BACKGROUND

The capital expenditure reporting process as approved by the Board provides for regular status reports on capital expenditures with interim reports sent to the Water, Liquid Waste, Zero Waste, and Performance and Audit Committees, in July and October, with a final year-end report to the Committees and the Boards in April of each year. This report covers projects managed by both the Water Services and the Project Delivery Departments.

This is the third in a series of three reports for 2021 and looks at both the overall capital program for the water utility with a multi-year view of capital projects and the actual capital spending for the 2021 fiscal year to December 31, 2021 in comparison to the annual budget. This report covers projects managed by both the Water Services and the Project Delivery Departments.

2021 CAPITAL EXPENDITURES

GVWD Capital Program Funding

The capital spending for the water utility is funded through the GVWD operating budget by a combination of contribution to capital (pay-as-you-go funding) and debt service costs (principal and interest payments). As a result, the annual impact on the ratepayers is significantly less than the level of budgeted capital expenditures.

Overall Capital Program

The overall capital program for the water utility includes capital projects which require multiple years to complete. These projects are broken down into various phases such as project definition, pre-design, detailed design and construction. With the completion of each phase, more information is learned for the appropriate costing of subsequent phases.

It is expected that the capital spending on all GVWD capital projects completed in 2021 or ongoing at some point in 2021 will be under budget by approximately $39 million, or within 0.5% of total budget.

Table 1 in Attachment 1 provides a summary of GVWD capital expenditures for both ongoing and completed projects. Completed Projects include a summary of actual spending compared to the Board approved spending limits while the Ongoing Projects include a summary of projected spending to completion compared to Board approved spending limits. With the rare exception, projects tend to complete with actual spending below the approved limits predominantly due to savings on budgeted contingency amounts.

Attachment 2 provides the details behind the summary information including specific capital projects, summary financial information and notes where required. Attachment 3 provides additional project status information for some of the key projects included in Attachment 1 – Table 1.

2021 Capital Program Process

The Metro Vancouver financial planning process includes Board approval of both an annual Operating Budget (operations, contribution to capital and debt service) and an annual Capital Budget for the planned capital infrastructure projects. The annual Capital Budget comprises the projected spending for a list of capital projects either continuing or to be started within the calendar year.

In 2021, capital expenditures for GVWD are $214.9 million to December 31, 2021 compared to the total capital budget of $431.3 million.

The current underspend is due to several factors including delays in permitting and land acquisition, as well as COVID-19 impacts.

Forecasted expenditures for the current GVWD capital program remain within the approved budgets for 2021 and through to completion.

Table 2 in Attachment 1 provides a summary of the 2021 actual capital spending to December 31, 2021 compared to the Board approved capital budget.

Capital Program Impacts from COVID-19

During these unprecedented times of health and economic uncertainty, all departments have been monitoring the impacts of the pandemic on their operations. This includes capital program expenditures.

Overall, the impact to the water utility's capital program has largely been schedule related, with some notable impacts to project expenditures confirmed to date. Staff are monitoring impacts on their projects regularly. Some impacts to project schedules or expenditures are included under the respective project section of Attachment 3.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

Capital expenditures are funded internally (pay-as-you-go) and through debt service costs (interest and principal payments). As capital expenditures are incurred, short-term financing is secured and converted twice per year to long-term debt through the Municipal Finance Authority.

CONCLUSION

This is the third in a series of three reports on capital expenditures for 2021. Overall, projected expenditures are expected to be under budget for capital projects ongoing or completed in 2021.

Forecasted expenditures for the current GVWD capital program are anticipated to remain within the approved budgets through to completion.

Attachments

1. Capital Expenditure Summary – Water Capital Projects *(47354536)*
2. Detailed Water Capital Expenditure Summary
3. GVWD Capital Project Status Information *(47359063)*

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Metro Vancouver

Capital Expenditure Summary
Water Capital Projects
As at December 31, 2021

Table 1 – Ongoing and Completed Project Summary

Water Services	Total Budget	Total Projected Expenditures At Completion	Total Budget Less Projected Expenditures
Ongoing	$ 7,360,071,000	$ 7,341,966,000	$ 18,105,000
Completed	60,050,000	39,208,000	20,842,000
Not Started	751,200,000	751,200,000	-
Cancelled	-	-	-
	$ 8,171,321,000	**$ 8,132,374,000**	**$ 38,947,000**

Table 2 – December 2021 Capital Spending Summary

Water Services	2021 Budget	Actual Expenditures to December 31, 2021	
Infrastructure Growth Capital	$ 167,550,000	$ 65,740,372	
Infrastructure Maintenance Capital	91,200,000	52,099,076	
Infrastructure Resilience Capital	155,600,000	93,729,326	
Infrastructure Upgrade Capital	14,900,000	3,340,447	
Opportunity Capital	2,000,000	-	
	$ 431,250,000	**$ 214,909,221**	**50%**

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Metro Vancouver
Water Capital Expenditures Summary As of
December 31, 2021

ATTACHMENT 2

Project Name	Project Location	Lifetime Total Project Budget	Lifetime Total Expenditures to Date	Lifetime Remaining Budget	Lifetime Total Projected Expenditures	Lifetime Total Budget Less Projected Expenditures	Lifetime Percent Complete	Status	Project on Schedule?	Note	Comments
Infrastructure Growth Capital											
Annacis Main No. 5 (Marine Crossing)	New West/Surrey	488,000,000	50,061,989	437,938,011	488,000,000	-	10%	Ongoing	N		Design delays
Annacis Main No. 5 (North)	New Westminster	51,500,000	854,555	50,645,445	51,500,000	-	2%	Ongoing	Y		
Annacis Main No. 5 (South)	Surrey	56,900,000	4,061,247	52,838,753	56,900,000	-	7%	Ongoing	Y		
Cape Horn Pump Station No. 3	Coquitlam	171,550,000	1,302,111	170,247,889	171,550,000	-	1%	Ongoing	Y		
Coquitlam Intake No. 2 & Tunnel	Coquitlam	1,181,230,000	8,105,533	1,173,124,467	1,181,230,000	-	1%	Ongoing	N		Project delayed due to value engineering optimized options.
Coquitlam Intake No. 2 (Water Treatment)	Coquitlam	1,486,000,000	887,669	1,485,112,331	1,486,000,000	-	1%	Ongoing	N		Project delayed due to value engineering optimized options.
Coquitlam Main No. 4 (Cape Horn)	Coquitlam	152,600,000	1,988,799	150,611,201	152,599,723	-	1%	Ongoing	Y		
Coquitlam Main No. 4 (Central Section)	Coquitlam	204,470,000	5,826,397	198,643,603	204,470,000	-	3%	Ongoing	Y		
Coquitlam Main No. 4 (South Section)	Coquitlam	408,250,000	6,302,346	401,947,654	408,250,000	-	2%	Ongoing	N		South Section Prebuilds delayed due to longer detailed design.
Fleetwood Reservoir	Surrey	43,367,000	6,809,477	36,557,523	43,367,000	-	16%	Ongoing	N		Project delayed due to property approval.
Grandview Reservoir Unit No. 2	Surrey	26,000,000	-	26,000,000	26,000,000	-		Not Started	Y		
Haney Main No. 4 (West Section)	Port Coquitlam	74,050,000	370,846	73,679,154	74,050,000	-	1%	Ongoing	Y		
Hellings Tank No. 2	Delta	29,411,000	5,643,855	23,767,145	29,411,000	-	19%	Ongoing	Y		
Jericho Reservoir No. 1	Langley Township	38,065,000	39,971,888	(1,906,888)	40,565,000	(2,500,000)	99%	Ongoing	Y	(c) (h)	
Kennedy Newton Main	Surrey	132,550,000	58,765,976	73,784,024	116,710,000	15,840,000	44%	Ongoing	N	(b)	Route selection delays.
Newton Pump Station No. 2	Surrey	50,800,000	5,311,398	45,488,602	50,800,000	-	10%	Ongoing	N		Property acquisition delays.
Newton Reservoir Connection	Surrey	27,050,000	-	27,050,000	27,050,000	-	0%	Not Started	Y		
Port Mann Main No. 2 (South)	Surrey	36,800,000	31,534,819	4,500,000	36,034,819	765,000	95%	Ongoing	Y		
South Surrey Main No. 2	Surrey	143,700,000	91,086	143,608,914	143,700,000	-	1%	Ongoing	Y		
South Surrey Main No. 2 Nickomekl Dam Prebuild	Surrey	2,000,000	-	2,000,000	2,000,000	-	0%	Not Started	Y		
Whalley Kennedy Main No. 2	Surrey	96,000,000	-	96,000,000	96,000,000	-	0%	Not Started	Y		
Whalley Main	Surrey	31,800,000	29,834,419	1,965,581	31,800,000	-	95%	Ongoing	Y		
		4,932,093,000	**257,724,410**	**4,674,368,590**	**4,954,787,542**	**(22,695,000)**					
Infrastructure Maintenance Capital											
Annacis Main No. 2 - Queensborough Crossover Improvement	New Westminster	1,200,000	-	1,200,000	1,200,000	-	0%	Not Started	Y	(e)	Likely not required. MOTI may not relocate Queensborough Main.
Annacis Main No. 3 BHP Potash Facility Pipe Protection	Surrey	600,000	-	600,000	600,000	-	0%	Not Started	Y	(e)	
Beach Yard Facility - Site Redevelopment	Dist of North Van	45,500,000	-	45,500,000	45,500,000	-	0%	Not Started	Y		
Boundary Road Main No. 2 & No. 3 Decommissioning	Burnaby	1,500,000	424,821	1,075,179	1,500,000	-	50%	Ongoing	Y		
Burnaby Mountain Main No. 2	Burnaby	10,200,000	-	10,200,000	10,200,000	-	0%	Not Started	Y		
Burnaby Mountain Pump Station No. 2	Burnaby	21,000,000	242,082	20,757,918	21,000,000	-	1%	Ongoing	N		Scope of work under review.
Cape Horn Reservoir Condition Assessment and Structural Repair	Coquitlam	1,550,000	-	1,550,000	1,550,000	-	0%	Not Started	Y		
Capilano Main No. 5 (South Shaft to Lost Lagoon)	Vancouver	260,000,000	12,374,911	247,625,089	260,000,000	-	5%	Ongoing	N		Delayed due to project approval timelines.
Capilano Main No. 7 Line Valve & Swing Connection	Dist of North Van	2,100,000	1,962,662	137,338	2,100,000	-	100%	Completed	Y		
Capilano Raw Water Pump Station Bypass PRV Upgrades	Dist of North Van	1,500,000	95,796	1,404,204	1,500,000	-	6%	Ongoing	Y		
Capilano Watershed Security Gatehouse	Dist of North Van	2,300,000	534,219	1,765,781	2,300,000	-	23%	Ongoing	Y		
Central Park Main No. 2 (10th Ave to Westburnco)	Burnaby	28,350,000	28,454	28,321,546	28,350,000	-	0%	Not Started	N		Delayed due to project scope review.
Central Park Main No. 2 (Patterson to 10th Ave)	Burnaby	91,900,000	32,275,586	59,624,414	91,900,000	-	35%	Ongoing	Y		
Central Park Reservoir Structural Improvements	Burnaby	1,900,000	-	1,900,000	1,900,000	-	0%	Not Started	Y		
Central Park WPS Starters Replacement	Burnaby	8,000,000	1,346,916	6,653,084	8,000,000	-	17%	Ongoing	N		Delayed due to re-zoning.
CLD & SFD Fasteners Replacement & Coating Repairs	Dist of North Van	2,100,000	1,720,354	379,646	2,100,000	-	82%	Ongoing	Y		
Cleveland Dam - Lower Outlet HBV Rehabilitation	Dist of North Van	4,900,000	2,210,055	2,689,945	4,900,000	-	75%	Ongoing	Y	(g)	
Cleveland Dam Drumgate Seal Replacement	Dist of North Van	1,250,000	269,208	980,792	1,250,000	-	22%	Ongoing	Y		
Coquitlam Pipeline Road Remediation	Coquitlam	2,000,000	1,855,820	144,180	1,856,960	143,000	100%	Completed	Y	(f)	
CWTP Ozone Sidestream Pipe Heat Trace and Insulation	Coquitlam	900,000	9,374	890,626	900,000	-	1%	Ongoing	Y		
CWTP Ozone Sidestream Pump VFD Replacement	Coquitlam	1,400,000	60,882	1,339,118	1,400,000	-	4%	Ongoing	Y		
CWTP pH, Alkalinity Upgrades	Coquitlam	1,700,000	1,684,847	15,153	1,700,000	-	99%	Ongoing	Y		
Dechlorination for Reservoir Overflow and Underdrain Discharges	Burnaby	2,700,000	245	2,699,755	2,700,000	-	0%	Not Started	Y		
Douglas Road Main No. 2 - Kincaid Section	Burnaby	12,300,000	9,705,838	2,594,162	12,300,000	-	80%	Ongoing	N		Alignment changes.
Douglas Road Main No. 2 (Vancouver Heights Section)	Burnaby	21,486,000	19,869,722	1,616,278	21,486,000	-	95%	Ongoing	N	(b)	Procurement delays.
Douglas Road Main No. 2 Still Creek	Burnaby	63,100,000	16,027,392	47,072,608	63,100,000	-	25%	Ongoing	N		Alignment changes.
Douglas Road Main Protection	Burnaby	1,500,000	14,101	1,485,899	1,500,000	-	1%	Ongoing	Y	(e)	
E2 Shaft Phase 3	Dist of North Van	16,500,000	15,535,852	964,148	16,500,000	-	95%	Ongoing	Y		
First Narrows Tunnel Isolation Chamber Improvements	Dist of North Van	7,000,000	4,341,548	2,658,452	5,000,000	2,000,000	95%	Ongoing	Y	(a)(b)	
Improvements to Capilano Mains No. 4 and 5	Dist of North Van	1,700,000	108,039	1,591,961	1,700,000	-	6%	Ongoing	Y		
Kersland Reservoir No. 1 Structural Improvements	Vancouver	6,250,000	1,025,137	5,224,863	6,250,000	-	16%	Ongoing	Y		
Little Mountain Reservoir Roof Upgrades	Vancouver	3,450,000	1,019,331	2,430,669	1,650,000	1,800,000	100%	Completed	Y	(g)	
Lulu Island - Delta Main - Scour Protection Phase 2	Richmond	3,550,000	-	3,550,000	3,550,000	-	0%	Not Started	Y	(e)	
Lulu Island - Delta Main No. 2 (Marine Crossing)	Richmond	370,000,000	-	370,000,000	370,000,000	-	0%	Not Started	Y		
Maple Ridge Main West Lining Repairs	Maple Ridge	3,500,000	190,470	3,309,530	3,500,000	-	7%	Ongoing	N		Project delayed as a result of delays on Seymour Main No. 2 Joints Improvement project.
Newton Rechlorination Station No. 2	Surrey	5,000,000	-	5,000,000	5,000,000	-	0%	Not Started	N		Project delayed to coordinate with Newton Pump Station Project.
Port Mann Main No. 1 (Fraser River Crossing Removal)	Coq/Surrey	18,500,000	255,000	18,245,000	500,000	18,000,000	100%	Completed	Y		This project is no longer required.

Metro Vancouver
Water Capital Expenditures Summary As of
December 31, 2021

ATTACHMENT 2

Project Name	Project Location	Lifetime Total Project Budget	Lifetime Total Expenditures to Date	Lifetime Remaining Budget	Lifetime Total Projected Expenditures	Lifetime Total Budget Less Projected Expenditures	Lifetime Percent Complete	Status	Project on Schedule?	Note	Comments
Port Moody Main No. 1 Christmas Way Relocation	Coquitlam	2,350,000	-	2,350,000	2,350,000	-	0%	Not Started	Y	(e)	
Port Moody Main No. 3 Dewdney Trunk Rd Relocation	Coquitlam	2,700,000	4,523	2,695,477	2,700,000	-	85%	Ongoing	Y	(e)	
Port Moody Main No. 3 Scott Creek Section	Coquitlam	12,000,000	277,851	11,722,149	12,000,000	-	4%	Ongoing	Y		
Queensborough Main Royal Avenue Relocation	New Westminster	7,500,000	8,342	7,491,658	7,500,000	-	5%	Ongoing	Y		
Rechlorination Station SHS Storage Tank Replacement	Regional	1,200,000	204,025	995,975	1,200,000	-	17%	Ongoing	Y		
Rechlorination Station Upgrades	Regional	15,000,000	407,302	14,592,698	15,000,000	-	3%	Ongoing	Y		
Rehabilitation of AN2 on Queensborough Bridge	New West/Delta	2,500,000	829,859	1,670,141	2,500,000	-	33%	Ongoing	Y		
Relocation and Protection for MOTI Expansion Project Broadway	Vancouver	8,900,000	65,004	8,834,997	8,900,000	-	1%	Ongoing	Y	(e)	
Relocation and Protection for MOTI George Massey Crossing Replacement	Delta / Richmond	2,450,000	-	2,450,000	2,450,000	-	0%	Not Started	Y	(e)	
Relocation and Protection for Translink Expansion Project Surrey Langley SkyTrain	Surrey	6,600,000	-	6,600,000	6,600,000	-	0%	Not Started	Y	(e)	
Sapperton Main No. 2 North Road Relocation and Protection	Coquitlam	6,500,000	-	6,500,000	6,500,000	-	0%	Not Started	Y		
SCFP Centralized Compressed Air System	Dist of North Van	900,000	39,769	860,231	900,000	-	4%	Ongoing	Y		
SCFP Clearwell Membrane Replacement	Dist of North Van	17,400,000	-	17,400,000	17,400,000	-	0%	Not Started	Y		
SCFP Concrete Coatings	Dist of North Van	2,500,000	2,501,262	(1,262)	2,501,262	(1,000)	100%	Completed	Y		
SCFP OMC Building Expansion	Dist of North Van	2,650,000	123,403	2,526,597	2,650,000	-	5%	Ongoing	Y		
SCFP Polymer System Upgrade	Dist of North Van	3,450,000	503,748	2,946,252	3,450,000	-	15%	Ongoing	Y		
SCFP SCADA/ICS Controller Replacement	Dist of North Van	1,400,000	-	1,400,000	1,400,000	-	0%	Not Started	Y		
South Delta Main No. 1 - Ferry Road Check Valve Replacement	Delta	600,000	106,185	493,815	600,000	-	18%	Ongoing	Y		
South Surrey Main No. 1 Nickomekl Dam Relocation	Surrey	7,100,000	-	7,100,000	7,100,000	-	0%	Not Started	N	(e)	Project delayed by City of Surrey.
South Surrey Supply Main (Serpentine River) Bridge Support Modification	Surrey	400,000	79,469	320,531	400,000	-	20%	Ongoing	Y		
Sunnyside Reservoir Unit 1 Upgrades	Surrey	8,850,000	7,894,106	955,894	7,950,000	900,000	100%	Completed	Y	(b)	
Tilbury Main North Fraser Way Valve Addition	Burnaby	3,100,000	398,828	2,701,172	3,100,000	-	13%	Ongoing	Y		
Water Chamber Improvements and Repairs	Burnaby	2,000,000	36,226	1,963,774	2,000,000	-	2%	Ongoing	Y		
Westburnco Pump Station No. 2 VFD Replacements	New Westminster	2,550,000	254,118	2,295,882	2,550,000	-	10%	Ongoing	Y		
		1,148,986,000	**138,922,683**	**1,010,063,317**	**1,128,644,222**	**20,342,000**					
Infrastructure Resilience Capital											
Barnston/Maple Ridge Pump Station - Back-up Power	Pitt Meadows	9,000,000	240,156	8,759,844	9,000,000	-	3%	Ongoing	N		Delayed due to property selection.
Burnaby Mountain Tank No. 2	Burnaby	21,650,000	64,104	21,585,896	21,650,000	-	1%	Ongoing	Y		
Burnaby Mountain Tank No. 3	Burnaby	21,400,000	-	21,400,000	21,400,000	-	1%	Ongoing	Y		
Cambie Richmond Main No. 3 (Marine Crossing)	Richmond/Van	490,250,000	2,069,434	488,180,566	490,250,000	-	2%	Ongoing	Y		
Cape Horn Pump Station 2 - Back-Up Power	Coquitlam	8,000,000	131,722	7,868,278	8,000,000	-	2%	Ongoing	Y		
Capilano Mid-Lake Debris Boom	Dist of North Van	750,000	15,610	734,390	750,000	-	2%	Ongoing	Y		
Capilano Raw Water Pump Station - Back-up Power	Dist of North Van	33,000,000	11,830,734	21,169,266	33,000,000	-	36%	Ongoing	N		Site selection delays.
Capilano Reservoir Boat Wharf	Dist of North Van	850,000	69,235	780,765	850,000	-	8%	Ongoing	Y		
Clayton Langley Main No. 2	Surrey	16,900,000	-	16,900,000	16,900,000	-	0%	Not Started	Y		
Cleveland Dam Power Resiliency Improvements	Dist of North Van	1,700,000	30,530	1,669,470	1,700,000	-	2%	Ongoing	Y		
Cleveland Dam Seismic Stability Evaluation	Dist of North Van	800,000	-	800,000	800,000	-	0%	Not Started	Y		This project phase to start in 2022 after completion of the CLD Canyon Amplification/Concrete Dam Analysis project
Coquitlam Intake Tower Seismic Upgrade	Coquitlam	26,000,000	1,431,915	24,568,085	26,000,000	-	6%	Ongoing	Y		
Critical Control Sites - Back-Up Power	Regional	1,800,000	-	1,800,000	1,800,000	-	0%	Not Started	Y		
CWTP Ozone Back-up Power	Coquitlam	7,450,000	-	7,450,000	7,450,000	-	0%	Not Started	Y		
Emergency Power Strategy for Regional Water Facilities	Regional	400,000	158,699	241,301	400,000	-	40%	Ongoing	Y		
Grandview Pump Station Improvements	Surrey	2,600,000	387,271	2,212,729	2,600,000	-	15%	Ongoing	Y		
Haney Main No. 4 (Marine Crossing)	P.Coq/P.Meadows	390,250,000	235,112	390,014,888	390,250,000	-	1%	Ongoing	Y		
Mackay Creek Debris Flow Mitigation	Dist of North Van	9,700,000	9,115,257	584,743	9,700,000	-	98%	Ongoing	N		Delays due to challenging ground conditions.
Pebble Hill Pump Station Seismic Upgrade	Delta	1,800,000	-	1,800,000	1,800,000	-	0%	Not Started	N	(d)	Coordinating with City of Delta.
Pebble Hill Reservoir No. 3 Seismic Upgrade	Delta	9,500,000	361,525	9,138,475	9,500,000	-	4%	Ongoing	Y		
Pebble Hill Reservoir Seismic Upgrade	Delta	14,800,000	1,342,314	13,457,686	12,800,000	2,000,000	15%	Ongoing	N	(b)	Design delays due to geotechnical conditions.
Reservoir Isolation Valve Automation	Regional	6,450,000	1,192,875	5,257,125	6,450,000	-	18%	Ongoing	N		Delayed due to scope refinement.
Scour Protection Assessments and Construction General	Regional	4,000,000	-	4,000,000	4,000,000	-	0%	Not Started	Y		
Second Narrows Crossing (Tunnel)	Burnaby/DNV	468,550,000	279,843,998	188,706,002	468,550,000	-	60%	Ongoing	Y		
Seymour Falls Boat Wharf	Dist of North Van	800,000	65,345	734,655	800,000	-	11%	Ongoing	Y		
Seymour Lake Debris Boom	Dist of North Van	800,000	287,175	512,825	800,000	-	36%	Ongoing	Y		
Seymour Main No. 2 Joint Improvements	Dist of North Van	5,252,000	663,540	4,588,460	5,252,000	-	16%	Ongoing	N		Work delayed to coordinate with Broadway Skytrain relocation work.
Seymour Main No. 5 III (North)	Dist of North Van	236,900,000	5,019,663	231,880,337	236,900,000	-	2%	Ongoing	Y		
Seymour Reservoir Mid-Lake Debris Boom	Dist of North Van	2,300,000	1,230,676	1,069,324	2,300,000	-	54%	Ongoing	Y		
Sunnyside Reservoir	Surrey	19,300,000	7,556,887	11,743,113	19,300,000	-	50%	Ongoing	Y		
Vancouver Heights System Resiliency Improvements	Burnaby	1,500,000	6,661	1,493,339	1,500,000	-	0%	Not Started	Y		
Westburnco Pump Station - Back-up Power	New Westminster	23,500,000	1,238,752	22,261,248	23,500,000	-	5%	Ongoing	N		Design delay, scope modification.
		1,837,952,000	**324,589,191**	**1,513,362,809**	**1,835,952,000**	**2,000,000**					
Infrastructure Upgrade Capital											
CWTP Ozone Generation Upgrades for Units 2 & 3	Coquitlam	7,000,000	3,271,087	3,728,913	7,000,000	-	47%	Ongoing	N		Delay due to operational requirements.
Lower Seymour Conservation Reserve Learning Lodge Replacement	Dist of North Van	5,000,000	876,931	4,123,069	5,000,000	-	18%	Ongoing	Y		
Online Chlorine Monitoring Stations	Regional	4,150,000	-	4,150,000	4,150,000	-	0%	Not Started	Y		

Metro Vancouver
Water Capital Expenditures Summary As of
December 31, 2021

ATTACHMENT 2

		Lifetime									
Project Name	**Project Location**	**Total Project Budget**	**Total Expenditures to Date**	**Remaining Budget**	**Total Projected Expenditures**	**Total Budget Less Projected Expenditures**	**Percent Complete**	**Status**	**Project on Schedule?**	**Note**	**Comments**
Sapperton Main No. 1 New Line Valve and Chamber	New Westminster	3,800,000	977,716	2,822,284	3,800,000	-	26%	Ongoing	N		Tie-ins delayed.
South Delta Main No. 1 - 28 Ave to 34B Ave	Delta	22,650,000	20,708,558	1,941,442	22,650,000	-	100%	Completed	N		Construction delays due to unforeseen environmental and geotechnical conditions.
South Delta Mains - 28 Ave Crossover	Delta	10,500,000	10,439,252	60,748	10,500,000	-	99%	Ongoing	N		Utility conflicts and additional scope of work.
Tilbury Junction Chamber Valves Replacement with Actuators	Richmond	5,600,000	4,542,070	1,057,930	5,600,000	-	81%	Ongoing	N		Tie-ins delayed due to railway permitting requirements.
Water Meter Upgrades	Regional	22,400,000	5,437,226	16,962,774	22,400,000	-	24%	Ongoing	N		Procurement delays.
Water Optimization - Flow Meters (Non-billing) Phase 1	Regional	16,500,000	-	16,500,000	16,500,000	-	0%	Not Started	Y		
Water Optimization - Flow Meters (Non-billing) Phase 2	Regional	19,500,000	-	19,500,000	19,500,000	-	0%	Not Started	Y		
Water Optimization - Instrumentation	Regional	11,400,000	-	11,400,000	11,400,000	-	0%	Not Started	Y		
Water Optimization Automation & Instrumentation	Regional	9,540,000	8,018,834	1,521,166	9,540,000	-	84%	Ongoing	N		Procurement delays.
		138,040,000	**54,271,675**	**83,768,325**	**138,040,000**	**-**					
Opportunity Capital											
Capilano Hydropower	Dist of North Van	114,250,000	218,368	114,031,632	114,250,000	-	1%	Ongoing	N		Project currently on hold.
		114,250,000	**218,368**	**114,031,632**	**114,250,000**	**-**					
Grand Total Water Capital		**8,171,321,000**	**775,726,327**	**7,395,594,673**	**8,132,374,000**	**38,947,000**					

Notes:

(a) Contingency not required.
(b) Construction costs lower than estimated.
(c) City of Surrey share - 33.72%, Township of Langley share - 66.28%.
(d) Cost sharing proposal with City of Delta
(e) Project start is dependent on a 3rd party. External agency yet to begin work.
(f) GVWD Cost Share City of Coquitlam, Fortis and BC Hydro
(g) Extent of construction scope less than originally anticipated.
(h) Design change/consutant

GVWD Capital Project Status Information

December 31, 2021

GREATER VANCOUVER WATER DISTRICT

Major GVWD capital projects are generally proceeding on schedule and within budget. The following capital program items and exceptions are highlighted:

Infrastructure Growth Program

- **Annacis Main No. 5 (Marine Crossing)** – A 2.3 km long, 4.5 metre diameter water supply tunnel is required under the Fraser River to meet growing water demand south of the Fraser and to provide increased system resiliency. Detailed design, and property acquisition are complete. The construction contract was awarded in late October 2021, and construction will commence in March 2022.

