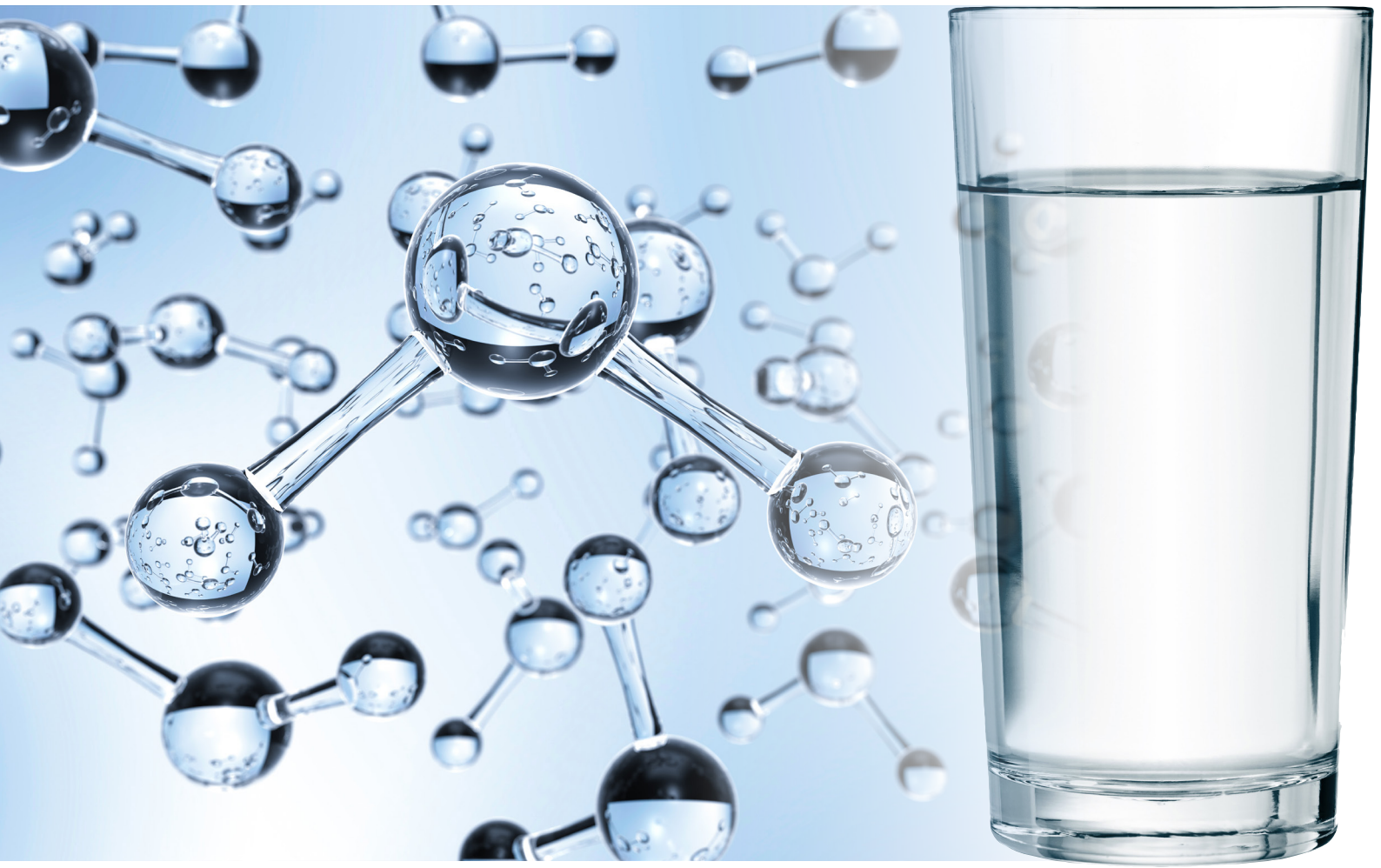
St. Catharines

2019 Annual Summary Report

Water Distribution System



CITY OF ST. CATHARINES

WATER DISTRIBUTION SYSTEM
2019 ANNUAL SUMMARY REPORT

March 2020

Waterworks #260003279

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DEFINITIONS

Backflow – the undesirable reversal of flow possibly containing contaminations in to the potable water supply.

Background Count – the bacterial content in water which can be used to measure water quality deterioration in distribution systems.

Cross Connection – an actual or potential connection between a potable water system and any source of contamination.

