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The District of North Vancouver REPORT TO COUNCIL

September 4, 2015
File: 11.5600.50/003.000

AUTHOR: Shaun Carroll, P.Eng. Manager, Utilities.

SUBJECT: District of North Vancouver Drinking Water Quality Annual Report, 2014.

RECOMMENDATION:

That this report be received for information.

REASON FOR REPORT:

To inform Council on the status of drinking water quality in the District of North Vancouver (DNV) and to provide background information on the *District of North Vancouver Drinking Water Quality Annual Report – 2014*.

SUMMARY:

A summary of the 2014 Drinking Water Quality Annual report is provided below. A copy of the report and the letter acknowledging the report and review by the Vancouver Coastal Health Medical Health Officer (MHO) for the North Shore is attached.

- Beginning in 2001 the MHO requested formal annual water quality reports from the DNV.
- The DNV operates its waterworks system under a permit issued by the Ministry of Health Services. For many years DNV staff has worked with North Shore Vancouver Coastal Health to ensure the consistent delivery of high quality drinking water. Dr. Mark Lysyshyn, the current MHO for the North Shore Vancouver Coastal Health has been empowered through the B.C. Drinking Water Protection Act and Regulation to require permit holders to conduct testing, provide information and notify the public of drinking water quality issues.
- In 2014 the DNV distributed 18.3 million cubic meters of potable water purchased directly from the GVWD. Our water comes from two sources - the Capilano and the Seymour Reservoirs. The Capilano Reservoir was in service between May 28 and September 23 (99 days) during which time DNV received water from both the Capilano and the Seymour-Capilano Filtration Plant (SCFP). Outside of this time frame (246 days) water was delivered solely from the SCFP.
- In 2014 a total of 1352 regular water samples from 39 points in the DNV distribution network were collected and analysed tested in three categories:
 1. **Bacteriological** including total coliform, E. coli and Heterotrophic Plate Count (HPC)
 2. **Physical** including temperature and turbidity

3. **Chemical** including free Chlorine, Haloacetic acids (HAA), Trihalomethanes (TMH), pH and metals
- The Drinking Water Protection Act dictates the total number of sampling sites required based on population. The DNV uses the GVRD's Water Quality Monitoring Plan to determine sample location.
 - All bacteriological and chemical analysis results satisfied the requirements. Physical parameters results, temperature and turbidity deviated slightly from desired targets with no significant impact on overall quality. Temperature results were above the desired 15°C for 12% of the readings. Turbidity was above the target <1 or 'best possible' Nephelometric Turbidity Units (NTU) for 0.4% of the readings.
 - The MHO is pleased with the progress made over the past few years towards improving water quality for DNV residents. He has not identified any specific water quality issues requiring rectification and requests that we continue to provide public access to the report through the DNV website.

BACKGROUND:

The DNV receives all of its treated drinking water from the GVWD which is supplied through two sources; the Capilano Reservoir and the Seymour Reservoir via the Seymour-Capilano Filtration Plant (SCFP). The GVWD and its member municipalities have adopted a "multi-barrier" approach to reduce the risk of water borne infection. The main barriers are watershed protection, treatment, distribution system maintenance (to maintain chlorine residuals for the control of bacteria regrowth) and water quality monitoring. As of 2010, filtration, UV and chlorination were used to treat water supplied by the SCFP. Chlorine provides primary disinfection for protection against bacteria, waterborne parasites and viruses.

The SCFP, in operation since January 15, 2010, supplied water from the Seymour reservoir. The Capilano water was delivered to the SCFP as of January 15, 2015 when the tunnels connecting the Capilano and Seymour sources reservoirs were brought into service. 2014 was therefore the last year that DNV is expected to receive unfiltered water from the Capilano reservoir.

For many years the DNV has been working with the MHO and his staff to ensure the delivery of high quality drinking water. Beginning in 2001, the MHO requested formal annual water quality reports from each North Shore municipality for water quality data collected. The MHO has completed his annual review of our current municipal annual report and has forwarded a letter-report to DNV's Mayor and Council. The DNV's *Drinking Water Quality Annual Report – 2014 and related* MHO's letter to Mayor and Council is included with this report as Attachment 1.

EXISTING POLICY:

Amendments to the B.C. Drinking Water Protection Act came into force on May 16, 2003. The amendments included a new Drinking Water Protection Regulation, replacing the B.C. Safe Drinking Water Regulation. The Act and Regulation provides a more comprehensive framework for the protection of drinking water.

The GVRD published the 'Water Quality Monitoring and Reporting Plan for the GVRD and Member Municipalities' in 2006 which provides a template for monitoring and reporting.

In 2012 Health Canada published new water quality guidelines in the *Guidelines for Canadian Drinking Water Quality*. There were no significant updates from that release that impacted our municipal distribution system maintenance and operation.

Each member municipality of the GVWD is considered a water purveyor and must operate its waterworks system under a Permit to Operate issued by the Ministry of Health Services.

Submission of the Drinking Water Quality Annual Report is a condition of our Permit to Operate.

ANALYSIS:

A copy of the annual report is attached with highlights listed below.

Bacteriological Quality

- All samples met the bacteriological standards of the Regulation, which require 10 or less total coliform and no fecal coliform or *e-coli* per 100 millilitres of sample volume.

Physical Parameters

- **Turbidity:** Turbidity or cloudiness caused by fine sediment suspended in the water continued to be less of a challenge to the GVWD due to the SCFP. Only 0.4%, or five of the samples contained turbidity greater than 1 NTU. In 2013, 0.2% of the samples were greater than 1 NTU. Of the 5 samples greater than 1 NTU, one was over 5 and was caused as a direct result of scheduled water main construction and upon retesting was 0.1 NTU.
- The Capilano source was out of service for a total of 246 days in 2014 due to source water turbidity issues and operational preferences.
- **Temperature:** Samples from most sampling locations had average water temperatures above 15° C (the aesthetic objective) during July, August, September and October. Temperatures above 15° C can promote bacteria regrowth in the piping system. During the months in question the temperature of GVWD-supplied water depends mainly on the amount of snowmelt contributing to reservoir inflow.

Chemical Parameters

- All samples had free chlorine residuals at or above the desirable target of 0.2 mg/L (milligrams per litre). Free chlorine in the system continues to be consistently stable and greater than targets since the SCFP has come in operation. A graph of average free chlorine residuals for each sampling site is presented in Appendix A of the attached report.
- Disinfection by-products Haloacetic Acids (HAAs) and Trihalomethanes (THMs) remained at acceptable levels, less than 80 ppb (parts per billion) and 100 ppb respectively. The

running annual average for HAAs and THMs concentrations continue to be significantly lower than they were prior to the operation of the Seymour-Capilano filtration plant.

- Eight samples from four locations were analysed for 22 different metals as per the drinking water guidelines. Concentrations of all metals tested were less than the guideline limits. A complete list of metals and allowable guideline is provided in Table 2 of the attached report.

Operator Training and Certification

- The DNV currently has the appropriate levels of certified operating staff to remain in full compliance with the Drinking Water Protection Regulation.
- Province-wide discussions continue on the imposition of continuing education requirements on all certified operators by the Environmental Operators Certification Program, which is the agency designated by the Province to certify operators. The requirements have issues related to additional training expenses for operators or their employers, and of remuneration for employees who maintain their certified status. To date the GVRD Labour Relations department has not addressed the remuneration issue.

The Medical Health Officer Comments

- The MHO's letter commenting on 2014 report is attached. The MHO has not identified any specific water quality issues requiring rectification. He has suggested that the DNV notify residents to the presence of our annual report on our website.

Timing/Approval Process:

The Drinking Water Quality Annual Report is required to be submitted to Vancouver Coastal Health on June 30 of each year as a condition to operate. The report is jointly reviewed between DNV and Vancouver Coastal Health then acknowledged by the North Shore Medical Health officer to the Mayor and Council.

Financial Impacts:

There is the potential for additional water-related expenditures if changes in mandated monitoring procedures, recommended monitoring procedures, or physical system additions/modifications that would benefit water quality. We are not aware of any significant increase requirements and therefore expenditure related to.

Liability/Risk:

Chlorine residual in the distribution system is one of several "barriers" in place to ensure the safety of drinking water in the DNV. Although the risk of harm from our drinking water is very low, if efforts to provide adequate chlorine residuals are not continued and a serious outbreak occurs, the DNV could be in a position of liability. Continuous or recurrent high concentrations of disinfection by-products in drinking water can present long-term health risks as they are potential carcinogens. The MHO has not expressed any concern that current water quality results present any risks but he would urge the DNV to ensure that processes are in place to keep concentrations as low as possible while at the same time ensuring a chlorine residual adequate to assure water quality.

Social Policy Implications: The adequate supply of safe drinking water is a fundamental service that a community requires in order to ensure a high standard of public health.

Environmental Impact: High chlorine residuals can increase the risk of harm to fish and aquatic life if large quantities of drinking water are released to creeks during uncontrolled events such as watermain breaks.

Public Input: The public will continue to be advised of the status of the DNV's drinking water quality through the posting of the report on the DNV website.

Conclusion/ Options:
 Received for information.

Respectfully submitted,



Shaun Carroll, P.Eng.
 Manager, Utilities.

Attachments:
 DNV Drinking Water Quality Annual Report # 2600700
 Medical Health Officer acknowledgement # 2726452

REVIEWED WITH:		
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Office of the Medical Health Officer
Vancouver Coastal Health – North Shore
5th Floor, 132 West Esplanade Ave.
North Vancouver, BC V7M 1A2
Telephone: 604-983-6701
Facsimile: 604-983-6839

September 2, 2015

Mayor and Council
District of North Vancouver
355 West Queens Rd.
North Vancouver, B.C.
V7N 4N5

Dear Mayor and Council:

Re: District of North Vancouver - 2014 Annual Drinking Water Quality Report

The District of North Vancouver's 2014 annual drinking water quality report has been reviewed. The report highlights the continued progress made toward improving water quality for the residents of the District of North Vancouver. Data from the current in-line chlorine residual analyzer has proved helpful in providing information on chlorine residual levels in the distribution system. Ongoing staff education, preventative maintenance, and operational measures, should also aide in improving water quality for the residents.

In our continued effort to bring the annual drinking water report to residents' attention, please continue to provide information on the District's website along with other communications to residents.

Thank you for the report, and I look forward to our continued collaboration on improving drinking water quality in the District of North Vancouver.

Yours truly,

A handwritten signature in black ink, appearing to read "Mark Lysyshyn", is written over a light blue horizontal line.

Mark Lysyshyn, MD, MPH, FRCPC
Medical Health Officer, North Shore
Vancouver Coastal Health



**NORTH VANCOUVER
DISTRICT**

DRINKING WATER QUALITY ANNUAL REPORT

2014

June 2015

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APPENDICES

APPENDIX A

1. Map of Water System, Sampling Site Locations and Pressure Zones
2. List of Sampling Site Locations
3. 2014 Schedule for Sampling and Reporting

APPENDIX B

1. Graphs (39 total) - Water Quality Results by Sample Site, 2000, 2010 - 2014
2. Graph (2 total) - Average Chlorine Residuals for DNV Sampling Sites, 2000, 2010 - 2014

APPENDIX C

1. District of North Vancouver Response Procedures For Loss of Municipal System Integrity

A. INTRODUCTION

This report represents the fourteenth Drinking Water Quality Annual Report prepared by the District of North Vancouver (DNV) under the *Water Quality Monitoring and Reporting Plan For The GVRD and Member Municipalities*. The purpose of the report is to provide DNV water consumers with drinking water sampling test results for 2014, as well as to present background information on DNV and regional issues concerning water supply, treatment, and specific measures being taken to protect and enhance drinking water quality as per requirements under the Drinking Water Protection Act.

B. GENERAL DESCRIPTION

The DNV delivers potable water to its customers via a waterworks system incorporating approximately 364 km of watermains, 7 water pumping stations, 11 water storage reservoirs, and 36 pressure reducing stations. A population of approximately 88,000 is served through approximately 21,000 water connections.

In 2014, 18.3 million cubic metres of water was delivered to the DNV distribution system. All of this water was purchased from and delivered by the Greater Vancouver Water District (GVWD).

A map of the overall water system, showing pressure zones and water quality sampling site locations, is included in Appendix A.

C. SOURCE WATER

1. General

All drinking water supplied to customers in the DNV is surface water purchased and treated by the GVWD and is drawn from both the Capilano and Seymour reservoir sources. The GVWD tests untreated source water for pathogens including total coliforms and *E. coli*, giardia, and cryptosporidium. Source waters are also tested for general water chemistry, softness, turbidity, metals, and contaminants such as pesticides and organic compounds. For 2014, the GVWD used a combination of the Capilano Source and the new Seymour-Capilano Filtration Plant - SCFP (supplying filtered Seymour source waters) to the DNV. This is discussed in more detail in Section D. After treatment, but prior to transmission in GVWD watermains, the GVWD tests for total coliforms and *E. coli*, general water chemistry, turbidity, and metals.

