



Seymour Capilano Filtration Plant

Greater Vancouver Water District Water Supply System 2022 Annual Update

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EXECUTIVE SUMMARY

The *Greater Vancouver Water District Water Supply System 2022 Annual Update* report summarizes key initiatives undertaken in 2022 by the Greater Vancouver Water District, operating under the name Metro Vancouver. In 2022, Metro Vancouver undertook water system risk mitigation, water conservation, and maintenance activities to continue to meet service objectives. Capital projects were undertaken to maintain and upgrade the existing infrastructure, increase resiliency, and accommodate regional growth. Further, Metro Vancouver responded to an emergency affecting the drinking water system.

This report was prepared following the Ministry of Health's (the Ministry) draft *Guidance for Water User Communication*.

Report Background

The purpose of the report is to remain aligned with the communication requirements stipulated in the provincial *Drinking Water Protection Act* and *Drinking Water Protection Regulation*. As a water supplier regulated under the *Drinking Water Protection Act* and *Drinking Water Protection Regulation*, Metro Vancouver must communicate with water users on topics defined in the legislation.

The Ministry has developed the draft *Guidance for Water User Communications* to create a standardized approach to stay aligned with the legislated communication requirements. By completing the *Greater Vancouver Water District Water Supply System 2022 Annual Update* report, Metro Vancouver aligns with the Ministry's direction. This report provides transparent and proactive communication with water users. It also promotes public awareness and involvement in the drinking water program, one of the six elements of Health Canada's *Multi-Barrier Approach to Safe Drinking Water*.

Report Summary

Metro Vancouver sources drinking water from three protected water supply areas of Coquitlam, Seymour and Capilano. The water is then treated at either Seymour Capilano Filtration Plant or Coquitlam Water Treatment Plant and distributed, wholesale, to member jurisdictions within the region via over 520 kilometres (km) of large diameter transmission mains, 19 pump stations, 27 storage reservoirs and eight re-chlorination stations. Member jurisdictions then distribute the water to consumers via their distribution system. This water is tested throughout all of the processes to guarantee that high-quality drinking water is being distributed to member jurisdictions. To ensure the provision of clean, safe drinking water, Metro Vancouver maintains, upgrades, and builds infrastructure to meet current and future needs.

Key initiatives undertaken by Metro Vancouver in 2022 included the following:

- Water Quality Sampling, involving:
 - Conducting over 160,000 tests on the water through the drinking water quality program; the results of which can be found in the *2022 Annual Water Quality* report.
- Water System Risk Mitigation, involving:
 - Auditing the *Quality Management System for Drinking Water Operational Plan* and conducting long-term water supply infrastructure planning to mitigate risks to the drinking water system.
- Water Conservation, involving:
 - Tracking, monitoring, and analysis of drinking water demand. The highest peak day consumption in the summer of 2022 was 1.59 billion litres/day, which was recorded on Saturday, July 30, 2022;
 - Promoting water conservation through the We Love Water Campaign and the relaunch of the Water Wagon Program post-COVID-19; and,
 - Rolling out communication and education related to the *Drinking Water Conservation Plan*, which sets out watering restrictions, and piloting the Summer Support Program.
- Financial Planning, involving:
 - Total water sales of \$330 million with seasonal bulk water rates intended to incentivize members to control demand in the high season; and,
 - Progressing the development of a new development cost charge for regional water infrastructure. The concept of funding regional water infrastructure through development cost charges was a Greater Vancouver Water District's Administration Board priority (2019-2022) and is a critical component of our long-term financial plan.
- Water System Management involving:
 - Producing the *State of the Assets Report – Water Services* as part of the Asset Management Program;
 - Conducting annual maintenance projects, including the cleaning of six reservoirs, completing 95 condition assessments, performing 1,673 preventative maintenance work orders, and conducting thousands of asset inspection, rehabilitation and replacement

- activities to ensure our existing infrastructure continues to perform as required to meet service objectives;
- Completing the detailed design for the Stanley Park Water Supply Tunnel to replace the aged existing Capilano Main No. 4;
 - Installing the steel water mains inside the Second Narrows Water Supply Tunnel under the Burrard Inlet, between North Vancouver and Burnaby, to increase the reliability of supply in the event of a major earthquake as well as to provide additional long-term supply capacity;
 - Completing Phase 1 of the Jericho Reservoir, which included two new cells to address the growth of the Township of Langley and the City of Surrey; and,
 - Commencing the construction of the Fleetwood Reservoir and Newton Pump Station No. 2 and the detailed design of the Cape Horn Pump Station No. 3; all three projects to address regional growth.
- Emergency Response, involving:
 - Conducting successful activation of Metro Vancouver's Water Services Department Operations Centre to locate, contain, and repair a leak on the Tilbury Water Main and to ensure effective communication with all stakeholders.

ACRONYMS

BC	British Columbia
BL	Billion Litres
CWTP	Coquitlam Water Treatment Plant
DBPs	Disinfection By-Products
DWCP	Drinking Water Conservation Plan
GVWD	Greater Vancouver Water District
ha	Hectares
km	Kilometres
LSCR	Lower Seymour Conservation Reserve
ML	Million Litres
MLD	Million Litres per Day
QMSDW	Quality Management System for Drinking Water
SCFP	Seymour Capilano Filtration Plant
SSP	Summer Support Program
UV	Ultraviolet
WSEMP	Water Services Emergency Management Plan
WSRP	Water Shortage Response Plan

1.0 INTRODUCTION

1.1. Purpose

As a Water Supplier regulated under BC's *Drinking Water Protection Act* and *Drinking Water Protection Regulation*, Metro Vancouver is required to communicate with water users on various topics defined in the legislation. The *Greater Vancouver Water District Water Supply System 2022 Annual Update* is recommended by the Ministry of Health to meet the *Drinking Protection Act* and *Regulation's* public communication requirements. This report was prepared following guidance from the Ministry of Health's draft *Guidance for Water User Communication*.

The purpose of the *Greater Vancouver Water District Water Supply System 2022 Annual Update* is to proactively communicate with member jurisdictions and the public by providing an annual update on the water supply system. Through the *Greater Vancouver Water District Water Supply System 2022 Annual Update*, Metro Vancouver seeks to promote public awareness and involvement in the drinking water program, which has been identified as one of the components of the *Multi-Barrier Approach to Safe Drinking Water* by Health Canada.

