Water Services' Annual and Summary Report

January 1 to December 31, 2020

Guelph Drinking Water System

Corporation of the City of Guelph

Gazer Mooney Subdivision Distribution System

Township of Guelph/Eramosa

Water Services

Environmental Services Department

Last Revision: July 23, 2021

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Executive Summary

The purpose of this report is to provide information to system owners and stakeholders to satisfy the regulatory requirements of the Safe Drinking Water Act (SDWA) including the Drinking Water Quality Management Standard (DWQMS); Section 81 of the Clean Water Act (CWA); and regulatory reporting required under O. Reg. 170/03 - Section 11 and Schedule 22.

This report is a compilation of information that helps to demonstrate the ongoing provision of a safe, consistent supply of high quality drinking water to customers located within the City of Guelph and the Gazer Mooney Subdivision (located in the Township of Guelph/Eramosa).

Water Services is a municipally-owned and operated water utility, established in 1879. The Guelph Drinking Water System (Guelph DWS) consists of water supply and treatment facilities and a water distribution system. The Guelph DWS is a Class II Water Treatment Subsystem and Class IV Water Distribution Subsystem.

The Gazer Mooney Subdivision Distribution System (Gazer Mooney SDS) is a Class I Distribution System supplied with water from the Guelph DWS. Guelph Water Services is the Operating Authority for this system owned by Guelph/Eramosa Township.

Both the Guelph DWS and the Gazer Mooney SDS are required to comply with the Safe Drinking Water Act (SDWA) and other regulations as well as requirements contained in Permits to Take Water (PTTW), Municipal Drinking Water Licences (MDWL), and Drinking Water Works Permits (DWWP). Having met the quality management system requirements of the SDWA, Guelph Water Services is an accredited Operating Authority with an up-to-date Operational Plan. The Operational Plan is available upon request from Guelph Water Services or at Service Guelph located in Guelph City Hall.

Guelph's Source Water

The source of Guelph's drinking water is a series of 21 operational groundwater wells and a shallow groundwater collector system. These sources consist primarily of true groundwater sources, with some "groundwater under the direct influence of surface water with effective in-situ filtration" (GUDI-WEF) sources (i.e., Carter 1, Carter 2, Arkell 1, Arkell 15 wells and the Arkell Springs Glen Collector System).

The water system is operated to meet daily, seasonal, and other operational demands (including fire demands) with various combinations of supply sources in operation at any given time. A total of 16,533,166 cubic meters (16.5 billion litres) of water was treated and

pumped to the system in 2020. The average daily water demand was 45,173 cubic metres (45.1 million litres). The maximum daily production of water in 2020 was 60,728 cubic metres (60.7 million litres) and occurred on July 8, 2020. The minimum daily production of water in 2020 was 33,366 cubic metres (33.4 million litres) and occurred on December 25, 2020.

Water Treatment and Distribution

All water provided to the Guelph Drinking Water System and the Gazer Mooney Subdivision Distribution System was treated via Water Services' 12 active Treatment Facilities for: primary disinfection using chlorine solution (10 sites) or ultraviolet irradiation (2 sites); secondary disinfection using chlorine solution for a free chlorine residual (12 sites); sequestration using sodium silicate for dissolved iron (2 sites); and manganese removal using green-sand filtration (1 site). All of the water supplied was regularly tested, including continuous turbidity and residual chlorine (disinfectant) measurements. City of Guelph Water Services' maintained the drinking water system in a fit state of repair and followed best industry practices during the repair and maintenance of the system.

The City of Guelph has approximately 44,000 fully metered water service connections, approximately 557.3 kilometres of underground watermains, and a population of approximately 131,794[1]. The Gazer Mooney Subdivision has approximately 72 fully metered water service connections, 2 kilometres of underground watermains, and an approximate population of 209[2] people.

Complying with Regulations

As the Operating Authority for both the Guelph DWS and Gazer Mooney SDS, Guelph Water Services is annually inspected by the Ministry of the Environment, Conservation and Parks (MECP) for compliance with regulatory requirements. Through the 2019-2020 MECP Inspection, Water Services received a 96.15% score for the Guelph DWS and a 100% score for the Gazer Mooney SDS.

In 2020, Guelph Water Services reported three Adverse Water Quality Incidents (AWQIs) in the Guelph Drinking Water System – please refer to section b) Adverse Water Quality Incidents. In conjunction with the Wellington-Dufferin-Guelph Public Health (WDGPH) and

[1] Statistics Canada, 2016 Census of Population.
[2] Estimated based on 72 water connections multiplied by 2.9 people per household (as per Statistics Canada for low density residential).

the MECP, all appropriate corrective actions and required reporting were completed with no health-based issues for the AQWIs.

