Drinking Water Quality – 2019 Annual Report

JUNE 2020 | ENGINEERING, PARKS AND ENVIRONMENT

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1.0 Summary

The City of North Vancouver's Drinking Water Quality Annual Report provides annual operating information about our drinking water and supports the City's application for the water distribution system annual Operating Permit. The Medical Health Officer issues the permit as required by the Drinking Water Protection Act.

In conjunction with the Greater Vancouver Water District (Metro Vancouver), the City continues to deliver safe, high-quality water to its residents and other users. The City's capital plan for the water utility continues to prioritize ongoing replacement of aging or problematic water infrastructure and to provide funding for the maintenance programs related to water quality.

The Regional Drinking Water Management Plan (DWMP), prepared by Metro Vancouver in 2011, provides direction for a sustainable water supply and includes commitments at both the municipal and regional level. The 2011 DWMP is an update of the 2007 plan and reflects fundamental improvements in water quality treatment at the Seymour Filtration Plant and a larger focus on sustainability of the drinking water resource.

The primary goals of the Plan remain unchanged and are as follows:

Goal 1: Provide Clean, Safe Drinking Water

Goal 2: Ensure the Sustainable Use of Water Resources

Goal 3: Ensure the Efficient Supply of Water

2.0 Source Water

Metro Vancouver has three watersheds that provide our drinking water: Capilano and Seymour Watersheds on the North Shore and Coquitlam Watershed in Coquitlam. Drinking water is supplied to 2.4 million residents from these sources. Both the Capilano and Seymour water sources are filtered and disinfected at the Seymour Falls Water Filtration Plant prior to distribution and are both sources for the City of North Vancouver.

The watersheds are protected from urban development, closed to public access, and managed as natural assets of the highest importance to the region we live in. Protecting the source of our drinking water protects other natural assets.

Metro Vancouver is responsible for monitoring and testing water for bacteriological, chemical, and physical quality. Metro Vancouver maintains a laboratory for the drinking water program, testing all source water as well as samples collected by member municipalities from their distribution systems. Metro Vancouver prepared a comprehensive annual water quality control report providing information for the entire Metro Vancouver service area. Extensive information on water in general is provided on the Metro Vancouver web site (www.metrovancouver.org).

The City of North Vancouver is located between the Capilano and Seymour source water reservoirs, and since all water from both reservoirs is treated at Seymour Falls there is no variation in the quality of source water across the City under normal operating conditions. Source water delivered to Pressure Zone 2 (south of Tempe Heights and north of Keith Road) is delivered by the from the Lynn Valley Road feed and temporarily stored in the Metro Vancouver Greenwood Reservoir in Greenwood Park. The area south of Keith Road (CNV Pressure Zone 3) is primarily fed by the Metro Vancouver Capilano Main No. 7. Isolated portions of the City in the Tempe Heights and Queensbury School area (CNV Pressure Zone 1) are serviced from water from the District of North Vancouver water mains to provide efficient distribution of water without additional pumping infrastructure. Conversely, isolated portions of the District are serviced by the City of North Vancouver water utility for the same reason.

3.0 Distribution System

3.1 General

The City of North Vancouver's water distribution system serves an estimated population of 56,700, along with an institutional, commercial, and industrial base, accounting for approximately 67% and 33% of the yearly water consumption respectively. The comprises roughly 127 kilometres of pipe divided into four pressure zones, with nine pressure reducing stations, and over 7,100 service connections. Approximately 43% of the water main system is cast iron, 47% is ductile iron, 9% is PVC, and 1% is steel. The oldest pipes in the system were installed circa 1911. Appendix A contains map showing the sampling station locations, the pressure reducing stations which correlate with the GVWD water sources to the City, and the various pressure zones.

3.2 Testing

The City's water quality sampling program is based on accepted protocols developed in consultation with the Medical Health Officer (MHO). The program provides bacteriological, chemical, and physical testing to evaluate water quality. There are 20 sampling stations located throughout the City to give a broad cross-section of the water quality in the distribution system. Samples are taken from half the stations each week, such that each station is tested on a bi-weekly basis. The City monitors pressure and temperature data for source water supplied by Metro Vancouver at all of the pressure reducing valve stations.

The *Guidelines for Canadian Drinking Water Quality* classifies water quality parameters into the following groups:

- microbiological
- chemical and physical
- radiological

Parameters that have been included in the guidelines, include: Health-Based concerns, Aesthetic Objectives, or Operational Guidelines. For the health-based parameters, a maximum acceptable concentration is provided under the guidelines, aesthetic objectives and operational guidelines also have suggested limits or ranges. In some cases, a parameter may have a health-based maximum limit, and a more stringent aesthetic objective.

Maximum acceptable concentration limits have been established for certain substances known or suspected to cause adverse effects on health. The Health Canada standards have been developed to safeguard health on the basis of lifelong consumption and the use of the water for all usual domestic purposes, including personal hygiene.

The bi-weekly samples from all 20 stations are tested for the following health-based parameters:

- microbiological evidence (E.coli, HPC, coliform)
- turbidity

Three sampling stations are tested for the health-based parameters Haloacetic Acids (HAA) and Trihalomethanes (THMs) that are the byproducts of chlorine disinfection, on a less frequent basis:

- No. 807 – 1900 Hamilton
- No. 808 – 980 West 1st Street
- No. 812 – 539 East 20th Street

Metals analysis is also provided at three additional stations and are tested at a lower frequency:

- No. 801 – 550 West 28th Street
- No. 803 – 264-268 East 9th Street
- No. 804 – 848 East 6th Street

Most metals are health-based parameters, but not all. A list of aesthetic-based parameters is provided in the following section

The bi-weekly samples from all 20 stations are tested for the following aesthetic parameters:

- temperature
- chlorine residual

Additional chemical and physical based water quality parameters that are not health-based include:

- ammonia
- calcium
- chlorine
- colour
- copper
- hardness
- iron
- magnesium
- odour
- pH
- silver
- sodium
- sulphate
- sulphide
- taste
- temperature
- total dissolved solids
- zinc

3.3 Water Quality Sampling Results

DISCUSSION ON HEALTH-BASED PARAMETERS

In 2019 none of the health-based parameters tested exceeded the maximum acceptable limits under the Guidelines.

Micro-Biological Parameters

Microbiological results for the 2019 testing year were that all E.coli and coliform tested below the guidelines, with no instances of positive E.coli or coliform samples. This is indicative of positive system-wide disinfection.

Data regarding E.coli and Coliform testing is provided in the following two tables.

E. coli Sample Summary Since 2013

Year	Average E. coli (MF/100mL)	Sample Count	# Outside Guidelines	% Outside Guidelines
2013	0	530	0	0.0%
2014	0	520	0	0.0%
2015	0	520	0	0.0%
2016	0	520	0	0.0%
2017	0	520	0	0.0%
2018	0	520	0	0.0%
2019	0	530	0	0.0%

The City has not had any positive tests for E. coli in the past seven years of water quality testing as can be seen in the table above. Detectable levels of total coliforms were observed between 2014 and 2017, none of which exceeded public health guidelines. Total coliforms have not been detected in any of the sampling in 2018 and 2019.

Coliform Sample Summary Since 2013

Year	Average Coliform (MF/100mL)	Sample Count	# Outside Guidelines	% Outside Guidelines
2013	0.0	530	0	0.0%
2014	0.00192	520	0	0.0%
2015	0.00577	520	0	0.0%
2016	0.00385	520	0	0.0%
2017	0.00962	520	0	0.0%
2018	0.0	520	0	0.0%
2019	0.0	530	0	0.0%

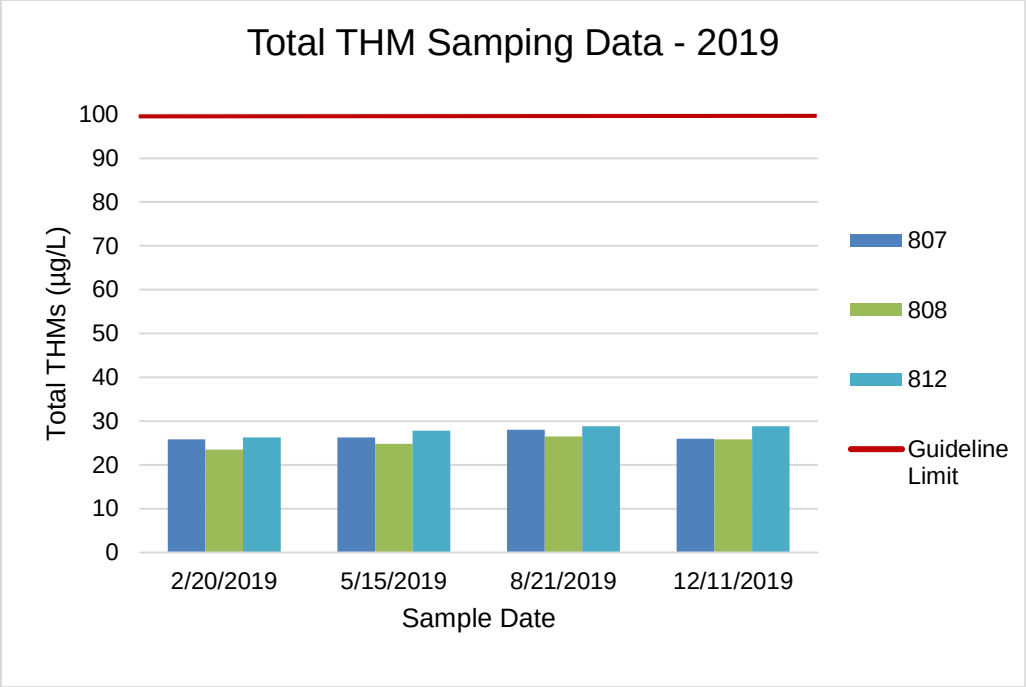
Chemical and Physical Parameters

The concentration of total HAAs and THMs in the samples collected quarterly remained consistently low, at about one-fourth of the maximum acceptable limit.

