

# Drinking Water Quality – 2015 Annual Report

APRIL 2016 | ENGINEERING, PARKS AND ENVIRONMENT



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# 1.0 SUMMARY

The City of North Vancouver's Drinking Water Quality Annual Report provides pertinent information about our drinking water and supports the City's application for the 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 (GVWD), the City continues to deliver safe, high-quality water to its residents. The City's Ten Year Plan continues to support the ongoing replacement of the 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 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

The GVWD (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.

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 program, testing all source water as well as samples collected by member municipalities from their distribution systems. The Greater Vancouver Water District Quality Control Annual Report provides a comprehensive report on water quality 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](http://www.metrovancouver.org)).

The City of North Vancouver is located between the two North Shore - Metro Vancouver source water reservoirs; consequently, it receives water from both sources. Predominately, water from the Seymour Watershed has been delivered to areas north of Keith Road from the Metro Vancouver source on Lynn Valley Road (CNV Pressure Zone 2). Source water to the western portion of this area is temporarily stored in the Metro Vancouver Greenwood Reservoir. The area south of Keith Road (CNV Pressure Zone 3) is primarily fed by the Metro Vancouver Capilano Main No. 7. Additionally, 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.

In the first half of 2015, Metro Vancouver completed commissioning of the Capilano-Seymour water tunnels, which now provide filtration of the Capilano Reservoir source water prior to distribution. This is a fundamental change to water quality management in the City, as the Capilano source water was often prone to turbidity events and widely varying chlorine concentrations.

## 3.0 DISTRIBUTION SYSTEM

### 3.1 General

The City of North Vancouver's water distribution system serves an estimated population of 54,300, along with an institutional, commercial, and industrial base that accounts for approximately 68% and 32% of the yearly water consumption respectively. There are 127 kilometres of pipe divided into four pressure zones with nine pressure reducing stations and over 7,100 service connections. Approximately 53% of the water main system is cast iron, 37% is ductile iron, 9% is PVC, and 1% is steel. The oldest pipes in the system were installed in 1911. Appendix A is a 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. In 2014, the City commissioned a continuous inline chlorine analyzer in the Westmoreland PRV chamber to provide real-time free chlorine, pH, and temperature data for source water supplied by Metro Vancouver.

The samples are tested for:

- chlorine residual
- bacteriological evidence (E.coli, HPC, coliform)
- temperature
- turbidity

Three sampling stations, No. 807 – 1904 Hamilton, No. 808 – 961 West 1<sup>st</sup> Street, and No. 812 – 533 East 12<sup>th</sup> Street are tested quarterly for Haloacetic Acids (HAA) and Trihalomethanes (THMs). Metals analysis is provided at three stations and vinyl chloride at one station. Metro Vancouver provides the testing and data summary services and alerts the City to any water quality problems.

Maximum acceptable concentration levels 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.

Appendix B provides a description of the sampling parameters, the allowable limits, and a detailed summary of the 2015 test results.

## 3.3 Results

### Chemical

Chlorine residual sampling results showed a system average at 0.59 mg/l, which is well above the 0.2 mg/l minimum standard. Of the 20 sampling stations, seven locations exhibited chlorine concentrations below the 0.2 mg/l criteria between 1 and 9 times, for a total of 25 instances out of 520 samples (4.8%).

Stations that had higher instances of low chlorine concentration include:

- Station No. 807 – 1904 Hamilton: 9 low concentration samples
- Station No. 812 – 533 East 20<sup>th</sup> Street: 7 low concentration samples

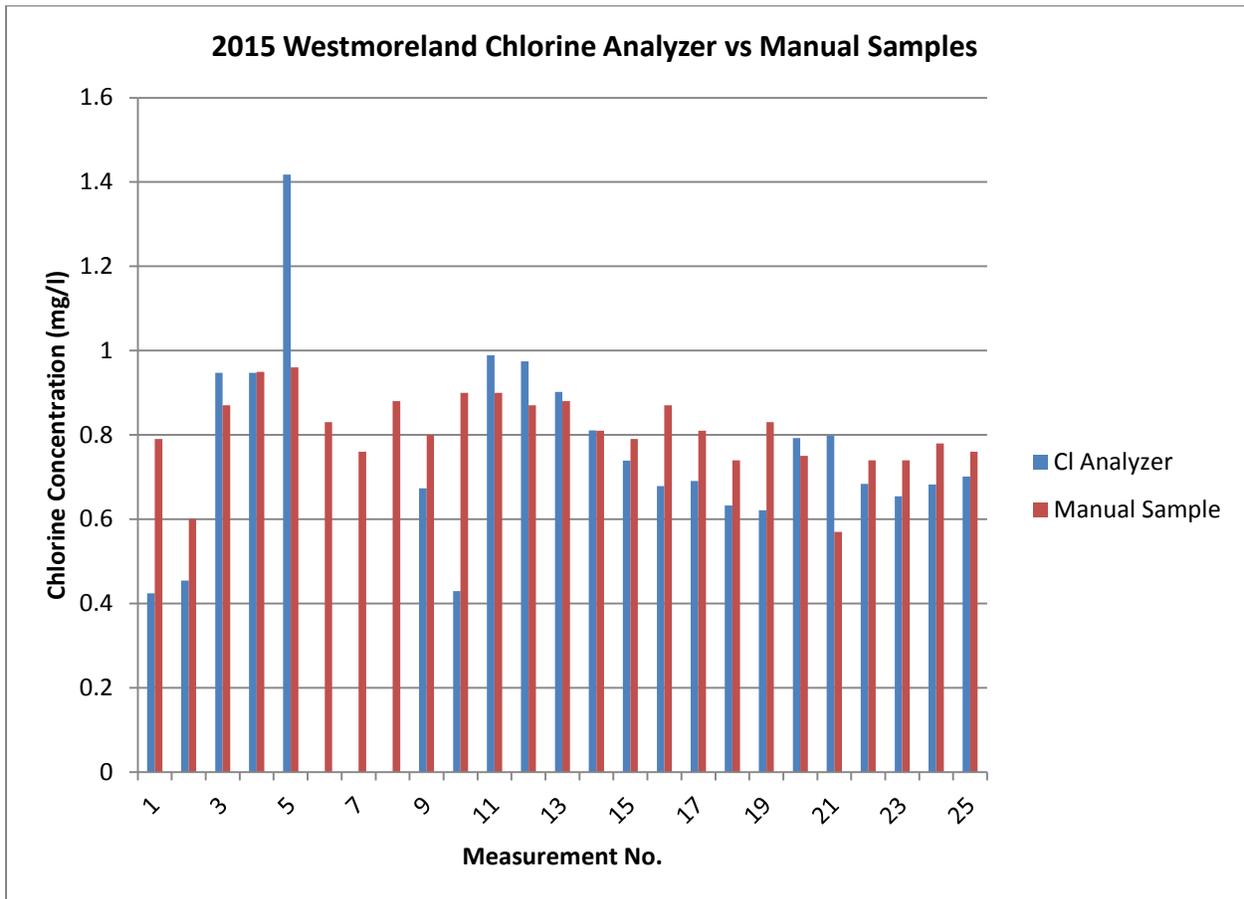
This is an improvement from 2014, where a total of 62 samples fell below the 0.2 mg/l threshold. In 2014, Station 807 and 812 had a total of 2 and 17 samples below guideline concentrations respectively. Large improvements were also made at Station No. 801 (550 West 28<sup>th</sup>) and 803 (264 East 9<sup>th</sup>), where in 2014 there was a total of 27 samples below guidelines and in 2015 only 2 per location. These improvements at Station Nos. 801 and 803 are largely due to some operational changes made in the fall of 2014 to increase water demands slightly in these areas at controlled locations. Due to water shortage response activities in the summer of 2015, the water quality operational measures were curtailed, as was general water use to conserve water, which may have resulted in decreased chlorine concentrations in that period.