Water quality information on these source waters, will be available from "*The Greater Vancouver Water District Quality Control Annual Report, 2014*".

2. Challenges

The Capilano source was only in service from May 28, 2014 to September 23rd, 2014 for a total of 119 days due mostly to operational preferences related to GVWD's ability to meet the demand using filtered water. The GVWD maintains a rigorous program of enhanced

2. Challenges

One of the regional Medical Health Officers' historic concerns was turbidity in the Capilano and Seymour source waters. The SCFP has greatly reduced the turbidity issue. Filtered Capilano water will not be available until 2015, however, Metro removed the Capilano source from service during the off-peak season in late fall, winter, and early spring when most turbidity events occur. This greatly reduced the risk of high turbidity in the DNV until the time that both water sources supplying the DNV are filtered.

3. Issues

GVWD supplies monthly plant performance and water quality data to Vancouver Coastal Health. To date there have been no issues as result of this process.

The GVWD continued moving ahead with the bringing the Seymour-Capilano Filtration Plant in service with a focus on the twin tunnel commissioning.

4. Proposed Work

The SCFP plant was completed in 2010, with planned overall project in-service date in April 2015.

DISTRIBUTION SYSTEM

5. General

The water distribution system is comprised of two separately operated networks; the GVWD water transmission mains and the DNV distribution system. For the purposes of water quality monitoring and reporting in the DNV, the locations where water is drawn from the GVWD transmission system into the DNV system are considered "sources" for the DNV system.

The document entitled "*Water Quality Monitoring And Reporting Plan For The GVRD and Member Municipalities – 2006*" (the Plan) provides a common template for all municipalities within Metro Vancouver (formerly the GVRD) to report annually on water quality results and issues. That document has been followed as closely as possible in the creation of this report.

A map of the overall water system, showing pressure zones and water quality sampling site locations, is included in Appendix A. Appendix A also includes a list of water quality sampling site locations and a schedule of sampling and reporting for 2014.

6. Testing

a. Bacteria

Sample collection for monitoring bacteria levels in the DNV water distribution system is performed twice-weekly by DNV Utilities personnel. Samples are delivered to the Metro Vancouver lab for analysis and reporting. Standard bacteriological parameters analysed by the Metro Vancouver lab are total coliform, *E. coli* and heterotrophic plate count (HPC). Standard testing for *E. coli* rather than fecal coliform was implemented in January 2006 in

sampling and reporting to continually monitor turbidity, bacteriology, and chlorine residuals in the region's drinking water.

3. Issues

The peak demand day for 2014 occurred on July 16, when 1.63 BL of water was delivered through the GVWD system. This was similar to the previous year's 1.61 BL peak day on July 24, 2013 and GVWD's and DNV's water delivery systems performed well, with no problems encountered.

4. Proposed Work

Commissioning of the tunnel system connecting the Capilano Reservoir with the SCFP near Rice Lake continued in 2014. The work will improve the intake hydraulics, allowing the Capilano reservoir to be drawn down to a lower elevation, which in turn will increase the reservoir's useable storage volume.

D. SOURCE WATER TREATMENT

1. General

Until December 2009 the GVWD's only form of treatment for both the Capilano and Seymour sources was primary disinfection using chlorine. As of January 15, 2010 all Seymour water supplied to the DNV has been filtered by the new Seymour-Capilano Filtration Plant. The plant site is located near Rice Lake in the Lower Seymour Conservation Reserve, with Capilano water conveyed to and from the site via twin tunnels bored deep in the bedrock between the Capilano reservoir and the plant. Metro continued the commissioning of the tunnels in 2014 with an in-service date scheduled for April 2015. The long term plan is to treat both sources, Capilano and Seymour, combine the treated water then supplies the combined sources from the Seymour-Capilano Filtration Plant (SCFP). In order to reduce the amount of chemicals used in water treatment as well as to provide additional protection against giardia and cryptosporidium, the treatment includes ultra-violet (UV) light for primary disinfection.

The Capilano source was off-line for 246 days in 2014, and as a result, all DNV customers received filtered water from SCFP during that time. When the Capilano source was in service (when the Capilano supply source is needed to satisfy regional seasonal water demands) only areas of the DNV east of approximately St. Georges Avenue received filtered water from Seymour. Due to the lower turbidity levels, lower amounts of chlorine were required to maintain chlorine residual that remained higher in the system for longer than for prefiltration.

The GVWD tests treated water for total coliforms and *E. coli*, general water chemistry, turbidity and metals prior to transmission in GVWD watermains.

Water quality information on treated water, will be available from "*The Greater Vancouver Water District Quality Control Annual Report, 2014*".

There are no secondary chlorination stations in the DNV.

accordance with a 2005 amendment to the *BC Drinking Water Protection Regulation* (the Regulation). The sampling locations are listed in Appendix A.

Approximately 13 samples are collected twice each week for a total of 26 samples per week. These are collected on a rotational basis from 3 groupings of 13 sampling sites (39 sampling sites in all), with each grouping comprised of sampling site locations that are widely distributed across the District.

In addition, samples may be taken from areas where water quality complaints have originated or where waterworks construction or maintenance activities are underway. In 2014 a total of twenty two (22) of these additional samples were collected and tested.

Locations of water quality sampling points in the DNV system are based on a guideline provided by the regional Medical Health Officers as follows:

- i. 10% of sampling points at "source" (supply points off GVWD transmission mains)
- ii. 40% of sampling points at locations with medium flow
- iii. 40% of sampling points at locations with low flow
- iv. 10% of sampling points at system dead-ends (very low flow)

Sampling frequency for presence of bacteria was completed in accordance with the Plan and the Regulation in 2014, with an average of 110 samples per month collected.

A graph showing the number of samples collected and analysed per month in 2014 is included in Appendix B. Appendix B also contains graphs showing the 2014 coliform and *E. coli* test results as well as the 2014 HPC test results.

b. Physical Parameters

Drinking water in the distribution system is tested for turbidity and temperature when bacteriological lab testing is carried out by the GVRD lab. Taste, odour and turbidity are monitored on a complaint basis and comprise the majority of water quality complaints.

c. Chemical Parameters

In 2014, chemical monitoring in the water distribution system was conducted for the following:

- i. Free chlorine residual – measured at all sampling sites when bacteriological samples are collected
- ii. Haloacetic acids (HAA's) – HAA's are disinfection by-products sampled from 4 selected sampling sites and tested by the Metro Vancouver lab. In 2014, 4 separate tests were carried out for each of the 4 selected sites for a total of 16 tested samples in total.

- iii. Trihalomethanes (THM's) – THM's are disinfection by-products sampled with HAA's. . In 2014, 4 separate tests were carried out for each of the 4 selected sites for a total of 16 tested samples in total.
- iv. pH – measured on samples collected at one of the sample sites for HAA/THM testing
- v. Metals – during 2001, the regional Medical Health Officers developed a strategy for sampling metals “at the tap”. The requirement is to sample 10% of the sample sites twice yearly for lead, copper and zinc, with sample locations consisting of a mixture of private homes and public buildings, including schools. In 2014, the required total of eight samples was collected.

No testing for PAH's (polynuclear aromatic hydrocarbons) or BETX (benzene, ethylbenzene, toluene, xylene) was conducted. These are compounds associated with pipe wall lining materials in steel watermains, and usually they can only be detected in watermains newer in age than approximately five years. The newest lined steel watermain in the DNV was constructed in 1969. Since there are no significant lengths of PVC watermain in the DNV, no testing was performed for vinyl chloride.

7. Results

Test results for bacteria, turbidity, and chlorine residual are compiled for each sample site in Appendix B. The data for each site for the years 2000 (included as the “baseline” year for comparison) and 2011 through 2014 are presented in graphs to more clearly indicate trends over this period.

a. Bacteria

Bacteriological standards in water distribution systems should meet the requirements of the *BC Drinking Water Protection Regulation*, which stipulates the following criteria for sample tests results:

- i. *E. coli* – no detectable *E. coli* / 100 mL
- ii. Total Coliform – 10 or less total coliform / 100 mL
- iii. Total Coliform - 90% or more of the samples for a given month must have no detectable total coliform / 100 mL
- iv. HPC – Currently no maximum acceptable concentration limit. Increases in HPC concentrations above baseline levels are considered undesirable. Historic limits were set at 500 CFU/mL.

All samples collected in 2014 satisfied the bacteriological requirements of the *BC Drinking Water Protection Regulation*. All samples collected in 2014 were below the baseline HPC concentrations.

A graph of results of bacteriological testing for 2014 is included in Appendix B.

b. Physical Parameters

Water turbidity and temperature are measured for all samples collected for bacteriological testing and are reported in the overall microbiology test results from the Metro Vancouver lab. Turbidity test results are presented along with bacteriological results and chlorine residuals in the graphs for each sample site in Appendix B.

The Nephelometric Turbidity Unit (NTU) is used to test and record the turbidity in our water for all regularly collected samples. The target NTU is < 1 or “best possible”. Turbidity continues to be good in the DNV. In 2014 all but five (5) samples from five (5) different sites tested below 1 NTU. Only one site had an NTU >5 at 7.6, which when retested was 0.13. The cause for the high (7.6 NTU) reading was found to be a direct consequence of short term abnormally high water velocity resulting from approved construction related use.

During the months of June, July, August and September, October average water temperatures 159 readings at 27 different sample were above 15° C, which is the aesthetic objective.

c. Chemical Parameters

- i. **Free chlorine residual** – free chlorine residual results are provided with the bacteriological sample test results for each sample site in the graphs in Appendix B. Locations with low chlorine residuals (less than 0.2 mg/l) are discussed in Sub-section 5.
- ii. **Haloacetic acids (HAA's)** –In 2008 a new Canadian standard for HAA concentrations was established in the *Guidelines for Canadian Drinking Water Quality* (GCDWQ). The maximum acceptable concentration for HAA's is 80 ppb (based on a running annual average calculated with quarterly results for different locations within the system). None out of the sixteen quarterly average HAA's at all four locations tested on the DNV distribution system were above 80 ppb in 2014. This was discussed at Section 5. Issues. Sample test results for HAA's are shown in Table 1 below.
- iii. **Trihalomethanes (THM's)** – the *Guidelines for Canadian Drinking Water Quality* (GCDWQ) list a maximum acceptable concentration for THM's at 100 ppb (based on a running annual average calculated with quarterly results for different locations within the system). Quarterly average THM's for all four locations tested on the DNV distribution system were below 100 ppb in 2014. This was discussed at Section 5. Issues. Sample test results for THM's are shown in Table 1 below.

TABLE 1. 2014 DISINFECTION BYPRODUCT SAMPLING PROGRAM					
Sample	Date Sampled	THM (ppb)		HAA (ppb)	
		Total Trihalomethanes	Total THM Quarterly Average (Guideline Limit 100ppb/mL)	Total Haloacetic Acid	Total HAA Quarterly Average (Guideline Limit 80ppb/mL)
DNV-727	3/4/2014	15.8	16	24.2	24
	6/2/2014	18.7	17	12.4	18
	9/3/2014	23.3	19	21.2	19
	11/18/2014	22.5	20	24	20
DNV-733	3/4/2014	17.1	17	24.9	25
	6/2/2014	25.8	21	43.3	34
	9/3/2014	23	22	49.7	39
	11/18/2014	24.8	23	31.5	37
DNV-734	3/4/2014	18.6	30	28.4	33
	6/3/2014	<2	17	<3	20
	9/3/2014	27.1	18	53.7	28
	11/18/2014	25.6	18	29.9	29
DNV-736	3/4/2014	22.7		35.2	
	6/2/2014	35.3		45.1	
	9/3/2014	46.4	35	64.2	48
	11/18/2014	30.9	34	39.2	46

*MAC = Maximum Acceptable Concentration

**AE = Aesthetic Objective

- iv. **Metals** – A total of eight samples for metals, including copper, lead and zinc, were collected from four locations in 2014. Sample locations, results, and maximum limits are given in Table 2 below. All the metals tested were under the recommended maximum concentrations.

Table 2: 2014 METALS SAMPLE GUIDELINE LIMITS & RESULTS in µg/L

Parameter & Guideline Limit (µg/L)	Site ID	DNV-721		DNV-730		DNV-734		DNV-747	
	Site Description	2838 Panorama Dr.		Braemar Reservoir		1181 West 22nd		1231 Lennox St. PRV	
	Sample Date	6/3/2014 8:00	11/10/2014 7:50	6/3/2014 9:00	11/10/2014 10:45	6/3/2014 12:50	11/10/2014 13:25	6/3/2014 8:30	11/10/2014 9:15
	Sample Type	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
Aluminum Total	200 µg/L *	27	42	55	41	98	44	27	54
Antimony Total	6 µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic Total	10 µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Barium Total	1000 µg/L	3.2	3.6	2.8	3.2	2.4	3.1	2.9	3.2
Boron Total	5000 µg/L	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium Total	5 µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Calcium Total	none	3330	3830	2480	3460	1420	3360	3090	3400
Chromium Total	50 µg/L	0.07	<0.05	<0.05	<0.05	0.06	<0.05	0.07	<0.05
Cobalt Total	none	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper Total	1000 µg/L	3.3	3.8	1.9	5.0	10.7	9.6	<0.5	<0.5
Iron Total	≤ 300 µg/L	14	31	28	16	73	10	<5	<5
Lead Total	10 µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Magnesium Total	none	139	129	141	134	149	134	144	138
Manganese Total	≤ 50 µg/L	1.0	1.7	2.2	1.3	3.9	1.6	2.1	3.3
Mercury Total	1.0 µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Molybdenum Total	none	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel Total	none	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Potassium Total	none	145	161	141	161	141	159	145	155
Selenium Total	50 µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver Total	none	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium Total	≤ 200,000 µg/L	1270	1510	1460	1510	546	1500	1290	1500
Zinc Total	≤ 5000 µg/L	<3	<3	<3	3.6	<3	<3	<3	<3

* No health-based guideline for aluminium has been established in Canada, however where aluminium-based coagulants are used in water treatment plants, these operational guidelines should be targeted.