- **Annacis Main No. 5 (South)** – This project comprises approximately 3.0 km of 1.8 metre diameter steel pipe connecting the south shaft of the Annacis Water Supply Tunnel to the Kennedy Reservoir in the City of Surrey. Preliminary design has been completed and detailed design is in progress and expected to be complete in February 2022.

- **Cape Horn Pump Station No. 3** – Cape Horn Pump Station No. 3 with a back-up power system, will supplement the existing pump station to deliver Coquitlam source water to meet growing demand in the areas south of the Fraser River. Preliminary design of the new station started in Q1 2020 and is nearing completion. The RFP for detailed design and construction engineering services will be issued by end of Q1 2022

- **Coquitlam Intake No. 2** – A new intake, tunnel and treatment plant are proposed at the Coquitlam Reservoir to increase the regional supply from this source and meet growing future demand. A Value Engineering Optimization exercise, completed in early 2021, confirmed a preferred project option of a North Intake with Smaller Initial Filtration Treatment, which was endorsed by the Board. The Final Project Definition Report has been submitted for review. The project is now in the permitting and regulatory phase, which will focus on engagement with First Nations and stakeholders.

- **Coquitlam Main No. 4** – This 12 km long steel water main, consisting of the Central, South, South Tunnel and Cape Horn Sections, will increase the transmission capacity from the Coquitlam source to the Cape Horn Pump Station and Reservoir in the City of Coquitlam. This project is required to address capacity constraints in the existing Coquitlam transmission system and also provide additional transmission capacity for the Coquitlam Intake No. 2. Detailed design of the Central, South and Cape Horn Sections continues. Preliminary design of the South Tunnel Section is underway. Construction of the South Section Prebuild will commence in Q4 2022.

- **Fleetwood Reservoir** – Phase 1 of the Fleetwood Reservoir project includes a 13.6 ML reservoir, valve chamber, piping, access building and associated work located at Meagan Ann MacDougall Park in the City of Surrey. The City of Surrey has finalized the Property Lease Agreement and a Coordinated Works Agreement to include a portion of the city water main in the tender package and they are currently reviewing the building permit application. The construction tender has closed and will go

before the Board in March for award approval. Construction is expected to commence in Q2 2022.

- **Jericho Reservoir** – Phase 1 of the Jericho Reservoir project includes a 20.6 ML reservoir, chambers, piping and associated work located at 20400 73A Avenue in the Township of Langley. Construction is substantially complete with minor deficiencies remaining. The reservoir is currently in service.

- **Kennedy Newton Main** – This project comprises approximately 9.0 km of 1.8 metre diameter steel water main between the Kennedy Reservoir and the Newton Reservoir in the City of Surrey and is divided into 3 phases. Construction of Phase 1, between 72nd Avenue and 84th Avenue, is complete. Construction of Phase 2, between 72nd Avenue and Newton Reservoir commenced in September 2020 and is nearing completion. Design of the remaining Phase 3, from 84th Avenue to Kennedy Reservoir, is complete with the construction tender to be released in Q1 2022.

- **Newton Pump Station No. 2** – This project, located at 6287 128th Street in the City of Surrey, consists of replacing the existing Newton Pump Station and includes full back-up power redundancy, connections to existing and future infrastructure, and installation of new outlets to the existing Newton Reservoir. The detailed design is in progress with completion expected in Q1 2022. Construction of the new reservoir outlets is anticipated to start in fall 2022 with the main pump station construction planned in spring 2023.

- **Port Mann Main No. 2 (South)** – This 2.8 km long, 1.5 metre diameter steel water main will twin the existing Port Mann Main No. 1 between the south shaft of the Port Mann Water Supply Tunnel and the Whalley Main in the City of Surrey. The project is required to meet growing water demand south of the Fraser River. The water main installation and commissioning are now complete and the new main is now in service.

- **Whalley Main** – This 2.0 km long, 1.5 metre diameter steel main will twin the existing Whalley Clayton Main between the Whalley Reservoir and the Whalley Kennedy Link Main in the City of Surrey. The water main installation and commissioning are now complete and the new main is now in service.

Infrastructure Maintenance Program

- **Douglas Road Main No. 2 – Still Creek Section** - This project comprises approximately 2.5 km of 1.5 metre diameter steel pipe with trenchless crossings of Highway 1, Still Creek and the BNSF rail line. The water main alignment has been finalized in consultation with the City of Burnaby. The Project is planned to be constructed in three phases, with the North Open Cut Section and the Trenchless Crossing Section currently under construction. Design of the South Open Cut Section is underway.

- **Douglas Road Main No. 2 – Vancouver Heights Section** - This project comprises approximately 2.0 km of 1.5 metre diameter steel pipe connecting the Vancouver Heights Reservoir to the Douglas Road Main No. 2 at Beta Avenue and Albert Street in the City of Burnaby. The installation construction contract is complete. Final tie-ins and commissioning are planned for fall 2022.

- **Central Park Main No. 2 – Patterson to 10th Ave** - This project comprises approximately 7.0 km of 1.2 metre diameter steel pipe connecting the Central Park Pump Station in Burnaby to the existing Central Park Main in New Westminster at 10th Avenue. The water main is divided into three phases with the 500 m long Maywood Pre-build completed in December 2020. Construction of Phase 1 of the project commenced in October 2020 with completion anticipated in mid-2022. Design of Phase 2 is underway and is expected to be complete in summer 2022.

- **Capilano Main No. 5 (Stanley Park Section)** – This 1.4 km long steel water main, in a tunnel, will replace the aged existing Capilano Main No. 4 through Stanley Park to meet growing water demand and provide increased system resiliency. Detailed design is nearing completion. Work to secure permits and land agreements is on-going. The procurement phase for construction is scheduled to commence in April or May 2022, with construction anticipated to start in 2023.

Infrastructure Resilience Program

- **Mackay Creek Debris Flow Mitigation** – Construction commenced in spring 2019 and was completed in March 2020. Site restoration was completed in late 2021.

- **Second Narrows Water Supply Tunnel** – This project comprises a 1.1 km long, 6.5 metre diameter water supply tunnel under Burrard Inlet, between North Vancouver and Burnaby, to increase the reliability of supply in the event of a major earthquake and provide additional long-term supply capacity. Construction commenced in early 2019. Construction of the north and south shafts is complete. The Tunnel Boring Machine began tunnel excavation in the fall of 2020 and the tunnel was completed in fall 2021. Construction of the south valve chamber and installation of the steel water mains inside the tunnel commenced in late 2021. Overall construction is scheduled to be complete by late 2023, followed by site restoration and final tie-ins and commissioning in 2024 and 2025.

- **Capilano Raw Water Pump Station – Back-up Power** – This project consists of installing diesel generators to provide 8 MW of back-up power to the pump station. A portion of the equipment has already been delivered and the design for the construction tender is nearing completion. Construction is anticipated to start in early fall 2022 with overall project completion in 2024.

- **Coquitlam Intake Tower Seismic Upgrade** – The Coquitlam Intake Tower is located in the southeast corner of the Coquitlam Reservoir. Constructed in 1913, the tower provides the GVWD its primary intake of water from Coquitlam Reservoir. The Tower is a 27 metre-high and 5.5 metre diameter unreinforced concrete structure, founded on bedrock. Detailed design of the seismic upgrade is 75% complete. Completion of detailed design is expected in Q2 of 2022. Due to coordination with BC Hydro work and water supply operations, construction will be completed over two winter periods 2024 to 2026.

- **Pebble Hill Reservoir No. 1, 2 and 3 Seismic Upgrade** – Pebble Hill Reservoir in south Delta is comprised of three units. Construction is scheduled to be completed in stages, taking only one unit out of service at any time. Construction of Unit 1 is ongoing and will finish in the summer of 2022. Unit 2 will commence in the fall of 2022 and finish in the summer of 2023. A separate tender will be issued for Unit 3 which is not expected to start until 2025.

- **Westburnco Pump Station – Back-up Power** – This project consists of installing diesel generators to provide 5 MW's of back-up power to the pump station. Preliminary design was completed in 2019 and detailed design is underway.

- **Cambie-Richmond Water Supply Tunnel** – This project comprises an approximately 1 km long 4.5 m diameter tunnel under the Fraser River between the City of Vancouver and the City of Richmond to increase the reliability of supply in the event of a major earthquake and provide additional long-term supply capacity. Conceptual design commenced in 2019 and is almost complete. Preliminary design is scheduled to commence later this year.

Infrastructure Upgrade Program

- **Coquitlam Ozone Upgrade** – This project consists of upgrades to the ozone generators at the Coquitlam Water Treatment Plant. The generators for units 1, 2 and 3 have been replaced and units 1 and 2 are in service. Testing and commissioning of unit 3 is scheduled for Q1 2022. Completion of the upgrades to the ozone control system will follow.

47359063

To: Water Committee

From: Jesse Montgomery, Division Manager, Environment, Water Services

Date: March 1, 2022 Meeting Date: April 6, 2022

Subject: **2021 Contribution Agreement Annual Reports - Seymour Salmonid Society and Coquitlam River Watershed Roundtable**

RECOMMENDATION

That the Water Committee receive for information the report dated March 1, 2022, titled "2021 Contribution Agreement Annual Reports - Seymour Salmonid Society and Coquitlam River Watershed Roundtable".

EXECUTIVE SUMMARY

The Seymour Salmonid Society (SSS) operates the Seymour River Hatchery on Greater Vancouver Water District (GVWD) land and conducts comprehensive area stewardship activities. The GVWD and SSS have been partners since 1989. The GVWD has a current three-year (2021 – 2023) Contribution Agreement with the SSS for $125,000 annually. The SSS released over 500,000 juvenile salmonids into local waterways in 2021.

The Coquitlam River Watershed Roundtable (CRWR) has a mission "To preserve and enhance the health of the Coquitlam River Watershed through collaboration, education and advisory action". The GVWD has a three-year (2020 – 2022) Contribution Agreement to the CRWR for $34,000 annually. The CRWR took action on stormwater management engagement in 2021 and constructed a demonstration rain garden in Port Coquitlam.

The SSS and CRWR have met the requirements of the respective GVWD Contribution Agreements in 2021. The two attached annual reports provide an overview of the programs in 2021.

PURPOSE

To provide the Committee and Board with the SSS's and CRWR's 2021 annual reports in accordance with the contribution agreements between the GVWD and these two non-profit societies contributing to regional environmental stewardship.

BACKGROUND

In 2014, the first three-year Contribution Agreement from the GVWD to SSS was drafted to formalize a historic funding arrangement. At its October 2, 2020 meeting, the GVWD Board adopted the following resolution to renew the agreement for a third consecutive three-year term:

> *That the GVWD Board approve the renewal of the Contribution Agreement between the Greater Vancouver Water District and the Seymour Salmonid Society for a three-year term, and annual contribution amount of $125,000, commencing on January 1, 2021 and ending on December 31, 2023.*

A three-year Contribution Agreement, the first between the GVWD to CRWR, was approved in 2020 to provide funding via the Watershed Watch Salmon Society (acting as Financial Trustee). At its November 1, 2019 meeting, the GVWD Board adopted the following resolution:

> *That the GVWD Board approve the Contribution Agreement between the Greater Vancouver Water District and the Watershed Watch Salmon Society for a three-year term and annual contribution of $34,000 commencing on January 1, 2020 and ending on December 31, 2022.*

A requirement of the contribution agreement with each society is to submit an annual report on its activities to the GVWD by January of the following year. This report provides the annual update of the societies as identified in the 2022 Water Committee Work Plan. Operations for both societies in 2021, particularly as it pertains to public engagement and education initiatives, continued to be impacted by public health restrictions due to the COVID 19 Pandemic.

SEYMOUR SALMONID SOCIETY HISTORY

The Seymour River Hatchery is located on GVWD land near the base of the Seymour Falls Dam. The hatchery commenced operations in 1977 in response to declining fish stocks in the Seymour River and Burrard Inlet. The hatchery was managed by the BC Institute of Technology (BCIT) for the first decade of operation. The SSS was formed in 1987 to oversee hatchery operations, volunteer activities and educational programming. Initially, solely funded by Fisheries and Oceans Canada (DFO), the GVWD began contributing to the core funding for the SSS in 1996. The relationship between the GVWD, DFO and the SSS has been highly collaborative since the hatchery facility was established.

Seymour Salmonid Society Contribution Agreement Funding

The SSS utilized core funding from the GVWD and DFO to administer regular hatchery operations in 2021. They also leveraged an additional $405,659 primarily from the BC Salmon Restoration and Innovation Fund, and the Habitat Conservation Trust fund to continue rock breaking activities at the 2014 Seymour River Canyon rockslide site. These funders along with a number of other community stewardship supporters further contributed to equipment upgrades for hatchery infrastructure, educational initiatives, and other operational objectives.

COQUITLAM RIVER WATERSHED ROUNDTABLE HISTORY

The CRWR was formed in 2011 with roots back to a Coquitlam River Watershed Strategy from 2007 developed by a number of local stakeholders. The group completed a *Lower Coquitlam Watershed Plan* in 2014 and identified action plans and implementation strategies which have been ongoing since 2016. Priorities of the CRWR pertain to advocacy and actions contributing to improvements in development practices, stormwater and invasive species management.

Coquitlam River Watershed Roundtable Contribution Agreement Funding

The CRWR primarily utilized the GVWD funding to support the full-time Roundtable Coordinator position and public outreach activities. Ongoing partnership funding was received from the Kwikwetlem First Nation, City of Coquitlam and the City of Port Coquitlam, and additional short term funding was received from Fisheries and Oceans Canada and several stewardship-minded business organizations.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

The GVWD is a primary contributor to the SSS and CRWR, providing $125,000 annually through 2023, and $34,000 annually through 2022 respectively, within the Watersheds & Environment Program budget. Renewal requests for subsequent contribution agreements are expected to be received from both organizations and will be brought forward to the Board for consideration.

CONCLUSION

Under the terms of the contribution agreement with the GVWD, the SSS and CRWR are required to submit annual reports on their activities for the prior year. Despite ongoing challenges with the COVID 19 Pandemic and associated gathering restrictions, particularly in community engagement and public education, both organizations fulfilled the obligations of their respective contribution agreements.

Attachments

1. Seymour Salmonid Society's 2021 Annual Report for Greater Vancouver Water District *(50160639)*
2. Coquitlam River Watershed Roundtable's 2021 Annual Report for Greater Vancouver Water District *(50271806)*

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ATTACHMENT 1

2021

Seymour Salmonid Society's Annual Report For Greater Vancouver Water District

Seymour Salmonid Society

PO Box 52221, North Vancouver, V7J 3V5

12/20/2021

SEYMOUR
SALMONID
SOCIETY

Mission Statement

To enhance Seymour River salmon and educate the public about the importance of the river as a resource for drinking water, wildlife and the forest.

SEYMOUR SALMONID SOCIETY

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Executive Summary

Acknowledgements

The Seymour Salmonid Society (SSS) would like to recognize the significant annual contribution of $125,000 for the period to December 31, 2023 by the Greater Vancouver Water District (GVWD) to support enhancement and education efforts at the Seymour Hatchery. The money that GVWD contributes to the hatchery operations allows the SSS to leverage monies from other sources, including Fisheries and Oceans Canada (DFO) and other external funding sources. These contribute to a significant proportion of our annual operating budget.

We would also like to thank significant financial contributions from BC Salmon Restoration and Innovation Fund (BCSRIF), the Habitat Conservation Trust Foundation (HCTF) and the Pacific Salmon Foundation (PSF) in 2021. These funds were generously provided for the rockslide mitigation project, enhancement activities, hatchery operations and equipment improvements. We are also grateful for the ongoing support by the DNV Firefighters Charitable Society, Neptune Terminals, CN Rail and BC Gaming for our community education programs and for the many community donations provided by local individuals and stakeholders during 2021.

We would also like to thank GVWD, DFO and the District of North Vancouver for their ongoing support with staff hours or in-kind contributions for hatchery operations. We would also like to acknowledge the BC Ministry of Forests, Lands, and Natural Resource Operations and Rural Development (FLNRORD) for their ongoing support of our steelhead program.

We are most grateful for the contribution by our over 900 registered volunteers, who are an integral part of the operation of the hatchery and SSS. This includes Sarah Leslie and Katelynn Hansell from BCIT who worked on our radio telemetry monitoring program in the lower river as part of their second year Fish, Wildlife and Recreation Diploma Program. Without the significant community involvement, our staff would not be able to accomplish a fraction of what is completed at the hatchery or the work we do in the watershed.

COVID-19

The pandemic's ongoing restrictions effected our normal community outreach activities, but with the relaxing of some restrictions we were able to welcome our volunteers during 2021 at the hatchery and within the watershed. The pandemic resulted in cancellation of our annual community events, including Blueridge Days Festival, the chum fry release at Maplewood Farm, O.W.L Community Event, Family Fishing Day, Hatchery Open House and the Coho Festival. The steps we took included self monitoring prior to arrival at the hatchery, physical distancing while at the hatchery or assisting in activities in the watershed, regular hand hygiene and use of personal protective equipment including masks within confined areas.

Habitat Conservation and Enhancement

The SSS and its partners have continued to work hard to mitigate the effects of the rockslide in 2021 and have confirmed that adult salmon and steelhead are continuing to successfully migrate through the Seymour Canyon to spawn within the river upstream, albeit only at certain flow conditions. We completed work at Junior Creek Enhancement Area with significant support from GVWD and DFO and will continue to monitor the inlet channel to ensure it maintains flows into the habitat ponds throughout the winter and spring 2022. Despite the natural challenge of the rockslide over the past six years, and thanks to GVWD's continued support, fish populations on the Seymour River have a realistic long-term future within the watershed.

Broodstock Collection and Production

We released 10,000 fed fry above the Seymour Falls Dam in May, along with 51 coho adults in November. A total of 372,238 chum fry comprising approximately 43,673 Seymour origin and 328,565 Alouette origin were released in the lower river in May. Smolt releases were successful for both our coho and summer/winter run steelhead, with 55,807 coho smolts released from the hatchery into Hurry Creek, and 32,644 steelhead smolts transported to West Vancouver laboratory and released directly into the ocean.

This year saw our broodstock anglers out regularly during the summer and fall periods for steelhead, coho, pink and chum salmon. This was in addition to the five hatchery pool seine events to collect adult broodstock. We spawned 74 pairs of coho, 7 pairs of chum and 112 pairs of pink salmon from the Seymour River. We have also collected 444,110 Alouette River chum eggs for our broodstock program. We continue to search for summer and winter run steelhead adults in preparation for spawning in spring 2022. We are also continuing the egg incubation activities to ensure sufficient fry and smolt production for the coming year ahead.

Environmental Monitoring

Radio telemetry studies commenced to monitor progress of the rockslide remediation project and passage of returning adults to the spawning grounds above the rockslide. A total of 20 adult coho had gastric radio tags installed and released downstream of the rockslide. The tagged fish were monitored using two primary identification approaches, these being four fixed receiver telemetry stations and mobile telemetry tracking both upstream and downstream of the rockslide. We did not register any tagged fish upstream of the rockslide during the monitoring period, but regularly tracked fish downstream of the rockslide. It is interesting that no tagged fish were encountered upstream of the rockslide in 2021, especially given the number of salmonids captured during broodstocking upstream of the rockslide.

Hatchery staff also undertook mark and recapture activity during broodstock collection, along with carcass recovery surveys in October. A total of 161 fish that were captured during our hatchery pool seine events and had their left operculum punched before being released back to the hatchery pool. This mark and recapture process is then used during carcass recovery activity to estimate the total number of adult coho returning to the river in 2021. To date we have identified 35 coho carcasses during surveys, with seven having had the left operculum punch. Thus, the estimated coho returns during 2021 is 805 ± 460 fish.

Community Outreach and Education

Due to the restrictions associated with COVID-19, the SSS cancelled annual community events, including Blueridge Days Festival, the chum fry release at Maplewood Farm, O.W.L Community Event, Family Fishing Day, Hatchery Open House and the Coho Festival However, with the loosening of COVID restrictions we were able to welcome a greater number of our community volunteers to the hatchery for activities such as fin clipping, rive seine events and the fertiliser release program. In addition, the District of North Vancouver Firefighters were able to hold their annual Fishing Derby during September, albeit in a socially reduced capacity. The only community event we were able to hold in 2021 was to celebrate International Rivers Day, where we organised an estuary clean-up and replanting at the river mouth at the end of September. With help from GVWD staff and volunteers from the SSS, a significant amount of invasive plant species was removed and replaced with native shrubs and tree species. A large amount of trash was also removed from the estuary area.

The Spring and Fall in-person education program under our Gently Down the Seymour (GDS) program had to be cancelled again due to COVID restrictions. However, we were able to operate our online education program called Zoom in on the Seymour (ZIS) to 55 classes in the Spring and 31 during the Fall. This resulted in 1,765 elementary school children enjoying the ZIS program. We are hopeful that 2022 will provide the opportunity to run our GDS program again for Grade 2-6 students.

Hatchery Infrastructure Upgrades and Maintenance

We were able to install our new feed-storage container at the hatchery, thereby providing a food storage system that is not only secure to environmental conditions, but also to wildlife. We were also able to continue our ongoing equipment maintenance and replacement program. These facility upgrades also provided safe, warm and visually appealing facilities for our hatchery staff, volunteers and visitors coming to the hatchery in 2021, while also reducing the health and safety risks to the hatchery staff.

Human Resources

The following provides an overview of the hatchery facility staffing and governance for the Seymour Salmonid Society.