1904 Hamilton Avenue is located in a quiet residential area north of Marine Drive and west of Fell Avenue. Water in this area is drawn from the 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. In 2015, the lower chlorine concentrations tended to be in the summer months and could be linked to regional water conservation efforts. The City plans to flush the water mains in this area in 2016 to improve chlorine longevity in the summer months.

533 East 20<sup>th</sup> Street is located in the Queensbury School neighbourhood, which is an area that receives water from the District of North Vancouver via the 29<sup>th</sup> 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 2015, the lower chlorine concentrations were all grouped between August 5<sup>th</sup> and November 25<sup>th</sup> and could have been due to operational decisions by the District of North Vancouver or water demands through that period.

A review of the chlorine analyzer at the Westmoreland source was conducted for 2015 and it was found that while the instrument generally agreed with the manual samples, the equipment is maintenance-intensive and results can be erroneous. The following chart shows 25 manual measurements made in 2015 and the corresponding daily average chlorine concentration. The majority of the values agree well, but there was a period between measurement 5 and 8 where values were likely erroneous or not recorded. Based on the review, operation of the chlorine

analyzer has been more reliable than in 2014, but early in the year the operational needs of the instrument were not met, which was likely due to overcommitted staff.



The City has set alarms for the chlorine analyzer since the period of no data to trigger early and more frequent maintenance. Since that time, there have been very few alarms and no substantial data gaps.

The chlorine analyzer at Westmoreland has been shown to provide reliable data if regular maintenance and calibration of the sensor are completed; however, the data has not been shown to provide a large value in terms of operations and the delivery of high-quality drinking water. Should another sensor be added to the system, the location and operational needs should be well justified given that the sensors require an ongoing maintenance commitment. Relocation of the current sensor may be more beneficial than the addition of a second unit.

### Bacteria

Bacteriological results for the 2015 testing year were that all E.coli and coliform tested below the guidelines. This is indicative of positive system-wide disinfection despite some lower chlorine residual concentrations.

## Physical

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 2015, water temperature exceeded the recommended value a total of 130 times out of 520 samples, or a total of 25% of the time. The peak station was Station No. 812 – 539 West 20<sup>th</sup> Street, which exceeded temperature values as much as 36% of the time. The lower instance of temperature samples testing above recommended values was 11% and occurred at Station No. 817 – 2200 Block St. Andrew's Avenue.

Turbidity is generally caused by rainfall events affecting the watersheds and is beyond the control of the City; it 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 also 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 2015, only five samples exceeded the recommended turbidity level of 1.0 NTU, for a total of 1% of the 520 samples, which is considered very low given the large percentage of cast iron water mains in the utility. These exceedances occurred at four stations throughout the City and could have been the result of any number of the above-mentioned operational conditions.

## Disinfection By-Products

Sampling for disinfection by-products, vinyl chloride, and metals were all within the Canadian Guidelines.

## 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 have been 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

2015 had a much higher average temperature during the summer months, which resulted in a significantly higher temperature in our water system and caused lower than usual chlorine residuals during that period.

## 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
Zone 1/5 - 785	Annually
Zone 2 - 632	Annually
Zone 3 - 601	Annually and some areas twice per year
Zone 4 - 385	Annually
Turbid Water Reports	As required

It should be noted that water main flushing activities in 2015 were heavily curtailed due to the regional water shortage response plan.

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 2015, a total of three water projects were constructed with a total length of 882 m of new water main. Due to the water shortage response plan, flushing and commissioning of the new water main on West 1<sup>st</sup> Street was delayed, which moved some capital work to 2016.

2015 Water Main Construction	2016 Water Main Construction
A. 300 Blk East 8 <sup>th</sup> (R) – 247 m	A. 400-500 East 8 <sup>th</sup> Street (R)
B. 800-900 Blk W 1 <sup>st</sup> Street (R) – 402 m	B. 4 <sup>th</sup> Street-Heywood to Kennard (R)
C. 100 Blk Hanes Avenue (R) – 233 m	C. 200 East 10 <sup>th</sup> Street (R)
D.	D. 29 <sup>th</sup> Regent to 793 East 29 <sup>th</sup> Street (R)
E.	E. Brooksbank: North of Cotton Dr. (R)
F.	F. 100 Block East Keith to 6 <sup>th</sup> (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.