Water Services' risk assessment updates, emergency response testing, and internal and external audits help facilitate continual improvement of Water Services' processes and programs through implementation of corrective actions.

Water Services continues to implement:

- Recommendations of the 2016 Water Efficiency Strategy.
- Source water protection based on a MECP-approved Source Water Protection Plan.
- The Lead Reduction Plan in accordance with the regulatory relief provisions of the SDWA.
- Facility asset management and infrastructure reviews to optimize priority projects.
- A robust backflow prevention program overseeing 2,932 properties with 6,644 backflow prevention devices installed.

Details of ongoing and emerging water quality, supply/treatment, and distribution initiatives are outlined in section g) Operational Performance and Statistics of this report and include successful programs related to: water conservation and efficiency, source water protection, and lead reduction.

The City has completed this Annual & Summary Report to satisfy the regulatory requirements of the Safe Drinking Water Act (SDWA) including the Drinking Water Quality Management Standard (DWQMS), Clean Water Act (CWA) and regulatory reporting required under O. Reg. 170/03 - Section 11 and Schedule 22.

For more information please contact Guelph Water Services at (519) 837-5627 or waterservices@guelph.ca.

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Water Services' Annual and Summary Report

Purpose

The purpose of this report is to provide information to stakeholders and to satisfy the regulatory requirements of the Safe Drinking Water Act (SDWA) including the Drinking Water Quality Management Standard (DWQMS), Clean Water Act (CWA) and regulatory reporting required under O. Reg. 170/03 - Section 11 and Schedule 22. The report is a compilation of information that helps to demonstrate the ongoing provision of a safe, consistent supply of high quality drinking water to customers located within the City of Guelph and the Gazer Mooney Subdivision, located in the Township of Guelph/Eramosa.

Scope

This Water Services Annual and Summary Report includes information from both the **Guelph Drinking Water System** and the **Gazer Mooney Subdivision Distribution System** for the period of January 1 to December 31, 2020, unless otherwise noted. The information is required to be reported to the following:

- the Drinking Water System Owners:
  - Guelph City Council
  - Township of Guelph/Eramosa (Council and CAO);
- Senior officials of Guelph Water Services and Township of Guelph/Eramosa; and
- the general public and interested stakeholders.

This report satisfies the requirements of Ontario Regulation 170/03 made under the SDWA, as follows:

Section 11, Annual Reports, which includes:

- a brief description of the drinking water systems;
- a list of water treatment chemicals used;
- a summary of the most recent water test results required under O. Reg. 170/03 or an approval, Municipal Drinking Water Licence (MDWL) or order;
- a summary of adverse test results and other issues reported to the Ministry of the Environment, Conservation and Parks (MECP) including corrective actions taken;
- a description of major expenses incurred to install, repair or replace required equipment; and
- the locations where this report is available for inspection.

Schedule 22, Summary Report, which includes:

- list the requirements of the SDWA, the regulations, the system's approval, Drinking Water Works Permit (DWWP), MDWL, and any orders applicable to the system that were not met at any time during the period covered by the report;
- for each requirement that was not met, the duration of the failure and the measures that were taken to correct the failure;
- a summary of the quantities and flow rates of the water supplied during the period covered by the report, including monthly average and maximum daily flows; and
- a comparison of this information to the rated capacity and flow rates approved in the system's approval, DWWP and/or MDWL.

This report satisfies applicable requirements for both the Guelph Drinking Water System and the Gazer Mooney Subdivision Distribution System, including requirements of the SDWA including the DWQMS and Section 81 of the CWA.

A copy of this report is available for viewing at:

- **City of Guelph Water Services**, 29 Waterworks Place, Guelph;
- **Township of Guelph/Eramosa**, 8348 Wellington Rd. 124, Rockwood; and
- **Online** at guelph.ca/water-testing.

Due to the global pandemic, we encourage the online version of this report be accessed for review.

Any inquiries can be made to:

- City of Guelph Water Services by e-mailing waterservices@guelph.ca or by calling 519-837-5627.
- Township of Guelph/Eramosa Public Works – Water / Wastewater by e-mailing general@get.on.ca or by calling 519-856-9596.

Notice

Please note that every reasonable effort is made to ensure the accuracy of this report. This report is published with the best available information at the time of publication. In the event that errors or omissions occur, the online report will be updated. Please refer to the online version of the report for the most current version.

Please note that some hyperlinks in the document are linked to Guelph's electronic document management system (EDMS), which is available for internal City use only.