1.2. Greater Vancouver Water District

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

The GVWD and its member jurisdictions work together to provide clean, safe drinking water to the customers within the region. The GVWD membership consists of 18 municipalities, one Electoral Area, and one Treaty First Nation. The GVWD, working together with its members, plans for and delivers regional-scale drinking water services to approximately 2.7 million people. Table 1 shows the list of member jurisdictions that are supplied water from the GVWD.

Table 1: Greater Vancouver Water District Member Jurisdictions

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

Metro Vancouver is responsible for the following:

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

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

2.0 DRINKING WATER SYSTEM OVERVIEW

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

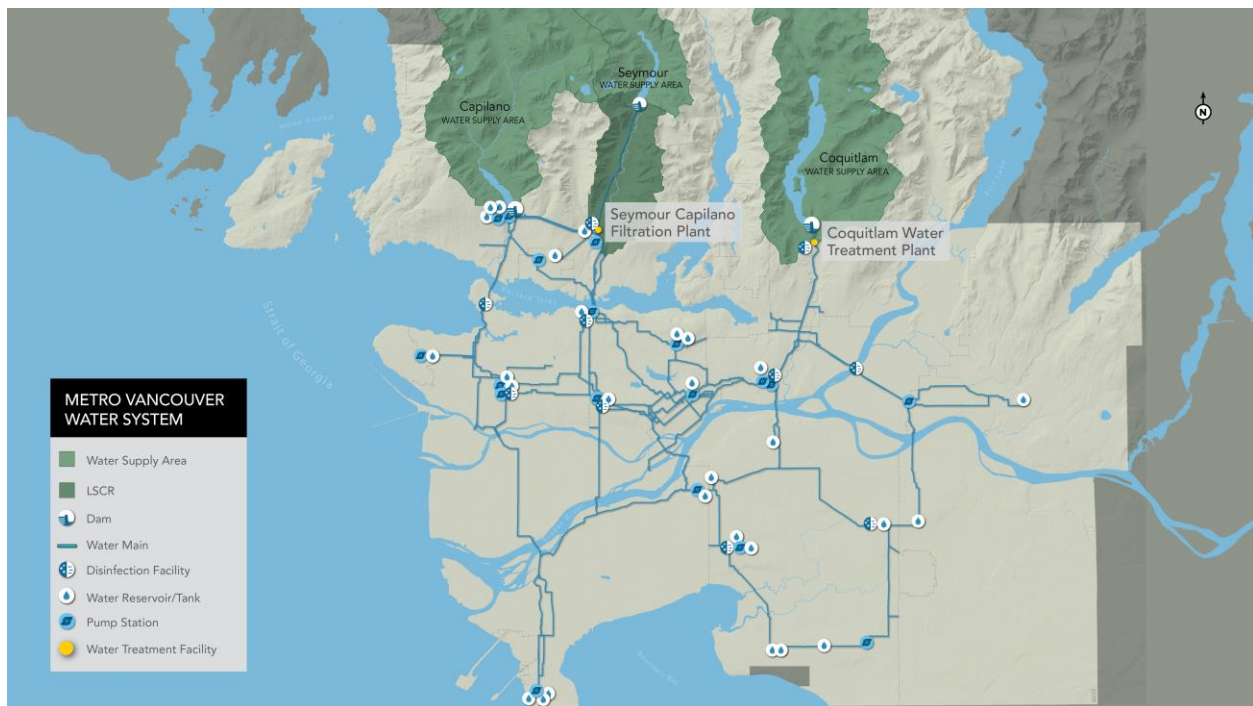


Figure 1: Metro Vancouver Drinking Water System Overview

2.1. Source Water

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

Metro Vancouver's most eastern water supply is Coquitlam Reservoir. Coquitlam Reservoir is owned by the Province and managed by BC Hydro for power generation. Metro Vancouver is licenced by the Province to use 451 billion litres (BL) of water per year from Coquitlam Reservoir. Every year, additional water is purchased from BC Hydro. In 2022, Metro Vancouver purchased an additional nomination of 79 BL.

The Seymour Water Supply Area is 12,375 ha and is located north of the District of North Vancouver. The Seymour Falls Dam and the reservoir created behind it are the highest of the three sources of supply for the water system. The Seymour Falls Dam was built in 1961 to replace the original dam that was built in 1927. Also, within the Seymour Water Supply Area are two alpine lakes of Burwell Lake and Loch Lomond. Burwell Lake and Loch Lomond have storage capacities of 12 BL and 7 BL, respectively.

The Capilano Water Supply Area is 19,535 ha in area and the most western of Metro Vancouver's water supply areas. The Cleveland Dam is located on the Capilano River to store drinking water for the region; it is a concrete dam that was built in 1954. The Capilano Water Supply Area has one alpine lake, Palisade Lake, with a storage capacity of 10 BL. The dams on all three alpine lakes are only opened during high-demand periods in the summer.

2.2. Water Treatment Facilities

Metro Vancouver's source water is required by the Ministry to be treated to meet the *Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia*. In addition, Metro Vancouver's treated water meets the requirements for physical and chemical parameters listed in the federal *Guidelines for Canadian Drinking Water Quality*. Metro Vancouver's water is treated at either the Seymour Capilano Filtration Plant (SCFP) or the Coquitlam Water Treatment Plant (CWTP).

2.2.1. Seymour Capilano Filtration Plant

The Capilano and Seymour Reservoirs' water is treated at the SCFP. Twin tunnels transport both raw and treated water between Capilano Reservoir and SCFP, over 7 km, for treatment at SCFP. Since the SCFP is at a higher elevation than the Capilano Reservoir, excess pressure is available from the returning treated water, for which an energy recovery system has been constructed. The recovered energy partially offsets the power requirements for the Capilano Raw Water Pump Station.