## 4.0 SIGNIFICANT INCIDENTS

There were no incidents in the City's water distribution system that significantly compromised water quality in 2015. 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	Waterworks Supervisor	Water Distribution I&II Other trades related education		36 years
D. Price	Utility Tradesman	Tradesman Plumber	EOCP Water Distribution II	28 years
M. Trinkl	Utility Tradesman		EOCP Water Distribution II	26 years
D. Sherwood	Pipefitter		EOCP Water Distribution II	16 Years
W. Mason	Pipefitter	Tradesman Plumber	EOCP Water Distribution III	15 years
G. Stead	Irrigation System Worker	Cross Connection Control		27 years
T. Stefas	Pipefitter		EOCP Water Distribution I	9 years
T. Van Nes	Utility Crew		EOCP Water Distribution I	3 years
J. Siemens	Plumbing and Gas Inspector	Cross Connection Control Tradesman Plumber Hydronic Technician		13 years
Bryce Pollock	Plumbing and Gas Inspector	Cross Connection Control Tradesman Plumber Hydronic Technician		10 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 III distribution system, which includes staff with Level III certification. The City staff complement is knowledgeable, experienced, and eminently competent 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 in reality 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

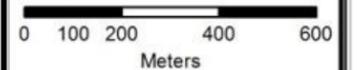
# Sampling Station Locations

## Legend

-  Sampling Stations
-  PRV Stations
-  By-Pass Meter
-  GVRD Meter
-  Zone Meter
-  Water pipe
-  City Border

## Pressure Zone

-  ZONE 1 (785 HGL)
-  ZONE 2 (601 HGL)
-  ZONE 3 (385 HGL)
-  ZONE 4 (632 HGL)
-  ZONE 5 (890 HGL)



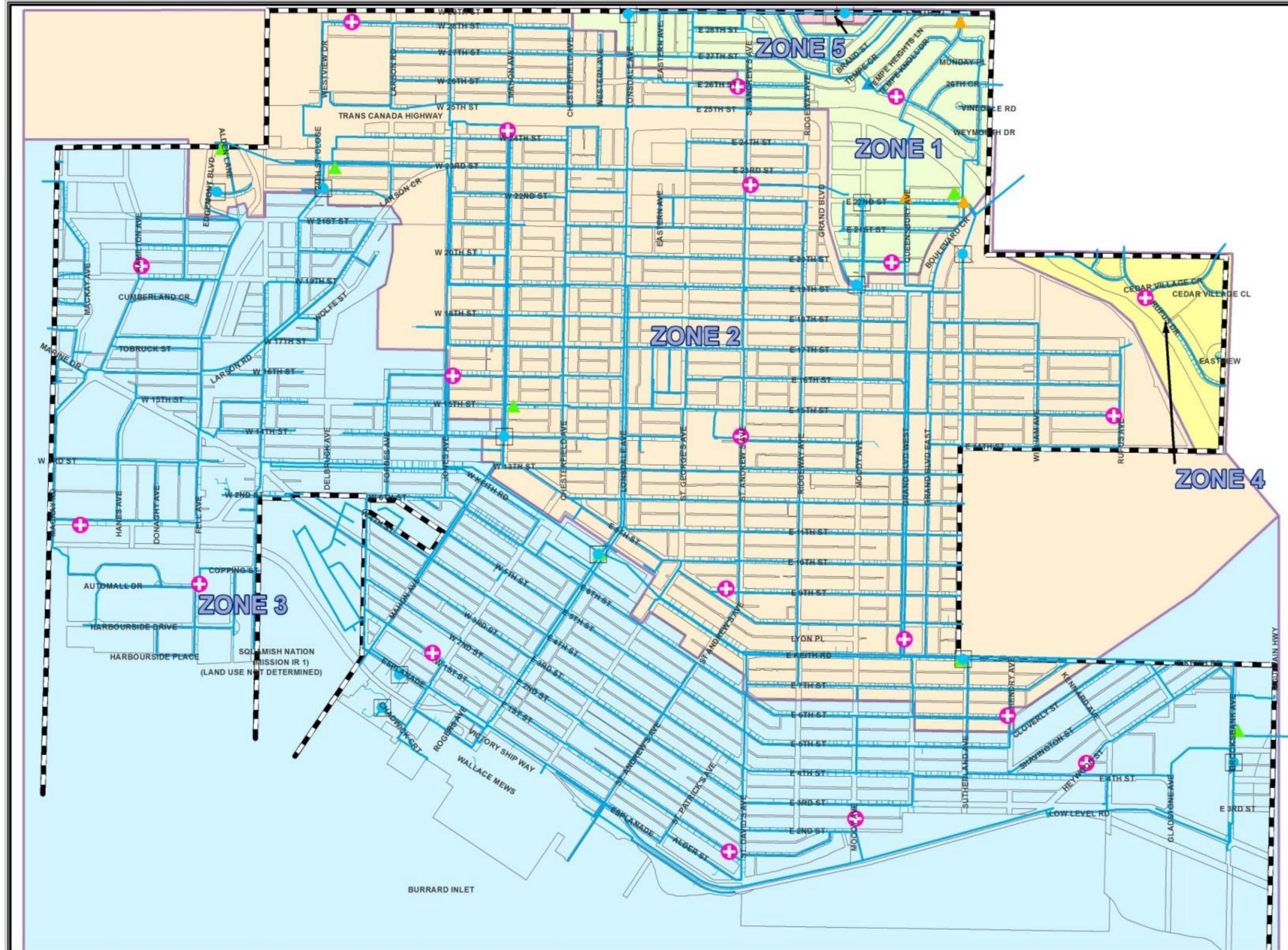
**DISCLAIMER**  
 This map was produced on the City of North Vancouver's Geographic Information System. Data provided herein is derived from sources with varying levels of accuracy and detail. The City of North Vancouver disclaims all responsibility for the accuracy or completeness of information contained herein.

