GREATER VANCOUVER WATER DISTRICT (GVWD)
BOARD OF DIRECTORS

REGULAR BOARD MEETING
Friday, April 29, 2022
9:15 A.M.
Meeting conducted electronically pursuant to the Procedure Bylaw
28th Floor Boardroom, 4515 Central Boulevard, Burnaby, British Columbia
Webstream available at http://www.metrovancouver.org

Membership and Votes

A G E N D A[1]

A. ADOPTION OF THE AGENDA

1. April 29, 2022 Regular Meeting Agenda
That the GVWD Board adopt the agenda for its regular meeting scheduled for April 29, 2022 as circulated.

B. ADOPTION OF THE MINUTES

1. March 25, 2022 Regular Meeting Minutes *pg. 4*
That the GVWD Board adopt the minutes for its regular meeting held March 25, 2022 as circulated.

2. April 14, 2022 Regular Joint Meeting Minutes *pg. 8*
That the GVWD Board adopt the minutes for its regular joint meeting of the MVRD, MVHC, GVWD and the GVS&DD Board of Directors held April 14, 2022 as circulated.

C. DELEGATIONS

D. INVITED PRESENTATIONS

E. CONSENT AGENDA
Note: Directors may adopt in one motion all recommendations appearing on the Consent Agenda or, prior to the vote, request an item be removed from the Consent Agenda for debate or discussion, voting in opposition to a recommendation, or declaring a conflict of interest with an item.

[1] *Note: Recommendation is shown under each item, where applicable. All Directors vote unless otherwise noted.*

1. WATER COMMITTEE REPORTS

1.1 Regional Public Works Mutual Aid Agreement *pg. 12*

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

1.2 GVWD 2021 Water Quality Annual Report *pg. 45*

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

1.3 Environmental Policy for the Greater Vancouver Water District *pg. 106*

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".

1.4 Engagement Plan and Proposed Rates for Water DCC Program Implementation *pg. 115*

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.

1.5 2022 Lawn Watering Communications and We Love Water Campaign Update *pg. 122*

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

2. PERFORMANCE AND AUDIT COMMITTEE REPORTS

2.1 Audited 2021 Financial Statements *pg. 132*

That the GVWD Board approve the Audited 2021 Financial Statements for the Greater Vancouver Water District.

3. COMMISSIONER REPORTS

3.1. Asset Management and Long Term Financial Planning *pg. 169*

That the GVWD Board direct staff to provide context for decision making by completing long-range plans for major capital projects including an asset inventory, asset condition assessment, and a proposed timeline of maintenance, repair, replacement, and funding requirements for these major projects and report back to the Board with this plan.

F. ITEMS REMOVED FROM THE CONSENT AGENDA

G. REPORTS NOT INCLUDED IN CONSENT AGENDA

H. MOTIONS FOR WHICH NOTICE HAS BEEN GIVEN

I. OTHER BUSINESS

1. GVWD Board Committee Information Items and Delegation Summaries *pg. 174*

J. BUSINESS ARISING FROM DELEGATIONS

K. RESOLUTION TO CLOSE MEETING

Note: The Board must state by resolution the basis under section 90 of the Community Charter on which the meeting is being closed. If a member wishes to add an item, the basis must be included below.

L. RISE AND REPORT (Items Released from Closed Meeting)

M. ADJOURNMENT/CONCLUSION

That the GVWD Board adjourn/conclude its regular meeting of April 29, 2022.

GREATER VANCOUVER WATER DISTRICT
BOARD OF DIRECTORS

Minutes of the Regular Meeting of the Greater Vancouver Water District (GVWD) Board of Directors held at 11:35 a.m. on Friday, March 25, 2022 in the 28th Floor Boardroom, 4515 Central Boulevard, Burnaby, British Columbia.

MEMBERS PRESENT:

Burnaby, Chair, Director Sav Dhaliwal
North Vancouver City, Vice Chair Director Linda Buchanan*
Anmore, Director John McEwen*
Belcarra, Director Jamie Ross*
Burnaby, Director Pietro Calendino*
Burnaby, Director Mike Hurley*
Coquitlam, Director Craig Hodge*
Coquitlam, Director Richard Stewart*
Delta, Director George Harvie*
Delta, Director Jeannie Kanakos*
Electoral Area A, Director Jen McCutcheon*
Langley City, Director Gayle Martin*
Langley Township, Director Jack Froese*
Langley Township, Director Kim Richter*
Maple Ridge, Director Mike Morden*
New Westminster, Director Jonathan Coté*
North Vancouver District, Director Lisa Muri*
Pitt Meadows, Director Bill Dingwall*
Port Coquitlam, Director Brad West*
Port Moody, Director Rob Vagramov*
Richmond, Director Malcolm Brodie*
Richmond, Director Harold Steves*
Surrey, Director Linda Annis*
Surrey, Director Doug Elford*
Surrey, Director Laurie Guerra*
Surrey, Director Doug McCallum*
Surrey, Director Mandeep Nagra*
Surrey, Director Allison Patton*
Tsawwassen, Director Ken Baird*
Vancouver, Alternate Director Jean Swanson* for Christine Boyle
Vancouver, Director Adriane Carr*
Vancouver, Director Melissa De Genova*
Vancouver, Director Lisa Dominato*
Vancouver, Director Colleen Hardwick*
Vancouver, Director Kennedy Stewart*
Vancouver, Director Michael Wiebe*
West Vancouver, Director Mary-Ann Booth*
Commissioner Jerry W. Dobrovolny (Non-voting member)

MEMBERS ABSENT:

None

STAFF PRESENT:

Chris Plagnol, Corporate Officer
Natalia Melnikov, Legislative Services Coordinator, Board and Information Services

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

A. ADOPTION OF THE AGENDA

1. March 25, 2022 Regular Meeting Agenda

It was MOVED and SECONDED
That the GVWD Board adopt the agenda for its regular meeting scheduled for March 25, 2022 as circulated.

CARRIED

B. ADOPTION OF THE MINUTES

1. February 25, 2022 Regular Meeting Minutes

It was MOVED and SECONDED
That the GVWD Board adopt the minutes for its regular meeting held February 25, 2022 as circulated.

CARRIED

C. DELEGATIONS

No items presented.

D. INVITED PRESENTATIONS

No items presented.

E. CONSENT AGENDA

It was MOVED and SECONDED
That the GVWD Board adopt the recommendations presented in the following item as presented in the March 25, 2022 GVWD Board Consent Agenda:

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

CARRIED

The item and recommendation referred to above is as follows:

1.1 Award of Contract Resulting from Tender No. 21-001: Construction – 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 GVWD Board 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.

Recommendation:
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.

Adopted on Consent

F. ITEMS REMOVED FROM THE CONSENT AGENDA

No items presented.

G. REPORTS NOT INCLUDED IN CONSENT AGENDA

No items presented.

H. MOTIONS FOR WHICH NOTICE HAS BEEN GIVEN

No items presented.

I. OTHER BUSINESS

1. GVWD Board Committee Information Items and Delegation Summaries

It was MOVED and SECONDED

That the GVWD Board receive for information the GVWD Board Committee Information Items and Delegation Summaries, dated March 25, 2022.

CARRIED

J. BUSINESS ARISING FROM DELEGATIONS

No items presented.

K. RESOLUTION TO CLOSE MEETING

It was MOVED and SECONDED

That the GVWD Board close its regular meeting scheduled for March 25, 2022 pursuant to the *Community Charter* provisions, Section 90 (1) (g) as follows:

"90 (1) A part of a board meeting may be closed to the public if the subject matter being considered relates to or is one or more of the following:
(g) litigation or potential litigation affecting the regional district."

CARRIED

L. RISE AND REPORT (Items Released from Closed Meeting)

No items presented.

M. ADJOURNMENT/CONCLUSION

It was MOVED and SECONDED
That the GVWD Board adjourn its regular meeting of March 25, 2022.

CARRIED
(Time: 11:36 a.m.)

CERTIFIED CORRECT

Chris Plagnol, Corporate Officer

Sav Dhaliwal, Chair

51665908 FINAL

REGULAR JOINT MEETING
MVRD, MVHC, GVWD, and GVS&DD BOARDS

Minutes of the Regular Joint Meeting of the Metro Vancouver Regional District (MVRD), Metro Vancouver Housing Corporation (MVHC), the Greater Vancouver Water District (GVWD), and the Greater Vancouver Sewerage and Drainage District (GVS&DD) Board of Directors held at 1:00 p.m. on April 14, 2022 in the 28th Floor Boardroom, 4730 Kingsway, Burnaby, British Columbia, to participate in a workshop on preparations for the 2023 budget.

MEMBERS PRESENT:

Burnaby, Chair, Director Sav Dhaliwal
North Vancouver City, Vice Chair Director Linda Buchanan*
Anmore, Director John McEwen*
Belcarra, Director Jamie Ross*
Bowen Island, Director David Hocking*
Burnaby, Director Pietro Calendino*
Burnaby, Director Mike Hurley* (departed at 2:47 p.m.)
Coquitlam, Director Craig Hodge* (arrived at 1:11 p.m.)
Coquitlam, Director Richard Stewart* (arrived at 1:01 p.m.)
Delta, Director George Harvie*
Delta, Alternate Director Bruce McDonald* for Jeannie Kanakos
Electoral Area A, Director Jen McCutcheon*
Langley City, Director Gayle Martin*
Langley Township, Director Jack Froese*
Langley Township, Alternate Director Petrina Arnason* for Kim Richter
Lions Bay, Director Ron McLaughlin* (arrived at 1:05 p.m.)
Maple Ridge, Director Mike Morden*
New Westminster, Director Jonathan Coté*
North Vancouver District, Director Lisa Muri*
Pitt Meadows, Director Bill Dingwall*
Port Coquitlam, Director Brad West* (arrived at 1:14 p.m.)
Port Moody, Director Rob Vagramov* (arrived at 1:02 p.m.)
Richmond, Director Malcolm Brodie*
Richmond, Director Harold Steves*
Surrey, Director Linda Annis*
Surrey, Director Doug Elford*
Surrey, Director Laurie Guerra*
Surrey, Director Doug McCallum* (departed at 2:00 p.m.)
Surrey, Director Mandeep Nagra* (arrived at 1:37 p.m.; departed at 2:22 p.m.)
Surrey, Director Allison Patton*
Tsawwassen, Director Ken Baird*
Vancouver, Director Christine Boyle* (arrived at 1:43 p.m.)
Vancouver, Director Adriane Carr*
Vancouver, Director Melissa De Genova* (arrived at 1:03 p.m.)
Vancouver, Director Lisa Dominato* (arrived at 1:01 p.m.)
Vancouver, Director Colleen Hardwick* (arrived at 1:01 p.m.)
Vancouver, Alternate Director Pete Fry* for Kennedy Stewart
Vancouver, Director Michael Wiebe*
West Vancouver, Director Mary-Ann Booth* (arrived at 1:02 p.m.)
White Rock, Director Darryl Walker*

MEMBERS ABSENT:

None

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

STAFF PRESENT:
Jerry W. Dobrovolny, Chief Administrative Officer
Katie Karn, Deputy Corporate Officer
Natalia Melnikov, Legislative Services Coordinator, Board and Information Services

A. ADOPTION OF THE AGENDA

1. April 14, 2022 Regular Joint Board Meeting Agenda

It was MOVED and SECONDED
That the MVRD, GVS&DD, GVWD, and MVHC Board adopt the agenda for its regular joint meeting scheduled for April 14, 2022 as circulated.

CARRIED

1:01 p.m. Directors Hardwick, Stewart, and Dominato arrived at the meeting.
1:02 p.m. Directors Booth and Vagramov arrived at the meeting.
1:03 p.m. Director De Genova arrived at the meeting.
1:05 p.m. Directors McLaughlin and Wiebe arrived at the meeting.

B. PRESENTATION AND DISCUSSION

1. Board Budget Workshop Background Materials

Jerry W. Dobrovolny, Chief Administrative Officer/Commissioner introduced the 2023 Metro Vancouver Districts and Housing Corporation Budget Workshop, highlighting the process, timeline, and the context for the 2023 budget.

1:11 p.m. Director Hodge arrived at the meeting.
1:14 p.m. Director West arrived at the meeting.

2022 – 2026 Financial Plan
Jennifer Crosby, Director, Project Management Office, provided members with an overview of how asset management ties into the budget process, including a review of the existing processes that are used for asset assessment, assessment management, and projecting future needs.

Culture of Continuous Improvement
Dean Rear, Chief Financial Officer/General Manager, Financial Services, provided members an overview of the culture of continuous improvement, reviewing ongoing strategic improvements and an overview of the financial planning environment.

Financial Planning Environment
The Board members were provided information on the financial context in which Metro Vancouver operates, including a review of the legislation and the four legal

entities comprising Metro Vancouver, the financial environment, including bond returns and treasury yields; inflation and deflation; and commodity prices, a review of major utility projects, and mitigating financial risks.

2023 Budget Approach

Jerry W. Dobrovolny, Commissioner/Chief Administrative Officer, provided an overview of the 2023 Financial Plan outlining the proposed approach to manage the household impact with focus on services and plans currently underway.

1:37 p.m. Director Nagra arrived at the meeting.
1:43 p.m. Director Boyle arrived at the meeting.

Discussion ensued on the 2023 budget information including the following:

- clarification regarding how Metro Vancouver will be examining hedging strategies
- the use of short-term levers versus long-term strategies; taking from reserves is not sustainable for the long-term
- projects are driven either by regulatory requirements or growth and the need to have full understanding of the cost of growth
- new design factors and requirements are being put in place to take into consideration the acceleration of extreme climate change
- the obligation to the current population and the population coming forward to provide regional services
- the suggestion to have the budget split into core service costing and non-core service costing
- the promotion of growth versus the management of growth and the distinction between population growth and new housing

Staff advised that a Special Joint meeting of the Boards would be scheduled in the future to further discuss the 2023 budget and items raised at the April 14, 2022 Joint Board meeting.

2:00 p.m. Director McCallum departed the meeting.
2:22 p.m. Director Nagra departed the meeting.
2:47 p.m. Director Hurley departed the meeting.

Presentation material titled “Board Budget Workshop - 2023 Financial Planning Cycle” is retained with the April 14, 2022 Metro Vancouver Joint Board Meeting agenda.

C. ADJOURNMENT/CONCLUSION

It was MOVED and SECONDED
That the MVRD/MVHC/GVWD/GVS&DD Board conclude its regular joint meeting of April 14, 2022.

CARRIED
(Time: 2:51 p.m.)

CERTIFIED CORRECT

Katie Karn, Deputy Corporate Officer

Sav Dhaliwal, 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

51293895

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 <u>Reimbursement</u>

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
04/02/30.
Gil Mervyn

The Corporate Seal of the Corporation of

City of Surrey

Authorized signing Officers

Mayor Clerk June 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

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

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.

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)*

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metrovancouver

Greater Vancouver Water District

2021 Water Quality Annual Report

Volume 1 of 2

March 2022

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Volume 2 of 2 (*51027522*)
(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.

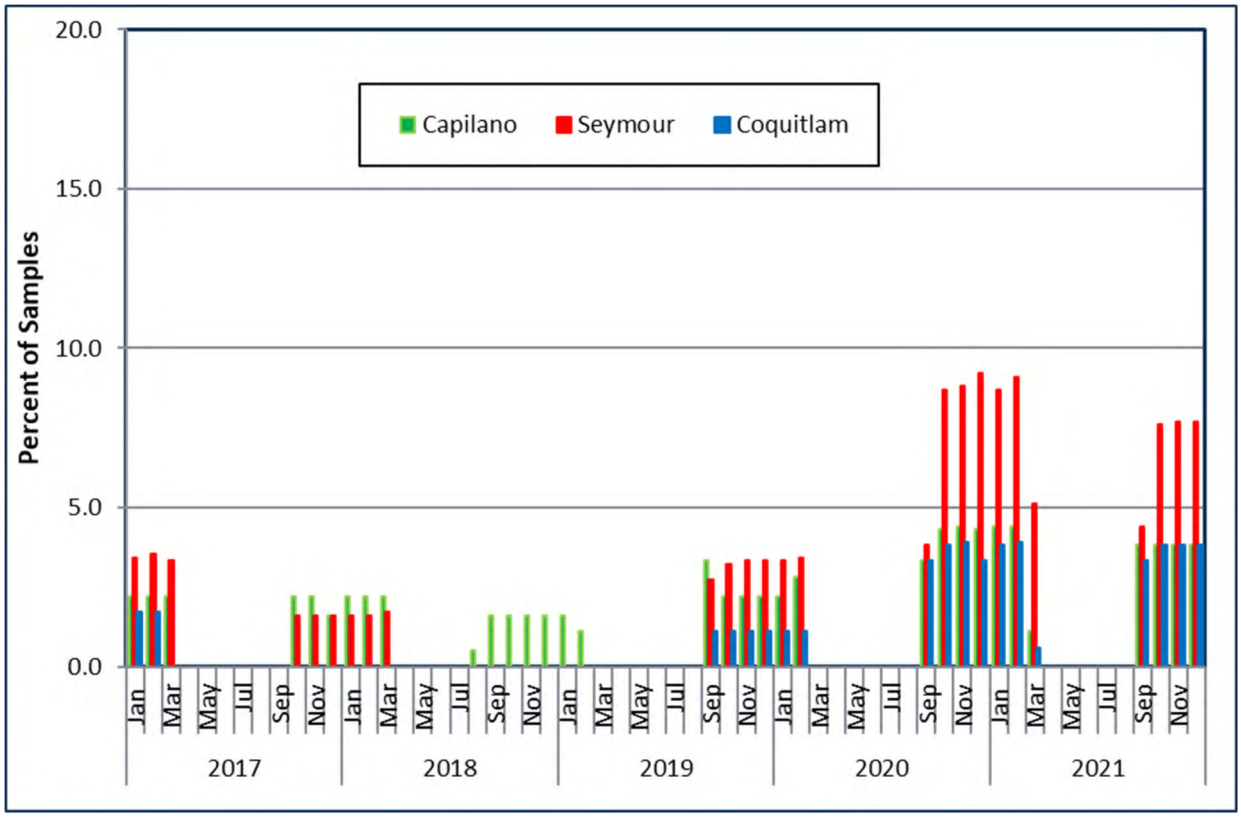


Figure 1: Percent of Samples Exceeding 20 E. coli/100 mL at all Three Sources (2017 to 2021)

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.