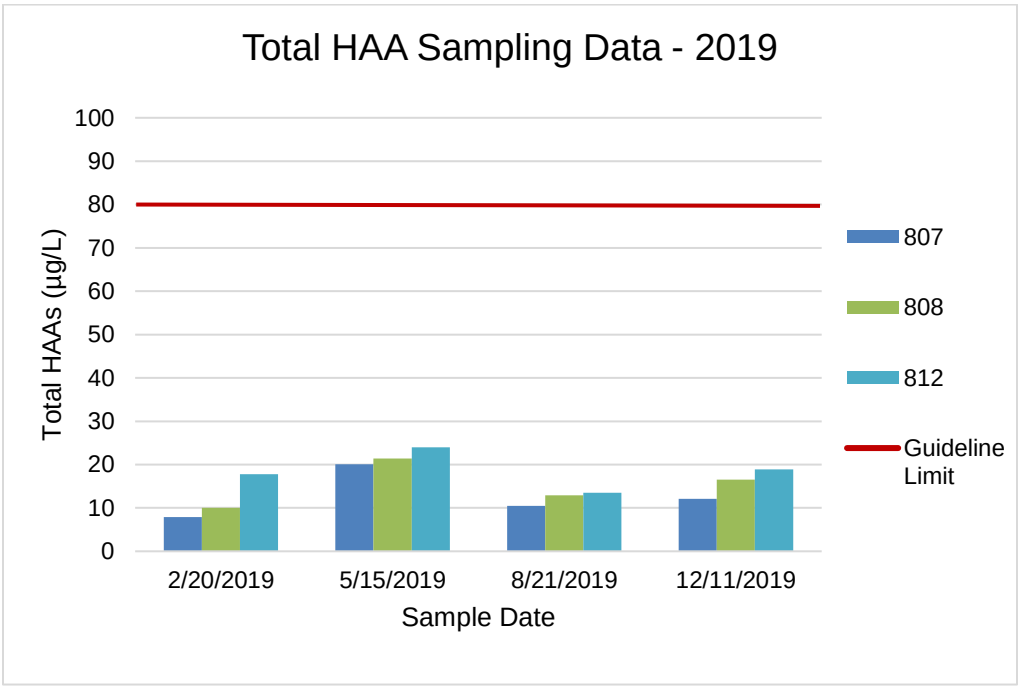
Vinyl chloride testing is conducted at one station in Tempe Heights, where the water system is constructed entirely from PVC pipe. Measurable concentrations were not detected in 2019. Metro Vancouver provides the testing and data summary services and alerts the City to any water quality problems. The table and figures below summarize the HAA, THM and vinyl chloride data collected in 2019.

Station ID	Station Name	Period 2019	Total THMs µg/L (100 µg/L max acceptable)	Total HAAs Acids µg/L (80 µg /L max acceptable)	Chloride Vinyl µg/L (2 µg/L max acceptable)
807	1900 Block Hamilton	1st Qtr	25.8	7.9	-
		2nd Qtr	26.3	20.1	-
		3rd Qtr	28.0	10.5	-
		4th Qtr	26.0	12.1	-
808	980 West 1st	1st Qtr	23.5	10	-
		2nd Qtr	24.8	21.4	-
		3rd Qtr	26.5	12.9	-
		4th Qtr	25.8	16.5	-
812	539 East 20th	1st Qtr	26.3	17.8	-
		2nd Qtr	27.8	24	-
		3rd Qtr	28.8	13.5	-
		4th Qtr	28.8	18.9	-
814	2640 Tempe Knoll	-	-	-	<0.00040
		-	-	-	<0.00040

The following two figures summarize the total THM and HAA concentrations graphically by station and sampling period. Spatially the results for total THMs for all sites were very comparable, with almost no difference between the three sites. Temporally, the 4th quarter sampling period yielded slightly higher results for all stations than the three previous periods in 2019. All the total THM concentrations are substantially lower than the allowable guideline value.



The following figure plots total HAA by period and sampling station, where total HAA was slightly higher in the spring, and lowest in the summer months. This could be due to the higher summer time water use and lower residence time between filtration and sampling. All of the total HAA concentrations are substantially lower than the allowable guideline value.

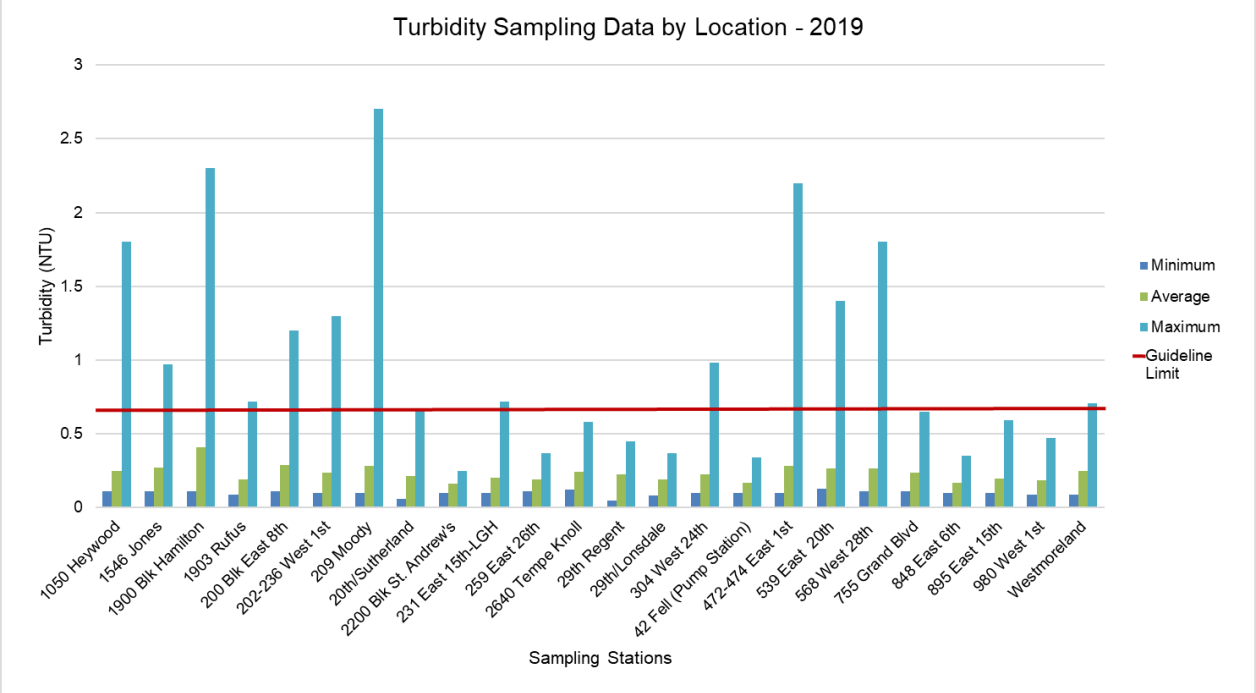


Turbidity caused by rainfall events affecting the watersheds is beyond the control of the City and is less common now due to universal filtration of both North Shore sources (since April 2015). Water main cleaning, water main breaks, and high velocity flows due to firefighting are the other primary sources of turbidity in the City and they are primarily managed annually through water

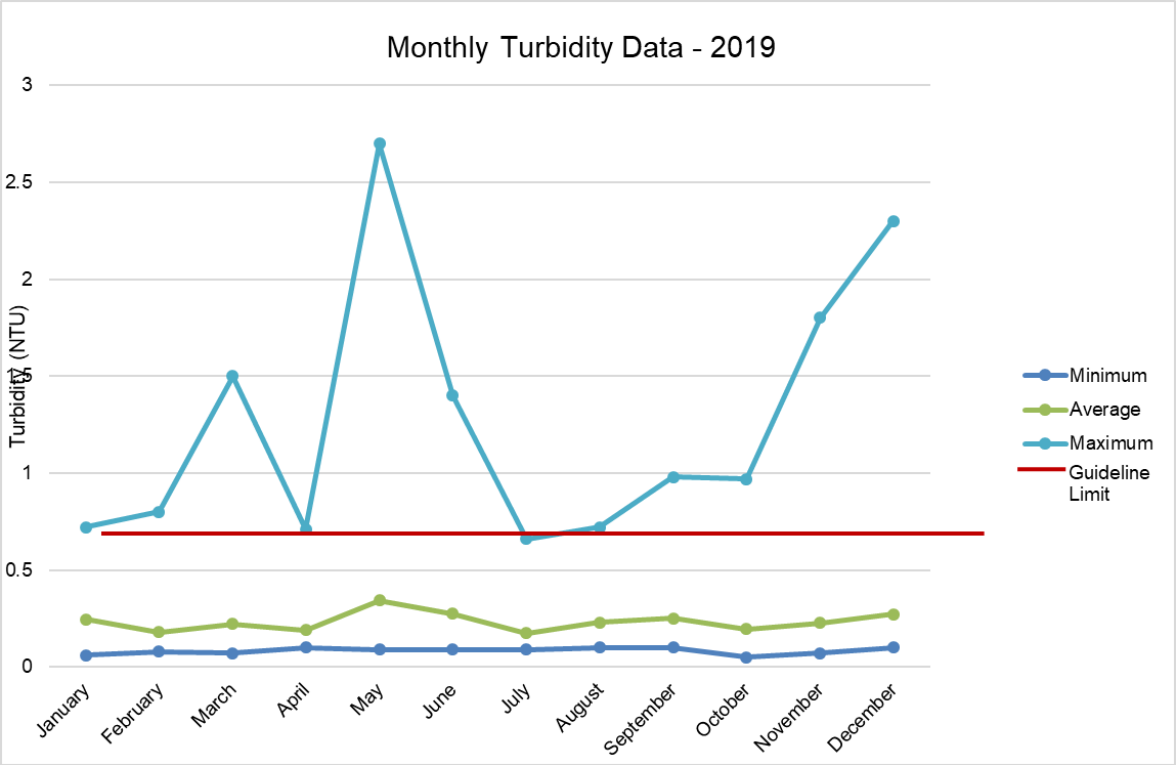
main flushing programs, as well as being addressed on a longer-term basis through water main replacement.