GIS Division, Information Technology,  
 City of North Vancouver

PLOTTED: June 23, 2011  
 FILE: H:\CIV\_Maps\Engineering\Water\Utilities\PressureZones\_11x17.mxd  
 COORDINATE SYSTEM: NAD 83 UTM Zone 18



2011

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

City of North Vancouver - Water Sampling Locations																								
<b>Number</b>	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	<b>Source Samples</b>			
<b>Zone</b>	601	601	601	601	601	601	385	385	385	385	385	785	632	785	385	601	601	601	601	385	S	S	S	S
<b>Address</b>	568 West 28th	1546 Jones	200 Block East 8th	848 East 6th	895 East 15th	259 East 26th	1900 Block Hamilton	980 West 1st	202 - 236 West 1st	472 - 474 East 1st	1050 Heywood	539 West 20th	1903 Rufus	2640 Tempe Knoll	42 Fell	231 East 15th	2200 Block St. Andrew's	755 Grand Blvd.	304 West 24th	209 Moody	20th & Sutherland	Westmoreland	29th & Regent	29th & Lonsdale
<b>Flow</b>	B	A	B	C	B	B	B	B	A	B	B	C	B	C	B	A	A	A	B	B	S	S	S	S

Flow Description 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)

Sampling Station Work Program

In general the City distribution system is in sound condition and has a good water quality record. The water is supplied by the GVRD from the Capilano and Seymour watersheds through eight connections with meters. The system is not complex, comprising of 133,000 metres of water main in a basic grid format.

Sampling is done on Wednesdays. Each station is sampled on a bi-weekly basis and the GVRD provides the testing and data summary services.

## Appendix B: Water Sampling Parameters and 2015 Sampling Results

The following provides a simple description of the sampling parameters:

Sample Parameter	Sample Description	Guideline Limit
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CL2Free mg/L	Free Chlorine in milligrams per litre	Min 0.2
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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/100mLs	E.coli coliforms – Membrane Filtered per 100 millilitres	0
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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/mLs	Heterotrophic Plate Count – Colony Forming Units per milliliters	Max 500
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Aerobic heterotrophic plate count bacteria are a group useful in monitoring the effectiveness of disinfection and in assessing the changes in finished water quality during distribution and storage. The bacteria are measured in colony-forming units per milliliter.

Tcoli MF/100mLs	Total coliforms – Membrane Filtered per 100 millilitres	Max 10
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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 °C	Temperature – Degrees Celsius	Max 15
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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	Max 1
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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 and turbidity for the source water stations in 2015. The 29<sup>th</sup> and Lonsdale and 29<sup>th</sup> and 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.

2015 Metro Vancouver Source Water

<b>601</b> <b>20th/Sutherland</b>							<b>385</b> <b>Westmoreland</b>						
					<b># Outside</b>	<b>% Outside</b>					<b># Outside</b>	<b>% Outside</b>	
	<b>count</b>	<b>high</b>	<b>low</b>	<b>average</b>	<b>Guidelines</b>	<b>Guidelines</b>		<b>count</b>	<b>high</b>	<b>low</b>	<b>average</b>	<b>Guidelines</b>	<b>Guidelines</b>
<b>Free-CL2</b>	27	0.98	0.69	0.82	0	0%	<b>Free-CL2</b>	25	0.96	0.57	0.81	0	0%
<b>Turbidity</b>	27	0.38	0.06	0.17	0	0%	<b>Turbidity</b>	25	0.65	0.10	0.31	0	0%
<b>782</b> <b>29TH/Regent</b>							<b>782</b> <b>29th/Lonsdale</b>						
					<b># Outside</b>	<b>% Outside</b>						<b># Outside</b>	<b>% Outside</b>
	<b>count</b>	<b>high</b>	<b>low</b>	<b>average</b>	<b>Guidelines</b>	<b>Guidelines</b>		<b>count</b>	<b>high</b>	<b>low</b>	<b>average</b>	<b>Guidelines</b>	<b>Guidelines</b>
<b>Free-CL2</b>	25	0.76	0.33	0.57	0	0%	<b>Free-CL2</b>	25	0.71	0.20	0.50	0	0%
<b>Turbidity</b>	25	0.65	0.11	0.27	0	0%	<b>Turbidity</b>	25	0.58	0.11	0.25	0	0%

The tables on the next two pages summarize the sampling results for each of the 20 stations.

**Table 1: 2015: Zone 601**

801 601 568 West 28th						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.67	0.08	0.33	2	7%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	2.00	0.00	0.31	0	0%
Coliform	27	0.00	0.00	0.00	0	0%
Temp	27	20.00	6.00	12.27	8	30%
Turbidity	27	2.20	0.12	0.30	1	4%

806 601 259 East 26th						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.74	0.35	0.58	0	0%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	2.00	0.00	0.23	0	0%
Coliform	27	0.00	0.00	0.00	0	0%
Temp	27	18.00	5.50	11.00	5	19%
Turbidity	27	0.32	0.11	0.17	0	0%

802 601 1546 Jones						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.89	0.21	0.51	0	0%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	6.00	0.00	0.46	0	0%
Coliform	27	0.00	0.00	0.00	0	0%
Temp	27	20.00	6.00	12.04	8	30%
Turbidity	27	0.32	0.11	0.17	0	0%

816 601 231 East 15th-LGH						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.93	0.62	0.78	0	0%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	14.00	0.00	1.46	0	0%
Coliform	27	0.00	0.00	0.00	0	0%
Temp	27	18.00	5.00	10.58	4	15%
Turbidity	27	0.25	0.09	0.13	0	0%

803 601 200 Block East 8th						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.86	0.08	0.34	2	7%
EColi	27	0.00	0.00	0.00	0	0%
HPC	25	16.00	0.00	1.04	0	0%
Coliform	27	0.00	0.00	0.00	0	0%
Temp	27	20.00	6.00	12.34	8	30%
Turbidity	27	0.84	0.17	0.37	0	0%

817 601 2200 Block St. Andrew's						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.98	0.29	0.72	0	0%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	2.00	0.00	0.23	0	0%
Coliform	27	0.00	0.00	0.00	0	0%
Temp	27	17.00	4.50	9.99	3	11%
Turbidity	27	0.26	0.09	0.14	0	0%

