

**DRINKING  
WATER  
QUALITY  
2017  
ANNUAL  
REPORT**

## LIST OF ABBREVIATIONS

AC	=	Asbestos Cement
BBR	=	Brunswick Beach Road
BWA	=	Boil Water Advisory
CEU	=	Continuing Education Unit
CI	=	Cast Iron
CWWF	=	Clean Water and Wastewater Fund
DI	=	Ductile Iron
E. coli	=	Escherichia Coli
EMBC	=	Emergency Management BC
EOCP	=	Environmental Operators Certification Program
FLNRO	=	Ministry Of Forests, Lands, Natural Resources, and Operations
GVWD	=	Greater Vancouver Water District
HOCl	=	Hypochlorous Acid
KGW	=	Kelvin Grove Way
L	=	Litre
LBA	=	Lions Bay Avenue
m <sup>3</sup>	=	Cubic Meters
mg	=	Milligram
ML	=	Mega Litre
mL	=	Millilitre
MOU	=	Memorandum of Understanding
NaOCl	=	Sodium Hypochlorite
NBCF	=	New Building Canada Fund
NRW	=	Non-Revenue Water
NTU	=	Nephelometric Turbidity Units
OCl <sup>-</sup>	=	Hypochlorite Ion
ppb	=	Parts Per Billion
ppm	=	Parts Per Million (Equal To 1 Mg/L)
PRV	=	Pressure Regulating Valve
PVC	=	Polyvinyl Chloride
SCADA	=	Supervisory Control and Data Acquisition
THM	=	Trihalomethane
UBC	=	University Of British Columbia
USEPA	=	United States Environmental Protection Agency
UV	=	Ultraviolet
UVT	=	Ultraviolet Transmittance
VCH	=	Vancouver Coastal Health Authority
VOLB	=	Village of Lions Bay
WHO	=	World Health Organization
WTP	=	Water Treatment Plant

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## EXECUTIVE SUMMARY

The Village of Lions Bay (Municipality) is a supplier and distributor of water through two surface water supplies: Magnesia Creek and Harvey Creek. In accordance with the requirements of the *Drinking Water Protection Regulation*, the Municipality sends weekly drinking water samples from various locations throughout its water distribution system to an independent third party laboratory for analysis. Test results are communicated to the Municipality and the Vancouver Coastal Health Authority (VCH) every week and documented in this annual report. In 2017, the Municipality met all regulatory requirements for drinking water quality set out in the *Drinking Water Protection Regulation*:

- ◆ No samples tested positive for E. coli
- ◆ For each 30-day period, over 90% of samples had 0 total coliform per 100 mL, and no sample had more than 10 total coliform per 100 mL

In monitoring unregulated drinking water quality parameters, the Municipality follows and compares laboratory results to the Health Canada Guidelines for Drinking Water Quality. Where Health Canada recommendations are not present, the Municipality follows U.S. Environmental Protection Agency (EPA) recommendations. In 2017, municipally treated water in the Village of Lions Bay did not exceed any maximum limits recommended by Health Canada or the EPA.

## INTRODUCTION

The Municipality operates a Municipal Water Utility under the provisions of the provincial *Local Government Act*, the *Drinking Water Protection Act*, and the *Drinking Water Protection Regulation*. These obligate the Municipality to meet several requirements, including:

- ◆ Operating the utility under permit issued by the Provincial Ministry of Health Services
- ◆ Engaging in water quality monitoring, and
- ◆ Preparing an annual report on water quality for the year.

The Provincial Ministry of Health develops and maintains the *Drinking Water Protection Act* and the *Drinking Water Protection Regulation*. Administration and enforcement of the legislative regulations and requirements falls to regional Medical Health Officers who work with municipalities to provide safe drinking water and to notify local residents of water quality problems.

This report comprises the 2017 Drinking Water Quality Annual Report prepared by the Municipality in accordance with our annual Operating Permit (Appendix A), issued by the Medical Health Officer. The purpose of this report is to provide Municipal water consumers with drinking water sampling test results for 2017, as well as to present background information on Municipality-specific issues concerning water supply, treatment, and distribution as well as measures being taken to protect and enhance drinking water quality.

## BACKGROUND

Lions Bay is a small, picturesque, seaside Municipality nestled at the base of southern British Columbia's Coast Mountain Range. Situated approximately 11 km north of Horseshoe Bay along Howe Sound, the Municipality is a member of the Metro Vancouver Regional District (Metro Vancouver). However, unlike the many member municipalities comprising Metro Vancouver who receive their water supply from the Greater Vancouver Water District (GVWD), the Municipality owns and operates its own water supply, treatment, and distribution system. The Municipality's water system is responsible for providing potable (safe to drink) water to their 1334 residents for domestic, irrigation and fire protection usage

Water supply for the Municipality is drawn from two local creeks – Harvey Creek and Magnesia Creek. This raw water is treated and conveyed to the consumers through the following distribution system infrastructure:

- ◆ 17 km of water main (various sizes and materials)
- ◆ 2 water treatment plants (Harvey Creek WTP, Magnesia Creek WTP)
- ◆ 8 water tanks (5 of which contain potable water and 3 of which contain non-potable water)
- ◆ 2 raw water intakes (Harvey Creek, Magnesia Creek)
- ◆ 551 property service connections
- ◆ 13 pressure reducing valve stations
- ◆ 72 hydrants
- ◆ 250 valves

The system is separated into eighteen pressure zones with the boundaries along each pressure zone comprised of a series of closed valves and pipes, and pressure regulating valve (PRV) stations. These pressure zones serve to decrease the pressure to an acceptable range for delivery of water to end users.

Potable water from the system is analyzed for the presence of microbiological pathogens (and other indicator organisms) and metals by laboratories approved by the Medical Health Officer. Testing for chlorine residuals and turbidity levels is conducted by EOCP Certified in-house staff.

## SOURCE WATER

The Municipality's watershed areas include Magnesia Creek (421 hectares), Harvey Creek (635 hectares), Alberta Creek (51 hectares), and Rundle Creek (20 hectares). The Municipality's total water supply is drawn only from the Magnesia Creek and Harvey Creek watersheds.

## LICENSES

The Municipality holds six water licenses, issued by the Ministry of Environment. Of these licenses, five are currently being utilized. Table 1 lists the licenses and quantity of water associated with each.

**Table 1. Municipal Water Licenses**

License No	Metric Quantity (m <sup>3</sup> /year)	Stream Name
C059405	45,460.90000	Magnesia Creek
C065267	19,911.87420	Magnesia Creek
C065316	33,186.45700	Magnesia Creek
C042330	82,966.14250	Alberta Creek *
C119916	41,483.07125	Harvey Creek
C119917	248,898.42750	Harvey Creek

\*Alberta Creek is not currently utilized by the Municipality

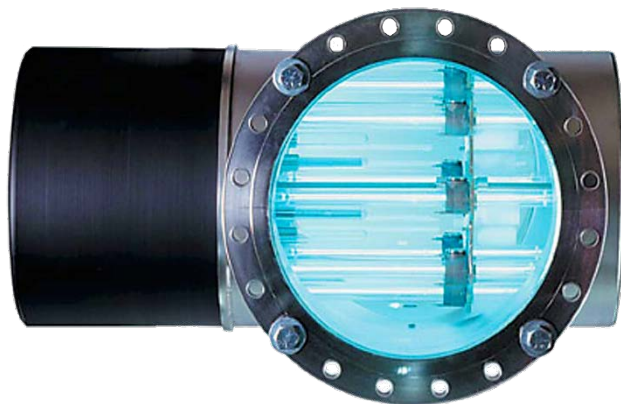
## FOUR BARRIER APPROACH TO WATER QUALITY

The Municipality uses a "4-barrier" approach to mitigate source water quality issues that include the potential for waterborne disease, seasonal raw water turbidity fluctuations, and bacterial regrowth in its treatment and distribution systems.

## WATER TREATMENT

The first two barriers pertain to the treatment of raw water from the Harvey and Magnesia Creek intakes and includes primary ultraviolet (UV) disinfection and secondary chlorine disinfection.

### PRIMARY BARRIER – UV DISINFECTION



*Inside a Trojan Swift UV Reactor*

Raw water passes through a UV reactor where specialized lamps emit UV light, which alters the DNA of microorganisms' cells, inactivating them and impeding reproduction. UV light is a very effective disinfectant and has a demonstrated efficacy against pathogenic organisms, including those responsible for cholera, polio, typhoid, hepatitis, Giardia, Cryptosporidium and other bacterial, viral and parasitic diseases.

UV treatment is affected by turbidity, which is defined as a cloudiness or haziness in water that's caused by matter such as organics, minerals, or chemicals. This matter can absorb or scatter UV light, resulting in a low UV transmittance (UVT) rate. The UV reactor automatically increases lamp intensity to counter high turbidity and lower UVT. If the UV reactor cannot maintain the required UVT, the Supervisory Control and Data Acquisition (SCADA) system will notify the Municipal staff, and the UV reactor shuts down stopping the production of treated water. During turbidity events in excess of 5 Nephelometric Units (NTU's), microbiological sampling and testing is increased at all sampling locations; chlorine residual sampling and testing is likewise increased; and the Municipality will contact VCH, who may issue a Boil Water Advisory.

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## SECONDARY BARRIER – SODIUM HYPOCHLORITE

Once through the UV reactor, the disinfected water is injected with sodium hypochlorite (NaOCl). When NaOCl dissolves in water, two substances form, which play a role in for oxidation and disinfection. These are hypochlorous acid (HOCl) and the hypochlorite ion ( $\text{OCl}^-$ ). As a strong oxidizing agent, NaOCl kills microorganisms by damaging and disrupting two processes critical for a cell's survival: cell respiration and DNA activity. Soon after adding NaOCl to water, the chlorine within the compound begins reacting with the inorganic and organic matter and microbes that commonly grow in water supply reservoirs, on the walls of water mains, and in storage tanks, and neutralizes them<sup>1</sup>, thereby causing chlorine levels to degrade. Public Works staff monitors the chlorine levels in water throughout the distribution system on a daily (workdays) basis to ensure enough chlorine is present to inactivate contaminants.



*Debris buildup and biofilm formation with a section of ductile iron water main*

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<sup>1</sup> Calderon, R. L. (2000). "The Epidemiology of Chemical Contaminants of Drinking Water". Food and Chemical Toxicology. 38 (1 Suppl): S13-S20. doi:10.1016/S0278-6915(99)00133-7. PMID 10717366.

## DISTRIBUTION SYSTEM

The balance of the 4-barrier approach pertains to the water distribution system and includes water quality monitoring (daily, weekly, and biannually) throughout the distribution system as well as a system maintenance program that consists of water main flushing and water tank internal cleaning. These two barriers are intended to ensure chlorine residual within the system by purging potential contaminants from the system.

The Municipal distribution system's main components include water mains and storage tanks. The system's water mains are constructed primarily of ductile iron (DI); however, a variety of materials including asbestos cement (AC), cast iron (CI), and polyvinyl chloride (PVC) also exist within the Municipality. The oldest pipes in the Municipality's distribution system were installed between 1970 and 1971. The system's tanks are all cast in place concrete. Table 2 lists their capacity and the year in which they were built.

**Table 2. Potable Water Storage Tanks**

Tank	Capacity (ML)	Year Built
Harvey	1.72	1980
Magnesia	0.44	2002
Phase IV	0.08	1960
Phase V	0.10	1960
Highway	0.09	1960

### TERTIARY BARRIER – WATER SAMPLING

The Municipality's Public Works staff draw samples throughout the distribution system on a daily (workdays) basis to ensure a chlorine residual within the distribution network. Chlorine residuals are monitored at the treatment plants, in the middle, and at the ends of the distribution system with dosages being adjusted to ensure there is enough chlorine within the system at all times.

### QUATERNARY BARRIER – WATER MAIN FLUSHING & TANK CLEANING

Water main flushing is a method of cleaning water mains that involves manipulating valves and discharging water through fire hydrants or blow off points at a velocity great enough to scour the walls of the water mains. The discharged water carries sediment and other solids with it, assisting in the scouring effect. The Municipality cleans 17 km of the distribution system twice per year using this method. In support of summer water conservation efforts, the Municipality's annual flushing takes place in April and October.

Due to the complexity and scope of the task, cleaning of the Municipality's water storage tanks occurs on a 5-year cycle. Two methods of cleaning tanks are used by the Municipality:

1. In service cleaning: Water tanks remain in service providing potable water to the residents. Divers are disinfected by spraying them down with chlorine after which they enter the tanks and use vacuum equipment to remove sediment build up from the bottom of the tanks.

2. Water tanks are bypassed removing them from service after which they are drained of all water. Municipal staff enter the tanks to manually clean the walls and floors using pressure-washing equipment. Once cleaned, the tanks are then disinfected using super-chlorinated water before being put back into service.

In 2014 the Municipality engaged a dive company to clean out its potable water storage tanks.

## OPERATOR TRAINING

Another approach to mitigating issues within a water supply and distribution system is through employee training. The Environmental Operators Certification Program (EOCP) is the body charged under the *Drinking Water Protection Act* and the *Drinking Water Protection Regulation* with classifying water supply and distribution system in order to determine training requirements for system operators.

*“Certified employees can maximize the performance of water and wastewater facilities, which will in turn minimize health risks and environmental concerns, optimize the costs of operations, protect the investment in infrastructure, and provide greater return on the utility’s or industry’s capital investment.”<sup>2</sup>*

Under the EOCP guidelines, each system is required have a minimum of one operator, designated the “chief operator(s),” who must be certified by the EOCP at the matching classification level of the system. Additionally, any person whose actions may affect the operation of a water system requires certification by the EOCP. Certified Operators are required to earn continuing education units (CEU’s) on a biannual basis to remain “In Good Standing.” This ensures that certified operators remain well trained, current, and are capable of operating and maintaining their facilities in a responsible and professional manner.

The EOCP has classified the Municipality’s water treatment system as a Class 1 system and the distribution system as a Level 2 system. In 2017, the Municipality complied with operator training and had one Chief Operator classified as a Water Treatment Plant Operator Class 1 and as a Water Distribution System Operator Level 2. An additional 2 employees working on the water system are also classified as Water Distribution System Operator Level 1.

## DRINKING WATER QUALITY PARAMETERS & RESULTS

The Municipality is responsible for monitoring water quality in different parts of the drinking water system. The quality of water distributed within the Municipality is monitored in accordance with requirements set out in provincial regulations. This section describes the monitoring program and water quality results for 2017.

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<sup>2</sup> <http://www.eocp.ca/wp-content/uploads/2014/04/EOCP-Program-Guide-1-March-2014-v13.pdf> (accessed March 24, 2018)

## WATER QUALITY SAMPLING AND MONITORING

Water quality is monitored for regulatory compliance on a weekly basis at the Municipality's sampling locations (Appendix B). Samples are taken on a daily, weekly, and monthly basis by Public Works Department staff and sent to an approved laboratory for analysis. The results are communicated to the Municipality and VCH. Operational responses to undesirable results varies from re-sampling to flushing water mains to possibly issuing a boil water advisory by VCH, depending on confirmation and the significance of the parameter of concern. The Municipality's emergency response protocol to various drinking water related contingencies is provided in Appendix C.

On a daily basis (Monday to Friday) the Municipality draws water samples from stations located at the front, middle and end of the distribution system and tests them for turbidity and chlorine residual. Once a week, further samples are taken from each of the aforementioned sites along with monthly raw water and disinfected samples from either side of the UV reactors. These samples are sent to a VCH accredited laboratory and tested for *Escherichia coli* (*E. coli*) and total coliforms. More extensive biannual testing is conducted for general water chemistry, hardness, metals, and other contaminants including organic compounds.

The monitoring program provides a representative picture of drinking water quality within the municipal water mains. It is important to note that Municipal sampling is not a definitive picture of drinking water quality in a system. Once water reaches private water systems, water quality can change significantly due to pipe material, standing time, temperature, and other factors. It can be assumed that samples taken within buildings will be of different quality than those taken from municipal mains. The Municipality is not responsible for water quality testing on private property.



*Analysing a water sample using a Spectrophotometer*

## BACTERIOLOGICAL MONITORING AND RESULTS

The *Drinking Water Protection Regulation* requires the Municipality to carry out routine sampling and testing for *E. coli* and total coliform bacteria. These are considered “indicator organisms” because their presence or absence provides an indication of microbial water quality.

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## ESCHERICHIA COLI



E. coli is a type of coliform bacteria present exclusively in the feces of humans and other animals. The existence of E. coli in a water sample indicates recent fecal contamination and the possible presence of intestinal disease-causing bacteria, viruses, and protozoa. Fecal matter can enter the water supply where humans and animals defecate in or near the watersheds and above the raw water intakes. The *Drinking Water Protection Regulation* standard for E. coli is none detectable per 100 ml. In 2017, none

of the weekly samples taken throughout the potable water system tested positive for E. coli.

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## TOTAL COLIFORM

The total coliform group of bacteria is composed of various types with similar characteristics. The natural niches for members of this group range from being fecal-specific, such as E. coli, to those being widely distributed in water, soil, and vegetation. The *Drinking Water Protection Regulation* standards for total coliform indicate that there can be no detectable E. coli per 100 ml; and that total coliform bacteria samples (for more than 1 sample taken per month) must have at least 90% of samples with no detectable total coliform bacteria per 100 ml; and no one sample can have more than 10 total coliform bacteria per 100 ml. No test samples taken from the potable water system exceeded these parameters in 2017.

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## FREE CHLORINE [CHLORINE RESIDUAL]

Free chlorine is not regulated by the *Drinking Water Protection Act* or the *Drinking Water Protection Regulation*. The Guidelines for Canadian Drinking Water Quality indicate that for health considerations, a “guideline value [maximum acceptable concentration level for chlorine] is not necessary due to low toxicity at concentrations found in drinking water.”