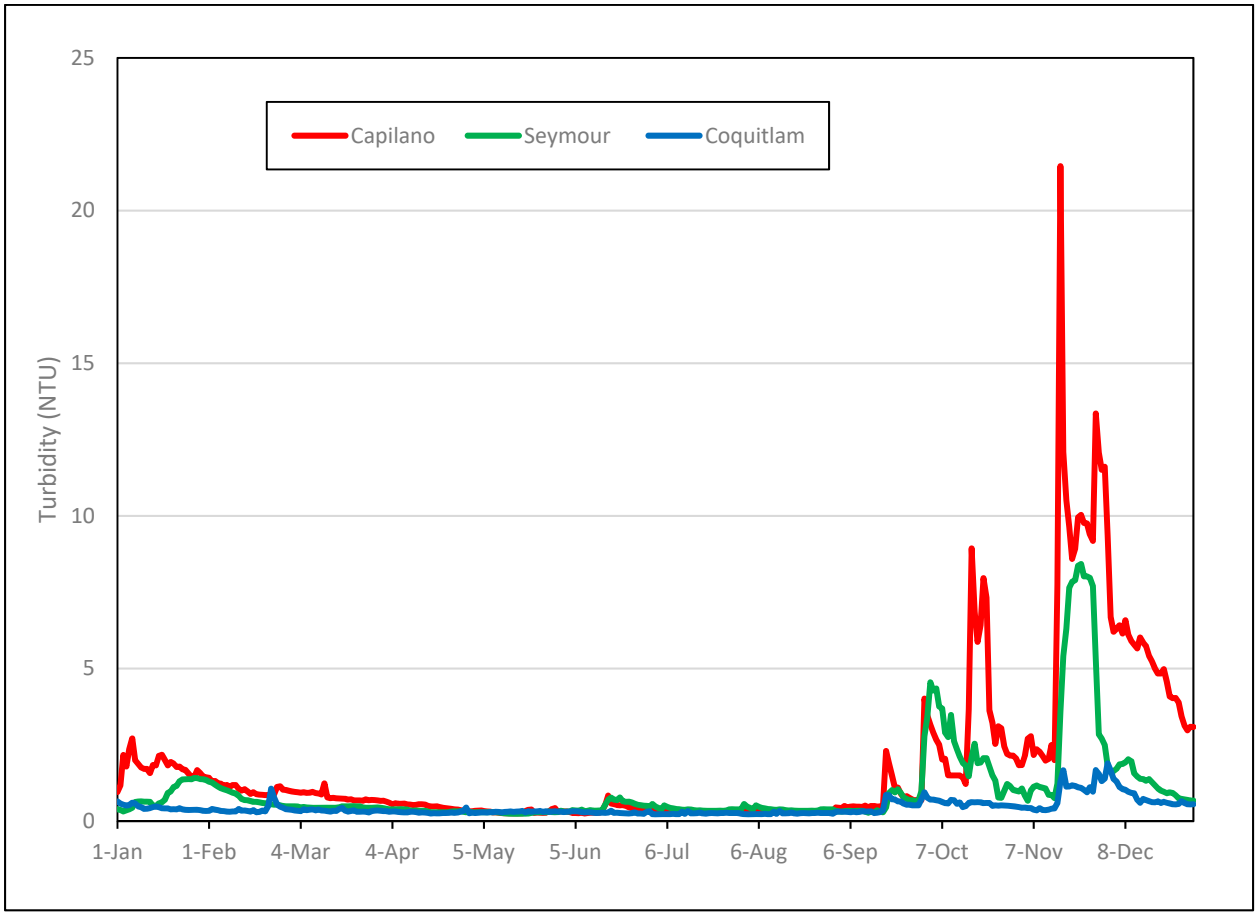


Figure 2: Average Daily Turbidity of Source Water (From In-line Readings)

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.

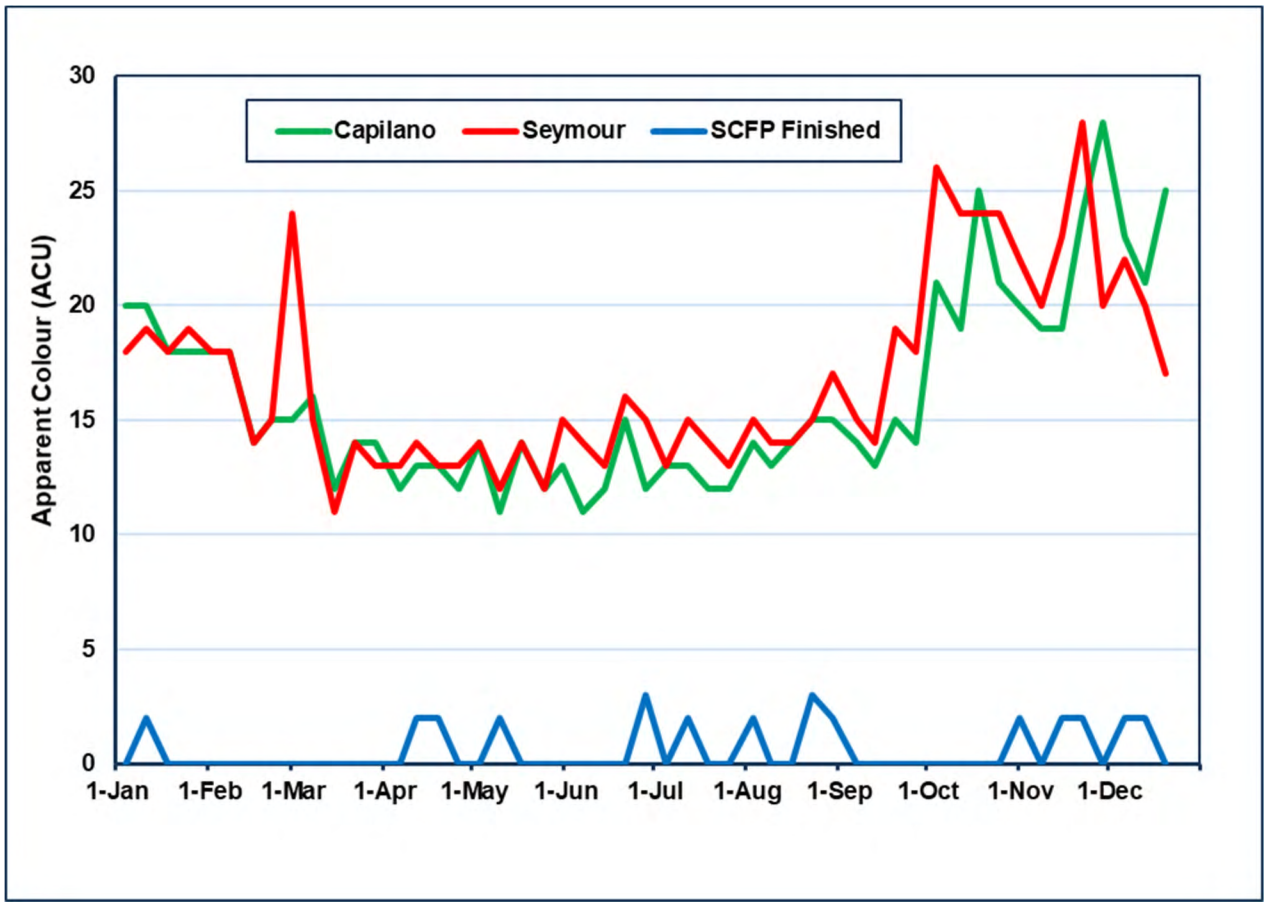


Figure 3: Apparent Colour Levels Before and After Filtration

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.

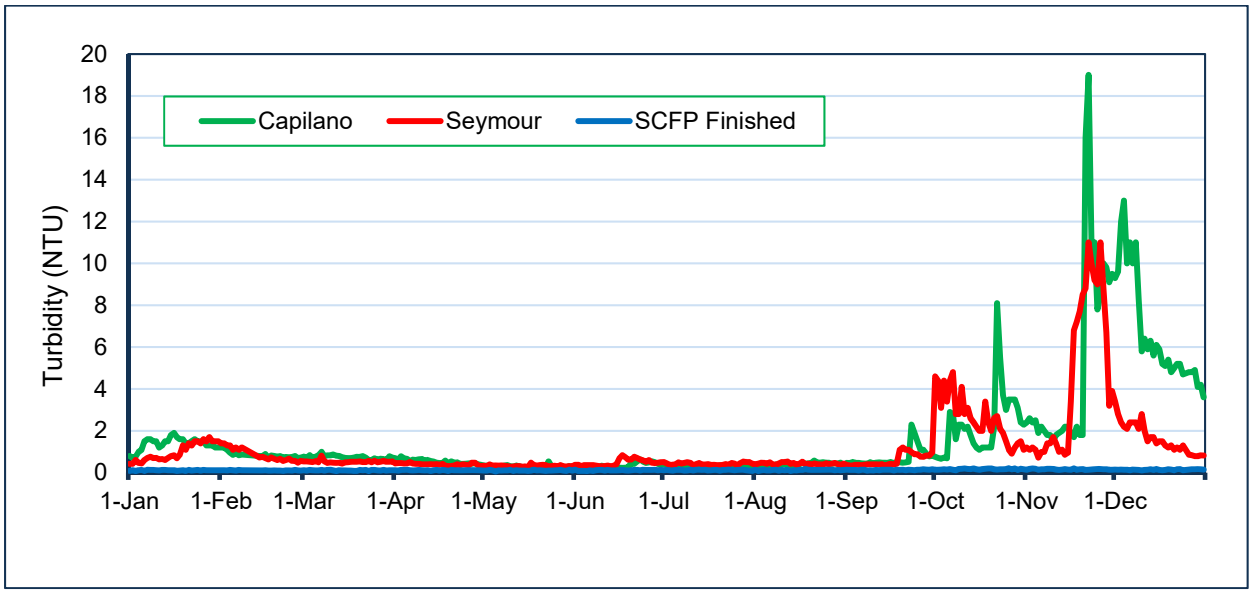


Figure 4: Average Daily Turbidity Levels Before and After Filtration

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.

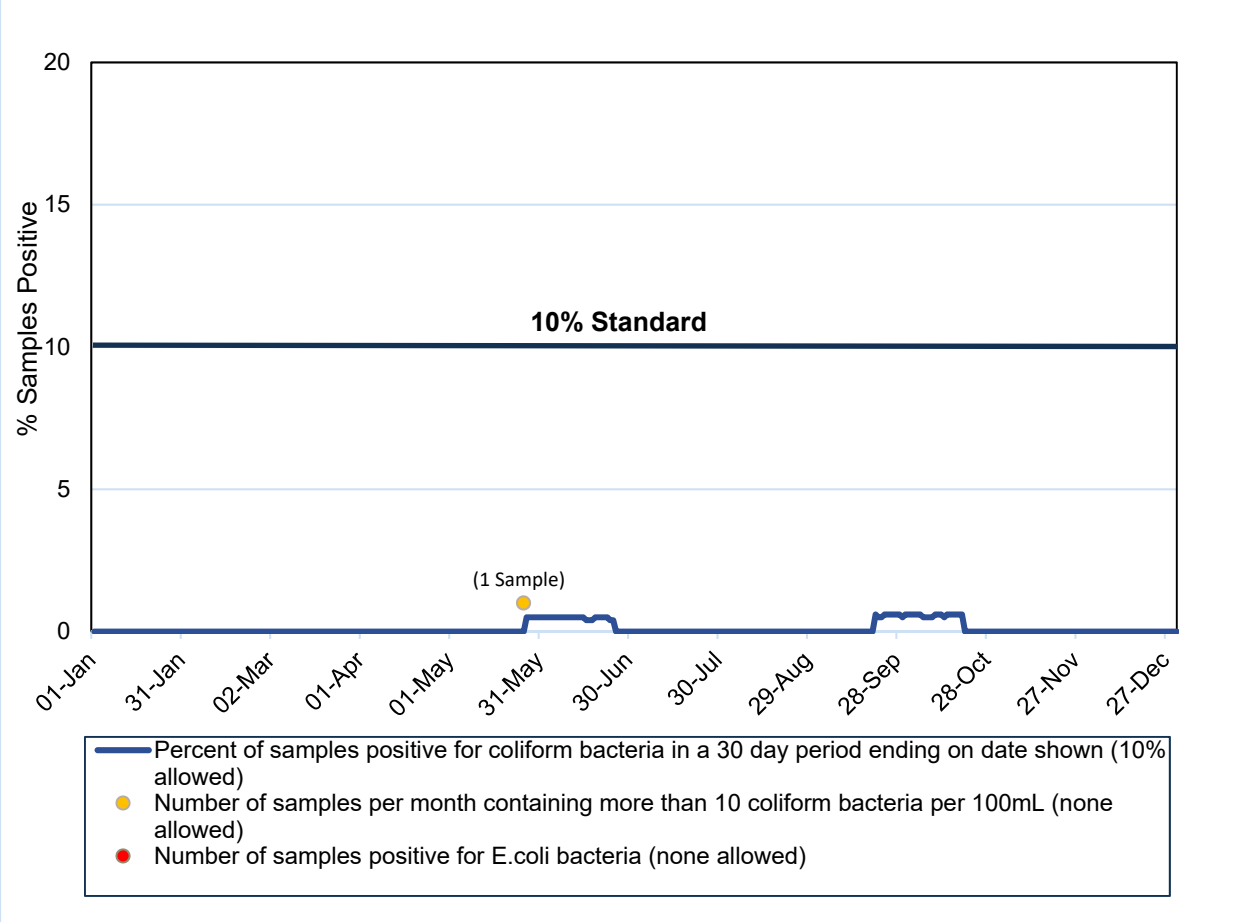


Figure 5: Bacteriological Quality of Water in GVWD Water Mains

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.