804 601 848 East 6th						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.80	0.45	0.65	0	0%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	12.00	0.00	1.54	0	0%
Coliform	27	1.00	0.00	0.04	0	0%
Temp	27	21.00	7.00	13.03	9	33%
Turbidity	27	0.35	0.08	0.14	0	0%

818 601 755 Grand Blvd						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.99	0.44	0.78	0	0%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	6.00	0.00	0.46	0	0%
Coliform	27	0.00	0.00	0.00	0	0%
Temp	27	18.00	5.00	10.50	4	15%
Turbidity	27	0.29	0.08	0.13	0	0%

805 601 895 East 15th						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.77	0.32	0.58	0	0%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	4.00	0.00	0.46	0	0%
Coliform	27	1.00	0.00	0.04	0	0%
Temp	27	20.00	6.50	12.20	7	26%
Turbidity	27	0.51	0.12	0.26	0	0%

819 601 304 West 24th						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	27	0.84	0.60	0.72	0	0%
EColi	27	0.00	0.00	0.00	0	0%
HPC	26	2.00	0.00	0.23	0	0%
Coliform	27	0.00	0.00	0.00	0	0%
Temp	27	18.00	5.00	10.89	5	19%
Turbidity	27	0.25	0.10	0.14	0	0%

**Table 2: 2015: Zones 385, 632, 785**

807 385 1900 Block Hamilton						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.83	0.00	0.39	9	36%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	60.00	0.00	4.42	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	21.00	6.00	13.07	8	32%
Turbidity	25	1.70	0.08	0.41	1	4%

812 785 539 East 20th						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.49	0.02	0.26	7	28%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	18.00	0.00	1.08	0	0%
Coliform	25	1.00	0.00	0.04	0	0%
Temp	25	20.00	8.00	13.54	9	36%
Turbidity	25	0.44	0.13	0.18	0	0%

808 385 980 West 1st						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.81	0.36	0.66	0	0%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	24.00	0.00	4.25	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	22.00	7.00	13.33	8	32%
Turbidity	25	0.40	0.09	0.15	0	0%

813 632 1903 Rufus						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	1.00	0.68	0.79	0	0%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	2.00	0.00	0.25	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	18.00	6.00	11.72	6	24%
Turbidity	25	0.52	0.08	0.15	0	0%

809 385 202-236 West 1st						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.86	0.28	0.70	0	0%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	48.00	0.00	2.25	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	18.00	6.00	11.78	6	24%
Turbidity	25	1.20	0.08	0.22	1	4%

814 785 2640 Tempe Knoll						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.62	0.12	0.38	2	8%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	4.00	0.00	0.50	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	20.00	8.00	12.99	7	28%
Turbidity	25	0.62	0.12	0.21	0	0%

810 385 472-474 East 1st						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.80	0.06	0.57	2	8%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	2.00	0.00	0.25	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	20.00	6.00	12.88	8	32%
Turbidity	25	1.50	0.10	0.28	2	8%

815 385 42 Fell (Pump Station)						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.82	0.50	0.68	0	0%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	10.00	0.00	0.67	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	19.00	7.70	12.44	6	24%
Turbidity	25	0.55	0.09	0.15	0	0%

811 385 1050 Heywood						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.89	0.12	0.64	1	4%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	2.00	0.00	0.25	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	18.00	6.00	11.96	7	28%
Turbidity	25	0.46	0.08	0.16	0	0%

820 385 209 Moody						
	count	high	low	average	# outside guidelines	% outside guidelines
Free-CL2	25	0.92	0.48	0.68	0	0%
EColi	25	0.00	0.00	0.00	0	0%
HPC	24	2.00	0.00	0.08	0	0%
Coliform	25	0.00	0.00	0.00	0	0%
Temp	25	20.00	6.00	11.47	4	16%
Turbidity	25	0.92	0.08	0.20	0	0%

The following analytical results are from the City's distribution system and include: disinfection by-products (DBPs) (Haloacetic Acids and Trihalomethanes), metals, and vinyl chloride. 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.

<b>Parameter</b>	<b>Guidelines for Canadian Drinking Water</b>
Total Trihalomethanes	100 µg/L (ppb) or 0.1 mg/L (ppm)
Total Haloacetic Acids	80 µg/L (ppb) or 0.080 mg/L (ppm)
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)
Zinc	≤ 5000 µg/L (ppb) or ≤ 5.0 mg/L (AO)
Vinyl Chloride	2 µg/L (ppb) or 0.002 mg/L (MAC)

(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 2<sup>nd</sup> and 4<sup>th</sup> quarters for Station 814 in the Tempe Heights area. Both samples were within Canadian guideline limits.

## Quarterly Disinfection By-Products Results – 2015

Source	Period 2015	Total THMs Ppb (100 mg/L max acceptable)	Total HAAs Acids ppb (80 mg/L max acceptable)	Quarterly Average THMs ppb	Quarterly Average HAAs ppb	Chloride Vinyl ug/L (2mg/L max acceptable)
807	1 <sup>st</sup> Qtr	20.8	12.9	24	32	
	2 <sup>nd</sup> Qtr	25.6	16.3	23	25	
	3 <sup>rd</sup> Qtr	32.3	12.8	26	17	
	4 <sup>th</sup> Qtr	23.6	23.8	26	16	
808	1 <sup>st</sup> Qtr	24.2	23.2	28	37	
	2 <sup>nd</sup> Qtr	18.5	21.7	24	30	
	3 <sup>rd</sup> Qtr	31.5	24.9	25	24	
	4 <sup>th</sup> Qtr	22.7	24.9	24	24	
812	1 <sup>st</sup> Qtr	28.7	20.3	36	29	
	2 <sup>nd</sup> Qtr	25.8	19.3	33	24	
	3 <sup>rd</sup> Qtr	35.9	17.4	30	21	
	4 <sup>th</sup> Qtr	27.7	21.5	30	20	
814	2 <sup>nd</sup> Qtr					<0.0010
814	4 <sup>th</sup> Qtr					<0.0010

The maximum acceptable concentration (MAC) in the Canadian guidelines for TTHMs 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.