8. Challenges

Challenges facing the DNV in 2014 for maintaining good water quality in the distribution system were ensuring that water system maintenance and replacement programs have the greatest possible positive effect on maintaining good water quality, while at the same time achieving target levels for infrastructure repair and replacement.

Chlorine residual issues, generally related to flow from the Capilano Source during times of high turbidity, have been substantially reduced due to GVWD's operational strategy of the two sources and the performance of the SCFP plant.

9. Issues

a. Chlorine Residuals

In October 2001, during a review of 2000 water quality data with the three North Shore municipalities, the Medical Health Officer for Vancouver Coastal Health (North Shore) determined that there were locations in all three North Shore municipalities where chlorine residual levels in the water distribution system were below a level that is desirable for the prevention of regrowth of bacteria in the piping system. Chlorine is added by the GVWD at the source to initially disinfect the water, but because of the elapsed time from adding chlorine to the time of water consumption, it may have dissipated (disappeared).

The Medical Health Officer has indicated that the minimum concentration for chlorine residual in the distribution system should be 0.2 mg/L free chlorine. All of the locations identified as having low chlorine residuals in 2001 had average chlorine residuals at or above 0.2 mg/L from 2002 to present.

In 2014 only one sample had chlorine residual concentrations below 0.2 mg/L. This occurred at the Prospect Pump Station on August 14 and was 0.15 mg/L.

Results from sample sites receiving filtered water from the new Seymour-Capilano Filtration Plant continue to show that chlorine residuals are lasting longer and residuals have improved at sites where historically residuals have been low. The average chlorine residual just downstream of the Seymour filtration plant was 0.71 mg/L (0.72 in 2013). The average system chlorine residual through the system in 2014 was 0.62 mg/L (0.64 in 2013). These results demonstrate that the level of chlorination continues to provide good chlorine residual levels throughout the water distribution system and on average Metro used less chlorine in 2014 than in 2012 to maintain good chlorine residuals in our system.

A comparison of chlorine residuals at DNV sampling sites for 2000 ("baseline" year) and 2011 through 2014 is included in Appendix B.

b. Disinfection By-Products

Ongoing monitoring of disinfection by-products has indicated that Haloacetic acids (HAA) levels in DNV water remain at acceptable levels. The running annual average levels of HAAs are now significantly lower than they were prior to the operation of the Seymour-Capilano filtration plant.

Trihalomethanes (THMs) also remain at acceptable levels. The running annual average levels of THMs in DNV water are now significantly lower than they were prior to the operation of the Seymour-Capilano filtration plant.

10. Work Program

a. Water Main Flushing 2014

The water main flushing program continued with an objective of delivering water with optimal chlorine residuals to all areas. Approximately 43,000 m, (about 12% of DNV's watermain network) of watermain cleaning was completed using the unidirectional flushing method. Areas flushed in 2014 include the L1, L1a and L2 pressure zones.

b. Water Main Replacement

The 2014 watermain replacement program accomplished the replacement of 4,945 metres of pipe including 1,285 meters or 26% cast iron pipe, which will improve water quality by replacing old unlined pipe with new cement mortar-lined ductile iron pipe. There were no water main extensions or additions in 2014.

Table 3 and 4 on the following pages lists the water mains replaced in 2014 and those proposed to be replaced in 2015.

Table 3. Water Main Replaced					
Street	From	To	Exist Pipe Material	New Pipe Material	New Pipe Length
Haverhill Place	Hoskins Road	1666 Haverhill Place	AC	DI	90
Ayleslynn Drive	Appin Road	1688 Ayleslynn Drive	AC	DI	120
E 29th Street	Lynn Valley Road	William Avenue	AC/CI	DI	735
Masefield Road	E 29th Street	Viney Road	AC	DI	110
Harbour Avenue	Main Street	Rupert Street	AC/CI	DI	230
Pierard Road	Westover Road	1694 Pierard Road	AC	DI	270
Roslyn Boulevard	Mt Seymour Parkway	Bakerview Drive	CI	DI	700
Byron Road	Berkley Road	Bronte Drive	AC	DI	120
Bronte Drive	Byron Road	Bronte Drive	AC	DI	240
Sarita Place	Sarita Avenue	5619 Sarita Place	CI	DI	85
Sarita Avenue	Prospect Avenue	Ranger Avenue	AC	DI	340
Cove Cliff Road	Lockhaven Road	Banbury Road	AC	DI	370
Duval Road	Draycott Road	Westover Road	AC	DI	260
Scott Road	Duval Road	1870 Scott Road	AC	Cu	45
Laing Drive	Philip Avenue	1515 Laing Drive	AC	DI	130
E Windsor Road	Saint Georges Avenue	Lonsdale Avenue	AC/CI	DI	300
Saint Marys Avenue	E Osborne Road	E Carisbrooke Road	AC	DI	65
Chamberlain Drive	Mountain Hwy	Symonds Road	AC	DI	185
E 29th Street	St Kilda Avenue	Regent Avenue	AC/CI	DI	200
Gladstone Avenue	Cloverley Street	Drayton Street	AC/CI	DI	350

The proposed water main replacement schedule for 2015 is provided in Table 4. Our plan included the replacement of 6,235 m of water main. In 2015 Metro Vancouver will be completing a replacement of their water main #4 that runs along on Capilano Road from the Cleveland Dam to Edgemont Boulevard, referred to the 'Metro Cap Main 9" project. The DNV has negotiated to have 2,480 m of DNV main replaced as part of the project. The balance of the water main replacement plan, 3,755 m will be performed by DNV construction.

STREET	FROM	TO	Length (m)	Material
W 15 Avenue (Philips - Tatlow)	1407 15TH ST	1691 15TH ST	277	WS
Norwood Avenue (Rockland - North)	3715 NORWOOD AVE	4193 NORWOOD AVE	305	AC/CI/ST
Ranger Avenue (Tudor - Ruskin)	4359 RANGER AVE	4422 RANGER AVE	218	AC
Burrill Avenue (East of Phyllis)	1856 BURRILL AVE	1898 BURRILL AVE	98	AC
Donegal Place	703 DONEGAL PL	798 DONEGAL PL	389	CI
Dovercourt Road (Mnt Hwy to Maginnis)	1308 DOVERCOURT RD	MAGINNIS AVE	253	AC/CI
Welligton Dr (Mnt Hwy - Maginnis)	1310 WELLINGTON DR	1456 WELLINGTON DR	245	AC
Maginnis Ave (Frederick to Wellington)	3618 MAGINNIS AVE	3692 MAGINNIS AVE	112	AC
Edgewood Road (Edgewood Pl - Sycmore)	1192 EDGEWOOD RD	SYCAMORE PL	325	CI
Lions Ave (Arundel - Tudor)	TUDOR	4396 ARUNDEL RD	135	CI
Philips Avenue (Woods - Paisley)	2700 PHILIPS AVE	PAISLEY RD	186	AC
Banbury (Reigburn - Naughton)	1907 BANBURY	2091 BANBURY	236	CI
Beaconsfield (Highland - Skyline)	944 BEACONSFIELD RD	977 BEACONSFIELD RD	180	CI
Essex (Lions - CDS)	990 ESSEX RD	954 ESSEX RD	140	CI
Forest Hills Dr (Glenview Crc - Fairmont Rd)	910 FOREST HILLS RD	805 FOREST HILLS RD	150	DI
Murdoe Frazer Park (Woods Rd)	ELIZABETH WAY	PEMBERTON	296	GA
Redwood Street (McBride - Pinewood)	MCBRIDE ST	1176 PINEWOOD CRC	210	CI
Capilano Main 9. (DNV main replace by Metro)	PROSPECT AVE	EDGEMONT BLVD	2152	AC/ST
Metro Cap Main 9. Include Teviot Pl	4628 TEVIOT PL	4590 TEVIOT PL	89	AC
Metro Cap Main 9. Include Riviere Pl	EDGEMONT RD	3712 RIVIERE PL	166	AC/GA
Metro Cap Main . Include Capilano Road	Cul de Sac	4585 CAPILANO ROAD	73	AC

E. INCIDENTS/SIGNIFICANT COMPLAINTS

There were no significant incidents or complaints in 2014.

F. GENERAL WATER ADVISORIES

In his November 23, 2001 report on drinking water quality in the DNV, the local Medical Health Officer requested that general drinking water advisories be published on a quarterly basis. In late 2011 the MHO agreed that there is no further need to advertise these advisories.

G. OPERATOR TRAINING/QUALIFICATIONS

The *BC Drinking Water Protection Regulation*, which came into effect on May 16, 2003, outlines qualification standards for water supply system operators. Water systems are to be classified by the Environmental Operators Certification Program (EOCP) based on the complexity of the system and the population served. System classifications range from Level 1 for the smallest, simplest systems to Level 4 for the largest, most complex systems. The chief "operator(s)" of

the system must be certified by the EOCP at a level matching the level of classification of the system.

In April 2004 the DNV received a Level 3 classification from the EOCP for its water distribution system. The DNV currently has two distribution system operators with Level 3 operator's certification from the EOCP, keeping the DNV in full compliance with the Regulation.

The DNV, in association with Metro Vancouver and its other member municipalities, has continued its efforts to obtain clarification from the EOCP and the Ministry of Health with respect to operator training, continuing education and certification requirements for all employees engaged in work on the water distribution system. Unfortunately, a process that had been established in 2007 to work through the issues with the EOCP has fallen behind schedule, although discussions continued in 2014. In addition, as a result of EOCP continuing education requirements for all certified operators, the issue of remuneration of employees for maintaining their certification status still exists. The DNV and other municipalities are attempting to resolve this issue through the Metro Vancouver labour classification system.

H. SECURITY MEASURES

There were no security threats to the DNV water system in 2014.

In 2001 international and local events brought increased attention to the security of water supply systems. In early 2001, incidents of tampering at water storage reservoirs (tanks) in other lower mainland municipalities prompted a complete review of security at DNV facilities.

All DNV water storage reservoirs consist of either steel or concrete tanks, and although existing security measures were sound, some improvements were considered to be necessary, including:

- Modifying and strengthening points of access
- Improved alarm capability
- Increased frequency of inspections and patrols
- Details and locations provided to RCMP for increased security surveillance
- Detailed incident-response procedures developed

Assessments of new technology and improved systems to protect DNV water supply facilities are ongoing.

NOTIFICATION AND EMERGENCY RESPONSE PLAN

1. Notification Requirements

Table 4 below outlines the notification process for unusual situations that could potentially affect water potability.

TABLE 4 NOTIFICATION FOR UNUSUAL SITUATIONS POTENTIALLY AFFECTING WATER QUALITY			
Situation	Notifying Agency	Agency Notified	Time Frame For Notification
<i>E. coli</i> -positive sample	M.V. Laboratory or BC Centre for Disease Control	DNV and Vancouver Coastal Health (North Shore)	Immediate
Total coliform over 10 mg/L and no free chlorine residual	DNV	Vancouver Coastal Health (North Shore)	Immediately upon receipt of sample test results
Chemical Contamination	DNV	Vancouver Coastal Health (North Shore)	Immediate
Turbidity > 5 NTU	M.V. Laboratory or GVWD Operations	DNV and Vancouver Coastal Health (North Shore)	Immediate
GVRD Disinfection failure	GVWD Operations	DNV and Vancouver Coastal Health (North Shore)	Immediate in any situation in which the BCSDWR or the GCDWQ may not be met
Loss of pressure due to high demand	DNV	GVWD Operations and Vancouver Coastal Health (North Shore)	Immediate
Watermain break where contamination is suspected	DNV	Vancouver Coastal Health (North Shore)	Immediate

2. Response Plans

The flow diagram in Appendix C illustrates the process that has been put in place for response to incidents that could potentially affect water quality.

a. E. coli-Positive Samples

If a sample analysed by the Metro Vancouver laboratory or the BC Centre for Disease Control tests positive for *E. coli*, the following response plan will be put into action.