The City includes turbidity testing for each sample in the field as part of the sampling program. This ensures an immediate response to turbidity problems if necessary, rather than a delay caused by waiting for GVWD lab results.

In 2019 a total of 9 samples exceeded the recommended turbidity level of 1.0 NTU, for a total of 1.7% of the 530 samples, which is considered very low given the large percentage of cast iron water mains in the utility. These exceedances occurred at eight stations, with not more than two instances per station, throughout the City. Given that typically only one instance of high turbidity was experienced at most sites, none of these sites are considered to be chronic problems and where likely due to local higher water use or construction activity disturbing settled sediment or iron precipitate in the water main.



When high turbidity measurements are found in the field, waterworks operations staff reviews current activities in the water utility and surrounding construction activity to try to determine the cause of the higher turbidity. The City tracks all reports of high turbidity as part of the comprehensive asset management processes for the water utility.



The figures above summarize the turbidity data by station and by month. Appendix B provides a description of the sampling parameters, the allowable limits, and a detailed summary of the 2019 test results.

The high turbidity samples are located in areas of the utility that still have a large percentage of cast iron mains, and lower water use associated with detached single unit homes. Both the Tempe Knoll and the West 28th areas have water main replacement programs in the next 10 years to further reduce the potential for turbidity events.

DISCUSSION ON NON-HEALTH-BASED PARAMETERS

Chlorine Residual

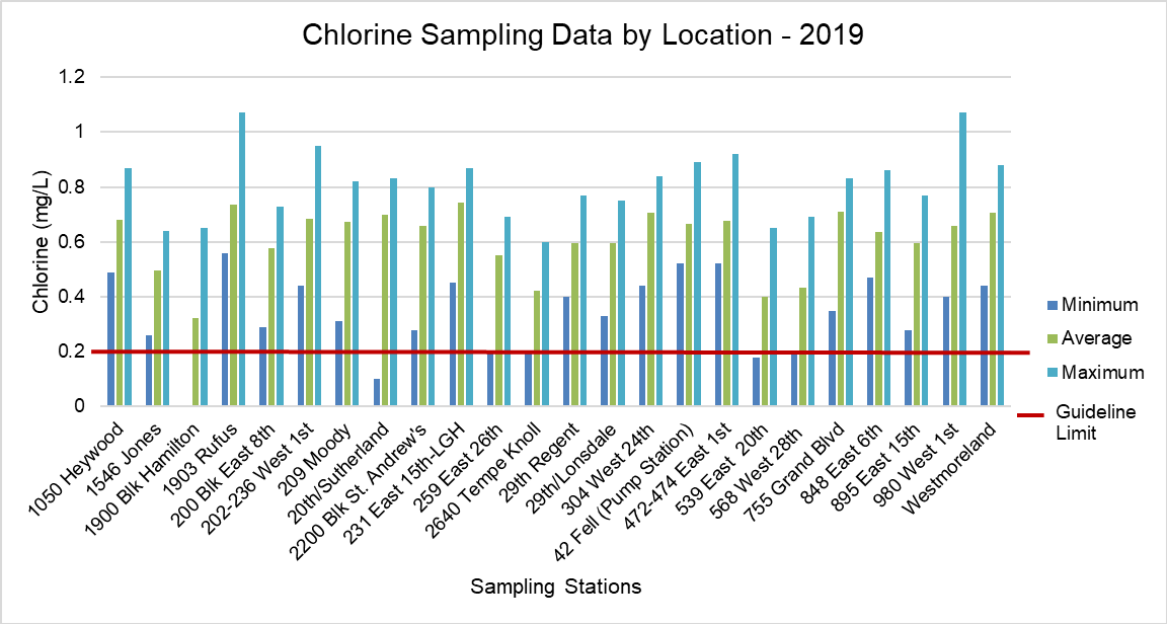
Chlorine residual, while not a health-based parameter, is a requirement for all distribution systems as chlorine is the barrier for micro-biological regrowth following initial filtration and disinfection. It is a requirement to maintain a chlorine residual of at least 0.2 mg/L for distribution systems.

Chlorine residual sampling results showed a system average at 0.60 mg/l, which is well above the 0.2 mg/l minimum standard. Of the 20 sampling stations, two monitoring locations exhibited chlorine concentrations below the 0.2 mg/l criteria for a total of 6 instances out of 530 samples (1.1 %).

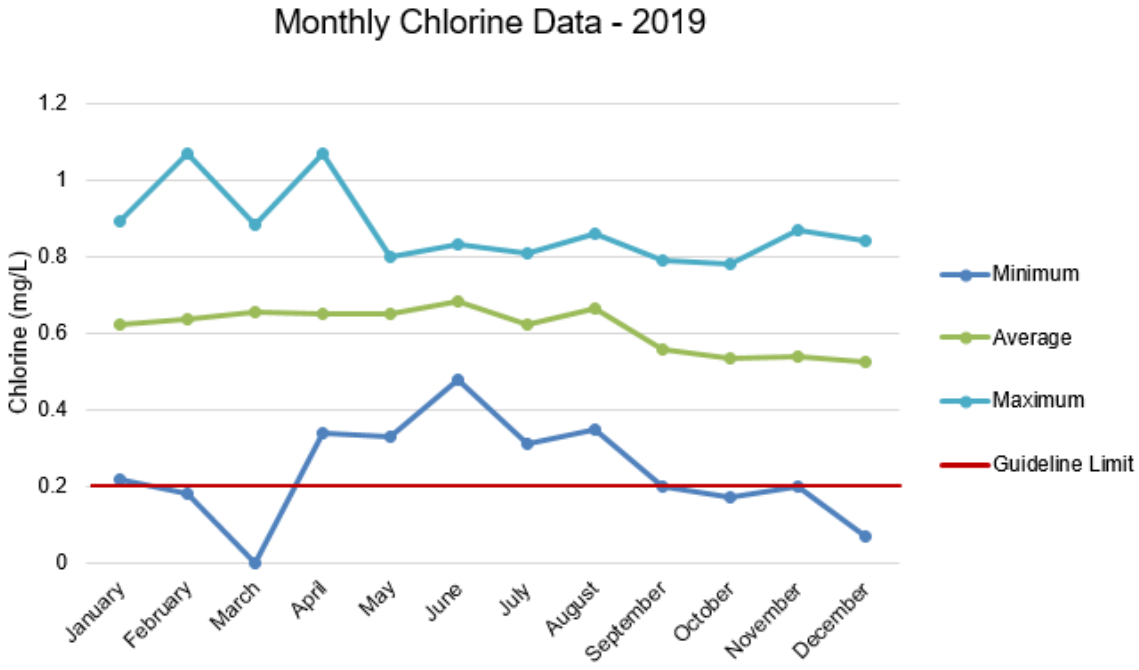
Stations that had low chlorine concentration include:

- Station No. 807 – 1900 Hamilton: 5 low concentration samples
- Station No. 812 – 539 East 20th Street: 1 low concentration sample

This is similar to 2019, where low chlorine residuals were seen at the same stations; however, the frequency of low chlorine residuals at Station 807 increased slightly to a total of 5 instances out of 27 samples. The figures below summarize the chlorine sampling data for 2019.



The figure above includes four additional sites that the City monitors at feed locations from Metro Vancouver (20th/Sutherland, Westmoreland), and the District of North Vancouver (29th Regent, 29th/Lonsdale). These sites are not part of the standard reporting requirements, but rather reflect the concentration of chlorine of water entering the distribution system.



Based on an aggregate monthly summary of chlorine residual data, more than one lower chlorine residuals occurred in the months of February, March, and December. This may have indicate some more regional or system-wide factors that are influencing chlorine residual.

A total of five low chlorine concentration samples were identified at 1900 Hamilton Avenue in 2018 and 2017, and three low samples in 2016. In this quiet residential area north of Marine Drive and west of Fell Avenue, water in this area is drawn from the nearby Westmoreland Metro Vancouver source, but due to older cast iron water mains and lower residential demands, it is likely that the chlorine concentrations were reduced more quickly than water was being consumed. The City continues to flush the water mains in this area, and was last flushed in November 2019.