The primary water treatment processes at the SCFP are filtration and ultraviolet (UV) disinfection. Filtration treats water by removing particulates, organic matter, and microorganisms. An added benefit of filtration is that less chlorine is required to maintain disinfection in the transmission and distribution systems. Treatment after filtration includes UV disinfection, which works to inactivate microorganisms. Sodium hypochlorite (chlorination) is then added to maintain disinfection within the transmission and distribution mains. The pH and alkalinity are adjusted using a combination of

lime (calcium hydroxide) and carbon dioxide before the water enters the transmission system. Figure 2 describes the individual treatment processes. In 2022, SCFP treated an average of 721 million litres per day (MLD) and a maximum of 906 MLD; the plant is designed to treat up to 1,800 MLD.

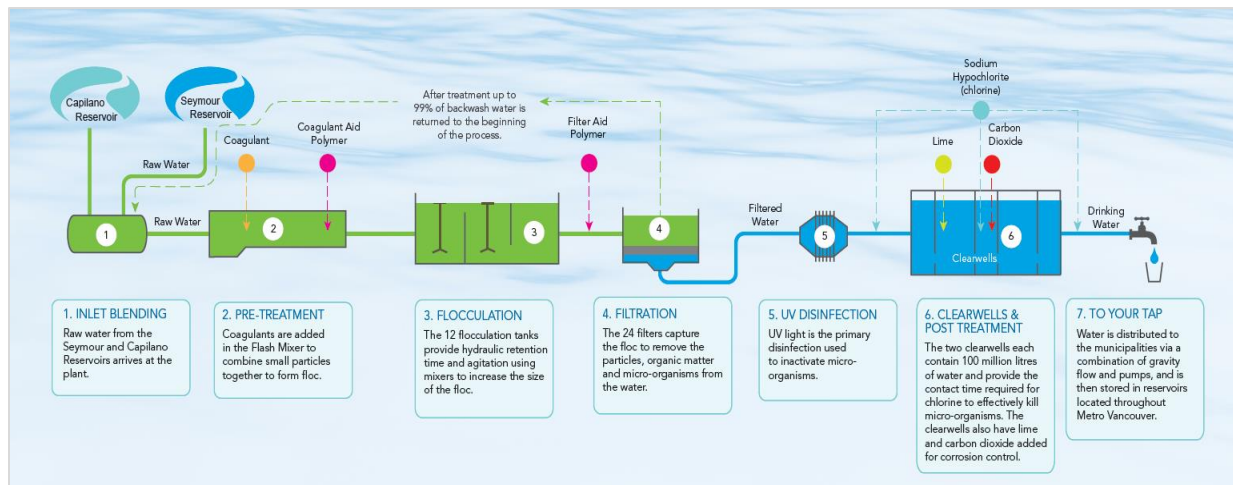


Figure 2: Seymour Capilano Filtration Plant Process Overview

2.2.2. Coquitlam Water Treatment Plant

The CWTP is located north of the City of Coquitlam and treats water from the Coquitlam Reservoir. In 2022, CWTP treated an average of 369 MLD and a maximum of 825 MLD; the plant is designed to treat a maximum of 1,200 MLD.

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

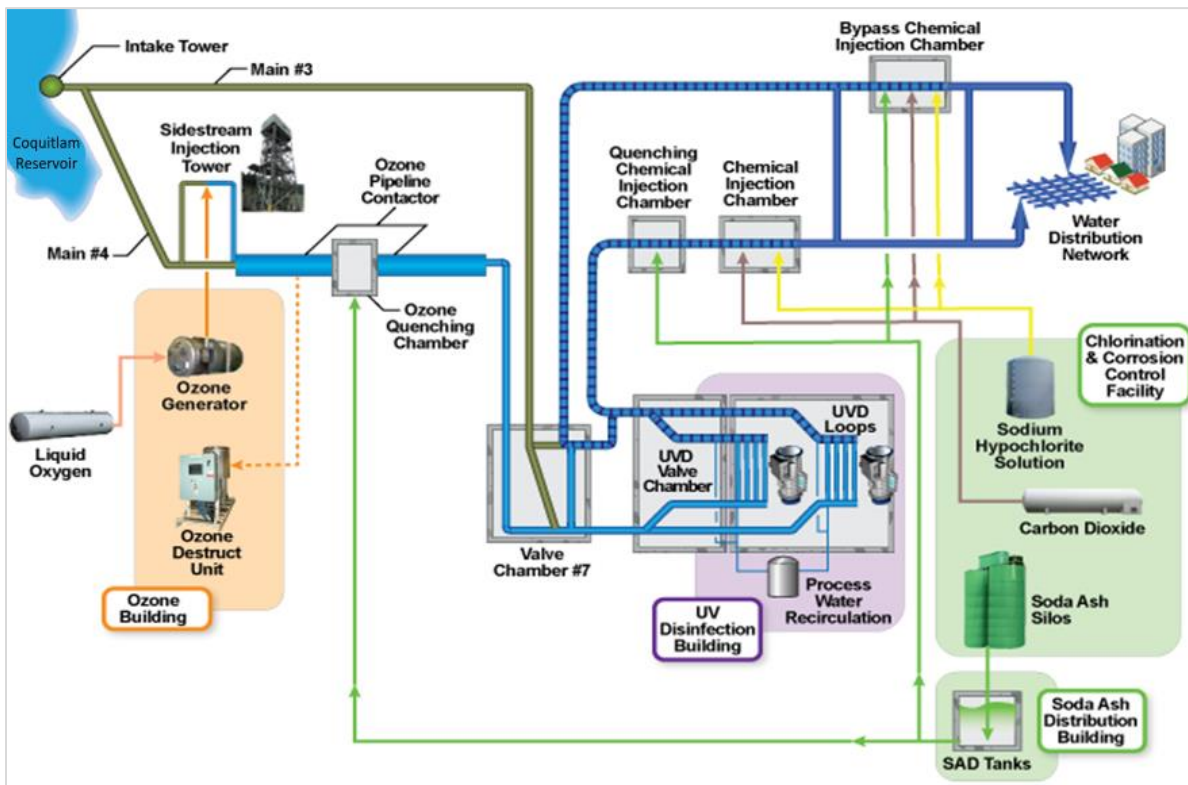


Figure 3: Coquitlam Water Treatment Plant Process Overview

2.3. Transmission System

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

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

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

3.0 WATER QUALITY SAMPLING PROGRAM

Metro Vancouver conducts daily tests on the water. In 2022, Metro Vancouver conducted over 160,000 tests on the water; the results of which are public and can be found in [Annual Water Quality reports](#) on the Metro Vancouver website. The 2022 Annual Water Quality report will be available in April 2023. The Annual Water Quality report provides a summary of the water quality analysis results for source, treated, and distributed water.