Board of Directors

President	Shaun Hollingsworth
Treasurer	Darren Radons
Secretary	Graeme Budge
Directors	Stephen Vincent
	Nick Martinovic
	Dee-Dee Soychuke
	Brian Halabourda
	Naomi Yamamoto
	Kyla Jeffrey
	Glen Parker
	Mark Whorrall
	Sean Ramsden
	Derek James

Hatchery Staff

Marc Guimond: Executive Director & Hatchery Manager

Marc grew up in Toronto and attended the University of Guelph, earning a degree in Biological Sciences in 1995. In 1997 he moved to Vancouver and volunteered at the Vancouver Aquarium teaching students about marine invertebrates. The following year, Marc joined the SSS and has been overseeing all aspects of salmonid production and monitoring for over 20 years.

Reece Fowler: Environmental Coordinator

Reece was born and raised on the banks of the Whanganui River in New Zealand. He attended Massey University in Palmerston North (NZ), gaining a Bachelor of Science (BSc) in 1995, before completing a Doctorate in Freshwater Ecology in 2000. After university, Reece went on to work in the environmental consultancy sector for over 16 years, before volunteering at the hatchery in 2017 and joining the SSS in May 2018.

Sasha Gale: Program Coordinator

Sasha grew up on the BC Coast. She obtained a diploma in Environmental Studies from Langara College in 2009 and continued her studies at BCIT in 2010 in the Fish, Wildlife and Recreational Management program. After receiving her diploma, she went on to complete a Bachelor of Science in Ecological Restoration in 2015. She worked on the Estuary Projects on the North Shore and as an Environmental Consultant for the City of Richmond prior to being hired at the Seymour Hatchery in January 2016.

Megan Samson: Seasonal Fisheries & Monitoring Technician

Megan was born in Vancouver and raised in White Rock before pursuing her interest in science at BCIT. She completed her diploma in Fish, Wildlife and Recreational Management in 2021 and worked for Freshwater Fisheries Society of BC at the Nechako White Sturgeon Conservation Centre in Vanderhoof (BC) following her diploma, before joining the SSS in August to assist with hatchery operations and radio telemetry monitoring.

Significant Weather Events

The Seymour River had multiple significant flow events in Fall 2021 that resulted in sustained high flows through the Seymour Canyon and rockslide area. The significant peak flows as measured from the Grantham Street Bridge flow gauge were on September 30th (352m^3s), October 17th (276m^3s), November 15th (502m^3s), November 28th (277m^3s) and December 1st (263m^3s). The November 15th flow event coincided with the weather system that resulted in significant flooding in the Sumas Prairie in the Fraser Valley. Figure 1 shows a before and during photo of the rockslide during the highest flow event on November 15th, while Figure 2 shows the rockslide as it currently exists.

FIGURE 1 SEYMOUR ROCKSLIDE BEFORE (LEFT) AND DURING (RIGHT) THE 502 M^3/S FLOW EVENT

The series of high flow events during fall 2021 resulted in mobilization of additional material within the rockslide areas, with early indications suggesting that it has benefitted fish passage through the Seymour canyon and rockslide area. We will continue to monitor the rockslide and canyon throughout winter and spring 2022 to better understand whether fish passage is possible during all flow conditions.

FIGURE 2 SEYMOUR ROCKSLIDE ON DECEMBER 14, DURING AVERAGE FLOWS

Habitat Conservation and Enhancement

Hatchery staff supported by DFO and GVWD undertook a series of habitat activities within the watershed during 2021. The following provides an overview of activities undertaken based on habitat area:

Seymour Rockslide Remediation Project

The objective of the 2021 work was to continue rock breaking activities to create and improve a wetted channel through the rockslide area during all flow conditions. Rock breaking activities began on August 3rd, with the primary aim of establishing a primary channel on river-right to enable fish passage during low-medium river flows, along with a secondary channel on river-left for passage during higher river flows. In-river works comprised:

- Rock drilling and small level rock breaking activities within the house rock rubble pile to break down the large boulders into smaller boulders
- Wedge and feather method of cracking boulders during high to extreme fire danger ratings in summer 2021
- Pneumatic rock breaking of smaller boulders into basketball sized rocks
- Using expanding grout to crack and break up larger boulders
- Using air bags and manual manipulation to push larger boulders within the rockslide to establish the primary and secondary primary channel
- Manual manipulation, side casting and using scaling bars to move smaller boulders within rubble pile
- Lowering of the former house rock rubble pile along a longitudinal distance of 20 - 30m through the rockslide

Note that Nxburst was not required during rock breaking and moving activities in 2021. In addition, mitigation activities were not required at The Well site this year as the activities during 2020 were completed and confirmed that fish passage was possible though this area of the river. All equipment for the rock moving activities was sourced via the professional engineers commissioned on the project, with in-river rock moving activities completed on September 3rd (Figure 3).

Following the 2021 rock moving activities and monitoring surveys (i.e., visual observations and radio telemetry monitoring of returning adults), we confirm that passage for adult coho salmon and summer run steelhead was possible through the rockslide at certain river flows. Although we are yet to confirm the actual number of fish that moved through the canyon in 2021 (i.e., as carcass recovery counts continue into January 2022), we successfully seine netted 351 coho from the hatchery pool, broodstock angled nine summer run steelhead and over 40 coho above the rockslide this year. We also visually observed good numbers of spawning coho salmon in the tributaries and habitat enhancement sites during our ongoing carcass recovery works. We are continuing our carcass recovery operations with the aim of improving our estimate of fish successfully migrating into the upper river to spawn naturally.

Our observations this year suggest that the number of adult coho and summer run steelhead moving through the rockslide was higher this year than in 2020 and likely due to improved fish passage through the canyon area. As part of this, the high flow events during the September to November period provided benefit by moving rock debris and improving the fish passage through the Seymour canyon area.

FIGURE 3 SEYMOUR ROCKSLIDE FOLLLOWING COMPLETION OF MITIGATION WORKS

In addition, we were able to broodstock coho, pink and chum salmon in the lower river due to significant effort provided by our volunteer broodstock anglers during the August to November period. We successfully broodstock angled 399 pink salmon and 27 chum salmon in the lower river, along with 95 coho salmon for use in our broodstock program (refer Table 1). In addition, we observed a reasonable number of chum and pink salmon spawning in the lower river, along with coho salmon within tributary streams in the upper watershed as well as the lower river.

Once water levels recede in spring 2022, geotechnical engineers will again survey the canyon area to understand the movement of debris over the 2021/22 winter period. SSS staff are also aiming to undertake drift-dive activities during the winter period to better understand the underwater conditions throughout the Seymour canyon area, and to identify locations where summer and winter run steelhead may be holding in the upper river. Following this, a work plan will be established for any instream activities that may be required during the summer 2022.

Fish Above Seymour Falls Dam Project

Coho salmon once migrated up the Seymour River to habitat that is now isolated upstream of Seymour Falls Dam. In 2019 the SSS, DFO and GVWD successfully collaborated on an agreement to enable transport of adult salmon above the dam, so they can once again spawn and rear in the upper watershed. The aim of the project is to focus transport on the early run coho, since it is this portion of the adult returns that would have likely migrated above the Seymour Falls during the higher freshet flows. Of note, the former Seymour Falls is now part of the existing Seymour Dam.

The agreement allows the release of up to 400 adults above the dam each year. This figure is based on the Bradford's bio-standard of 85 smolts/female and a target of producing 17,000 wild smolts from natural habitat above dam each year. Annual wild spawned fry releases will be augmented by up to 40,000 hatchery fed fry above the dam. This will continue until it is possible to release more than 200 adults above the dam each year. After which the plan would be to reduce hatchery fed fry releases accordingly.

Ultimately, we would like to reach a point where 400 adults are transported above the dam annually, thereby negating the need to augment with any hatchery fed fry.

Transporting adult coho above the dam would partially mitigate the historic impact of dam construction and re-establish wild salmonid stocks in a pristine area that is more resilient to future stressors such as climate change given the lower water temperatures in the upper watershed. The number of adult coho being transported above the dam annually is determined by the number of adult fish returning to the river, along with the number of fish we can collect as part of our broodstock program.

On November 19th and December 3rd, with the assistance of GVWD staff, the SSS transported 51 adult early run coho salmon to the Seymour River above the dam. These fish were captured during river seining events at the hatchery pool a short distance downstream of the dam and were retained at the hatchery until sufficient fish were secured for our broodstock program. The fish were released at the 21km mark in the upper watershed at a location known locally as Rustad Branch. Each fish was transferred via catch net from the hatchery truck tank and released directly to the river.

River Fertilization Project

The Program was originally initiated by the province to mitigate for the possible impacts of the Seymour Falls Dam on the downstream habitat of summer-run juvenile steelhead, and to make up for poor ocean conditions for salmon resulting in reduced adult returns. The prevailing thought is that the over-wintering period for juvenile steelhead is a population bottleneck in the Seymour River. Thus, making the fry bigger and (presumably) healthier during the Summer/Fall months because of greater food availability, would improve over-winter survival of the juvenile steelhead population, resulting in a greater number of smolts that would then out-migrate to the ocean in the Spring (with the assumption that sending more fish to the ocean would result in more fish coming back).

The fertilization program, led by GVWD and SSS hatchery staff, continued in 2021. Hatchery staff and volunteers support the program by filling the burlap bags with fertiliser and placing them in three locations in the river each spring. Fertiliser bags were deployed on July 6th by hatchery staff and volunteers. Loading rates were the same as previous eight years (i.e., 1,350kg of fertiliser total: 27 bags at Dam Outflow, 54 bags at Hatchery Pool, and 54 bags at Spur 4). The pellet fertiliser used was supplied by Ostara (Ostara.com) and the product is called Crystal Greene, with a pellet size of SGN 300. Concurrent with this fertiliser installation, GVWD performed bi-weekly water quality sampling during the summer growth period (June to October) at locations upstream and downstream of the fertiliser release sites as described in the monitoring section of this report.

Junior Creek Enhancement Project

The Junior Creek enhancement area comprises a man-made channel that flows between Paton Creek and the juvenile rearing ponds in the enhancement area. The bank along a small section of this man-made inlet channel has degraded over time and required additional work to ensure it maintains sufficient flow to the Junior Creek ponds. The primary focus of work in 2021 included improvements to the inlet channel banks using DFO habitat specialists and a mechanical excavator to re-establish the channel banks and introducing additional large woody debris. Figure 4 show Junior Creek following habitat works in summer 2021.

FIGURE 4 JUNIOR CREEK FOLLOWING COMPLETION OF HABITAT WORKS DURING SUMMER 2021

SSS Staff undertook regular visual inspections of the Junior Creek works during the Fall to ensure than the habitat works were operating as designed. Following the significant high flow events from the storms in September to November, it was identified that significant accumulation of fine material had re-occurred in the channel. In addition, part of the stream bank had eroded away again and caused water to flow away from the Junior Creek ponds and into the forest and Paton Creek. Visual observations of the lower section of Junior Creek during the carcass recovery program suggested insufficient water depth to provide effective spawning habitat for the returning salmon downstream of the Junior Creek ponds.

As such, temporary sand-bagging works were undertaken by SSS staff on December 9 to ensure more water flowed into the Junior Creek habitat area (Figure 5, Figure 6). The sand used to fill the bags was shovelled from outside the flowing channel to avoid disruption to wetted gravels. A

follow-up visual inspection on December 10th showed that more water was flowing into the Junior Creek habitat area and water depth was more appropriate for the spawning salmon. Visual inspections will continue at Junior Creek during our carcass recovery program to ensure that sufficient water flow and depth is maintained for the spawning gravels. More permanent works will be required in Spring/Summer 2022 to the Junior Creek intake channel to ensure future effective water flow to the enhancement area.

FIGURE 5 JUNIOR CREEK SAND-BAGGING ON DECEMBER 9, 2021

FIGURE 6 TEMPORARY REPAIRS AT JUNIOR CREEK ON DECEMBER 9, 2021

Mid-Valley Enhancement Project

The Mid-Valley enhancement area is man-made and was established over 20 years ago to provide significant salmonid juvenile rearing and adult spawning habitat. This enhancement area supplements for aquatic habitat lost in the upper watershed via historical human activities. This area also benefits the watershed by providing valuable habitat for other aquatic species such as amphibians, birds, insects and invertebrates. However, over the past eight years the inlet channel has become clogged with finer sediment, in part because of a beaver dam at the outlet to the habitat area.

The aim of the habitat works at Mid-Valley during 2021 was to bring the enhancement area back into effective use for both juvenile salmonids and returning adult spawners. Works comprised the removal of a beaver dam in Fall 2020, which was blocking access for salmonids to the enhancement area, along with channel cleaning works in the inlet channel and deposition of additional spawning gravel material. Monthly site visits were undertaken by SSS staff between April and December 2021 to confirm the beaver mitigation works were successful. Site visits confirmed they had not returned and that the entrance channel remained free of obstructions. In addition, without the beaver dam impoundment the water flows through the inlet channel and habitat area also improved and allowed mobilisation of some finer sediments within the inlet channel.

Additional channel clearing works were planned for summer 2021; however, due to fire risk restrictions, along with the songbird nesting season work window, we were unable to undertake the channel cleaning works during 2021. We will be reviewing the Mid-Valley habitat area in conjunction with Murray Manson of DFO to identify whether these works can go ahead during summer 2022, especially given the positive impact the beaver dam removal has had on the level of fine sediment within the inlet channel.

Nevertheless, the Mid-Valley habitat area remains free of fish passage issues and visual inspections confirmed that salmon fry are again using the habitat area for juvenile rearing purposes. Carcass recovery surveys during Fall 2021 also confirmed that returning adult salmonids were regularly using the habitat area for spawning purposes.

Broodstock Collection and Production

The following provides an overview of the broodstock collection and production activities undertaken in the Seymour watershed during 2021. Table 1 provides a summary of the fish collected from these broodstock activities for the Seymour Hatchery fish production program.

TABLE 1 BROODSTOCK COLLECTION FOR THE SEYMOUR RIVER HATCHERY IN 2021

Species	Seine Netting	Broodstock Fishing	Pairs Spawned, or Eggs Collected
Coho salmon (early and late run)	351	95	74
Steelhead (2022 summer run brood year)	-	10	-
Steelhead (2021 winter run brood year)	-	8	3
Chum salmon (Seymour River)	-	27	7
Pink salmon (Seymour River)	-	350	112 pairs (164,652 eggs)
Chum salmon (Alouette River)	-	-	191 pairs (444,110 eggs)
Pink salmon (Tenderfoot Creek)1	-	-	-

Notes: ***1*** *– eyed eggs were not available for broodstock from tenderfoot hatchery during this season.*

Hatchery Pool Seines

During the late summer period coho salmon began congregating in the Hatchery Pool. The SSS undertook five seine events between September and November and captured 351 adult coho, with 51 of these transported and released above the dam, while 161 of these captured fish had their left operculum punched and released back to the river for the carcass recovery program (i.e., to provide an estimate of the total coho return for 2021). The remaining 139 captured adults were used at the hatchery for use in our broodstock program. No steelhead were captured during the seine events (Figure 7, Figure 8). Table 1 summarises the broodstock collected for the Seymour River Hatchery in 2021.

FIGURE 7 HATCHERY POOL SEINE EVENT DURING OCTOBER 2021

FIGURE 8 SORTING COHO DURING HATCHERY POOL SEINE EVENT

Broodstock Angling

Our broodstock anglers were out regularly during the June to December period for summer run steelhead, coho, pink and chum salmon fishing, along with the January to May period for winter run steelhead. The aim of the broodstock program was to capture as many returning adult fish in the river and begin to capture the winter and summer run steelhead (Figure 9). To date we collected 95 coho, 27 chum and 10 summer run steelhead via our broodstock angling program (Table 1).

FIGURE 9 SECURING AN ADULT COHO INTO A BROODSTOCK BAG FOR TRANSPORT TO THE HATCHERY

Egg Transplants

Further to our ongoing broodstock collection within the Seymour River, each Fall hatchery staff visit the Alouette River with DFO to collect additional eggs to continue rebuilding the chum salmon population in the Seymour River. We also generally visit the Tenderfoot Hatchery during odd numbered years to collect eyed pink salmon eggs to continue rebuilding the pink salmon population in the Seymour River.

During Fall 2021 we collected an additional 191 pairs of chum (~458,000 eggs) from the Alouette River for this purpose (Table 1). We have estimated 2,400 eggs per adult Alouette female in 2021. However, eyed pink eggs were not available for broodstock from Tenderfoot Hatchery during this season due to insufficient returning pink salmon to enable collection.

Hatchery Broodstock Production

The SSS are contracted by DFO to produce three salmonid species: coho and chum annually, and pink salmon every odd numbered year. The SSS also has an agreement with the BC Ministry of Forests, Lands, and Natural Resource Operations and Rural Development (FLNRORD) to produce summer and winter run steelhead smolts. The SSS's goal is to enhance and maintain salmonid populations within the Seymour River to historical levels.

The 2020 brood were incubated at the hatchery over winter 2020 and released as fry in selected habitats throughout the LSCR and above the Seymour Reservoir in Spring 2021. Whereas the current 2021 brood year eggs will be incubated at the hatchery over winter 2021 and be released as fry in the mid-reaches of the river and side channel habitat during spring 2022. All fry releases augment the numbers of adult coho that spawn in the watershed during each Fall to maintain fry numbers to historical wild production levels. Table 2 illustrates the fry and smolts that were released in 2021.

Generally, we release 40,000 fry above the Seymour Falls dam, but we only released 10,000 this Spring as we used the balance to release in the river downstream of the dam (i.e., to account for lower likely wild spawned fish due to rockslide impacts.

TABLE 2 SMOLT AND FRY RELEASES FROM THE SEYMOUR HATCHERY IN 2021

Species	Brood year	Number
Coho salmon fry	2020	40,754
Coho salmon smolts[1]	2019	55,807
Summer Steelhead smolts	2020	13,787
Winter Steelhead smolts	2020	18,857
Chum Salmon fry (Seymour River)	2020	43,673
Chum Salmon fry (Alouette River)	2020	328,565
Pink Salmon fry (Tenderfoot Creek)	2020	-

***Note**: **1** – 7,500 of these smolts were scheduled for release into temporary DFO net pens in Port Moody, but was cancelled due to COVID-19.*

Environmental Monitoring

Radio Telemetry Monitoring

As part of the rockslide mitigation project, radio telemetry studies continued to monitor adult coho salmon migration through the Seymour canyon area. In partnership with BCIT the SSS completed the monitoring program to determine when and if fish can migrate through the canyon where the rockslide occurred. A total of 20 adult coho salmon had gastric radio tags installed on the riverbank before being released downstream of the rockslide and the Well areas. No steelhead were tagged in 2021 due to insufficient numbers of returning fish being captured to enable tagging. The fish were released downstream of the Rockslide within one hour of radio tag insertion (Figure 10).

FIGURE 10 RELEASING A RADIO TAG COHO SALMON IN THE LOWER RIVER

The tagged fish were monitored using two primary identification approaches, these being four fixed receiver telemetry stations and mobile telemetry tracking. The fixed receivers are set up along the river, one at Spur 4 (above the rockslide), one at Twin Bridges (above the rockslide), the third at Pool 91 (below the rockslide) and the fourth at the fish fence (below the rockslide 1km from the river mouth). These fixed receivers record if any of the radio tagged fish pass by them. Mobile tracking was undertaken at least once per week from September until December 2020. We would like to thank Sarah Leslie and Jacklynn Hansell from BCIT's second year Fish, Wildlife and Recreation Diploma Program for their invaluable radio tracking efforts during this period. The tagged adults were detected at one of the fixed stations downstream of the rockslide. We did not register any tagged fish upstream of the rockslide during the monitoring period, either through fixed stations or mobile telemetry.

Many of tagged fish were still being registered at the Pool 91 fixed station, given the high flow events and regular watershed closures due to rainfall it has been difficult to undertake comprehensive mobile tracking downstream of the rockslide. Some of the tagged fish may have been flushed downstream and out of the river during the significant flow events in the Fall, while

others may still be in the lower river but too far away from the fixed stations to be identified regularly. It is interesting that no tagged fish were encountered upstream of the rockslide in 2021, especially given the >350 coho captured during seine events or broodstocking upstream of the rockslide. SSS staff are seeking further guidance from radio tagging specialists and DFO staff managing the Big Bar rockslide, to better understand passage of tagged fish upstream, of rockslides.

Coho Escapement, Mark and Recapture

As a compliment to the radio telemetry monitoring project, hatchery staff re-established carcass recovery operations in October 2021 after a seven-year hiatus due to the rockslide and will continue through until January 2022. During seines upstream of the canyon and below the dam, adult coho are given a visualized mark (usually an operculum hole punch) and released to remix with the population. Once spawners begin to spawn in the tributaries and enhancement sites, staff, students and volunteers periodically walk these waterways to find carcasses to examine whether they are marked or not. Data such as date, location, sex, origin (W or H), punch observed or not, and percent spawn of females is recorded and the carcass is cut in half to avoid recounting. The data from marking and carcass recovery are used to formulate a population estimate.

Carcass recovery surveys were undertaken twice per week between October and December to maximise the number of fish identified. This data enables us to formulate an estimate of coho numbers that migrated through the rockslide during the Fall of 2021. A total of 161 fish that were marked and released during our hatchery pool seine events. To date we have identified 35 coho carcasses during surveys, seven of which had the LOP. The estimate to date of coho returns during 2021 is 805 ± 460 fish.

Drift Dive Surveys

Two drift surveys were undertaken in 2021 primarily to identify the current fish passage status of the rockslide area and fish presence. Surveys were undertaken on January 26th and July 15th between the Wedding Pool (100m above Twin Bridges) down through the Rockslide to The Well. One steelhead was observed at the Wedding Pool in January, while the July survey identified approximately 40 coho at the base of the rockslide.

Water Quality Monitoring

GVWD continues to lead the water quality sampling during the summer growth period downstream of the dam. These samples are collected as part of the fertiliser release project on the river as presented in the Habitat Conservation and Enhancement section of this report. Background water quality samples were collected on June 4th prior to fertiliser installation, while eight post-installation sampling sessions were scheduled every second Friday thereafter (i.e., June 18; July 2/16/30; August 13/27; September 10/24). Samples were processed at ALS Labs.

The Seymour Hatchery, as part of hatchery operations, monitors water temperatures from several sources including reservoir, groundwater seepage, chilled and boiler water, and dissolved oxygen regularly. Water from the Seymour Reservoir feeds into an aeration tower on the hatchery site and maintenance and flow levels are regularly monitored.

Community Education Programs

Gently Down the Seymour (GDS)

A field trip to the Seymour Hatchery expands student learning of the salmon life cycle to include experience and observation of salmon habitat and the surrounding watershed ecosystem. Students, teachers and parents have an opportunity to connect with their local ecosystem and gain a greater understanding of how urban development impacts natural resources. We hope visitors become greater stewards for salmon, ensuring there will be salmon in our region for generations to come.

The Gently Down the Seymour (GDS) program has a lasting impact on participants as shown by the considerable volume of thank you letters received from the students, along with teachers regularly commenting on how students recall details and experiences from the field trip many years later. Unfortunately, due to the ongoing restrictions associated with the COVID-19 pandemic, the SSS had to cancel our in-person GDS education program for 2021. We hope to re-start our education program in 2022 once permitted by Provincial Health Orders.

Zoom in on the Seymour (ZIS)

Given the cancellation of the GDS program due to COVID, in it's place the SSS initiated an online education program called Zoom in on the Seymour (ZIS), which was operated during 2021. The ZIS aims to temporarily replace GDS and teachers choose one of the following programs:

1. Salmonids of the Seymour River – students will learn about the life cycle of salmonids and the role of Seymour Hatchery (i.e., salmon life stages, anatomy, predator-prey relations, journey challenges, salmon-human interactions, species); or

2. Healthy Streams, Healthy Salmon - students will be introduced to Aquatic Ecology and learn about ecosystems interactions and stream health indicators (i.e., habitat requirements, food chain interactions and aquatic macroinvertebrates).

The ZIS classes meet via Zoom and were scheduled during the Spring and Fall periods. Each ZIS class is approximately one hour in length and includes a presentation, interactive games and videos. Registration for ZIS went live in February and bookings were secured quickly for the program. The ZIS program was successfully undertaken with 55 classes (1,120 students) during the Spring and a further 31 classes (645 students) during the Fall period, which totalled 1,765 elementary school children enjoying the ZIS program.

Community Outreach

Unfortunately, due to the ongoing restrictions associated with COVID-19 we had to cancel our community outreach activities in 2021. In addition, the community events organised by others were also cancelled. In addition, while the District of North Vancouver Firefighters, a major financial supporter of our education programs, were able to hold their annual Fishing Derby on September 25, in a socially reduced capacity, we were unable to attend the weigh in event at the end of the day.

The hatchery was open for access to the public and volunteers throughout 2021, subject to appropriate health and safety protocols to ensure everyone was kept safe. The four steps we took included self monitoring prior to arrival at the hatchery, physical distancing while at the hatchery or assisting in activities in the watershed, regular hand hygiene and use of personal protective equipment and mask wearing in enclosed spaces. Further information relating to COVID-19 is provided earlier in this report.