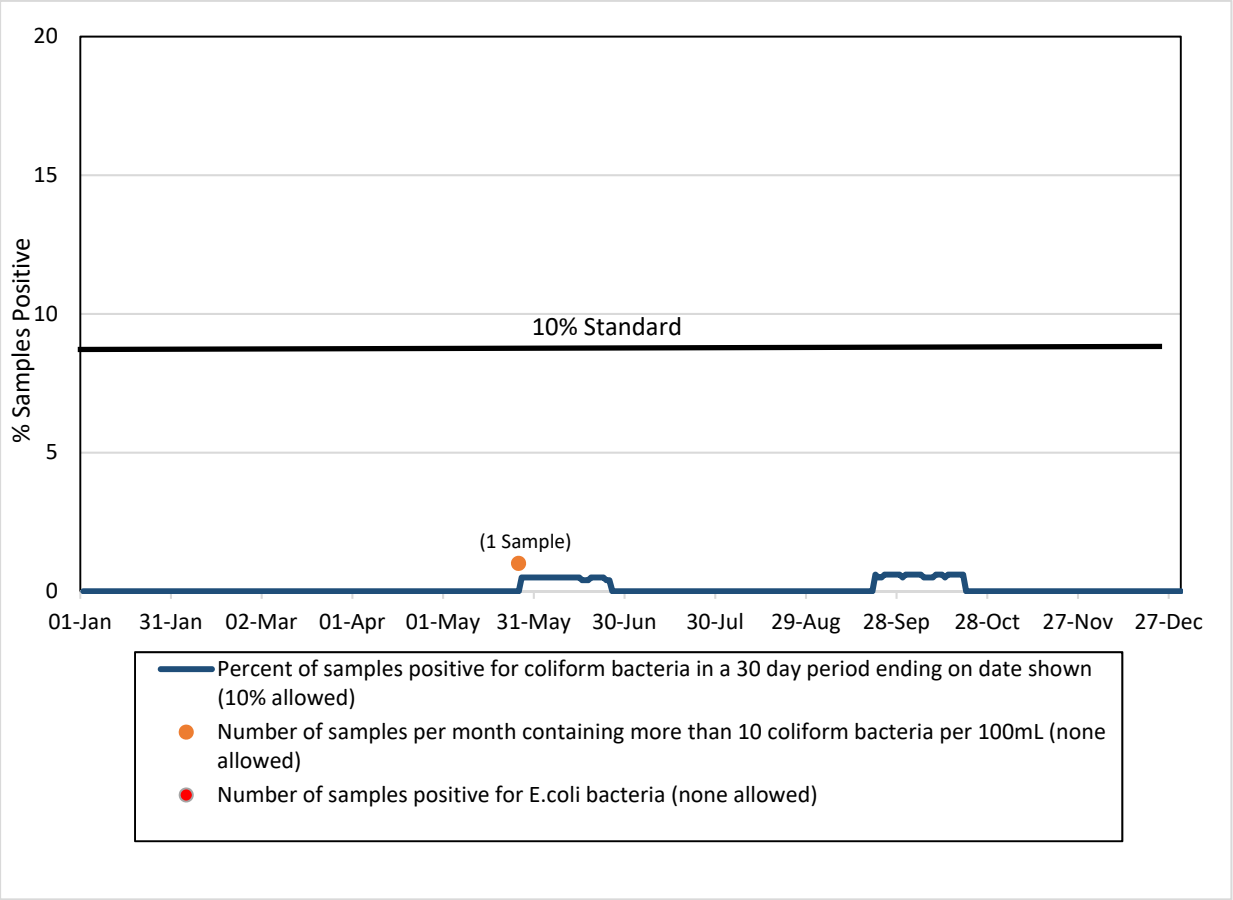


Figure 6: Bacteriological Quality of Water in GVWD Reservoirs

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.

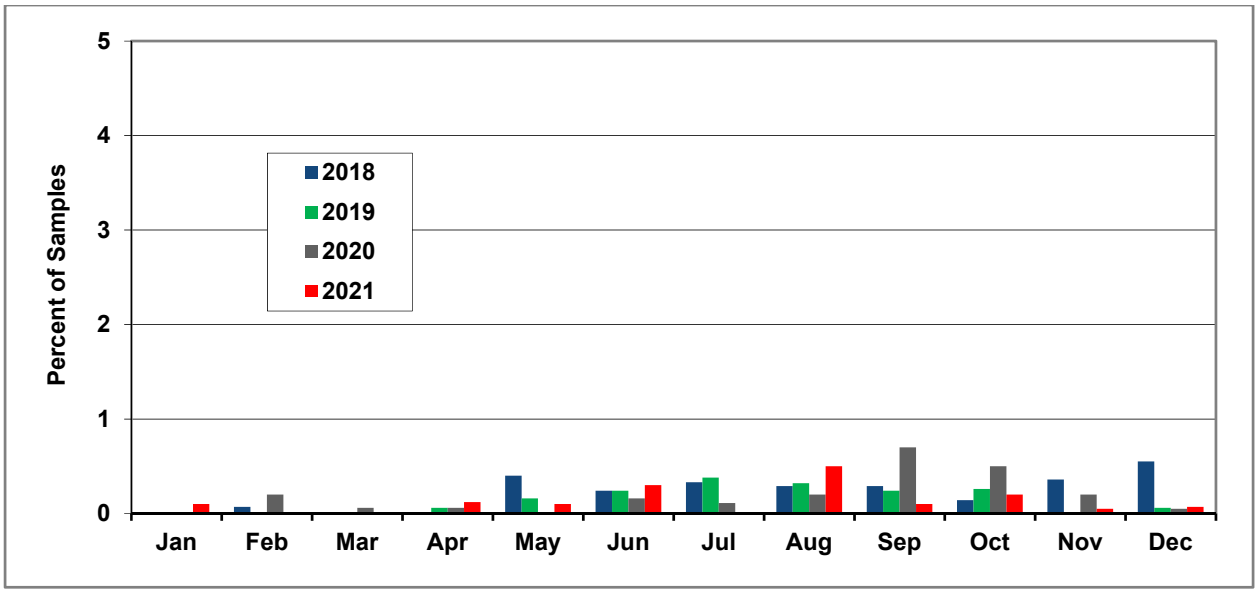


Figure 7: Percent of Samples per Month Positive for Total Coliform Bacteria (2018 to 2021)

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.

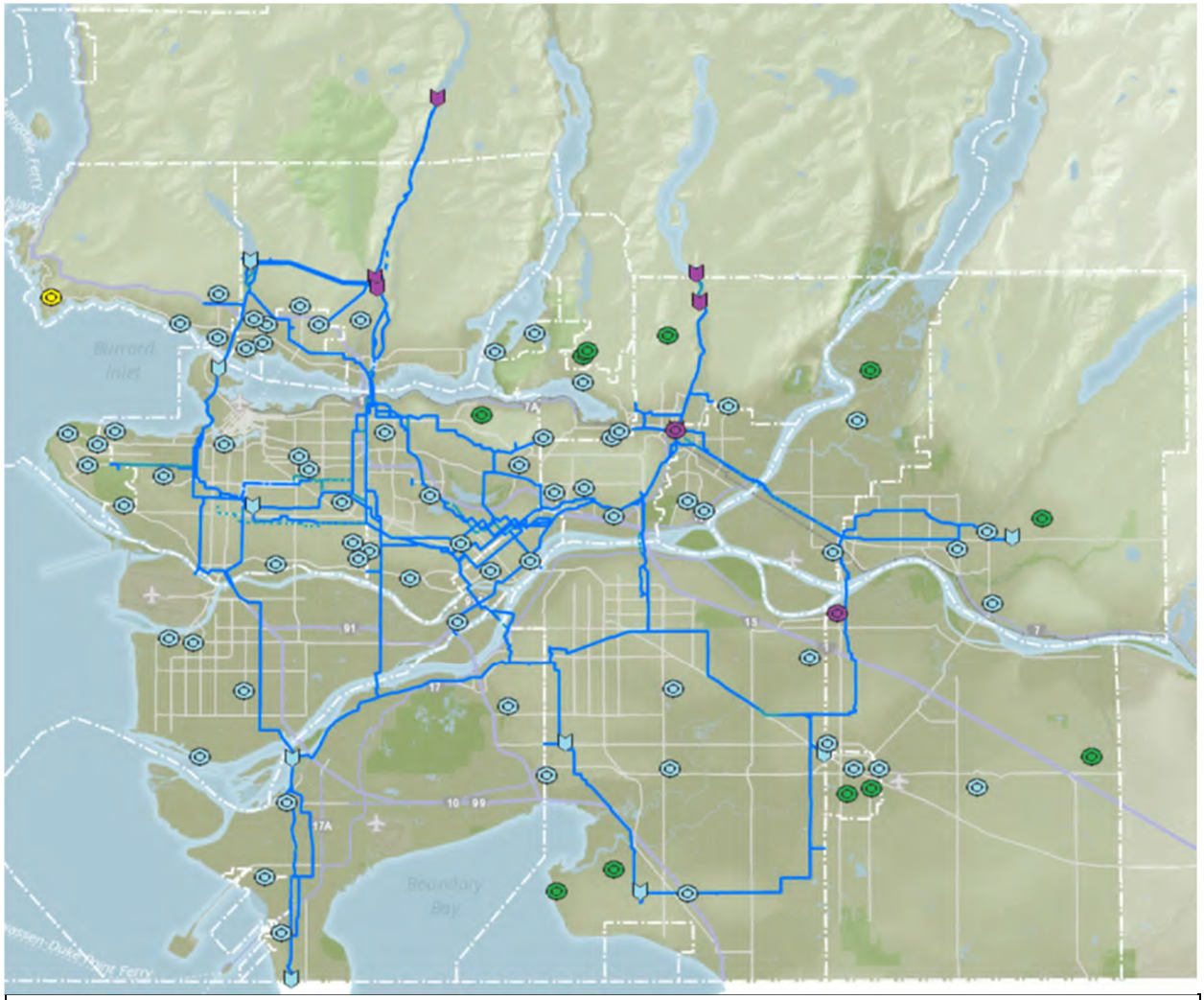
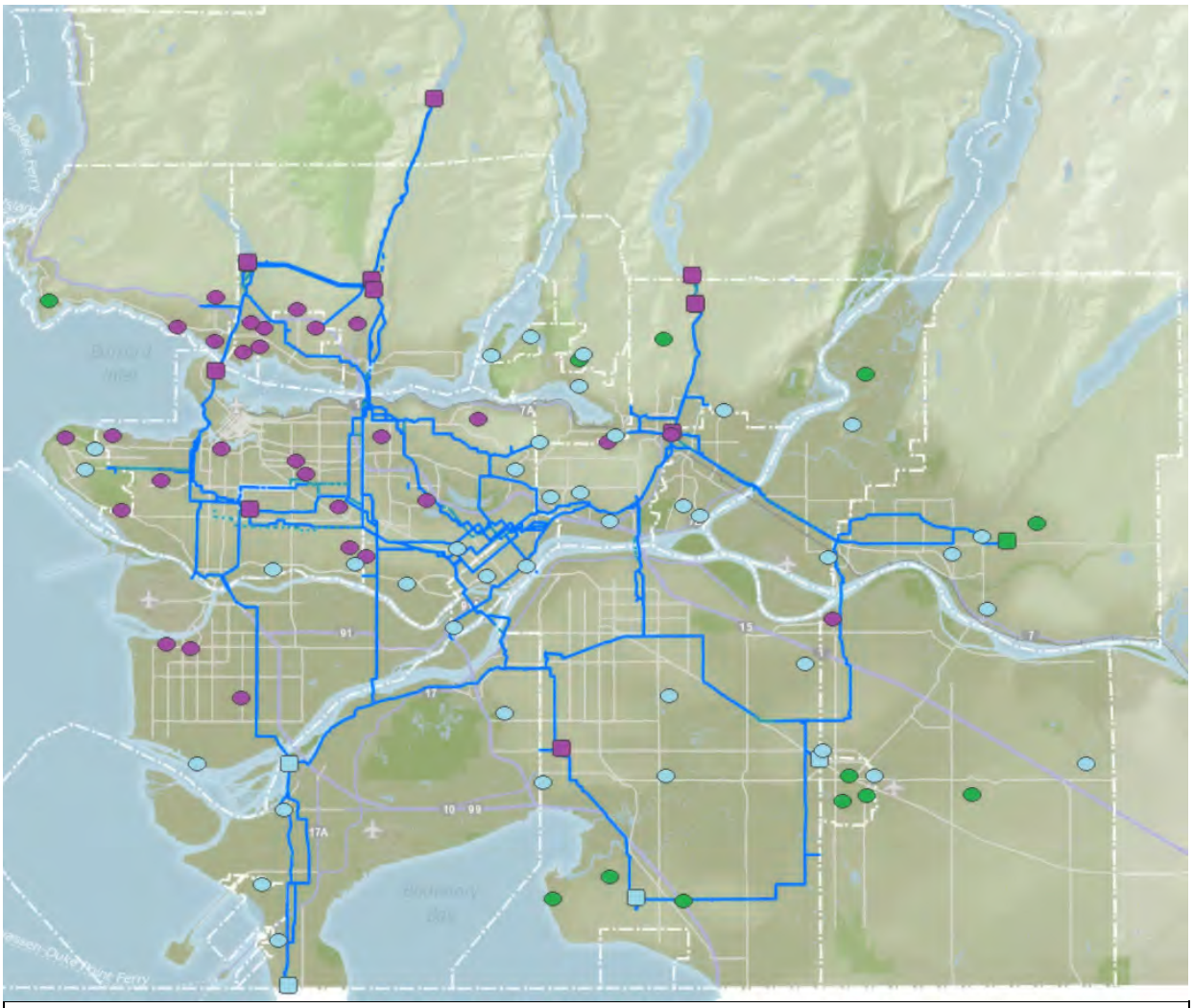


Figure 8: Average Total Trihalomethane Levels

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

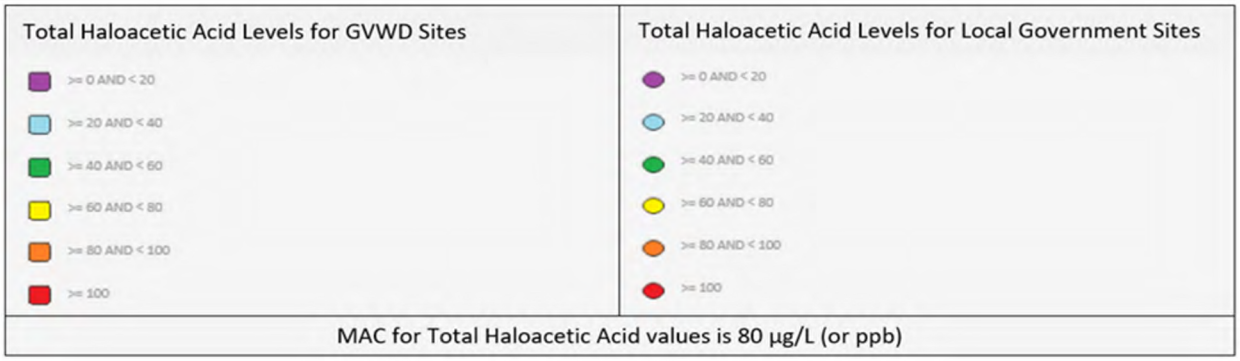


Figure 9: Average Total Haloacetic Acid Levels

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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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

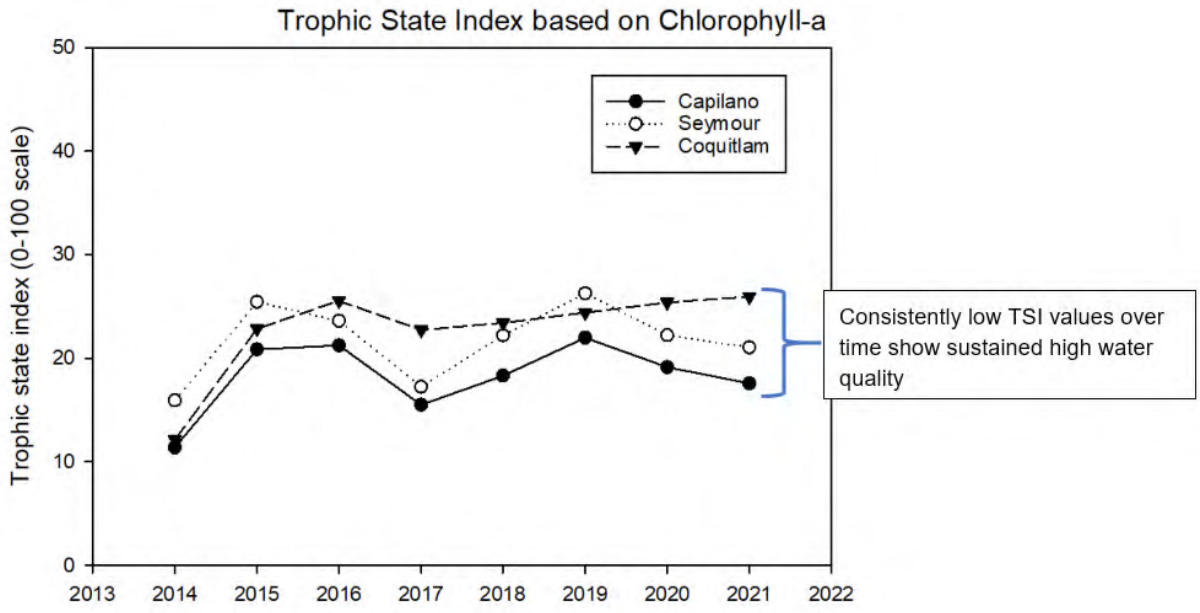
Comparison of Water Quality in GVWD Water Supply Sources to Standard Water Quality Classifications