With respect to a minimum chlorine concentration [chlorine residual], no regulations exist for British Columbia. However, Health Canada reports the following:

“The U.S. Environmental Protection Agency Surface Water Treatment Rule requires a minimum



Testing for a chlorine residual

disinfectant residual of 0.2 mg/L for water entering the distribution system and that a detectable level be maintained throughout the distribution system. The World Health Organization (WHO) has suggested that, for areas with little risk of cholera or related outbreaks, a free chlorine residual range of 0.2–0.5 mg/L be maintained at all points in the supply (WHO, 1997). In general, a free chlorine residual of 0.2 mg/L is considered a minimum level for the control of bacterial regrowth in the distribution system.<sup>3</sup>

Health Canada also reports that “Free chlorine concentrations in most Canadian drinking water distribution systems range from 0.04 to 2.0 mg/L.”<sup>4</sup>

Residual chlorine concentrations are affected by various parameters such as water age, turbidity levels, pipe material, and temperature. Table 3 shows that the average free chlorine residual at all stations was greater than 0.2 mg/L in all samples collected for 2017 – note that the readings in Table 3 are in ppm which are equivalent mg/L (i.e. 1 ppm = 1 mg/L). Detailed treated water free chlorine residual data for 2017 is charted in Appendix D and graphs charting chlorine residuals against turbidity readings are presented in Appendix E.

**Table 3. 2017 Chlorine Residual Readings (ppm)**

	Harvey Creek System					Magnesia Creek System		
	Tank	PRV-3	Cafe	LBA	KGW	Tank	PRV-5	BBR
<b>Average</b>	0.93	0.89	0.72	0.66	0.60	0.92	0.88	0.70
<b>Maximum</b>	1.36	1.32	1.09	1.19	1.22	1.25	1.42	1.00
<b>Minimum</b>	0.54	0.50	0.28	0.20	0.20	0.50	0.46	0.24

Lions Bay Avenue (LBA), Kelvin Grove Way (KGW), Brunswick Beach Road (BBR)

## TURBIDITY

Provincial guidelines for turbidity within a distribution system do not exist. Variations in turbidity within a distribution system are normal. Higher levels may be associated with turbidity in source water or local system events such as high flow rates from unidirectional flushing, fire fighting, or water main breaks. In the event that a high level of turbidity is detected, the Municipality will determine whether this is expected due to system operations. If the event is unexpected, the Municipality will confirm turbidity level and flush the mains to clear any disturbance. During periods of high turbidity, the Municipality will adjust chlorine dosages to compensate – graphs charting chlorine residuals against turbidity are presented in Appendix E. Average turbidity values at all sample stations are displayed below in Table 4 and detailed treated water turbidity data for 2017 is charted in Appendix D. No boil water advisories related to high turbidity were issued for 2017.

<sup>3</sup> Health Canada (2009) Guidelines for Canadian Drinking Water Quality: Guideline Technical Document—Chlorine

<sup>4</sup> Health Canada (2009) Guidelines for Canadian Drinking Water Quality: Guideline Technical Document—Chlorine

Table 4. Turbidity Readings (NTU)

	Harvey Creek System					Magnesia Creek System		
	Tank	PRV-3	Cafe	LBA	KGW	Tank	PRV-5	BBR
<b>Average</b>	0.64	0.40	0.41	0.28	0.26	0.54	0.42	0.39
<b>Maximum</b>	4.52	2.19	1.93	1.16	1.92	2.66	1.96	4.50
<b>Minimum</b>	0.11	0.12	0.13	0.11	0.11	0.14	0.12	0.18

Lions Bay Avenue (LBA), Kelvin Grove Way (KGW), Brunswick Beach Road (BBR)

Municipal staff also sample and test raw source water for turbidity from both creeks on a daily basis. Table 5 presents the raw water turbidity test results for 2017.

Table 5. 2017 Raw Water Turbidity Results

	Harvey Creek Raw Water	Magnesia Creek Raw Water
<b>Average NTU</b>	0.48	0.59
<b>Maximum</b>	2.1	33.2
<b>Minimum</b>	0.13	0.12
<b>No. of events &gt; 2 NTU</b>	0	2

Excessive turbidity events may result in a boil water advisory being issued by VCH.

In 2017, two turbidity events occurred within the Magnesia Creek system. The first, which occurred on June 9, 2017, was the result of a summer rainfall instance that likely dislodged a large volume of gravel and cobble that plugged the intake. The second event occurred on September 12, 2017 and was the result of the construction of the infiltration gallery. Placement of the bedding for the gallery resulted in a disturbance of the substrate causing the high turbidity reading. Detailed Raw Water Turbidity readings for 2017 is charted in Appendix F.

## DISINFECTION BYPRODUCTS

Disinfection by-products such as trihalomethanes (THMs) can form when chlorine used to disinfect drinking water reacts with naturally occurring organic matter. Health risks may be associated with long-term exposure to high levels of THMs. Health Canada considers THMs to be possibly carcinogenic to humans. Health Canada also reports that:

*“High Levels of THMs may also have an effect on pregnancy. A California study found that pregnant women who drank large amounts of tap water with high THMs had an increased risk of miscarriage. These studies do not prove that there is a link between THMs and cancer or miscarriage. However, they do show the need for further research in this area to confirm potential health effects.”<sup>5</sup>*

<sup>5</sup> <https://www.canada.ca/en/health-canada/services/healthy-living/your-health/environment/drinking-water-chlorination.html> accessed March 23, 2018.

Health Canada recommends Total THMs remain below 100 ppb. THM concentrations in all 2017 biannual samples remained below 50 ppb at all locations. Detailed THM test results are provided in Appendix G.

## PH

pH is a measure of the acid-base equilibrium of water. pH is of concern in a water distribution system because at low values water becomes corrosive while at high values scale can potentially form and chlorine disinfection is less efficient. Health Canada indicates that an acceptable pH range for drinking water is 6.5 – 8.5 pH units. All of the 2017 biannual distribution system samples were tested for pH. Test results ranged of 6.88 to 7.22 pH units. Full pH results are provided in Appendix F.

## METALS

Metals are inorganic substances that enter our water supplies through a variety of means, some natural and some due to human activity. Some metals are essential for life while others can cause chronic or acute poisoning. Health Canada has set maximum concentration limits for most metals with the exception of for calcium, cobalt, magnesium, molybdenum, nickel or potassium.

In 2017, one treated water sample exceeded the limits set in the Guidelines for Canadian Drinking Water Quality for lead. A tap within the Public Work Yard facility in Kelvin Grove sampled at 0.0365 mg/L, which exceeds the maximum acceptable concentration of 0.010 mg/L. Given that lead test results within the distribution system have been below detectable limits, the most likely source of lead found at this location would be from lead in the private-side service line, lead solder in plumbing, or brass fittings such as faucets. Upon flushing, the sample tested below the acceptable limit. Appendix F contains metals and general chemistry test results for 2017.

## CHALLENGES AND CONCERNS WITH LIONS BAY'S WATER

As previously mentioned, Lions Bay is one the few Metro Vancouver member municipalities that supply their own water – this comes with a unique set of challenges and concerns:

- ◆ Adequate Supply
- ◆ Consumption
- ◆ Increased Turbidity
- ◆ Intake Blockages

### ADEQUATE SUPPLY

The Municipality obtains its water from the Harvey Creek and Magnesia Creek watersheds. Both of these watersheds are fed by surface water sources that are highly susceptible to reduced snow packs, and consequently highly vulnerable to the influences of climate change. During the summer of 2015, stream flows in both creeks was diminished due to a significantly reduced snowpack accumulation the preceding winter. The Municipality was able to avert running out of water thanks to the concentrated conservation efforts of local residents.

In 2017, the Municipality signed a Memorandum of Understanding (MOU) with the Engineering Department at the University of British Columbia (UBC) to collaborate on collecting data from the Municipality in order to perform hydrological research and modelling of the water supply. This collaboration stemmed from the Municipality's desire to better understand their summer water supply situation and the impacts of climate change on the surface water supplies. Through the MOU, UBC and the Municipality intend to jointly address topics such as:

- ◆ Groundwater recharge through various precipitation events;
- ◆ Modelling of groundwater and its flows;
- ◆ Impacts of snowpack availability on groundwater and surface water flows and levels.

Ultimately, this endeavour will help the Municipality determine the long-term viability of these surface water sources and better guide the expenditure of capital investments in the intakes, access roads, and treatment methodologies.

#### WATER CONSUMPTION AND PER CAPITA USE

Coupled with the seasonal variability and impacts of climate change is the historically high per capita water use by local residents. Since 2006 there has been a steady decrease in the per capita consumption rate; however, consumption remains comparatively high even when factoring in non-revenue water.

#### NON REVENUE WATER

While considering the Municipality's yearly consumption, and consequently the Per Capita rate, it is important to recognize the contribution of Non-Revenue Water (NRW) to overall water use. NRW is water that has been produced at the treatment plants but is "lost" before reaching the consumer. NRW in the Municipality's water system escapes through water main breaks, service leaks, leaking joints, and activities such as water main flushing. Based upon drawdown testing conducted in 2016, Non-Revenue Water (NRW) accounts for 26% of the total water consumption in the Municipality. The Municipality has implemented two strategies to help reduce NRW:

1. **Pressure Management** – it is a well-documented fact that high pressures coupled with ageing pipes leads to higher than normal water loss. By continually monitoring and adjusting pressures within the distribution systems 13 pressure reducing stations (PRV's) the Municipality keeps pressures at the minimum possible level to extend water main life and reduce NRW.
2. **Active Leak Control** – the Municipality conducts a biannual leak detection program that involves checking residential lots and distribution system fire hydrants using acoustic leak detection methods to actively locate leaks. Continual monitoring of consumption rates for spikes in water use will also trigger active leak investigations.

In 2017 the Active Leak Control program identified 6 private side leaks and 5 municipal side leaks.

## RESIDENTIAL CONSUMPTION

By factoring out the NRW rate from the yearly consumption figures we can see that the most recent 2017 average resident water consumption rate is 718 L/capita/day. This rate is 62% higher than the Metro Vancouver average of 444 L/capita/day reported for 2016<sup>6</sup>.

Table 6. Yearly Consumption and Per Capita Rates

Year	Yearly Consumption (m <sup>3</sup> )	Census Population	Per Capita (L / capita / day)	Reduced Per Capita (L / capita / day)
2010	857,457	1,318	1,782	1,319
2011	806,522	1,318	1,677	1,241
2012	766,273	1,318	1,593	1,179
2013	827,509	1,318	1,720	1,270
2014	772,301	1,318	1,605	1,188
2015	437,433	1,318	909	673
2016	351,318	1,334	722	534
2017	472,527	1,334	970	718

Residential water conservation offers many benefits to the Municipality including delaying or avoiding capital expenditures on water supply expansion, decreasing operating costs, and a “co-benefit” of reducing the energy required to treat and distribute drinking water. The American Water Works Association<sup>7</sup> highlights the following benefits of water conservation:

- ❖ Operations and maintenance cost savings by reducing the volume of water treated.
- ❖ Future cost savings through deferral of capital investment as a result of population growth and expansion.
- ❖ Environmental benefits: less water could be removed from the environment for human purposes, and more water is available to support downstream aquatic life and important riparian habitat.
- ❖ Competing beneficial uses: more water could be available for competing beneficial uses such as watercourse health and environment, or recreation.
- ❖ Stewardship: utilities that conserve water demonstrate leadership in resource management.
- ❖ Regulatory compliance: some governmental/regulatory agencies require water conservation plans to qualify for permits, grants and loans.

<sup>6</sup> [http://www.metrovancouver.org/services/water/WaterPublications/2016\\_Water\\_Consumption\\_Statistics\\_Report.pdf](http://www.metrovancouver.org/services/water/WaterPublications/2016_Water_Consumption_Statistics_Report.pdf) (Metro Vancouver 2016 Water Consumption Statistics Report)

<sup>7</sup> M52 Water Conservation Programs - A Planning Manual, Second Edition

- ◆ Public perception: the public often insists on a demonstration of efficient use of existing water supplies before supporting expansion of supplies to meet new water needs.

The primary water conservation initiative implemented by the Municipality is the adoption of Outdoor Water Use Bylaw No. 484, 2015. This bylaw outlines the levels of water use restrictions for residential, commercial and public water uses. The levels are posted on the Village of Lions Bay official webpage and presented on a colour coded Water Conservation Level boards throughout the Municipality. Water use outside of the applied restrictions is only permissible for new lawns through the purchase of a permit from the Municipality. Appendix C depicts the restrictions for typical residential, commercial, and public water use activities for each conservation level. To aid in the conservation efforts, the Municipality provides real time water consumption data on their website<sup>8</sup>.

#### INCREASED TURBIDITY

The Municipality draws all of its water from surface sources that are subject to fluctuating turbidity levels, and are designated as unstable terrain upslope. This fluctuation in raw water turbidity presents many challenges for Municipal staff in ensuring that turbidity and chlorine residuals throughout the entire distribution system are not adversely affected. The water treatment plants are monitored remotely via a Supervisory Control and Data Acquisition (SCADA) system, and are checked daily (Monday through Friday) by Municipal crews; each intake is checked at least weekly, unless safe work procedures prohibit entry along the intake road.

In times of severe weather, Municipal staff will increase the frequency of testing and adjust chlorine injection rates to compensate for any fluctuating chlorine demand caused by varying turbidity levels.

#### INTAKE BLOCKAGES

The watershed areas for the Municipality's raw water intakes are contained by steep, rocky, unstable terrain upslope on one side, and steep flowing creeks subject to debris torrents on the other. Access to the intakes is via narrow gravel roads that are subject to rock fall and tree throw hazards from above. Strict safe working guidelines for unstable terrain upslope prohibit crews from entering the watershed areas and water intakes if rainfall parameters are exceeded. This prevents crews from being able to investigate decreased water flow or increased raw water turbidity levels during periods of heavy rain – the exact times most likely to cause either event.



*Excavator removing debris from behind Magnesia Creek intake weir.*

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<sup>8</sup> <https://www.lionsbay.ca/services/public-works/water-consumption-graph>

During an event, organic and inorganic debris flows down the creek channel and becomes trapped behind an intake weir at either of the two raw water intakes. This necessitates manual clearing efforts by staff. In 2017, the Municipality experienced four separate water outages. For the duration of these outages, residents were put on water restrictions and kept up to date via alerts posted on the Municipality's website and through an email notification system for those residents who elect to be notified in this manner.

**Table 7. 2017 Water Outages**

Start Date	Duration of outage (days)	Source Water System	Cause
January 20, 2017	4	Magnesia Creek	Minor debris torrent resulting in blocked intake.
April 10, 2017	9	Magnesia Creek	Minor debris torrent resulting in blocked intake.
June 7, 2017	5	Magnesia Creek	Minor debris torrent resulting in blocked intake.
November 14, 2017	4	Magnesia Creek	Minor debris torrent resulting in blocked intake.

## Annual Work Programs

The Municipality's annual operating work program revolves around regulatory monitoring and reporting that is required in order to meet the *Drinking Water Protection Act* and the *Drinking Water Protection Regulation* requirements. The Core Service Level Review<sup>9</sup>, available on the Municipality's web site details the routine tasks and staff resources involved with operating and maintaining the Municipal Water system.

The Municipal capital works program facilitates minor and major improvements and replacement of the water systems components. More often than not, capital upgrades are facilitated by grant funding opportunities.

## 2017 ACCOMPLISHMENTS

The 2017 operating work program was augmented by PRV repairs and replacement throughout the distribution system and new watershed protection signage, which was installed at various locations along trails in both the Harvey Creek and Magnesia Creek watersheds.

In 2017, the Municipality completed two Capital funded projects through New Building Canada Fund (NBCF) grant program including the construction of a new intake weir on the Harvey Creek watershed at a total cost of \$170,860.00 and an infiltration gallery on the Magnesia Creek watershed at a total cost of \$46,000.00.

<sup>9</sup> <https://www.lionsbay.ca/government/reports-documents-library/core-service-level-review>

Finally, in 2016 the Municipality successfully applied for to the federal and provincial Clean Water and Wastewater Fund (CWWF) program for the replacement of the Municipality's water storage facilities. In 2017 the Municipality engaged the services of AECOM to design and project-manage the construction of two new water storage tanks and the replacement of two redundant storage tanks with PRV's. Construction of this \$2.71 million dollar project is slated to take place in 2018.

#### 2018 WORK PROGRAM

Planned activities for the 2018 work program include routine flushing of the water mains in April and October, the installation of new water sampling stations at two key locations, and the installation of automated flushing stations at water main dead ends in order to improve water quality.

Operator education will consist of three operators obtaining CEU's to remain current with their certification as well as the certification of the remaining Municipal Public Works staff.

## APPENDIX A – ANNUAL OPERATING PERMITS



Vancouver Coastal Health

# PERMIT TO OPERATE

## Drinking Water System 301-10,000 Connections

**Facility Number:** 3317552347  
**Name of Facility:** Lions Bay Magnesia Creek Water System  
**Address:** Upper Sunset Road  
Lions Bay, BC  
**Owner:** Municipality of The Village of Lions Bay  
**Conditions:**

1. Submit weekly water samples for bacteriological testing at sites approved by VCH.
2. Chlorine residuals must be recorded daily at locations approved by VCH.
3. Biannual flushing on the entire distribution system.
4. Daily turbidity testing.
5. Annual chemical testing of source
6. Submit annual updated ERP to VCH.

September 29, 2010

**Effective Date**

A blue ink signature of Rod Schluter, the Environmental Health Officer.

**Rod Schluter**  
Environmental Health Officer

*This permit must be displayed  
in a conspicuous place and is nontransferable.*





Vancouver Coastal Health

# PERMIT TO OPERATE

## Drinking Water System 301-10,000 Connections

**Facility Number:** 3317552348  
**Name of Facility:** Lions Bay Harvey Creek Water System  
**Address:** Upper Oceanview Road  
Lions Bay, BC  
**Owner:** Municipality of The Village of Lions Bay  
**Conditions:**

1. Submit weekly water samples for bacteriological testing at sites approved by VCH.
2. Chlorine residuals must be recorded daily at locations approved by VCH.
3. Biannual flushing on the entire distribution system.
4. Daily turbidity testing.
5. Annual chemical testing of source
6. Submit annual updated ERP to VCH.