Thus, although 2021 has been a difficult year for community outreach, we were able to provide access to over 550 people at our hatchery and education centre via the Coho Trail (Figure 11).

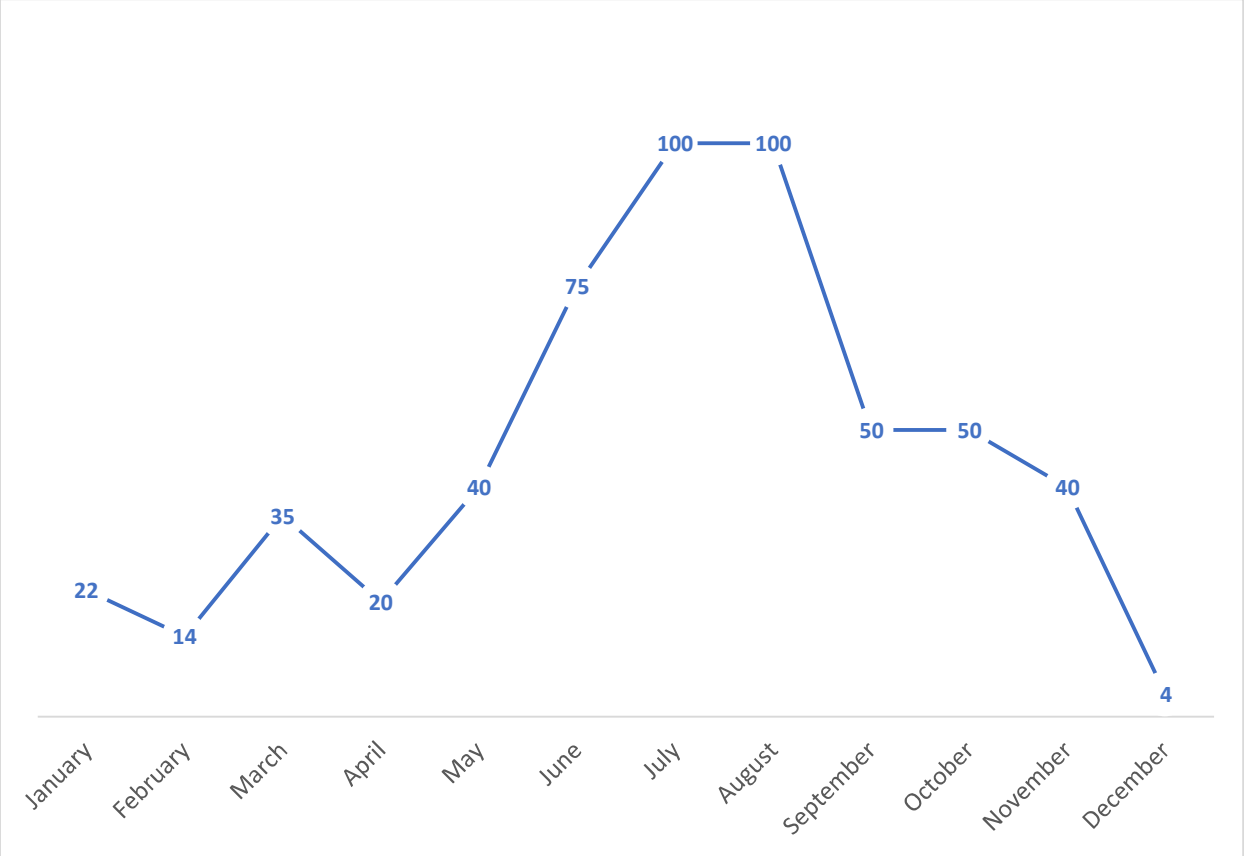

FIGURE 11 NUMBER OF VISITORS TO THE SEYMOUR RIVER FISH HATCHERY IN 2021

World Rivers Day Event

The only community event we were able to hold in 2021 was to celebrate World Rivers Day, where we organised an estuary clean-up and replanting at the river mouth on September 26th. With help from GVWD staff and volunteers from the SSS, we were able to undertake considerable replanting and cleanup work at the Seymour Estuary (Figure 12). The following species were planted at the estuary:

- Salmonberry (*Rubus spectabilis*)
- Red flowering currant (*Ribes sanguineum*)
- Pacific ninebark (*Physocarpus capitatus*)
- Nootka Rose (*Rosa nutkana*)
- Salal (*Gaultheria shallon*)

A significant amount of invasive plant species were removed and replaced with native shrubs and tree species, while many bags of trash were also removed from the site. We would also like to acknowledge the District of North Vancouver for collecting and disposing of the invasive plants and trash from the day.

FIGURE 12 REPLANTING AND INVASIVE PLANT REMOVAL AT THE ESTUARY ON WORLD RIVERS DAY

Social Media

The SSS continues to operate our website (www.seymoursalmon.com), with the assistance of Rudy Kehler (The Simplify Company). The SSS also continues to communicate though social media via our Instagram and Facebook internet platforms. The SSS Facebook page has gone from 747 followers in 2018 to over 1,000 followers in 2021, while our Instagram site has increased from 256 followers in 2018 to over 925 followers in 2021. These social media platforms are two effective ways for members of the community to see what we are doing on a weekly basis.

Volunteering

Volunteers are an integral aspect of the operation of the hatchery and SSS. Without the high level of public involvement, the staff would not be able to accomplish a fraction of what is completed at the Hatchery or SSS events. The SSS currently has over 900 volunteers registered to assist with the ongoing activities at the hatchery or within the watershed.

Our hatchery and conservation activities were supported by over 1,900 volunteer working hours during 2021 (Figure 13). Student participation remained at zero given cancellation of the in-person GDS activities. We are most grateful for the volunteer assistance we receive each year and would not be able to undertake all the work we do in the watershed without their help.

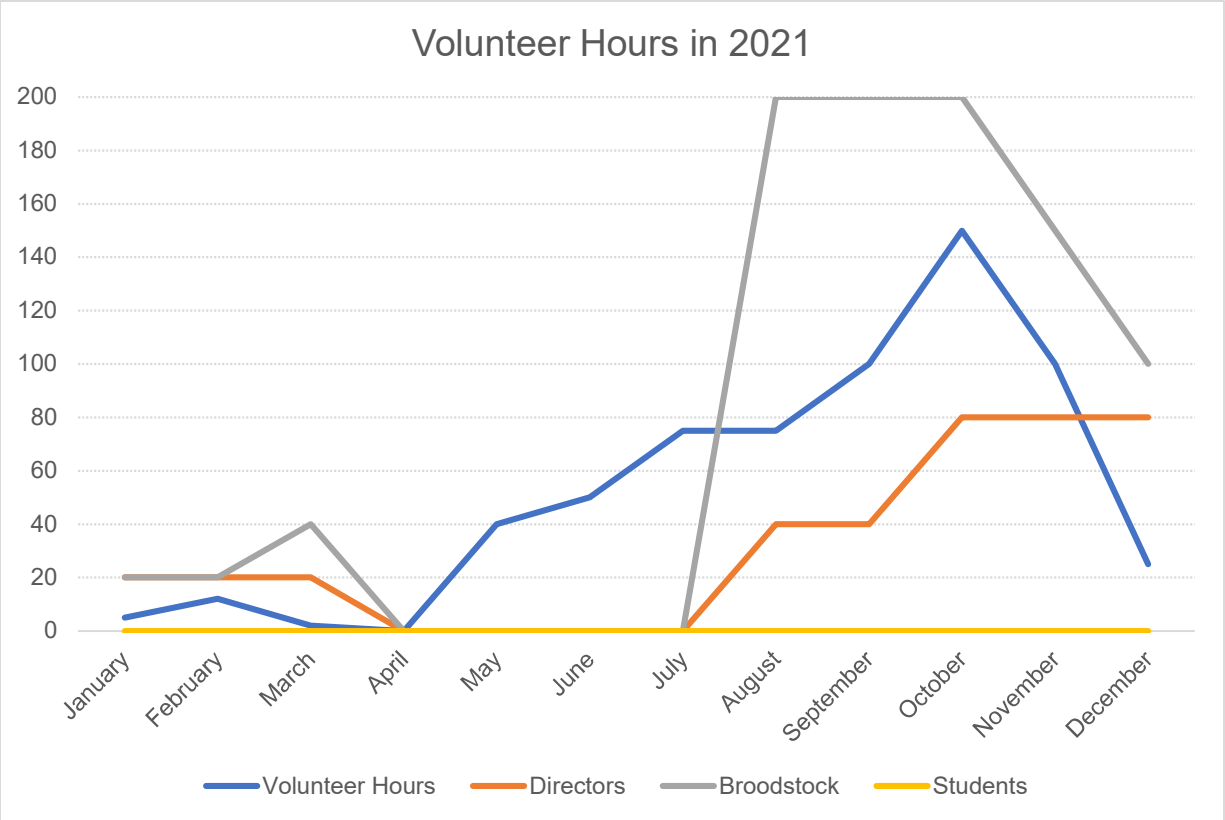

FIGURE 13 VOLUNTEER WORKING HOURS DURING 2021

Hatchery Infrastructure Upgrades and Maintenance

We continued our ongoing facility infrastructure and maintenance upgrades during 2021, including out fitting and installation of a standalone secure feed storage shed, along with planning and preparation for renovations to the hatchery workshop. The new feed shed was delivered and installed on November 11 and is now storing our fish food for use at the hatchery (Figure 14; Figure 15; Figure 16).

Plans were also in place to renovate the existing hatchery workshop, undertake repairs to the perimeter fence and repairs to the structural poles in the outdoor steelhead rearing ponds 1 – 6 and coho ponds A and B. However, due to the significant rainfall we received in the lower mainland during Fall 2021contractors were either not able to access the hatchery due to LSCR access restrictions, or because our contractors live in the Fraser Valley and could not travel due to highway flooding closures. In addition, we have found it difficult to source the piping for the rearing pond structural pole repairs due to COVID-19 supply chain delays in the lower mainland during 2021. Our plan is to undertake these renovation works and repairs as soon as environmental conditions and construction material availability allow.

Other upgrades or replacements included equipment such as waders and wet weather gear for hatchery staff, along with waders for volunteer use at the hatchery or our works sites within the watershed.

FIGURE 14 INSTALLATION OF FITTED-OUT FEED STORAGE CONTAINER

FIGURE 15 NEW FISH FEED-CONTAINER INSTALLED AT THE HATCHERY ON NOVEMBER 11, 2021

FIGURE 16 THE NEW FEED-STORAGE CONTAINER WITH FIRST LOAD OF FISH FOOD

Financials

The following sections provide an overview of the funding proposals, revenue and expenditure for the SSS during 2021. Please note that the SSS's fiscal year runs between April 1, 2021 to March 31, 2022.

Significant 2021 Funding Approvals

Multiple funding proposals were prepared by hatchery staff and submitted for consideration of funding for the hatchery and education centre, along with our conservation activities within the watershed. Successful funding agreements outside of our annual contribution agreements from DFO and GVWD are summarised in the following sections.

BC Salmon Restoration and Innovation Fund (BCSRIF) - Habitat

The final contract was agreed on July 9, 2020 for funding from the BCSRIF totalling $135,011 for the 2021/22 fiscal year. These funds are allocated for the Rockslide Mitigation project, radio telemetry monitoring, along with other habitat restoration and enhancement activities within the watershed. The SSS completed habitat restoration and enhancement works for 2021 by November, while radio telemetry monitoring work will continue into January 2022. We are grateful to BCSRIF for this significant funding agreement, without which mitigation and monitoring works would not have been possible for the rockslide.

BCSRIF – Hatchery Infrastructure

The final contract was agreed on July 28, 2021 for funding from the BCSRIF totalling $28,490 for the 2021/22 fiscal year. These funds are allocated for purchase, fit-out and installation of the new feed-storage container, repairs to the perimeter fence and outdoor rearing pond roof structures, along with a backup mobile generator. The feed-storage container was delivered and installed to the hatchery in November. The mobile generator was purchased and delivered to the hatchery. Unfortunately, given the significant rainfall events restricting contactor access to the hatchery, the feed-container is awaiting connection to the mains-power and have vegetation planted around the container to provide a visual buffer. We are grateful to BCSRIF for this significant funding agreement, without which our hatchery infrastructure repair and improvements would not have been possible.

Habitat Conservation Trust Foundation (HCTF)

An emergency proposal was submitted to the HCTF during March 2021 to request $80,000 to support the mitigation works at the rockslide. Additional works were required in 2021 as there were no high flow events during the winter to mobilise the rubble pile associated with the house rock that was created in December 2020. HCTF approved the emergency funding on April 1st, so we had the funds required for the additional rockslide mitigation works. We are grateful to HCTF for this significant funding, without which the mitigation works as the rockslide would not have been possible.

Pacific Salmon Foundation (PSF)

The proposals were approved on April 30, 2021 for funding totalling $16,250 for use on the production and installation of new information signage at the hatchery. The new hatchery signage will replace the existing 20+ year old signs and is no longer fit-for-purpose or providing up to date information. The new signage will provide education and community outreach information for students, volunteers and visitors to the hatchery. The signage design and production are currently progressing, with the aim to install the new signage during spring 2022. We are most grateful to PSF for this significant funding, without which the information signage replacement would not have been possible.

DNV Fire Fighters Charitable Society

The DNV Firefighters Charitable Society again continue to generously contribute towards our education program, as part of their annual Firefighters Fishing Derby, which was held on September 24, 2021. Funding from the firefighters has been an annual funding contribution and this year the contribution was $30,052. The SSS have allocated these funds to help operate the GDS and ZIS program and we are most appreciative for this funding support, without which the GDS education program would not be possible.

Neptune Terminals

Neptune Terminals generously contributed $10,000 towards our community education programs. Funding from the Neptune Terminals is based on a three-year funding contribution for education, without which the GDS education program would not be possible.

CN Rail

We were successful in our application to CN Rail as part of their CN Stronger Communities Fund, who generously contributed $10,000 towards our community education programs during May 2021. Funding from CN Rail is to go towards upgrades to the hatchery educational signage, without which we would not be able to provide suitable learning facilities at the hatchery for local visitors and students.

British Columbia Community Gaming Grants

We were successful in our application to BC Gaming as part of their Community Gaming Grant Fund, who generously contributed $7,500 towards our GDS education program for 2022. Funding from BC Gaming will go towards the GDS education program, or our online ZIS program. Without this funding we would not be able to run our education program at the hatchery for elementary school students.

Lower Seymour Conservation Reserve (LSCR)

We are very grateful for LSCR on behalf of the GVWD for approximately $10,000 worth of in-kind lumber that will be used during the hatchery signage upgrade. Without this generous in-kind contribution, we would not be able to construct the sign kiosks at the hatchery.

Great Canadian Landscaping Company (GLC)

We are very grateful for GLC and their associates for significant in-kind construction materials that will be used during the hatchery entrance and landscaping upgrades. Without these in-kind contributions we would not be able to upgrade our entrance and landscaping strategy at the hatchery.

Seymour Salmonid Society 2021 Revenue

Table 3 provides a summary of the SSS revenue for 2021.

TABLE 3 SEYMOUR SALMONID SOCIETY OPERATIONS REVENUE 2021

Funding Partner	Allocations	Funding Amount
GVWD	Hatchery Operations	$125,000
Fisheries & Oceans Canada	Hatchery Operations	$100,000
Additional Revenue'	Education/Projects	$405,659
	Total Revenue	**$630,659**

Additional 2021 Revenue Summary* (from 'Additional Revenue' in Table 3)

The funds provided by GVWD enabled SSS staff to accrue supplementary monies for specific projects and programs. Table 4 provides a summary of these amounts and allocations.

TABLE 4 SEYMOUR SALMONID SOCIETY ADDITIONAL REVENUE 2021

Source	Project	Amount
BC Salmon Restoration & Innovation Fund (BCSRIF)[1]	Habitat Restoration Project	$229,969
Habitat Conservation Trust Foundation (HCTF)	Rockslide	40,000
BCSRIF[1]	Infrastructure Renewal Project	$18,760
Pacific Salmon Foundation (PSF)	Capital Improvements	$20,000
PSF	Signage	16,250
DNV Fire Fighters Charitable Society	Education Programs	$30,052
Neptune Terminals	Education Programs	$10,000
CN Rail	Education Programs	$10,000
BC Gaming	Education Programs	$7,500
Canada Summer Jobs Fund	Seasonal staff wages	$7,229
Public Events/Donations/Memberships	General Society business	$7,539
Richard Tak/Kate Keogh Donation	Education Programs	$5,000
HCTF	Funding MSc Student	$2,500
ZIS Registrations	Education Programs	$860
	Total Revenue	**$405,659**

***Note**: **1** - this is the revenue received in 2021 as of December 13, 2021; however, the total funds allocated by BCSRIF for the Habitat Restoration Project and the Hatchery Infrastructure Renewal Project for the fiscal year to March 31, 2022, is $135,011 and $28,490, respectively. The remaining BCSRIF funds for both projects will be expended by March 31, 2022.*

Seymour Salmonid Society 2021 Expenditures

Table 5 provides a summary of the SSS expenditure for 2020.

TABLE 5 SEYMOUR RIVER HATCHERY OPERATIONAL EXPENDITURE 2021

Expenditure Type	Expenditure
Wages (including monitoring technician wages)	$220,111
Overhead (includes insurance, WCB, health benefits)	$39,671
Fish Food	$8,935
Vehicle Maintenance / Fuel	$4,455
Fish Culture Equipment	$431
Operations / Maintenance	$955
Mileage	$655
Safety and Training	$90
Communications (Mobile Phone / Internet)	$1,448
Additional Expenditure	$292,398
Total Expenditure	**$569,151**

Additional 2021 Expenditure Summary (from 'Additional Expenditure' in Table 5)

Table 6 provides a summary of the additional expenditure incurred by the SSS that is secured via external funding applications.

TABLE 6 SEYMOUR SALMONID SOCIETY ADDITIONAL EXPENDITURE 2021

Expenditure Type	Expenditure
BCSRIF Habitat Restoration Project	$221,115
BCSRIF Hatchery Infrastructure Renewal Project	$17,582
Environmental Education[1]	$13,496
Landscaping Upgrade Concept Drawings and deposit	$15,795
GDS Video production	$14,513
Mid-Valley Beaver Management	$5,454
Junior Creek Habitat Project Excavator Machine time	$4,443
Total Additional Expenditure	**$292,398**

***Note**: **1** - expenditure was significantly lower in 2021 as the GDS program was cancelled due to COVID-19 and replaced with the online Zoom in on the Seymour (ZIS) education program.*

Looking Forward

The year ahead is expected to be as busy as the last, with the most significant major projects we will be focusing on are as follows:

- **The Rockslide Mitigation** – drift dives during winter 2021/22 and above-water review in Spring 2022 following freshet to identify what works may be required next year to maintain and improve fish passage during all flow conditions
- **Juvenile Salmon and Steelhead Smolt Releases** - juvenile steelhead and coho will continue rearing in the ponds over the winter and released during June 2022
- **Juvenile Salmon Fry Releases** – release of coho fry upstream of the dam, along with off channel habitat between the dam and the rockslide during Spring 2022. The chum and pink salmon fry will also be released to the lower river during Spring 2022
- **Adult Radio Telemetry Tracking** – for returning adult salmon to monitor movement through the rockslide
- **Adult Carcass Recovery** - within the river and tributaries to better understand the number of coho migrating through the rockslide to spawn naturally
- **Restoration Activities** – for existing and new aquatic habitat for both juvenile rearing and adult spawning activities as part of our BCSRIF project
- **GDS Education Program** – subject to COVID-19 restrictions; we would like to re-start our GDS program to provide potentially a spring 2022 program at least
- **Community Events and Enhancement Program** – subject to COVID-19 restrictions; we would welcome the ability to host and/or attend community events in 2022
- **Ongoing Hatchery Infrastructure Renewal** – to secure the hatchery and education facility for the next generation of community volunteers, elementary school children and fisheries

Coquitlam River Watershed Roundtable

2021 Annual Report

Addressing Climate Change Through Engagement

coquitlamriverwatershed.ca | info@coquitlamriverwatershed.ca

Published by:
Coquitlam River Watershed Roundtable

January 15th, 2022

Our Mission

To preserve and enhance the health of the Coquitlam River Watershed through collaboration, education and advisory action.

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Executive Summary

Acknowledgements

We wish to thank our funders for their generous financial support in 2021. Our deepest gratitude to our partners for their contributions of time and staff resources.

Core Committee

The Roundtable lost one of its founding members Norm Fletcher when he passed in November 2021. He will be dearly missed. Cllr. Nancy McCurrach, Scott Walmsley and Cllr. Laura Dupont joined the Core Committee from the City of Port Coquitlam. Due to staff shortages from the COVID-19 pandemic, the Provincial seat remained empty in 2021.

Active committees for 2021 included the standing committees for Resilience and Capacity Building and Communications; Project Committees included Roundtable Meeting Planning, Water Use and Stormwater Management task groups.

Operations

The Roundtable continues to follow its COVID-19 response plan and adheres to Provincial mandates for gathering restrictions.

Projects and Public Outreach

The COVID-19 pandemic has created staffing shortages for industries world-wide. The Roundtable is pleased to report that it has been able to continue implementation of its *Lower Coquitlam River Watershed Plan*, albeit with some delays due to partner staff availability.

The Development Committee continues to work on its strategy to encourage low-impact development (LID) in the watershed. The committee is producing a paper on the effects of urban development and LID techniques. UBC's Centre for Law and the Environment is currently assisting with an analysis of associated regulations. The paper expected to be released in the summer of 2022.

The Stormwater Committee is currently engaged in two strategies: a watershed-wide adaptive monitoring program for stormwater and public outreach to single family homeowners. The group facilitated presentations by all governments with jurisdiction in the watershed to speak to their stormwater management and monitoring programs. The committee installed a demonstration rain garden in Lions Park, Port Coquitlam to educate the community and encourage implementation of rain gardens on private property.

The Roundtable commissioned a report by the University of Victoria's Environmental Law Centre titled *Reducing Water Extraction and Increasing Environmental Flows in the Coquitlam River*, which was reviewed by the Core Committee in January 2021. A Water Use Committee is currently liaising with governments in the watershed to discuss how to best implement recommendations provided in the report.

Facilitated by our Engagement team, the Roundtable developed a three-fold strategy to address littering and dumping during Earth Week, which included education to newcomers to the watershed,

empowering individuals that are homeless to participate in an incentivized clean-up and engaging students to create litter art.

The Earth Week program engaged with 84 individuals and removed approximately one cubic yard of waste from the watershed. On Rivers Day, our Engagement team partnered with the three other local organizations to conduct an in-stream *and* streamside clean-up and successfully removed approximately 4 cubic yards of waste from the watershed.

Thanks to the Canada Summer Jobs program the Roundtable hired videographer Ethan Moore to produce a *Hidden Gems* video series that aimed to encourage community members to visit some of the lesser-known areas thereby emoting concern and promoting stewardship. Videos in the series were viewed a total of 4362 times during the year.

The Roundtable hosted two Community Roundtable Meetings/Webinars during the year. The webinars, *Building Resilience: Weathering the Stormwater* and *Fire Prevention in Urban Watersheds* were viewed by 113 and 131 people (recorded and live) respectively. During each event, participants were asked to prioritize which *Watershed Plan* strategies should be implemented in the coming months. The pre-show video for the webinar, *Stormwater Management in the Coquitlam River Watershed*, featured inspirational examples of stormwater management in the community. It was also viewed by 99 people outside of the webinar.

Meetings and Presentations

The Core Committee convened six times during the year. The Resilience and Capacity Building Committee met five times and the Communications Committee assembled quarterly. The Community Roundtable Meeting/Webinar planning group met fourteen times, while the Development Project and Water Use committees convened once each, and Stormwater Management committee assembled fourteen times. Finally, the Financial Trustee Task Force met once to reconcile annual expenditures for year-end reporting.

One delegation presentation was given to the City of Coquitlam Council as a core funder and three presentations were made to community groups: SUCCESS Immigration Services (as part of our Waste Ban campaign), BCIT's Fish, Wildlife and Recreation program students and Code-Blue BC.

Social Media and Website

The Roundtable website was updated to feature the organization's growing video library. Website analytics show the average number of monthly website users to be 629 individuals, with a total of 7553 annual users. Facebook likes have increased from 814 at the start of the year to 861 at the end, Twitter followers have grown from 829 to 882 and Instagram from 432 to 591. YouTube video views have increased from 982 in 2020 to 2734 in 2021.

Communications

An annual Backgrounder was published in Spring and bi-annual Implementation Updates were distributed in Spring and late Summer. E-news is published on a quarterly basis. These publications had an open rate of between 33%-45%. Efforts made late in the year to increase subscribers by boosting posts promoting the newsletter appear to be effective and should be continued moving forward.

In-kind Contributions

In-kind contributions were valued at $19,566 including 707 hours of time and $700 of venue and skilled trades donations.