539 East 20th Street is located in the Queensbury School neighbourhood, which is an area that receives water from the District of North Vancouver via the 29th and Regent source. Given that this water is received from the District, it is expected to have a longer residence time in the distribution system, which would lead to the lower chlorine concentrations. In 2016, the overall average chlorine residual was 0.35mg/l with 2 recorded low chlorine concentrations. In 2017 and 2018 only one low concentration was sampled, at a concentration slightly below the standard at 0.16 mg/l and 0.18 mg/l respectively. In 2019, one low concentration was sampled at 0.18 mg/L.

One other low chlorine residual was measured at 20th and Sutherland in December 2019, which is located at the City connection to the Metro Vancouver Lynn Valley feed. This indicates low chlorine levels from the regional water source prior to reaching the City system.

Water Temperature

Water temperature during the summer months at times exceeds the recommended value of 15 degrees Celsius in the City distribution system. While higher temperatures are not aesthetically pleasing and may influence bacterial regrowth, City Water Utility Operations cannot influence water temperature to a large degree.

In 2019, water temperature exceeded the recommended value a total of 84 times out of 530 samples, or a total of 15.8% of the time. Higher water temperatures were observed in all of the sampling stations, and temperatures in excess ranged from 17ºC to 19ºC. The most frequent exceedances were observed in the 568 West 28th, 1900 Hamilton, and 539 East 20th stations, where a total of 7 samples exceeded the 15ºC guideline at each station.

The primary non-health-based metals that are often detected in drinking water include: iron, copper, and zinc. In the City's water system all concentrations measured are below the aesthetic objectives, with iron being the most prevalent metal detected in the three sample sets.

Appendix B provides a description of the sampling parameters, the allowable limits, and a detailed summary of the 2019 test results.

3.4 Risks

Risks to distribution water quality include the following issues related to disinfection and maintenance-related activities. The City's Water Utility procedures were developed to minimize and mitigate these foreseen risks.

Increased chlorine residuals can increase the levels of Haloacetic Acid (HAA) and Trihalomethanes (THMs). Longer-than-average exposure to THMs is an indicator of by-product-related cancer risk.

Chlorine residuals below 0.2 mg/l can potentially allow pathogenic organisms to multiply.

Insufficient levels of maintenance and care can put the water system at risk. Water main cleaning is an essential component of the care that is required to maintain high-quality drinking water. Planned replacement of aging pipes reduces the risk of water main breaks and the associated risk of contamination.

3.5 Issues

In 2019 source water for the entire year was treated at the Seymour Falls filtration plant, which has led to the delivery of consistent chlorine residuals at the City feeds from Metro Vancouver. Temperature continues to be a challenge, as average water temperatures in August, September, and October tend to exceed the guideline threshold.

In 2019 the City has seen improvements in maintaining consistent chlorine residuals in the distribution system and continues to see complete compliance with respect to health-related micro-biological parameters, chlorine by-products and vinyl chloride concentrations. On-going replacement of unlined cast-iron water mains continues to be an annual priority for the City to continue to achieve the water quality goals around residual chlorine concentrations and turbidity.

3.6 Water System Operation and Maintenance

The goal for water system flushing is to clean all mains on a 365-day cycle and the following table depicts the generalized water system cleaning schedule. Some areas are cleaned twice per cycle based on observations and operational decisions. The zones are mapped in Appendix A.

City of North Vancouver Water Main Cleaning Plan	
Water Pressure Zones	**Frequency Goal**
Zone 1/5	Annually
Zone 2	Annually
Zone 3	Annually and some areas twice per year
Zone 4	Annually
Turbid Water Reports	As required

Combining the cleaning program with the valve actuation program has the added benefit of ensuring all valves in the system are open and maintaining flows in the designed fashion.

In 2019, a total of five water projects were constructed with a total length of 1,420 m of new water main.

2019 Water Main Construction	2019 Water Main Construction
A. East 3rd: St David's to St Georges (R)	A. East 3rd: St Georges to Lonsdale (R)
B. St. David's 2nd to 4th (R)	B. Mosquito Creek Lane and Fell Avenue (R)
C. Cotton Road at Gladstone (R)	C. Gladstone north of Cotton Road
D. Mosquito Creek Crossing at Marine Drive (R)	D. West 6th – 100 Block (R)
E. 100 Block East 15th	E. St Georges 2100 to 2200 (N)
F.	F. St Andrews 2200 to 2400 (R)

R – Replacement water main construction
N – New water main construction

All the new and replacement water main construction improves flow capability and pipe quality, both of which have a positive influence on water quality and overall system resiliency.

The City has a number of objectives associated with asset replacement and new main construction. These include:

- Replacement of aging unlined cast iron water mains for improved water quality and reliability (i.e. unplanned water main breaks).
- Increase in water main size of replacement mains to meet current and future needs.
- Addition of new water main connections to increase distribution and circulation and to add redundancy.
- To provide more resilient water mains that are restrained at each connection in the event of earthquakes.

In replacing water mains, the City also replaces water services that are part of the public utility for increased reliability and to decrease foreseeable service leaks and breaks.

The City has a goal of replacing between about 1% and 1.3% of aging cast iron water mains every year, in order to progressively renew the water utility for improved reliability and water quality.

4.0 Significant Incidents

There were no incidents in the City's water distribution system that significantly compromised water quality in 2019. Of note, the City of North Vancouver's Engineering Department updated its Emergency Plan, which includes identification of critical elements in the water system infrastructure as well as key water quality topics.

A comprehensive water communication protocol for source water turbidity events was established through a task force of Metro Vancouver member municipalities and the Vancouver Coastal and Fraser Health Authorities and endorsed in March 2008. The protocol is now included in the Appendix D Response Plan.

5.0 Operator Qualifications

The table below highlights the qualifications and experience of City of North Vancouver staff directly involved in the operation of the water system.

Employee	Position	Courses	Qualifications	Work Experience
R. Greenlees	Section Manager Utilities	Water Distribution I&II Other trades related education		40 years
D. Price	Utility Tradesman	Tradesman Plumber	EOCP Water Distribution II	32 years
M. Trinkl	Supervisor Operations		EOCP Water Distribution II	30 years
D. Sherwood	Assistant Supervisor		EOCP Water Distribution II	20 years
W. Mason	Utility Tradesman	Tradesman Plumber Cross Connection Control	EOCP Water Distribution III	19 years
L. Beaupre	Irrigation System Worker	Cross Connection Control	Irrigation Industry assoc. of B.C. level 1+2	8 years
T. Stefas	Pipefitter		EOCP Water Distribution I	13 years
T. Van Nes	Pipefitter	Cross Connection Control	EOCP Water Distribution II	7 years
J. Giovinazzo	Labourer 2		EOCP Water Distribution I	6 years
Bryce Pollock	Plumbing and Gas Inspector	Cross Connection Control Tradesman Plumber Hydronic Technician		13 years

The City recognizes the value that operator education and training provides. Staff members participate annually in a variety of workshops, product orientations, and technical courses. The City's water system is a Class II distribution system, which includes staff with Level III certification. The City staff complement is knowledgeable, experienced, and appropriately qualified to operate the City's water distribution system.

6.0 Security Measures

Security measures for water systems typically concentrate on the protection of water sources and reservoirs. The City's system relies upon the GVWD for water supply and storage and therefore has not employed any extraordinary measures. Supply points (GVWD meter stations and PRVs) could be the most vulnerable components of our system but are no more vulnerable than fire hydrants and individual service connections. City staff will continue to keep apprised of security issues and will implement operational changes as required.

7.0 Notification and Emergency Response Plan

The City's Notification and Emergency Response Plan is included in Appendix D. The City of North Vancouver's Engineering, Parks and Environment Emergency Response Plan is up to date and tested annually to ensure new staff are aware of expectations in the event of an emergency.

8.0 Appendices

Appendix A: CNV Water Zones and Sampling Station Locations

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The following chart shows the sampling station locations with a designation for the type of flow being evaluated.

Table A-1: Water Sampling Locations

Station	Zone	Location	Flow Type
801	2	568 West 28th	B
802	2	1546 Jones	A
803	2	200 Block East 8th	B
804	2	848 East 6th	C
805	2	895 East 15th	B
806	2	259 East 26th	B
807	3	1900 Block Hamilton	B
808	3	980 West 1st	B
809	3	202-236 West 1st	A
810	3	472-474 East 1st	B
811	3	1050 Heywood	B
812	1	539 West 20th	C
813	4	1903 Rufus	B
814	1	2640 Tempe Knoll	C
815	3	42 Fell	B
816	2	231 East 15th	A
817	2	2200 Block St Andrew's	A
818	2	755 Grand Blvd	A
819	2	304 West 24th	B
820	3	209 Moody	B
Source A	2	20th & Sutherland	S
Source B	3	29th & Regent	S
Source C	1	29th & Lonsdale	S
Source D	1	Westmoreland	S

Flow Type Descriptions for Sampling Locations
S = Source water (14% of samples)
A = High to medium flow - transmission mains (24% of samples)
B = Medium to low flow - distribution mains (48% of samples)
C = Very little flow - dead ends, unlooped lines, poor circulation (14% of samples)

The system comprises of 127,000 metres of water main in a basic grid format. Sampling is done on Wednesdays. Each station is sampled on a bi-weekly bases and the GVRD provides the testing and data summary.

Appendix B: Water Sampling Parameters and 2019 Sampling Results

The following provides a simple description of the sampling parameters:

Chlorine (mg/L) – Free Chlorine in milligrams per litre: Minimum 0.2

The chlorine residual within the water distribution system is the indicator for the effectiveness of the disinfection process. The source water at Capilano and Seymour is treated to 1.5 mg/L and the goal is to maintain 0.2 to 0.4 mg/L at the extremities of the distribution system.