September 29, 2010

**Effective Date**

  
**Rod Schluter**  
Environmental Health Officer

*This permit must be displayed  
in a conspicuous place and is nontransferable.*



## APPENDIX B – SAMPLE STATIONS AND TESTS

Table 8. Harvey Creek Water System Sampling Stations

Sampling Location	Type	Free Chlorine	Turbidity	Bacteriological	Metals & Chemical
Harvey Crk. Intake	Raw Water	N/A	Daily	Monthly	Biannual
Harvey Tank	Treated Water	Daily	Daily	Weekly	Biannual
PRV-3	Treated Water	Daily	Daily	Weekly	N/A
Lions Bay Café	Treated Water	Daily	Daily	Weekly	Biannual
Lions Bay Avenue	Treated Water	Daily	Daily	Weekly	Biannual
Kelvin Grove	Treated Water	Daily	Daily	Weekly	Biannual
Harvey UV Reactor	Treated Water	N/A	N/A	Monthly	N/A
Community Centre	Treated Water	N/A	N/A	N/A	Biannual

Note: Daily samples are taken Monday to Friday not including weekends and statutory holidays.

Table 9. Magnesia Creek Water System Sampling Stations

Sampling Location	Type	Free Chlorine	Turbidity	Bacteriological	Metals & Chemical
Magnesia Crk. Intake	Raw Water	N/A	Daily	Monthly	Biannual
Magnesia Tank	Treated Water	Daily	Daily	Weekly	Biannual
PRV-5	Treated Water	Daily	Daily	Weekly	N/A
Brunswick Beach	Treated Water	Daily	Daily	Weekly	Biannual
Magnesia UV Reactor	Treated Water	N/A	N/A	Monthly	N/A

Note: Daily samples are taken Monday to Friday not including weekends and statutory holidays.

## APPENDIX C – Response to Potential Contamination

Table 9 below outlines the notification protocol for unusual situations that could potentially affect the Municipality's potable water system.

**Table 9. Notification of Unusual Situations Potentially Affecting Water Quality**

Situation	Notifying Agency	Agency Notified	Notification Time Frame
E. coli – positive sample	VCH Labs	VOLB & VCH	Immediate
Total coliform >10/100 ml & low chlorine residual	VOLB	VCH	Immediate
Chemical contamination	VOLB	VCH	Immediate
Turbidity events >5 NTU	VOLB	VCH	Immediate
Disinfection failures/continued loss of residual	VOLB	VCH	Immediate for continued loss of residual
Loss of pressure due to high demand	VOLB	VCH	Immediate
Water main breaks	VOLB	VCH	Immediate
Lack of water due to drought or other causes	VOLB	EMBC & VCH	Information only; as drought situation progresses

### E. COLI POSITIVE SAMPLES

Any interim samples (samples that have been taken in the period between the time the E. coli sample was first drawn and when the laboratory determined it to be positive) that have been taken from the same sampling station will be immediately examined by the laboratory.

The chlorine residual noted on the Water Operator's field sheet will be reviewed by the laboratory and compared to previous test results to determine if there is any localized loss of disinfectant residual.

The Public Works Manager (or designate) and VCH will be notified immediately by the laboratory.

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

VCH and the Public Works Manager (or designate) will liaise and determine the need for a Boil Water Advisory (BWA) to be issued. If it is determined to be warranted, VCH will issue the BWA.

The laboratory will continue to test the subsequent samples. Once consecutive negative sample results are returned, the Public Works Manager (or designate) will liaise again with VCH and determine whether the BWA can be lifted.

## CHEMICAL CONTAMINATION

In the event of chemical contamination to the Municipality's water supply or distribution system, VCH will immediately be notified, and steps will commence to isolate the contaminated area. The level of contamination will be determined through water sampling and analysis; identified and any public health risk factors associated with the chemical presence and level will be determined. A public advisory will be issued and carried out by the Public Works Manager (or designate) under the guidance of VCH. Once the contamination is remedied and consecutive negative sample results are returned from the laboratory, the Public Works Manager (or designate) will again liaise with VCH and determine whether the public advisory can be lifted.

## TURBIDITY EVENTS

Turbidity in the Municipality's treated water system is monitored on a regular basis through the water sampling and local analysis program. Water sample turbidity results that register  $>1 - 3$  NTU are scrutinized, along with corresponding chlorine residual levels, and actively monitored. Any sections of the water distribution system generating high turbidity results are field-checked and flushed if required.

Turbidity events in the raw source water affect the Municipality's water treatment plants. The performance of the primary UV treatment is affected by increased turbidity because water that has higher turbidity absorbs a significant amount of UV light, and will therefore have a correspondingly low UV transmittance (UVT) rate. The UV system automatically increases lamp intensity to counter the lower UVT. Once the UVT drops below the minimum set point of  $26.25 \text{ mJ/cm}^2$ , the UV reactors shut down and an alarm signal is sent via SCADA to municipal on-call staff. Municipal staff will immediately inform the Public Works Manager (or designate) and investigate the alarm at the plant.

During turbidity events in excess of 5 NTU in the distribution system, microbiological sampling and testing is increased at all sampling locations; chlorine residual sampling and testing is likewise increased; and the Municipality will contact VCH, who may issue a Boil Water Advisory.

## DISINFECTION FAILURES

Chlorine residuals in the Municipality's treated water system are monitored on a regular basis through the water sampling and local analysis program. If a daily sample registers below the generally accepted minimum chlorine residual of 0.2 ppm, the Water Operator will first flush water through the system to attempt to bring the chlorine residual up to the minimum required. Should the chlorine residual continue to be below the minimum level, the Municipality will immediately commence increased monitoring of all chlorine residuals in the system, including the storage tanks, and determine the root cause of the problem. Chlorine will be added manually to the storage reservoirs if necessary; and residuals checked frequently at all locations. The Public Works Manager (or designate) will contact VCH, who may issue a Boil Water Advisory if continued loss of residual is observed.

## LOSS OF PRESSURE DUE TO HIGH DEMAND

In the event of adverse pressure loss due to high demand, Municipal crews will adjust the system to isolate the affected section, and then take effective measures to supplement pressure in the affected area. The

Public Works Manager (or designate) 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 MAIN BREAKS

In the event of a water main break where chemical or microbiological contamination of the system is suspected, Municipal crews will adjust the system to isolate the contaminated section from the rest of the distribution system. The Public Works Manager (or designate) 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 and downstream of the break if possible, and tested for the suspected contamination. The same procedures as noted under E. coli positive samples above will be implemented if required.

#### LACK OF WATER DUE TO DROUGHT OR OTHER CAUSES

In the event of a lack of water due to low streamflow or other causes affecting supply (such as debris torrents, lack of safe access to intakes, or Municipality-wide water use in excess of supply), an escalating conservation system is implemented to address the lack of water in the system.

Conservation efforts now commence annually from June 1 through to September 30 of each year, in accordance with Level 1 of the Municipality's Outdoor Water Use Bylaw. Further stages of conservation are then utilized as required to reduce the outdoor use of water in the Municipality, combined with extensive public notification (via electronic notifications, printed media delivered to every home, and town hall meetings). The highest levels of restrictions are intended for emergent situations that directly affect the supply of water in the system.

The flow rate of raw water entering the creek intakes to their respective water treatment plants is monitored daily, during the water sampling and testing program. If the water flow entering either plant is compromised, Municipal crews ascertain the root cause of the problem (i.e. whether the decrease is due to a blockage or drought) and work to either repair (if blocked) and/or mitigate the impact on the system as a whole by implementing conservation measures noted in Table 10 below.

When a lack of water continues despite conservation efforts, Municipal staff will liaise with EMBC, VCH, and FLNRO for both information and a consolidated response to events as they unfold. Municipal staff will then arrange for water tankers to truck in potable water and use this method to fill one or both tanks to keep potable water in the water system. Neighboring municipalities will also be informed in the event they can lend assistance. Increased testing and monitoring of the water system is undertaken, in conjunction with VCH, until the system as a whole is once again restored.

Table 10. Outdoor Water Use Conservation Levels

	ACTIVITY	CONSERVATION LEVEL 1	CONSERVATION LEVEL 2	CONSERVATION LEVEL 3
RESIDENTIAL & COMMERCIAL USES	Watering lawns, 4 am – 9 am only	Even-numbered addresses: Monday, Wednesday and Saturday.	Even-numbered addresses: Monday only	Prohibited
	Newly planted lawns may be watered outside allowed times with a municipal permit displayed	Odd-numbered addresses: Tuesday, Thursday and Sunday.	Odd-numbered addresses: Thursday only	
	Watering flowers, vegetables, planters, shrubs, trees	No restrictions	Only by hand using spring-loaded nozzle, containers, or drip irrigation. Sprinklers and soaker hoses prohibited	Prohibited
	Use of pools, spas, fountains/ponds	No restrictions. Must have a recirculation pump. “One-time-through” uses are prohibited at all times		Filling prohibited
	Washing outdoor impermeable surfaces such as driveways, buildings, sidewalks and roads, including pressure washing	No restrictions	Only for health and safety purposes, or to prepare a surface for painting or similar treatment	Prohibited
	Washing vehicles and boats	Only with a hose using spring-loaded shut off	Only by bucket	Prohibited, except for windows, lights, and license plates
	Flushing boat engines	No restrictions		4 minutes maximum
	Filling outdoor water storage	No restrictions		Prohibited
PUBLIC USES	Watering of school property, including Lions Bay Field	No restrictions	Minimum to maintain in useable condition	Prohibited
	Watering of parks, municipal lawns, and grassed boulevards 1 am to 6 am only	Even-numbered addresses: Monday and Wednesday. Odd-numbered addresses: Tuesday and Thursday. Parks Friday only	Even-numbered addresses: Monday only Odd-numbered addresses: Thursday only	Prohibited
	Flushing of water mains and hydrants	Only for safety or public health reasons		

## APPENDIX D – TREATED WATER TURBIDITY AND CHLORINE RESIDUAL READINGS

	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
Date	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
Jan. 03	0.19	0.94	0.27	0.77	0.50	0.69	0.21	0.56	0.27	0.24	0.27	0.90	0.18	0.78	0.23	0.84
Jan. 04	0.30	0.97	0.27	0.94	0.28	0.63	0.28	0.57	0.19	0.34	0.35	0.90	0.14	0.77	0.25	0.80
Jan. 05	0.16	0.92	0.42	0.89	0.40	0.74	0.17	0.57	0.37	0.52	0.22	0.97	0.13	0.86	0.26	0.77
Jan. 06	0.75	1.15	0.29	1.12	0.32	0.90	0.32	0.63	0.15	0.57	0.39	0.97	0.23	0.94	0.24	0.76
Jan. 09	0.22	1.18	0.31	1.15	0.45	0.93	0.24	0.78	0.26	0.60	0.36	1.11	0.21	1.08	0.29	0.88
Jan. 10	0.68	0.99	0.44	0.96	0.38	0.80	0.40	0.86	0.23	0.97	0.22	0.95	0.27	1.15	0.30	0.88
Jan. 11	0.50	0.90	0.87	0.84	0.57	0.73	0.29	0.68	0.16	0.99	0.39	0.96	0.38	0.86	0.36	0.88
Jan. 12	1.16	0.93	0.66	0.87	0.64	0.68	0.44	0.95	0.32	0.85	0.27	0.95	0.29	0.80	0.32	0.88
Jan. 13	1.03	0.86	0.69	0.82	1.06	0.64	N/A	N/A	0.15	0.72	0.27	0.91	0.31	0.91	0.29	0.85
Jan. 16	0.12	0.81	0.31	0.77	0.60	0.59	N/A	N/A	0.24	0.47	0.19	0.99	0.17	0.91	0.36	0.83
Jan. 17	0.41	0.82	0.42	0.78	0.65	0.71	N/A	N/A	0.27	0.49	0.30	1.18	0.20	1.09	0.45	0.83
Jan. 18	0.87	0.89	0.96	0.85	0.73	0.71	N/A	N/A	0.34	0.60	0.86	1.10	0.67	1.05	0.25	0.83
Jan. 19	1.36	0.84	2.19	0.80	1.09	0.54	N/A	N/A	0.53	0.69	1.91	0.92	0.64	0.70	0.37	0.98
Jan. 20	1.10	0.87	0.90	0.83	1.22	0.50	N/A	N/A	0.36	0.61	1.67	0.66	1.05	0.68	0.61	0.91
Jan. 23	0.94	1.08	0.48	1.04	0.58	0.80	N/A	N/A	0.32	0.57	0.82	0.85	0.34	0.87	0.70	0.38
Jan. 24	0.54	1.04	0.37	1.01	0.42	0.75	1.16	0.59	0.32	0.76	0.75	0.91	0.59	0.85	0.57	0.52
Jan. 25	0.56	0.89	0.70	0.86	0.40	0.64	0.46	0.62	0.31	0.68	0.62	1.05	0.49	0.95	0.51	0.60
Jan. 26	0.77	0.83	0.48	0.79	0.35	0.62	0.66	0.67	0.24	0.62	0.65	1.08	0.88	1.00	0.58	0.65
Jan. 27	0.30	0.76	0.45	0.73	0.44	0.57	0.76	0.64	0.26	0.51	0.73	1.05	0.65	1.02	0.42	0.79
Jan. 30	0.24	0.89	0.20	0.85	0.36	0.67	0.25	0.54	0.17	0.31	0.40	0.98	0.27	0.92	0.27	0.85
Jan. 31	0.53	0.98	0.28	0.95	0.46	0.62	0.25	0.55	0.25	0.61	0.34	1.02	0.34	1.00	0.54	0.82
Feb. 01	0.40	0.95	0.30	0.92	0.42	0.82	0.32	0.64	0.37	0.59	0.53	1.06	0.47	1.03	0.47	0.82
Feb. 02	0.18	1.12	0.20	1.08	0.46	0.93	0.55	0.67	0.45	0.54	0.27	1.03	0.32	1.00	0.34	0.86
Feb. 03	0.21	1.02	0.39	0.98	0.35	0.88	0.28	0.64	0.21	0.72	0.46	1.07	0.28	1.00	0.28	0.89
Feb. 06	0.13	1.06	0.38	1.04	0.34	0.91	0.36	0.77	0.22	0.65	0.21	1.03	0.28	0.97	0.38	0.88
Feb. 07	0.51	1.04	0.49	1.01	0.52	0.86	0.23	0.77	0.29	0.88	0.41	0.97	0.29	0.89	0.23	0.91
Feb. 08	0.17	0.94	0.33	0.91	0.38	0.77	0.26	0.79	0.24	0.83	0.39	0.91	0.31	0.80	0.25	0.87
Feb. 09	0.35	0.94	0.91	0.90	0.44	0.69	0.33	0.74	0.29	0.73	0.39	0.93	0.29	0.89	0.31	0.84
Feb. 10	1.24	0.75	0.70	0.71	0.48	0.58	0.44	0.72	0.26	0.70	0.62	0.93	0.39	0.91	0.39	0.82
Feb. 14	0.20	1.08	0.26	0.91	0.19	0.84	0.19	0.58	0.20	0.63	0.16	1.11	0.17	0.94	0.34	0.85
Feb. 15	0.32	1.04	0.22	0.93	0.21	0.80	0.29	0.51	0.62	0.79	0.43	1.02	0.23	0.98	0.29	0.97
Feb. 16	1.79	0.78	1.91	0.80	0.68	0.52	0.29	0.66	0.48	0.81	2.25	0.83	0.72	0.86	0.18	0.89
Feb. 17	1.02	0.78	0.96	0.53	0.93	0.51	0.33	0.67	0.35	0.79	1.93	0.92	1.65	0.66	0.23	0.83

Lions Bay Drinking Water Quality 2017 Annual Report

	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
Date	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
Feb. 20	0.34	1.04	0.46	0.95	0.38	0.82	0.46	0.35	0.25	0.34	0.77	1.01	0.72	0.87	0.92	0.43
Feb. 21	0.32	0.95	0.41	0.91	0.36	0.79	0.73	0.41	0.29	0.94	0.67	0.98	0.59	0.90	0.69	0.73
Feb. 22	0.38	0.97	0.30	0.94	0.39	0.74	0.80	0.54	0.45	0.84	0.53	1.01	0.52	0.96	0.60	0.73
Feb. 23	0.25	1.06	0.38	1.02	0.45	0.72	0.50	0.72	0.27	0.65	0.48	1.04	0.40	0.99	0.75	0.75
Feb. 24	0.26	0.97	0.52	0.93	0.28	0.86	0.34	0.60	0.35	0.56	0.53	1.03	0.43	0.98	0.44	0.77
Feb. 27	0.24	1.02	0.26	0.99	0.26	0.90	0.27	0.69	0.17	0.42	0.26	0.96	0.25	0.94	0.25	0.79
Feb. 28	0.26	1.14	0.29	1.11	0.38	0.84	0.26	0.71	1.92	0.81	0.19	1.01	0.23	0.97	0.27	0.81
Mar. 01	1.10	1.14	0.68	1.10	0.53	0.90	0.25	0.76	0.34	0.77	0.26	1.02	0.22	0.97	0.27	0.83
Mar. 02	0.17	1.09	0.29	1.06	0.24	0.97	0.21	0.78	0.30	0.89	0.33	0.98	0.33	0.94	0.30	0.85
Mar. 03	0.62	1.01	0.45	0.98	0.49	0.83	0.34	0.84	0.30	0.91	0.32	1.05	0.32	0.96	0.53	0.85
Mar. 06	0.16	1.05	0.16	1.03	0.34	0.79	0.18	0.74	0.35	0.80	0.40	1.05	1.96	1.05	0.29	0.82
Mar. 07	0.17	1.02	0.47	0.99	0.29	0.82	0.25	0.79	0.18	0.68	0.25	1.01	0.22	1.00	0.27	0.91
Mar. 08	0.29	0.99	0.36	0.96	0.46	0.85	0.23	0.81	0.41	0.83	0.31	1.01	0.28	1.01	0.23	0.93
Mar. 09	0.48	0.98	0.79	0.94	0.44	0.85	0.23	0.79	0.44	0.74	0.30	1.03	0.34	0.89	0.28	0.91
Mar. 10	0.35	0.92	0.24	0.91	0.40	0.82	0.42	0.76	0.19	0.83	0.61	1.02	0.50	0.96	0.26	0.89
Mar. 13	0.42	0.63	0.19	0.59	0.21	0.41	0.25	0.61	0.64	0.58	0.30	0.93	0.20	0.91	0.25	0.85
Mar. 14	0.87	0.84	0.85	0.80	0.69	0.37	0.62	0.59	0.25	0.45	0.30	0.96	0.34	0.95	0.42	0.83
Mar. 15	1.23	0.92	1.22	0.89	0.42	0.65	0.51	0.40	0.29	0.27	0.41	0.90	0.38	0.90	0.39	0.78
Mar. 16	1.00	0.96	0.98	0.93	0.77	0.69	0.65	0.34	0.39	0.37	0.56	0.92	0.78	0.91	0.35	0.82
Mar. 17	0.47	0.94	0.49	0.91	0.44	0.74	0.37	0.34	0.30	0.30	0.56	0.87	0.60	0.85	0.26	0.74
Mar. 20	0.27	1.24	0.44	1.21	0.31	1.08	0.36	0.61	0.30	0.24	0.36	0.92	0.37	0.89	0.35	0.62
Mar. 21	0.56	1.25	0.30	1.22	0.31	1.03	0.26	0.72	0.22	0.42	0.42	0.89	0.35	0.87	0.38	0.76
Mar. 22	1.13	0.91	0.31	0.93	0.40	0.76	0.18	0.81	0.30	0.94	0.62	0.91	0.41	0.87	0.29	0.79
Mar. 23	1.25	0.74	0.42	0.70	0.41	0.50	0.22	0.83	0.21	0.88	0.34	0.84	0.34	0.75	0.32	0.76
Mar. 24	1.28	0.65	0.61	0.55	0.38	0.40	0.35	0.78	0.23	0.70	0.32	0.81	0.58	0.74	0.30	0.71
Mar. 27	0.26	0.76	0.29	0.72	0.38	0.69	0.20	0.34	0.20	0.20	0.27	0.82	0.24	0.78	0.20	0.62
Mar. 28	0.92	0.85	0.71	0.81	0.49	0.70	0.23	0.33	0.39	0.65	0.28	0.90	0.32	0.84	0.24	0.67