Financials

The Roundtable received $128,781 and carried over $35,434 from 2020 for a total of $164,215 available funds for the year. Cash expenditures totaled $99,422. When combined with in-kind contributions of $19,566, the organization's operating costs totaled $118,988. GVWD Funds were largely attributed to operational costs, the greatest of which was to maintain the Roundtable Coordinator.

Year in Review

Much like the previous year, 2021 was one for the books with continued challenges presented by the COVID-19 pandemic and extreme examples of climate change. We are once again proud to say that the Roundtable was able to adapt and took the challenges as an opportunity to increase community engagement on strategies that aim to reduce the effects of climate change. The increase in outreach is exhibited by the metrics for our virtual platforms, which have all shown excellent growth: average monthly website use is up 15% compared to 2020, social media growth 210% from the previous year and YouTube by 158%.

In-kind contributions were comparable and due to funding uncertainties fiscal expenditures were conservative. In December, Kwikwetlem First Nation committed to doubling its annual contribution for the next five years; the City of Coquitlam also agreed to renew its funding agreement for five years and the City of Port Coquitlam for one year.

Moving Forward

In 2022 funding agreements with the City of Port Coquitlam and Metro Vancouver's Greater Vancouver Water District will be up for renewal. The Roundtable will seek renewed funding agreements with those partners and continue to pursue alternate sources to ensure a balanced budget. With a clear direction provided by community Roundtable members, the CRWR will continue to advance its Lower Coquitlam River Watershed Plan as capacity allows.

The Roundtable would like to express its deepest gratitude to all partners, volunteers and contributors for their ongoing support through these challenging times. We look forward to continued partnerships for years to come.

Acknowledgements

We wish to thank the following organizations for their generous financial support in 2021:

Our deepest gratitude to the following partners for their contributions of time, staff resources and venue and refreshment supplies:

- City of Coquitlam
- City of Port Coquitlam
- Watershed Watch Salmon Society
- Jack Cewe Construction Ltd.

Core Committee Sectors and Representatives

The Core Committee comprises a team of 19 sector representatives from 12 diverse sectors, all of whom contribute their time in-kind to attend Core Committee and Community Roundtable meetings, sit on standing and project committees and attend outreach events. Without their dedication and collaborative efforts, the Roundtable would not be what it is today. Each member sits on the Core Committee for 18-24 month terms, although many continue on for years beyond their tenure. We wish to thank our Core Committee members for their generous contributions of time in 2021.

Federal Government

Scott Ducharme
Fisheries and Oceans Canada

Regional Government

Dave Dunkley
Greater Vancouver Water District

Local Government

Cllr. Steve Kim
City of Coquitlam

Local Government

Caresse Selk
City of Coquitlam

Local Government

Cllr. Nancy McCurrach
City of Port Coquitlam

Local Government

Scott Walmsley
City of Port Coquitlam

First Nations Government

Cllr. George Chaffee
Kwikwetlem First Nation

First Nations Government

Craig Orr
Kwikwetlem First Nation

Utilities

Cam Hiebert
BC Hydro

Real Estate Development

Geoff Nagle
Morguard

Industrial

Sophie Mullen
Lehigh Hanson Materials Ltd.

Industrial

Kirsten Wilson
Jack Cewe

Education

Marvin Rosenau
BC Institute of Technology

Stewardship

Eve Gauthier
Tri-City Green Council

Stewardship

Norm Fletcher
Port Coquitlam & District Hunting and Fishing Club

Stewardship

Tony Matahlija
North Fraser Salmon Assistance Project

Arts & Culture

Sherry Carroll
ArtsConnect

Community

Susan Devlin
Vancity

Note: *For 2021 the Provincial Government seat remained vacant and is not represented here*

Roundtable Representatives

The following representatives are not members of the Core Committee but provide vital services to the Roundtable. The Financial Trustee and Engagement Coordinator contribute a large portion of their time in-kind to attend meetings and participate in sub-committees.

Financial Trustee

Shayla Walker
Watershed Watch Salmon Society

Engagement Coordinator

Melissa Chaun
Coquitlam River Watershed Roundtable

Roundtable Coordinator

Sharee Dubowits
Coquitlam River Watershed Roundtable

Late in the year, the Core Committee lost one of its founding members, Norm Fletcher, when he passed away in November. The Roundtable remembers Norm for his incredible contributions to the watershed and community; he will be dearly missed. City of Port Coquitlam designate Cllr. Nancy McCurrach and staff representative Scott Walmsley joined as new members, and Cllr. Laura Dupont, also from the city of Port Coquitlam was welcomed back late in the year. Due to staff shortages during the COVID-19 pandemic, the Roundtable was unable to secure a Provincial Government representative and the seat remained vacant throughout 2021.

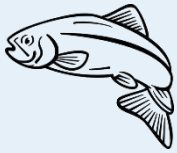
Subcommittees

Resilience and Capacity Building Committee

Cllr. Steve Kim, Cllr. Nancy McCurrach, Caresse Selk, Shayla Walker, Kirsten Wilson

Communications Committee

Shayla Walker, Melissa Chaun, Shannon Wagner, Scott Walmsley

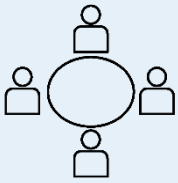


Habitat Committee

Tony Matahlija, Scott Ducharme

Development Project Committee

Melissa Chaun, Geoff Nagle, Lilian Kan



Roundtable Meeting Planning Committees

Eve Gauthier, Susan Devlin, Cllr. Nancy McCurrach, Sophie Mullen, Mitch Mivehchi

Stormwater Management Committee

Scott Walmsley, Eve Gauthier, Glen Joe

Water Use Committee

Cllr. Nancy McCurrach, Jim Allard, Margaret Birch

Financial Trustee Task Force

Shayla Walker, Jace Harrison

Operations

COVID-19 Response

The Roundtable continues to follow its COVID-19 response plan and adheres to Provincial mandates for gathering restrictions. Core Committee, subcommittee and Community Roundtable meetings continue to be held virtually when possible. Any events or projects that require in-person activities are held outdoors, observe physical distancing and personal protective equipment such as masks and gloves when appropriate. While Watershed Plan projects continue to be prioritized by the Community Roundtable, activities are modified to observe COVID-19 safety protocols.

Projects and Public Outreach

The COVID-19 pandemic has created staffing shortages for industries world-wide. The Roundtable is pleased to report that is has been able to maintain implementation of its *Lower Coquitlam River Watershed Plan* strategies, however progress on some projects has slowed due to staffing availability of some of our partner organizations.

Development

Development is the top-rated pressure on the Coquitlam River Watershed and affects the highest number of components in the area. Our subcommittee was originally formed to address a *Development Incentives* strategy that proposed an incentives program for developers who choose to implement low-impact development (LID) techniques. Subcommittee members from the Urban Development Institute noted a lack of awareness of the effects of urban development, LID techniques that could help to alleviate these pressures and relevant bylaws and policies. The subcommittee adjusted the strategy to focus on education and engagement of developers, planners and end-users.

Low-Impact Development Engagement Project

With the assistance of a volunteer technical writer and various post-secondary institutions, the Roundtable is producing a report that will identify evidence-based impacts of urban development in the watershed. This paper will discuss low-impact development (LID) strategies that can help to alleviate this pressure and describe the associated maintenance practices. It will also identify the relevant Provincial building codes and local policies and bylaws that may either assist or inhibit the implementation of these features and provide recommendations to reduce barriers.

The information related to development impacts and LID techniques has been drafted and is in review by committee members from the Development sector. UBC's Centre for Law and the Environment has agreed to perform a review of local policies and bylaws that either facilitate or inhibit the implementation of LID approaches. The paper is expected to be published in summer 2022.

Once the report has been finalized, the findings will be presented to the development community at a virtual workshop.

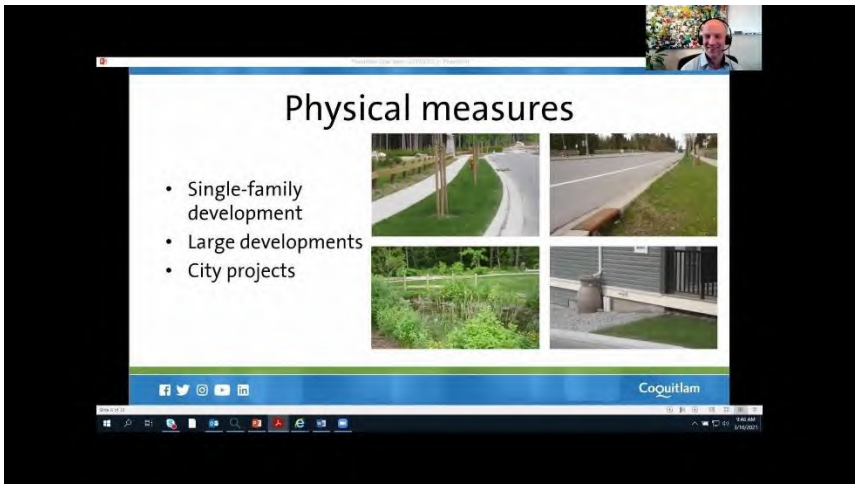
Stormwater Management

Stormwater is another high-rated pressure in the watershed that is associated with the introduction of foreign or excess material into hydrologic systems due to surface water loading and runoff from the

built environment. Stressors to the watershed ecosystem may include toxins (from vehicles, pavement, roofs, etc.), fertilizers and refuse (plastics, etc.). These stressors can result in degraded water quality, altered hydrological dynamics, increased nutrient loading, and consequently, compromised human, aquatic/riparian species and habitat health.

Watershed-wide Adaptive Monitoring Program

A subcommittee is currently facilitating regular presentations by the cities of Coquitlam and Port Coquitlam and Kwikwetlem First Nation regarding their progress in developing an adaptive monitoring program for stormwater management. Once each government has completed their relevant integrated stormwater management plan and adaptive monitoring program, the goal is to coordinate monitoring schedules, techniques and adaptations to facilitate a watershed-wide monitoring program with consistent information-sharing sessions. These local governments met for the first time in March regarding stormwater management practices and have committed to regular updates.



Outreach to Single-Family Homeowners

This strategy aims to develop outreach materials to help single-family homeowners improve stormwater practices in the lower Coquitlam River watershed. Key actions include:

- Encouraging best practices in rainwater management, water quality and riparian areas
- Providing outreach awareness of stormwater problems caused by everyday actions
- Reducing stormwater impacts on the river system, riparian areas, salmon, cultural and spiritual values, human health and safety, and resources industries.

To accomplish this, the subcommittee began installation of a demonstration rain garden in Lions Park, Port Coquitlam. The project encouraged the participation of community members and provides how-to signage for installing a rain garden, including a link to an instructional video and a mural depicting how rain gardens work to filter stormwater. It also features two rain barrels that capture stormwater from disconnected downspouts on the adjacent building, which will be used to water the garden during the dry season. The project was generously supported by Vancity, the City of Port Coquitlam and Jack Cewe Construction Ltd. The city of Port Coquitlam will be using this as a pilot project to gauge feasibility for this type of green infrastructure elsewhere in the municipality.

The rain garden filters water from approximately 150 m^2 of impermeable surface. The installation events engaged and educated 28 community members about the purpose and procedures for creating a rain garden.

Water-Use

The Roundtable commissioned a report by the University of Victoria's Environmental Law Centre titled *Reducing Water Extraction and Increasing Environmental Flows in the Coquitlam River*. The paper was released in November 2020 and reviewed by the Core Committee in January 2021, after which a subcommittee was formed to address the recommendations in the report. The recommendations included suggestions for reducing water use, regulating impermeable surfaces, determining environmental flow needs and creating a Water Sustainability Plan for the Lower Coquitlam River Watershed. The subcommittee met to discuss implementation of these recommendations and is currently liaising with local governments in the watershed to determine their plans for incorporating the advice provided in the report.

Anti-Littering and Dumping Engagement

During Earth Week the Roundtable launched its renewed anti-littering and dumping campaign. Typical litter clean-ups engage community members that are already aware of and active in solutions for the problem. This campaign took a three-fold approach to littering:

1. Educated newcomers to the watershed by hosting a webinar for SUCCESS Immigration Services. During this event we gathered information on cultural perceptions of the littering problem, shared information about the impacts of litter, where the local litter "hot spots" are and how we can reduce our waste production.
2. Empowered people who are homeless or facing homelessness from Hope for Freedom, Raincity Housing and ACCESS Youth Outreach Services to get involved in an incentivized clean-up program, supported by the Downtown PoCo BIA.

3. Engaged local students to use the litter collected from the clean-up program to create a litter art piece that spoke to the ongoing waste problem in the watershed.


During Earth week we engaged with 84 community members through the webinar, clean-ups and litter-art construction. Approximately one cubic yard of litter was removed from the shoreline.

The campaign was resumed on Rivers Day when the Roundtable teamed up with The Web of Life, Chandos Construction, the Beaver Canoe Club and community volunteers to conduct an in-stream AND streamside clean-up.



An incredible 30 participants endured a very soggy day to remove approximately four cubic yards of waste from the river and its riparian area. The waste collected was primarily from abandoned homeless camps and spurred discussions of adding the pressure of homelessness to the *Lower Coquitlam River Watershed Plan*. A portion of the litter collected was used by artists Dolores Altin and Elvira Monteverde to create a public litter art piece that will be displayed in Gates Park for 2022.

Mainstream Cultural Norms Outreach

Mainstream cultural norms pressure is associated with a disconnection from or lack of understanding of the value of local ecosystem services provided to people by local natural resources. Stressors associated with mainstream cultural norms include increased apathy, decreased stewardship, lack of environmental awareness and knowledge, lack of respect for nature and decreased sense of value. Outreach programs were identified as the most effective strategy to alleviate this pressure.

Hidden Gems Video Series

Thanks to the Government of Canada's Canada Summer Jobs program, the Roundtable was able to hire a videographer to produce regular communications content for release on social media and to Telus Community Television's *Community Content* channel. Videographer Ethan Moore's main project was to create a video series, titled *Hidden Gems of the Coquitlam River Watershed*, depicting some of the lesser-known spots to visit in the area. The goal of the project was to encourage people to visit, engage with and be stewards of the watershed.

The series has had excellent reach on our social media platforms:

Table 1. 2021 Views of the Hidden Gems video series

Video	YouTube Views	Facebook Views	Total Views
Hoy Creek	61	20	81
Westwood Wetlands	33	261	294
Fjords	33	65	98
Colony Farms	30	15	45
Upper Coquitlam River Park	66	4950	5016
The Oxbow Side Channels	258	36	294
Ridge Park	29	58	87
The Upper Watershed	305	352	657
Hidden Gems Sneak Peek	11	33	44
			6616

Community Roundtable Webinars

The Roundtable aims to host one to two Community Roundtable meetings each year, which are typically in-person events. Due to COVID-19 restrictions, meetings have been modified to a webinar format until further notice. The benefit of the online format is a huge reduction in cost, which allowed the Roundtable to host two webinars within their annual budget.

Building Resilience: Weathering the Stormwater

The Spring event tied into work by the stormwater subcommittee that year. Guest speakers Mitch Mivehchi (BMP Engineering) and Joanna Ashworth (SFU, North Shore Rain Garden Project) discussed what rain and stormwater are and how participants could help alleviate stormwater's negative effects on the watershed. The event was well-attended by local representatives and community members, and the Roundtable received valuable feedback on how to prioritize *Watershed Plan* strategies in the coming months. Survey results (n=19) indicated that participants prioritized outreach on tree management, engagement with developers on implementing low-impact development techniques and outreach to single-family homeowners about stormwater, which was to take shape as a demonstration rain garden. A recording of the webinar was posted on our YouTube channel and Facebook page for subsequent viewing/input.

Table 2. 2021 Spring Community Roundtable Webinar Attendance and Views

Pre-registrations	Attended Live	YouTube Views	Facebook Views
88	60	29	28
Total Views	**117**		

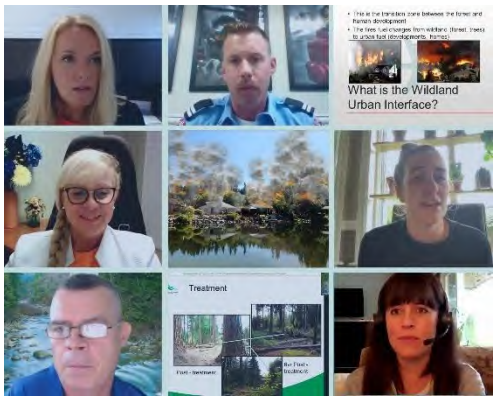
The full event report is available on our website.

Stormwater Management in the Coquitlam River Watershed

For the Spring Community Roundtable Webinar event pre-show, the Roundtable put together a short video titled *Stormwater Management in the Coquitlam River Watershed* featuring community members and organizations that are working to reduce the effects of stormwater in an effort to inspire viewers to

do the same. The video was later released as a public outreach piece to further address mainstream cultural norms. The video is available on our YouTube, website and social media pages. In 2021 the video had 74 views on YouTube and 36 on Facebook for a total of 110 views throughout the year.

Fire Prevention in Urban Forests



Coming off a historic fire season, the Roundtable hosted a Community Roundtable webinar in the late Summer / early Fall to provide education about how to manage urban forests and community properties to help reduce the risk of wildfire in the watershed. Guest speakers Richard Boase (District of North Vancouver) and Cptn. Chad Evans (Port Coquitlam Fire Department) spoke to urban forest management techniques that mimic the natural structure of a forest, defined the urban-wildland interface and provided examples of how to reduce combustible material around the home. Presentations were engaging, event operations ran smoothly and valuable feedback was received to prioritize *Watershed Plan* activities. Attendance was slightly lower than previous events, however the recorded versions were well-viewed. Prioritization survey results (n=12) indicated a preference to focus on tree management, a natural space strategy for developers, low-impact development techniques and invasive species management. A recording of the webinar was posted on our YouTube channel and Facebook page for subsequent viewing/input.

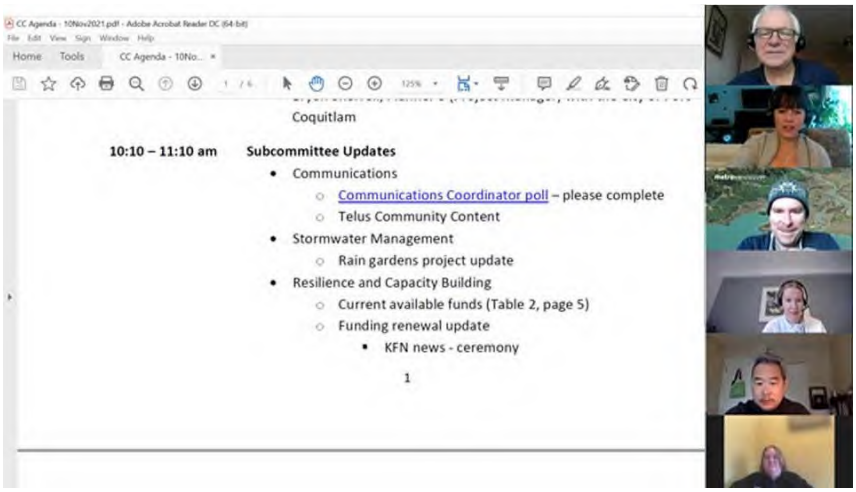
Pre-registrations	Attended Live	YouTube Views	Facebook Views
28	39	28	71
Total Views	**138**		

The full event report is available on our website.

Meetings and Presentations

As a collaborative governance organization, meetings and presentations are a key component of the success of the Roundtable. Due to COVID-19, all meetings and presentations were held virtually via Zoom. Most members are growing more comfortable with this technology however, the virtual format does at times limit engagement within meetings since body language is poorly transmitted remotely. Fortunately, Zoom provides a phone-in option for those without access to computers, and the Roundtable continues to use online surveys as an effective method of gathering feedback. All members contributed their time in-kind.

Core Committee and Subcommittee Meetings



The Core Committee met for five two to three-hour meetings in the months of January, March, June, September and November and one additional one and a half hour meeting in June. These meetings discussed prioritizing Watershed Plan implementation strategies, funding agreement renewals, budgeting issues, project updates, outreach campaigns and issues of watershed health.

Subcommittee Meetings

Subcommittees include standing committees for resilience and capacity building, communications and habitat and ad hoc project committees for community roundtable meeting planning, development, stormwater management, water use and financial matters. Littering and dumping pressures were addressed with our Engagement Coordinator.

The Resilience and Capacity Building committee met five times to discuss funding agreement renewals and strategies for increasing Roundtable capacity, business plans, prioritizing strategies and budget drafts. The Communications committee met on a quarterly basis to discuss communications strategies and publications, social media and the Roundtable website. The Habitat committee typically convenes when issues arise concerning fish or wildlife habitat. We are happy to report that there were no incidents that required the committee to meet. The Community Roundtable Meeting Planning committee met fourteen times during the course of the year to plan the Spring and Summer/Fall events, shoot videos for pre-shows and execute the events. The committee is responsible for organizing guest speakers, venues, activities, refreshments, facilitators, communications (including photography, videography, promotions and social media), speeches and agendas. The Development project committee met once to discuss edits to the first part of the LID paper and is awaiting further progress by UBC's Centre for Law and the Environment department, who is assisting with writing the assessment of codes, regulations, policies and bylaws.

The Stormwater committee met eleven times during the year to work on two strategies: a watershed-wide adaptive management program and outreach to single family homeowners, which took shape as a demonstration rain garden in Lions Park, Port Coquitlam. The team was responsible for conducting research on adaptive monitoring programs in the Province, liaising with all governments in the watershed, facilitating a collaborative meeting with those parties and planning, designing and installing the rain garden.

The Water Use committee met once to review recommendations provided in a water flows report written by the University of Victoria Environmental Law Centre for the Roundtable and liaised with municipal governments via email to discuss implementation of these counsels. Finally, a Financial Trustee task force met twice to reconciliate annual finances for reporting purposes.

Presentations

To help build capacity and engage in community outreach, the Roundtable gives delegation presentations to potential and existing funders and other organizations/groups. Due to COVID, these presentations were given virtually.

Two delegation presentations were given to core funders (the cities of Coquitlam and Port Coquitlam) to provide an update on the Roundtable's activity for the year. Three community presentations were made to SUCCESS Immigration Services, BCIT's Fish, Wildlife and Recreation Program and CodeBlue BC Community Volunteers. The first presentation was part of an outreach program about littering and dumping, the second was a general presentation to post-secondary students about the Roundtable and the third was to promote volunteer opportunities in the watershed.

Social Media and Website

The Coquitlam River Watershed Roundtable maintains a website at www.coquitlamriverwatershed.ca to provide details about watershed history, the Roundtable and Core Committee, event and media promotions and contacts. Over the year, the site was modified to feature the Roundtable's growing library of videos, including virtual watershed tours and our Hidden Gems series

Website analytics show the average number of monthly website users to be 629 individuals, with a total of 7553 annual users. There is a typical decline in website use during the warmer summer months.

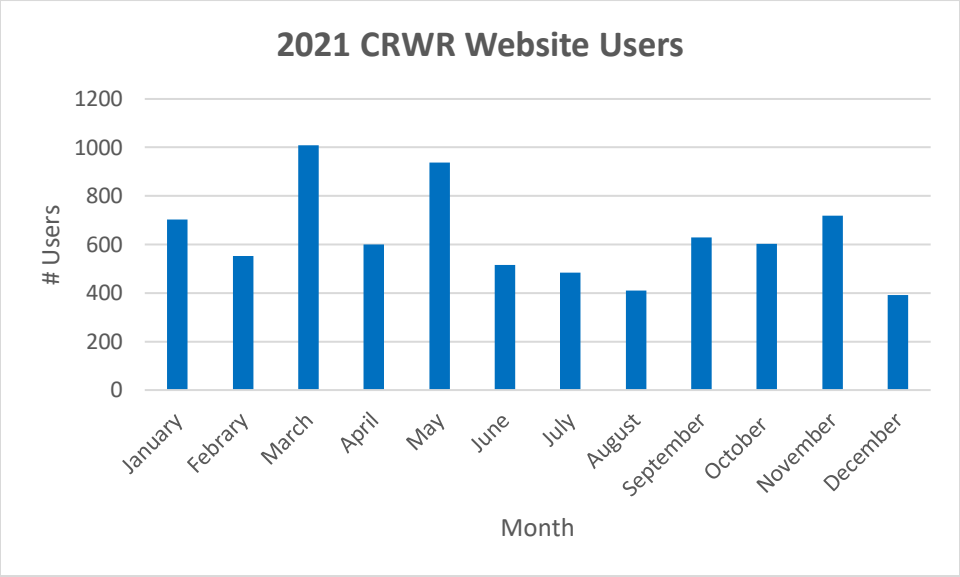


Figure 1. 2021 CRWR Website Users

The Roundtable also reaches community members via social media outlets Facebook, Twitter, Instagram and YouTube. Each is used to promote project and event information with the main goal to direct users to the Roundtable website. Facebook followers have increased from 814 at the start of the year to 861 at the end. Twitter followers have grown from 829 to 882 throughout the year and Instagram from 432 to 591, which made Instagram the platform with the largest growth in 2021.