E. coli-Positive Sample From DNV Water Distribution System

- i) Results of interim samples, if any, from the site will be examined by the lab. Interim samples are any 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.
- ii) 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 had been a localized loss of disinfectant residual.
- iii) The DNV Section Manager of Utilities Construction and Maintenance (SMUCM) or designate and Vancouver Coastal Health (North Shore) will be notified immediately by the laboratory.
- iv) Arrangements will be made for the immediate collection of a repeat sample (including, where possible, samples from upstream and downstream of the positive sample location).
- v) Vancouver Coastal Health (North Shore) will be contacted and the need for a "boil water" advisory will be evaluated.
- vi) If a "boil water" advisory is warranted, the public notification process as outlined in the *Water Quality Monitoring And Reporting Plan For The GVRD and Member Municipalities* will be followed.
- vii) The lab will contact the DNV with repeat sample results and the results of the species identification tests. The DNV will contact Vancouver Coastal Health (North Shore) to evaluate these results and to determine whether or not the advisory can be lifted.

b. Chemical Contamination

In the event of chemical contamination in the DNV water distribution system, Vancouver Coastal Health (North Shore) 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. Through consultation with Vancouver Coastal Health (North Shore), a public advisory will be carried out.

c. Turbidity Events

Turbidity in the DNV water distribution system is monitored on a regular basis through the water sampling program. Water sampling results yielding readings greater than 1 NTU are scrutinized, along with corresponding free chlorine. Any areas from which high turbidity results came will be re-sampled for chlorine residual and turbidity and flushed if necessary.

In 2007 a task force comprised of Metro Vancouver, Vancouver Coastal Health, Fraser Health and member municipalities developed a communications template for source water major turbidity events. The template outlines the responsibilities of Metro Vancouver, the Health Authorities, and municipalities for notification and communications to each other and the public.

d. GVRD Disinfection Failure

Upon notification by GVWD Operations that an interruption in disinfection has occurred, DNV Water Quality personnel will immediately commence monitoring free chlorine residual levels at strategic locations and will contact the Vancouver Coastal Health (North Shore) if continued loss of residual is observed.

e. Loss of Pressure Due to High Demand

In the event of adverse pressure loss due to high demand, DNV Utilities crews will make adjustments to the system to isolate the section or facility from the system and then take measures to supplement pressure in the affected area. The DNV will immediately consult with GVWD and Vancouver Coastal Health (North Shore) regarding further actions, and all water quality complaints from the public will be immediately and thoroughly investigated for potential contamination.

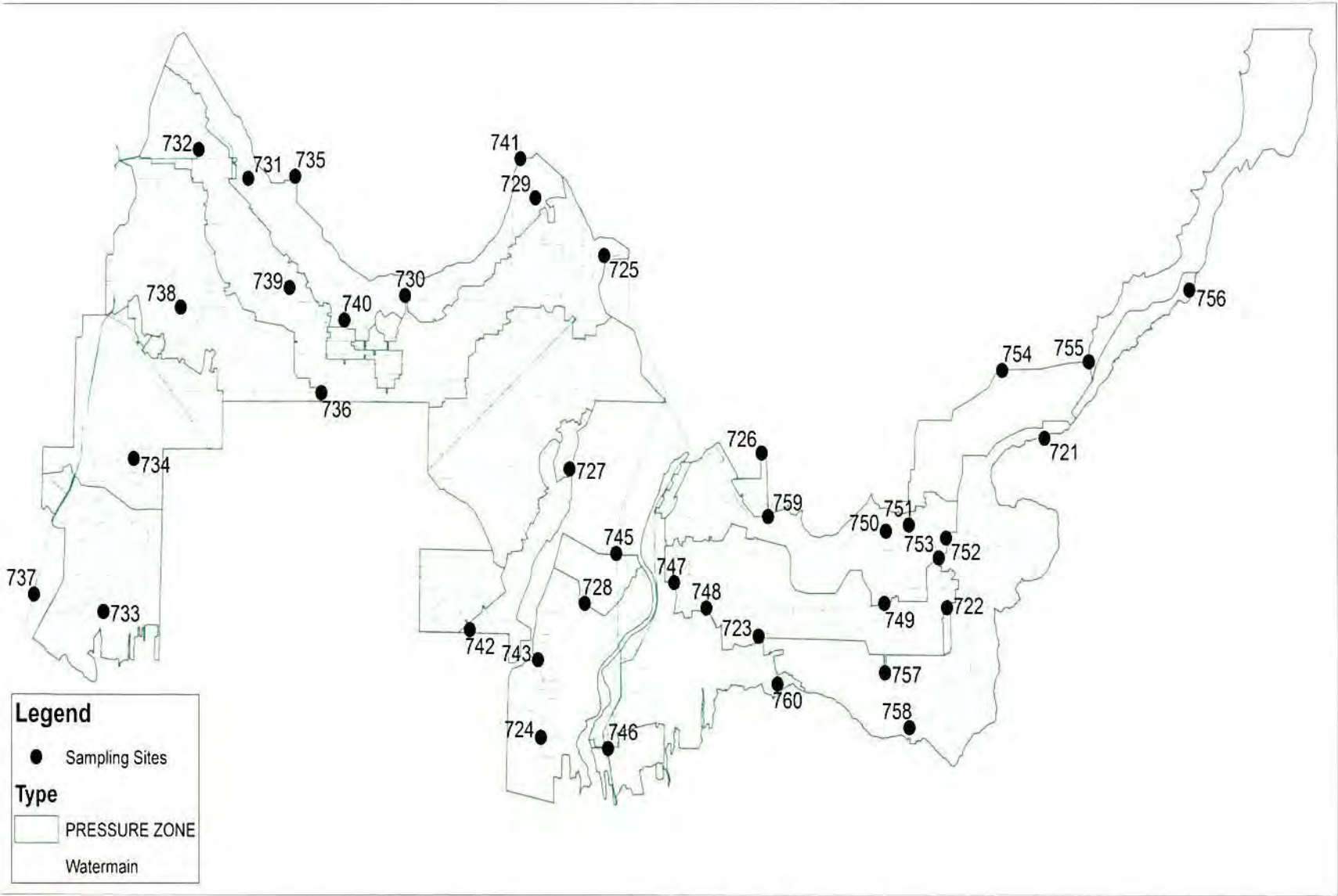
f. Watermain Break Where Contamination is Suspected

For watermain breaks where chemical or microbiological contamination of the system is suspected, DNV Utilities crews will make adjustments to the system to isolate the section or facility from the system. The DNV will immediately consult with Vancouver Coastal Health (North Shore) regarding further actions, and all water quality complaints from the public will be immediately and thoroughly investigated for potential contamination.

For all watermain breaks, water samples will be taken from the vicinity of the break and tested for bacteria. If chemical contamination is suspected, the procedures outlined in 2. Response Plans, b) chemical contamination, will be carried out.

APPENDIX A

1. Map of Water System, Sampling Site Locations and Pressure Zones
2. List of Sampling Site Locations
3. 2014 Schedule for Sampling and Reporting



Legend

- Sampling Sites

Type

- PRESSURE ZONE
- Watermain

List of Sampling Site Locations

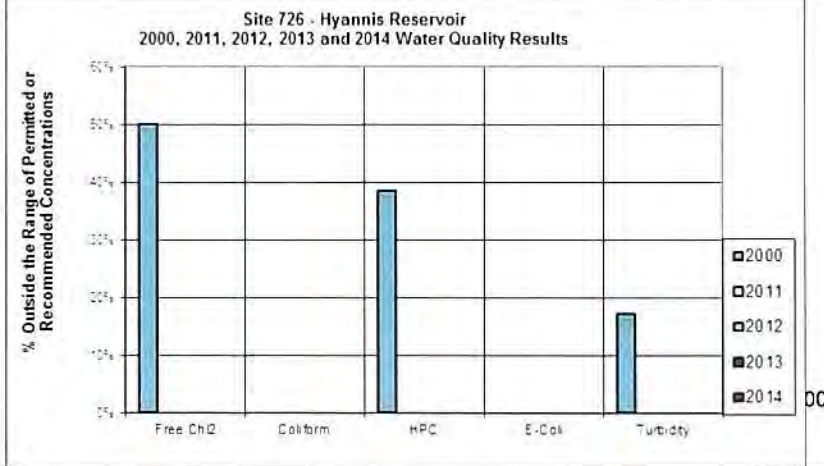
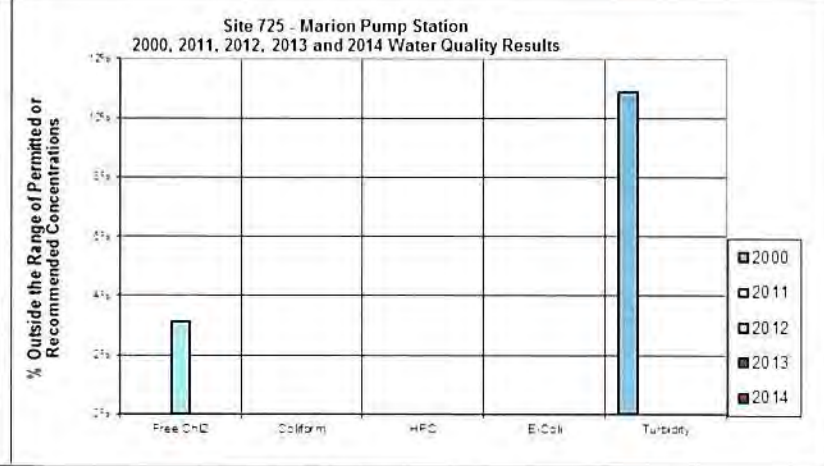
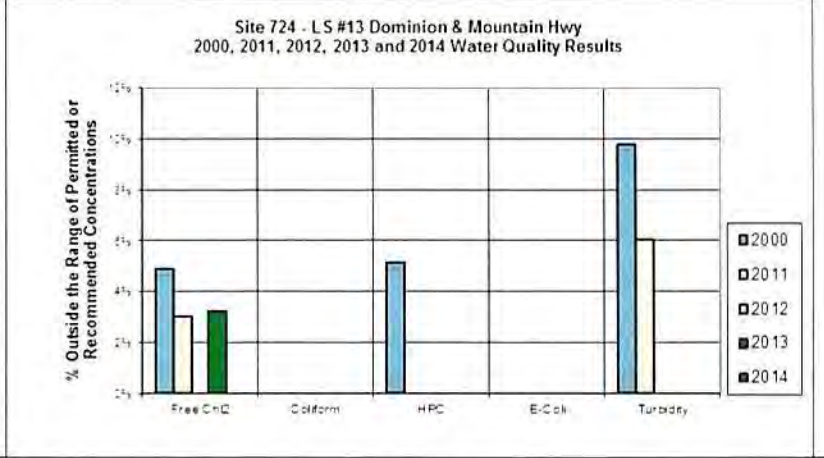
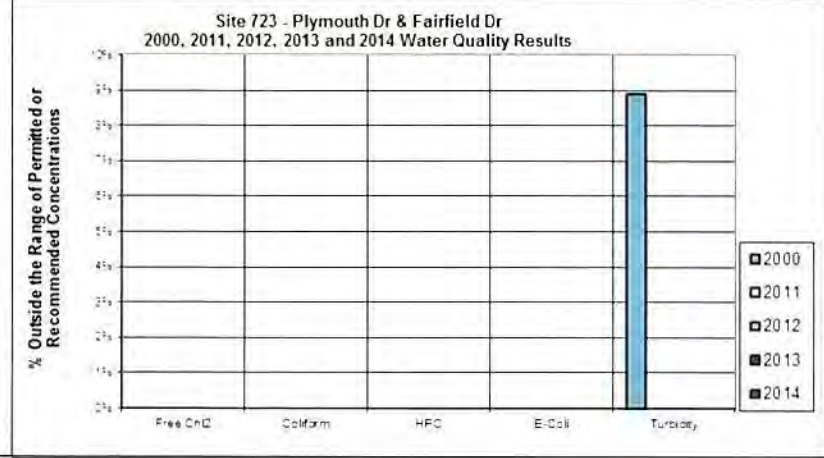
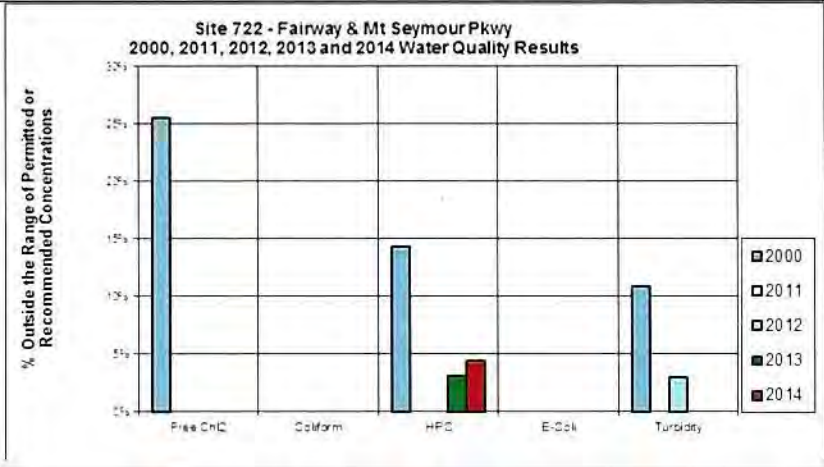
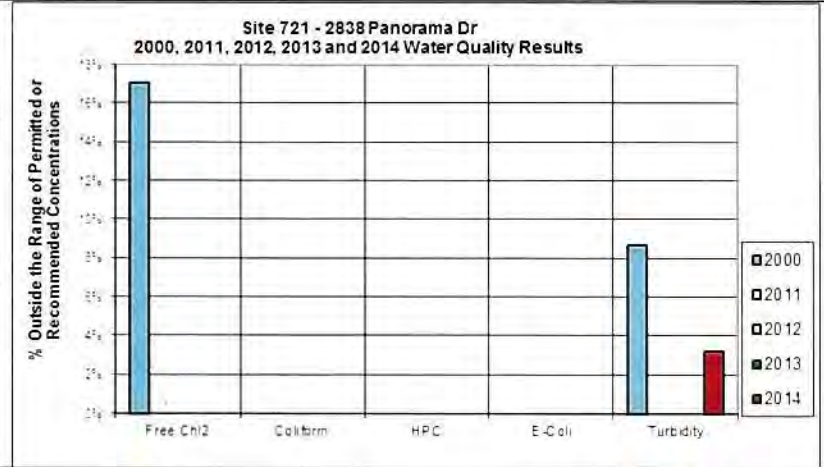
Site I.D.	Lab No.	Location	Flow Rate
1	721	2838 Panorama Dr.	Low
2	722	Fairway & Mt Seymour Pkwy.	Medium
3	723	Plymouth Dr & Fairfield Dr.	Low
4	724	LS #13 Dominion & Mountain Hwy.	Low
5	725	Marion Pump Station	Source
6	726	Hyannis Reservoir	Low
7	727	Hoskins Rd & Kilmarnock Cres.	Medium
8	728	Lillooet Road	Low
9	729	Ramsay Pump Station	Medium
10	730	Braemar Reservoir	Low
11	731	Skyline Pump Station	Medium
12	732	Sarita Pump Station	Source
13	733	McKeen Ave & Phillip Ave.	Medium
14	734	Pemberton Heights	Low
15	735	Prospect Reservoir	Medium
16	736	PRV #4 (W Queens Rd. & Lonsdale Ave.)	Dead End
17	737	N. of BC Rail Tracks just East of Lower Cap. Rd.	Source
18	738	3906 Sunnycrest Dr.	Medium
19	739	376 Cartelier Rd.	Medium
20	740	PRV #5 (190 E. Braemar Rd.)	Medium
21	741	Mountain Hwy Reservoir (North up access Rd., N. of Mountain Hwy.)	Low
22	742	PRV # 11 (Across from 1086 Cloverly St.)	Source
23	743	PRV #7 (N across from 481 Mountain Highway)	Dead End
24	744	Not in use	
25	745	PRV # 13 (N. of 1388 Monashee Drive (Capilano College))	Source
26	746	PRV #17 (60 Riverside Dr.)	Medium
27	747	PRV # 19 (1231 Lennox St.)	Dead End
28	748	PRV # 16 (2592 Bendale Rd.)	Dead End
29	749	PRV # 18 (3728 Mt. Seymour Parkway)	Low
30	750	up path behind 1610 Mt. Seymour Rd.	Medium
31	751	Access Rd, N. end of Cascade Ct.	Low
32	752	PRV # 25 (4068 Deane Pl.)	Medium
33	753	PRV # 20 (1501 Theta Ct.)	Low
34	754	Woodlands reservoir (2.1 km N. of Hixon Rd. on Indian River Dr.)	Low
35	755	PRV # 26 3.7 km NE of Hixon Rd. on Indian River Dr.	Low
36	756	End of Fire Lane # 7 (Firelane #7 is 3.6 km from Hixon Rd.)	Dead End
37	757	PRV 200 m south of 879 Roche Point Dr.	Medium
38	758	3860 Dollarton Hwy.	Medium
39	759	Hyannis Pump Station (1919 Hyannis drive)	Low
40	760	3000 Block Dollarton Hwy.	Low