4.0 WATER SYSTEM RISK MITIGATION

Metro Vancouver follows the *Quality Management System for Drinking Water (QMSDW) Operational Plan* which includes risk assessment outcomes and implementation of critical control measures. Risk assessment is a fundamental part of the QMSDW Operational Plan process. It forms the foundation for building a set of specific prioritized actions to safeguard drinking water and to aid in strategic decision making, planning, and resource allocation. The analysis includes identifying, assessing, controlling, and mitigating the risks of the hazardous events that may occur in Metro Vancouver's drinking water system. A formal audit of the QMSDW Operational Plan was completed in late 2022 and the report is under review.

4.1. Water Supply Area Risks

Metro Vancouver highly restricts access to the water supply areas to minimize human-caused pollution and wildfire. A changing climate continues to pose the most significant risk to water quality and quantity in the water supply areas. Climate models predict more frequent and intense precipitation events through the winter and spring and hotter drier summers and falls. This shift in weather patterns may increase landslide and wildfire activity, which could result in turbidity events capable of overwhelming current treatment systems. Climate models also predict a general reduction in snowpack accumulation which will reduce late-season water storage levels and increase wildfire risk at higher elevations. Increased turbidity and changes in precipitation patterns that may impact source supply volumes have been considered in long-term water supply infrastructure planning through filtration pretreatment, changes in intake location, and treatment designs. Additional mitigation measures are underway, including upgrading reservoir debris booms, enhanced snowpack monitoring, and wildfire risk planning.

4.2. Treatment System Risks

The existing raw water quality at Coquitlam Reservoir and treated water quality at CWTP meet the current provincial objectives for filtration exemption, and on this basis, the current CWTP was designed to include ozone and UV disinfection only. Although the water quality in Coquitlam Reservoir is very good, turbidity events do happen, and more frequent significant events are expected to occur in the future due to climate change. Therefore, filtration of water from the Coquitlam Reservoir may be required in the future to comply with regulatory requirements as well as to increase the resiliency of the CWTP to the anticipated impacts of climate change that would affect water quality.

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

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

4.3. Transmission System Risks

In 2021 Metro Vancouver completed the “*Regional Water Supply System Lifeline Study: Seismic Vulnerability Assessment*”, which updated the previous Lifeline Study that was done in 1993. The 2021 study investigated Metro Vancouver’s water mains’ seismic vulnerabilities and all other facilities, excluding dams. This report evaluated the water mains and facilities for earthquakes with a 1:2,475-year and 1:10,000-year return period, respectively, per *Metro Vancouver’s Seismic Design Criteria* and draft 2020 *National Building Code of Canada* requirements. This study recommended additional site-specific assessments and structural analysis for facilities to improve the predictions of seismic damage. The study also provided recommendations on other seismic resiliency measures. Metro Vancouver is working on implementing specific recommendations with the consideration of budgetary constraints.

4.4. Evolving Guidelines

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

5.0 WATER USE AND CONSERVATION

5.1. Water Availability and Use Trends

The Metro Vancouver region experienced an above-average snowpack during the winter of 2022, combined with a cool and wet spring. The source reservoirs were proactively managed through the spring and early summer to capture the incoming streamflow to ensure Capilano and Seymour Reservoirs reached their respective full pool elevations on July 8, 2022, and June 19, 2022, respectively.

As shown in Figure 4, the peak day consumption in the summer of 2022 was 1.59 BLD, recorded on Saturday, July 30. In 2021, the peak day occurred one month earlier than usual due to record-breaking air temperatures during the notable June heat dome. The peak day demand in 2022 was 12 per cent lower than in 2021. The daily demands through 2022 were consistently lower than in 2021 before mid-August. The late-season increase in demands in 2022 can be attributed to the warm and dry end to the summer and early fall that the region experienced.