Lions Bay Drinking Water Quality 2017 Annual Report

	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
Date	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
Mar. 29	0.80	0.87	0.66	0.84	0.51	0.73	0.26	0.38	0.41	0.67	1.06	0.86	0.42	0.80	0.38	0.71
Mar. 30	1.41	0.95	0.45	0.92	0.75	0.68	0.21	0.38	0.40	0.71	0.45	0.78	0.39	0.75	0.50	0.68
Mar. 31	1.27	0.94	0.34	0.91	0.55	0.71	0.40	0.63	0.36	0.78	0.47	0.92	0.51	1.10	0.24	0.63
Apr. 03	0.22	1.09	0.32	1.06	0.23	0.97	0.17	0.63	0.20	0.28	0.29	1.03	0.46	1.00	0.26	0.81
Apr. 04	0.26	1.06	0.33	1.03	0.28	0.87	0.17	0.66	0.27	0.67	0.22	1.00	0.20	0.98	0.21	0.78
Apr. 05	0.23	0.94	0.29	0.91	0.27	0.90	0.17	0.65	0.21	0.70	0.27	0.99	0.32	0.94	0.30	0.85
Apr. 06	0.98	0.88	0.80	0.84	0.51	0.70	0.19	0.69	0.40	0.73	0.64	0.90	0.60	0.99	0.27	0.85
Apr. 07	1.81	0.74	0.79	0.70	0.54	0.52	0.25	0.68	0.21	0.58	0.78	1.00	0.58	0.78	0.31	0.73
Apr. 10	0.33	0.94	0.39	0.91	0.36	0.69	0.34	0.43	0.29	0.24	1.48	0.50	0.42	0.90	0.47	0.35
Apr. 11	0.32	1.14	0.43	1.11	0.36	0.91	0.24	0.56	0.28	0.30	1.32	0.68	0.33	1.06	0.27	0.48
Apr. 12	1.05	1.28	0.27	1.24	0.34	0.98	0.26	0.72	0.45	0.39	1.06	0.80	0.65	1.42	0.29	0.65
Apr. 13	0.74	1.16	0.24	1.13	0.46	0.82	0.33	0.92	0.20	0.56	0.89	0.87	0.41	1.15	0.19	0.71
Apr. 15	0.23	1.01	0.31	0.97	0.39	0.76	0.24	0.81	0.37	0.58	0.33	0.99	0.62	0.91	0.21	0.72
Apr. 18	0.25	0.94	0.25	0.91	0.38	0.82	0.26	0.61	0.37	0.33	0.55	1.05	0.18	0.99	0.29	0.70
Apr. 19	0.28	0.87	0.27	0.84	0.33	0.68	0.25	0.59	0.21	0.43	0.50	1.16	0.67	1.09	0.21	0.74
Apr. 20	0.37	0.68	0.28	0.64	0.36	0.51	0.19	0.62	0.33	0.45	0.44	1.06	0.53	1.05	0.47	0.90
Apr. 21	0.99	0.80	0.24	0.76	0.38	0.54	0.31	0.55	0.21	0.33	0.51	0.93	0.41	0.92	0.52	0.87
Apr. 24	0.32	0.82	0.40	0.78	0.29	0.59	0.21	0.35	0.25	0.37	0.35	0.84	0.45	0.77	0.29	0.68
Apr. 25	0.89	0.95	0.37	0.92	0.25	0.72	0.25	0.46	0.28	0.46	0.34	0.89	0.57	0.62	0.38	0.54
Apr. 26	0.48	0.99	0.53	0.86	0.51	0.80	0.28	0.38	0.20	0.60	0.74	0.96	0.49	0.85	0.36	0.54
Apr. 27	0.33	0.99	0.40	0.96	0.26	0.84	0.22	0.42	0.31	0.66	0.57	0.93	0.77	0.87	0.34	0.63
Apr. 28	0.34	1.00	0.25	0.96	0.28	0.90	0.23	0.43	0.27	0.75	0.34	0.96	0.34	0.90	0.38	0.63
May. 01	0.21	1.09	0.28	1.06	0.23	1.03	0.24	0.66	0.28	0.73	0.28	0.98	0.22	0.98	0.21	0.80
May. 02	1.51	1.04	0.39	1.00	0.18	0.84	0.34	0.68	0.25	0.55	0.45	0.85	0.44	0.89	0.21	0.75
May. 03	0.61	0.94	0.49	0.90	0.50	0.74	0.31	0.75	0.41	0.80	0.38	0.88	0.26	0.85	0.49	0.75
May. 04	1.75	0.63	0.27	0.60	0.47	0.53	0.20	0.72	0.28	0.67	0.53	0.75	0.66	0.74	0.46	0.67
May. 05	2.02	0.61	0.73	0.57	0.84	0.57	0.35	0.63	0.33	0.47	0.95	0.65	0.73	0.61	0.69	0.59

# Lions Bay Drinking Water Quality 2017 Annual Report

Date	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
May. 08	0.70	1.11	0.46	1.08	0.35	0.93	0.32	0.53	0.29	0.55	0.54	1.13	0.45	1.10	0.43	0.52
May. 09	0.47	1.15	0.32	1.12	0.33	0.95	0.29	0.73	0.33	0.75	0.42	1.05	0.37	1.01	0.41	0.88
May. 10	0.35	1.14	0.33	1.11	0.29	0.94	0.27	0.91	0.30	0.81	0.53	0.96	0.41	0.91	0.36	0.95
May. 11	1.13	0.94	0.31	0.91	0.37	0.73	0.25	0.84	0.23	0.79	0.40	0.84	0.35	0.81	0.46	0.81
May. 12	1.19	0.83	0.52	0.79	0.44	0.71	0.22	0.79	0.29	0.70	1.01	0.73	0.91	0.75	0.37	0.72
May. 15	0.58	0.79	0.50	0.75	0.40	0.70	0.34	0.50	0.29	0.47	0.91	1.15	0.70	1.08	0.67	0.51
May. 16	1.04	0.98	0.40	0.95	0.28	0.83	0.24	0.51	0.22	0.51	0.62	1.04	0.52	0.98	0.54	0.71
May. 17	1.62	0.97	0.46	0.93	0.60	0.76	0.31	0.50	0.33	0.54	0.75	0.96	0.77	0.92	0.46	0.77
May. 18	1.00	0.92	0.26	0.88	0.27	0.75	0.23	0.59	0.22	0.49	0.80	0.93	0.53	0.86	0.56	0.72
May. 19	0.72	1.02	0.30	0.98	0.28	0.80	0.21	0.56	0.22	0.70	0.97	0.99	0.45	0.89	0.53	0.69
May. 23	0.28	0.84	0.35	0.80	0.34	0.67	0.39	0.75	0.26	0.57	0.44	0.64	0.85	0.62	0.37	0.52
May. 24	0.41	0.85	0.33	0.81	0.25	0.66	0.18	0.62	0.19	0.48	0.60	0.83	0.56	0.69	0.32	0.45
May. 25	0.41	0.86	0.30	0.82	0.42	0.70	0.54	0.58	0.26	0.48	0.47	0.86	0.69	0.82	0.42	0.39
May. 26	0.34	0.86	0.36	0.82	0.29	0.64	0.40	0.79	0.44	0.48	0.49	0.97	0.46	0.91	0.70	0.51
May. 29	0.52	0.73	0.37	0.69	0.53	0.56	0.37	0.65	0.22	0.40	0.68	0.93	0.54	0.87	0.46	0.74
May. 30	0.46	0.76	0.43	0.73	0.33	0.60	0.30	0.53	0.29	0.44	0.90	0.85	0.74	0.85	0.45	0.71
May. 31	0.55	0.94	0.54	0.91	0.36	0.64	0.29	0.62	0.35	0.41	1.27	0.83	1.00	0.77	0.46	0.57
Jun. 01	1.10	0.96	0.42	0.92	0.95	0.82	0.25	0.54	0.30	0.58	1.09	0.82	1.23	0.79	0.85	0.51
Jun. 02	0.32	0.98	0.25	0.91	0.27	0.72	0.23	0.56	0.25	0.60	0.63	0.93	0.56	0.75	0.59	0.46
Jun. 05	0.37	1.06	0.23	1.02	0.25	0.85	0.25	0.85	0.26	0.57	0.44	0.89	0.37	0.86	0.35	0.62
Jun. 06	0.51	0.91	0.31	0.87	0.25	0.68	0.20	0.77	0.19	0.65	0.64	0.97	0.44	0.97	0.33	0.64
Jun. 07	0.71	0.77	0.32	0.73	0.30	0.59	0.38	0.75	0.21	0.69	0.72	1.07	0.56	1.03	0.38	0.76
Jun. 08	1.32	0.70	0.34	0.66	0.37	0.53	0.22	0.55	0.49	0.48	0.85	0.87	0.47	0.86	4.50	0.73
Jun. 09	0.78	0.60	0.91	0.56	0.68	0.38	0.21	0.43	0.38	0.34	2.66	0.70	1.56	0.68	0.47	0.65
Jun. 12	3.72	0.92	0.51	0.88	0.42	0.71	0.39	0.70	0.34	0.37	1.79	0.89	0.57	0.77	1.43	0.57
Jun. 13	0.89	0.94	0.31	0.90	0.34	0.74	0.26	0.62	0.23	0.50	0.93	0.94	0.75	0.94	0.79	0.67
Jun. 14	0.42	1.17	0.26	1.13	0.63	0.63	0.22	0.61	0.31	0.61	0.86	1.00	0.55	0.99	0.74	0.64

Lions Bay Drinking Water Quality 2017 Annual Report

Date	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
Jun. 15	0.31	1.08	0.29	1.07	0.52	0.66	0.21	0.73	0.28	1.00	0.54	0.96	0.36	0.95	0.45	0.70
Jun. 16	1.14	0.78	0.69	0.74	1.21	0.45	0.22	0.90	0.24	0.77	1.97	0.73	1.77	0.71	0.44	0.67
Jun. 19	0.82	0.97	0.34	0.93	0.34	0.71	0.27	0.45	0.25	0.45	0.68	1.00	0.59	0.95	0.60	0.66
Jun. 20	1.33	0.91	0.43	0.87	0.44	0.71	0.27	0.60	0.28	0.53	1.02	1.09	0.73	1.07	0.65	0.93
Jun. 21	0.63	0.90	0.33	0.86	0.26	0.67	0.21	0.53	0.24	0.50	0.60	0.94	0.46	0.94	0.40	0.85
Jun. 22	0.76	0.87	0.35	0.83	0.27	0.64	0.20	0.58	0.19	0.59	0.66	0.87	0.47	0.80	0.35	0.76
Jun. 23	0.32	0.86	0.25	0.82	0.23	0.62	0.18	0.66	0.34	0.55	0.51	0.80	0.39	0.80	0.38	0.73
Jun. 26	0.82	0.78	0.21	0.74	0.29	0.55	0.40	0.64	0.17	0.44	0.64	0.67	0.55	0.66	0.42	0.56
Jun. 27	0.32	0.83	0.32	0.79	0.24	0.61	0.19	0.56	0.28	0.46	0.60	0.81	0.48	0.73	0.41	0.54
Jun. 28	0.36	0.92	0.24	0.88	0.30	0.63	0.23	0.73	0.24	0.55	0.55	0.84	0.47	0.79	0.43	0.54
Jun. 29	0.19	0.91	0.17	0.89	0.27	0.72	0.17	0.70	0.36	0.53	0.38	0.93	0.41	0.80	0.48	0.59
Jun. 30	0.23	0.97	0.24	0.91	0.23	0.69	0.21	0.73	0.48	0.56	0.44	0.93	0.32	0.85	0.35	0.71
Jul. 04	0.15	0.83	0.17	0.83	0.19	0.66	0.14	0.69	0.18	0.53	0.29	0.91	0.26	0.81	0.30	0.69
Jul. 05	0.16	0.81	0.17	0.81	0.21	0.62	0.20	0.82	0.42	0.56	0.27	0.88	0.36	0.86	0.29	0.53
Jul. 06	0.20	0.87	0.17	0.95	0.22	0.65	0.13	0.66	0.21	0.48	0.26	0.95	0.25	0.89	0.23	0.64
Jul. 07	0.16	0.96	0.15	0.90	0.24	0.77	0.13	0.70	0.41	0.68	0.24	1.00	0.24	0.75	0.24	0.71
Jul. 10	0.13	1.00	0.15	0.97	0.35	0.85	0.14	0.90	0.21	0.74	0.21	0.97	0.27	0.92	0.23	0.76
Jul. 11	0.16	1.00	0.17	1.01	0.16	0.88	0.13	0.81	0.35	0.85	0.26	0.95	0.35	0.88	0.28	0.56
Jul. 12	0.16	1.01	0.19	0.97	0.39	0.74	0.17	0.89	0.17	0.91	0.27	0.85	0.22	0.81	0.24	0.69
Jul. 13	0.23	0.98	0.16	0.95	0.18	0.78	0.15	0.83	0.20	0.74	0.28	0.81	0.27	0.79	0.24	0.65
Jul. 14	0.26	0.91	0.25	0.87	0.29	0.76	0.16	0.84	0.16	0.75	0.29	0.78	0.22	0.73	0.23	0.62
Jul. 17	0.16	0.83	0.15	0.79	0.22	0.70	0.20	0.78	0.22	0.49	0.25	0.84	0.21	0.87	0.20	0.77
Jul. 18	0.24	0.89	0.27	0.85	0.31	0.70	0.16	0.75	0.16	0.53	0.20	0.93	0.56	0.93	0.21	0.69
Jul. 19	0.17	0.92	0.24	0.88	0.25	0.71	0.29	0.81	0.20	0.64	0.27	0.91	0.20	0.89	0.20	0.77
Jul. 20	0.19	1.00	0.18	0.96	0.26	0.73	0.15	0.91	0.23	0.67	0.27	0.93	0.19	0.87	0.21	0.79
Jul. 21	0.20	1.01	0.75	0.96	0.21	0.78	0.16	0.85	0.16	0.70	0.29	0.93	0.19	0.85	0.21	0.73
Jul. 24	0.15	0.88	0.17	0.84	0.26	0.68	0.16	0.76	0.19	0.53	0.31	0.91	0.18	0.91	0.19	0.77