DISTRICT OF NORTH VANCOUVER WATER QUALITY SAMPLING AND REPORTING CALENDAR - 2014

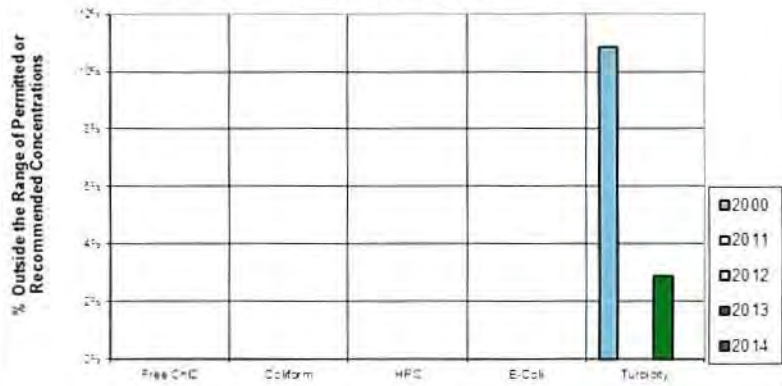
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<u>DISTRIBUTION SYSTEM SAMPLING</u>												
bacteria, turbidity, chlorine, temperature (twice weekly)	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
HAA's, THM's, pH (quarterly)		x			x				x		x	
metals - copper, lead, zinc (semi-annually)					x						x	
<u>NOTIFICATION</u>												
Annual Report:												
Annual report sent to MHO					x							
MHO sends Council his response						x						
Staff report to Council							x					
Posted on Web								x				

APPENDIX B

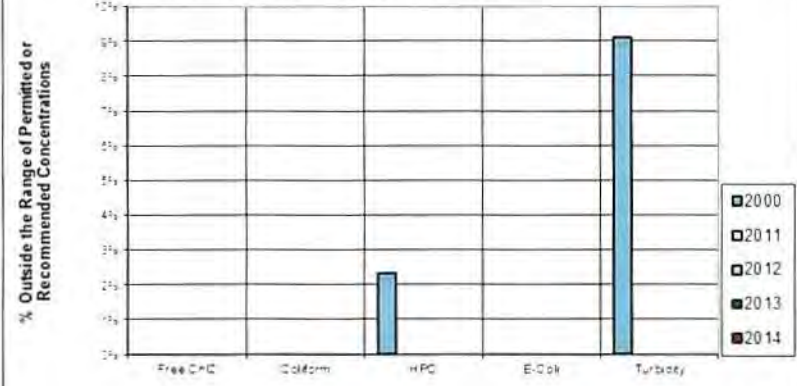
1. Graphs (39 total) - Water Quality Results by Sample Site, 2000, 2011 - 2014
2. Graph (2 total) - Average Chlorine Residuals for DNV Sampling Sites, 2000, 2011 - 2014



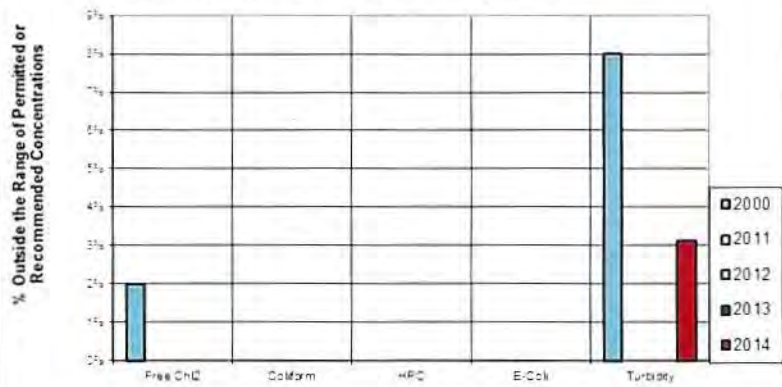
Site 727 - Hoskins Rd & Kilmarnock Cres
2000, 2011, 2012, 2013 and 2014 Water Quality Results



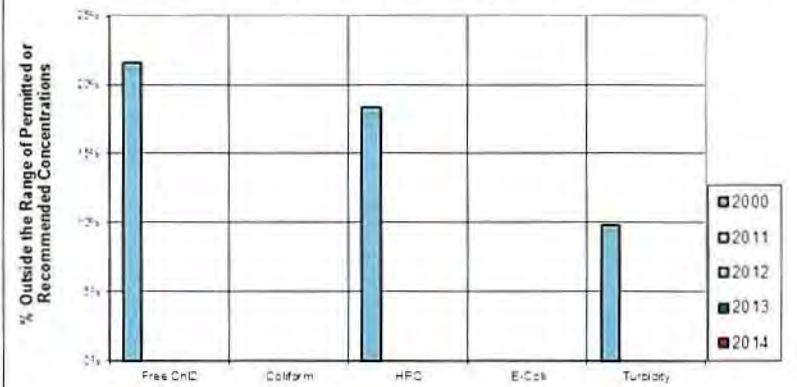
Site 728 - Lillooet Road
2000, 2011, 2012, 2013 and 2014 Water Quality Results



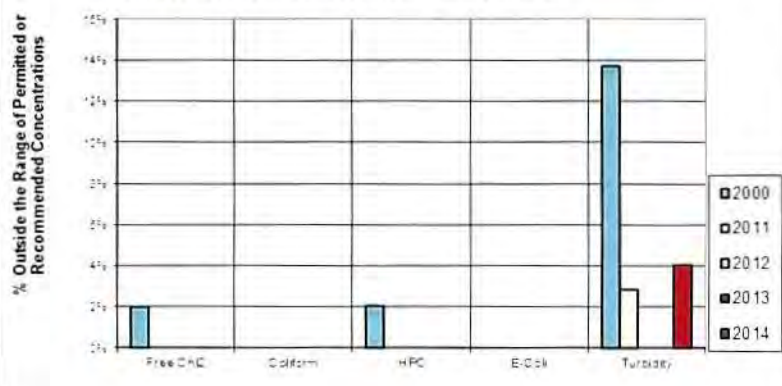
Site 729 - Ramsay Pump Station
2000, 2011, 2012, 2013 and 2014 Water Quality Results



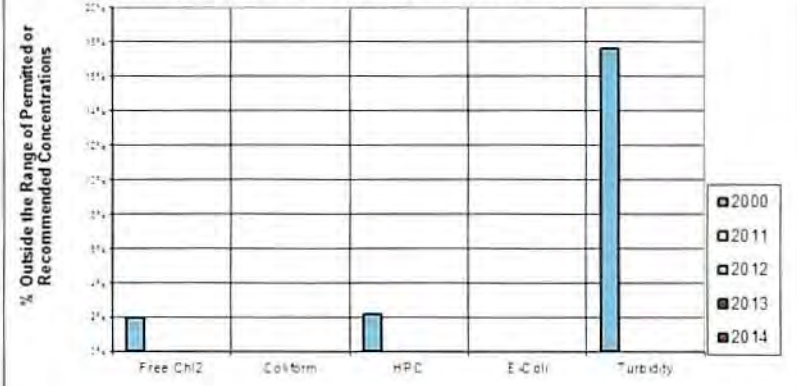
Site 730 - Braemar Reservoir
2000, 2011, 2012, 2013 and 2014 Water Quality Results



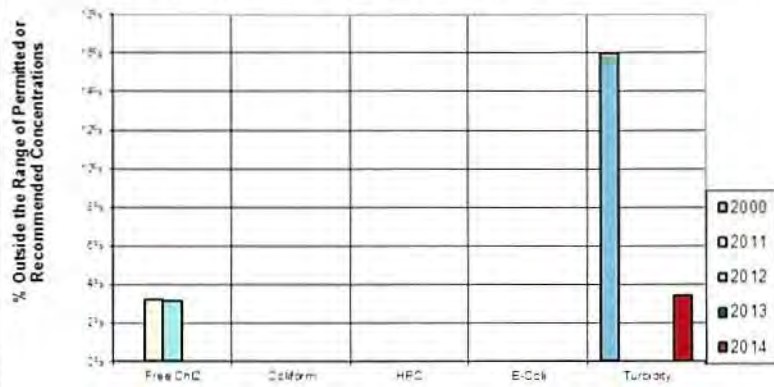
Site 731 - Skyline Pump Station
2000, 2011, 2012, 2013 and 2014 Water Quality Results



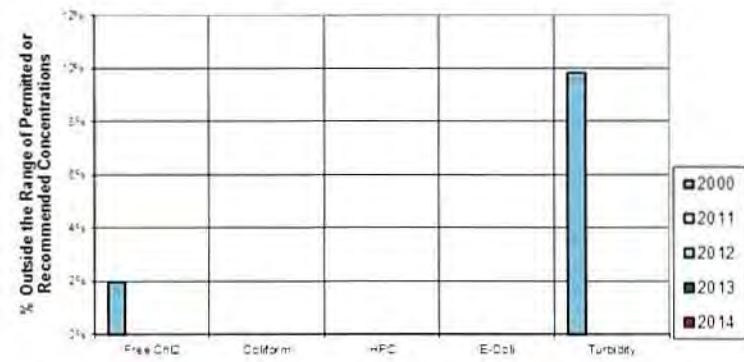
Site 732 - Sarita Pump Station
2000, 2011, 2012, 2013 and 2014 Water Quality Results