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

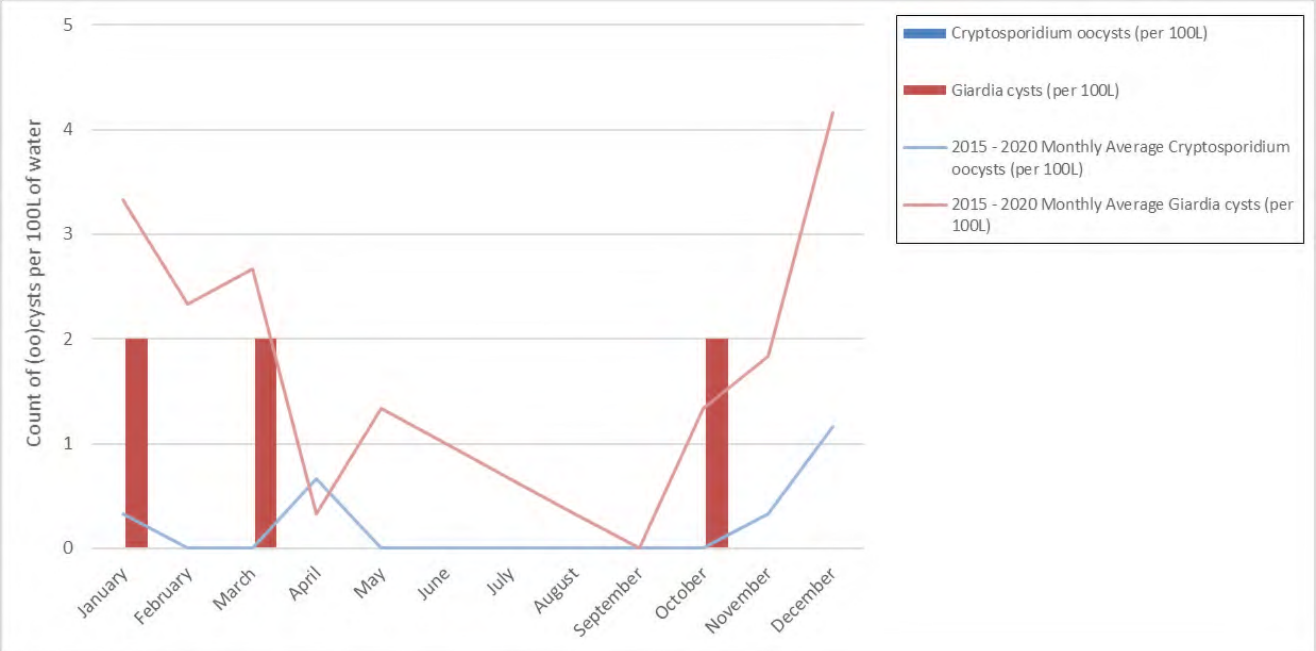

Figure 1. Capilano Reservoir *Cryptosporidium* Oocysts and *Giardia* Cysts Counts per 100 Litres of Raw Water in 2021

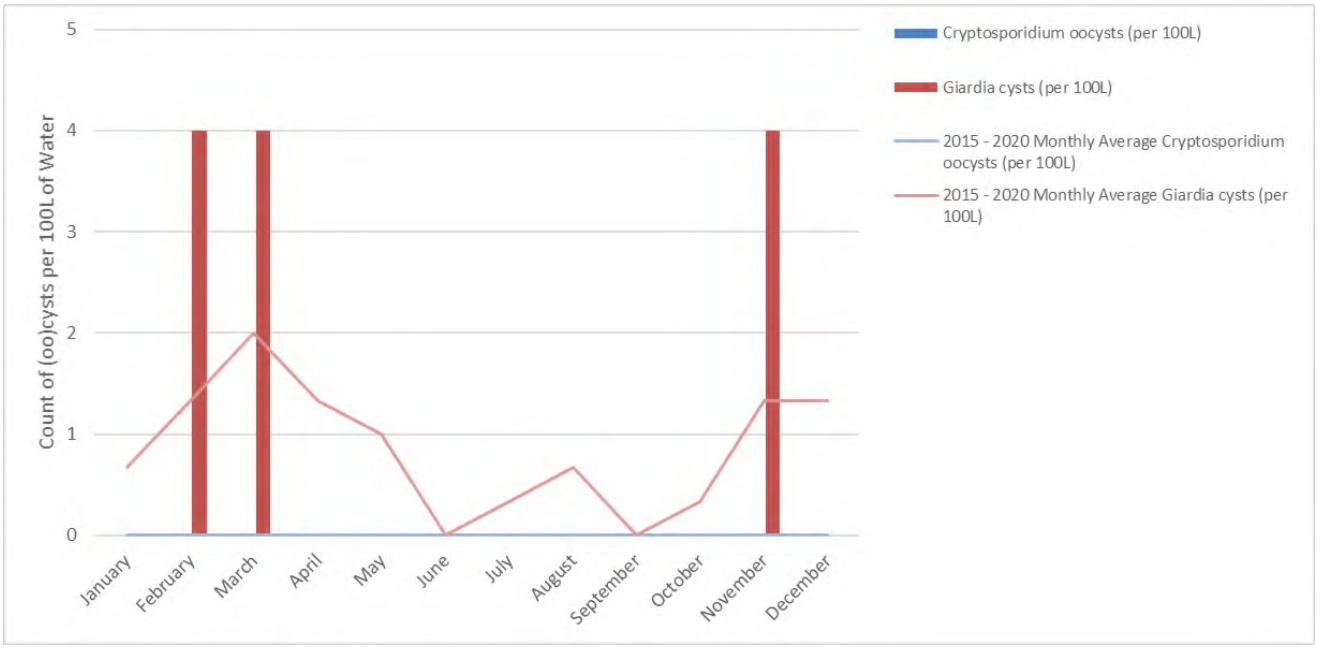

Figure 2: Coquitlam Reservoir *Cryptosporidium* Oocysts and *Giardia* Cysts Counts per 100 Litres of Raw Water in 2021

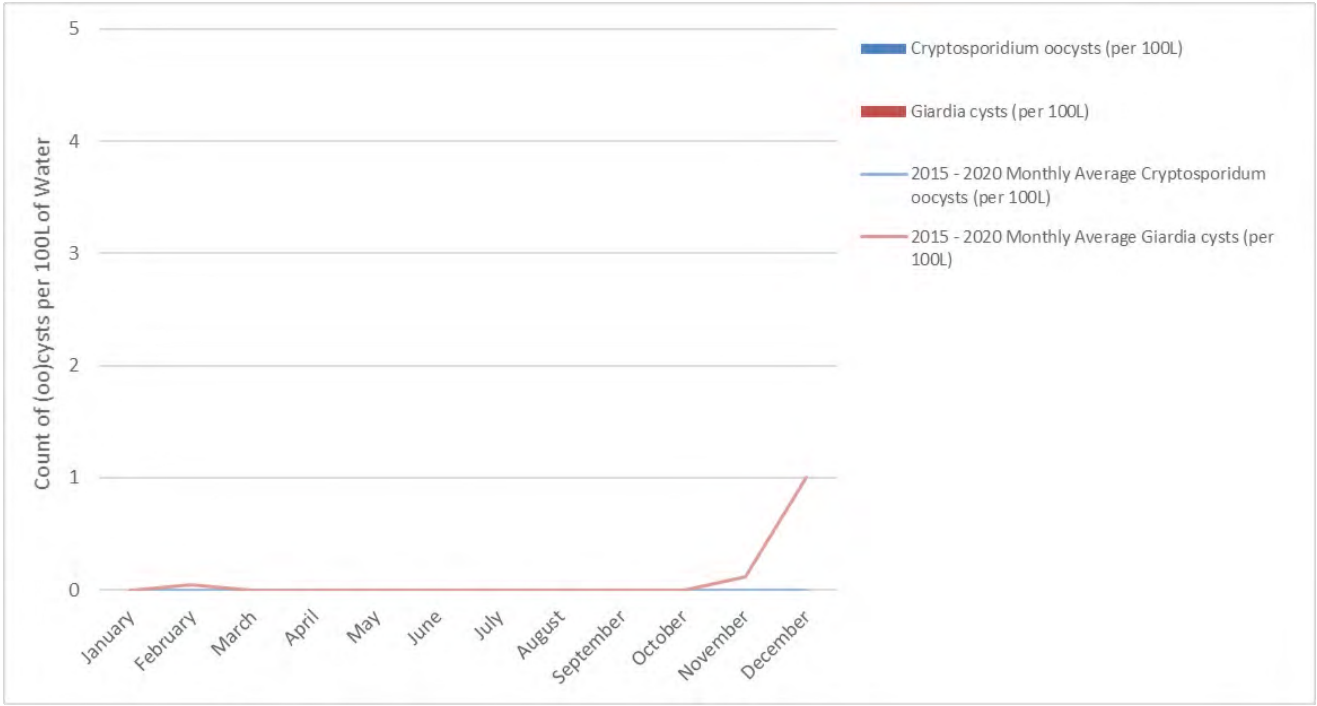

Figure 3: Seymour Capilano Filtration Plant - Recycled Clarified Water *Cryptosporidium* Oocysts and *Giardia* Cysts Counts per 100 Litres of Raw Water in 2021

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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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.

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: GVWD Board of Directors

From: Water Committee

Date: April 8, 2022 Meeting Date: April 29, 2022

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

WATER COMMITTEE 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 50% assist factor.

At its April 6, 2022 meeting, the Water Committee considered the attached report titled "Engagement Plan and Proposed Rates for Water DCC Program Implementation", dated March 3, 2022. The Committee subsequently amended the recommendation as presented above in underline style.

The Water Committee amended the main motion to change the assist factor from 90% to 50% and the main motion as amended passed with a 6-4 vote.

This matter is now before the Board for its consideration.

Attachment
"Engagement Plan and Proposed Rates for Water DCC Program Implementation", dated March 3, 2022.

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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

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metrovancouver
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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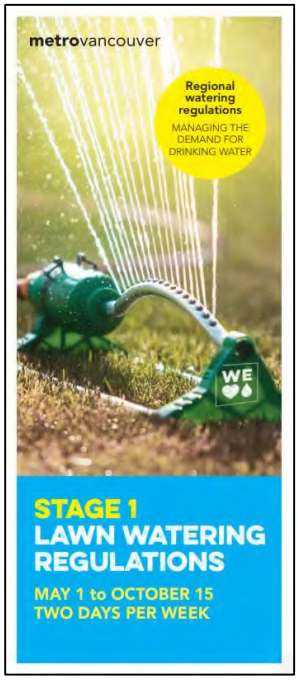
2021 Watering Regulations Communications Materials – Updating with new regulations for 2022

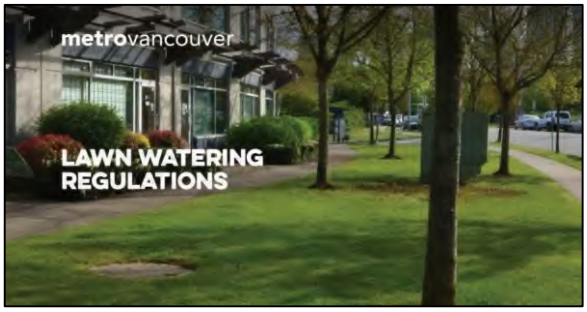
Direct mail postcard

Residential education leaflet

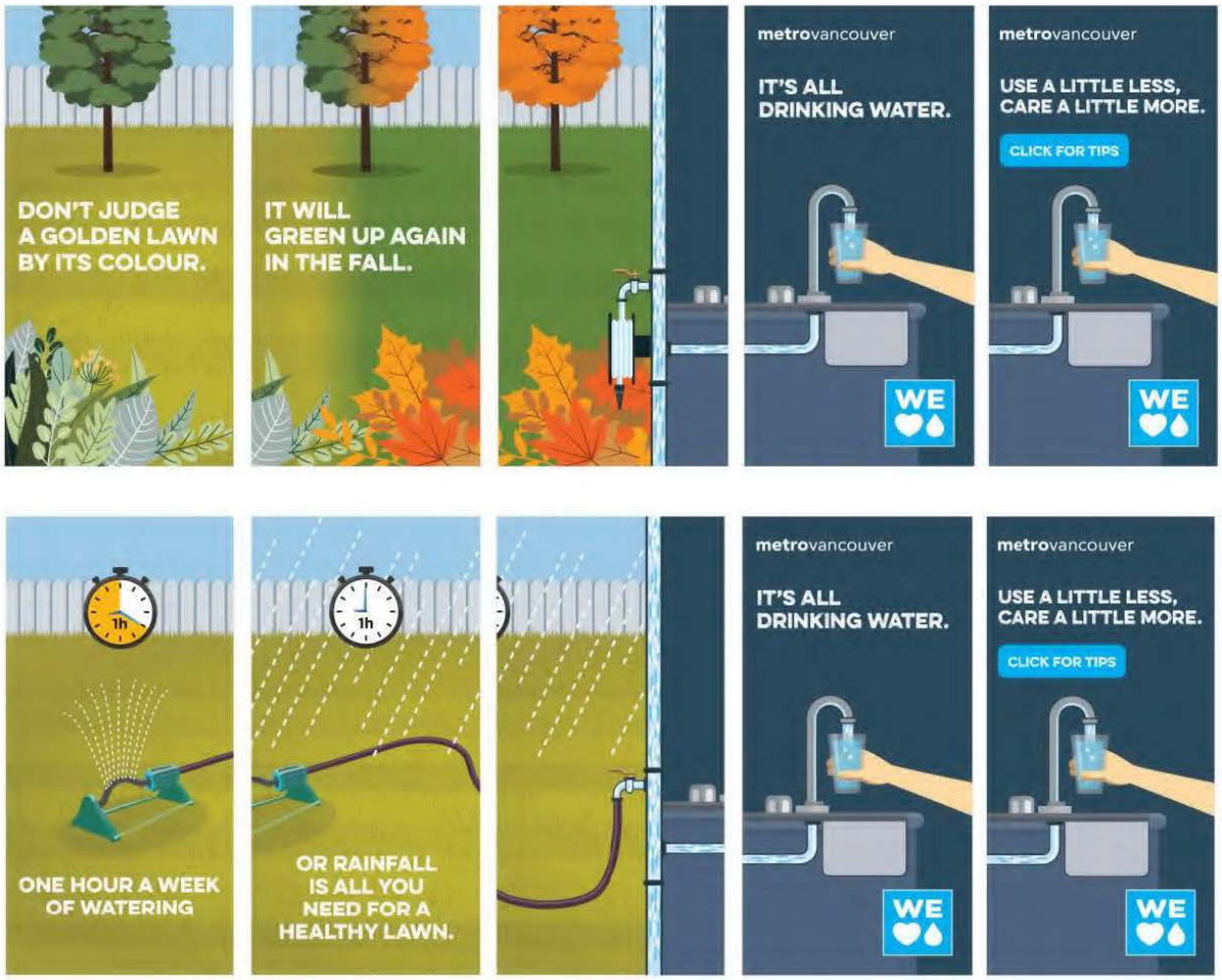


Non-residential education leaflet

Social media image examples



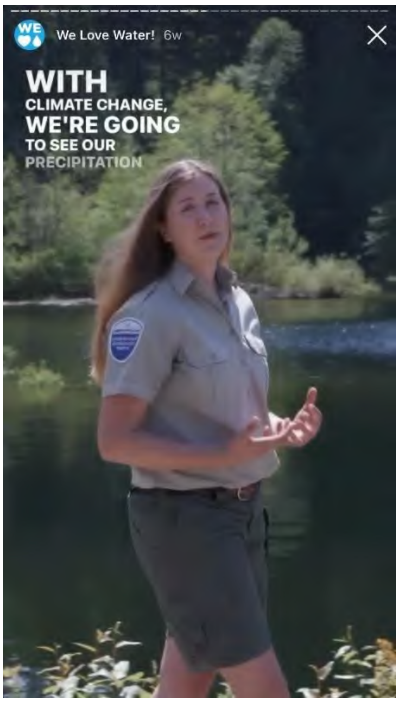
Animated banner ads for social media and digital advertising

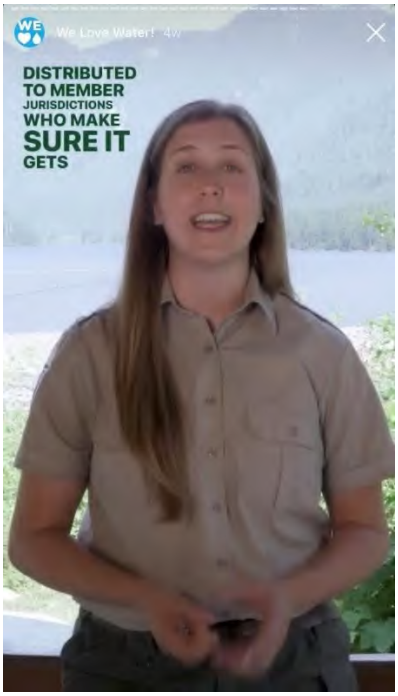

DON'T JUDGE A GOLDEN LAWN BY ITS COLOUR.
IT WILL GREEN UP AGAIN IN THE FALL.
metrovancouver
IT'S ALL DRINKING WATER.
WE
metrovancouver
USE A LITTLE LESS, CARE A LITTLE MORE.
CLICK FOR TIPS
WE
1h
ONE HOUR A WEEK OF WATERING
1h
OR RAINFALL IS ALL YOU NEED FOR A HEALTHY LAWN.
metrovancouver
IT'S ALL DRINKING WATER.
WE
metrovancouver
USE A LITTLE LESS, CARE A LITTLE MORE.
CLICK FOR TIPS
WE