Disinfection – effective destruction by chemical or physical processes of pathogenic microorganisms capable of causing disease.

***Escherichia* coli (E. coli)** – a sub-group of Coliform bacteria. It is most frequently associated with recent fecal pollution. The presence of E. coli in drinking water may be an indication of sewage contamination.

Free Chlorine Residual - the amount of chlorine available for disinfection.

Heterotrophic Plate Count (HPC) – a microbiological test indicating the overall water quality in drinking water systems. Increases in HPC can indicate a problem with drinking water treatment.

Lead – present as a result of corrosion of lead solder, lead containing brass fittings or lead water service pipes.

MAC – Maximum Acceptable Concentration - this is a health-related standard established for parameters which, when present above a certain concentration, have known or suspected adverse health effects. The length of time the MAC can be exceeded without injury to health will depend on the nature and concentration of the parameter.

Microbiological parameters (i.e. bacteria) – bacteria which may come from wastewater treatment plants, livestock operations, septic systems and wildlife. Microbiological analysis is the most important aspect of drinking water quality due to its association with dangerous water-borne diseases.

Total Coliforms – the group of bacteria most commonly used as an indicator of water quality. Total coliforms are a group of closely related bacteria that are usually free-living in the environment, but are also normally present in water contaminated with human or animal feces. With certain exceptions, they do not cause disease. Coliforms are used as a screen for fecal contamination. The presence of these bacteria in a water sample indicates inadequate filtration and/or disinfection.

Disinfection By-Products - Trihalomethanes (THMs), Haloacetic Acids (HAAs) – disinfection by-products are produced when chlorine reacts with naturally occurring organic material found in water.

INTRODUCTION

The Safe Drinking Water Act (SDWA), requires Municipal Council members be provided with a summary report for the drinking water system that falls under their municipal responsibility. The report must list any time the City was unable to meet the requirements of the Act, the regulations, the system's approval, drinking water works permit, municipal drinking water license or any order issued by the Ministry of the Environment, Conservation and Parks (MECP). Each failure must specify the duration and measures taken to correct the failure. The report must also summarize the amount of water supplied by the system.

Waterworks Description

The St. Catharines water distribution system is classified by the MECP as a Class II, large residential system. The City's waterworks consists of:

- 605 kilometres of watermains;
- Approximately 3,500 hydrants;
- Over 5,600 valves.

The Region of Niagara's Decew Water Treatment Plant treats and supplies the water;

- The source of water is surface water, from Lake Erie.
- The water is diverted via an intake from the Welland Canal located approximately six kilometers from the treatment plant, near Allanburg.
- The water travels along a 5.4 kilometre supply channel which flows by gravity directly to the treatment plant.
- The Decew Water Treatment Plant is a conventional surface water treatment plant which incorporates:
    - Zebra mussel control,
    - Screening,
    - Chemically assisted flocculation,
    - Coagulation,
    - Sedimentation,
    - Filtration,
    - Disinfection using sodium hypochlorite and ultraviolet light.

Municipal Drinking Water Licensing Program

Each municipal residential system must be licensed under the Municipal Drinking Water Licensing Program. This program requires municipalities to obtain a license to operate their water distribution system and to incorporate the concept of quality management into their operations. The license grants St. Catharines the ability to operate the water distribution system and identifies the conditions which must be met. The license must be renewed every five years. The City's Municipal Drinking Water License was renewed in October 2019.

There are four components to the license that are applicable to St. Catharines:
Drinking Water Works Permit - the Permit allows for the establishment and alteration of the water distribution system. It replaces the previous Certificate of Approval process and results in a single permit for the entire system.

The Drinking Water Quality Management System (DWQMS) – The DWQMS is a Quality Management System for the City's Water Distribution System. The DWQMS implements a systematic "continuous improvement" approach to planning, operations, corrective actions and management review to allow an organization to demonstrate sound system performance. The success of a DWQMS depends on the commitment from all levels and functions of an organization including operational staff and top management. The DWQMS is documented through the Operational Plan. The Operational Plan is regularly reviewed and continually improves.

In addition, internal audits take place and a yearly risk assessment is conducted and/or reviewed. The risk assessment was designed to meet the DWQMS standard and includes climate change hazards. Integrating climate hazards into existing workplans can help address these risks as well as provide context compared to other known risks (e.g. aging infrastructure). The higher risks to the drinking water system include staff shortages (e.g. pandemic, strike, lockout, lack of available staff etc.), supply issues from the Region of Niagara Decew Water Treatment Plant (loss of supply or contamination of the water supply), contamination of the distribution system (backflow, watermain breaks) and lead water services.