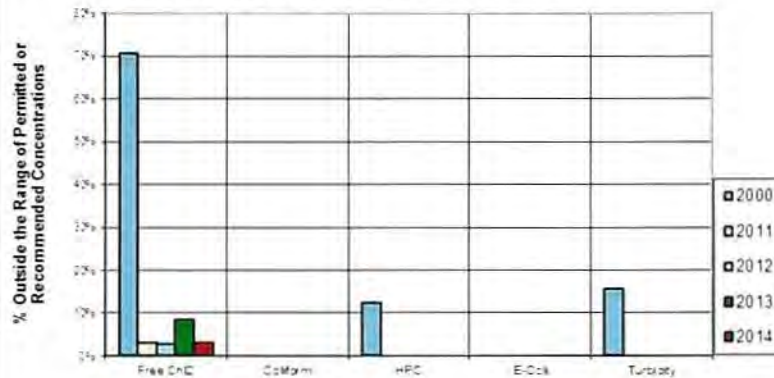
Site 733 - McKeen Ave & Phillip Ave
2000, 2011, 2012, 2013 and 2014 Water Quality Results



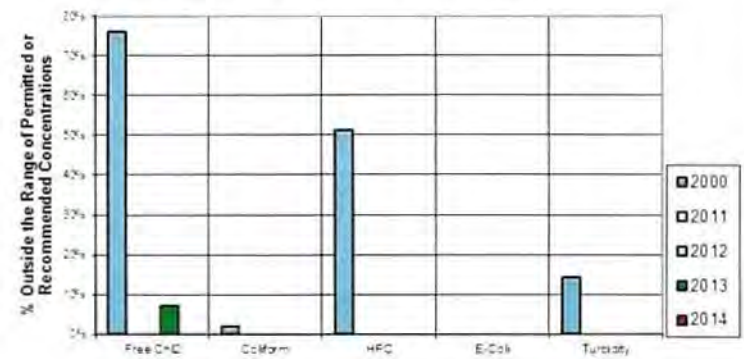
Site 734 - Pemberton Heights
2000, 2011, 2012, 2013 and 2014 Water Quality Results



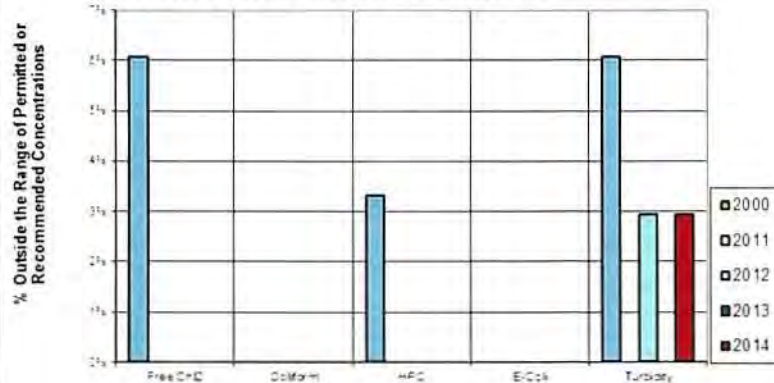
Site 735 - Prospect Reservoir
2000, 2011, 2012, 2013 and 2014 Water Quality Results



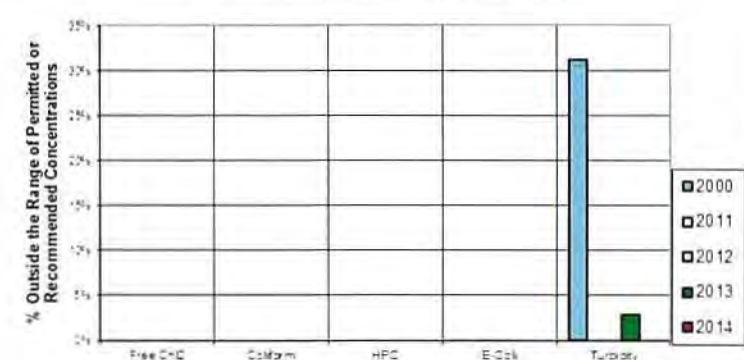
Site 736 - W Queens Rd & Lonsdale Ave
2000, 2011, 2012, 2013 and 2014 Water Quality Results

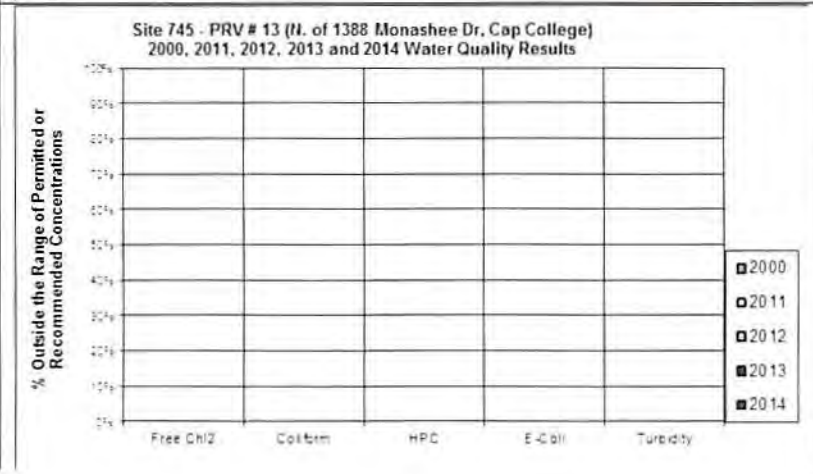
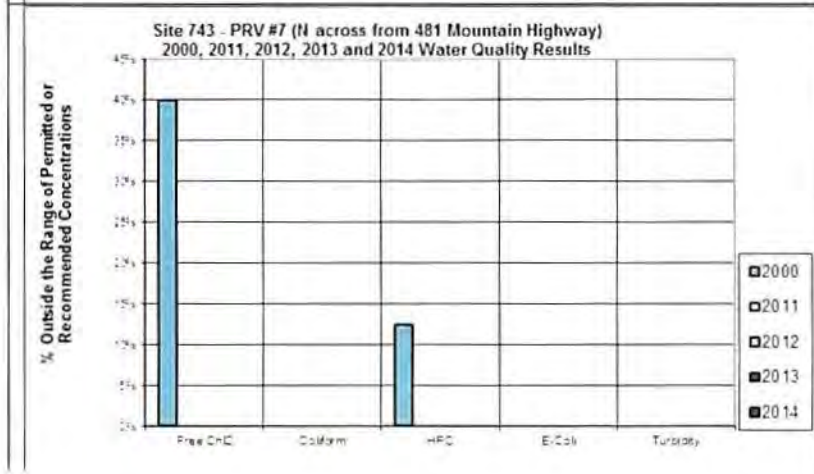
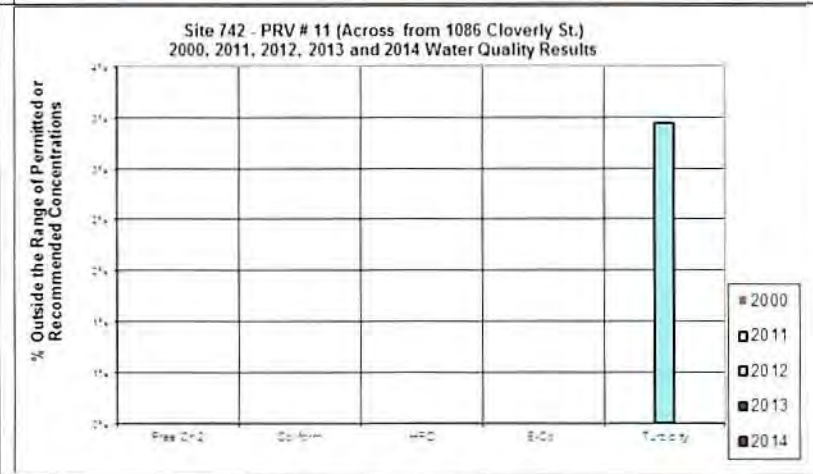
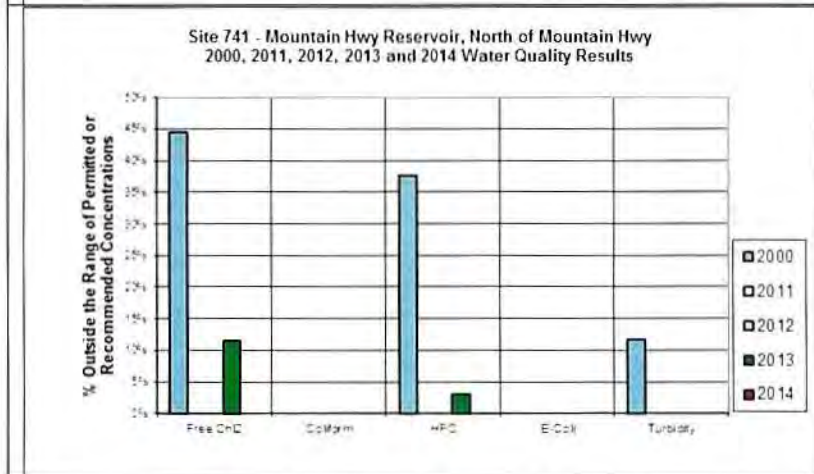
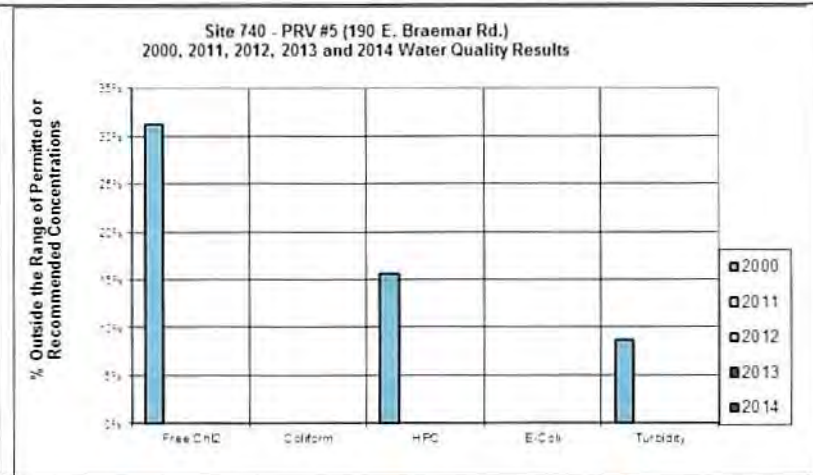
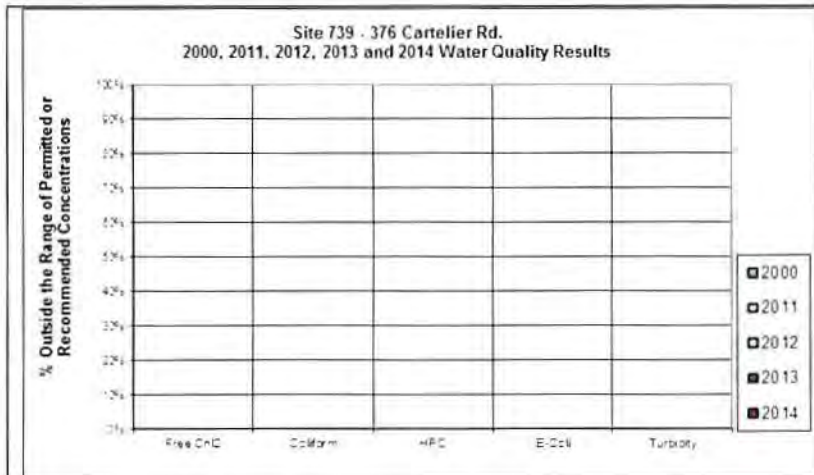