E. coli (MF/100 mL) – E. coli (Membrane Filtered per 100 millilitres): Maximum 0

The microbiological quality of water is measured by sampling the number of coliform organisms. E.coli coliforms are considered key indicators and could indicate sewage contamination. None of the coliform organisms detected should be E.coli coliforms.

In rare circumstances, the E.coli coliform test and the total coliform test will read MPN/100mLs. This indicates the sample was too turbid for the normal Membrane Filtration test and required an alternative method. MPN is an abbreviation of “Most Probable Number”.

HPC (CFU/mL) – Heterotrophic Plate Count (Colony Forming Units per millilitre): Maximum 500

Measuring the heterotrophic plate count (HPC) is an analytic method that is a useful operational tool for monitoring general bacteriological water quality throughout the treatment process and in the distribution system. HPC results are not an indicator of water safety and, as such, should not be used as an indicator of potential adverse human health effects. Each drinking water system will have a baseline range of HPC bacteria levels depending on the site-specific characteristics. Unexpected increases in the HPC baseline range could indicate a change in the treatment process, a disruption or contamination in the distribution system, or a change in the general bacteriological quality of the water.

Increases in HPC bacteria concentrations can be sudden or can gradually increase over time. Although some variation in HPC levels is normal and can occur seasonally, these increases can indicate a change in raw water quality, problems with drinking water treatment, or problems in the distribution system or plumbing and should be investigated.

Consistently low levels of HPC bacteria in the finished drinking water are an indicator that the treatment system is functioning properly. In the distribution system, HPC results outside of the normal range can provide some indication of stagnation, tuberculation, low or no residual disinfectant, and availability of nutrients for bacterial regrowth.

Coliforms (MF/100mL) – Total Coliforms (Membrane Filtered per 100 millilitres): Maximum 10

The microbiological quality of water is measured by sampling the number of coliform organisms. No sample should contain more than 10 total coliforms per 100 millilitres, and 90% or more of

the samples taken in a 30-day period must have zero coliform organisms. As well, no consecutive samples from the same site should show the presence of coliform organisms.

Temp (ºC) – Temperature (Degrees Celsius): Maximum 15

Temperature is measured in degrees Celsius at the time a sample is taken. Higher temperatures in the distribution system may contribute to bacterial regrowth.

Turbidity (NTU) – Turbidity (Nephelometric Turbidity Unit): Maximum 1

Turbidity describes the amount of disturbed sediment in water. The presence of turbidity can have significant effects on both the microbiological quality of water and on the detection of bacteria and viruses. More important, however, is that the sediment interferes with the disinfection process. Turbidity's interference with chlorination can range from negligible to severe.

Water Sampling Results

The following tables summarize the chlorine residual, E.coli, HPC, coliform, temperature and turbidity samples for the source water and sampling stations in 2019. In terms of the source water stations, the 29th & Lonsdale and 29th & Regent sites are from the District of North Vancouver distribution system and not direct from GVWD mains. Sutherland and Westmoreland are direct from GVWD mains.

Table B-1: Chlorine Sampling Results - 2019

Station	Location	Minimum Chlorine (mg/L)	Average Chlorine (mg/L)	Maximum Chlorine (mg/L)	Sample Count	Samples Below 0.2 mg/L
801	568 West 28th	0.20	0.43	0.69	26	0
802	1546 Jones	0.26	0.49	0.64	26	0
803	200 Blk East 8th	0.29	0.58	0.73	26	0
804	848 East 6th	0.47	0.64	0.86	26	0
805	895 East 15th	0.28	0.60	0.77	26	0
806	259 East 26th	0.20	0.55	0.69	26	0
807	1900 Blk Hamilton	0.00	0.32	0.65	27	5
808	980 West 1st	0.40	0.66	1.07	27	0
809	202-236 West 1st	0.44	0.68	0.95	27	0
810	472-474 East 1st	0.52	0.68	0.92	27	0
811	1050 Heywood	0.49	0.68	0.87	27	0
812	539 East 20th	0.18	0.40	0.65	27	1
813	1903 Rufus	0.56	0.73	1.07	27	0
814	2640 Tempe Knoll	0.20	0.42	0.60	27	0
815	42 Fell (Pump Station)	0.52	0.66	0.89	27	0
816	231 East 15th-LGH	0.45	0.74	0.87	26	0
817	2200 Blk St. Andrew's	0.28	0.66	0.80	26	0
818	755 Grand Blvd	0.35	0.71	0.83	26	0
819	304 West 24th	0.44	0.71	0.84	26	0
820	209 Moody	0.31	0.67	0.82	27	0
Source A	20th & Sutherland	0.10	0.70	0.83	26	1
Source B	29th & Regent	0.40	0.60	0.77	28	0
Source C	29th & Lonsdale	0.33	0.59	0.75	26	0
Source D	Westmoreland	0.44	0.71	0.88	27	0
Total	**All Locations**					

Table B-2: E. coli Sampling Results - 2019

Station	Location	Minimum E. coli (MF/100mL)	Average E. coli (MF/100mL)	Maximum E. coli (MF/100mL)	Sample Count	Samples Exceeding 0 MF/100mL
801	568 West 28th	0	0	0	26	0
802	1546 Jones	0	0	0	26	0
803	200 Blk East 8th	0	0	0	26	0
804	848 East 6th	0	0	0	26	0
805	895 East 15th	0	0	0	26	0
806	259 East 26th	0	0	0	26	0
807	1900 Blk Hamilton	0	0	0	27	0
808	980 West 1st	0	0	0	27	0
809	202-236 West 1st	0	0	0	27	0
810	472-474 East 1st	0	0	0	27	0
811	1050 Heywood	0	0	0	27	0
812	539 East 20th	0	0	0	27	0
813	1903 Rufus	0	0	0	27	0
814	2640 Tempe Knoll	0	0	0	27	0
815	42 Fell (Pump Station)	0	0	0	27	0
816	231 East 15th-LGH	0	0	0	26	0
817	2200 Blk St. Andrew's	0	0	0	26	0
818	755 Grand Blvd	0	0	0	26	0
819	304 West 24th	0	0	0	26	0
820	209 Moody	0	0	0	27	0
Total	**All Locations**	**0**	**0**	**0**	**530**	**0**

Table B-3: HPC Sampling Results - 2019

Station	Location	Minimum HPC (CFU/mL)	Average HPC (CFU/mL)	Maximum HPC (CFU/mL)	Sample Count	Samples Exceeding 500 CFU/mL
801	568 West 28th	0	0.42	4	26	0
802	1546 Jones	0	2.64	16	26	0
803	200 Blk East 8th	0	12.28	280	26	0
804	848 East 6th	0	0.68	6	26	0
805	895 East 15th	0	0.76	6	26	0
806	259 East 26th	0	1.16	26	26	0
807	1900 Blk Hamilton	0	8.12	180	27	0
808	980 West 1st	0	2.31	46	27	0
809	202-236 West 1st	0	0.81	8	27	0
810	472-474 East 1st	0	5.88	120	27	0
811	1050 Heywood	0	0.69	6	27	0
812	539 East 20th	0	0.31	2	27	0
813	1903 Rufus	0	0.15	2	27	0
814	2640 Tempe Knoll	0	0.35	2	27	0
815	42 Fell (Pump Station)	0	7.46	190	27	0
816	231 East 15th-LGH	0	3.92	16	26	0
817	2200 Blk St. Andrew's	0	0.76	8	26	0

Station	Location	Minimum HPC (CFU/mL)	Average HPC (CFU/mL)	Maximum HPC (CFU/mL)	Sample Count	Samples Exceeding 500 CFU/mL
818	755 Grand Blvd	0	0.36	4	26	0
819	304 West 24th	0	0.88	6	26	0
820	209 Moody	0	0.54	4	27	0
Total	**All Locations**	**0**	**4.16**	**1100**	**530**	**1**

It should be noted that one sample from Station 801 – 568 West 28th Street did not have results due to a reported Laboratory Accident, and results were not provided for any samples from December 2019 (total of 20).

Table B-4: Coliform Sampling Results - 2019

Station	Location	Minimum Coliform (MF/100mL)	Average Coliform (MF/100mL)	Maximum Coliform (MF/100mL)	Sample Count	Samples Exceeding 10 MF/100mL
801	568 West 28th	0	0	0	26	0
802	1546 Jones	0	0	0	26	0
803	200 Blk East 8th	0	0	0	26	0
804	848 East 6th	0	0	0	26	0
805	895 East 15th	0	0	0	26	0
806	259 East 26th	0	0	0	26	0
807	1900 Blk Hamilton	0	0	0	26	0
808	980 West 1st	0	0	0	26	0
809	202-236 West 1st	0	0	0	26	0
810	472-474 East 1st	0	0	0	26	0
811	1050 Heywood	0	0	0	26	0
812	539 East 20th	0	0	0	26	0
813	1903 Rufus	0	0	0	26	0
814	2640 Tempe Knoll	0	0	0	26	0
815	42 Fell (Pump Station)	0	0	0	26	0
816	231 East 15th-LGH	0	0	0	26	0
817	2200 Blk St. Andrew's	0	0	0	26	0
818	755 Grand Blvd	0	0	0	26	0
819	304 West 24th	0	0	0	26	0
820	209 Moody	0	0	0	26	0
Total	**All Locations**	**0**	**0**	**0**	**520**	**0**