Lions Bay Drinking Water Quality 2017 Annual Report

	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
Date	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
Jul. 25	0.18	0.91	0.20	0.87	0.42	0.66	0.17	0.79	0.17	0.58	0.22	0.91	0.31	0.86	0.21	0.71
Jul. 26	0.23	0.94	0.24	0.90	0.39	0.76	0.30	0.82	0.16	0.64	0.22	0.84	0.24	0.84	0.21	0.75
Jul. 27	0.16	0.93	0.16	0.90	0.72	0.76	0.14	0.81	0.16	0.67	0.24	0.88	0.19	0.85	0.21	0.73
Jul. 28	0.16	0.93	0.26	0.89	0.23	0.73	0.16	0.82	0.16	0.68	0.25	0.90	0.22	0.85	0.22	0.68
Jul. 31	0.14	0.97	0.14	0.93	0.13	0.74	0.12	0.75	0.15	0.69	0.16	0.96	0.15	0.90	0.20	0.75
Aug. 01	0.18	0.89	0.18	0.85	0.18	0.70	0.23	0.79	0.15	0.60	0.18	0.88	0.21	0.81	0.22	0.72
Aug. 02	0.22	0.92	0.17	0.89	0.21	0.77	0.16	0.79	0.18	0.63	0.19	0.94	0.21	0.80	0.20	0.74
Aug. 03	0.16	0.96	0.21	0.93	0.22	0.83	0.18	0.88	0.19	0.64	0.26	0.85	0.22	0.78	0.32	0.70
Aug. 04	0.18	0.94	0.17	0.90	0.29	0.73	0.19	0.85	0.21	0.66	0.23	0.85	0.17	0.82	0.25	0.68
Aug. 08	0.17	0.81	0.21	0.77	0.16	0.72	0.16	0.69	0.15	0.52	0.23	0.86	0.17	0.86	0.27	0.64
Aug. 09	0.21	0.82	0.20	0.78	0.19	0.68	0.21	0.78	0.17	0.59	0.22	0.77	0.18	0.76	0.24	0.65
Aug. 10	0.19	0.95	0.17	0.91	0.17	0.74	0.15	0.72	0.15	0.58	0.21	0.81	0.18	0.72	0.19	0.61
Aug. 11	0.70	0.93	0.18	0.90	0.18	0.77	0.21	0.81	0.15	0.64	0.24	0.80	0.17	0.70	0.21	0.58
Aug. 14	0.19	0.72	0.15	0.69	0.50	0.58	0.17	0.67	0.17	0.49	0.20	0.74	0.24	0.71	0.29	0.56
Aug. 15	0.17	0.92	0.16	0.88	0.25	0.72	0.14	0.53	0.16	0.44	0.22	0.97	0.25	0.88	0.27	0.52
Aug. 16	0.17	1.05	0.15	1.02	0.20	0.82	0.19	0.87	0.15	0.58	0.19	1.02	0.22	1.00	0.20	0.63
Aug. 17	0.19	1.06	0.17	1.03	0.16	0.90	0.16	0.89	0.18	0.68	0.21	1.10	0.30	1.04	0.25	0.77
Aug. 18	0.83	1.05	0.15	1.07	0.24	0.78	0.15	0.93	0.16	0.76	0.19	1.04	0.15	0.98	0.29	0.82
Aug. 21	0.15	0.89	0.13	0.85	0.14	0.74	0.15	0.81	0.13	0.59	0.17	0.84	0.20	0.84	0.30	0.71
Aug. 22	0.18	0.83	0.15	0.80	0.23	0.68	0.16	0.74	0.18	0.57	0.22	0.84	0.23	0.78	0.22	0.68
Aug. 23	0.15	0.81	0.17	0.77	0.22	0.64	0.16	0.72	0.21	0.60	0.30	0.78	0.24	0.77	0.91	0.63
Aug. 24	0.19	0.85	0.15	0.82	0.18	0.67	0.16	0.72	0.16	0.59	0.21	0.88	0.17	0.76	0.36	0.66
Aug. 25	0.28	0.84	0.21	0.81	0.23	0.62	0.17	0.73	0.15	0.59	0.22	0.88	0.14	0.84	0.21	0.62
Aug. 28	0.18	0.86	0.12	0.83	0.29	0.69	0.12	0.84	0.19	0.57	0.16	0.86	0.16	0.81	0.31	0.65
Aug. 29	0.13	0.86	0.15	0.82	0.27	0.72	0.12	0.78	0.15	0.59	0.26	0.92	0.17	0.86	0.18	0.72
Aug. 30	0.17	0.86	0.18	0.82	1.93	0.61	0.18	0.79	0.42	0.61	0.17	0.85	0.24	0.82	0.27	0.73
Aug. 31	0.16	0.89	0.15	0.85	0.19	0.71	0.28	0.73	0.30	0.55	0.39	0.94	0.33	0.88	0.23	0.73

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	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
Date	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
Sep. 01	0.16	1.14	0.18	1.10	0.20	0.70	0.16	0.81	0.14	0.58	0.24	0.96	0.19	0.90	0.29	0.68
Sep. 05	0.14	0.79	0.12	0.74	1.14	0.58	0.11	0.67	0.14	0.48	0.24	0.92	0.19	0.93	0.20	0.87
Sep. 06	0.15	0.83	0.13	0.79	0.17	0.63	0.15	0.67	0.14	0.52	0.20	0.98	0.21	0.91	0.18	0.81
Sep. 07	0.14	0.81	0.15	0.77	0.31	0.62	0.21	0.66	0.16	0.60	0.21	0.89	0.16	0.87	0.21	0.77
Sep. 08	0.34	0.89	0.15	0.85	0.16	0.64	0.23	0.70	0.16	0.53	0.21	0.82	0.19	0.81	0.22	0.69
Sep. 11	0.17	0.93	0.13	0.89	0.20	0.74	0.17	0.79	0.16	0.46	1.28	0.56	0.18	0.54	0.21	0.33
Sep. 12	0.54	0.98	0.24	0.94	0.29	0.76	0.23	0.76	0.17	0.51	0.72	0.77	0.29	0.69	0.35	0.38
Sep. 13	4.52	1.04	1.14	0.99	0.28	0.82	0.23	0.85	0.21	0.59	0.62	1.04	0.47	0.90	0.27	0.57
Sep. 14	0.23	0.98	0.32	0.94	0.29	0.80	0.18	0.82	0.16	0.69	0.43	1.10	0.26	1.05	0.35	0.63
Sep. 15	0.21	0.98	0.16	0.95	0.21	0.80	0.14	0.85	0.14	0.70	0.25	1.13	0.26	1.04	0.32	0.88
Sep. 18	0.34	0.76	0.24	0.72	0.31	0.66	0.22	0.81	0.15	0.64	0.19	1.03	0.16	1.04	0.27	0.82
Sep. 19	0.20	0.72	0.27	0.68	0.22	0.53	0.17	0.59	0.16	0.48	0.20	0.98	0.19	0.94	0.28	0.79
Sep. 20	0.20	0.73	0.19	0.70	0.22	0.45	0.19	0.46	0.16	0.45	0.34	0.93	0.27	0.89	0.38	0.78
Sep. 21	0.28	0.93	0.28	0.89	0.20	0.69	0.17	0.37	0.15	0.22	0.70	0.88	0.53	0.84	0.32	0.69
Sep. 22	0.12	1.17	0.14	1.13	0.22	0.91	0.19	0.62	0.25	0.56	1.20	0.91	1.10	0.84	0.48	0.66
Sep. 25	0.32	1.36	0.33	1.32	0.91	1.09	0.20	1.19	0.23	0.88	0.47	0.87	0.39	0.89	0.61	0.65
Sep. 26	0.21	1.26	0.20	1.22	0.25	1.08	0.21	1.12	0.19	0.98	0.71	0.82	0.72	0.73	0.56	0.67
Sep. 27	0.31	1.12	0.20	1.07	0.26	0.93	0.24	1.09	0.22	1.22	0.58	0.86	0.44	0.81	0.84	0.60
Sep. 28	0.27	1.00	0.37	0.96	0.39	0.83	0.21	0.97	0.23	0.87	0.57	0.89	0.38	0.83	0.67	0.61
Sep. 29	0.83	0.94	0.46	0.90	1.20	0.80	0.17	0.86	0.21	0.86	0.57	0.88	0.42	0.84	0.45	0.61
Oct. 02	0.16	0.93	0.19	0.89	0.27	0.75	0.17	0.59	0.59	0.46	0.22	0.99	0.20	0.98	0.31	0.63
Oct. 03	0.20	0.97	0.14	0.94	0.26	0.78	0.15	0.70	0.21	0.51	0.20	1.06	0.21	1.01	0.32	0.70
Oct. 04	0.17	1.04	0.20	1.00	0.25	0.75	0.15	0.75	0.19	0.75	0.35	0.99	0.26	0.95	0.50	0.77
Oct. 05	0.16	1.06	0.20	1.02	0.26	0.88	0.23	0.79	0.21	0.76	0.30	0.91	0.23	1.07	0.41	0.78
Oct. 06	0.35	1.04	0.23	1.00	0.24	0.88	0.17	0.88	0.20	0.80	0.38	0.87	0.25	0.81	0.54	0.72
Oct. 10	0.35	0.98	0.18	0.94	0.27	0.78	0.17	0.85	0.20	0.66	0.19	0.90	0.25	0.87	0.44	0.67
Oct. 11	0.20	1.02	0.18	0.98	0.25	0.82	0.17	0.86	0.19	0.70	0.28	0.71	0.20	0.62	0.34	0.66

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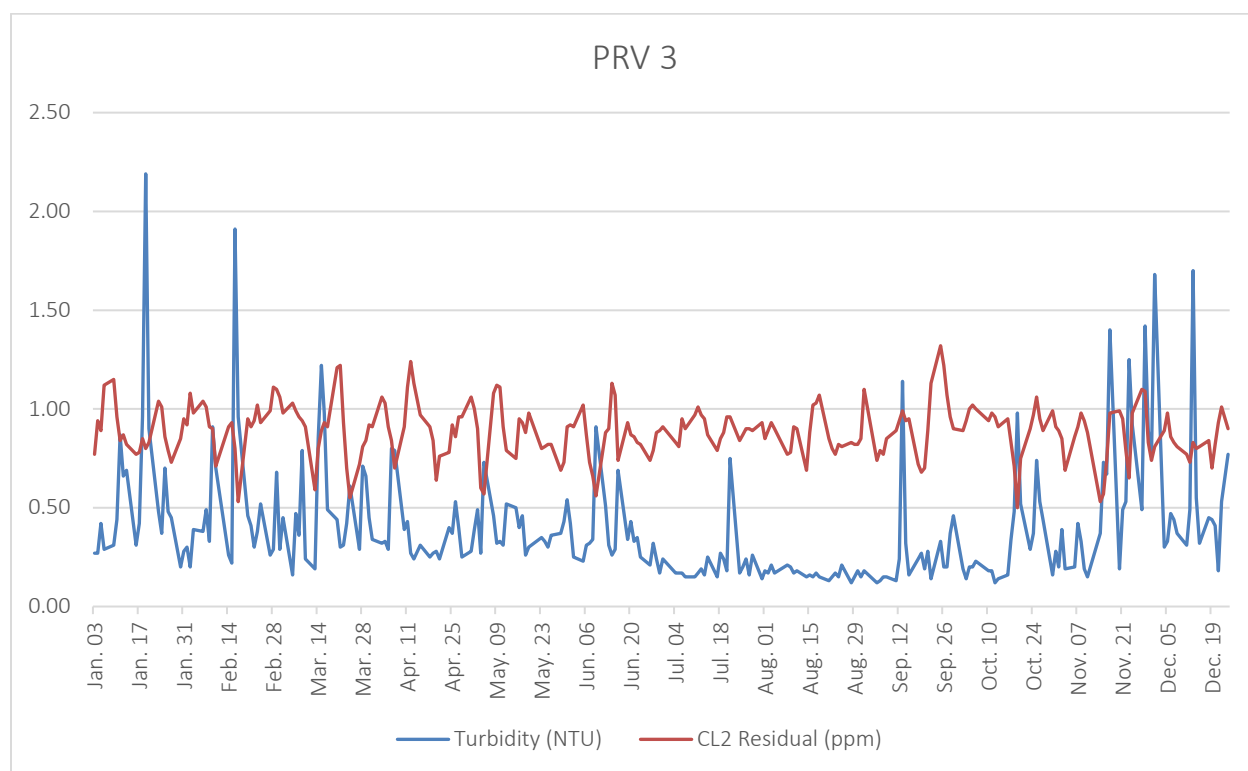
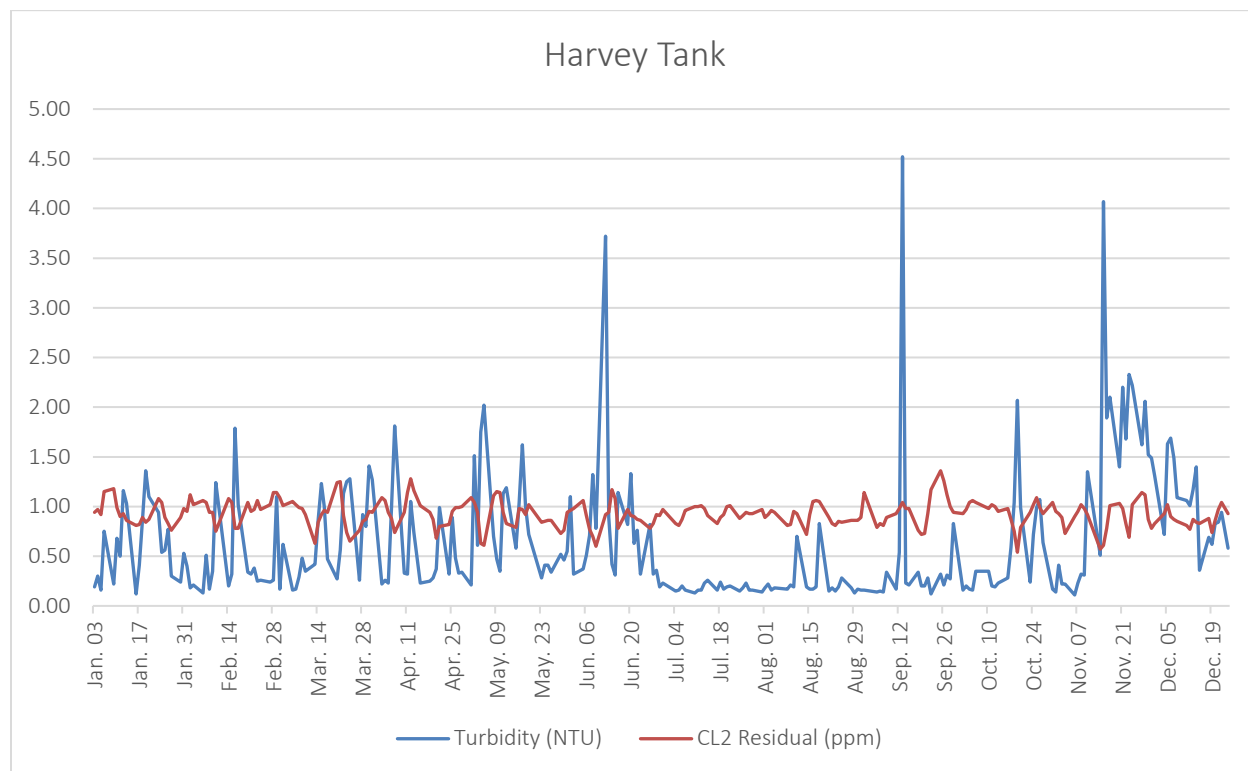
	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
Date	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
Oct. 12	0.19	1.00	0.12	0.96	0.20	0.82	0.17	0.79	0.17	0.77	0.32	0.87	0.26	0.80	0.30	0.55
Oct. 13	0.23	0.95	0.14	0.91	0.26	0.76	0.19	0.80	0.23	0.81	0.32	1.03	0.35	0.98	0.33	0.45
Oct. 16	0.28	0.98	0.16	0.95	0.24	0.81	0.35	0.74	0.21	0.73	0.26	1.21	0.29	1.15	0.43	0.87
Oct. 17	0.59	0.87	0.34	0.83	0.41	0.71	0.20	0.76	0.17	0.95	0.69	1.01	0.54	0.99	0.39	0.94
Oct. 18	1.04	0.75	0.48	0.71	0.39	0.48	0.27	0.72	0.19	0.61	0.81	0.68	0.81	0.64	0.43	0.93
Oct. 19	2.07	0.54	0.98	0.50	0.58	0.38	0.40	0.54	0.20	0.47	2.05	0.54	1.27	0.46	0.45	0.73
Oct. 20	0.99	0.79	0.52	0.75	0.47	0.50	0.28	0.40	0.30	0.23	1.39	0.54	0.54	0.53	0.45	0.29
Oct. 23	0.24	0.94	0.29	0.90	0.26	0.58	0.23	0.54	0.22	0.27	0.67	0.75	0.26	0.81	0.56	0.25
Oct. 24	0.72	1.02	0.37	0.97	0.44	0.79	0.36	0.53	0.28	0.98	0.69	0.65	0.34	0.88	0.56	0.33
Oct. 25	0.99	1.09	0.74	1.06	0.48	0.82	0.54	0.61	0.30	1.05	0.59	0.81	0.51	1.00	0.50	0.29
Oct. 26	1.07	0.99	0.53	0.95	0.31	0.84	0.27	0.69	0.24	0.88	0.58	1.01	0.44	0.92	0.50	0.27
Oct. 27	0.64	0.93	0.44	0.89	0.48	0.80	0.36	0.47	0.24	0.84	0.45	1.25	0.41	1.18	0.56	0.43
Oct. 30	0.17	1.04	0.16	0.99	0.26	0.79	0.29	0.72	0.22	0.57	0.28	1.21	0.26	1.20	0.35	0.88
Oct. 31	0.14	0.95	0.28	0.91	0.34	0.75	0.25	0.72	0.23	0.83	0.30	1.01	0.25	1.02	0.26	1.00
Nov. 01	0.41	0.93	0.20	0.89	0.47	0.71	0.17	0.71	0.39	0.72	0.28	0.91	0.23	0.88	0.24	0.93
Nov. 02	0.22	0.89	0.39	0.85	1.06	0.72	0.27	0.72	0.19	0.67	0.29	0.79	0.22	0.81	0.35	0.77
Nov. 03	0.22	0.73	0.19	0.69	0.20	0.58	0.21	0.69	0.20	0.60	0.28	0.82	0.23	0.76	0.22	0.65
Nov. 06	0.11	0.90	0.20	0.86	0.31	0.60	0.15	0.50	0.22	0.40	0.26	0.94	0.27	0.93	0.27	0.58
Nov. 07	0.23	0.95	0.42	0.91	0.27	0.79	0.31	0.55	0.23	0.61	0.65	0.93	0.23	0.90	0.40	0.64
Nov. 08	0.32	1.02	0.33	0.98	0.37	0.82	0.20	0.62	0.18	0.66	0.52	0.99	0.46	0.99	0.32	0.62
Nov. 09	0.31	0.98	0.19	0.94	0.38	0.83	0.11	0.62	0.36	0.73	0.23	0.96	0.17	0.94	0.31	0.75
Nov. 10	1.35	0.92	0.15	0.88	0.79	0.76	0.22	0.74	0.15	0.76	0.23	0.95	0.12	0.92	0.22	0.71
Nov. 14	0.51	0.57	0.37	0.53	0.44	0.28	0.21	0.52	0.28	0.31	0.90	0.69	0.30	0.53	0.31	0.50
Nov. 15	4.07	0.61	0.73	0.57	0.83	0.30	0.14	0.31	0.22	0.25	1.38	0.69	0.83	0.59	0.69	0.34
Nov. 16	1.89	0.78	0.67	0.74	0.52	0.51	0.24	0.20	0.24	0.20	1.36	0.80	1.12	0.70	0.51	0.34
Nov. 17	2.10	1.01	1.40	0.98	0.82	0.70	0.87	0.23	0.36	0.23	1.29	0.86	1.10	0.93	0.51	0.24
Nov. 20	1.40	1.03	0.19	0.99	0.21	0.80	0.29	0.54	0.31	0.48	0.16	1.09	0.37	0.96	0.54	0.65