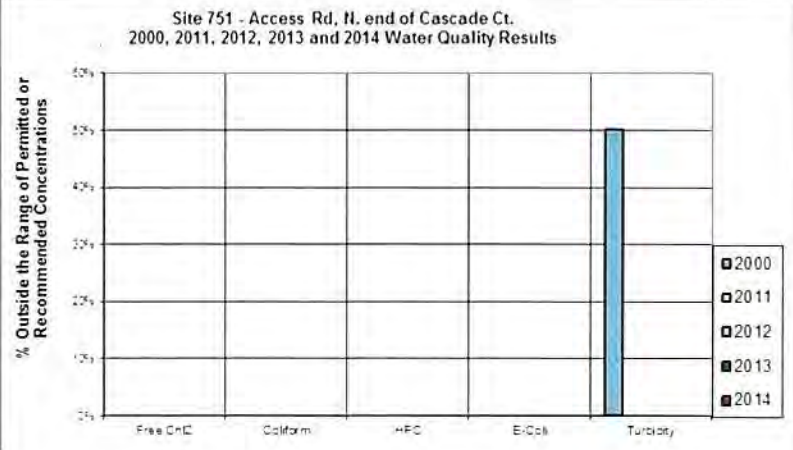
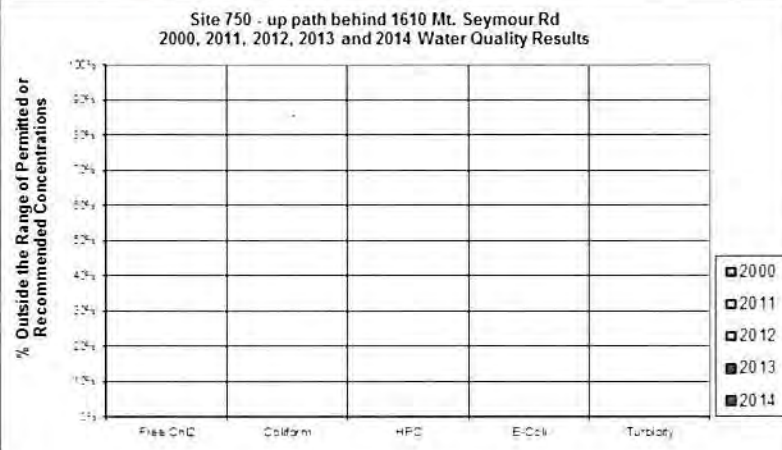
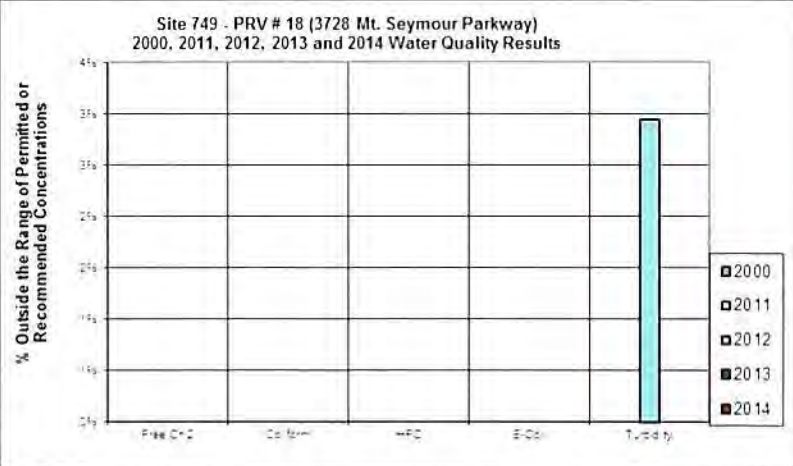
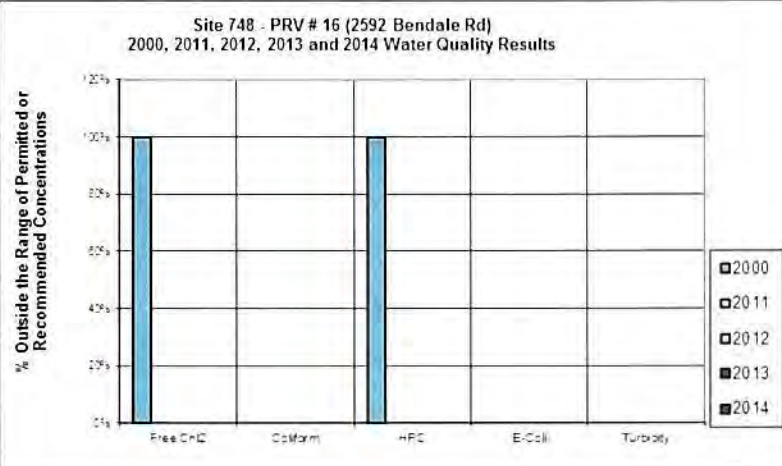
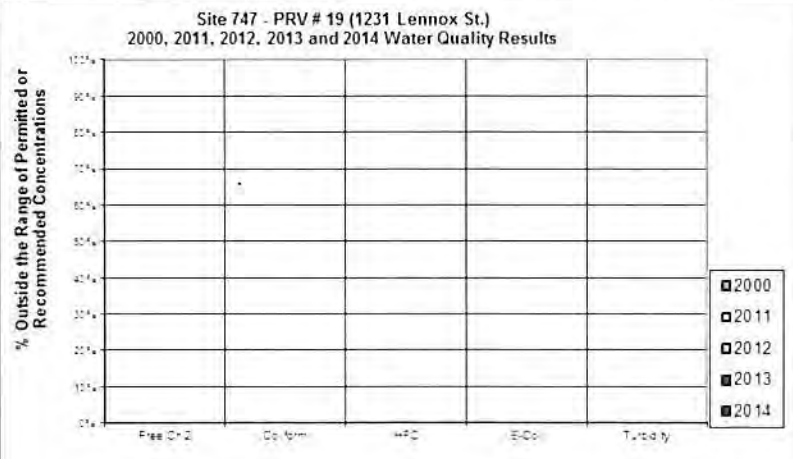
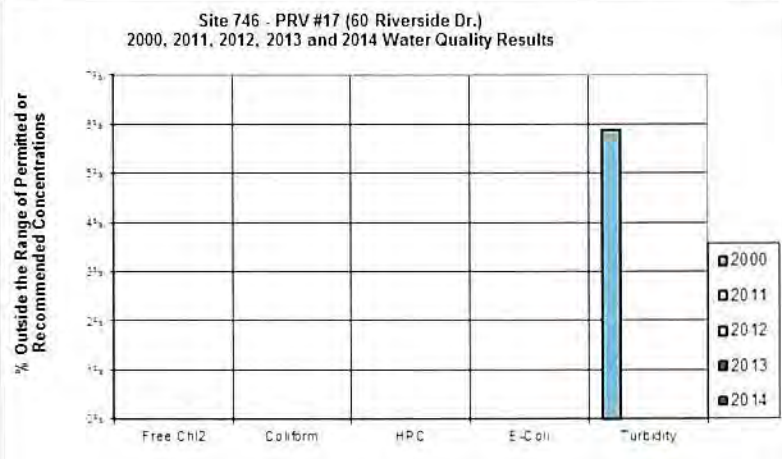
Site 737 - N. of BC Rail Tracks on Lower Cap. Rd
2000, 2011, 2012, 2013 and 2014 Water Quality Results

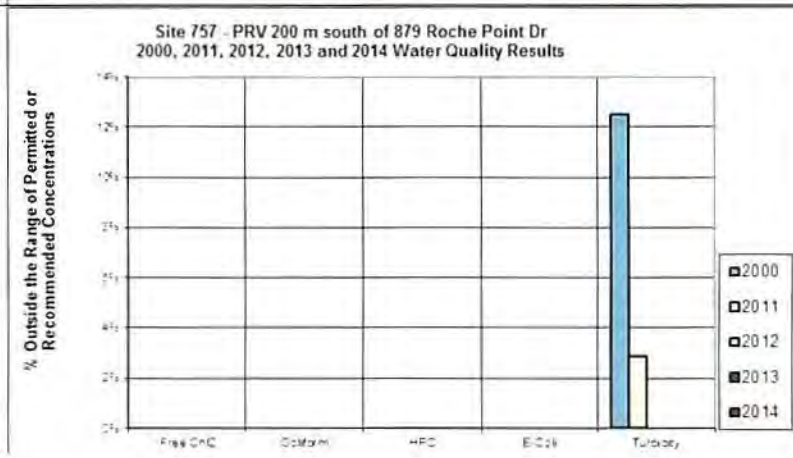
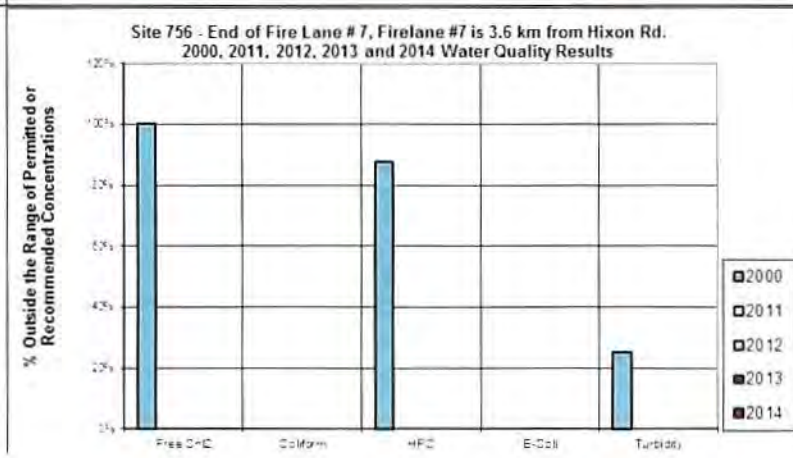
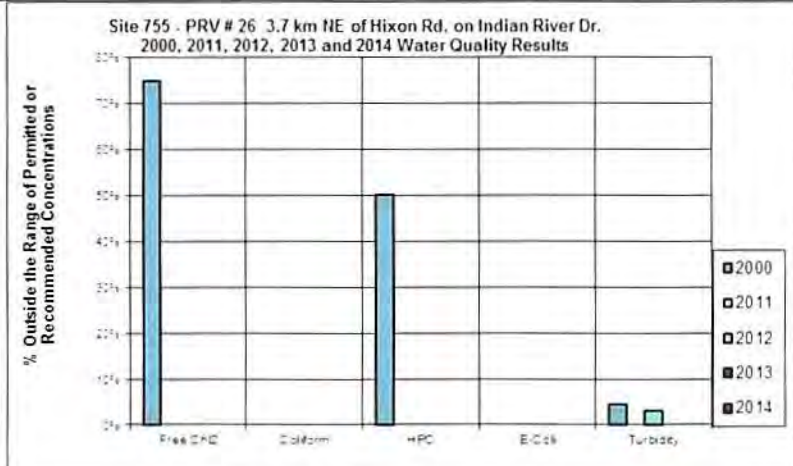
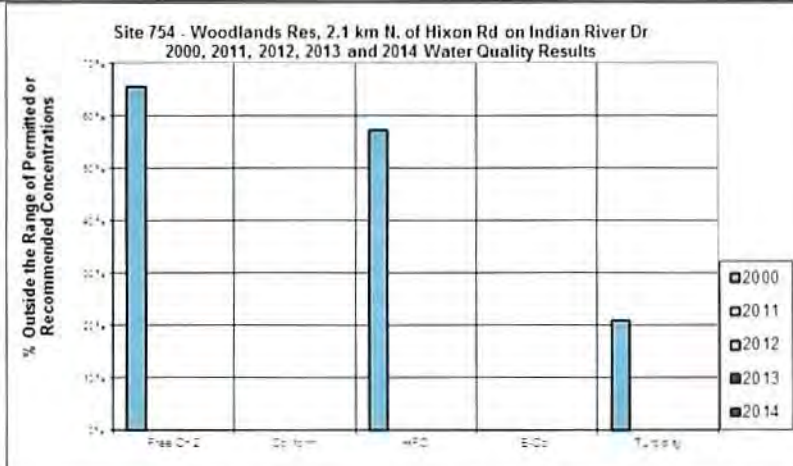
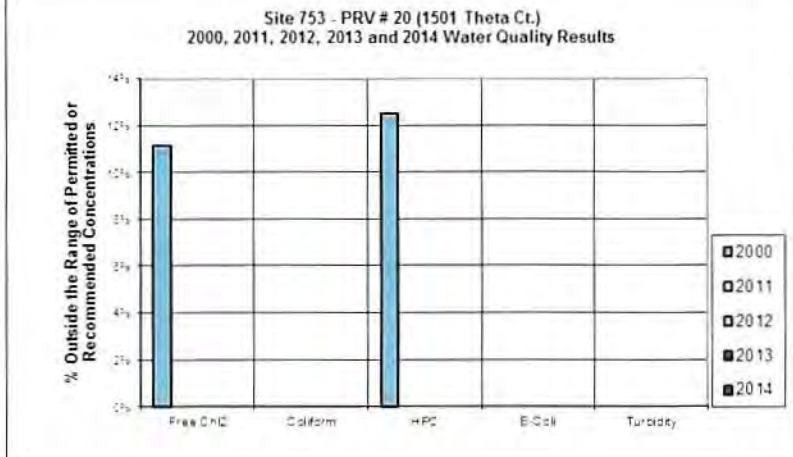
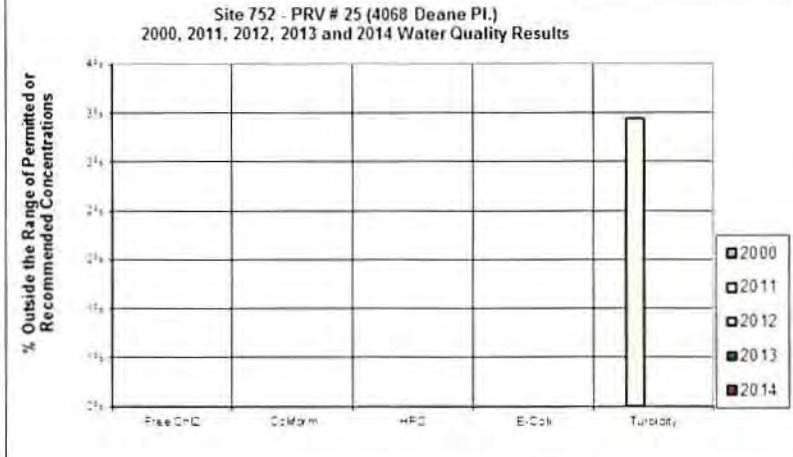