## Metals Sampling Results – 2015

Date Collected	Station 801 550 West 28th Street		Station 803 264-268 East 9th Street		Station 804 848 East 6th Street	
	1 <sup>st</sup> Half	2 <sup>nd</sup> Half	1 <sup>st</sup> Half	2 <sup>nd</sup> Half	1 <sup>st</sup> Half	2 <sup>nd</sup> Half
Aluminum Total ug/L	22	19	24	19	23	25
Antimony Total ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic Total ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Barium Total ug/L	2.9	3.8	2.8	3.7	2.9	3.9
Boron Total ug/L	<10	<10	<10	<10	<10	<10
Cadmium Total ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total ug/L	3310	4180	3270	4080	3340	4220
Chromium Total ug/L	0.08	0.20	0.09	0.18	0.05	0.20
Cobalt Total ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper Total ug/L	51.1	26.6	2.2	15.3	10.6	10.1
Iron Total ug/L	93	60	317	106	20	17
Lead Total ug/L	0.8	<0.5	<0.5	<0.5	<0.5	<0.5
Magnesium Total ug/L	163	205	165	208	166	211
Manganese Total ug/L	4.5	12.8	6.4	10.4	1.7	19.2
Mercury Total ug/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Molybdenum Total ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel Total ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Potassium ug/L	162	250	168	252	165	252
Selenium Total ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium Total ug/L	1500	1810	1490	1810	1480	1810
Zinc Total ug/L	7.7	<3	<3	<3	<3	<3

Parameter	<a href="#">Guidelines for Canadian Drinking Water</a>
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)
Zinc	≤ 5000 µg/L (ppb) or ≤ 5.0 mg/L (AO)

## Appendix C: Water Sample Trends

Appendix C was an addition to the Water Quality Report in 2003 and provides a year-to-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 four 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 acceptable limits for each category are listed in between the tables for comparison to the averages.

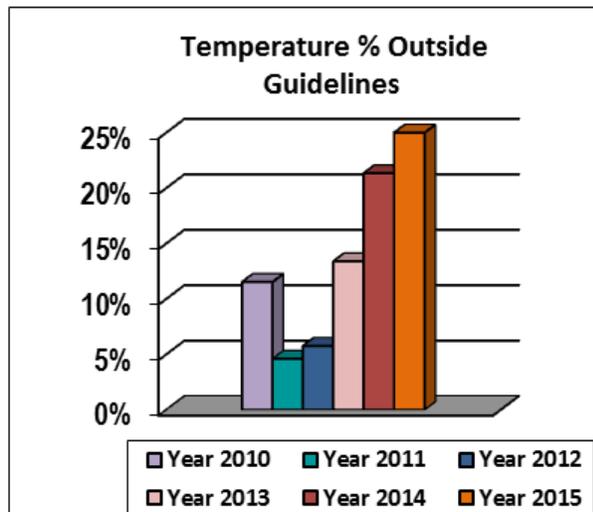
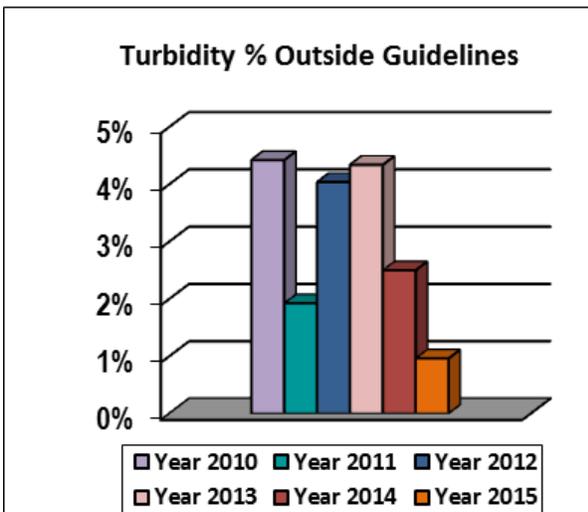
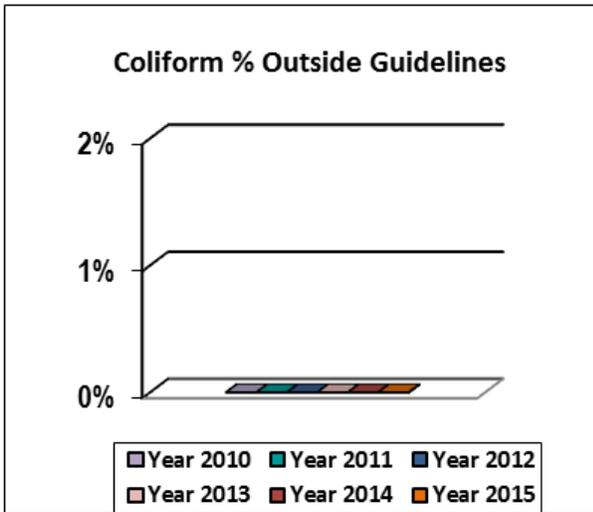
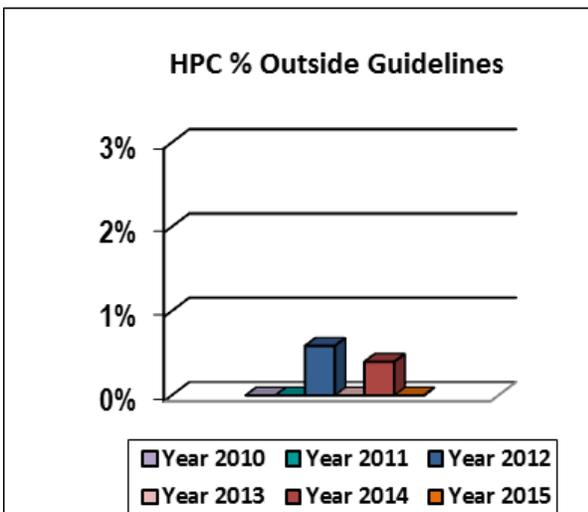
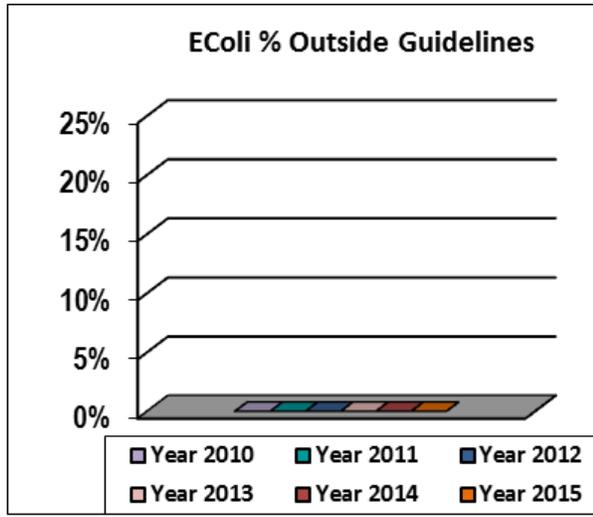
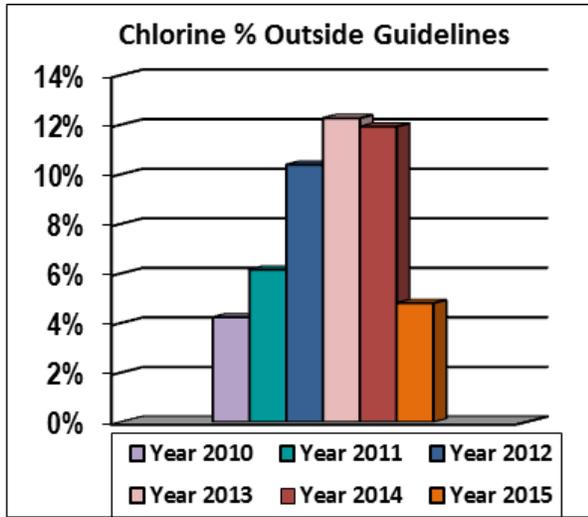
The six charts compare each sampling parameter by year with respect to the number of samples outside the target standards described in Appendix B.