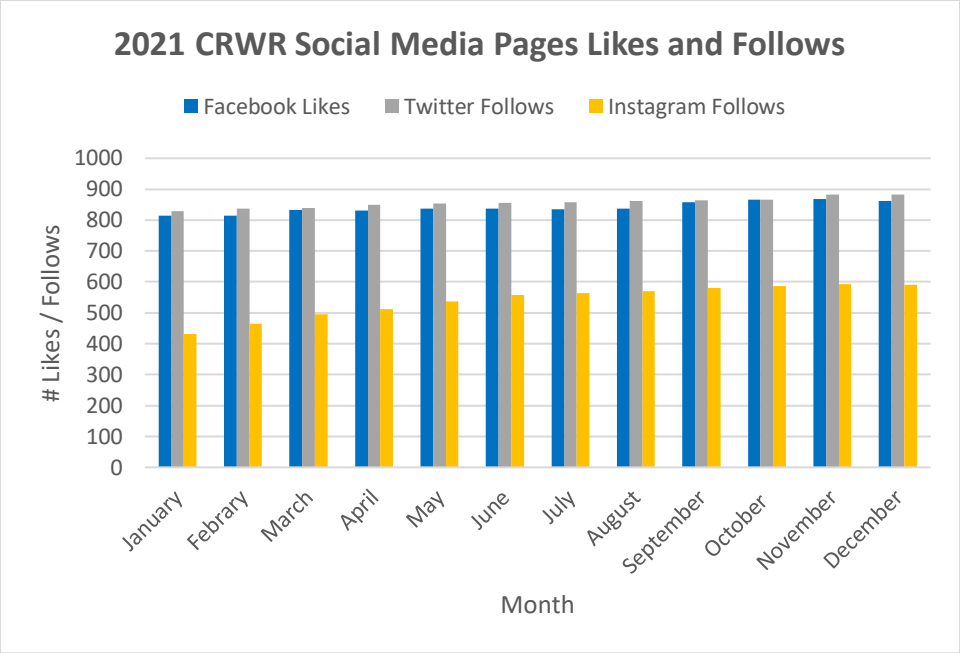


Figure 2. 2021 CRWR Social Media Pages Likes and Follows

Since COVID began the Roundtable has put a larger effort into producing virtual communications and the group's YouTube page has received steady viewership. Videos received an average of 228 views per month.

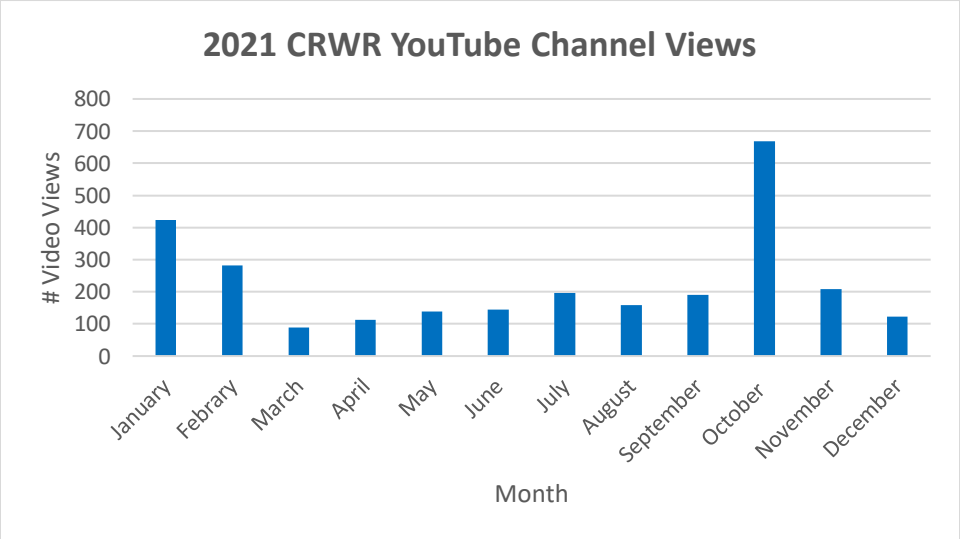


Figure 3. 2021 CRWR YouTube Views

2021 videos were viewed a total of 2734 times compared to 2020, which saw a total of 982 views.

Communications

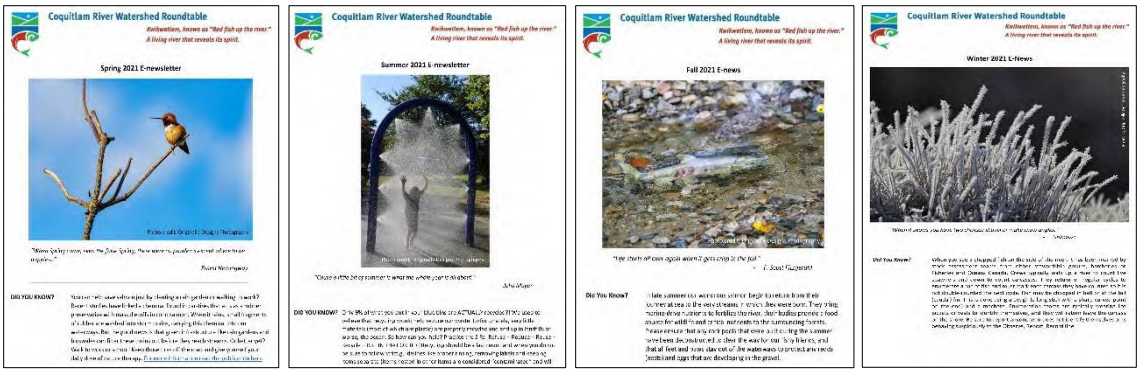
Regular publications are sent to a list of subscribers throughout the year and promoted on social media. These communications are intended to keep the community apprised of the Roundtable's activities and provide an avenue for open dialogue and feedback.

Backgrounder and Implementation Updates

Backgrounders are released annually each Spring and provide information about the Roundtable's history, funders, mission, vision, values, the current composition of the Core Committee and the watershed. The 2021 issue was sent to 275 subscribers and opened by 34% of recipients.

Lower Coquitlam River Watershed Plan Implementation Updates are released bi-annually in the Spring and Summer of each year. Our Spring update was sent to 271 subscribers and was opened by 34% of recipients and, our Summer update was sent to 264 subscribers and was opened by 45% of recipients.

E-news



E-news is sent out on a quarterly basis in Spring, Summer, Fall and Winter to provide an update on the Roundtable's activities and promote events and campaigns. Open rates for 2021 e-news editions ranged from 33% to 44%.

Table 3. 2021 CRWR E-news Subscribers and Open Rate

E-news Edition	# Subscribers	% Opened
Spring	272	33%
Summer	270	40%
Fall	263	37%
Winter	271	44%

In-kind Contributions

The Roundtable's success relies heavily on the generous contributions of time, staff resources and venue, event and refreshment supplies. In-kind contributions were valued at an incredible **$19,566** including **707 hours** of time.

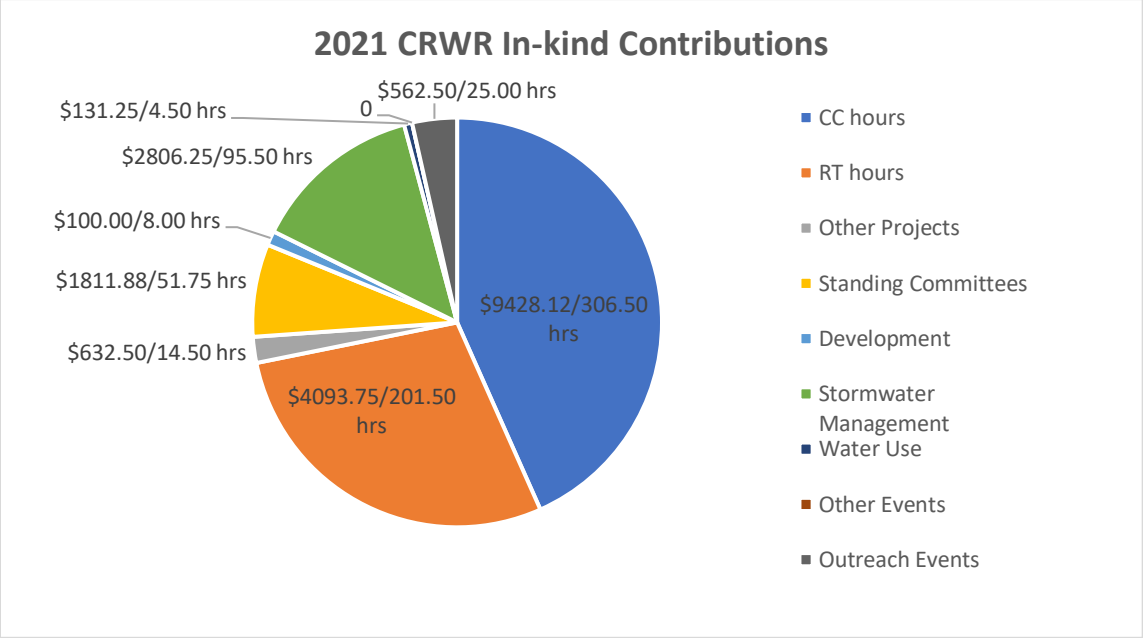


Figure 4. 2021 In-kind Contributions to the CRWR

Financials

Revenues

The Coquitlam River Watershed Roundtable currently operates on one of the smallest budgets of any Roundtable organization in British Columbia. Our Resilience and Capacity Building committee is currently working with funders to renew current funding agreements and seeking new partners so we can continue to advance our Lower Coquitlam River Watershed Plan with increased capacity.

In 2021, the Roundtable received $128,781 and carried over $35,434 from 2020 for a total of **$164,215** available funds for the year.

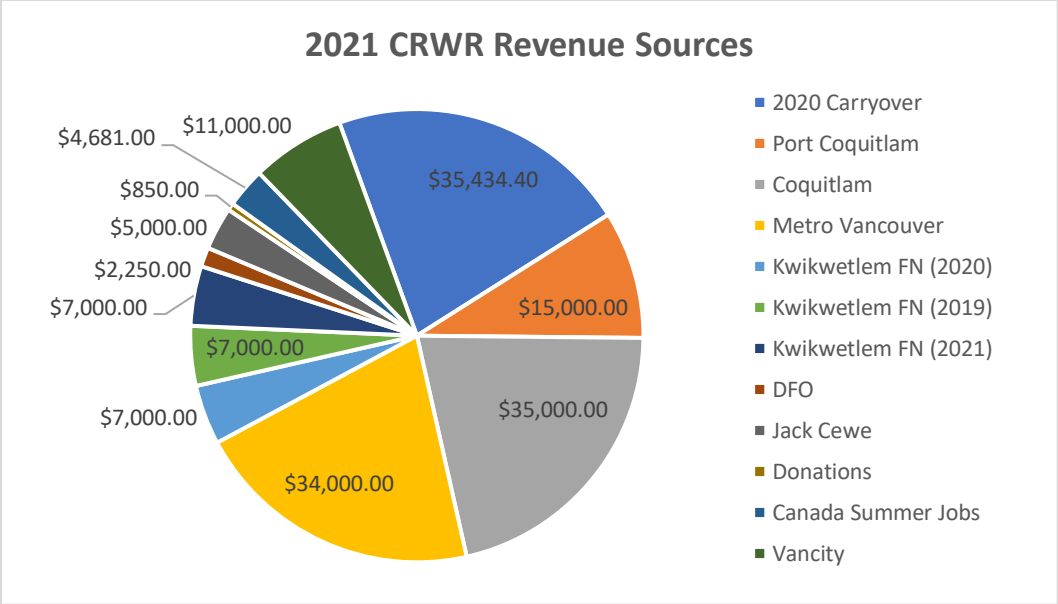


Figure 5. 2021 CRWR Revenue Sources

Expenditures

Core Committee and Roundtable meetings, public outreach, communications and Watershed Plan implementation projects are all organized by the Roundtable Coordinator, whose salary currently comprises the majority of Roundtable expenses, followed by administration fees, advertising and Roundtable meetings.

In 2021, the Roundtable's cash expenditures totaled **$99,422** (this does not include GST). When combined with in-kind contributions of $19,566, the organization's operating costs totaled **$118,988**.

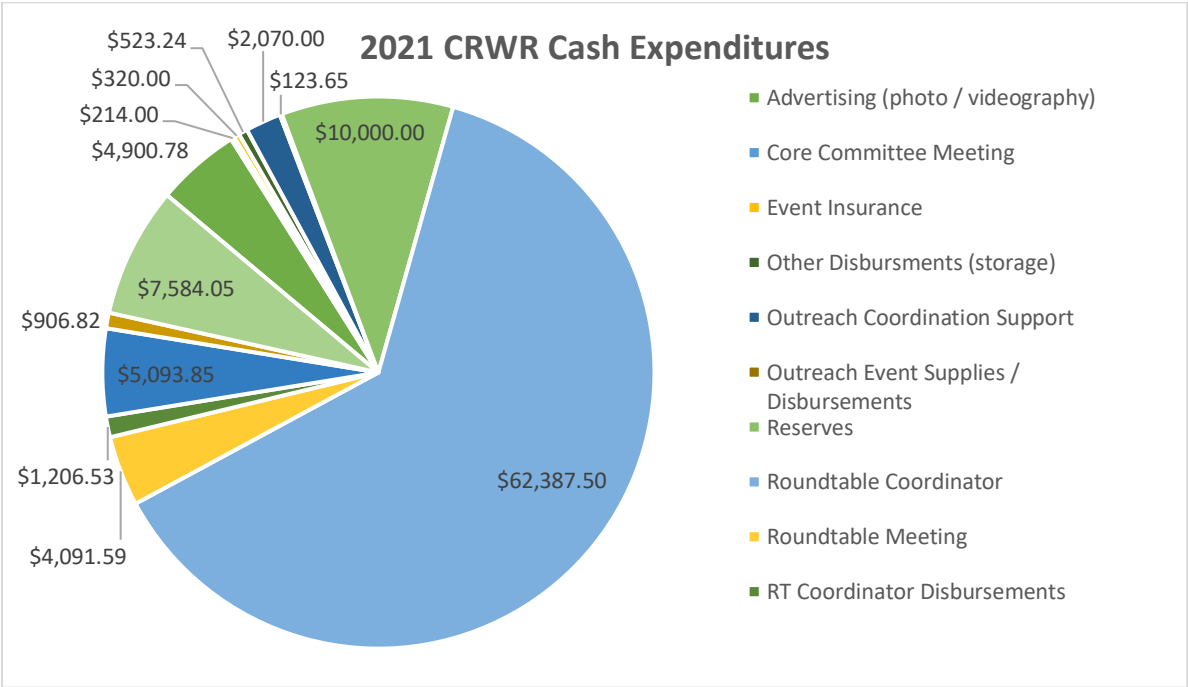


Figure 6. 2021 CRWR Cash Expenditures

Some projects required applications for additional funding and are not represented in the following figure, which shows expenditures specific to GVWD funding.

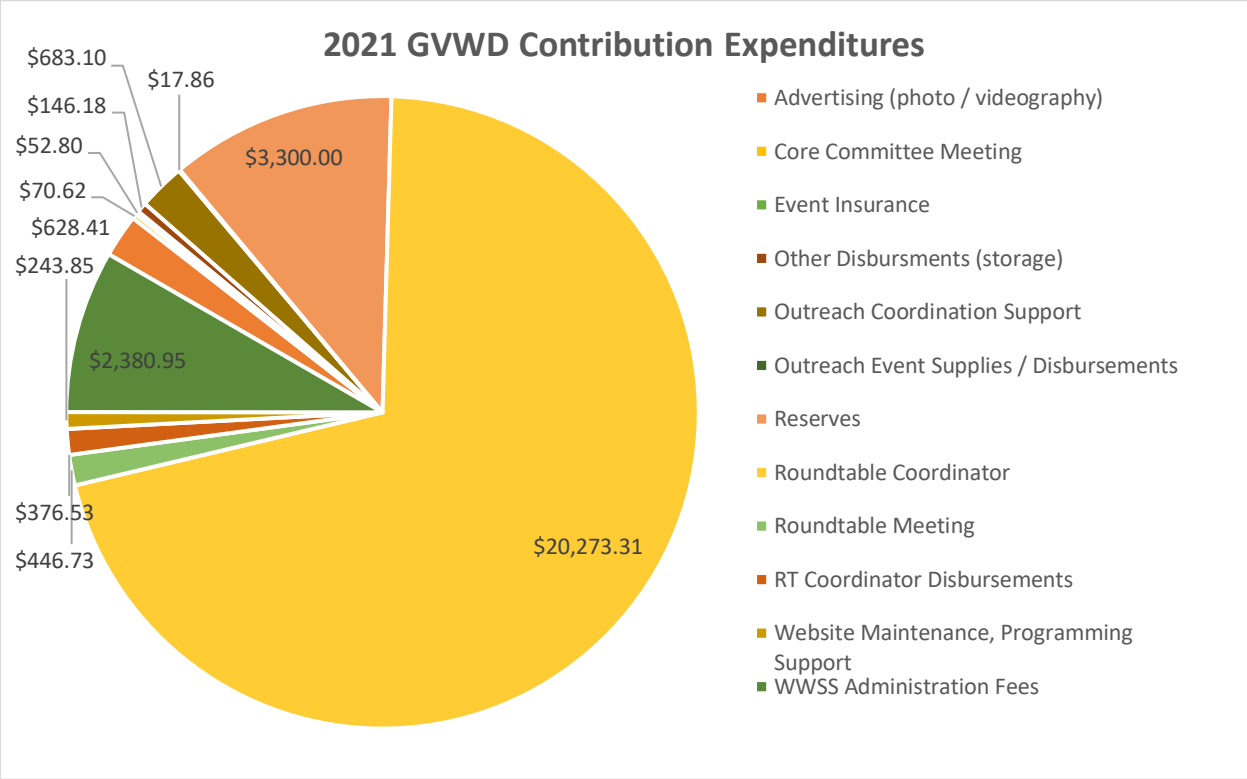


Figure 7. 2021 Greater Vancouver Water District Contribution Expenditures

Year in Review

The year 2021 was another for the books. Still amid the COVID-19 pandemic, facing challenges of staffing shortages and financial uncertainty, the watershed community also encountered drastic examples of climate change including droughts, “heat domes”, extreme fires and floods. The Roundtable took the opportunity to increase its engagement with the community and partners to facilitate responsible management of the watershed with the intent to reduce the effects of climate change:

- Community Roundtable meetings were prioritized to be held twice in the year
- A videographer was hired to increase media output
- Community engagement events focused on hands-on activities, when possible, to further encourage members to implement changes in their daily lives

The efficacy of our outreach is demonstrated by our virtual platform metrics. Website use has shown over 11% growth in monthly users with an average monthly usage of 629 users compared to 566 in 2020. The Roundtable’s social media presence was boosted with a commitment to post regularly on all three platforms (Facebook, Twitter and Instagram). Based on the growth of likes and follows for each platform, the Roundtable was able to engage 259 more people on social media compared to an increase of only 86 people in 2020, which is 201% growth. With the concentrated efforts on media communications, YouTube has demonstrated another excellent year of growth at 178% compared to the previous year.

Regularly scheduled communications (implementation reports, backgrounders and e-news) had an average open rate of 38.5%. This exceeds the average peer open rate of 37.7% as identified by Mailchimp. While the open rate of these publications is satisfactory, efforts could be made to increase the number of subscribers, which fluctuated and eventually decreased by a total of 1 subscriber over the year. Efforts made late in the year to boost one post each month encouraging viewers to sign up for the newsletter appear to correlate with a growth in subscribers; this strategy should be carried forward into subsequent years.

In-kind contributions were comparable to 2020 values, with a slight increased value of approximately $1000. Given that in-person events remain limited due to COVID-19 restrictions, these values are well within the expected range.

The Roundtable spent $99,422 of the $128,781.00 contributed in 2021. An amount of $35,434 was carried over from 2020, which is similar to the carryover from the previous year due to late municipal funding contributions in 2019. With the uncertainty of continued funding/agreement renewals due to COVID, fiscal expenditures were conservative, leaving a healthy carryover of $64,793 from 2021 into 2022. In mid-December, The Roundtable received confirmation from Kwikwetlem First Nation that its annual contribution would double for the next five years. The City of Coquitlam also confirmed that its current funding agreement would be renewed for five years, and the City of Port Coquitlam has confirmed funding for 2022.

Moving Forward

In the coming year, funding agreements with the cities of Port Coquitlam and Metro Vancouver's Greater Vancouver Water District will be up for renewal. The Roundtable intends to seek renewed agreements for the years 2023-2026 with both partners. Alternate partner funders will also be pursued to ensure a balanced budget in the years to come.

With a clear direction provided by community Roundtable members, the CRWR will continue to advance its Lower Coquitlam River Watershed Plan as capacity allows. Strategies to address the pressures of development, vandalism/illegal activity, stormwater and invasive species have been prioritized for the start of 2022.

The Roundtable would like to express its deepest gratitude to all partners, volunteers and contributors for their ongoing support through this challenging time. We look forward to continued partnerships for years to come.

To: Water Committee

From: Lucas Pitts, Director, Policy, Planning and Analysis, Water Services

Date: March 11, 2022 Meeting Date: April 6, 2022

Subject: **Drinking Water Conservation Program Update**

RECOMMENDATION

That the Water Committee receive for information the report dated March 11, 2022, titled "Drinking Water Conservation Program Update".

EXECUTIVE SUMMARY

The summer of 2021 was exceptionally warm and dry, with higher than usual drinking water consumption experienced throughout the Region. In response to those conditions, and the ongoing efforts to address household affordability, several new initiatives were developed for the summer 2022 season. The most significant of those changes was an update to the Drinking Water Conservation Plan which reduces the allowable watering days for lawns (both residential and commercial) from two days per week to one day per week. According to the Comprehensive Regional Water Supply Study a per capita consumption of drinking water of less than 202 litres per capita per day (LPCD) would need to be achieved by 2036 to avoid a supply shortage of between 5-55 billion litres. Currently the Region uses about 231 LPCD, so a reduction of an additional 10-15% is still required to meet the 2036 predicted values. This report details those changes and other upcoming improvements to the water conservation program currently in development for the summer of 2023.

PURPOSE

To summarize the changes to the Region's water conservation program for summer 2022 and new initiatives currently under development.

BACKGROUND

As identified in the *Water Supply Outlook 2120* study, mounting stresses on Metro Vancouver's water supply are occurring because of growing populations, urbanization and climate change. Of those threats, climate change poses the biggest uncertainty to the overall water supply. Precipitation forecasts indicate drier summers that could extend later into the year. Hotter days and longer dry spells over the summer months, combined with a reduction in the snowpack, could strain the existing water supply during times of the year when temperatures are high and water is in greatest demand. Potentially many different solutions exist to manage and meet these challenges.

Metro Vancouver will address these vulnerabilities over time through planned increases in supply and storage capacity, including constructing a second intake in the Coquitlam Reservoir that can access increased storage volumes to deeper depths. However, investing in capital infrastructure is expensive and can have impacts on the overall household affordability in the region. Metro Vancouver may be able to delay some of these large capital projects if we implement best practices to more sustainably manage residential, industrial, commercial and agricultural use of drinking water.

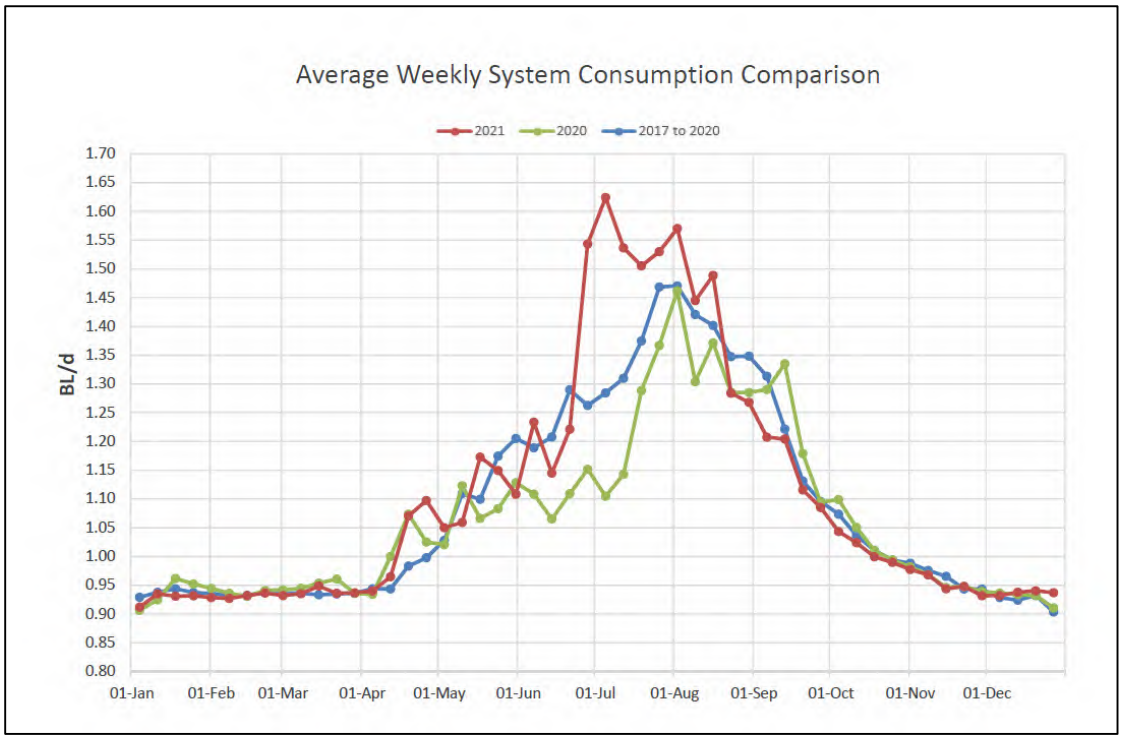
As part of the long-term planning for maintaining and expanding the overall drinking water supply, in 2016, the Comprehensive Regional Water Supply Study (CRWSS) was completed. That study modeled the potential water demand in 20 year increments to better plan for the Region's long-term infrastructure needs. That study identified the mid-2030s as the time when the Region would require an incremental addition to the drinking water supply (Coquitlam Intake #2). If that infrastructure is to be deferred, then the actual regional drinking water consumption in 2036 would need to be lower than the modeled values from the CRWSS. A summary of the projected drinking water use in 2036 is presented in Figure 1.