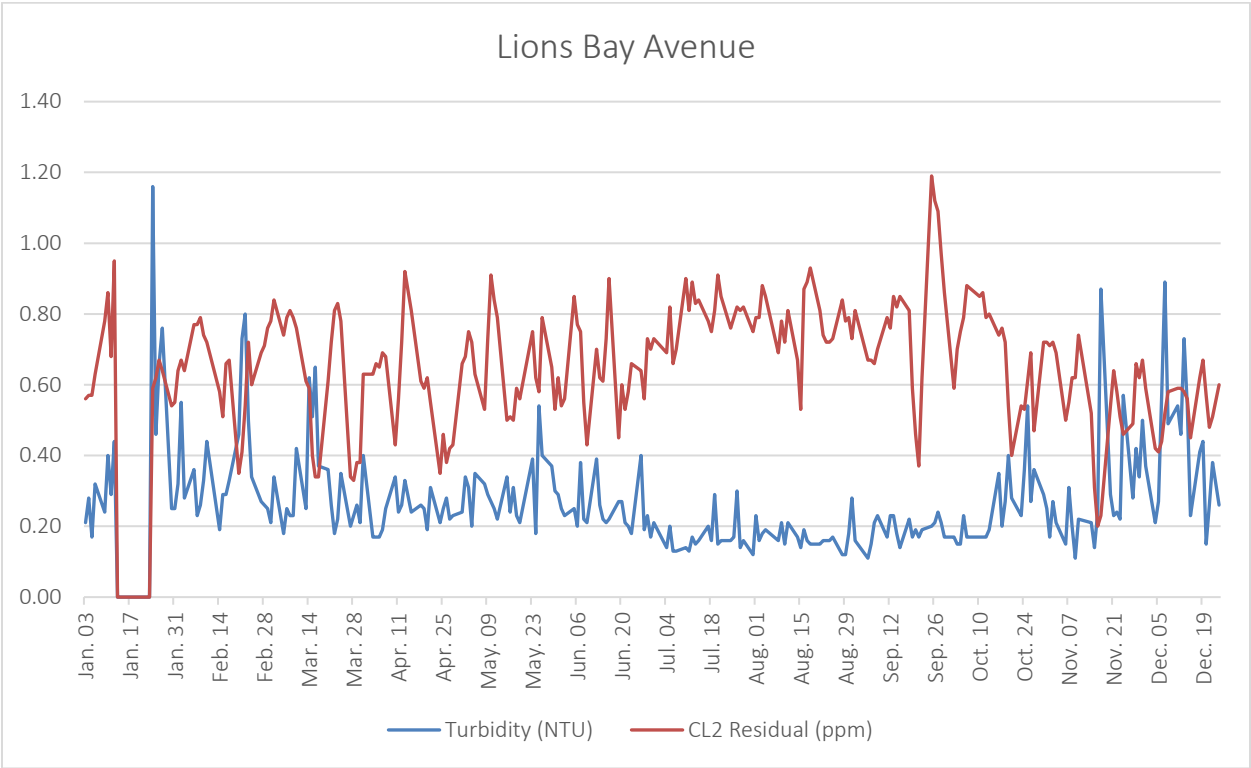
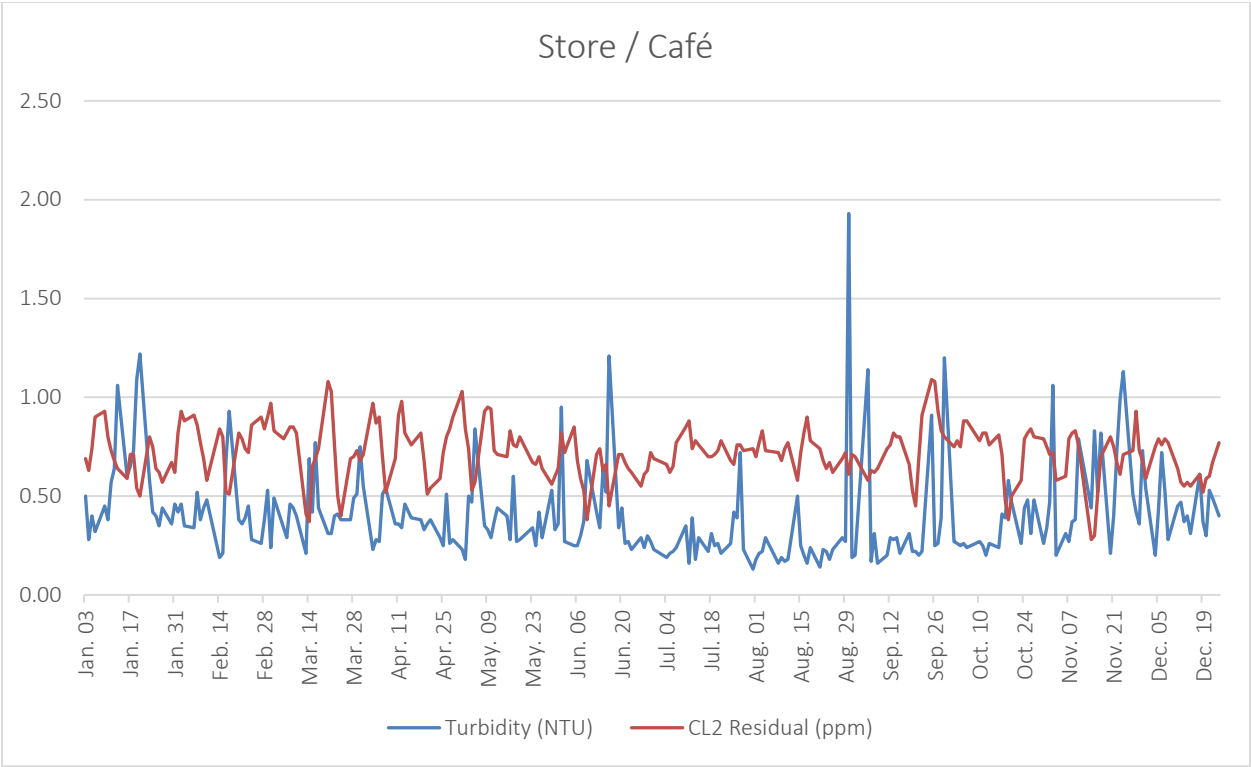
Lions Bay Drinking Water Quality 2017 Annual Report

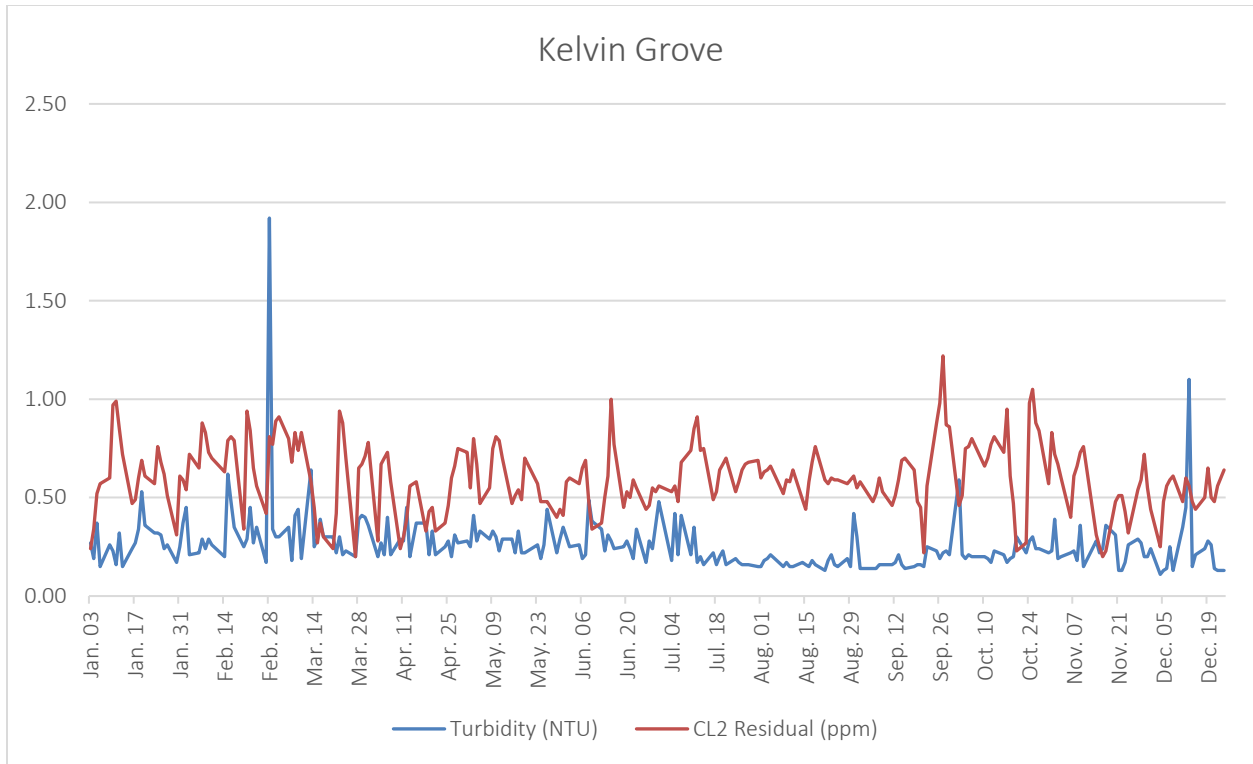
	HARVEY CREEK SYSTEM										MAGNESIA CREEK SYSTEM					
	Harvey Tank		PRV Station 3		Lions Bay Café		Lions Bay Ave.		Kelvin Grove Way		Magnesia Tank		PRV Station 5		Brunswick Beach	
Date	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)	T (NTU)	C (ppm)
Nov. 21	2.20	0.98	0.49	0.95	0.40	0.75	0.23	0.64	0.13	0.51	0.38	1.03	0.27	0.89	0.32	0.73
Nov. 22	1.68	0.83	0.53	0.79	0.73	0.67	0.24	0.58	0.13	0.51	0.91	1.01	0.59	0.84	0.46	0.73
Nov. 23	2.33	0.69	1.25	0.65	0.99	0.61	0.22	0.51	0.17	0.43	1.84	0.90	1.18	0.78	0.42	0.77
Nov. 24	2.22	1.02	0.92	0.98	1.13	0.71	0.57	0.46	0.26	0.32	1.64	0.90	0.93	0.90	0.67	0.65
Nov. 27	1.62	1.14	0.49	1.10	0.51	0.73	0.28	0.49	0.29	0.54	0.96	1.10	0.56	1.06	0.87	0.71
Nov. 28	2.06	1.12	1.42	1.09	0.42	0.93	0.42	0.66	0.27	0.59	0.94	1.13	0.56	1.10	0.59	0.79
Nov. 29	1.52	0.87	0.89	0.83	0.36	0.73	0.34	0.62	0.20	0.72	0.89	1.11	0.52	0.94	0.63	0.70
Nov. 30	1.49	0.78	0.76	0.74	0.73	0.68	0.50	0.67	0.20	0.55	1.31	1.02	0.51	0.86	0.56	0.74
Dec. 01	1.31	0.83	1.68	0.81	0.54	0.59	0.37	0.59	0.24	0.44	0.85	0.95	0.36	0.77	0.45	0.80
Dec. 04	0.72	0.93	0.30	0.89	0.20	0.75	0.21	0.42	0.11	0.25	0.21	0.77	0.45	0.87	0.33	0.65
Dec. 05	1.63	1.02	0.33	0.98	0.43	0.79	0.27	0.41	0.13	0.48	0.34	0.82	0.55	0.94	0.54	0.59
Dec. 06	1.69	0.90	0.47	0.86	0.72	0.76	0.57	0.44	0.14	0.56	0.47	0.99	0.56	0.96	0.42	0.57
Dec. 07	1.49	0.87	0.44	0.83	0.53	0.79	0.89	0.52	0.25	0.59	0.20	0.99	0.26	0.95	0.29	0.61
Dec. 08	1.09	0.85	0.37	0.81	0.28	0.77	0.49	0.58	0.13	0.61	0.36	0.93	0.52	0.93	0.26	0.76
Dec. 11	1.06	0.81	0.31	0.77	0.45	0.64	0.54	0.59	0.35	0.48	0.14	0.98	0.30	0.97	0.28	0.73
Dec. 12	1.01	0.77	0.49	0.73	0.47	0.57	0.46	0.59	0.45	0.60	0.29	0.88	0.28	0.94	0.23	0.77
Dec. 13	1.17	0.87	1.70	0.83	0.37	0.55	0.73	0.58	1.10	0.56	0.39	0.90	0.46	0.90	0.24	0.78
Dec. 14	1.40	0.84	0.55	0.80	0.40	0.57	0.54	0.56	0.15	0.48	0.39	0.89	0.43	0.89	0.23	0.76
Dec. 15	0.36	0.83	0.32	0.81	0.31	0.55	0.23	0.45	0.21	0.44	0.30	0.85	0.21	0.83	0.34	0.71
Dec. 18	0.69	0.88	0.45	0.84	0.61	0.61	0.41	0.62	0.24	0.50	0.45	0.88	0.29	0.87	0.24	0.76
Dec. 19	0.62	0.74	0.44	0.70	0.37	0.52	0.44	0.67	0.28	0.65	0.40	0.84	0.44	0.88	0.39	0.72
Dec. 20	0.83	0.86	0.41	0.82	0.30	0.59	0.15	0.57	0.26	0.50	0.22	0.90	0.29	0.88	0.22	0.64
Dec. 21	0.84	0.97	0.18	0.93	0.53	0.60	0.26	0.48	0.14	0.48	0.23	0.97	0.26	0.95	0.27	0.61
Dec. 22	0.94	1.04	0.53	1.01	0.49	0.67	0.38	0.51	0.13	0.56	0.86	0.99	0.23	0.95	0.22	0.63
Dec. 24	0.58	0.93	0.77	0.90	0.40	0.77	0.26	0.60	0.13	0.64	0.27	1.02	0.33	0.94	0.41	0.76