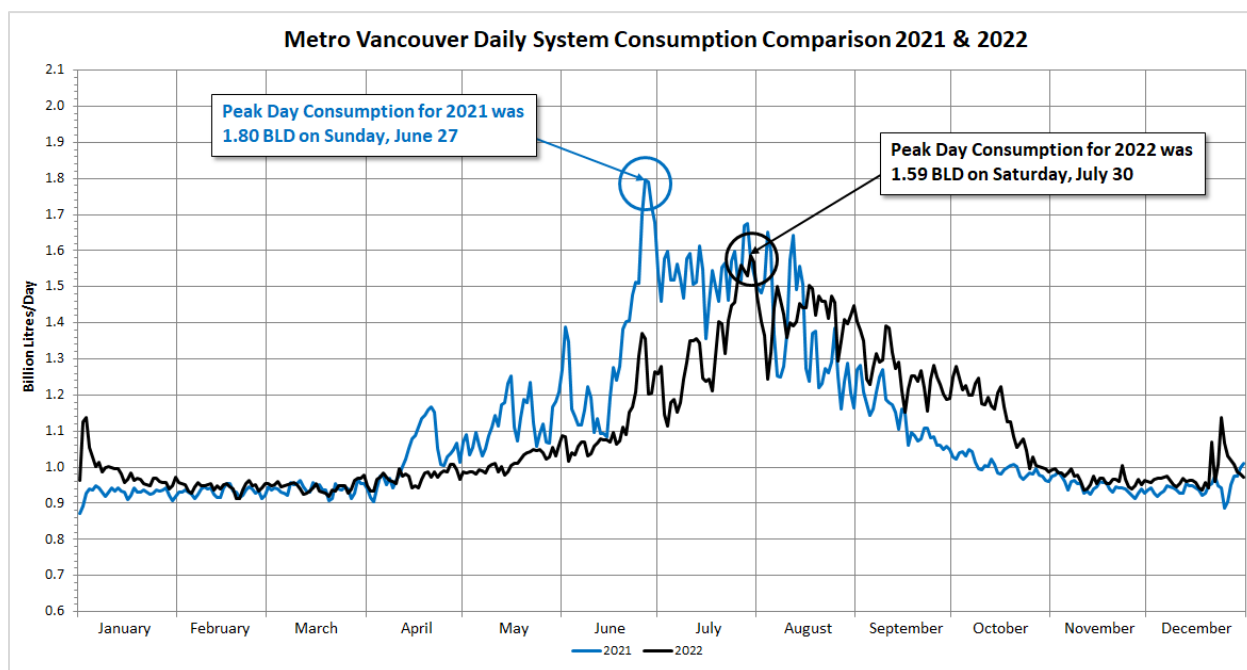


Figure 4: 2021 and 2022 Daily Water Consumption

Between 1998 and 2022, Metro Vancouver’s service population has grown by 870,000 people at an annual growth rate of approximately 1.63 per cent. Despite the population growth, average daily water demand has remained relatively constant over the past 25 years, as shown in Figure 5. Thus, per capita water use has been declining over the past 25 years, as shown in Figure 6, which is often

attributed to more efficient plumbing fixtures, densification, increasing public awareness about water conservation, and increasingly stringent lawn watering restrictions.

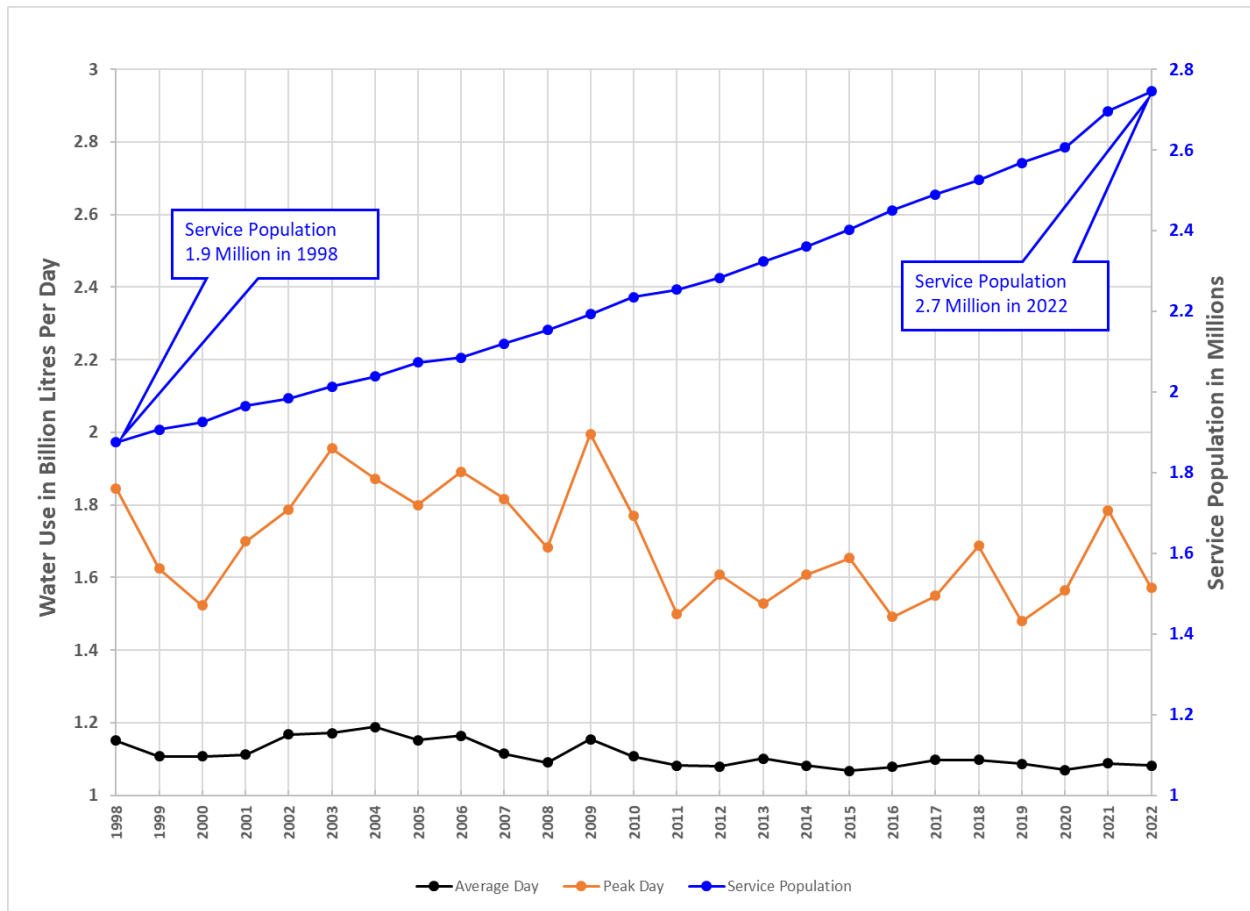


Figure 5: Regional Population and Water Use from 1998 to 2022

To ensure collective needs for drinking water are met affordably and sustainably now and in the future, Metro Vancouver together with member jurisdictions developed the *Drinking Water Conservation Plan (DWCP)*, formerly known as the *Water Shortage Response Plan (WSRP)*. The DWCP is a regional policy developed to manage the use of drinking water during periods of high demand, mostly during late spring to early fall, and during periods of water shortages and emergencies. The DWCP has evolved since it was first implemented in 1993. The following shows a timeline of its development:

- 1993: the first plan was approved by the Board following severe drought conditions and a 10-week sprinkling ban in 1992.
- 2004: update following severe drought conditions in 2003. This update involved instituting the automatic enactment of Stage 1 restrictions every year on June 1 and adding Stage 4 to address water shortages during emergencies.

- 2011: update eliminating evening lawn watering with the goal of reducing stress on the transmission system by reducing peak hour and peak day demands.
- 2016: minor updates to address immediate concerns raised during the 2015 summer drought. These changes included revising the Stage 1 activation period, and amending Stages 2 and 3 concerning commercial cleaning and exemption permits, respectively.
- 2017: update to the plan changing the activation date of Stage 1 to May 1 and reducing lawn watering from three to two mornings per week. There were additional updates made to sports field watering, and business water use in Stages 2 and 3.
- 2021: update to the plan reducing lawn watering from two to one morning per week in Stage 1 and a lawn watering ban in Stage 2.