System Accreditation – each year, the City participates in an Audit of its DWQMS. Every three years an onsite, external Verification Audit must be conducted. The 2019 external audit was conducted in August by NSF – International Strategic Registrations. No non-conformances were identified.

Financial Plan – the preparation of a Financial Plan is a requirement specified in Regulation 453/07 and intended to demonstrate that the municipality had considered all of the financial impacts of the drinking water system. A new Financial Plan must be submitted to Council and the Ministry of Municipal Affairs and Housing (MMAH) prior to each License renewal. Council's Resolution confirming approval of the Financial Plan must be included in the License renewal documents.

The Drinking Water Quality Management System Policy

The City of St. Catharines is committed to:

- Ensuring a consistent supply of safe, high quality drinking water;
- Maintaining and continuously improving its Quality Management System; and
- Meeting or surpassing applicable legislation and regulations.

Actions Taken to Comply with the Safe Drinking Water Act

The *Safe Drinking Water Act, 2002* provides for the protection of human health and the prevention of drinking water health hazards through the control and regulation of drinking water systems and drinking water testing services. Ontario has a multi-barrier drinking water safety net, a framework designed to protect drinking water from the source to the tap. To comply with the Act and its Regulations, the City undertakes the following actions:

- The City is required to take a minimum number of samples each month from a representative cross-section of its watermain network and to test these samples for microbiological indications of contamination. Testing for the free chlorine residual content is also a requirement. The chlorine residual must be sampled at the same time and location as the microbiological sample.

- The City's drinking water is sampled every three months at points within the distribution system where there is a likelihood for the potential of elevated formations of Disinfection Byproducts, including Trihalomethanes (THMs) and Haloacetic Acids (HAAs).

- The City must undertake a Community Wide Lead Testing Program. The volunteer based sampling program requires samples be taken from 20 residential homes and 5 samples taken directly from the distribution system twice each year. Additional lead samples are taken outside of the regulated and defined sampling periods each year.

- Anyone who conducts sampling from within the water distribution system must be certified as a Water Quality Analyst or Water Distribution Operator by the Ontario Water Wastewater Certification Office (OWWCO). These certifications must be renewed every three years and have mandatory, MECP-approved training requirements.

- All laboratory analysis must be carried out by an accredited laboratory. The City of St. Catharines currently uses a number of accredited laboratories. Accreditation ensures acceptable laboratory protocols and test methods are in place. It also requires the laboratory to provide evidence and assurances of the proficiency of the analysts performing the test methods. Laboratories are audited by the Canadian Association for Laboratories Accreditation (CALA) and accredited by the Standards Council of Canada (SCC).

- All drinking water sample results are available to the public. Annual reports are available at City Hall and on the City's website, www.stcatharines.ca. The daily sample records are available on request for the public to view.

- Notification is given to the MECP, the Regional Public Health Department, Niagara Region staff and the Decew Water Treatment Plant of all incidents of regular sampling which exceed the Maximum Allowable Concentration (MAC).

- On an annual basis, the MECP conducts a rigorous and comprehensive inspection of the municipal drinking water system to determine compliance under the SDWA and associated regulations.

WATER QUALITY TEST RESULTS

Summary of Results

In 2019, over 8,770 samples were taken throughout the City and analyzed for microbiological parameters, chlorine residual and chemicals analyses as part of the drinking water surveillance program. **Table 1** summarizes each parameter tested and it gives the number of samples required, the number of samples analyzed, and the range of results.

Table 1: Summary of Water Quality Test Results, 2019

Parameter	MAC	Minimum Number of Samples Required	Number of Samples Taken	Results Range	Comments
Microbiological Analysis (Units = CFU/100 mL)					
Escherichia coli (E. coli)	ND	1368	1709	0	Fecal coliform bacteria that indicates the presence of sewage or animal waste contamination.
Total Coliforms	ND	1368	1709	0 - 12	Not generally harmful; but the presence can indicate the possibility of fecal contamination.
Background Count	NA	1368	1709	0 - 110	General bacterial population used to indicate deterioration of water quality.
Heterotrophic Plate Count (HPC)	NA	342	860	0 -99	HPC levels are used to monitor the general overall water quality. (*units = CFU/1mL)