## APPENDIX E – CHLORINE RESIDUAL AGAINST TURBIDITY GRAPHS

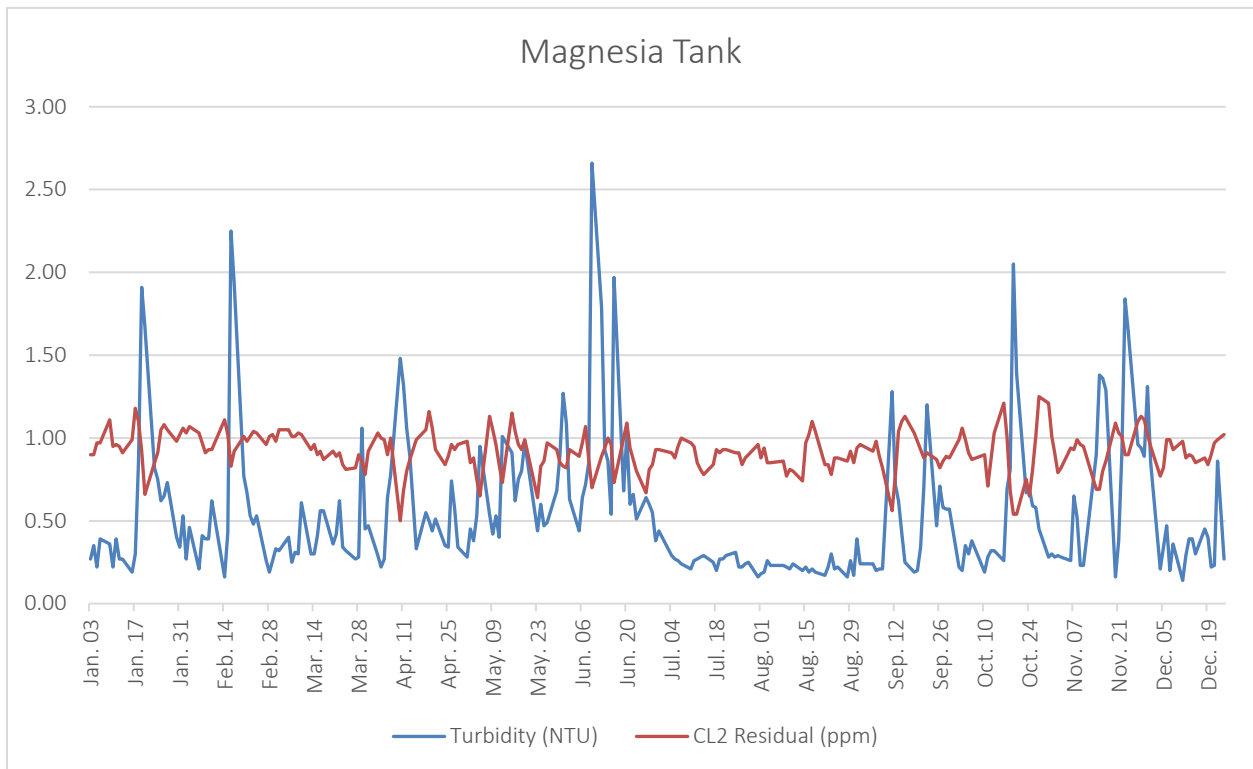
## HARVEY CREEK WATER SUPPLY

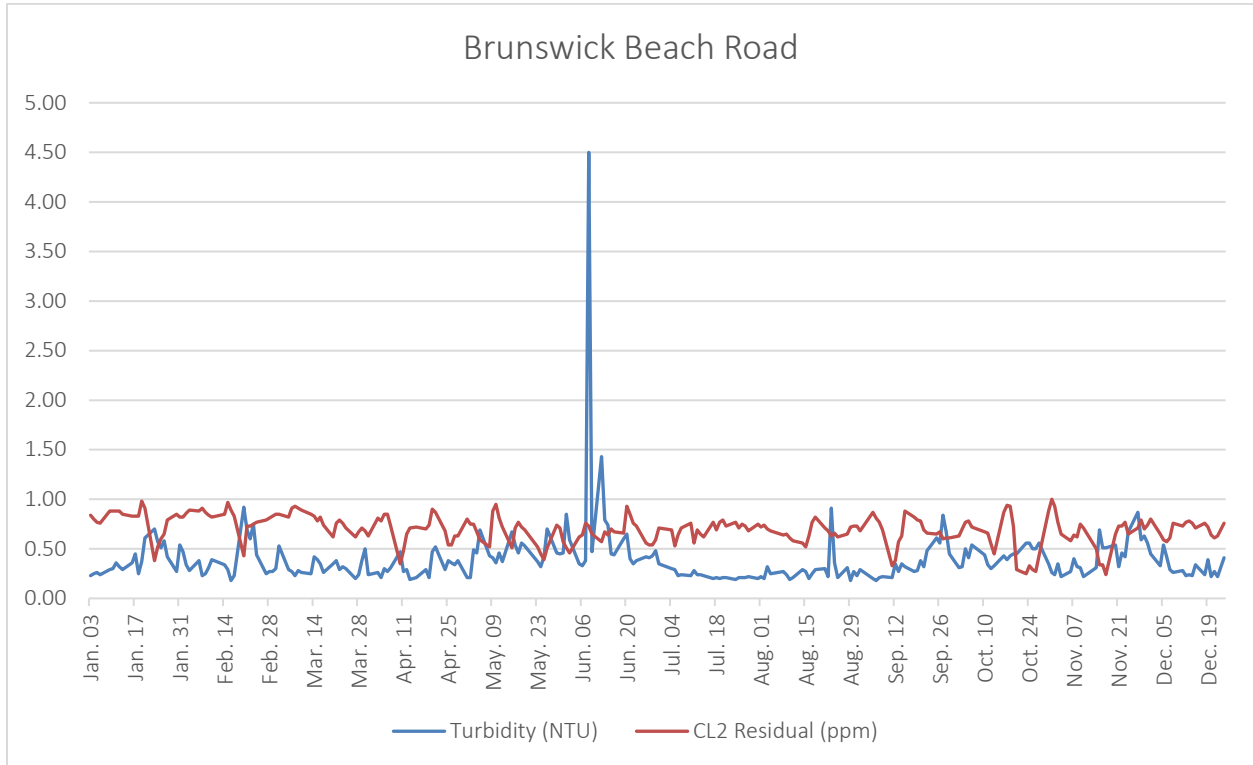
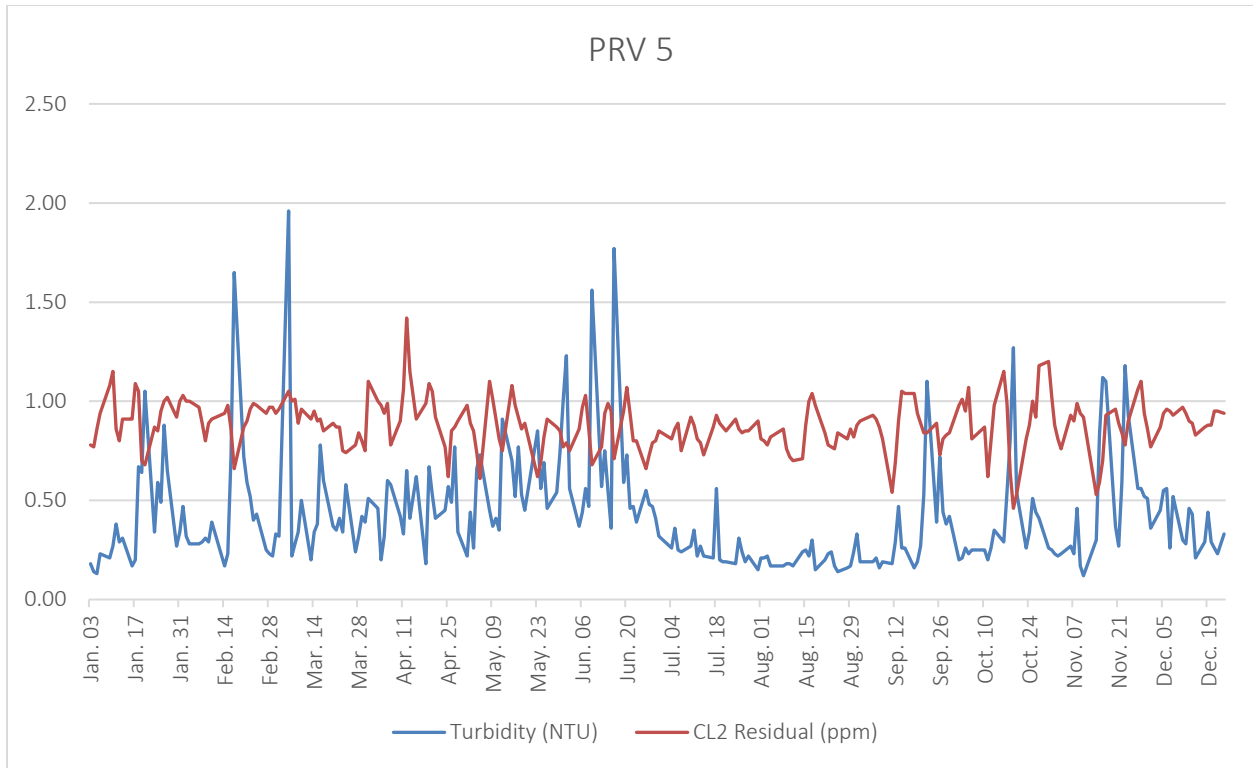






## MAGNESIA CREEK WATER SUPPLY





## APPENDIX F – RAW WATER TURBIDITY READINGS

# Lions Bay Drinking Water Quality 2017 Annual Report

Harvey			Magnesia			Harvey			Magnesia		
DATE	NTU	NTU	DATE	NTU	NTU	DATE	NTU	NTU	DATE	NTU	NTU
Jan. 03	0.17	0.24	Mar. 01	0.20	0.22	May. 01	0.33	0.34			
Jan. 04	0.17	0.16	Mar. 02	0.27	0.33	May. 02	0.72	0.27			
Jan. 05	0.18	0.23	Mar. 03	0.42	0.24	May. 03	0.34	0.39			
Jan. 06	0.54	0.26	Mar. 06	0.47	0.54	May. 04	0.77	0.91			
Jan. 09	0.33	0.23	Mar. 07	0.22	0.16	May. 05	1.13	1.08			
Jan. 10	0.34	0.18	Mar. 08	0.23	0.23	May. 08	0.38	0.42			
Jan. 11	0.48	0.28	Mar. 09	0.33	0.27	May. 09	0.45	0.27			
Jan. 12	0.45	0.22	Mar. 10	0.29	0.53	May. 10	0.34	0.28			
Jan. 13	0.50	0.20	Mar. 13	0.72	0.45	May. 11	0.95	0.51			
Jan. 16	0.39	0.23	Mar. 14	0.65	0.26	May. 12	0.73	0.84			
Jan. 17	0.58	0.51	Mar. 15	0.77	0.38	May. 15	0.28	0.50			
Jan. 18	0.81	1.84	Mar. 16	0.55	0.35	May. 16	0.33	0.53			
Jan. 19	0.78	1.54	Mar. 17	0.26	0.32	May. 17	0.44	0.94			
Jan. 20	0.51	1.57	Mar. 20	0.32	0.22	May. 18	0.40	0.71			
Jan. 23	0.47	0.29	Mar. 21	0.30	0.24	May. 19	0.48	0.77			
Jan. 24	0.35	0.25	Mar. 22	0.62	0.39	May. 23	0.44	0.63			
Jan. 25	0.45	0.22	Mar. 23	0.34	0.30	May. 24	0.34	0.50			
Jan. 26	0.39	0.44	Mar. 24	0.48	0.30	May. 25	0.31	0.32			
Jan. 27	0.20	0.70	Mar. 27	0.33	0.25	May. 26	0.44	0.42			
Jan. 30	0.33	0.22	Mar. 28	0.56	0.38	May. 29	0.61	0.95			
Jan. 31	0.39	0.22	Mar. 29	0.52	0.77	May. 30	0.51	0.90			
Feb. 01	0.19	0.18	Mar. 30	0.55	0.40	May. 31	0.43	1.09			
Feb. 02	0.18	0.25	Mar. 31	0.30	0.50	Jun. 01	0.74	0.64			
Feb. 03	0.32	0.24	Apr. 03	0.25	0.26	Jun. 02	0.48	0.55			
Feb. 06	0.38	0.25	Apr. 04	0.21	0.23	Jun. 05	0.30	0.27			
Feb. 07	0.19	0.20	Apr. 05	0.73	0.58	Jun. 06	0.29	0.34			
Feb. 08	0.23	0.27	Apr. 06	0.39	0.48	Jun. 07	0.59	0.86			
Feb. 09	0.65	0.35	Apr. 07	0.93	0.48	Jun. 08	1.08	0.67			
Feb. 10	0.59	0.34	Apr. 10	0.51	0.91	Jun. 09	1.62	33.20			
Feb. 14	0.31	0.34	Apr. 11	0.47	1.04	Jun. 12	1.79	1.05			
Feb. 15	1.49	1.51	Apr. 12	0.28	0.58	Jun. 13	0.49	0.48			
Feb. 16	2.10	3.35	Apr. 13	0.40	0.37	Jun. 14	0.52	0.44			
Feb. 17	0.41	0.71	Apr. 15	0.49	0.24	Jun. 15	0.52	0.33			
Feb. 20	0.19	0.30	Apr. 18	0.54	0.39	Jun. 16	1.22	1.54			
Feb. 21	0.21	0.30	Apr. 19	0.28	0.47	Jun. 19	0.45	0.41			
Feb. 22	0.43	0.31	Apr. 20	0.36	0.42	Jun. 20	0.59	0.81			
Feb. 23	0.21	0.26	Apr. 21	0.67	0.22	Jun. 21	0.41	0.49			
Feb. 24	0.19	0.20	Apr. 24	0.40	0.38	Jun. 22	0.29	0.39			
Feb. 27	0.26	0.23	Apr. 25	0.30	0.32	Jun. 23	0.26	0.33			
Feb. 28	0.22	0.33	Apr. 26	0.43	0.74	Jun. 26	0.38	0.56			
			Apr. 27	0.36	0.46	Jun. 27	0.23	0.47			
			Apr. 28	0.23	0.32	Jun. 28	0.54	0.40			
						Jun. 29	0.20	0.31			
						Jun. 30	0.48	0.49			

# Lions Bay Drinking Water Quality 2017 Annual Report

Harvey			Magnesia			Harvey			Magnesia		
DATE	NTU	NTU	DATE	NTU	NTU	DATE	NTU	NTU	DATE	NTU	NTU
Jul. 04	0.16	0.25	Sep. 01	0.30	0.15	Nov. 01	0.39	0.26			
Jul. 05	0.18	0.24	Sep. 05	1.18	0.18	Nov. 02	0.38	0.27			
Jul. 06	0.17	0.27	Sep. 06	0.35	0.15	Nov. 03	0.22	0.19			
Jul. 07	0.15	0.24	Sep. 07	0.30	0.22	Nov. 06	0.82	0.18			
Jul. 10	0.13	0.25	Sep. 08	0.52	0.20	Nov. 07	0.51	0.58			
Jul. 11	0.15	0.27	Sep. 11	1.36	0.18	Nov. 08	0.40	0.66			
Jul. 12	0.19	0.21	Sep. 12	1.04	9.17	Nov. 09	0.38	0.12			
Jul. 13	0.28	0.21	Sep. 13	0.36	0.28	Nov. 10	0.27	0.23			
Jul. 14	0.40	0.31	Sep. 14	0.30	0.25	Nov. 14	1.04	0.49			
Jul. 17	0.52	0.19	Sep. 15	0.31	0.15	Nov. 15	0.47	1.58			
Jul. 18	0.29	0.25	Sep. 18	0.77	0.17	Nov. 16	0.36	0.53			
Jul. 19	0.20	0.30	Sep. 19	0.42	0.21	Nov. 17	0.63	0.50			
Jul. 20	0.39	0.27	Sep. 20	0.20	0.21	Nov. 20	1.00	0.82			
Jul. 21	0.35	0.61	Sep. 21	0.61	0.25	Nov. 21	0.47	0.20			
Jul. 24	0.51	0.24	Sep. 22	0.16	0.22	Nov. 22	1.04	1.48			
Jul. 25	0.26	0.32	Sep. 25	0.63	0.27	Nov. 23	0.79	2.04			
Jul. 26	0.27	0.18	Sep. 26	0.44	0.33	Nov. 24	0.57	0.60			
Jul. 27	0.22	0.18	Sep. 27	0.48	0.39	Nov. 27	0.93	2.03			
Jul. 28	0.21	0.30	Sep. 28	0.46	0.30	Nov. 28	0.59	0.54			
Jul. 31	0.28	0.27	Sep. 29	0.40	0.33	Nov. 29	0.39	0.42			
Aug. 01	0.18	0.26	Oct. 02	0.77	0.19	Nov. 30	0.67	0.54			
Aug. 02	0.20	0.16	Oct. 03	0.34	0.21	Dec. 01	1.04	0.49			
Aug. 03	0.23	0.21	Oct. 04	0.32	0.25	Dec. 04	0.93	0.25			
Aug. 04	0.22	0.37	Oct. 05	0.50	0.41	Dec. 05	0.42	0.20			
Aug. 08	0.51	0.23	Oct. 06	0.37	0.24	Dec. 06	1.20	0.50			
Aug. 09	0.41	0.17	Oct. 10	0.93	0.19	Dec. 07	0.43	0.19			
Aug. 10	0.26	0.16	Oct. 11	0.42	0.27	Dec. 08	0.53	0.35			
Aug. 11	0.20	0.20	Oct. 12	0.43	0.45	Dec. 11	0.86	0.50			
Aug. 14	0.40	0.16	Oct. 13	0.27	0.18	Dec. 12	0.53	0.30			
Aug. 15	0.20	0.14	Oct. 16	0.86	0.45	Dec. 13	0.38	0.24			
Aug. 16	0.19	0.18	Oct. 17	0.50	1.36	Dec. 14	0.29	0.37			
Aug. 17	0.28	0.22	Oct. 18	0.58	0.59	Dec. 15	0.39	0.43			
Aug. 18	0.28	0.17	Oct. 19	0.61	0.89	Dec. 18	0.65	0.43			
Aug. 21	0.34	0.16	Oct. 20	0.41	0.60	Dec. 19	0.35	0.25			
Aug. 22	0.15	0.14	Oct. 23	0.82	0.39	Dec. 20	0.44	0.20			
Aug. 23	1.77	0.27	Oct. 24	0.45	0.29	Dec. 21	0.53	0.18			
Aug. 24	0.72	0.23	Oct. 25	0.68	0.25	Dec. 22	0.37	0.24			
Aug. 25	0.27	0.16	Oct. 26	0.44	0.28	Dec. 24	0.69	0.19			
Aug. 28	0.50	0.14	Oct. 27	0.39	0.38						
Aug. 29	0.53	0.22	Oct. 30	0.97	0.19						
Aug. 30	0.27	0.15	Oct. 31	0.30	0.20						
Aug. 31	0.39	0.17									

## APPENDIX G – BIENNIAL METALS AND CHEMISTRY RESULTS

## MARCH 14, 2017 RESULTS

## ALS ENVIRONMENTAL ANALYTICAL REPORT

L1901060 CONTD....

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Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L1901060-1 Water 14-MAR-17 10:20 HARVEY TANK (FIRST DRAW)	L1901060-2 Water 14-MAR-17 10:20 HARVEY TANK (AFTER FLUSH)	L1901060-3 Water 14-MAR-17 07:50 STORE/CAFE (FIRST DRAW)	L1901060-4 Water 14-MAR-17 07:50 STORE/CAFE (AFTER FLUSH)	L1901060-5 Water 14-MAR-17 11:35 LIONS BAY AVE (FIRST DRAW)
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	5.41 <sup>HTC</sup>	5.46 <sup>HTC</sup>	5.85 <sup>HTC</sup>	5.81 <sup>HTC</sup>	6.71 <sup>HTC</sup>
	pH (pH)	6.89		6.90		6.98
	Total Suspended Solids (mg/L)	<3.0		<3.0		<3.0
	Turbidity (NTU)	0.21		0.16		0.15
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	4.7		4.7		6.2
<b>Organic / Inorganic Carbon</b>	Total Organic Carbon (mg/L)	1.64		1.64		0.99
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.083	0.075	0.057	0.063	0.038
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	0.00012	0.00010	0.00012	0.00013	<0.00010
	Barium (Ba)-Total (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Calcium (Ca)-Total (mg/L)	1.76	1.78	1.93	1.92	2.25
	Chromium (Cr)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Copper (Cu)-Total (mg/L)	0.0197	0.0054	0.157	0.0217	0.0064
	Iron (Fe)-Total (mg/L)	<0.030	<0.030	0.067	0.082	<0.030
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	0.00487	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.25	0.25	0.25	0.24	0.26
	Manganese (Mn)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Mercury (Hg)-Total (mg/L)	<0.00020		<0.00020		<0.00020
	Potassium (K)-Total (mg/L)	0.11	0.10	0.10	0.10	0.13
	Selenium (Se)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Sodium (Na)-Total (mg/L)	2.2	2.3	2.1	2.2	2.2
	Uranium (U)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
<b>Aggregate Organics</b>	BOD (mg/L)	<2.0		<2.0		<2.0
<b>Trihalomethanes</b>	Bromodichloromethane (mg/L)	<0.0010		<0.0010		<0.0010
	Bromoform (mg/L)	<0.0010		<0.0010		<0.0010
	Dibromochloromethane (mg/L)	<0.0010		<0.0010		<0.0010
	Chloroform (mg/L)	0.0405		0.0452		0.0329
	Total THMs (mg/L)	0.0405		0.0452		0.0329

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

L1901060 CONTD....