Figure 6 shows the regional per capita water use graphs from 1998 to 2022 together with the major milestones of the DWCP, during this period.

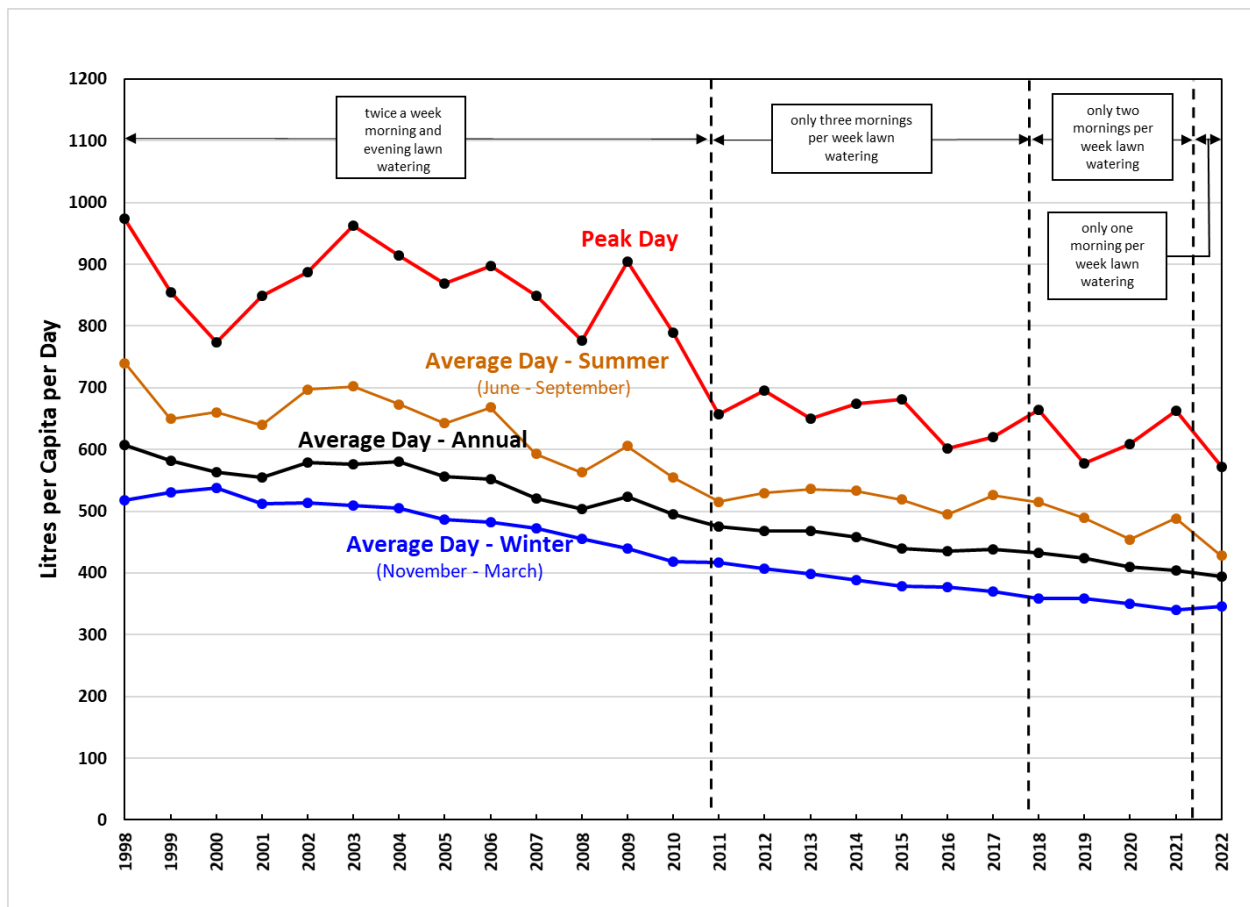


Figure 6: Regional Per Capita Water Use from 1998 to 2022

5.2. Water Conservation Measures

Metro Vancouver undertakes several communication initiatives annually to promote the efficient use of drinking water resources throughout the region. Key initiatives in 2022 included the communication of the updated region-wide watering restrictions, the We Love Water campaign, and the return of the Water Wagon Program. These initiatives work together to increase awareness of Metro Vancouver’s water system and the need for residential water conservation. The promotional strategy for the watering restrictions and We Love Water initiatives included a broad reach through television, radio, print, and outdoor advertising as well as targeted and weather-triggered digital tactics, direct mail, and social media. In total, paid broadcast and digital promotions delivered over 46.5 million impressions, with an additional 69 million impressions from earned media. The Water Wagon Program returned – after a two-year hiatus due to the COVID-19 pandemic – and resulted in 55,525 water bottle refills over 38 community event days.

Metro Vancouver also delivered the DWCP Summer Support Program (SSP) to assist member jurisdictions with the promotion and monitoring of regional lawn watering restrictions during the implementation of the updated region-wide watering regulations in 2022. Eleven of the GVWD’s 20 member jurisdictions participated in the 2022 SSP. The SSP’s targeted education and monitoring approach resulted in significant reductions in non-compliant lawn watering and was described through a post-program survey as very helpful for participating member jurisdictions, benefiting their education and enforcement programs. Figure 7 shows an example of the 2022 Lawn Watering Regulations’ public communication.



Figure 7: Example of 2022 Lawn Watering Regulations’ Public Communication

Water use was high due to an extended hot and dry season, stretching from July through October. Stage 1 watering restrictions were extended from October 15 to October 31 to help address a potential water shortage. Water conservation continues to be an important factor in determining future system needs. As the wholesale supplier with limited influence over end-user demand, Metro Vancouver partners with the twenty member jurisdictions to implement and enforce water conservation measures. Metro Vancouver’s role includes long-term planning for the region and sustained reduction in per capita water use over the coming years. This is key to ensuring adequate water supply as our population

grows, along with the development of new infrastructure to help address anticipated supply constraints well before they could cause issues.