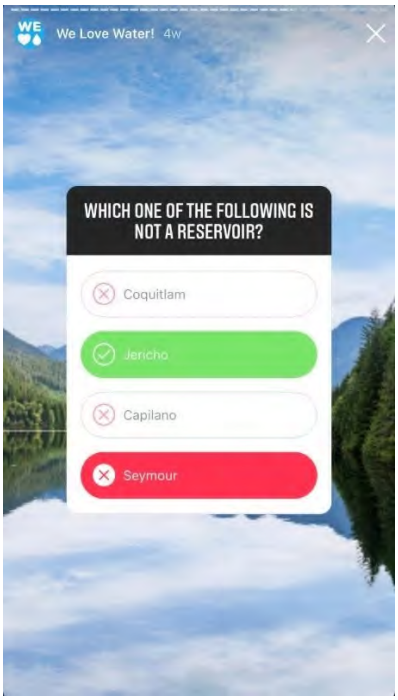
2021 'We Love Water' Communications Materials

Social media image examples

Still-shots from Instagram Story videos featuring Dayna Timmons from the Watershed Operations team

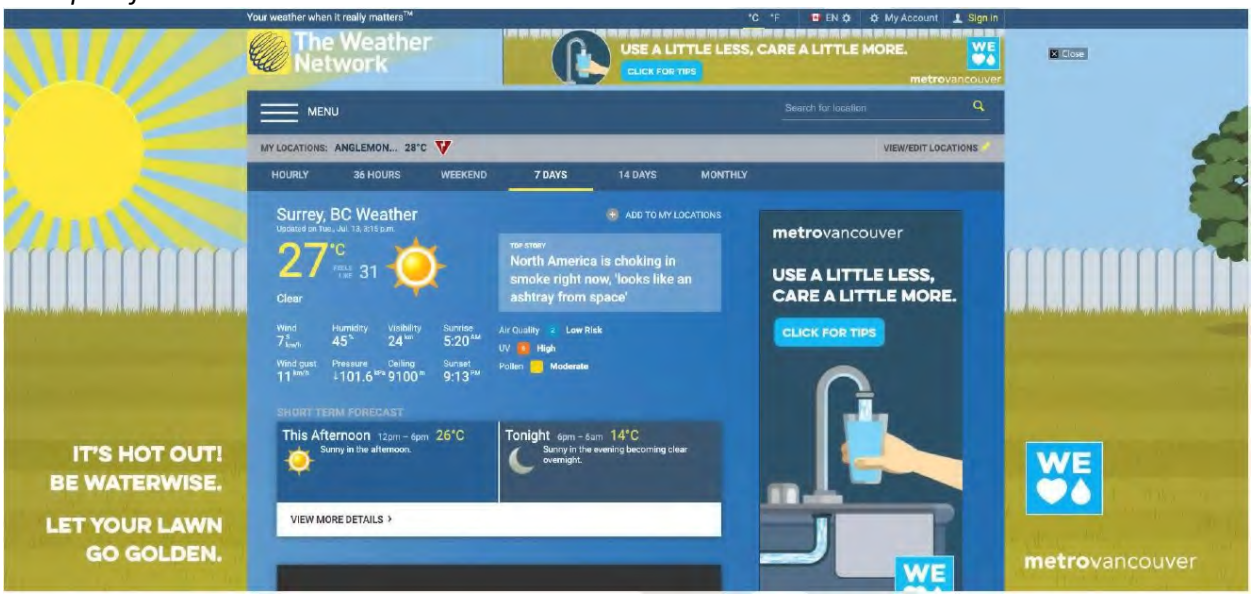






Videos – water source and system education and awareness examples

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.

To: Performance and Audit Committee

From: Linda Sabatini, Acting Director, Financial Operations

Date: April 7, 2022 Meeting Date: April 14, 2022

Subject: **Audited 2021 Financial Statements**

RECOMMENDATION

That the MVRD Board approve the Audited 2021 Consolidated Financial Statements for the Metro Vancouver Regional District;

That the GVS&DD Board approve the Audited 2021 Financial Statements for the Greater Vancouver Sewerage and Drainage District;

That the GVWD Board approve the Audited 2021 Financial Statements for the Greater Vancouver Water District;

That the MVHC Board approve the Audited 2021 Financial Statements for the Metro Vancouver Housing Corporation.

EXECUTIVE SUMMARY

Although we have encountered unprecedented global conditions, the 2021 Audited Financial Statements illustrate that Metro Vancouver entered this period in a strong financial position with excellent liquidity and solid reserves.

The financial statements have been prepared in accordance with Canadian Public Sector Accounting Standards ("PSAS") and have received an unqualified audit opinion by the external auditors, BDO Canada LLP Chartered Professional Accountants. The statements presented are currently draft and will be finalized upon approval by the Board on April 29, 2022.

PURPOSE

To present, for approval, the Audited 2021 Financial Statements for the Metro Vancouver Districts and the Metro Vancouver Housing Corporation.

BACKGROUND

Legislation requires that annual Audited Financial Statements be prepared for the Metro Vancouver Districts and Metro Vancouver Housing Corporation and presented at a public meeting of the Board of Directors. The Audited Financial Statements for 2021 have been prepared by management in accordance with Canadian Public Sector Accounting Standards ("PSAS") and have received an unqualified audit opinion by the external auditors, BDO Canada LLP Chartered Professional Accountants. The statements presented are currently draft and will be finalized upon approval by the Board on April 29, 2022.

2021 FINANCIAL STATEMENT HIGHLIGHTS

Under PSAS regulations, governments are required to present four statements with explanatory notes - Statement of Financial Position (Exhibit A), Statement of Operations (Exhibit B), Statement of Net Debt (Exhibit C) and Statement of Cash Flows (Exhibit D). It is important to note that there are differences between the presentation in these financial statements and the annual Metro Vancouver budget, which is prepared to determine the annual revenue requirements to meet expenditure obligations. These differences are outlined in note 16 of the consolidated statements.

The complete set of 2021 Audited Financial Statements is attached. These are presented for the Boards' approval and include:

Audited 2021 Consolidated Financial Statements for the Metro Vancouver Regional District
Audited 2021 Financial Statements for the Greater Vancouver Sewerage and Drainage District
Audited 2021 Financial Statements for the Greater Vancouver Water District
Audited 2021 Financial Statements for the Metro Vancouver Housing Corporation

The consolidated financial statements combine the accounts of the Metro Vancouver Regional District, Greater Vancouver Sewerage and Drainage District, Greater Vancouver Water District and the Metro Vancouver Housing Corporation.

Two statements, the Summarized *Consolidated Statement of Financial Position (Appendix 1)* and the *Consolidated Statement of Operations (Appendix 2)*, similar to the Balance Sheet and Income Statement in private organizations, are the foundation of the audited statements. They contain three key indicators, the accumulated surplus, annual surplus and net debt.

The *Summarized Statement of Financial Position (Appendix 1)* contains two of the indicators, the net debt and the accumulated surplus. The net debt position represents the amount by which the Districts' liabilities exceed the financial assets. Although the amount appears as unfavourable, the vast majority of the organization's liabilities are long-term debt which is repayable over several years. The organization's financial assets are more than sufficient to offset the amount of short-term obligations. The current ratio which is current assets divided by current liabilities and is a measure of an organization's liquidity is 3.2 to 1. A ratio of 2 to 1 is considered to be a measure of favourable liquidity. The net debt position increased by $198.0 million, while the increase in tangible capital assets was $633.0 million. This indicates that more of the District's investment in capital infrastructure is being funded through operations and reserves than debt.

The next indicator, also presented in the *Summarized Statement of Financial Position (Appendix 1)* is the accumulated surplus. Commonly thought of as "Net Worth" in private organizations, the District's accumulated surplus is favourable at $5.9 billion, which indicates that the organization owns (Financial and Non-Financial Assets) more than it owes (Liabilities). This reflects the member municipalities' net investment in the District's consolidated entity. It comprises reserve balances of $394.8 million and the investment in tangible capital assets (assets less debt owing) of $5.5 billion.

The accumulated surplus increased by $435.1 million in 2021 which represents the annual surplus for the year, the final indicator. The annual surplus is calculated as the difference between

revenues and expenses and detailed in Consolidated Statement of Operations (Appendix 2). For PSAS purposes, annual surplus does not include contributions to and from reserves, capital contributions or principal payments on long-term debt.

Additional explanations pertaining to the *Summarized Consolidated Statement of Financial Position (Appendix 1)* and the *Consolidated Statement of Operations (Appendix 2)* are included in the *2021 Financial Statement Highlights (Appendix 3)* and in a separate report titled *"5.3 2021 Financial Results Year-End".*

ALTERNATIVES

These financial statements are a statutory requirement prepared in accordance to specific accounting principles. No alternatives are presented.

FINANCIAL IMPLICATIONS

There are no financial implications relative to the approval of the Audited 2021 Financial Statements.

SUMMARY / CONCLUSION

The financial statements are part of the legislated reporting requirements for 2021 and staff recommends their approval. As noted in the Auditor's Report, it is the Auditor's opinion that these Financial Statements present fairly the financial position of the Metro Vancouver Districts and the Metro Vancouver Housing Corporation as of December 31, 2021, and the results of their financial activities and changes in their financial position for the year then ended in accordance with Canadian Public Sector Accounting Standards.

Attachments:

Appendix 1 - Summarized Consolidated Statement of Financial Position
Appendix 2 - Consolidated Statement of Operations
Appendix 3 - Management Discussion and Analysis - 2021 Financial Statement Highlights
Attachment 1 - Metro Vancouver Districts and Metro Vancouver Housing Corporation Financial Statements for the year ended December 31, 2021

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METRO VANCOUVER REGIONAL DISTRICT

Summarized Consolidated Statement of Financial Position
Year ended December 31, 2021
(in thousands of dollars)

	2021	2020
Financial Assets		
Cash, cash equivalents and investments	$ 1,027,885	$ 688,902
Accounts receivable	193,051	150,627
Debt reserve fund		
Total debt reserve fund	64,388	59,442
Less Debt reserve fund, member municipalities and Translink	(35,179)	(35,603)
Debt reserve fund, Metro Vancouver Districts	29,209	23,839
	1,250,145	**863,369**
Liabilities		
Accounts payable and other liabilities	384,234	294,806
Less accrued interest on debt (included in debt below)	(23,429)	(22,098)
Accounts payable and other liabilities	360,805	272,708
Deferred revenue and refundable deposits	341,016	311,451
Debt, Translink and member municipalities		
Debt, net of sinking fund	1,083,106	990,009
Accrued interest on debt	11,034	10,790
	1,094,140	1,000,799
Due from Translink and member municipalities	(1,094,140)	(1,000,799)
	-	-
Debt, Metro Vancouver		
Debt, net of sinking funds	1,851,489	1,385,445
Accrued interest on debt	12,395	11,309
	1,863,884	1,396,754
	2,565,705	**1,980,912**
Net Debt	**(1,315,560)**	**(1,117,543)**
Non-Financial Assets		
Tangible capital assets	7,172,479	6,539,503
Prepaids and inventories	24,723	24,624
	7,197,202	6,564,127
Accumulated Surplus (Equity)	**$ 5,881,642**	**$ 5,446,584**
Accumulated Surplus (Equity), beginning of year	$ 5,446,584	$ 4,888,771
Revenue	1,080,455	1,162,441
Expenses	645,397	604,628
Annual surplus	435,058	557,813
Accumulated Surplus (Equity), end of year	**$ 5,881,642**	**$ 5,446,584**
Accumulated Surplus (Equity) consists of		
Reserves	$ 394,831	$ 325,079
Non-financial assets (net of debt and capital funds)	5,486,811	5,121,505
	$ 5,881,642	**$ 5,446,584**

METRO VANCOUVER REGIONAL DISTRICT

Consolidated Statement of Operations
Year ended December 31, 2021
(in thousands of dollars)

	2021 Budget	2021 Actual	2020 Actual
Revenue			
MVRD property tax requisitions	$ 82,714	$ 82,714	$ 73,528
Metered sale of water	316,341	319,989	297,781
Sewerage and drainage levy	288,226	288,226	274,237
Tipping fees	108,517	112,610	100,880
Housing property rentals	41,303	42,416	41,607
BODTSS industrial charges	11,756	12,157	11,568
Development cost charges	88,145	42,204	81,653
Electricity sales	6,240	5,779	5,309
Grants and other contributions	263,811	76,174	184,641
User fees, recoveries and other revenue	26,619	37,124	33,425
Sinking fund and interest income	28,940	32,840	29,734
Sinking fund income, members and TransLink	28,698	28,222	28,078
	1,291,310	1,080,455	1,162,441
Expenses			
Sewer operations	229,598	199,788	191,431
Waste disposal, recycling and regulatory services	111,370	103,102	95,274
Water operations	151,627	146,841	139,227
Housing rental operations	38,890	33,682	27,211
Regional parks	36,440	33,747	29,670
General government services	5,674	5,376	5,221
Air quality	11,178	9,198	9,374
Regional employers services	2,856	2,378	2,459
911 emergency telephone system	4,543	4,452	4,364
Regional planning	3,797	2,809	3,128
Housing planning and policy	1,490	1,020	881
Invest Vancouver	1,500	1,526	206
Electoral areas	436	423	515
Regional global positioning system	304	221	204
Sasamat volunteer fire department	849	238	195
Regional emergency management	218	67	125
Corporate costs	64,440	55,343	51,473
Building operations	16,851	16,964	15,592
Sinking fund income attributed to members and TransLink	28,698	28,222	28,078
	710,759	645,397	604,628
Annual surplus	580,551	435,058	557,813
Accumulated surplus, beginning of year	5,446,584	5,446,584	4,888,771
Accumulated surplus, end of year	$ 6,027,135	$ 5,881,642	$ 5,446,584

Management Discussion and Analysis – 2021 Financial Statement Highlights

Summarized Consolidated Statement of Financial Position

The purpose of the *Consolidated Statement of Financial Position (Appendix 1)* is to present the organization's assets, liabilities, net debt position and accumulated surplus or equity position. The accumulated surplus could also be interpreted as the net worth of the organization.

Relevant explanations pertaining to the Summarized Consolidated Statement of Financial Position are as follows:

Accumulated Surplus

The key performance indicator on Statement of Financial Position is the Accumulated Surplus. The accumulated surplus for the District is favourable at $5.9 billion, which indicates that the organization owns (Financial and Non-Financial Assets) more than it owes (Liabilities). This amount is often referred to in private organizations as "Net Worth", and reflects the member municipalities' net investment in the District's consolidated entity. It comprises reserve balances of $394.8 million and the investment in tangible capital assets (assets less debt owing) of $5.5 billion.

The accumulated surplus increased by $435.1 million in 2021 which represents the annual surplus for the year, calculated as the difference between revenues and expenses and detailed in Appendix 2. For PSAS purposes, annual surplus does not include contributions to and from reserves, capital contributions or principal payments on long-term debt.

Financial Assets

Cash, Cash Equivalents and Investments

Cash, cash equivalents and investments consist of cash and both long and short-term investments. The 2021 balance was significantly higher than 2020 as a result of lower than expected capital spending for utility infrastructure projects that are funded from grants and reserves held in cash and investments.

Accounts Receivable

Accounts receivable are amounts due through the normal course of District business and are net of any allowance for doubtful accounts, which is negligible. The balance at December 31, 2021 comprises mainly of tipping fees due from commercial solid waste haulers, development cost charge (DCC) income, industrial sewer charges from commercial customers and payments due from our member municipalities for water sales. The 2021 receivable is higher than 2020 as it includes a $38 million grant claim receivable at year end from the Province for eligible costs relating to the North Shore Waste Water Treatment Plant project.

Financial Assets (continued)

Debt Reserve Fund

The debt reserve fund represents the amount required, under agreement with the Municipal Finance Authority (MFA), as security for debt service obligations related to MFA debentures issued to the Districts and its members. This represents 1% of the debenture issues. These amounts are refundable, with interest, upon debenture maturity. This balance fluctuates upward with new debt issues and downward as issues mature. The total debt reserve fund balance can be segregated into two components:

1) Member Municipalities and Translink ($35.2 million). This amount is the related to debt service obligations for these organizations and is fully refundable to them. Therefore, it has no impact on Metro Vancouver's financial position.
2) Metro Vancouver ($29.2 million). This amount is related to debt incurred to fund infrastructure projects in GVWD and GVS&DD.

Liabilities

Accounts Payable and Other Liabilities

Accounts payable and other liabilities consists of amounts owing:

- to suppliers for goods received and services rendered, primarily those relating to capital projects;
- to employees for future benefits which represent the potential payments to employees of entitled benefits, such as banked vacation;
- to MFA and mortgage providers for interest accrued on debt; and
- for the District's share of landfill closure and post closure costs at the Vancouver and Cache Creek landfills.