**Tables: System Wide Summary of Weekly Samples**

#Outside % Outside					Max Guideline	#Outside % Outside				
Year	Count	Guidelines	Guidelines	Averages		Year	Count	Guidelines	Guidelines	Averages
Year 2010	520	22	4.23%	0.74	<.2	Year 2011	520	32	6.15%	0.59
Free-CL2	520	0	0.00%	0.00	>0	EColi	520	0	0.00%	0.00
HPC	508	0	0.00%	1.65	>500	HPC	508	0	0.00%	2.39
Coliform	520	0	0.00%	0.00	>10	Coliform	520	0	0.00%	0.00
Temp	520	60	11.54%	10.09	>15	Temp	520	24	4.62%	8.79
Turbidity	520	23	4.42%	0.37	>1	Turbidity	520	10	1.92%	0.24
#Outside % Outside					Max Guideline	#Outside % Outside				
Year	Count	Guidelines	Guidelines	Averages		Year	Count	Guidelines	Guidelines	Averages
Year 2012	520	54	10.38%	0.60	<.2	Year 2013	530	65	12.26%	0.53
Free-CL2	520	0	0.00%	0.00	>0	EColi	530	0	0.00%	0.00
HPC	509	3	0.59%	12.10	>500	HPC	510	0	0.00%	7.51
Coliform	520	0	0.00%	0.00	>10	Coliform	530	0	0.00%	0.00
Temp	520	30	5.77%	9.08	>15	Temp	530	71	13.40%	10.08
Turbidity	520	21	4.04%	0.47	>1	Turbidity	530	23	4.34%	0.29
#Outside % Outside					Max Guideline	#Outside % Outside				
Year	count	Guidelines	Guidelines	averages		Year	Count	Guidelines	Guidelines	Averages
Year 2014	520	62	11.92%	0.48	<.2	Year 2015	520	25	4.81%	0.59
Free-CL2	520	0	0.00%	0.00	>0	EColi	520	0	0.00%	0.00
HPC	500	2	0.40%	4.27	>500	HPC	499	0	0.00%	1.02
Coliform	520	0	0.00%	0.00	>10	Coliform	520	0	0.00%	0.01
Temp	520	111	21.35%	10.79	>15	Temp	520	130	25.00%	12.00
Turbidity	520	13	2.50%	0.34	>1	Turbidity	520	5	0.96%	0.20

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.

Charts: Comparison of the Annual Percentage of Samples Outside of the Guidelines for CNV Water System



## Appendix D: Notification and Emergency Response Plan

**1. Notification Requirements:** for situations that may affect water potability.

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 12<sup>th</sup>, 2008 and by the Medical Health Officers from the Vancouver Coastal and Fraser Health Authorities at a meeting on April 7<sup>th</sup>, 2008.

### Metro Vancouver Communications Responsibilities

<b>Requirement</b>	<b>Status</b>	<b>Comments</b>
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 Water 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 (GVWD) 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.

<b>Requirement</b>	<b>Status</b>	<b>Comments</b>
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**

<b>Requirement</b>	<b>Status</b>	<b>Comments</b>
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 e-mail contact lists.	Updated on a regular basis.	