Figure 1 – Comprehensive Regional Water Supply Study 2036 Predicted Demand Factors

Item	**2016**	**2036 (Predicted range)**
Population (millions)	2.5	3.1 - 3.4
Total Annual Water Demand (BL)	394	405 - 443
Residential Per Capita Demand (L/Capita/Day)	268	202 - 212
Annual Water Supply Gap (BL)	0	5 - 55
Demand and Supply Uncertainties: Demographic growth, the density of growth, conservation effectiveness, water supply variability, water quality, climate change		

The summer of 2021 was particularly challenging to regional water conservation efforts. There were 40 days where the Greater Vancouver Water District (GVWD) delivered over 1.5 BL of water, and a peak day demand of 1.8 billion litres was experienced in June, as shown in red in Figure 2 (next page). Demands such as these are a rare occurrence in the Region as shown by the blue line in Figure 2, which shows the average weekly consumption for 2017 to 2020.

Figure 2 – Summer 2021 Drinking Water Consumption



While June, July and some of August experienced high drinking water consumption, September and October were unseasonably cold and wet and thus the overall per capita consumption did not increase.

Figure 3 – Residential Per Capita Consumption Trends

Year	Winter (Nov - March)		Summer (June - Sept)		Annual Average	
	Regional	Residential	Regional	Residential	Regional	Residential
	LPCD	LPCD	LPCD	LPCD	LPCD	LPCD
2010	418	243	606	323	495	273
2011	417	243	555	300	475	262
2012	407	241	515	314	468	271
2013	398	217	529	292	468	246
2014	388	206	536	283	458	234
2015	378	209	533	286	440	242
2016	377	204	519	268	435	232
2017	370	201	495	285	439	231
2018	359	232	526	332	433	272
2019	358	223	515	304	424	254
2020	350	201	489	284	411	235
2021	344	199	488	280	403	231
Avg	**380**	**218**	**526**	**296**	**446**	**249**

The focus of water conservation efforts continues to be on summer discretionary use through the Drinking Water Conservation Plan (DWCP). The summer months are when supply and system operations can be challenged because drinking water demand typically increases 30-45% over winter drinking water demand.

NEW IN 2021

For the summer of 2022, Metro Vancouver has implemented the following two new initiatives to further reduce summer discretionary water use.

DWCP Update

In November 2021, the Metro Vancouver board approved the updates to the DWCP that limits lawn watering in Stage 1 for both commercial and residential properties to one morning per week (down from two). During Stage 2, residential and commercial lawn watering is banned. The updated DWCP has been adopted into member jurisdiction bylaws for summer 2022. It is anticipated that these changes will save between 1-20% of summer water use, depending on engagement and enforcement.

DWCP Summer Support Program

This summer, Metro Vancouver will have a team of water conservation engagement specialists that will move throughout the Region addressing non-compliant water use through either direct engagement or reporting addresses directly to member jurisdictions. Member jurisdictions have the option to sign up for participation in this program and are able to guide what the program looks like in their community. The program is financed through the Policy, Planning and Analysis operational budget.

Anticipated Initiatives for 2023

Metro Vancouver is in the process of developing the following two new indexes to monitor and communicate the status of drinking water availability and drinking water use in the region.

Drinking Water Stress Index

The Drinking Water Stress Index (DWSI) is in development for rollout in the summer of 2023. Similar to the Province's Fire Danger Rating or Drought Response Levels, the DWSI will allow the GVWD to convey urgency around our drinking water resources without having to trigger stage 2 or stage 3 restrictions. The DWSI is in early development but will consider current consumption patterns, source storage, weather conditions, drought conditions and predictive modeling. The idea is to use the DWSI to draw attention to drinking water system conditions and supply during the critical summer months. The intent is to make sure the DWSI is widely shared throughout the Region and prominently displayed on our website. This project is funded through the Policy, Planning and Analysis operational budget.

Drinking Water Consumption Index

The Drinking Water Consumption Index (DWCI) is in development for rollout in the summer of 2023. The DWCI will consider current summer consumption patterns and compare them with historical trends. For example, in 2021, when the consumption was higher than usual, the DWCI would have been rated as high or extreme. Similar to the DWSI, the intent is to share the DWCI throughout the Region and prominently display it on the Metro Vancouver website. This project is funded through

the Sustainability Innovation Fund and is part of a larger suite of data analytic and predictive tools the GVWD is developing.

ALTERNATIVES
This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS
This is an information report. No financial implications are presented.

CONCLUSION
Water conservation continues to be a priority item for the region. The summer of 2022 will see updates to the DWCP as well as the implementation of the DWCP Summer Support Program. New initiatives are being planned for upcoming peak (summer) seasons as well. Staff will continue to work closely with member jurisdictions to develop region-wide approaches to water conservation. Sustained reductions in per capita water use are going to be key to consider any deferral of large capital projects and the impacts of those projects on household affordability.

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

To: Water Committee

From: Larina Lopez, Division Manager, Corporate Communications
Amy Weiss, External Relations Project Coordinator, Corporate Communications

Date: March 22, 2022 Meeting Date: April 6, 2022

Subject: **2022 Lawn Watering Communications and We Love Water Campaign Update**

RECOMMENDATION
That the GVWD Board receive for information the report dated March 22, 2022, titled "2022 Lawn Watering Communications and We Love Water Campaign Update".

EXECUTIVE SUMMARY
Water conservation is a major component of Metro Vancouver's planning to ensure the sustainable use of water resources. To support understanding of and compliance with water conservation policies and programs, and encourage personal pride in reduced water use, Metro Vancouver delivers an annual region-wide water conservation campaign with a reach in 2021 of over 36 million impressions. Starting April 14, Metro Vancouver will communicate the updated Drinking Water Conservation Plan, focusing on the change of lawn watering to only water one day per week for residential properties. The change comes into effect May 1. Promotional materials (including social media, a media release, and co-branded collateral) will be distributed to member jurisdictions for public education and enforcement throughout the summer season. The annual We Love Water campaign will continue to emphasize the importance of our future water supply and impacts of population growth, and will share outdoor water conservation information. A targeted media buy will include television, radio, outdoor, and digital promotions all leading to the We Love Water campaign website.

The Water Wagon program will proceed in 2022 using only the larger water wagon for an anticipated 55 event days, including 14 days at the PNE.

PURPOSE
To update the Water Committee on communication plans for watering regulations and the annual regional water conservation campaign.

BACKGROUND
Metro Vancouver undertakes several communications initiatives to ensure water resources are conserved and efficiently used throughout the region.

A communication strategy supports the region-wide watering regulations in the *Drinking Water Conservation Plan,* which was updated in 2021 to reduce permissible lawn watering at residential properties from two days down to one day per week.

These regulatory communications are also supported by the We Love Water campaign — which delivered over 36 million impressions in 2021 and is now in its seventh year. The campaign provides

residents with tips for using less water through the dry summer season and increases awareness of Metro Vancouver's water sources, system, and the need for residential water conservation.

The We Love Water campaign also reinforces how and why water conservation is a key component in managing the drinking water system over the coming decades. Because the region's population is growing, increased conservation and lower per capita demand can potentially work to defer capital infrastructure, lower operational costs and address challenges related to climate change.

The Water Wagon program and associated Tap Water Team also plays an important role in promoting water conservation while highlighting the quality of Metro Vancouver's drinking water and discouraging the consumption of bottled water.

This report provides an update on the communications for the 2022 watering regulations, the 2022 regional water conservation campaign and the 2022 water wagon program as identified in the 2022 Water Committee work plan. Results of the campaign will be reported back in November 2022.

WATER CONSERVATION COMMUNICATIONS

2022 Watering Regulations Communications

Metro Vancouver collaborates with members to determine the most effective messaging and methods for consistently communicating the regional watering regulations contained within the *Drinking Water Conservation Plan (DWCP)* to residents and businesses. The *DWCP* has been updated for 2022 with new restrictions on lawn watering — most notably a shift for residential homes and businesses only being permitted to water lawns one day a week in Stage 1. Communications will focus on these new updates.

Lawn Watering Regulations in effect May 1 – October 15. Communication will begin April 25.

In 2022, Metro Vancouver will undertake the following activities to create awareness of the new lawn watering regulations:

- Develop and distribute materials to support members' education and enforcement programs, including translated materials upon request – available March 21;
- Distribute information on the updated regulations via emailed communications to industry stakeholders including irrigation and lawn care businesses – April 2022;
- Send a direct mail postcard to all homes with lawns across the region informing residents of the updated restrictions and offering conservation tips – April 2022;
- Notify public of regulations via targeted social media and digital advertising – beginning April 25; and
- Issue a media release on April 25 and conduct interviews.

Communications will direct residents to Metro Vancouver's lawn watering regulations webpage. This page also features water-efficient lawn care and gardening content, including links to Metro Vancouver's Grow Green Guide, and a simplified schedule to help the user determine what watering activities are allowed on a given day.

In recent years, the language on gold lawns has shifted to be accompanied by reinforcement that a lawn that goes gold will recover only if it is given proper lawn maintenance. To support residents in maintaining healthy lawns while reducing water use, new messaging on best lawn care practices will be included.

Examples of communications materials to support the regional watering regulations are included in Attachment 1.

Regional Water Conservation Campaign Communications

The regional 'We Love Water' conservation campaign encourages mindful and responsible use of drinking water and increased awareness and pride for Metro Vancouver's water sources and system. This campaign is aligned with communications about the lawn watering regulations.

The 2022 campaign will be sequenced with two focus areas:

1. Water Source – May 16 to June 26
    a. Infrastructure cost deferrals
    b. Future water supply

2. Water Conservation – June 27 to September 4
    a. Lawn watering regulations
    b. Outdoor water conservation
    c. Climate change impact on drinking water

By teaching residents about their future water supply and the need for conservation to help postpone or mitigate costly infrastructure, they will better understand the importance of using less treated drinking water for discretionary purposes. Information about Metro Vancouver's water system will target the 18 – 34 age group (the least likely group to be well-informed on drinking water sources and systems), while outdoor conservation topics will target home owners with lawns who are most likely to use water outdoors.

Campaign components to be considered in 2022 to generate awareness and encourage conservation will include:

- Updated We Love Water website with improved navigation and focused content;
- Television broadcast partnership, featuring commercials and segments endorsed by media personalities, as well as branded online content;
- Commercials on additional television networks;
- Radio broadcast partnership featuring dry weather alerts from media personalities;
- Weather-triggered digital billboards on major transportation routes throughout Metro Vancouver;
- Targeted social media advertising; and
- Online banner, YouTube video, search engine advertising targeting users' interests (e.g., gardening, lawns, car washing), and weather forecast-activated digital advertising.

The 2022 campaign will build on the creative concept established in previous years, with a unified animated design linking the 2022 focus areas.

Examples of previous years' communication materials and draft concepts to support the regional conservation campaign are included in Attachment 2. New creative concepts are in the development and planning stage, including updated digital graphics to draw attention to the infrastructure and future water supply. All materials lead to the We Love Water website for conservation tips and information about Metro Vancouver's water sources and system. All materials will be shared with members for display and distribution through localized opportunities.

2022 WATER WAGON PROGRAM

The Water Wagon program and associated Tap Water Team promote water conservation and highlight the quality of Metro Vancouver's drinking water while discouraging the consumption of bottled water.

This program completed a ninth season in 2019 and was paused in 2020 and 2021 due to COVID-19. Now entering a tenth season, options have been considered for the program to ensure compliance with public health restrictions and for best use of resources with a lower number of in-person public events anticipated through the spring and summer season. Member jurisdictions were consulted through the Regional Communication Members group at the bi-monthly meeting on January 25, 2022. Several members confirmed in-person events were likely but at a reduced number, and others confirmed virtual events were primarily being planned for 2022.

Taking this into consideration, the Water Wagon program will proceed in 2022 using the larger of the two water wagons (the Quench Buggy) for an anticipated 55 event days, including 14 days at the PNE. Requests for events will open to member jurisdictions in late March, and remaining dates will open for community event requests in mid-April. The second smaller mobile unit will remain in storage through the 2022 season.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

The 2022 watering regulations communications and regional water conservation campaign, and Water Wagon 2022 program have a total budget of $417,719. These costs are included in the 2022 Water Services communications program budget managed by External Relations.

CONCLUSION

Metro Vancouver will support the updated Drinking Water Conservation Plan, including communicating the change to one day per week residential lawn watering starting April 25 via media release, social media advisory, digital advertising, and promotional materials distributed to members for public education and enforcement throughout the summer season. The We Love Water regional water conservation campaign will begin May 16, with a mix of television, radio, outdoor, and digital advertising. The campaign reinforces how and why water conservation is a key component in managing the drinking water system over the coming decades. With a growing population, increased conservation

and lower per capita demand can potentially work to defer capital infrastructure, lower operational costs and address challenges related to climate change. Creative materials and collateral will be shared with members so they can support the campaign through their own communications channels. The Water Wagon program will proceed in 2022 using the larger of our two water wagons (the Quench Buggy) for an anticipated 55 event days, including 14 days at the PNE.

Attachments

1. 2021 Watering Regulations Communications Materials – Updating with new regulations for 2022
2. 2021 'We Love Water' Communications Materials

References

1. We Love Water Campaign website: http://www.metrovancouver.org/welovewater/Pages/default.aspx
2. Lawn Watering Regulations website: http://www.metrovancouver.org/services/water/water-conservation/lawn-sprinkling/Pages/default.aspx
3. Grow Green Campaign website: http://www.growgreenguide.ca/

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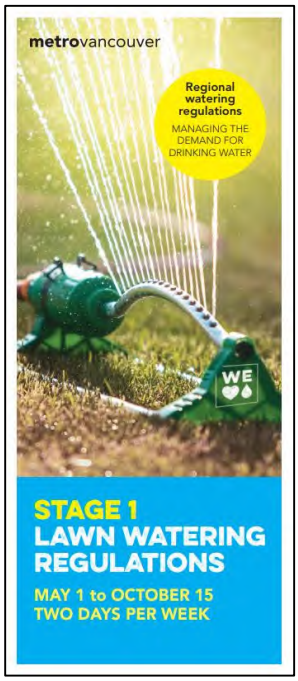
2021 Watering Regulations Communications Materials – Updating with new regulations for 2022

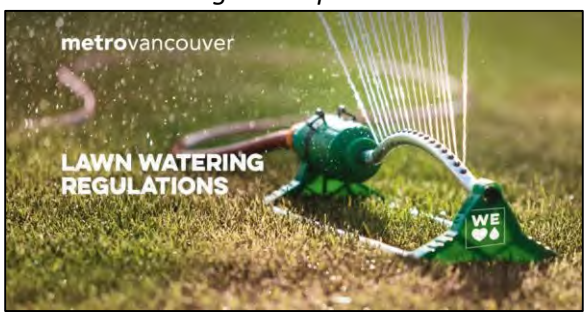
Direct mail postcard

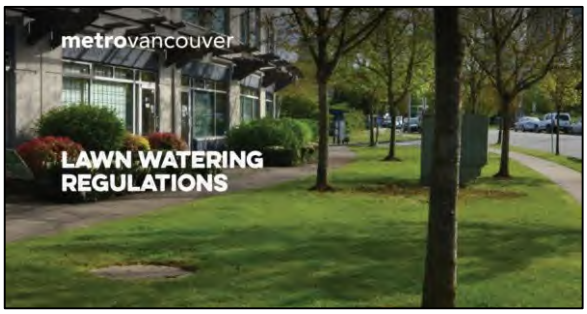
Residential education leaflet



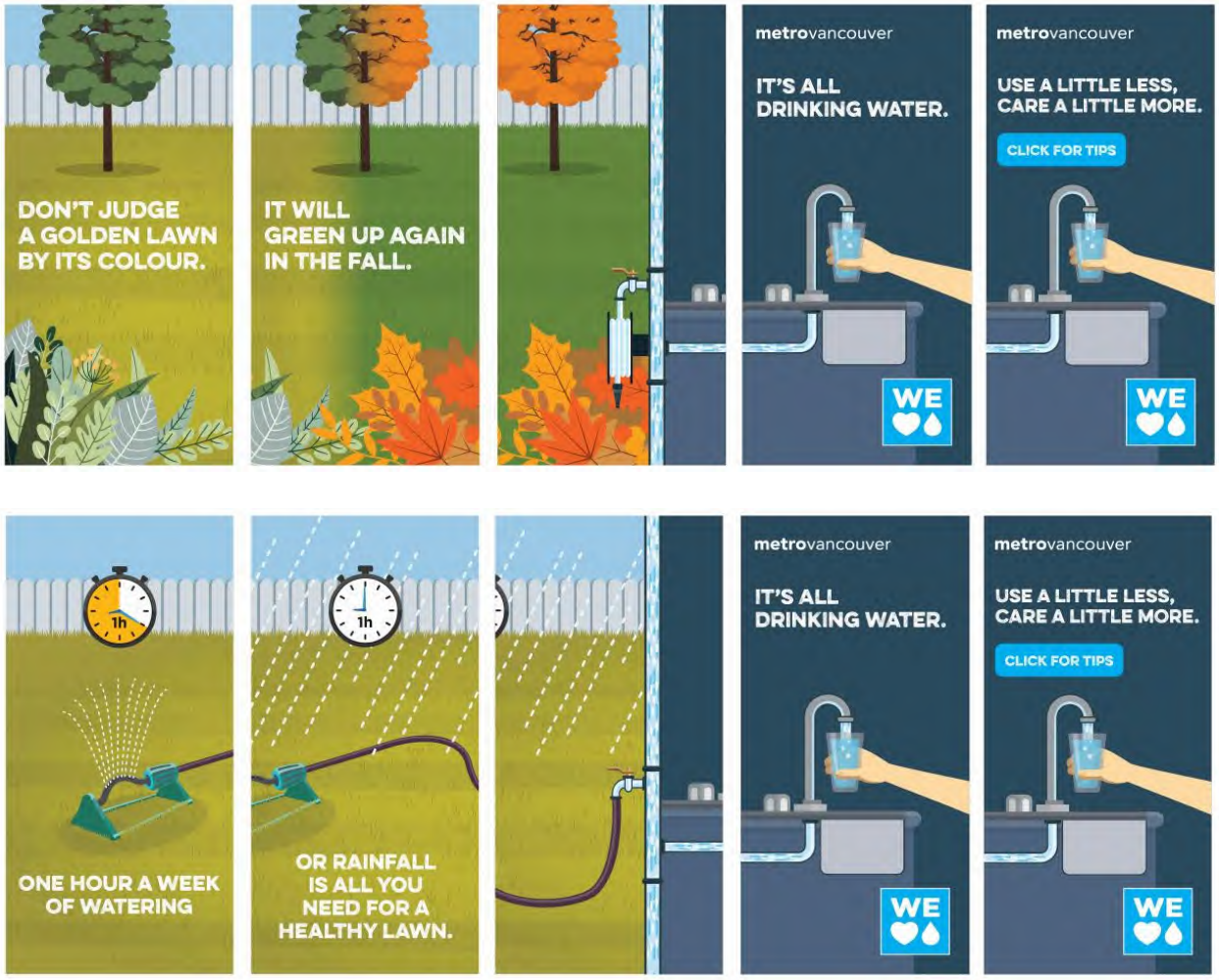
Non-residential education leaflet

Social media image examples





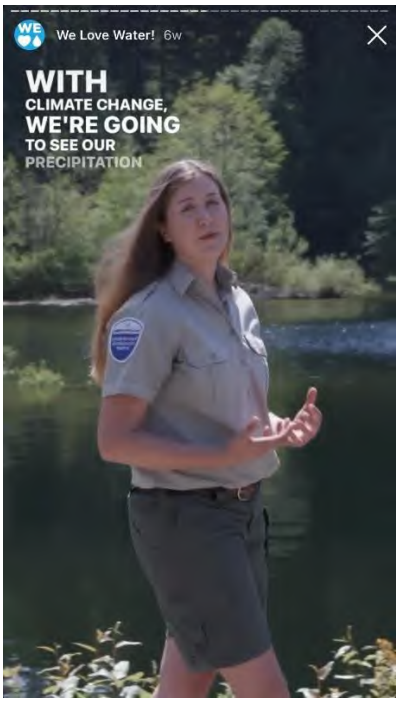
Animated banner ads for social media and digital advertising

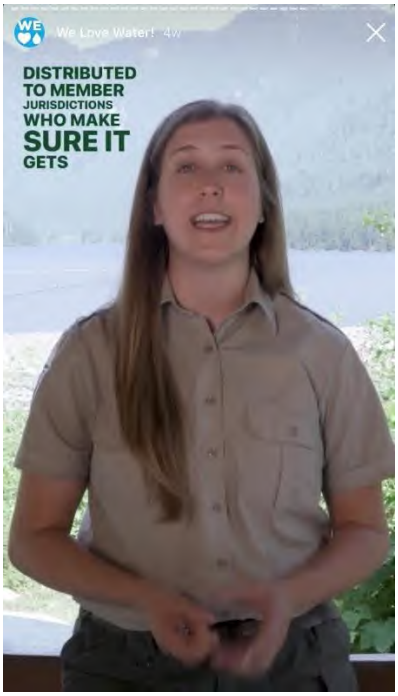

DON'T JUDGE A GOLDEN LAWN BY ITS COLOUR.
IT WILL GREEN UP AGAIN IN THE FALL.
metrovancouver
IT'S ALL DRINKING WATER.
WE
metrovancouver
USE A LITTLE LESS, CARE A LITTLE MORE.
CLICK FOR TIPS
WE
1h
ONE HOUR A WEEK OF WATERING
1h
OR RAINFALL IS ALL YOU NEED FOR A HEALTHY LAWN.
metrovancouver
IT'S ALL DRINKING WATER.
WE
metrovancouver
USE A LITTLE LESS, CARE A LITTLE MORE.
CLICK FOR TIPS
WE

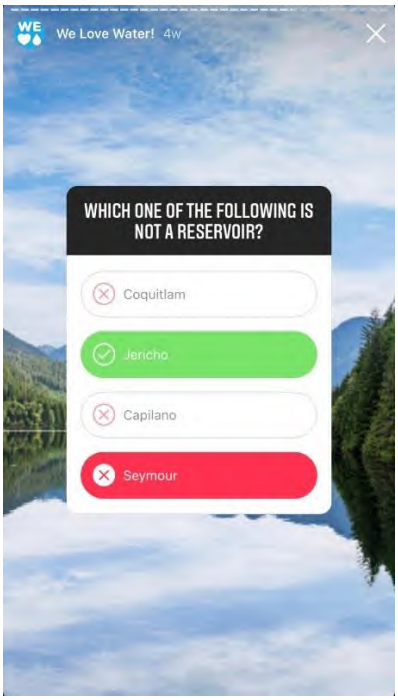
2021 'We Love Water' Communications Materials

Social media image examples

Still-shots from Instagram Story videos featuring Dayna Timmons from the Watershed Operations team







Videos – water source and system education and awareness examples

Example of Weather Network online banner takeover

Animated banner ads for social media and digital advertising

1. Capilano Reservoir.
2. Camera zooms out. We see a kitchen window.
3. Camera pans more to see the kitchen sink.
5. Kitchen fade out.
   The water tap circle appears over the sink.
   It's all drinking water.
5. Use a little less, care a little more.
   CTA Button.

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

To: Water Committee

From: Lucas Pitts, Director, Policy, Planning and Analysis, Water Services

Date: March 28, 2022 Meeting Date: April 6, 2022

Subject: **Water Supply Update for Summer 2022**

RECOMMENDATION
That the Water Committee receive for information the report dated March 28, 2022, titled "Water Supply Update for Summer 2022".