The increase of $88.1 million is mainly a result of $96.0 million more in trade payables and construction holdbacks due to timing of payments; offset by decreases payments made in 2021 for collective bargaining settlements of $7.0 million and contaminated site remediation work of $2.1 million paid.

Deferred Revenue and Refundable Deposits

Deferred revenue and refundable deposits include:

- $258.6 million of restricted funds raised through the collection of development cost charges (DCCs), which will be used to fund future liquid waste growth capital projects;
- $69.7 million for the Provincial grant associated with the construction of the new North Shore Wastewater Treatment plant;
- $3.4 million of restricted funds in MVHC which will be used for the replacement of equipment and specified building components and to offset future operating deficits in specific programs;
- $6.4 million in security deposits in MVHC and Regional Parks; and
- $2.9 million from miscellaneous deferred grants and revenues in other programs.

The increase of deferred revenue for the year of $29.6 million is largely from the reduction DCCs and grant application funding in 2021, due to capital project delays. In 2020, $42 million of DCCs was directly applied to project funding.

Liabilities (continued)

Debt

Debt, net of sinking funds reflects the amount of long term borrowing outstanding at the end of 2021. Sinking funds consist of principal payments made over the term of the debt issue. These payments are invested which along with the interest earned will offset the debt repayment at maturity.

TransLink and Member Municipalities

The debt owing to MFA for TransLink and member municipalities reflects borrowing on behalf of these entities to fund major capital projects. The amount is completely offset reflecting the fact that these entities are responsible for the debt. Therefore, the impact on Metro Vancouver's financial position is nil.

Overall debt for these entities increased by $93.3 million. New long-term borrowing during the year was $179.6 million relating to debt borrowed on behalf of the Surrey ($150.6 million) and Maple Ridge ($29 million). This increase is offset by debt and sinking fund payments of $58.3 million and sinking fund interest earned of $28.0 million. In addition, there was $72.1 million in debt maturities with an equal offsetting amount of sinking fund retirements.

Metro Vancouver

The debt owing on behalf of the Metro Vancouver Districts and Metro Vancouver Housing Corporation reflects borrowing to fund major infrastructure projects. The net amount owing for Metro Vancouver at the end of 2021 is $1.9 billion. To put this in context, Metro Vancouver has tangible capital assets of $7.2 billion and an investment in non-financial assets (assets less debt owing) of $5.5 billion.

The debt increased by $467.1 million. New long-term borrowing during the year was $600.0 million ($370.0 million for GVS&DD and $230.0 million for GVWD). This increase is offset by debt and sinking fund payments of $108.2 million and sinking fund interest earned of $24.7 million. In addition, there was $70.0 million in debt maturities with an equal offsetting amount of sinking fund retirements.

Net Debt

The net debt position indicates the amount by which the organizations' liabilities exceed the financial assets. Although the amount appears as unfavourable, the vast majority of the organization's liabilities are long-term debt which is repayable over several years. The organization's financial assets are more than sufficient to offset the amount of short-term obligations. The current ratio which is current assets divided by current liabilities and is a measure of an organization's liquidity is 3.2 to 1. A ratio of 2 to 1 is considered to be a measure of favourable liquidity.

The net debt position increased by $198.0 million, while the increase in tangible capital assets was $633.0 million. This indicates that more of the District's investment in capital infrastructure is being funded through operations and reserves than debt.

Non-Financial Assets

Non-financial assets represent the value of tangible capital assets, inventories of supplies held by the organization, the prepaid portion of land leases on housing properties, and prepaid expenses for items such as insurance.

The Tangible Capital Assets balance represents the historical cost of the asset less accumulated amortization. The increase in 2021 is the direct result of the capital expenditures made during the year, the majority of which were for water and sewer infrastructure projects.

Consolidated Statement of Operations

The *Consolidated Statement of Operations (Appendix 2)* identifies the results of the organization's financial activities for the year by presenting revenues less expenses, which is the annual surplus. This statement consolidates the revenues and expenses of the Districts and MVHC.

The annual surplus of $435.1 million serves as the 2021 addition to the organization's overall accumulated surplus position or net worth of $5.9 billion. The accumulated surplus in this statement is also articulated in the *Summarized Consolidated Statement of Financial Position and Equity (Appendix 1).*

As noted above, the annual surplus as presented under PSAS is different from the annual surplus as determined in the context of the annual budget, which is $47.2 million. The primary difference is that the PSAS framework excludes contributions to and from reserves as well as capital contributions and principal payments on long-term debt. These excluded items form a significant part of the annual approved budget. A reconciliation of the PSAS surplus to the budgeted surplus is provided in a separate report titled *"5.3 2021 Financial Results Year-End".*

Relevant explanations pertaining to the Consolidated Statement of Operations are as follows:

Revenue

Metered Sale of Water

Metered water sales for 2021 were higher than budget and prior year due to 0.7% more consumption than anticipated.

Tipping Fees

Tipping fee revenues in Solid Waste were higher than budgeted and prior year due to greater than expected waste flows during 2021.

Development Cost Charges

Development cost charges (DCCs) applied against growth capital project are lower than budget due to delays in capital spending. This resulted in a reduced direct application of DCCs to project funding in 2021. In 2020, $42 million of DCCs was directly applied to project funding.

Revenue (continued)

Housing Property Rentals Property rentals in the Housing Corporation were $1.1 million higher than budget and $0.8 million higher prior year as rental assistance subsidies were lower than anticipated. The vacancy rate was higher than expected for 2021 as limitations due to COVID-19 resulted in slower than expected unit turnovers.

BODTSS Industrial Charges BODTSS industrial charges were slightly higher than anticipated and higher than the prior year due to higher discharge than was anticipated.

Electricity Sales Electricity sales related to Solid Waste Operations were slightly lower than anticipated due to lower electricity production from unplanned maintenance and downtime of the turbine.

Grants and Other Contributions Grants and other contributions of $76.2 million are from GVS&DD capital projects ($61.0 million), Parks land contribution ($11.0 million), the COVID-19 British Columbia Restart grant ($1.3 million), grants-in-lieu of taxes ($1.0 million), and MVHC's subsidies and contributions ($1.9 million). Grants are significantly lower than budget and prior year due to less spending on the North Shore Wastewater Treatment project and therefore less grant application than anticipated. In addition, the prior year included $6.7 million from funds received for Heather Place redevelopment project.

User fees, Recoveries and Other Revenue User fees, recoveries and other revenue are amounts collected from Metro Vancouver's various functions, including property and facility rentals, parking and user fees, regulatory permits, trucked liquid waste fees, source control fees and cost sharing income. The amount is $10.5 million higher than anticipated due to unplanned revenue from cost sharing income for capital projects in GVWD of $8.3 million; higher parking revenue in Parks of $.6 million and higher other revenue from property rentals and leases of $1.6 million.

Sinking fund and Interest Income Sinking fund and interest income are funds earned on Metro Vancouver's sinking funds for debt and income earned on its investment portfolio balance. The income is higher than anticipated and the prior year due to delays in capital spending resulting in a higher than expected average investment balances for the year.

Sinking Fund Income, Members and TransLink Sinking fund income, members and TransLink is income earned on sinking funds for debt incurred on behalf of these organizations. This income, although recognized in the Financial Statements, is income attributed to the other organizations. There is an offsetting item under expenses, so the net impact to Metro Vancouver is nil.

Expenses

Liquid Waste Services

Expenses for Liquid Waste services were $29.8 million lower than budget primarily due to deferral and cancellation of some projects in minor capital, residuals, and research and innovation, resulting in lower than anticipated in consulting and contracting expenses of $17.9 million and other operating costs (materials, supplies, utilities and permits) of $3.9 million. Staff vacancies, where recruitment efforts continue, attributed to $2.0 million in lower costs. In addition, due to delays in capital spending, amortization of capital assets was $2.7 million lower than anticipated and interest costs on debt were $0.5 million lower budget.

Solid Waste Services

Expenditures in Solid Waste services were lower than budget by $8.2 million primarily due to lower costs related to City of Vancouver facilities ($1.7 million), lower tonnage throughput at the Waste-to-Energy Facility ($1.4 million), new lower cost contracts for organics and disposal ban inspections ($1.2 million), timing of the opening the new United Boulevard Recycling and Waste Centre ($1.0 million), decreased bottom ash disposal costs due to beneficial use ($0.8 million) and other miscellaneous operational costs of ($2.1 million).

Water Services

Water services were comparable to prior year but lower than budget by $4.8 million due to delays in Sustainability Innovation Fund (SIF) project work, equipment purchases, corrosion control implementation and easement acquisitions. Staff vacancies where recruitment efforts continue contributed to $3.2 million in lower expenditures.

Housing Rental Operations

Housing expenditures were $5.2 million lower than budget mainly due to lower than anticipated costs for utilities, permits and taxes ($2.3 million). In addition, delays in larger building envelope projects resulted in lower than expected costs of $2.9 million.

Regional Parks

Regional Parks expenses were $2.7 million lower than budget primarily as a result of lower than anticipated consulting and contract services as a result of delays in hiring contractors and changes to project timelines. The 2021 expenditures were higher than prior year, as 2020 saw reduced program offerings, event cancellations and filming disruptions due to the COVID-19 pandemic.

General Government Services

General government services were $300,000 lower as projects and initiatives were delayed due to COVID-19. The program expenditures are in line with the prior year.

Expenses (continued)

Air Quality	Air Quality expenditures were $2.0 million lower than budget and $200,000 lower than prior year primarily as a result of unspent consulting and legal fees due to delays in climate policy and extensions for regulation development.
Regional Employers Services	Expenditures in Regional Employers Services were $760 thousand lower than anticipated due to staff vacancies and lower consulting costs as a result of limited activity due to COVID-19 pandemic. The expenditures are in line with 2020.
911 Emergency Telephone System	E911 expenditures were slightly lower than budget for the year primarily due to translation costs being lower than anticipated. The expenditures are comparable to the prior year.
Regional Planning	Regional Planning ended the year slightly under budget and lower than prior year primarily due to staff vacancies and lower than planned consulting expenditures due to project delays.
Housing Planning and Policy	Housing Planning and Policy was lower than budget mainly due to consulting projects related to SIF funding delayed. Expenditures were higher than prior year due to fewer staff vacancies in 2021 versus 2020.
Invest Vancouver	Invest Vancouver was slightly higher than budget due to staffing structural changes and external resource requirements. Expenditures were significantly higher than 2020 due to staff vacancies in the prior year as the function was being established.
Electoral Areas	Electoral Areas expenditures were slightly lower than budget due to lower consulting expenditures than anticipated. Expenditures were lower than 2020 as the prior year included higher program spending that was offset by one-time grant revenue.
Regional Global Positioning System (RGPS)	The RGPS program was underspend by $80 thousand due to lower than expected equipment and consulting costs. The amount spent in 2021 was slightly higher than 2020 expenditures.
Sasamat Volunteer Fire Department	The Sasamat Volunteer Fire expenditures were significantly lower than budget as a result of procurement delays for a new fire truck budgeted at $600 thousand. It is anticipated the equipment will be delivered in 2022.
Regional Emergency Management	Regional Emergency Management's expenditures for 2021 were significantly lower than anticipated mainly due to COVID restrictions and difficulties in hiring staff.

Expenses (continued)

Corporate Program Costs

Corporate Program Costs represent expenditures for centralized services such as Finance, Human Resources, External Relations, Corporate Services, Legal and Indigenous Relations. Expenditures for the programs were lower than budget mainly due to labour underspends as a result of staff vacancies and underspends on travel, training and tuition as a result of COVID-19.

Building Operations

Building Operations shows expenditures slightly higher than budget by $110 thousand due to higher than anticipated repairs and maintenance, including cleaning and janitorial to address COVID-19 protocols. Although expenses are over budget, the overall program had a surplus of $98,000 as revenues were also higher than anticipated.

METRO VANCOUVER DISTRICTS
AND METRO VANCOUVER HOUSING CORPORATION

(OPERATING AS METRO VANCOUVER)

Financial Statements

Year ended December 31, 2021

April 7, 2022

Financial Statements of

GREATER VANCOUVER WATER DISTRICT

Year ended December 31, 2021

April 8, 2022

GREATER VANCOUVER WATER DISTRICT

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December 31, 2021

GREATER VANCOUVER WATER DISTRICT

MANAGEMENT REPORT

The Financial Statements contained in this report have been prepared by management in accordance with Canadian public sector accounting standards. The integrity and objectivity of these statements are management's responsibility. Management is responsible for all the statements and schedules, and for ensuring that this information is consistent, where appropriate, with the information contained in the financial statements.

Management is also responsible for implementing and maintaining a system of internal controls to provide reasonable assurance that reliable financial information is produced.

The Greater Vancouver Water District's Board of Directors is responsible for approving the financial statements and for ensuring that management fulfills its responsibilities for financial reporting and internal control and exercises this responsibility through the Performance and Audit Committee of the Board.

The external auditors, BDO Canada LLP, conduct an independent examination, in accordance with Canadian Auditing Standards, and express their opinion on the financial statements. Their examination does not relate to the other schedules and statements required by the *Financial Information Act*. The Independent Auditor's Report outlines the scope of the audit for the year ended December 31, 2021.

On behalf of Greater Vancouver Water District.

Date: April 29, 2022

Dean Rear, Chief Financial Officer

Independent Auditor's Report

To the Members of the Board of Directors of the Greater Vancouver Water District

Opinion

We have audited the financial statements of the Greater Vancouver Water District (the "District"), which comprise the Statement of Financial Position as at December 31, 2021, and the Statements of Operations, Change in Net Debt and Cash Flows for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the District as at December 31, 2021, and the results of its operations, change in net debt and cash flows for the year then ended in accordance with Canadian public sector accounting standards.

Basis for Opinion

We conducted our audit in accordance with Canadian generally accepted auditing standards. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the District in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Canadian public sector accounting standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the District's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the District or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the District's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian generally accepted auditing standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with Canadian generally accepted auditing standards, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the District's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the District's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the District to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Chartered Professional Accountants

Vancouver, British Columbia
DATE

GREATER VANCOUVER WATER DISTRICT

Exhibit A

Statement of Financial Position

Year ended December 31, 2021

	2021	2020
Financial Assets		
Cash	$ 1,780,988	$ 1,110,634
Accounts receivable	48,357,266	52,651,185
Due from (to) Metro Vancouver Regional District	169,401,485	(9,989,434)
Debt reserve fund (note 2)	15,647,006	14,026,840
	235,186,745	57,799,225
Liabilities		
Accounts payable and accrued liabilities (note 3)	69,616,281	54,903,222
Debt (net of sinking funds) (note 4)	711,163,290	557,737,244
	780,779,571	612,640,466
Net Debt	(545,592,826)	(554,841,241)
Non-Financial Assets		
Tangible capital assets (note 5)	2,855,862,044	2,681,331,071
Inventories of supplies	4,356,061	4,312,253
Prepaid expenses	562,801	617,268
	2,860,780,906	2,686,260,592
Accumulated surplus (note 6)	**$ 2,315,188,080**	**$ 2,131,419,351**

Contractual obligations and rights (note 7)
Contingencies (note 8)
COVID-19 (note 11)

The accompanying notes are an integral part of these financial statements.

_____ Chief Financial Officer

_____ Board Chair

GREATER VANCOUVER WATER DISTRICT

Exhibit B

Statement of Operations

Year ended December 31, 2021

	2021 Budget (note 9)	2021 Actual	2020 Actual
Revenue (note 10)			
Metered sale of water	$ 316,341,192	$ 319,989,323	$ 297,780,794
Sinking fund, debt retirement and interest income	17,594,045	20,734,421	19,233,123
Interest income	713,060	630,564	1,091,295
Building income from Metro Vancouver Districts	9,650,613	9,616,135	12,227,786
Building income from external parties	6,747,794	6,634,971	6,133,979
Other revenue	1,674,556	10,660,566	8,670,769
	352,721,260	368,265,980	345,137,746
Expenses (note 10)			
Water operations	172,616,063	167,532,829	158,192,895
Building operations	16,850,926	16,964,422	15,591,928
	189,466,989	184,497,251	173,784,823
Annual surplus	163,254,271	183,768,729	171,352,923
Accumulated surplus, beginning of year	2,131,419,351	2,131,419,351	1,960,066,428
Accumulated surplus, end of year	**$ 2,294,673,622**	**$ 2,315,188,080**	**$ 2,131,419,351**

The accompanying notes are an integral part of these financial statements.