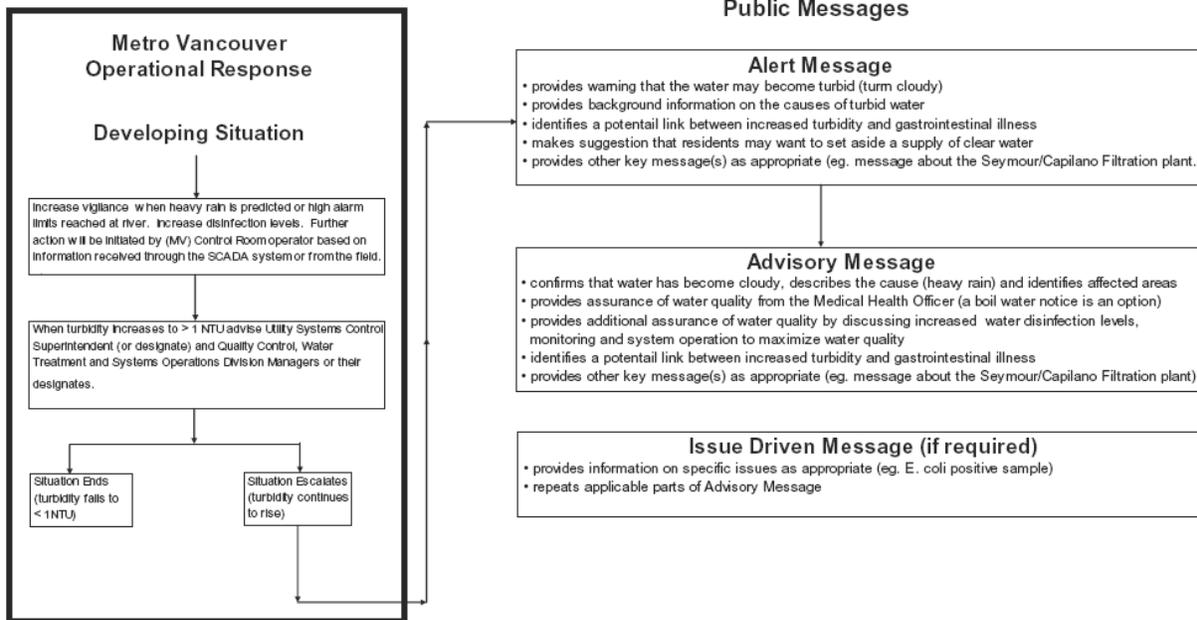
<b>Requirement</b>	<b>Status</b>	<b>Comments</b>
For extraordinary events, the VCH MHO will direct Metro Vancouver to organize and implement regular conference calls. VCH and FH (if applicable) and all member municipalities should be invited to participate.	New.	Highly effective way of coordinating response.
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**

<b>Requirement</b>	<b>Status</b>	<b>Comments</b>
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.
Include customer notification as part of the municipal water supply plan. Consult with the health 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 from 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 this process.	Will improve ability of municipalities to respond to questions from the public.

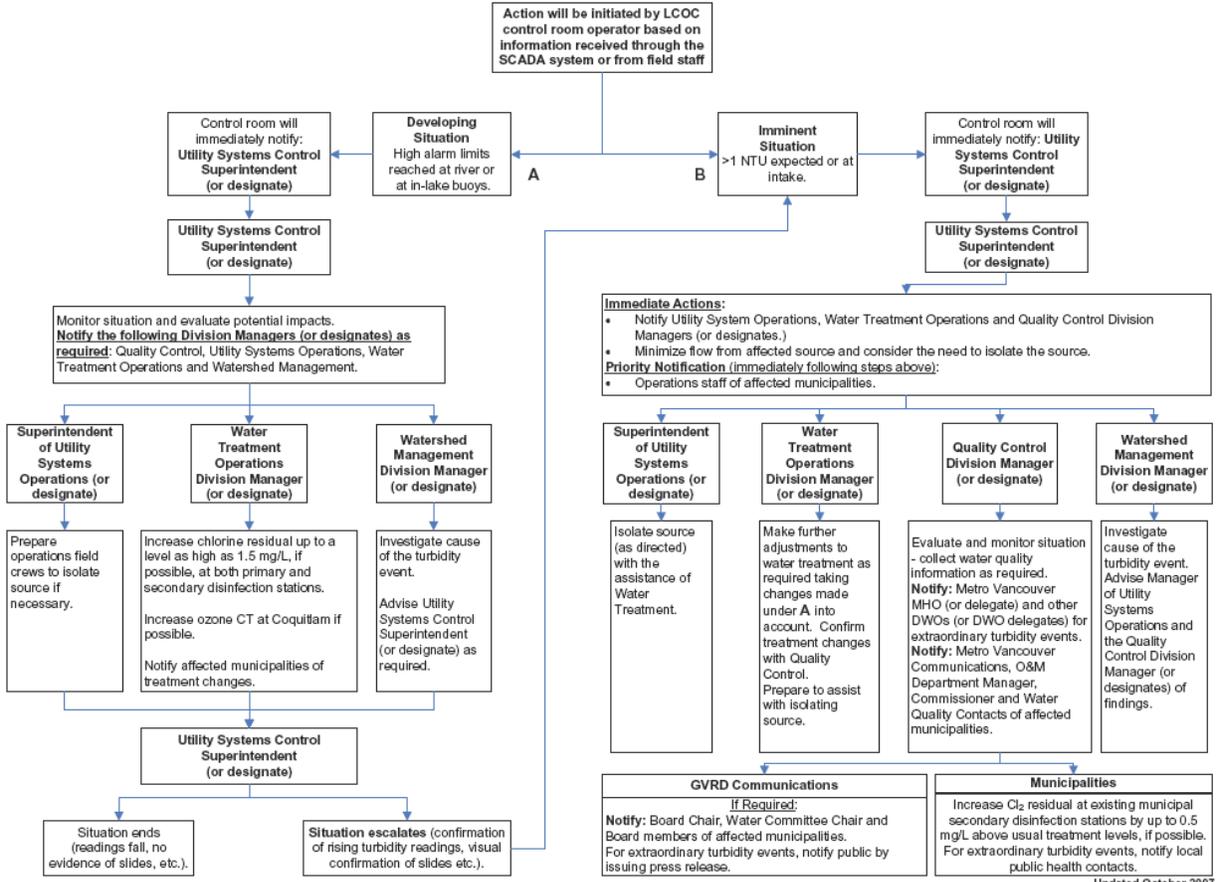
Requirement	Status	Comments
Ensure that local messages are consistent with Metro Vancouver messages and refer regional water system operational issues to Metro Vancouver.	Municipalities in various stages of this process.	Will improve ability of municipalities to respond to questions from the public.
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 Event Messages



# SOURCE WATER TURBIDITY EVENTS

## Metro Vancouver and Municipal Response Procedures



Updated October 2007