ND – None Detected NA – Not Applicable CFU – Colony Forming Units mL - Millilitres

Table 1: Summary of Water Quality Test Results, 2019 (continued)						
Parameter		MAC (mg/L)	Minimum Number of Samples Required	Number of Samples Taken	Results Range	Comments
Chemical Analysis						
Trihalomethanes mg/L		0.10	4	21	0.041	Disinfection By-product; reaction of chlorine with organic matter. The results are based on a four quarter annual running average.
Haloacetic Acids mg/L		0.08	4	21	0.014	Disinfection By-product; reaction of chlorine with organic matter. The results are based on a four quarter annual running average.
Lead mg/L	Residential	0.010	40	70	<0.001 – 0.043	Lead water service connections may be found in homes built prior to 1955. No lead piping was used in the distribution system.
	Distribution	0.010	10	10	<0.001	
Alkalinity		NA	10	10	87-112	The capacity for neutralizing an acid solution
pH		NA	50	80	6.5-8.3	Indicates the acidity of the water
Disinfectant						
Chlorine Residual		Must be between 0.05 mg/L & 4.0 mg/L	1368	2574	0.01 – 1.89	The free chlorine residual in the water distribution system is an indicator of the effectiveness of the disinfection process.

mg/L – Miligrams per Litre

Summary of Adverse Water Quality Incidents

An adverse water quality incident does not mean the drinking water supply is unsafe. An adverse incident simply indicates on that one occasion, a drinking water quality standard was exceeded. In 2019, seven Adverse Water Quality Incidents took place; three dealing with low free chlorine residual and four had elevated levels of Total Coliforms.

After each adverse water quality incident, a series of actions are required to ensure the safety of the water and compliance with provincial legislation. The City's Standard Operating Procedures provide clear and detailed instruction for follow up actions. This involves flushing hydrants located in the area of the adverse incident, taking additional water samples from the original location and locations around the adverse incident. It also involves notifying the MECP's Niagara office, the Spills Action Centre (SAC) and the Public Health Department both verbally and in writing. **Appendix A** summarizes all adverse water quality incidents throughout the City of St. Catharines in 2019 and the corrective action taken to resolve each incident.

Lead Exceedances

As part of the Community Wide Lead Testing Program, the City is required to take samples from within private residences. The results are site-specific, and not indicative of the quality of the water throughout the distribution system. When sampling for lead, the results simply represent the water sampled from within that residence. Potential lead sources include: older lead water service lines, usually built prior to the 1950's; internal plumbing, used mainly in the early 1900's; and older brass or bronze fittings and fixtures. When a lead exceedance occurs, both the Public Health Department and the MECP are notified. The affected resident is also immediately notified and a package containing the results and informational fact sheets detailing what options are available to the resident are delivered. In 2019, there were five lead exceedance found on private property.

Replacing Lead Water Services

When a lead water service is found, for example, during a new watermain construction project or when repairing a water service leak the City will replace the portion of the service on public property at the City's expense. The City will also replace the public property side of a lead service when a lead exceedance is found and also whenever the property owner first replaces the private portion of the lead service line. Lead lines are replaced with either copper or plastic service lines. Over 30.5 metres of lead service pipe was replaced in 2019.

OPERATIONAL ACTIVITIES

Water System Disruptions

Disruptions to the water distribution system typically are due to unplanned maintenance required in the system. In addition to watermain break repairs, this can include any repairs to service lines, valves and hydrants. The majority of these repairs require the water to be shut-off resulting in a disruption of water service to customers. Table 2 summarizes water disruptions in 2018 and 2019 respectively.

The Province's Watermain Disinfection Procedure outlines the requirements for responding and repairing watermain breaks. It includes a sampling procedure for post watermain break repairs; and requirements for classifying each break and documentation of each break. Following each repair, microbiological samples are collected from locations both upstream and downstream of the repair. The purpose of these samples is to determine the effectiveness of the disinfection procedures used during the repair.

Table 2: Number of Service Disruptions

Number of:	2018	2019
Mainbreaks	111	87
Services	52	43
Hydrant	8	6
Valve	15	9
Construction*	5	3
Total Repairs	191	148
Follow up water samples	342	257
Affected properties**	3,967	2530
Water off-hours***	700.5	587.50

* Construction refers to unplanned service disruptions in a Construction zone.
** Affected properties refers to the number of properties who were without water due to an unscheduled disruption (i.e. they had their water shut off during the repair).
*** Water off-hours is the total number of hours properties were without water due to an unscheduled disruption.