GREATER VANCOUVER WATER DISTRICT

Exhibit C

Statement of Change in Net Debt

Year ended December 31, 2021

	2021 Budget (note 9)	2021 Actual	2020 Actual
Annual surplus	$ 163,254,271	$ 183,768,729	$ 171,352,923
Change in tangible capital assets:			
Acquisition of tangible capital assets	(431,250,000)	(215,953,824)	(247,236,906)
Amortization of tangible capital assets	40,552,047	41,422,851	40,020,293
	(390,697,953)	(174,530,973)	(207,216,613)
Change in other non-financial assets:			
Acquisition of prepaid expenses	-	(562,801)	(617,268)
Use of prepaid expenses	-	617,268	528,445
Acquisition of inventories of supplies	-	(4,356,061)	(4,312,253)
Consumption of inventories of supplies	-	4,312,253	2,861,051
	-	10,659	(1,540,025)
Changes in net debt	(227,443,682)	9,248,415	(37,403,715)
Net debt, beginning of year	(554,841,241)	(554,841,241)	(517,437,526)
Net debt, end of year	**$ (782,284,923)**	**$ (545,592,826)**	**$ (554,841,241)**

The accompanying notes are an integral part of these financial statements.

GREATER VANCOUVER WATER DISTRICT

Exhibit D

Statement of Cash Flows

Year ended December 31, 2021

	2021	2020
Cash provided by (used in):		
Operating transactions:		
Annual surplus	$ 183,768,729	$ 171,352,923
Items not involving cash:		
Amortization	41,422,851	40,020,293
Sinking fund income	(20,696,085)	(19,187,680)
Debt reserve fund income	(111,875)	(278,655)
Change in non-cash assets and liabilities:		
Accounts receivable	4,293,919	8,441,772
Prepaid expenses	54,467	(88,823)
Accounts payable and accrued liabilities	14,713,059	(8,728,293)
Inventories of supplies	(43,808)	(1,451,202)
Net change in cash from operating transactions	223,401,257	190,080,335
Capital transactions:		
Acquisition of tangible capital assets	(215,953,824)	(247,236,906)
Net change in cash from capital transactions	(215,953,824)	(247,236,906)
Financing transactions:		
Due from Metro Vancouver Regional District	(179,390,919)	38,717,502
Debenture debt issued	230,000,000	70,000,000
Debt reserve fund issuance	(2,300,000)	(700,000)
Debt reserve fund maturity	791,709	57,874
Sinking fund payments	(55,877,869)	(51,574,488)
Net change in cash from financing transactions	(6,777,079)	56,500,888
Net change in cash and cash equivalents	670,354	(655,683)
Cash and cash equivalents, beginning of year	1,110,634	1,766,317
Cash and cash equivalents, end of year	**$ 1,780,988**	**$ 1,110,634**

The accompanying notes are an integral part of these financial statements.

1. Significant Accounting Policies

The Greater Vancouver Water District (the "District") was established by an Act of the same name in 1924. Its primary responsibility is the supply of potable water to its member municipalities. Its Board of Directors comprises the same councillors and mayors as appointed to the Metro Vancouver Regional District ("MVRD") Board by the participating municipalities.

The District owns or holds under a 999-year lease from the Province an extensive closed watershed network as its source of supply. It owns a series of dams, reservoirs, water treatment plants and a distribution network connecting to the municipal distribution systems. The member municipalities under the Act are jointly and severally liable for its debts. The District also owns and is responsible for operating and maintaining office buildings that are leased to MVRD and its related entities.

The District's financial statements are prepared by management in accordance with Canadian public sector accounting standards ("PSAS"). Significant accounting policies adopted by the District are as follows:

Basis of Accounting

The District follows the accrual method of accounting for revenues and expenses. Revenues are recognized in the year in which they are earned and measurable. Expenses are recognized as they are incurred and measurable as a result of the receipt of goods or services and/or the legal obligation to pay.

Government Transfers

Government transfers are recognized as revenue in the financial statements when the transfer is authorized and any eligibility criteria are met, except to the extent that transfer stipulations give rise to an obligation that meets the definition of a liability. The transfer of revenue is initially deferred and then recognized in the statement of operations as the stipulation liabilities are settled.

When the District is deemed the transferor, the transfer expense is recognized when the recipient is authorized and has met the eligibility criteria.

Sinking Fund, Debt Retirement and Interest Income

Interest income is reported as revenue in the period earned. When required, based on external restrictions, interest income earned on deferred revenue is added to and forms part of the deferred revenue balance and is recognized into income when related stipulations are met. Any surpluses received from upon debt retirement are recorded in the year received.

1. Significant Accounting Policies (continued)

Cash and Investments

In order to improve cash management, Metro Vancouver Districts accumulate cash and investment transactions in pooled accounts held by the MVRD. GVWD's cash is therefore presented as due from Metro Vancouver Regional District. Investments held by the MVRD consist of bonds issued by governments and Canadian chartered banks, money market instruments and term deposits. Interest earned on GVWD's fund balances is included in the amount owing from the MVRD and is recorded as interest income in the Statement of Operations.

Employee Future Benefits

Employees who provide services for the District are employees of the MVRD. Employee related costs are allocated by the MVRD to the District based on services rendered. These costs are shown as expenses in the financial statements and are included in amounts owing to MVRD.

Post-employment benefits of the MVRD, including accumulated banked sick and vacation pay, retirement severance and Worker's Compensation top-up benefits for employees pursuant to certain policies and union agreements, are actuarially determined based on service and best estimates of retirement ages and expected future salary and wage increases. The obligation under these benefit plans is allocated to the District based on projected benefits as the employees render services necessary to earn the future benefits and included in amounts owing to MVRD.

Non-Financial Assets

Non-financial assets are not available to discharge existing liabilities and are held for use in the provision of services. They have useful lives extending beyond the current year and are not intended for sale in the ordinary course of operations.

1. Significant Accounting Policies (continued)

Non-Financial Assets (continued)

Tangible Capital Assets

Tangible capital assets are recorded at cost which includes amounts that are directly attributable to acquisition, construction, development or betterment of the asset. The cost, less residual value, of the tangible capital assets, excluding land, is amortized on a straight line basis over the estimated useful lives of the assets as follows:

Asset	Useful Life Years
Buildings	
Corporate head office	40
Watershed	25
Infrastructure	
Dams and reservoirs	150
Supply mains	100
Distribution systems, drinking water treatment	50
Bridges and roads	50
Vehicles	5 - 10
Machinery, Equipment, Furniture and Fixtures	5 - 20

a. Annual amortization:

Annual amortization begins when the asset is put into service and is expensed over its useful life. Assets under construction are transferred to the appropriate asset class and are amortized from the date the asset is put into productive use.

b. Contributions of tangible capital assets:

Contributions of tangible capital assets are recorded at their fair value at the date of receipt and as contribution revenue.

c. Interest capitalization:

The District does not capitalize interest costs associated with the acquisition or construction of a tangible capital asset.

Inventories of Supplies

Inventories of supplies held for consumption are recorded on a first-in-first-out basis.

1. Significant Accounting Policies (continued)

Revenue Recognition

Metered sale of water, building income from external tenants, Metro Vancouver Districts and Housing Corporation, and other income are recognized as revenue on an accrual basis according to the usage and rates approved and set by the Board.

Use of Estimates

The preparation of these financial statements requires management to make estimates and assumptions that affect the reported amounts in the financial statements and the disclosure of contingent liabilities. These estimates and assumptions are based on management's best information and judgment and may differ from actual results. Adjustments, if any, will be reflected in the financial statements in the period that the change in estimate is made, as well as in the period of settlement if the amount is different.

Significant areas requiring the use of management's judgment relates to the determination of contaminated sites liabilities, the amortization rates of tangible capital assets and the assessment of the outcome of contingent liabilities.

Segmented Information

A segment is defined as a distinguishable activity or group of activities of a government for which it is appropriate to separately report financial information to achieve the objectives of the standard. Definitions of the District's segments and their related financial information are presented in note 10.

Liabilities for Contaminated Sites

A liability for remediation of a contaminated site is recognized when the site is no longer in productive use and the following criteria are satisfied: an environmental standard exists; contamination exceeds the standard; the District is either directly responsible or has accepted responsibility for remediation; it is expected that future economic benefits will be given up and a reasonable estimate of the liability can be made. Liabilities for contaminated sites are reported in accounts payable and accrued liabilities (note 3).

2. Debt Reserve Fund

The Municipal Finance Authority of British Columbia ("MFA") provides financing for regional districts and member municipalities. The MFA is required to establish a Debt Reserve Fund for each debenture issue equal to one-half the average annual installment of principal and interest. The debt reserve fund is comprised of cash deposits equal to 1% of the principal amount borrowed and a non-interest bearing demand note for the remaining requirement. Cash deposits held by the MFA are payable with interest to the ultimate borrower when the final obligations under the respective loan agreements have been made.

If, at any time, the District has insufficient funds to meet payments due on its obligations to the MFA, the payments will be made from the debt reserve fund. The demand notes are callable only if there are additional requirements to be met in order to maintain the level of the debt reserve fund. At December 31, 2021, $41,402,712 (2020 - $36,580,208) in callable demand notes were outstanding and have not been recorded in the statement of financial position.

3. Accounts Payable and Accrued Liabilities

	2021	2020
Trade accounts	$ 37,400,180	$ 26,565,725
Construction holdbacks	25,870,577	22,502,301
Accrued interest on debt	5,883,967	5,523,920
Contaminated sites (a)	461,557	201,323
Other	-	109,953
	$ 69,616,281	$ 54,903,222

(a) The District accrued $461,557 (2020 - $201,323) to remediate contaminated soils at its properties. The remediation work for one property identified in 2020 was completed in 2021. It is expected that the work on the site identified in 2021 will be completed by 2023.

4. Debt

a) All borrowings for the District are obtained from MFA by the MVRD on the District's behalf, although the District maintains the right to finance debt without MFA involvement.

Debt, debentures or other security issued by the District is a direct, joint and several obligation and liability of the District and each and every member municipality.

Debt servicing requirements comprising sinking fund contributions, serial repayments and interest are funded as incurred by revenue earned during the year.

b) Principal payments and sinking fund installments due within the next five years and thereafter are as follows:

	Total Payments
2022	$ 66,189,780
2023	61,712,326
2024	57,935,234
2025	50,943,480
2026	44,501,695
Thereafter	260,302,147
Total payments	541,584,662
Estimated sinking fund income	169,578,628
Total debt	**$ 711,163,290**

c) Sinking fund installments are invested by the MFA and earn income that, together with principal payments, are expected to be sufficient to retire the sinking fund debt at maturity. For sinking fund agreements, the MFA has established either a normal sinking fund or a capital repayment equalization fund.

4. Debt (continued)

d) Debt (net of sinking funds) reported on the Statement of Financial Position comprises the following and includes varying maturities up to 2036 with interest rates ranging from 1.28% to 4.20%.

Issue number	By-law number	Interest rate - %	Maturity date	Debentures authorized to be issued	Debenture debt outstanding 2021	Debenture debt outstanding 2020
67	813	1.75	November 5, 2022	$ 14,294,000	$ 14,294,000	$ 14,294,000
67	853	1.75	November 5, 2022	706,000	706,000	706,000
97	946	1.75	April 19, 2021	15,630,930	-	15,630,930
97	994	1.75	April 19, 2021	4,369,070	-	4,369,070
99	994	1.75	October 19, 2021	40,000,000	-	40,000,000
102	994	2.25	December 1, 2022	80,000,000	80,000,000	80,000,000
103	994	2.65	April 23, 2023	40,000,000	40,000,000	40,000,000
104	994	2.90	November 20, 2023	35,630,930	35,630,930	35,630,930
105	1073	2.25	June 3, 2024	60,000,000	60,000,000	60,000,000
106	1073	2.25	October 13, 2024	80,000,000	80,000,000	80,000,000
110	1073	1.28	April 8, 2025	50,000,000	50,000,000	50,000,000
112	1073	1.28	October 6, 2025	70,000,000	70,000,000	70,000,000
116	1073	4.20	April 4, 2026	30,000,000	30,000,000	30,000,000
118	1073	3.40	April 11, 2027	70,000,000	70,000,000	70,000,000
121	1073	2.90	October 4, 2027	20,000,000	20,000,000	20,000,000
126	1073	3.85	September 26, 2028	70,000,000	70,000,000	70,000,000
127	1073	3.30	April 7, 2029	60,000,000	60,000,000	60,000,000
130	1073	3.00	October 14, 2029	50,000,000	50,000,000	50,000,000
131	1073	2.20	April 8, 2030	60,000,000	60,000,000	60,000,000
137	1073	2.60	April 19, 2031	80,000,000	80,000,000	80,000,000
137	1224	2.60	April 19, 2031	20,000,000	20,000,000	20,000,000
141	1224	2.80	April 7, 2032	50,000,000	50,000,000	50,000,000
147	1224	2.66	April 9, 2034	22,000,000	22,000,000	22,000,000
150	1224	1.99	April 9, 2035	40,000,000	40,000,000	40,000,000
151	1224	1.28	June 1, 2035	30,000,000	30,000,000	30,000,000
153	1224	2.41	April 15, 2036	100,000,000	100,000,000	-
154	1224	2.41	May 28, 2036	130,000,000	130,000,000	-
Debt				$ 1,322,630,930	$ 1,262,630,930	$ 1,092,630,930
Less sinking funds					(551,467,640)	(534,893,686)
Total debt (net of sinking funds)					**$ 711,163,290**	**$ 557,737,244**

5. Tangible Capital Assets

Year ended December 31, 2021

	Cost						Net book value
	Balance at December 31, 2020	Additions	Balance at December 31, 2021	Balance at December 31, 2021	Amortization Expense	Balance at December 31, 2021	December 31, 2021
Land	$ 44,704,207	$ 8,959,945	$ 53,664,152	$ -	$ -	$ -	$ 53,664,152
Infrastructure	2,118,001,989	127,793,225	2,245,795,214	402,689,372	34,930,244	437,619,616	1,808,175,598
Buildings	216,476,101	-	216,476,101	19,224,621	5,463,049	24,687,670	191,788,431
Machinery, equipment furniture & fixtures	13,197,425	-	13,197,425	6,394,667	1,029,558	7,424,225	5,773,200
Assets under construction	717,260,009	79,200,654	796,460,663	-	-	-	796,460,663
	$ 3,109,639,731	**$ 215,953,824**	**$ 3,325,593,555**	**$ 428,308,660**	**$ 41,422,851**	**$ 469,731,511**	**$ 2,855,862,044**

Write-offs and disposals in 2021 were $nil (2020 - $nil).

Year ended December 31, 2020

	Cost						Net book value
	Balance at December 31, 2019	Additions	Balance at December 31, 2020	Balance at December 31, 2019	Amortization Expense	Balance at December 31, 2020	December 31, 2020
Land	$ 44,704,207	$ -	$ 44,704,207	$ -	$ -	$ -	$ 44,704,207
Infrastructure	2,116,289,696	1,712,293	2,118,001,989	369,121,481	33,567,891	402,689,372	1,715,312,617
Buildings	213,924,180	2,551,921	216,476,101	13,788,155	5,436,466	19,224,621	197,251,480
Machinery, equipment furniture & fixtures	12,729,772	467,653	13,197,425	5,378,731	1,015,936	6,394,667	6,802,758
Assets under construction	474,754,970	242,505,039	717,260,009	-	-	-	717,260,009
	$ 2,862,402,825	**$ 247,236,906**	**$ 3,109,639,731**	**$ 388,288,367**	**$ 40,020,293**	**$ 428,308,660**	**$ 2,681,331,071**

6. Accumulated Surplus

Accumulated surplus consists of individual fund surplus and reserves as follows:

	2021	2020
Reserves	$ 43,696,639	$ 34,595,530
Capital fund balance	126,792,687	(26,770,006)
Investment in tangible capital assets	2,144,698,754	2,123,593,827
Accumulated surplus, end of year	$ 2,315,188,080	$ 2,131,419,351

Capital fund balance represents the future expected level of funding required or accumulated.

6. Accumulated Surplus (continued)

Continuity of reserves is as follows:

	December 31, 2020	Interest	Annual Operating Surplus	Contributions from / (to) operations	December 31, 2021
Designated reserves					
Sustainability innovation fund	$ 13,901,697	$ 165,824	$ -	$ 242,046	$ 14,309,567
Laboratory equipment	750,275	8,946	-	25,512	784,733
	14,651,972	174,770	-	267,558	15,094,300
Non-designated reserves					
Operating reserve	19,943,558	234,255	8,424,526	-	28,602,339
Total reserves	$ 34,595,530	$ 409,025	$ 8,424,526	$ 267,558	$ 43,696,639

Investment in tangible capital assets is calculated as follows:

	2021	2020
Tangible capital assets	$ 2,855,862,044	$ 2,681,331,071
Amounts financed by:		
Long-term debt	(711,163,290)	(557,737,244)
	$ 2,144,698,754	$ 2,123,593,827

The change in the investment in tangible capital assets is as follows:

	2021	2020
Change in the investment in tangible capital assets		
Acquisition of tangible capital assets	$ 215,953,824	$ 247,236,906
Amortization of tangible capital assets	(41,422,851)	(40,020,293)
	174,530,973	207,216,613
Less funding of tangible capital assets		
Sinking fund and debt retirement	(55,877,869)	(51,574,488)
Sinking fund income	(20,696,085)	(19,187,680)
Debenture debt issued	230,000,000	70,000,000
	153,426,046	(762,168)
Change in investment in tangible capital assets	21,104,927	207,978,781
Investment in tangible capital assets, beginning of year	2,123,593,827	1,915,615,046
Investment in tangible capital assets, end of year	$ 2,144,698,754	$ 2,123,593,827

7. Contractual Obligations and Rights

a) Contractual Obligations:

i) As at December 31, 2021, the District had the following commitments outstanding related to capital projects in progress:

	2021	2020
Authorized for outstanding projects	$ 2,541,411,828	$ 2,298,311,822
Expended at December 31	(1,112,159,228)	(903,211,367)
Commitment remaining	$ 1,429,252,600	$ 1,395,100,455

ii) The District is committed under a number of lease and right-of-way agreements to make minimum annual payments. These agreements have varying terms, including one agreement with annual payments of $107,000 to perpetuity, with adjustments annually for CPI.