Table B-5: Temperature Sampling Results - 2019

Station	Location	Minimum Temperature (ºC)	Average Temperature (ºC)	Maximum Temperature (ºC)	Sample Count	Samples Exceeding 15 ºC
801	568 West 28th	5	11.35	19	26	7
802	1546 Jones	4	10.74	18	26	4
803	200 Blk East 8th	4	10.35	18	26	4
804	848 East 6th	5	11.58	18.5	26	6

Station	Location	Minimum Temperature (ºC)	Average Temperature (ºC)	Maximum Temperature (ºC)	Sample Count	Samples Exceeding 15 ºC
805	895 East 15th	4	10.56	18	26	4
806	259 East 26th	3	9.81	17	26	4
807	1900 Blk Hamilton	3	11.00	18	27	7
808	980 West 1st	3.5	10.78	18.5	27	6
809	202-236 West 1st	3	9.81	18	27	3
810	472-474 East 1st	3	9.91	18	27	3
811	1050 Heywood	3.5	10.15	17	27	3
812	539 East 20th	5	11.41	18.5	27	7
813	1903 Rufus	3	9.74	17	27	3
814	2640 Tempe Knoll	4	11.12	18.5	27	6
815	42 Fell (Pump Station)	4	10.22	17	27	3
816	231 East 15th-LGH	3	9.44	17	26	3
817	2200 Blk St. Andrew's	3	8.98	16.5	26	2
818	755 Grand Blvd	3	9.56	17	26	3
819	304 West 24th	4	9.58	17	26	3
820	209 Moody	3	9.48	18	27	3
Total	**All Locations**	**3**	**10.04**	**19**	**530**	**84**

Table B-6: Turbidity Sampling Results - 2019

Station	Location	Minimum Turbidity (NTU)	Average Turbidity (NTU)	Maximum Turbidity (NTU)	Sample Count	Samples Exceeding 1 NTU
801	568 West 28th	0.11	0.27	1.8	26	1
802	1546 Jones	0.11	0.27	0.97	26	0
803	200 Blk East 8th	0.11	0.29	1.2	26	1
804	848 East 6th	0.1	0.17	0.35	26	0
805	895 East 15th	0.1	0.20	0.59	26	0
806	259 East 26th	0.11	0.19	0.37	26	0
807	1900 Blk Hamilton	0.11	0.41	2.3	27	2
808	980 West 1st	0.09	0.19	0.47	27	0
809	202-236 West 1st	0.1	0.24	1.3	27	1
810	472-474 East 1st	0.1	0.29	2.2	27	1
811	1050 Heywood	0.11	0.25	1.8	27	1
812	539 East 20th	0.13	0.27	1.4	27	1
813	1903 Rufus	0.09	0.19	0.72	27	0
814	2640 Tempe Knoll	0.12	0.24	0.58	27	0
815	42 Fell (Pump Station)	0.1	0.17	0.34	27	0
816	231 East 15th-LGH	0.1	0.20	0.72	26	0
817	2200 Blk St. Andrew's	0.1	0.16	0.25	26	0
818	755 Grand Blvd	0.11	0.24	0.65	26	0
819	304 West 24th	0.1	0.22	0.98	26	0
820	209 Moody	0.1	0.28	2.7	27	1
Source A	20th & Sutherland	0.06	0.22	0.67	26	0
Source B	29th & Regent	0.05	0.22	0.45	28	0
Source C	29th & Lonsdale	0.08	0.20	0.37	26	0

Source D	Westmoreland	0.09	0.25	0.71	27	0
Total	**All Locations**	**0**	**0.25**	**4**	**637**	**9**

The following analytical results are from the City's distribution system and include: disinfection by-products (DBPs) (Haloacetic Acids and Trihalomethanes), vinyl chloride, and metals. DBP is a term used to describe a group of organic and inorganic compounds formed during water disinfection. This monitoring is required under the Water Quality Monitoring and Reporting Plan for the GVRD and Member Municipalities.

The table below shows the current guidelines.

Table B-7: Drinking Water Quality Guidelines

Parameter	Guidelines for Canadian Drinking Water Quality
Total Trihalomethanes	100 µg/L (ppb) or 0.1 mg/L (ppm)
Total Haloacetic Acids (5)	80 µg/L (ppb) or 0.080 mg/L (ppm)
Vinyl Chloride	2 µg/L (ppb) or 0.002 mg/L (MAC)
Aluminium	200 µg/L (ppb) or 0.2 mg/L (AO)
Antimony	6 µg/L (ppb) or 0.006 mg/L (MAC)
Arsenic	10 µg/L (ppb) or 0.01 mg/L (MAC)
Barium	1000 µg/L (ppb) or 1.0 mg/L (MAC)
Boron	5000 µg/L (ppb) or 5.0 mg/L (MAC)
Cadmium	5 µg/L (ppb) or 0.005 mg/L (MAC)
Chromium	50 µg/L (ppb) or 0.05 mg/L (MAC)
Copper	≤1000 µg/L (ppb) or ≤1.0 mg/L (AO)
Iron	≤ 300 µg/L (ppb) or 0.3 mg/L (AO)
Lead	10 µg/L (ppb) or 0.01 mg/L (MAC)
Manganese	≤ 50 µg/L (ppb) or ≤0.05 mg/L (AO)
Mercury	1.0 µg/L (ppb) or 0.001 mg/L (MAC)
Selenium	50 µg/L (ppb) or 0.05 mg/L (MAC)
Sodium	≤ 200,000 µg/L (ppb) or 200 mg/L (AO)
Zinc	≤ 5000 µg/L (ppb) or 5 mg/L (AO)

(MAC) Maximum Acceptable Concentration (AO) Aesthetic Objective

The table on the next page contains the data from the analysis carried out each quarter for the individual compounds in each group of disinfection by-products. The standard for these compounds is based on the total amount of the group detected; therefore, the total for each group has been calculated for each site. The table also contains the quarterly running average results for total Trihalomethanes and total Haloacetic Acids for individual sites. Both results are within Canadian guideline limits.

Semi-annual vinyl chloride analysis is done where PVC pipe is used in the distribution system. Analysis was provided in the 2nd and 4th quarters for Station 814 in the Tempe Heights area. Both samples were within Canadian guideline limits.

Table B-8: Quarterly Disinfection By-Products Results – 2019

Station ID	Station Name	Period 2019	Total THMs µg/L (100 µg/L max acceptable)	Quarterly Average THMs (µg/L)	Total HAAs Acids µg/L (80 µg /L max acceptable)	Quarterly Average HAAs (µg/L)	Chloride Vinyl µg/L (2 µg/L max acceptable)
807	1900 Block Hamilton	1st Qtr	19	26	7.9	16.1	-
		2nd Qtr	32	26	20.1	16.2	-
		3rd Qtr	26	28	10.5	15.7	-
		4th Qtr	27	26	12.1	12.7	-
808	980 West 1st	1st Qtr	16	24	10	17.9	-
		2nd Qtr	29	25	21.4	18.5	-
		3rd Qtr	28	27	12.9	17.6	-
		4th Qtr	30	26	16.5	15.2	-
812	539 East 20th	1st Qtr	22	26	17.8	16.6	-
		2nd Qtr	32	28	24	18.4	-
		3rd Qtr	28	29	13.5	18.2	-
		4th Qtr	33	29	18.9	18.6	-
814	2640 Tempe Knoll	2nd Qtr	-	-	-	-	<0.00040
		4th Qtr	-	-	-	-	<0.00040

The maximum acceptable concentration (MAC) in the Canadian guidelines for total THMs is a location yearly running average of 100 ug/L based on quarterly samples.

Metals analysis is done semi-annually. Copper, iron, lead, and zinc are the parameters required under the Water Quality Monitoring and Reporting Plan, but since the method of analysis produces other metals results as well, they were also included. All the results were within the guidelines.

Table B-9: Metals Sampling Results – 2019

	Station 801 568 West 28th Street		Station 803 200 Block East 8th Street		Station 804 848 East 6th Street	
Date Collected	June 13th	December 12th	June 13th	December 12th	May 1	December 12th
Aluminum Total (µg/L)	23	20	25	22	26	22
Antimony Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Barium Total (µg/L)	2.6	3.2	2.5	3.1	2.6	3.2
Boron Total (µg/L)	<10	<10	<10	<10	<10	<10
Cadmium Total (µg/L)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total (µg/L)	4330	3070	4080	3150	4520	3190
Chromium Total (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cobalt Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper Total (µg/L)	3.2	4.7	1.8	2.5	3.5	2.4
Iron Total (µg/L)	27	171	19	84	11	17
Lead Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Magnesium Total (µg/L)	160	170	162	179	164	178
Manganese Total (µg/L)	3.1	3.2	3.8	3.9	2.4	1.3
Mercury Total (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Molybdenum Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Potassium Total (µg/L)	150	180	150	187	150	186
Selenium Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total (µg/L)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium Total (µg/L)	1490	1600	1490	1650	1480	1630
Zinc Total (µg/L)	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Appendix C: Water Sample Trends

Appendix C was added to the Water Quality Report in 2003 and provides a 5 year comparison of sampling results to help understand trends with regard to water quality. The appendix provides information for the six most recent years.

The table and chart statistics are based on the results from the six weekly sampling parameters taken for the water distribution system as a whole and do not separate the five different pressure zones within the City's system.

The tables present a summary of the weekly sampling station results, not including the high and low categories, for each of the last six years.

The six charts compare each year by sampling parameter with respect to the number of samples outside the target standards described in Appendix B.