New Watermain Commissioning

When a new watermain is installed, the City is required to sample for microbiological parameters and chlorine residual. In 2019, over 200 samples were taken to test the new watermains before being put into service. If any bacteria are present, the new watermains are flushed, rechlorinated and sampled again until no bacterial contamination is found before being put into service. All of the watermains must also meet the required standard for chlorine residual.

Maintenance Costs

The total budget for the 2019 Water Improvement Program amounted to $5.7 million. The total budget addresses 1.1 km of previously approved projects and 2.3 km of newly identified watermain replacements.

Backflow Prevention Program

Backflow as a result of cross-connections between a drinking water system and any source of contamination has the potential to impact the users of the drinking water system. The purpose of backflow prevention programs is to ensure that the drinking water supply is protected against the entry of contaminants, from cross-connections which could harm users and negatively impact the water distribution network.

St. Catharines has had a backflow program in place since 2009 and is intended to prevent any cross connections between the City's potable water system and non-potable sources at industrial, commercial and institutional (ICI) properties. St. Catharines backflow program generally follows the Canadian Standards Association (CSA) standard B-64. The CSA standard defines hazards to the drinking water system in three categories; Severe, Moderate and Minor. The program is implemented by having surveys completed at the identified properties and ensuring the required backflow prevention device is installed and tested as per the CSA standard.

There are over 1750 properties that have been identified as falling into the severe or moderate hazard category. Of these properties, 47% have been contacted by staff and are in compliance or working on obtaining compliance. There are 201 properties identified as severe risk and 78% of those properties are in compliance.

Water Flows

Table 3 lists the monthly water flows from the Decew Water Treatment Plant to the City of St. Catharines (source: Regional Municipality of Niagara). More detailed flow data can be found the Decew Water Treatment Plant's 2019 Summary Report, available at: www.niagararegion.ca.

Table 4: Monthly Water Flows for 2018 and 2019		
Month	Quantity (MegaLitres)	
	2018	2019
January	1201.5	1195.6
February	1068.4	1069.6
March	1172.8	1193.9
April	1166.5	1116.6
May	1308.9	1175.3
June	1547.2	1357.0
July	1716.8	1459.1
August	1479.8	1395.0
September	1356.0	1246.3
October	1219.8	1131.6
November	1128.8	1081.1
December	1141.3	1108.8
Total	15,507.8	14,529.9
Monthly Average	1,292.3	1,210.8
Daily Average	42.5	39.8

Note: 1 MegaLitre (ML) = 1,000,000 Litres

Investing in the Future

Residents trust the City of St. Catharines for safe, clean, and reliable drinking water every time they turn on their tap. St. Catharines is proud to deliver on those expectations. We also know that investments are required to renew our drinking water systems and allow us to meet those expectations tomorrow and for future generations by improving water quality, reliability and increasing resiliency to extreme weather events, while lowering maintenance costs over time. The City continues to work on these essential improvements.

Additional Information

For additional information on the City of St. Catharines drinking water system or the content of this report, please contact the Manager of Environmental Services, Mark Green at 905-688-5600.

APPENDIX A

Summary of Adverse Water Quality Incidents, 2019

Incident Date	Location	Adverse Parameter	Result	Corrective Action	Corrective Action Date
March 25, 2019	472 Grantham	Free Chlorine	0.02 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	March 25, 2019
July 18, 2019	86 Ventura	Total Coliform	6 CFU /100 mL	Flushed nearby hydrants. Resampled the surrounding area, including the original location.	July 21, 2019
July 19, 2019	86 Ventura	Total Coliform	12 CFU /100 mL	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	July 21, 2019
Aug. 27, 2019	273 Parnall	Total Coliform	1 CFU /100 mL	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	Aug. 30, 2019
Nov. 20, 2019	71 Berryman	Total Coliform	7 CFU /100 mL	Flushed nearby hydrants. Resampled the surrounding area, including the original location. All of the resamples met the drinking water standard.	Nov. 23, 2019
Dec. 5, 2019	320 Geneva	Free Chlorine	0.02 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	Dec. 5, 2019
Dec. 6, 2019	320 Geneva	Free Chlorine	0.01 mg/L	Flushed area hydrants and flushed within the original location. Confirmed the chlorine residual was restored.	Dec. 6, 2019