	Amount
2022	$ 228,572
2023	106,948
2024	106,948
2025	106,948
2026	106,948
2027 - 2031	534,740
Total	$ 1,191,104

b) Contractual Rights:

The District is party to several property lease agreements that are anticipated to provide it with future revenues. These agreements are with third parties with varying terms to 2027. Amounts anticipated to be received over the future years are as follows:

	Amount
2022	$ 6,570,773
2023	6,609,902
2024	6,647,784
2025	5,580,353
2026	3,728,260
Thereafter	13,891,808
Total	$ 43,028,880

8. Contingencies

Lawsuits:

As at December 31, 2021, there were various lawsuits pending against the District arising in the ordinary course of business. The District has retained legal counsel to defend against these lawsuits. Where the outcomes or amounts cannot be reasonably determined, no liability has been recorded. None of these lawsuits are anticipated to result in a material loss to the District. Management is of the opinion that losses, if any, in connection with these lawsuits can be sufficiently funded by reserve funds or covered by insurance. Any expected losses will be accrued and recorded as expenses at the time they are considered likely and amounts are reasonably determinable.

Self Insurance Reserve:

A self insurance reserve has been established within the MVRD to cover losses resulting from uninsured liability exposures of the District, other MVRD Districts and Housing Corporation.

Each year a review is undertaken to determine if it would be beneficial to purchase additional liability insurance. The District, other Metro Vancouver Districts and the MVHC transfer amounts to the reserve depending on the reserve's adequacy to cover retained liability risk.

An estimate is made for all costs of investigating and settlement of claims annually and an adjustment is made to the fund to maintain an adequate balance to cover potential losses in excess of recorded liabilities. These estimates are changed as additional information becomes known during the course of claims settlement. Any likely losses would be expensed at the time the losses are known and the amounts are reasonably determinable.

8. Contingencies (continued)

Debt Reserve Fund: The MFA is required to establish a Debt Reserve Fund for each debenture which is comprised of cash deposits and a non-interest bearing demand note (refer to note 2). If, at any time, the District has insufficient funds to meet payments due on its obligations to MFA, the payments will be made from the debt reserve fund. The demand notes are callable only if there are additional requirements to be met to maintain the level of the debt reserve fund, and therefore have not been recorded in the statement of financial position.

9. Budget Information

The annual budget presented in these financial statements is based upon the 2021 operating and capital budgets approved by the District's Board in October 2020. The budget is based on operational and capital expenditure requirements and their associated funding. Amortization is a non-cash item that is not funded for budget purposes. Also, contributions to or from reserves and debt principal repayments are removed from the approved budget for financial statement presentation. The schedule below reconciles the approved operating budget to the budget figures reported in these financial statements. Capital expenditures of $431,250,000 were included in the capital budget approved by the Board.

	2021 Budget	2020 Budget
Budgeted annual surplus per Exhibit B - Statement of Operations	$ 163,254,271	$ 152,172,967
Items not included in the operating budget		
Amortization of tangible capital assets	40,552,047	40,277,716
Sinking and debt retirement fund income	(17,594,045)	(15,543,695)
Reserve interest	(713,060)	(675,592)
Items included in the budget but not in financial statements		
Debt principal payments	(55,877,869)	(51,574,488)
Transfers to capital	(130,975,759)	(127,075,627)
Transfers from reserve funds	2,102,934	3,187,719
Transfers to reserve funds	(748,519)	(769,000)
Annual surplus per approved budget	$ -	$ -

10. Segmented Information and Expenses by Object

The District's primary responsibilities are the supply of potable water to the municipalities of he MVRD and the property management of the office buildings owned by the District. For management reporting purposes, the District's operations and activities are organized and reported by these two primary areas of service. The information reported in the segmented information does not include $7,168,137 (2020 - $8,937,048) of salaries and benefits directly attributable to the construction of tangible capital assets which have been included in the cost of tangible capital assets in the Statement of Financial Position.

The services disclosed in the Segmented Information are as follows:

Water Operations Water Operations is responsible for the supply of potable water to the District's member municipalities. The District owns a series of dams, reservoirs, water treatment plants and a distribution network connected to the member municipalities' systems.

Building Operations Building Operations is responsible for operating and maintaining office buildings owned by the District. These facilities are leased to MVRD and its related entities for its head office operations as well as to external parties.

	2021 Budget	Water Operations	Building Operations	Inter-Program Adjustments	2021 Total	2020 Total
Revenue						
Metered sale of water	$ 316,341,192	$ 319,989,323	$ -	$ -	$ 319,989,323	$ 297,780,794
Sinking fund and debt retirement income	17,594,045	18,946,364	1,788,057	-	20,734,421	19,233,123
Interest income	713,060	630,564	-	-	630,564	1,091,295
Building income from Metro Vancouver Districts	9,650,613	-	14,679,881	(5,063,746)	9,616,135	12,227,786
Building income from external parties	6,747,794	-	6,634,971	-	6,634,971	6,133,979
Other income	1,674,556	10,389,769	270,797	-	10,660,566	8,670,769
	352,721,260	349,956,020	23,373,706	(5,063,746)	368,265,980	345,137,746
Expenses						
Salaries and benefits	45,981,808	42,181,362	529,297	-	42,710,659	41,863,753
Consulting, contracted and professional services	13,959,491	12,715,964	1,626,214	-	14,342,178	11,164,512
Asset repairs and maintenance	6,517,261	3,814,835	2,541,148	-	6,355,983	6,192,486
Materials and supplies	14,440,889	11,508,448	92,666		11,601,114	10,008,497
Utilities, permits and taxes	9,574,379	7,601,294	1,206,327	-	8,807,621	8,149,065
Corporate costs	23,878,450	25,755,210	-	(5,063,746)	20,691,464	18,965,912
Other	4,732,811	7,325,059	1,347,915	-	8,672,974	8,170,219
Amortization of tangible capital assets	40,552,047	36,508,211	4,914,640	-	41,422,851	40,020,293
Interest on long-term debt	29,829,853	25,186,192	4,706,215	-	29,892,407	29,250,086
	189,466,989	172,596,575	16,964,422	(5,063,746)	184,497,251	173,784,823
Annual surplus	**$ 163,254,271**	**$ 177,359,445**	**$ 6,409,284**	**$ -**	**$ 183,768,729**	**$ 171,352,923**

11. COVID-19

The COVID-19 global pandemic, declared in 2020, continued to impact the global economy in 2021. Throughout the pandemic, the District delivered key services to the Metro Vancouver region in line with its mandate. Management continues to monitor the impacts of the pandemic on taxpayers, suppliers and other third party business associates that could impact the timing and amounts realized on the Districts's assets and ability to provide services to the region. However, to date, the pandemic has not materially impacted revenue streams, expenses, cash flows or caused significant asset impairments.

To: MVRD/GVS&DD/GVWD/MVHC Board

From: Cheryl Nelms, General Manager, Project Delivery
Dean Rear, Chief Financial Officer

Date: April 19, 2022 Meeting Date: April 29, 2022

Subject: **Asset Management and Long Term Financial Planning**

RECOMMENDATION

That the MVRD/GVS&DD/GVWD/MVHC Board direct staff to provide context for decision making by completing long-range plans for major capital projects including an asset inventory, asset condition assessment, and a proposed timeline of maintenance, repair, replacement, and funding requirements for these major projects and report back to the Board with this plan.

EXECUTIVE SUMMARY

At the March 25, 2022 GVS&DD Board meeting, the GVS&DD Board referred a following motion to staff related to asset management and long range plans. Metro Vancouver has long-standing asset management practices, and is currently in a new cycle of asset management continuous improvement that will include the addition of a long term financial plan that will provide the Board with enhanced context for decision making. Asset management and long-range planning currently includes data collection, asset condition monitoring and reporting, strategic plans, management plans, and long-range plans. Staff are rolling out updated state of the asset reports, updating long-range management plans, and developing a long-term financial plan. The long-term financial plan will consider what financial resources are required to keep assets in a state of good repair, meet MVRD/GVS&DD/GVWD/MVHC policy objectives, meet regulatory requirements, meet increased demand for services as a result of population growth, and adapt to resiliency requirements.

PURPOSE

To provide the MVRD/GVS&DD/GVWD/MVHC Board an overview of the current asset management and financial planning practices at Metro Vancouver, and how they are being integrated into work to create a long-term financial plan that will support the board in decision making for major projects.

BACKGROUND

At the March 25, 2022 GVS&DD Board meeting, the GVS&DD Board referred the following motion to staff for review of the required elements of this undertaking:

> *Direct staff to provide context for the [Iona Wastewater Treatment Plant] project by completing a 20-year asset management plan for major water and liquid waste capital projects including an asset inventory, asset condition assessment, and a proposed timeline of maintenance, repair, replacement, and funding requirements for these major projects and report back to the Board with this plan.*

This report provides an overarching context of current practices on asset management and continuous improvement work underway that will help the Board to make informed decisions for major projects.

The original motion refers to both liquid waste and water. The proposed motion has been adapted so that it can be considered for the MVRD/GVS&DD/GVWD/MVHC Board and provide flexibility to the time range for long term planning.

ASSET MANAGEMENT AND FINANCIAL PLANNING

With significant infrastructure projects underway and on the horizon, Metro Vancouver has been making adjustments to practices and policies to better prepare for the upcoming work and prioritize projects in an environment of competing risks associated with funding and the ongoing provision of services.

As part of Metro Vancouver's regular and ongoing asset management and financial planning practices, Metro Vancouver produces:

- State of the asset reports,
- Facility asset management plans,
- Long-range management plans,
- Strategic plans, and
- Financial plans

Key drivers that inform Metro Vancouver's planning for asset management and financial planning include: keeping existing assets in a state of good repair, meeting regulatory requirements, accommodating population growth, improving resiliency, and meeting MVRD/GVS&DD/GVWD/MVHC policy objectives (see table 1).

Table 1: Drivers that inform service planning, asset management, and financial planning

State of the Asset Reports and Asset Management Plans

Metro Vancouver has active asset management and capital planning processes that have been in place for decades. In a culture of continuous improvement, we are working to improve these and create greater clarity, consistency, and transparency across the organization.

In 2018 and 2019, the MVRD/GVS&DD/GVWD/MVHC Board approved new asset management policies. Additionally, asset management plans exist throughout the organization to support specific assets.

Updated state of the asset reports for the service areas have been produced including housing (2018) and parks (2021), and are updated regularly. New state of the assets reports for liquid waste and water are complete and are planned to be delivered to the Committees and Board in May 2022. Existing water and liquid waste assets are generally in a state of good repair, and are not considered to be a significant driver of costs associated with the capital plan.

State of the assets reports give the organization an understanding of:

- The existing infrastructure (inventory)
- The state of that infrastructure (to determine when it is projected to require replacement)
- Valuation (estimate of cost to replace)
- Financial forecast of long-term investment needs to retain existing assets in a state of good repair

Growth, Resiliency, Policy Objectives, and Regulatory Requirements

The majority of Metro Vancouver's capital needs are driven by:

- Population growth in the region
- Resiliency needs (e.g. seismic upgrades)
- Regulatory requirements (e.g. increased level of treatment required for wastewater)
- Board policy objectives

Metro Vancouver identifies projects that address the above drivers through long-range plans, which exist for all service areas. These plans, in coordination with state of the asset reports and data, help inform annual budgets, anticipated expenditures, and funding projections. Work to update management plans has recently been completed or is underway (eg. Housing 10-Year Plan (2019), Regional Parks Plan (underway), Liquid Waste Management Plan (underway), Solid Waste Management Plan (underway), Drinking Water Management Plan (underway)). These plans identify significant capital projects.

Capital Planning and Long Term Financial Planning

Financial planning is informed by the Board Strategic Plan, the management plans, and the state of the asset reports. In 2017, Metro Vancouver established the development of five-year financial plans ("5-Year Outlook") in addition to its detailed annual plan. The 5-Year Outlook also highlights significant capital projects by year.

Currently, Metro Vancouver is developing a long term financial plan that considers the state of the assets and what they require on the operating side as well as the long-range plans and projects that need to be completed to address growth, regulatory requirements, and resiliency needs. An overview of the planning process for delivering the new long term financial plan was presented to the Finance Committee on February 10, 2022 (see Appendix 1).

2022 Reporting and Engagement

Key reports and engagement activities that will be coming forward to the Board in 2022 and 2023 related to asset management and the long term financial plan include:

- April – Board Budget Workshop
- May – State of the Assets: Liquid Waste – to Liquid Waste Cttee and Board (REAC - April 1)
- May – State of the Assets: Water – to Water Committee and Board (REAC - April 1)
- July – Corporate Asset Management Strategy to REAC/RFAC/Board
- April/July/Oct – Updates on Major Infrastructure Projects and Programs – to REAC and Board Committees
- October – Board Budget Workshop
- A long-term financial plan (Early 2023)

ALTERNATIVES

1. That the MVRD/GVS&DD/GVWD/MVHC Board direct staff to provide context for decision making by completing long-range plans for major capital projects including an asset inventory, asset condition assessment, and a proposed timeline of maintenance, repair, replacement, and funding requirements for these major projects and report back to the Board with this plan.
2. That the MVRD/GVS&DD/GVWD/MVHC receive for information the report dated April 18, 2022, titled "Asset Management and Long Term Financial Planning" and provide staff with alternate direction.

FINANCIAL IMPLICATIONS

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

CONCLUSION

At the March 25, 2022 GVS&DD Board meeting, the GVS&DD Board referred the following motion to staff for review. The motion requested that staff complete long-range plans for major capital projects including an asset inventory, asset condition assessment, and a proposed timeline of maintenance, repair, replacement, and funding requirements for these major projects and report back to the Board with this plan.

With significant infrastructure projects underway and on the horizon, Metro Vancouver has been making adjustments to practices and policies to better prepare for the upcoming work and prioritize projects in an environment of competing risks associated with funding and the ongoing provision of services. This work includes continued work on long-range plans and asset management reports, and will include a new long term financial plan that will be rolled out in 2023.

Appendix

a. Metro Vancouver Long Term Financial Planning – Report – February 10, 2022
b. Metro Vancouver Long Term Financial Planning – Presentation – February 10, 2022

References: MVRD

1. Board Policy: Asset Management for Regional Parks
2. Board Policy: Asset Management for Corporate Facilities and Equipment
3. Regional Parks State of Building Assets Report (2020 and 2021) and State of Built and Natural Assets Report (2021)
4. Regional Parks Plan (2016)
5. DRAFT - Regional Parks Plan Update (in progress)

References: GVS&DD

1. Board Policy: Asset Management for Liquid Waste Services
2. Board Policy: Asset Management for Solid Waste Services
3. Integrated Liquid Waste and Resource Management Plan (2010)
4. Integrated Solid Waste and Resource Management Plan (2010)

References: GVWD

6. Board Policy: Asset Management for Water Services
7. Drinking Water Management Plan (2011)
8. Water Supply Outlook 2120 (2019)

References: MVHC

9. Board Policy: Asset Management for Housing Corporation
10. 2018 State of Assets (updated annually)
11. Metro Vancouver Housing 10-Year Plan (2019)
12. Metro Vancouver Housing Redevelopment Plan (2020)

COMMITTEE INFORMATION ITEMS AND DELEGATION SUMMARIES

Greater Vancouver Water District
Board Meeting Date – Friday, April 29, 2022

This information item, listing recent information received by committee, is provided for the GVWD Board's information. Please access a complete PDF package here.

Water Committee – April 6, 2022

Delegation Summaries:
No delegations presented

Information Items:
5.3 GVWD Water Supply System 2021 Annual Update
5.6 GVWD Capital Program Expenditure Update to December 31, 2021
5.7 2021 Contribution Agreement Annual Reports - Seymour Salmonid Society and Coquitlam River Watershed Roundtable
5.8 Drinking Water Conservation Program Update
5.10 Water Supply Update for Summer 2022
5.11 GVWD Flow Meter Upgrade Program – Progress Report
5.12 Project Delivery Capital Portfolio Update

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