6.0 FINANCIAL PLANNING

Metro Vancouver had 2022 total water sales revenues of approximately \$330 million, with higher summer wholesale rates of \$1.0371/m³ for June through September and a wholesale rate of \$0.7119/m³ applying for the rest of the year (equating to an overall average water rate of \$0.8469/m³). The differential rates are intended to incentivize conservation efforts by member jurisdictions. Each member jurisdiction determines the specific way they collect fees to cover the cost of water purchased from Metro Vancouver.

Metro Vancouver progressed with the development of a new development cost charge for regional water infrastructure. The concept of funding regional water infrastructure through development cost charges was a Board priority (2019-2022) and a critical component of the long-term financial plan.

7.0 WATER SYSTEM MANAGEMENT

7.1. Asset Management Program

Metro Vancouver's Asset Management Program ensures that assets are managed in a manner that minimizes asset failure risks and optimizes the lifecycle value of assets to meet asset performance targets. In 2019, the Board approved the *Asset Management for Water Services Policy*. This policy establishes asset management principles and a framework to balance asset performance, risk, and cost to deliver Metro Vancouver water services. As part of the Asset Management Program, in 2022, Metro Vancouver produced and presented the *State of the Assets Report – Water Services* to the Board.

7.2. Operations and Maintenance Program

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

Metro Vancouver undertakes system maintenance daily through scheduled work orders performed by certified staff to ensure that existing equipment and facilities are in a good state of repair and to know when additional maintenance or replacement is needed.

Multi-year maintenance projects that took place in 2022 included the following:

Annual Reservoir Cleaning – Metro Vancouver’s in-system water storage reservoirs are periodically isolated and drained for interior cleaning, inspection, and repair or upgrade construction. Cleaning is conducted either through draining and using high-pressure water spray or using divers to remove sediment from the interior. In 2022, five reservoirs were isolated, drained and cleaned, and one reservoir was cleaned by divers.

Condition Assessments – Condition assessments follow the *Asset Management for Water Services Policy*, improve understanding of the water system’s overall condition and can lead to asset repair and replacement projects. In 2022, Metro Vancouver completed condition assessments of 84 chambers, three sections of water mains, five pump stations, and three reservoirs, as well as undertaking a pilot valve exercising program to better understand the condition of critical large diameter line valves in the transmission system.

Mechanical, Instrumentation, and Electrical Maintenance – In 2022, the maintenance team performed 1,673 preventative maintenance work orders. Examples of maintenance work include 10 pump rebuilds at various water pump stations and replacing variable frequency drive fans by the electrical team at the Capilano Raw Water Pump Station.

Capilano Energy Recovery Facility (CERF) Ventilation Improvement – Equipment inside the facility had experienced corrosion due to exposure to ambient conditions and humidity in the air. The CERF ventilation improvement project was carried out in 2022 to improve air circulation and air quality within the CERF Machine Hall. The work included the replacement of four backdraft dampers, and installation of air supply fans, and the associated electrical and controls work, as well as the installation of a new pressure reducing valve vent pipe and three ancillary fans. The construction is 90 per cent completed, pending final programming and commissioning.

Valve Replacement Program – Metro Vancouver is continually reviewing the water transmission system to ensure valve chambers are in good working order through condition assessments and isolation tests. A need has been identified for a more formalized approach to valve maintenance, including valve replacement. The Maintenance and Business Support team began developing formalized valve maintenance and replacement programs in 2022 and will continue developing these programs through 2023.

Water Chamber Inspection Program – Metro Vancouver operates and maintains approximately 2,400 chambers and maintenance hatches, including air valves, blowdowns, pipe hatches, and valve chambers. Regular inspection of these assets is required to prolong their operating lives and increase system reliability. In 2022, over 80 chambers were cleaned, inspected, and assessed using new and innovative technology. In addition, mechanical upgrades were completed on key facilities at Vancouver Heights.

Marine Water Main Crossings – Metro Vancouver continues to inspect and protect marine water main crossings that are subject to hydraulic scour. Staff monitor the condition of submerged beds in the area and scour protection is installed or upgraded, as required, over marine crossings. Monitoring of the marine water main crossings is conducted to assess the requirement of installation or maintenance of existing scour protection. In 2022, a total of 26 bathymetric surveys were carried out on 18 major water main crossings. A new scour protection was constructed at the south bank of the Tilbury Main South Arm Crossing and the detailed design of scour protection for the Annacis Main No. 2 Annacis Channel was completed.

Aerial Pipe Crossings Rehabilitation – Inspections on Lynn Valley, Canyon and Hyannis Creek Aerial crossings revealed these aerial pipe crossings required maintenance. The rehabilitation process, including the installation of safety equipment to protect workers and the public together with the replacement of equipment at the end of its service life, is the first step in addressing the maintenance items identified.

7.3. Capital Program

The 2022-2026 Water Services capital budget included \$471.3 million for capital projects in 2022 and a total of \$2.5 billion over the five years. In 2022, there were 142 projects on the five-year capital plan. These projects are largely driven by system expansion to meet the needs of a growing population, upgrades to improve system resiliency, and maintenance of aging infrastructure. Capital investments addressing population growth are the largest component of the budget, representing slightly more than 53 per cent of spending in the next 5 years.

In 2022 many major projects reached significant milestones, including the following key projects:

Annacis Water Supply Tunnel (Annacis Main No. 5 - Marine Crossing) – A 2.3 km long, 4.5-metre diameter water supply tunnel is required under the Fraser River, between the City of New Westminster and the City of Surrey, to meet growing water demand south of the Fraser River and to provide increased system resiliency. The construction contract was awarded in late 2021 and construction commenced in early 2022. The initial phase of construction, which is underway, involves the excavation of a deep vertical shaft on the south side of the Fraser River. Tunnel excavation will commence in late 2023.

Cape Horn Pump Station No. 3 – Cape Horn Pump Station No. 3 with a backup power system, will supplement the existing pump station No. 2 to deliver Coquitlam source water to meet growing demand in the areas south of the Fraser River. The preliminary design of the new station is now complete. Detailed design commenced in late 2022 with completion expected in summer 2024.

Stanley Park Water Supply Tunnel (Capilano Main No. 5 - Stanley Park Section) – This 1.4 km long steel water main located within an existing tunnel, will replace the aged existing Capilano Main No. 4 through Stanley Park and is designed to meet growing water demand and provide increased

system resiliency. Detailed design was completed in 2022 and construction is anticipated to start in 2024.