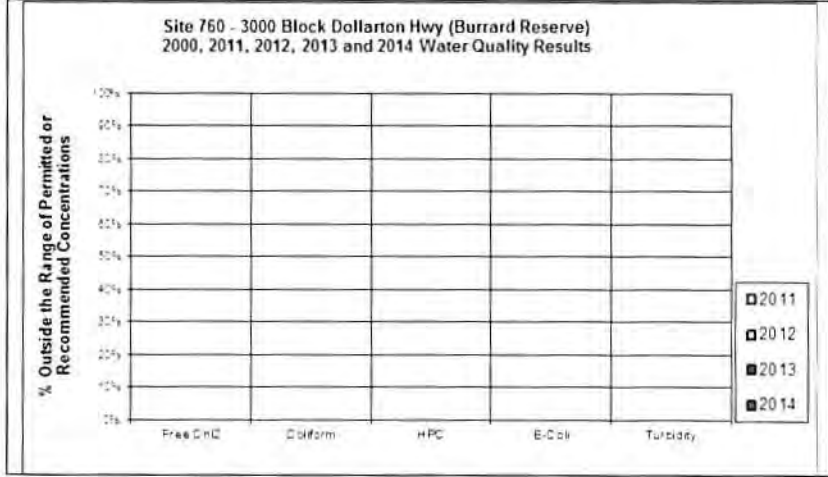
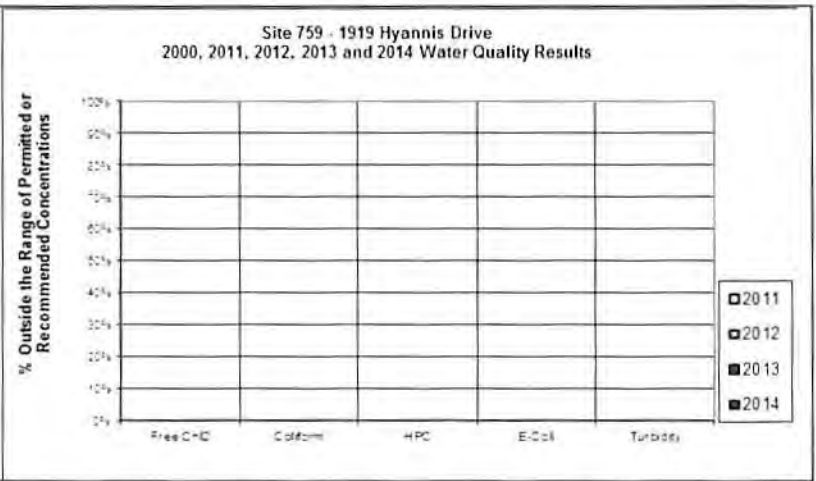
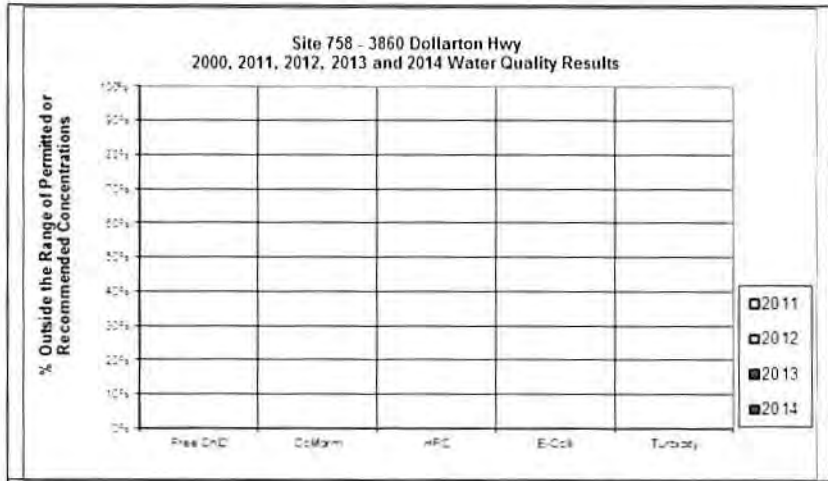
Site 738 - 3906 Sunnycrest Dr
2000, 2011, 2012, 2013 and 2014 Water Quality Results



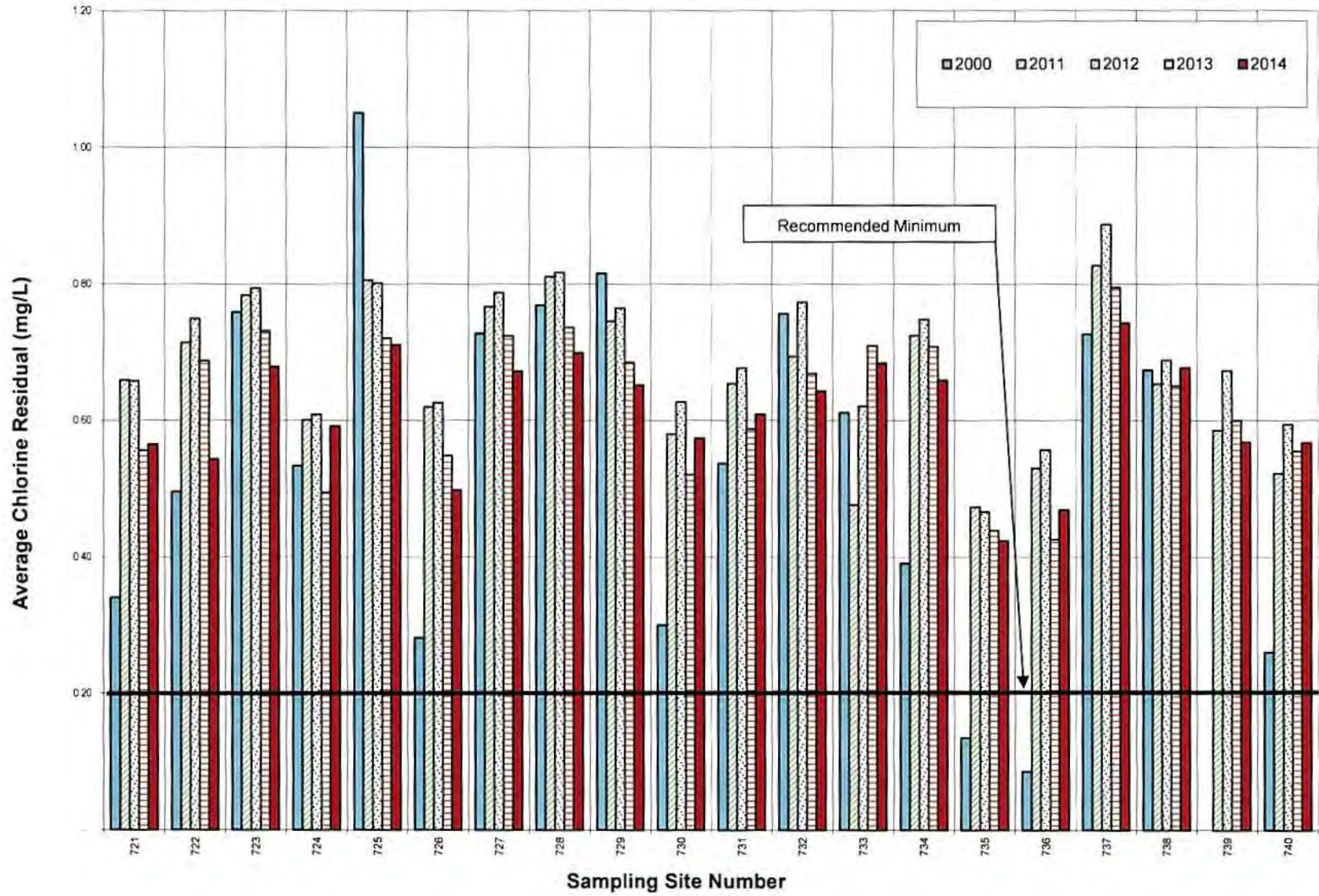




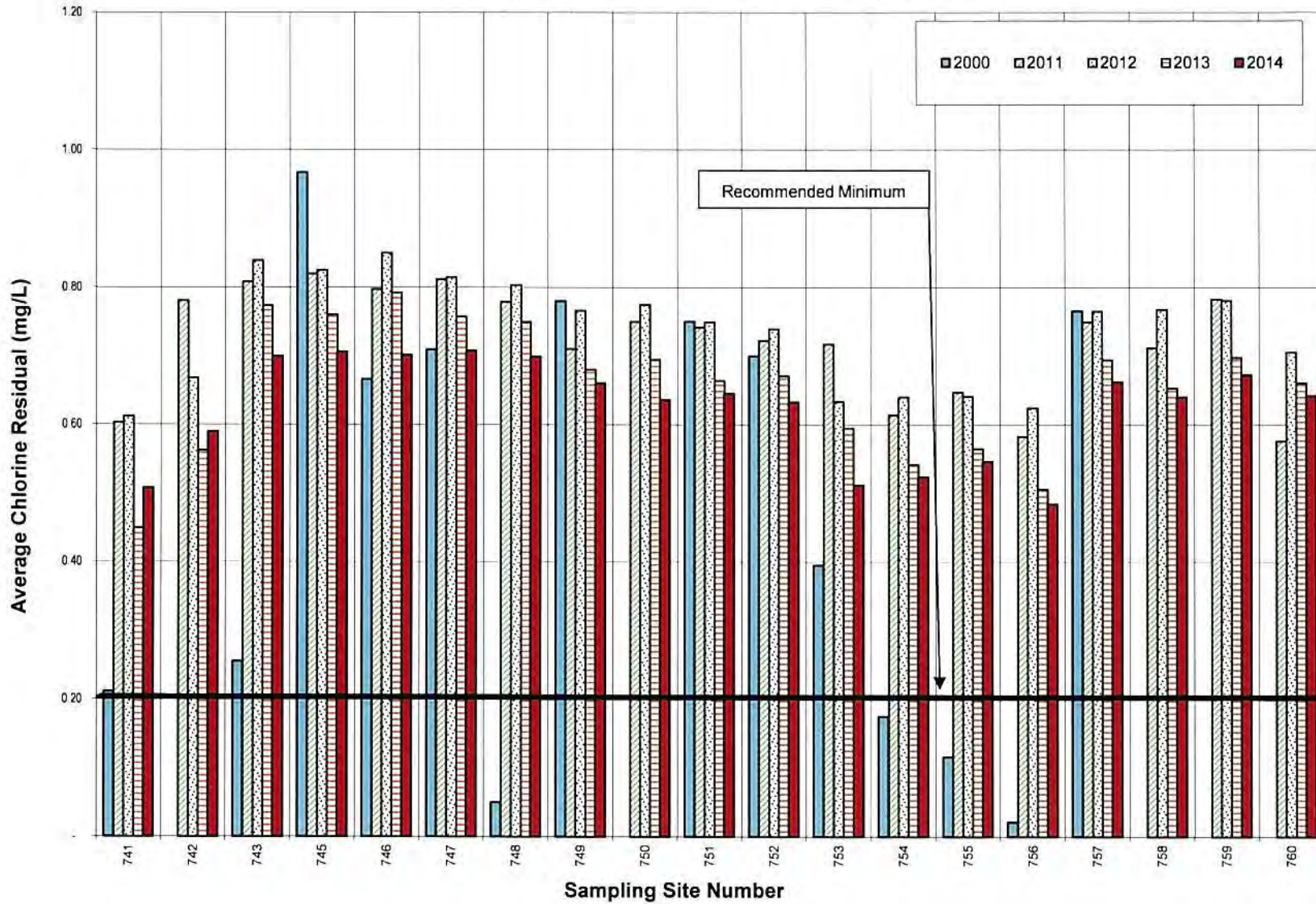




District of North Vancouver Drinking Water Quality
 2000, 2011, 2012, 2013 and 2014 Chlorine Residuals for DNV Sampling Sites 721 - 740



District of North Vancouver Drinking Water Quality
 2000, 2011, 2012, 2013 and 2014 Chlorine Residuals for DNV Sampling Sites 741 - 760



APPENDIX C

1. District of North Vancouver Response Procedures for Loss of Municipal System Integrity

**District of North Vancouver Response Procedures For Loss of Municipal System Integrity
(Line breaks, vandalism, loss of pressure, chemical or microbiological contamination)**