Table C-1: Yearly Chlorine Sample Summary

Year	Average Chlorine (mg/L)	Sample Count	# Outside Guidelines	% Outside Guidelines
2013	0.542	633	68	10.74%
2014	0.496	624	63	10.10%
2015	0.603	622	25	4.02%
2016	0.633	625	7	1.12%
2017	0.586	624	5	0.80%
2018	0.616	625	3	0.48%
2019	0.60	530	7	1.32%

Table C-2: Yearly E. coli Sample Summary

Year	Average E. coli (MF/100mL)	Sample Count	# Outside Guidelines	% Outside Guidelines
2013	0	530	0	0.0%
2014	0	520	0	0.0%
2015	0	520	0	0.0%
2016	0	520	0	0.0%
2017	0	520	0	0.0%
2018	0	520	0	0.0%
2019	0	530	0	0.0%

Table C-3: Yearly HPC Sample Summary

Year	Average HPC (CFU/mL)	Sample Count	# Outside Guidelines	% Outside Guidelines
2013	7.44	510	0	0.00%
2014	4.27	500	2	0.40%
2015	1.01	499	0	0.00%
2016	0.73	499	0	0.00%
2017	0.37	490	0	0.00%

Year	Average HPC (CFU/mL)	Sample Count	# Outside Guidelines	% Outside Guidelines
2018	4.16	501	1	0.20%
2019	2.53	530	0	0.00%

Table C-4: Yearly Coliform Sample Summary

Year	Average Coliform (MF/100mL)	Sample Count	# Outside Guidelines	% Outside Guidelines
2013	0.0	530	0	0.0%
2014	0.00192	520	0	0.0%
2015	0.00577	520	0	0.0%
2016	0.00385	520	0	0.0%
2017	0.00962	520	0	0.0%
2018	0.0	520	0	0.0%
2019	0.0	530	0	0.0%

Table C-5: Yearly Temperature Sample Summary

Year	Average Temperature (°C)	Sample Count	# Outside Guidelines	% Outside Guidelines
2013	10.08	530	71	13.40%
2014	10.79	520	111	21.35%
2015	11.98	520	130	25.00%
2016	11.46	520	93	17.88%
2017	9.75	520	47	9.04%
2018	10.04	521	51	9.79%
2019	10.28	530	84	15.8%

Table C-6: Yearly Turbidity Sample Summary

Year	Average Turbidity (NTU)	Sample Count	# Outside Guidelines	% Outside Guidelines
2013	0.30	633	24	3.79%
2014	0.33	623	13	2.09%
2015	0.21	622	5	0.80%
2016	0.25	624	8	1.28%
2017	0.35	616	13	2.11%
2018	0.25	625	8	1.28%
2019	0.23	637	9	1.41%

Note: It should be recognized the sampling parameter averages are sometimes skewed by high values for a low number of samples outside of the guidelines.

Appendix D: Notification and Emergency Response Plan

1. Notification Requirements: for situations that may affect water portability.

Situation	Notifying Agency	Agency Notified	Time Frame For Notification
E. coli Positive Sample	GVWD	CNV and VCH	Immediate
Total Coliforms over 10/100mLs and no chlorine residual	GVWD	CNV	Immediate
Chemical Contamination	GVWD	CNV and VCH	Immediate
Chemical Contamination - Municipality	CNV	VCH GVWD and DNV	Immediate
Turbidity > 5 NTU	CNV/GVWD	CNV and VCH	Immediate
GVWD Disinfection Failure	GVWD	CNV and VCH	Immediate in any situation where water quality regulations may not be met.
Loss of Pressure Due to High Demand	CNV	GVWD Operations and VCH	Immediate
Main Break With Suspected Contamination	CNV	VCH	Immediate
Main Break With Potential Environmental Damage	CNV	MOE	Immediate

2. Response Plans:

[a] E.coli Positive Samples

If any interim samples have been taken from the site they will be examined by the lab. Interim samples are samples that may have been taken from the site in the period between when the E.coli positive sample was taken and when it was determined to be positive.

The chlorine residual noted on the sampler's field sheet will be reviewed by the lab and compared to previous readings to determine if there was a localized loss of disinfectant residual.

The Section Manager – Utilities (or designate) and the VCH will be notified immediately by the GVWD laboratory.

Arrangements will be made for the immediate collection of a repeat sample and, where possible, the collection of samples from upstream and downstream of the E.coli-positive sample location.

VCH will be contacted and the need for a “boil water” notice will be evaluated.

If a boil water notice is warranted, the public notification process as outlined in the Water Quality Monitoring and Reporting Plan for the GVWD and Member Municipalities will be followed. The boil water notice will be under the direction of Vancouver Coastal Health.

The lab will initiate the procedures necessary for the identification of E.coli with standard biochemical tests.

The lab will contact the CNV with consecutive negative sample results and the results of the species identification tests. The CNV will contact VCH to evaluate these results and to determine whether the advisory can be lifted.

[b] Chemical Contamination

In the event of chemical contamination in the water distribution system, VCH will be immediately notified. Immediate steps will be taken to isolate the contaminated area and the level of contamination will be determined through water sampling and testing. The chemical will be identified and any public health risk factors associated with the chemical presence will be determined. A public advisory will be carried out under the guidance of VCH.

[c] Turbidity Events

Turbidity in the water distribution system is monitored on a regular basis through the water sampling program. Water sampling results yielding readings > 1 NTU are scrutinized, along with corresponding free chlorine. Any sections of the water system generating high turbidity results will be field checked and flushed if necessary.

For turbidity sample results > 5 NTU, VCH will be immediately notified and an evaluation will be made for any necessary actions. The Source Water Turbidity Event procedures are noted below.

[d] GVWD Disinfection Failure

Upon notification by GVWD that an interruption in disinfection has occurred, the City will immediately commence more frequent monitoring of free chlorine residual levels at strategic locations. The monitoring frequency will be at the advice of the GVWD and VCH, and will continue until disinfection is resumed.

[e] Loss of Pressure

In the event of extreme pressure loss, the City will isolate the section or facility from the distribution system and supplement pressure to the affected area. The City will immediately consult with GVWD and VCH regarding further actions. All water quality complaints from the public will be immediately and thoroughly investigated for potential contamination.

[f] Water Main Break

For water main breaks where chemical or microbiological contamination of the system is suspected, the City will isolate the contaminated section from the rest of the distribution system. The City will immediately consult with VCH regarding further actions. All water quality complaints from the public will be immediately and thoroughly investigated for potential contamination.

Water samples will be taken from the vicinity of all water main breaks and tested for bacteria if contamination is suspected. The procedures outlined above in [b] will be implemented if necessary.

Emergency Management British Columbia will also be notified if a water main break results in potential harm to fish habitat (chlorine or siltation).

3. Follow Up

Following a return to normal after any of the above situations, an assessment will be made for the need to notify the affected public.

4. Response Protocol addition for part [c] Turbidity Events

The procedures below are from the Source Water Turbidity Communications Task Force and were endorsed by the REAC Water Subcommittee at its meeting on March 12th, 2008 and by the Medical Health Officers from the Vancouver Coastal and Fraser Health Authorities at a meeting on April 7th, 2008.

Metro Vancouver Communications Responsibilities

Requirement	Status	Comments
Notify Vancouver Coastal Health (VCH) as required under the Drinking Water Protection Act and provide timely updates to VCH and Fraser Health (FH) as required.	No change from current practice.	Vancouver Coastal Health is the Regulator of the Greater Vancouver District under the Drinking Water Protection Act.
Notify member municipalities and provide timely updates. Concurrent or advance notification is required when public messages are involved. Notify municipal Water Quality Contacts (or alternate as required) by phone (24/7) for extraordinary turbidity events.	There is an established practice to notify both operations and water quality contacts of municipalities.	The intent is to use telephone, email, pager or other means of communication as required until it is confirmed that the notification of an extraordinary event has been received by each municipality.
Maintain up-to-date phone and e-mail contact lists.	Updated on regular basis.	
For water quality issues related to the regional (GVWD) water system, take the lead in the development of public messages in advance by working with the Vancouver Coastal Health Authority (GVWD Regulator) and the Fraser Health Authority.		General guidelines for public messages for source water turbidity events are shown on page 4.
For water quality issues related to the regional (GWVD) water system, notify the general public by using appropriate means.	No change from current practice.	Metro Vancouver is responsible for broad public communications. Communications to specific groups is the responsibility of the municipalities and Health Authorities.
For extraordinary turbidity events, organize conference calls and invite municipalities to participate along with health authorities.	As required.	Highly effective way of coordinating response.
For extraordinary turbidity events, notify the BC Nurse Line.	New	Improved communication.
Answer calls from the public and refer calls to health authorities and specific municipalities as required.	No change from current practice.	
At the end of the event, provide information to the Health Authorities and affected municipalities that the situation has improved to the point where normal operations can be resumed.	New.	