Coquitlam Lake Water Supply (Coquitlam Intake No. 2) – A new intake, tunnel, and treatment plant is proposed at the Coquitlam Reservoir to increase the regional supply from this source and meet growing future demand. The Project Definition Report has been issued. The project is now in the permitting and regulatory phase, which will focus on engagement with First Nations, the City of Coquitlam, regulators, and stakeholders. Phase 2 site investigations and treatment pilot testing are also anticipated to start in the second half of 2023 under this phase of work. In 2022, procurement of professional services for Phase 2 of the project was initiated.

Coquitlam Water Main (Coquitlam Main No. 4) – This 12 km long steel water main, consisting of the Robson to Guildford, Pipeline Road North, Cape Horn, and City Centre Tunnel Sections, will increase the transmission capacity from the Coquitlam source to the Cape Horn Pump Station and Reservoir in the City of Coquitlam. This project is required to address capacity constraints in the existing Coquitlam transmission system and also provide additional transmission capacity for the future Coquitlam Lake Water Supply Project. Detailed design of the Central and Cape Horn Sections continues. Construction is scheduled to commence in mid-2023.

Fleetwood Reservoir – This project will construct a new reservoir located at Meagan Ann MacDougall Park in the City of Surrey to supply the City of Surrey’s Fleetwood Pump Station and feed the Anniedale Tynehead area. Construction of Phase 1 which started in August of 2022 includes a 13.6 million litres (ML) reservoir, valve chamber, piping, access building, and associated work. Phase 1 is expected to complete in the last quarter of 2024 and Phase 2 is planned for 2040 depending on regional demands.

Jericho Reservoir Cell #1 – The Jericho Reservoir is a key component of Metro Vancouver’s supply to the Township of Langley and the City of Surrey. Located in the Township of Langley, the reservoir is being constructed in two phases and will have a total combined storage volume of 39.1 ML. Construction of Phase 1, which included two cells with a combined storage volume of 20.6 ML, was completed in 2022. The second phase of the reservoir is being planned for 2040 depending on regional demands.

Kennedy Newton Water Main – This 1.8 metre-diameter, 8 km-long water main will connect the Newton Reservoir to the Kennedy Reservoir in the City of Surrey and is being built to meet growing water demand south of the Fraser River. Construction of Phase 1 was completed in 2021 and Phase 2 was largely completed in 2022. The final phase of the project commenced in 2022 and is expected to be complete in 2025.

Newton Pump Station No. 2 – This project replaced the existing Newton Pump Station located in the City of Surrey and includes full backup power redundancy, connections to existing and future

infrastructure, and installation of new outlets to the existing Newton Reservoir. The detailed design is complete and the construction of the new reservoir outlets is underway.

Second Narrows Water Supply Tunnel – This project comprises a 1.1 km long, 6.5-metre diameter water supply tunnel under the Burrard Inlet, between North Vancouver and Burnaby, to increase the reliability of supply in the event of a major earthquake as well as to provide additional long-term supply capacity. Construction commenced in early 2019. Construction of the north and south shafts, tunnel, and installation of the three steel water mains inside the tunnel is complete. Currently, construction of the north and south valve chambers is in progress. Overall construction is scheduled to be complete by early 2024, followed by site restoration and final tie-ins and commissioning in 2025 and 2026.

Water Meter Upgrade Program – There are over 200 water meters located at key locations in Metro Vancouver’s water transmission system that are used to measure water consumption by member jurisdictions for billing and operational purposes. The Water Meter Upgrade Program is a capital project that started in 2017 and involves installing seven new water meters and replacing 30 existing water meters. In 2022, one new water meter was installed, two water meters were replaced, and the design for the installation or replacement was progressed on 11 water meters.

Water Operation Optimization – In addition to billing purposes, Metro Vancouver installs various meters to monitor flows and pressures to verify performance within the water transmission network. Metro Vancouver is installing additional flow and pressure meters at various locations to optimize and monitor performance. Network-wide, 154 locations for new meters and instrumentation have been identified under this program. Thirteen meters have been constructed/installed during the first phase of the project. Currently, the second iteration of the project, titled the Water Instrumentation Installation Project, is underway for the installation of 25 meters.

8.0 EMERGENCY RESPONSE SUMMARY

8.1 Water Services Emergency Management Plan Summary

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

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

Ultimately, Metro Vancouver will endeavour to maintain the continuity of drinking water delivery to our member jurisdictions. In an emergency, Metro Vancouver's priorities are:

1. Deliver drinking water whenever possible to members for consumption and/or firefighting; and,
2. Protect the integrity of water in its system for public health.

In meeting these priorities, Metro Vancouver subscribes to the following Response Objectives, in this order of priority:

1. Ensure the safety and health of all responders and Metro Vancouver staff;
2. Save lives;
3. Reduce suffering;
4. Protect the public;
5. Protect critical infrastructure;
6. Protect property;
7. Protect the environment; and,
8. Reduce social and economic losses.

8.2. Emergency Recovery

There was a major leak in Metro Vancouver's Tilbury Water Main, a key water main that feeds the Cities of Richmond and Delta. Metro Vancouver's Main Control Room continuously monitors the operating conditions of the transmission system. On December 21, 2022, during a period of significant snowfall and extremely cold temperatures, Metro Vancouver's Utility Systems Control staff detected higher-than-normal flows within the transmission system. The Cities of Richmond and Delta were promptly notified, while Metro Vancouver's field operations crews were dispatched to the area along the Tilbury Water Main. Since weather conditions made it challenging to travel, Metro Vancouver's field operations needed the assistance of helicopter services to locate the leak in a large field adjacent to Highway 91.

In collaboration with the Cities of Richmond and Delta as well as the land owner, the Tilbury Water Main was isolated and the leak was contained within the adjacent area. Metro Vancouver's Utility Systems Operations confirmed that there was no impact on the delivery of drinking water to our member jurisdictions. The Water Services Department Operations Centre was successfully activated to coordinate the initial response to locate, contain, and repair the water main and to ensure effective communication with all stakeholders.