EXECUTIVE SUMMARY
This report provides a summary of the current state of source water supply, past trends in water use, and an update on the current plans for operating the source reservoirs and water system during the summer and fall of 2022.

The existing snowpack, precipitation in the form of rainfall, and expected full source lake storage will be sufficient to ensure an adequate water supply for the 2022 summer season. The peak day and average summer day water usage saw an increase in 2021, primarily because of the record-breaking heat dome of 2021. Winter water use continues to decrease while average day water use is starting to stabilize, indicating the importance of conservation initiatives and continued support to these initiatives from our member jurisdictions. System improvements have increased the capacity of the transmission system to meet peak summer demands.

PURPOSE
To provide the Committee with the annual update on the current water supply and water consumption projections in advance of the approaching summer peak demand period.

BACKGROUND
As per the Committee's 2022 Work Plan, and those of previous years, water supply and water consumption status reports are brought forward each spring. These reports are developed based on the current state of source water supply and trends in water use and reflect current plans for operating the source reservoirs and water system during the summer and fall.

CURRENT SOURCE WATER SUPPLY SITUATION
Snowpack
Snowpack measurements are routinely conducted at sample sites across the Capilano, Seymour and Coquitlam Water Supply Areas. The March 1, 2022 survey results indicate that the depth and water equivalent of the snowpack is 98% and 107% respectively of the historical average for this survey period. April 1 snow survey results are not available for this report print date although there has been modest snowpack accumulation through upper elevations during March. The March 1 survey results and recent snowfall indicates an average spring runoff from snowmelt.

While snowpack is important, it should be noted that the region's water supply is not solely dependent on snowpack. Rainfall further contributes to the water levels in the three primary source reservoirs that serve Metro Vancouver.

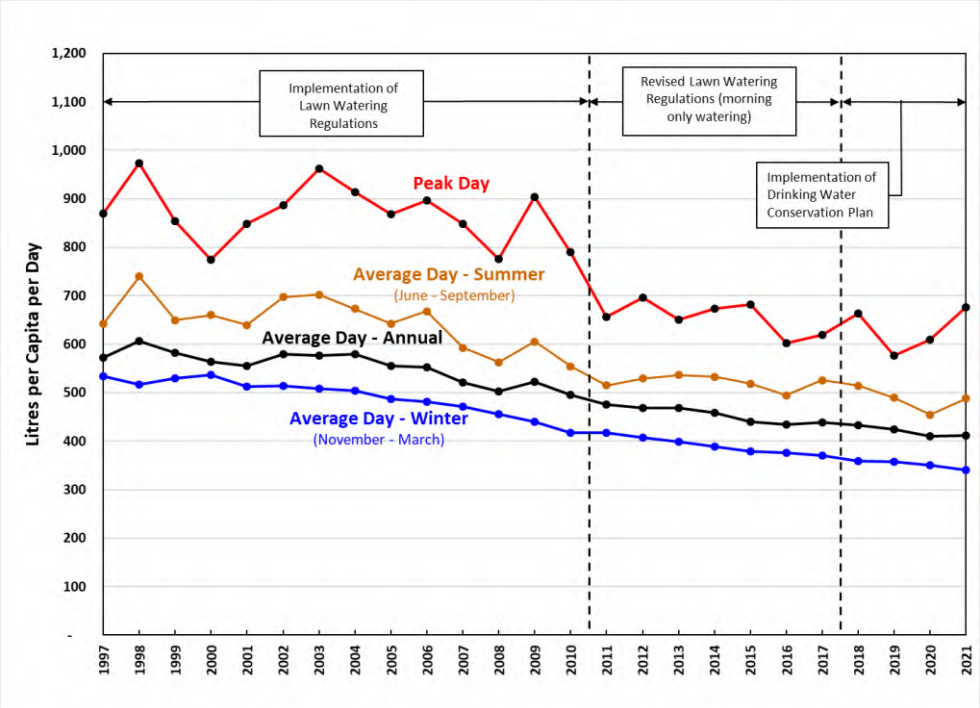
Stored Water - Source Reservoirs

a) Capilano Reservoir: currently being managed under the spring operating protocol, with the reservoir currently at 66% of full summer storage capacity. The GVWD expects the Cleveland Dam Drum Gate to be raised by late April and anticipates that the reservoir will be at full capacity by late spring.
b) Seymour Reservoir: currently being managed under the spring operating protocol, with the reservoir currently at 99% of full summer storage capacity. The reservoir is expected to be at full capacity by late spring.
c) Coquitlam Reservoir: controlled by BC Hydro within a condition established by an agreement with the GVWD. It is expected that BC Hydro will have Coquitlam Reservoir sufficiently full to provide for adequate regional summer water supply. BC Hydro is upgrading their tunnel gates in the fall, and there will be no impact on the summer water supply.
d) Alpine Lakes: GVWD's three alpine lake sources, Palisade, Burwell, and Loch Lomond, which are used as reserves for Capilano and Seymour reservoirs during the summer period, are all expected to be at full capacity by late spring.

Trends in Water Consumption/Use

This section discusses trends in water consumption/use, as well as some of the factors affecting water use. Figure 1 shows water use in the region in litres per capita per day for the last 25 years (1996 to 2021).

Figure 1: Per Capita Water Use in the Region



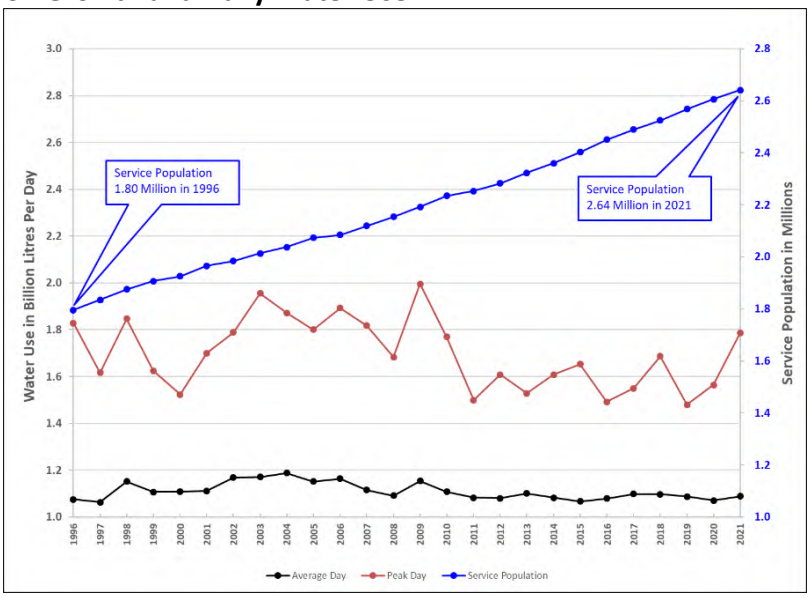
Historically, peak day per capita use (red line in Figure 1) occurs on a hot and dry summer day when many people in the region are watering their lawns. In 2021, the record-breaking heat dome resulted in a peak day per capita use higher than the previous five year's peak day per capita use. To curb this increase in peak day per capita water use, the updated *Drinking Water Conservation Plan* (DWCP), which was approved by the Greater Vancouver Water District (GVWD) Board in November 2021, includes the annual implementation of Stage 1 restrictions on May 1 that limit lawn watering for residential and non-residential properties to one morning a week. During Stage 2, residential and non-residential lawn watering is banned. The updated DWCP has been adopted into member jurisdiction bylaws in preparation for summer 2022.

The black line in Figure 1 shows the yearly average day per capita water use. This represents the overall regional water use on a per capita basis, which has been gradually trending downwards. The summer of 2021 was challenging to the regional water supply as there were 40 days where the GVWD delivered over 1.5 BL of water. This resulted in a spike in the average summer day per capita use (brown line). However, the overall annual average day per capita demand remained stable, primarily because of lower water usage during an unseasonably cold and wet fall. Metro Vancouver is updating the *Region-Wide Guide for Enforcement of the DWCP*, and will continue to work with member jurisdictions to enhance the water conservation education programs and enforcement efforts of the updated DWCP.

The blue line in Figure 1 shows winter per capita water use steadily declining since 1996, due to water efficiency and conservation policies. During the winter months of November to March, outdoor water use is generally low with little fluctuation due to weather conditions, making winter water use on a per capita basis a good measure for comparing baseline water use from year to year.

Figure 2 below shows the serviced population and total water use in billions of litres per day. Although total water use has stabilized in recent years, it is expected to increase as the effect of population growth on water demand begins to exceed per capita water use reductions due to water efficiency.

Figure 2: Population Growth and Daily Water Use



SYSTEM OPERATIONS OUTLOOK FOR SUMMER 2022

Water usage patterns will be monitored and adjustments made to withdrawals from each of the three main sources and within the transmission system to meet the regional water demand through the summer and fall. Additional withdrawals from Coquitlam Reservoir have been secured from BC Hydro for 2022. The three alpine lakes will also be utilized within their refillable storage limits, as required.

Hot and dry summer weather conditions drive demands and may create challenges for the transmission system to meet service levels in parts of the region, most notably in the southern and eastern parts that are both geographically furthest from the sources and are experiencing the fastest population growth rates. System upgrades such as the Port Mann Water Supply Tunnel, Clayton Reservoir, Jericho Reservoir Cell # 1, South Delta Main No. 1 Replacement (Phases 3 and 4), Port Mann Main No. 2 (South), Port Mann Main No. 2 (North), and Whalley Main have all contributed to additional transmission system capacity to meet summer peak demands in both the eastern and southern jurisdictions and will continue to benefit the regional transmission system during the summer.

If summer water storage supplies become stressed, Metro Vancouver will introduce additional water restrictions as per the DWCP.

ALTERNATIVES

This is an information report; no alternatives are presented.

FINANCIAL IMPLICATIONS

During the hotter and drier months, the demand for water increases significantly compared to the winter months, putting additional stress on the water supply system. Metro Vancouver's seasonal pricing structure, where annual rate increases are applied to the peak rate only, reflects the cost of building larger infrastructure and higher operating costs such as increased pumping to meet peak summer demands.

CONCLUSION

Based on the April 1, 2022 snowpack survey and anticipated spring precipitation, expected source storage will be sufficient to ensure adequate water supply for the 2022 summer season.

Although the region's population continues to grow, overall water demand has remained relatively steady, generally offset by conservation measures. It is, however, anticipated that overall water use will increase gradually as the effect of population growth on water demands begins to exceed the per capita water use reductions. Outdoor watering regulations, along with our regional partners' implementation of the *Region-wide Guide for Enforcement of the DWCP*, are expected to help manage water demands during the upcoming peak season.

System improvements have increased the capacity of the transmission system to meet peak summer demands.

48996419

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

To: Water Committee

From: Lucas Pitts, Director, Policy, Planning and Analysis, Water Services
Farshad Mortazavi, Senior Project Engineer, Water Services

Date: March 22, 2022 Meeting Date: April 6, 2022

Subject: **GVWD Flow Meter Upgrade Program – Progress Report**

RECOMMENDATION

That the Water Committee receive for information the report dated March 22, 2022 titled "GVWD Flow Meter Upgrade Program – Progress Report".

EXECUTIVE SUMMARY

Metro Vancouver (MV) owns and operates over 200 large diameter flow meters, located either at boundaries of Greater Vancouver Water District (GVWD) member jurisdictions or at some individual connections, to measure the amount of drinking water utilized by each member in the region. The region annually consumes around 390 billion liters of water per year, which translates to around $320 million in revenue. Metro Vancouver continues to improve the collection and processing of data by the continued improvements made through the Water Meter Upgrade Program (WMUP). This program allows Metro Vancouver to continually improve data collection, processing, and quality control, resulting in improved billing accuracy for our members. Accurate water consumption data also allows the region to focus on targeted water conservation initiatives.

PURPOSE

That the Water Committee receive for information the nature and progress of the Metro Vancouver Flow Water Meter Upgrade Program and associated improvement projects.

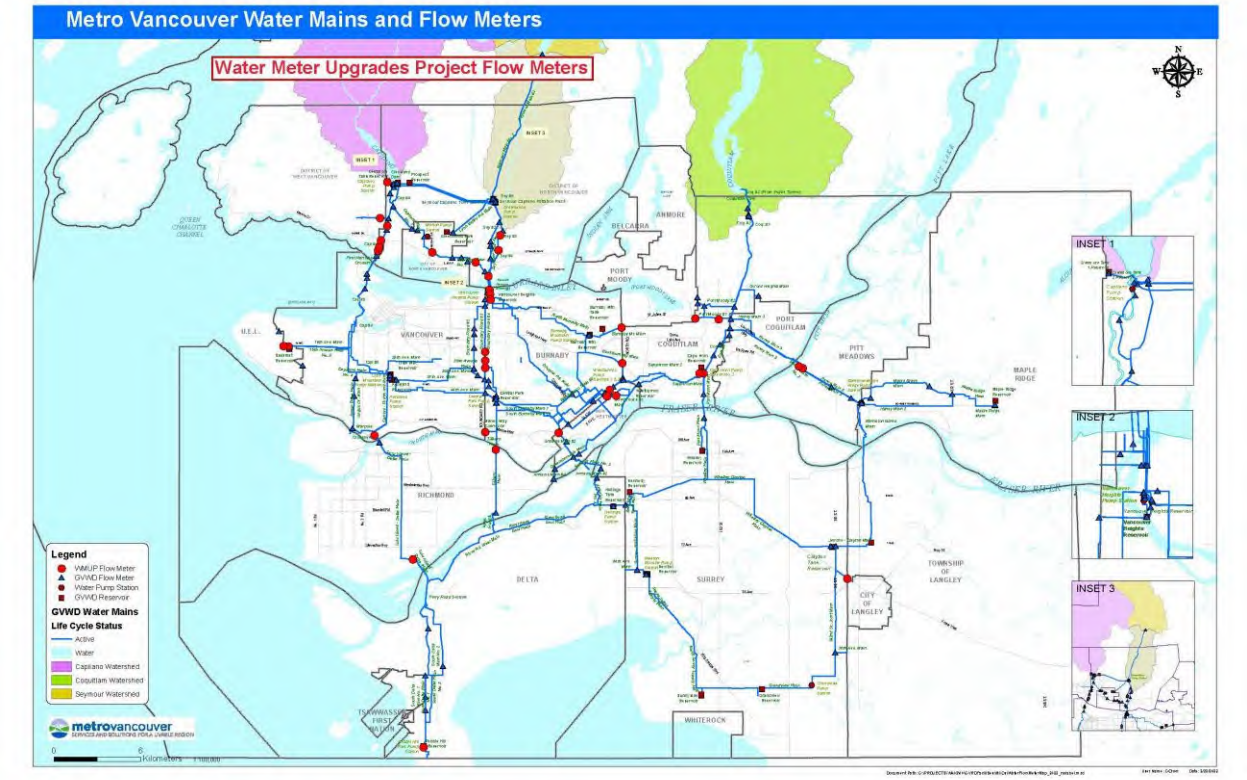
BACKGROUND

Drinking water consumed by the GVWD's member jurisdictions (customers) is measured via regional water flow meters located in key locations throughout the region. The regional water utility is continually upgrading its metering network in order to accurately measure the amount of water flowing throughout the water system and to replace meters as they reach the end of their service life. Meters are connected to the Supervisory Control and Data Acquisition (SCADA) system, which can process the flow data on a near real-time basis and allows data to be shared with customers.

The data received from the water flow meters undergoes a quality control process and is then used to prepare the Monthly Water Consumption Report and to issue water billing invoices. Annual metered water consumption is in the range of 390 billion litres. This translates into revenue of around $320 million per year.

Over 200 large diameter water flow meters are utilized for operational, billing, and planning purposes. Meters are generally located at the boundaries between customers and on some individual connections. Figure 1 below highlights locations of projects in WMUP.

Figure 1: Water Meter Upgrade Project Flow Meters



WMUP

The primary benefit of the WMUP is the continuous improvement of the accuracy of the overall network of existing GVWD billing water meters. WMUP also encourages the installation of water meters on new and existing connections, which aligns with Section 3.2.3 of the current Drinking Water Management Plan.

WMUP includes 37 flow meter projects (7 new and 30 replacements), which were selected from a ranking analysis study, and are being implemented through three separate contracts, designated as 'Sets':

- Set 1 (WMUP1) includes 14 meters
- Set 2 (WMUP2) includes 10 meters
- Set 3 (WMUP3) includes 13 meters

Figure 2: Project Schedule

Set	2018	2019	2020	2021	2022	2023	2024	2025	2026	LRP Budget
WMUP1										$7.6M
WMUP2										$7.8M
WMUP3										$7.0M
							Total			$22.4M

ALTERNATIVES
This is an information report. No alternatives are provided.

FINANCIAL IMPLICATIONS
Out of 37 water meter upgrade projects, 8 have been completed, 16 are in the design stage, and 13 have not yet started. As of January 2022, $5.3 million has been spent. WMUP is currently under budget and behind schedule because there are project delays related to the timing of tenders, construction delays, and issues related to access to infrastructure and resources required for isolation of water mains.

CONCLUSION
WMUP is designed to improve the data collection, processing, and quality control of water consumption data. With the better data, Metro Vancouver is better able to realize continuous improvement for the water meter billing process and share more accurate flow information with our customers.

48986298

To: Water Committee

From: Cheryl Nelms, General Manager, Project Delivery

Date: March 23, 2022 Meeting Date: April 6, 2022

Subject: **Project Delivery Capital Portfolio Update**

RECOMMENDATION

That the Water Committee receive for information the report dated March 23, 2022 titled "Project Delivery Capital Portfolio Update".

EXECUTIVE SUMMARY

Metro Vancouver is providing an update on the Water portfolio of major capital projects being delivered by the Project Delivery Department. This update contains project specific information and a portfolio dashboard that provides information on the various programs and projects being delivered by the Department. The next updates will be in July and October 2022.

PURPOSE

This report provides an update on the progress of major capital projects being delivered by the Project Delivery Department.

BACKGROUND

Metro Vancouver is implementing best practices related to governance and oversight on the highest value, risk, and consequence capital projects. A key deliverable is to provide regular, standardized updates on the portfolio of major capital projects being delivered by the Project Delivery Department. Metro Vancouver has developed a standardized dashboard report, which includes the following information for each major capital project:

- Primary location
- Project schedule over the next 10 years
- Project update
- Current status
- Anticipated date for next review by the relevant Metro Vancouver Board

To improve communication and transparency on these major capital projects, Metro Vancouver plans to provide three updates in 2022 – April, July and October.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

This is an information report. No financial implications are presented.

CONCLUSION

This report provides a progress update on the portfolio of capital projects being delivered by the Project Delivery Department. The next updates will be in July and October 2022.

Attachment

Project Delivery Capital Portfolio Dashboard – Water Projects – April 2022 *(49922081)*

ATTACHMENT

Metro Vancouver Capital Projects Gantt Chart - Project Delivery

April 2022

Definition | Preliminary Design | Detailed Design | Construction

Grandparent Name	Project Name	Municipality	Years	Comments	Status	Next Expected Board Review Date
			2022-2026 Capital Plan 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031			
Water						
Annacis Water Supply Tunnel						
	Annacis Water Supply Tunnel	New West/Surrey		Construction contract awarded in October 2021, with construction to start in March 2022		Oct 2022
Cambie Richmond Water Supply Tunnel						
	Cambie Richmond Water Supply Tunnel	Richmond/Van		Conceptual design essentially complete. Preliminary design to commence in mid 2022.		Sep 2022
Coquitlam Water Supply						
	Coquitlam Intake No. 2 & Tunnel	Coquitlam		In Permitting and Regulatory phase. Engagement with First Nations and Stakeholders underway. Project construction is deferred to 2038 completion and is contingent on ongoing water conservation efforts.		Jan 2023
	Coquitlam Intake No. 2 (Water Treatment)	Coquitlam		In Permitting and Regulatory phase. Engagement with First Nations and Stakeholders underway. Project construction is deferred to 2038 completion and is contingent on ongoing water conservation efforts.		Jan 2023
	Coquitlam Main No. 4 (Cape Horn)	Coquitlam		Detailed design has started with a refinement of the alignment through Riverview Lands		Sep 2023
	Coquitlam Main No. 4 (Central Section) - WTP to Gravel Pit	Coquitlam		Detailed design at approximately 60%		Sep 2023
	Coquitlam Main No. 4 (Central Section) - Gravel Pit to Robson	Coquitlam		Detailed design at approximately 60%		Sep 2024
	Coquitlam Main No. 4 (South Section) - Prebuild	Coquitlam		Detailed design at 100% with construction RFP anticipated in Q2 2022		May 2022
	Coquitlam Main No. 4 (South Section) - Tunnel	Coquitlam		Preliminary design has commenced		Jan 2023
Haney Water Supply Tunnel						
	Haney Water Supply Tunnel	P.Coq/P.Meadows		Conceptual design/definition to commence in early 2022		May 2022
Lulu-Delta Water Supply Tunnel						
	Lulu-Delta Water Supply Tunnel	Richmond		Early planning in progress. Conceptual design/definition to commence in 2023.		Jun 2023
Second Narrows Crossing						
	Second Narrows Water Supply Tunnel	Burnaby/DNV		Construction in progress, approx. 75% complete. On track to complete and in-service in 2025		Oct 2022
	Second Narrows Crossing 1 & 2 (Burrard Inlet Crossing Removal)	Burnaby		Planning/design to commence in late 2022, pending requirement from Port of Vancouver.		No reports anticipated
Stanley Park Water Supply Tunnel						
	Stanley Park Water Supply Tunnel	Vancouver		Construction procurement in 2022, with construction start mid 2023. Delays for approval on land and right of way with Park Board.		Apr 2022

To: Water Committee

From: Marilyn Towill, General Manager, Water Services

Date: March 22, 2022 Meeting Date: April 6, 2022

Subject: **Manager's Report**

RECOMMENDATION
That the Water Committee receive for information the report dated March 22, 2022, titled "Manager's Report".

1. **WC Tour – Coquitlam Water Treatment Plant**
   Date: Thursday June 23, 2022
   Time: 9:00 am to 12:00 pm
   Location: Coquitlam Water Treatment Plant, 1818 – 1850 Pipeline Road

   For planning purposes, please let Marilyn or Judy know by April 15, 2022 if you plan to attend.

2. **Cleveland Dam Spillway Gate Verbal Update**

3. **Work Plan**

Attachment
Water Committee 2022 work Plan

48993882

ATTACHMENT

Water Committee 2022 Work Plan

Priorities

1st Quarter	Status
Annual Energy Management Program Update	Complete
Capilano Hydropower Feasibility Study	Pending
Development Cost Charges (DCC) Update	In Progress
Project Delivery Capital Portfolio Update	In Progress
Quality Management System for Drinking Water Update	Complete
Regional Water Supply System Lifeline Study - Seismic Vulnerability Assessment	Complete
Whalley Main and Port Mann Main No. 2 Project Completion	Complete
Contract Approvals – Contracts > $5 Million (as applicable)	Complete
Water Policies (as applicable)	Complete
2nd Quarter	
BC Ministry of Health Guidelines for Water Systems	In Progress
Contribution Agreement Annual Reports	In Progress
Douglas Road Main No. 2 Construction Update	Pending
Drinking Water Conservation Program Update	In Progress
Drinking Water Management Plan Update	Pending
GVWD Water Quality Annual Report	In Progress
Lawn Water Regulations Communication & Regional Water Conservation Campaign	In Progress
Status of GVWD Capital Expenditures	In Progress
Temporary Water Supply Points for Members	Pending
Water Conservation: Influence On Capital Planning	Pending
Water Meter Replacement Program	In Progress
Water Services Wildfire Preparedness Update	Pending
Water Supply Update for Summer 2022	In Progress
Water Tunneling Projects Update	Pending
Contract Approvals – Contracts > $5 Million (as applicable)	Pending
Water Policies (as applicable)	Pending
3rd Quarter	
Annual Dam Safety Program Update	Pending
Capital Projects Permitting Best Practices Guide	Pending
Coquitlam Main No. 4 Update	Pending
Coquitlam River Watershed Roundtable – Contribution Agreement 2023-2025	Pending
Kennedy Newton Main Construction Update	Pending
Status of GVWD Capital Expenditures	Pending
Contract Approvals – Contracts > $5 Million (as applicable)	Pending
Water Policies (as applicable)	Pending
4th Quarter	
Annual Budget and 5-year Financial Plan – Water Services	Pending
Corrosion Control Program Monitoring Update	Pending
Coquitlam Lake Water Supply Project Update	Pending
Fleetwood Reservoir Construction Update	Pending

Long Term Financial Plan	Pending
Regional Water Conservation Campaign and Water Regulations Communications 2022	Pending
Status of GVWD Capital Expenditures	Pending
Summer 2022 Water Supply Performance	Pending
Water Use-by-Sector Report	Pending
Watershed Fisheries Initiatives Annual Update	Pending
Contract Approvals – Contracts > $5 Million (as applicable)	Pending
Water Policies (as applicable)	Pending