Communications Responsibilities of Health Authorities

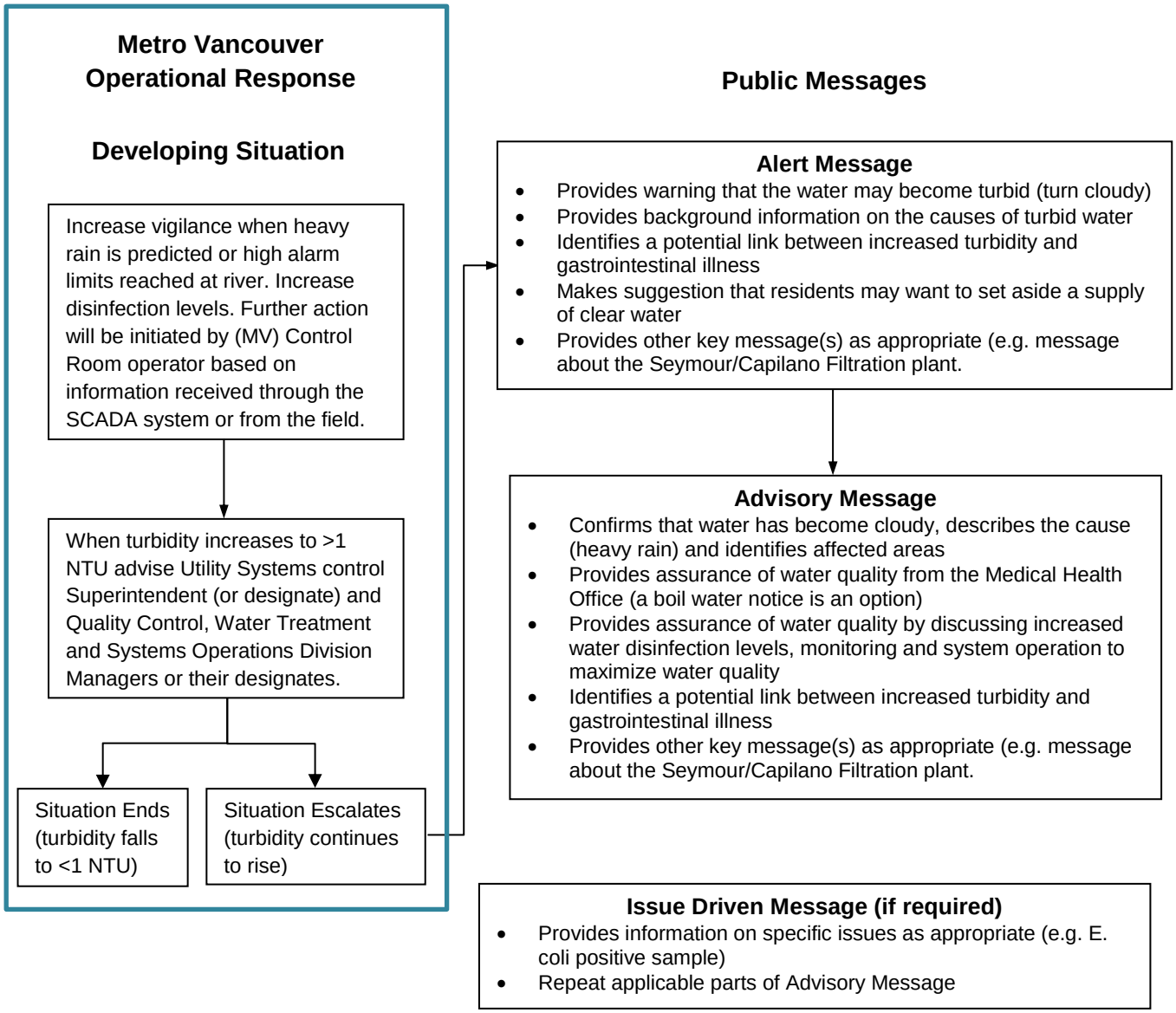
Requirement	Status	Comments
Regulatory issues.	Underway.	Working to ensure clarity and consistency of terminology.
Assist water suppliers with drafting answers to health-related questions from the public and with identifying communications responsibilities for specific groups.	New.	Will facilitate consistent and appropriate communication and messaging.
Refer regional water system operational questions to Metro Vancouver.	No change.	
Refer local water system questions to the appropriate municipality.	No change.	
Improve communication protocols between Vancouver Coastal and Fraser Health Authorities.	Underway.	For example, VCH and FH will harmonize their Question and Answer sheets for Turbidity.
As required, answer calls from the public and refer calls to Metro Vancouver and specific municipalities.	No change.	
Maintain up-to-date phone and email lists.	Updated on a regular basis.	
For extraordinary events, the VCH MHO will direct Metro Vancouver to organize and implement regular conference call. VCH and FH (if applicable) and all member municipalities should be invited to participate.	New.	Highly effective way of coordinating response.
Confirm to all participants that normal operations can be resumed and special communications efforts (e.g. web site messages etc.) can be ended.	New.	

Communications Responsibilities of Municipalities

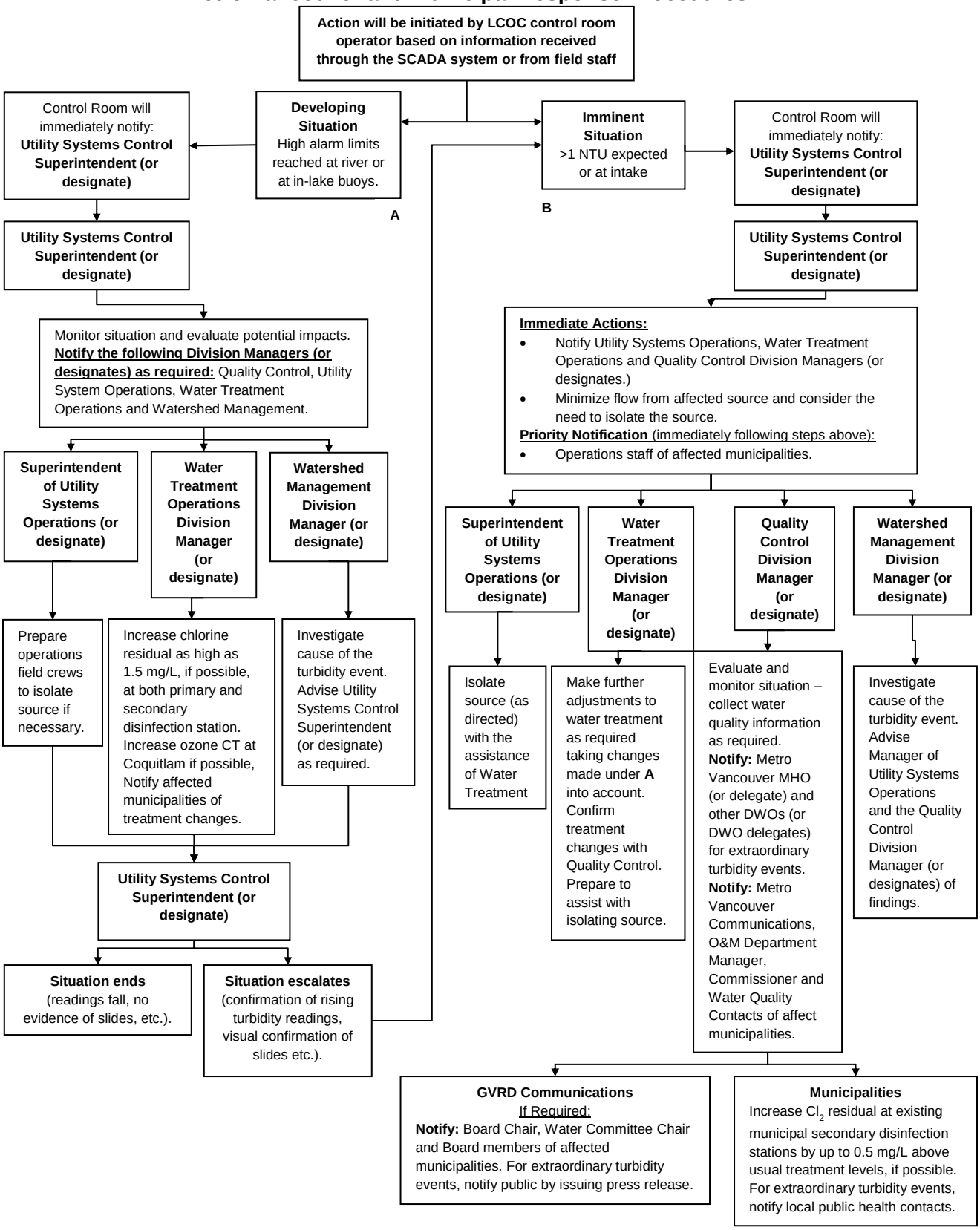
Requirement	Status	Comments
Municipalities must notify the appropriate health authority drinking water program staff of an extraordinary turbidity event (unless both parties participate in a conference call - the conference call will constitute notification).	No change.	Meets regulatory requirement.

Requirement	Status	Comments
Include customer notification as part of the municipal water supply plan. Consult with the healthy authority about notification responsibilities for specific groups.	Some municipalities have begun this work.	Will clarify customer notification processes.
Answer local calls and enquiries and refer calls to Metro Vancouver and health authorities as required.	No change.	
Maintain up-to-date phone and e-mail contact lists.	Updated on a regular basis.	
Respond to local issues.	No change form current practices.	
Develop answers to anticipated questions from consumers. For matters related to health, consult the health authority before finalizing messages which involve health issues. In consultation with the health authority, develop processes for referring callers with questions about clinical symptoms to health professionals.	Municipalities in various stages of the process.	Will improve ability of municipalities to respond to questions from the public.
Ensure that local messages are consistent with Metro Vancouver messages and refer regional water system operational issue to Metro Vancouver.	Municipalities in various stages of the process.	Will improve ability of municipalities to respond to questions from the public.
Based on information received from Metro Vancouver regarding the resumption of normal operations, inform the applicable health authority that normal operations can be resumed.	New.	

Guidelines for Source Water Turbidity Events



SOURCE WATER TURBIDITY EVENTS
Metro Vancouver and Municipal Response Procedures



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