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21-MAR-17 13:21 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID		L1901060-6 Water 14-MAR-17 11:35 LIONS BAY AVE (AFTER FLUSH)	L1901060-7 Water 14-MAR-17 08:20 KELVIN GROVE (FIRST DRAW)	L1901060-8 Water 14-MAR-17 08:20 KELVIN GROVE (AFTER FLUSH)	L1901060-9 Water 14-MAR-17 07:30 COMMUNITY CENTRE (FIRST DRAW)	L1901060-10 Water 14-MAR-17 07:30 COMMUNITY CENTRE (AFTER FLUSH)
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	6.58 <sup>HTC</sup>	8.91 <sup>HTC</sup>	7.01 <sup>HTC</sup>	9.04 <sup>HTC</sup>	6.04 <sup>HTC</sup>
	pH (pH)		7.05		6.92	
	Total Suspended Solids (mg/L)		<3.0		<3.0	
	Turbidity (NTU)		0.14		0.15	
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)		6.4		5.4	
<b>Organic / Inorganic Carbon</b>	Total Organic Carbon (mg/L)		1.27		1.43	
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.042	0.029	0.045	0.032	0.054
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	0.00011	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)-Total (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Calcium (Ca)-Total (mg/L)	2.18	2.74	2.42	2.00	2.04
	Chromium (Cr)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Copper (Cu)-Total (mg/L)	0.0033	0.206	0.0036	0.165	0.0285
	Iron (Fe)-Total (mg/L)	<0.030	0.075	0.032	<0.030	0.059
	Lead (Pb)-Total (mg/L)	<0.00050	0.0365	0.00057	0.00286	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.28	0.50	0.24	0.98	0.23
	Manganese (Mn)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Mercury (Hg)-Total (mg/L)		<0.00020		<0.00020	
	Potassium (K)-Total (mg/L)	0.13	0.12	0.11	0.11	<0.10
	Selenium (Se)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Sodium (Na)-Total (mg/L)	2.2	2.3	<2.0	2.2	<2.0
	Uranium (U)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Total (mg/L)	<0.050	0.073	<0.050	0.219	<0.050
<b>Aggregate Organics</b>	BOD (mg/L)		<2.0		<2.0	
<b>Trihalomethanes</b>	Bromodichloromethane (mg/L)		<0.0010		<0.0010	
	Bromoform (mg/L)		<0.0010		<0.0010	
	Dibromochloromethane (mg/L)		<0.0010		<0.0010	
	Chloroform (mg/L)		0.0477		0.0446	
	Total THMs (mg/L)		0.0477		0.0446	

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

L1901060 CONTD....

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21-MAR-17 13:21 (MT)

Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1901060-11 Water 14-MAR-17 09:20 MAGNESIA TANK (FIRST DRAW)	L1901060-12 Water 14-MAR-17 09:20 MAGNESIA TANK (AFTER FLUSH)	L1901060-13 Water 14-MAR-17 10:50 BRUNSWICK BEACH (FIRST DRAW)	L1901060-14 Water 14-MAR-17 10:50 BRUNSWICK BEACH (AFTER FLUSH)	L1901060-15 Surface Water 14-MAR-17 10:25 HARVEY RAW WATER
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	13.2 <sup>HTC</sup>	13.2 <sup>HTC</sup>	15.0 <sup>HTC</sup>	14.9 <sup>HTC</sup>	4.15 <sup>HTC</sup>
	pH (pH)	6.96		7.07		6.69
	Total Suspended Solids (mg/L)	<3.0		<3.0		<3.0
	Turbidity (NTU)	0.17		0.19		0.55
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	5.5		6.6		2.9
<b>Organic / Inorganic Carbon</b>	Total Organic Carbon (mg/L)	0.81		<0.50		1.99
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.028	0.027	0.015	0.019	0.108
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	<0.00010	0.00010	<0.00010	<0.00010	0.00011
	Barium (Ba)-Total (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Calcium (Ca)-Total (mg/L)	4.36	4.39	5.01	5.02	1.36
	Chromium (Cr)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Copper (Cu)-Total (mg/L)	0.0147	0.0093	0.189	0.0046	0.0088
	Iron (Fe)-Total (mg/L)	<0.030	<0.030	0.030	0.030	<0.030
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	0.00455	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.56	0.55	0.59	0.58	0.18
	Manganese (Mn)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Mercury (Hg)-Total (mg/L)	<0.00020		<0.00020		<0.00020
	Potassium (K)-Total (mg/L)	<0.10	<0.10	0.10	0.11	<0.10
	Selenium (Se)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Sodium (Na)-Total (mg/L)	3.1	3.1	3.1	3.1	<2.0
	Uranium (U)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
<b>Aggregate Organics</b>	BOD (mg/L)	<2.0		<2.0		<6.0
<b>Trihalomethanes</b>	Bromodichloromethane (mg/L)	<0.0010		<0.0010		
	Bromoform (mg/L)	<0.0010		<0.0010		
	Dibromochloromethane (mg/L)	<0.0010		<0.0010		
	Chloroform (mg/L)	0.0199		0.0164		
	Total THMs (mg/L)	0.0199		0.0164		

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

L1901060 CONTD....

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Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
		L1901060-16				
		Surface Water				
		14-MAR-17				
		09:25				
		MAGNESIA RAW WATER				
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	11.2 <sup>HTC</sup>				
	pH (pH)	6.90				
	Total Suspended Solids (mg/L)	<3.0				
	Turbidity (NTU)	0.18				
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	4.8				
<b>Organic / Inorganic Carbon</b>	Total Organic Carbon (mg/L)	0.92				
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.034				
	Antimony (Sb)-Total (mg/L)	<0.00050				
	Arsenic (As)-Total (mg/L)	<0.00010				
	Barium (Ba)-Total (mg/L)	<0.020				
	Boron (B)-Total (mg/L)	<0.10				
	Cadmium (Cd)-Total (mg/L)	<0.00020				
	Calcium (Ca)-Total (mg/L)	3.71				
	Chromium (Cr)-Total (mg/L)	<0.0020				
	Copper (Cu)-Total (mg/L)	0.0052				
	Iron (Fe)-Total (mg/L)	<0.030				
	Lead (Pb)-Total (mg/L)	<0.00050				
	Magnesium (Mg)-Total (mg/L)	0.48				
	Manganese (Mn)-Total (mg/L)	<0.0020				
	Mercury (Hg)-Total (mg/L)	<0.00020				
	Potassium (K)-Total (mg/L)	<0.10				
	Selenium (Se)-Total (mg/L)	<0.0010				
	Sodium (Na)-Total (mg/L)	<2.0				
	Uranium (U)-Total (mg/L)	<0.00010				
	Zinc (Zn)-Total (mg/L)	<0.050				
<b>Aggregate Organics</b>	BOD (mg/L)	<2.0				
<b>Trihalomethanes</b>	Bromodichloromethane (mg/L)					
	Bromoform (mg/L)					
	Dibromochloromethane (mg/L)					
	Chloroform (mg/L)					
	Total THMs (mg/L)					

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## OCTOBER 2, 2017 RESULTS

## ALS ENVIRONMENTAL ANALYTICAL REPORT

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Sample ID Description Sampled Date Sampled Time Client ID		L1993647-1 WATER 19-SEP-17 10:00 HARVEY TANK (FIRST DRAW)	L1993647-2 WATER 19-SEP-17 10:00 HARVEY TANK (AFTER FLUSH)	L1993647-3 WATER 19-SEP-17 07:05 STORE / CAFE (FIRST DRAW)	L1993647-4 WATER 19-SEP-17 07:05 STORE / CAFE (AFTER FLUSH)	L1993647-5 WATER 19-SEP-17 11:05 LIONS BAY AVE (FIRST DRAW)
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	7.14 <sup>HTC</sup>	6.92 <sup>HTC</sup>	8.56 <sup>HTC</sup>	6.98 <sup>HTC</sup>	7.82 <sup>HTC</sup>
	pH (pH)	6.96		7.01		7.09
	Total Suspended Solids (mg/L)	<3.0		<3.0		<3.0
	Turbidity (NTU)	0.15		0.13		0.20
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	6.6		6.3		6.9
<b>Organic / Inorganic Carbon</b>	Total Organic Carbon (mg/L)	1.30		0.93		0.80
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.072	0.030	0.022	0.027	<0.010
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	0.00012	0.00012	<0.00010	<0.00010	<0.00010
	Barium (Ba)-Total (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Calcium (Ca)-Total (mg/L)	2.37	2.33	2.93	2.36	2.65
	Chromium (Cr)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Copper (Cu)-Total (mg/L)	0.102	0.0060	0.128	0.0164	0.315
	Iron (Fe)-Total (mg/L)	0.039	<0.030	0.031	0.046	<0.030
	Lead (Pb)-Total (mg/L)	0.00126	<0.00050	0.00231	<0.00050	0.00297
	Magnesium (Mg)-Total (mg/L)	0.30	0.27	0.30	0.26	0.29
	Manganese (Mn)-Total (mg/L)	0.0022	<0.0020	<0.0020	<0.0020	<0.0020
	Mercury (Hg)-Total (mg/L)	<0.00020		<0.00020		<0.00020
	Potassium (K)-Total (mg/L)	0.16	0.15	0.17	0.15	0.18
	Selenium (Se)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Sodium (Na)-Total (mg/L)	2.4	2.4	2.4	2.3	2.4
	Uranium (U)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Total (mg/L)	<0.050	<0.050	0.064	<0.050	0.158
<b>Aggregate Organics</b>	BOD (mg/L)	<2.0		<2.0		<2.0
<b>Trihalomethanes</b>	Bromodichloromethane (mg/L)	<0.0010		<0.0010		<0.0010
	Bromoform (mg/L)	<0.0010		<0.0010		<0.0010
	Dibromochloromethane (mg/L)	<0.0010		<0.0010		<0.0010
	Chloroform (mg/L)	0.0297		0.0331		0.0318
	Total THMs (mg/L)	0.0297		0.0331		0.0318

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

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## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1993647-6 WATER 19-SEP-17 11:05 LIONS BAY AVE. (AFTER FLUSH)	L1993647-7 WATER 19-SEP-17 05:55 KELVIN GROVE (FIRST DRAW)	L1993647-8 WATER 19-SEP-17 05:55 KELVIN GROVE (AFTER FLUSH)	L1993647-9 WATER 19-SEP-17 07:25 COMMUNITY CENTRE (FIRST DRAW)	L1993647-10 WATER 19-SEP-17 07:25 COMMUNITY CENTRE (AFTER FLUSH)
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	7.73 <sup>HTC</sup>	9.57 <sup>HTC</sup>	9.15 <sup>HTC</sup>	7.99 <sup>HTC</sup>	7.07 <sup>HTC</sup>
	pH (pH)		7.22		7.05	
	Total Suspended Solids (mg/L)		<3.0		<3.0	
	Turbidity (NTU)		0.14		0.13	
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)		8.0		6.0	
<b>Organic / Inorganic Carbon</b>	Total Organic Carbon (mg/L)		0.56		<0.50	
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.023	0.029	0.038	0.017	0.025
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	<0.00010	0.00012	0.00012	<0.00010	0.00010
	Barium (Ba)-Total (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Calcium (Ca)-Total (mg/L)	2.62	3.24	3.29	2.67	2.41
	Chromium (Cr)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Copper (Cu)-Total (mg/L)	0.0036	0.0187	0.0014	0.102	0.0248
	Iron (Fe)-Total (mg/L)	<0.030	0.058	0.037	<0.030	0.034
	Lead (Pb)-Total (mg/L)	<0.00050	0.00328	<0.00050	0.00155	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.29	0.36	0.23	0.32	0.26
	Manganese (Mn)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Mercury (Hg)-Total (mg/L)		<0.00020		<0.00020	
	Potassium (K)-Total (mg/L)	0.18	0.17	0.17	0.16	0.15
	Selenium (Se)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Sodium (Na)-Total (mg/L)	2.4	2.5	2.4	2.4	2.3
	Uranium (U)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Total (mg/L)	<0.050	<0.050	<0.050	0.161	<0.050
<b>Aggregate Organics</b>	BOD (mg/L)		<2.0		<2.0	
<b>Trihalomethanes</b>	Bromodichloromethane (mg/L)		<0.0010		<0.0010	
	Bromoform (mg/L)		<0.0010		<0.0010	
	Dibromochloromethane (mg/L)		<0.0010		<0.0010	
	Chloroform (mg/L)		0.0448		0.0326	
	Total THMs (mg/L)		0.0448		0.0326	

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

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## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1993647-11 WATER 19-SEP-17 08:30 MAGNESIA TANK (FIRST DRAW)	L1993647-12 WATER 19-SEP-17 08:30 MAGNESIA TANK (AFTER FLUSH)	L1993647-13 WATER 19-SEP-17 10:35 BRUNSWICK BEACH (FIRST DRAW)	L1993647-14 WATER 19-SEP-17 10:35 BRUNSWICK BEACH (AFTER FLUSH)	L1993647-15 WATER 19-SEP-17 06:45 LIONS BAY BEACH PARK (FIRST DRAW)
Grouping	Analyte					
<b>WATER</b>						
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	19.1 <sup>HTC</sup>	18.7 <sup>HTC</sup>	21.1 <sup>HTC</sup>	21.4 <sup>HTC</sup>	7.42 <sup>HTC</sup>
	pH (pH)	6.94		7.04		7.07
	Total Suspended Solids (mg/L)	<3.0		<3.0		<3.0
	Turbidity (NTU)	0.15		0.23		0.15
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)	4.7		5.8		6.2
<b>Organic / Inorganic Carbon</b>	Total Organic Carbon (mg/L)	<0.50		0.51		0.56
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	<0.010	0.023	<0.010	0.020	0.021
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	<0.00010	0.00013	<0.00010	0.00013	0.00011
	Barium (Ba)-Total (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Calcium (Ca)-Total (mg/L)	6.57	6.46	7.35	7.44	2.50
	Chromium (Cr)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Copper (Cu)-Total (mg/L)	0.476	0.0117	0.337	0.0039	0.0582
	Iron (Fe)-Total (mg/L)	<0.030	<0.030	0.059	0.033	0.036
	Lead (Pb)-Total (mg/L)	0.00109	<0.00050	0.00354	<0.00050	0.00176
	Magnesium (Mg)-Total (mg/L)	0.65	0.62	0.68	0.68	0.28
	Manganese (Mn)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Mercury (Hg)-Total (mg/L)	<0.00020		<0.00020		<0.00020
	Potassium (K)-Total (mg/L)	0.12	0.12	0.13	0.12	0.15
	Selenium (Se)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Sodium (Na)-Total (mg/L)	3.6	3.5	3.8	3.8	2.4
	Uranium (U)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Zinc (Zn)-Total (mg/L)	0.187	<0.050	<0.050	<0.050	<0.050
<b>Aggregate Organics</b>	BOD (mg/L)	<2.0		<2.0		<2.0
<b>Trihalomethanes</b>	Bromodichloromethane (mg/L)	<0.0010		<0.0010		<0.0010
	Bromoform (mg/L)	<0.0010		<0.0010		<0.0010
	Dibromochloromethane (mg/L)	<0.0010		<0.0010		<0.0010
	Chloroform (mg/L)	0.0210		0.0315		0.0361
	Total THMs (mg/L)	0.0210		0.0315		0.0361

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1993647-16	L1993647-17	L1993647-18		
		Description	WATER	SURFACE WATE	SURFACE WATE		
		Sampled Date	19-SEP-17	19-SEP-17	19-SEP-17		
		Sampled Time	06:45	10:05	08:35		
		Client ID	LIONS BAY BEACH PARK (AFTER FLUSH)	HARVEY RAW WATER (AFTER FLUSH)	MAGNESIA RAW WATER (AFTER FLUSH)		
Grouping	Analyte						
<b>WATER</b>							
<b>Physical Tests</b>	Hardness (as CaCO <sub>3</sub> ) (mg/L)	7.40 <sup>HTC</sup>	5.86 <sup>HTC</sup>	16.2 <sup>HTC</sup>			
	pH (pH)		6.93	6.88			
	Total Suspended Solids (mg/L)		<3.0	<3.0			
	Turbidity (NTU)		0.30	0.23			
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO <sub>3</sub> ) (mg/L)		4.8	4.2			
<b>Organic / Inorganic Carbon</b>	Total Organic Carbon (mg/L)		1.75	0.84			
<b>Total Metals</b>	Aluminum (Al)-Total (mg/L)	0.026	0.050	0.032			
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050			
	Arsenic (As)-Total (mg/L)	0.00010	0.00011	0.00013			
	Barium (Ba)-Total (mg/L)	<0.020	<0.020	<0.020			
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10			
	Cadmium (Cd)-Total (mg/L)	<0.00020	<0.00020	<0.00020			
	Calcium (Ca)-Total (mg/L)	2.49	1.95	5.50			
	Chromium (Cr)-Total (mg/L)	<0.0020	<0.0020	<0.0020			
	Copper (Cu)-Total (mg/L)	0.0142	0.0110	0.0100			
	Iron (Fe)-Total (mg/L)	0.043	<0.030	0.036			
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	0.00057			
	Magnesium (Mg)-Total (mg/L)	0.29	0.24	0.59			
	Manganese (Mn)-Total (mg/L)	<0.0020	<0.0020	<0.0020			
	Mercury (Hg)-Total (mg/L)		<0.00020	<0.00020			
	Potassium (K)-Total (mg/L)	0.14	0.12	0.12			
	Selenium (Se)-Total (mg/L)	<0.0010	<0.0010	<0.0010			
	Sodium (Na)-Total (mg/L)	2.4	<2.0	<2.0			
	Uranium (U)-Total (mg/L)	<0.00010	<0.00010	<0.00010			
	Zinc (Zn)-Total (mg/L)	<0.050	<0.050	<0.050			
<b>Aggregate Organics</b>	BOD (mg/L)		<2.0	<2.0			
<b>Trihalomethanes</b>	Bromodichloromethane (mg/L)						
	Bromoform (mg/L)						
	Dibromochloromethane (mg/L)						
	Chloroform (mg/L)						
	Total THMs (mg/L)						

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.