Systems Overview

Guelph Drinking Water System

Water Services at the City of Guelph is committed to providing consumers with a safe, consistent supply of high quality drinking water while meeting or exceeding, and continually improving on legal, operational and quality management system requirements. Water Services strives to provide reliable and cost-effective water treatment and distribution systems for the safe production and delivery of high quality water. Established in 1879, Water Services and is a municipally-owned and operated water utility.

The Guelph Drinking Water System is classified as a Class II Water Treatment Subsystem and a Class IV Water Distribution Subsystem. All necessary licences have been obtained by staff to operate the Guelph Drinking Water System. As of December 31, 2020, 44 team members held drinking water certificates to operate and maintain the water system.

In 2020, Water Services maintained full accreditation to the DWQMS Version 2.0 after a successful on-site verification audit, conducted by the third-party accreditation body - NSF International Strategic Registrations. This accreditation satisfies part of the requirements under the Municipal Drinking Water Licensing Program.

Water Distribution System

The distribution system (including watermains, valves, fire hydrants, water services, and meters) serves a population of approximately 131,794[3] within the City of Guelph. All new system components meet NSF 61[4] and NSF 372[5] requirements, or approved equivalents, and are installed and maintained in accordance with approved industry standards. Water system customers are fully metered and billed in accordance with the Water and Wastewater Customer Rates and Charges by-law.

The Guelph Drinking Water System distribution system is comprised of the following infrastructure:

- 6.38 kilometres of a 900-1,050 mm diameter water supply aqueduct;

[3] Statistics Canada, 2016 Census of Population.
[4] NSF/ANSI Standard 61: Drinking Water System Components – Health Effects
[5] NSF/ANSI Standard 372: Drinking Water System Components – Lead Content

- five underground storage reservoirs with a combined approximate capacity of 48,000 cubic metres (48 million litres);
- three water towers with a combined approximate capacity of 11,200 cubic metres (11.2 million litres);
- approximately 557.3 kilometres of buried watermain with a diameter < 900 mm;
- 4,286 watermain valves;
- 2,809 fire hydrants; and
- approximately 44,000 water services and water meters.

Guelph Source Water and Treatment Facilities

The source of Guelph's drinking water is a series of 21 operational groundwater wells and a shallow groundwater collector system. The drinking water sources consist primarily of true groundwater, with some "groundwater under the direct influence of surface water with effective in-situ filtration" (GUDI-WEF) sources. The GUDI-WEF sources include: Carter Well 1 and 2; Arkell 1; Arkell 15; and the Arkell Springs Glen Collector System.

The Guelph Drinking Water System uses 12 per cent Sodium Hypochlorite (that is NSF 60[6] certified) for primary disinfection for the following 11 sources:

- Downey Well
- Burke Well
- Park Well 1 and 2
- Emma Well
- Dean Well
- University Well
- Queensdale Well
- Helmar Well
- Calico Well
- Water Street Well

Twelve per cent Sodium Hypochlorite along with ultraviolet light treatment is used as part of a multi-barrier primary disinfection for the following ten sources:

- Arkell Wells 1, 6, 7, 8, 14, 15 and the Arkell Springs Glen Collector System
- Carter Wells 1 and 2
- Membro Well

[6] NSF/ANSI Standard 60: Drinking Water Treatment Chemicals – Health Effects

NSF 60-certified Sodium Silicate, is used at Helmar Well and Queensdale Well for aesthetic purposes to sequester dissolved iron and manganese.

In total, Water Services operates and maintains 35 facilities.

The current replacement value of the Guelph Drinking Water System is estimated to be $773.9 million[7].

The Guelph Drinking Water System operations are funded directly from the sale of water, with minor additional funding through government grant programs. Property taxes are not used to fund the operation, maintenance or capital renewal of the drinking water system.

A total of 16,533,166 cubic meters (16.5 billion litres) of water was treated and pumped to the system in 2020. The average daily water demand was 45,173 cubic metres (45.1 million litres). The maximum daily production of water in 2020 was 60,728 cubic metres (60.7 million litres) and occurred on July 8, 2020. The minimum daily production of water in 2020 was 33,366 cubic metres (33.4 million litres) and occurred on December 25, 2020.

In 2020, all regulatory microbiological and chemical quality samples collected throughout the drinking water system were taken by certified operators and laboratory testing was performed by accredited, licensed laboratories. These tests include both regulatory and operational testing; however, in most cases only regulatory reporting is included in this report. In all cases, the drinking water supplied to all customers was confirmed safe and the water was of higher quality than all Ontario and Canadian health-related guidelines.

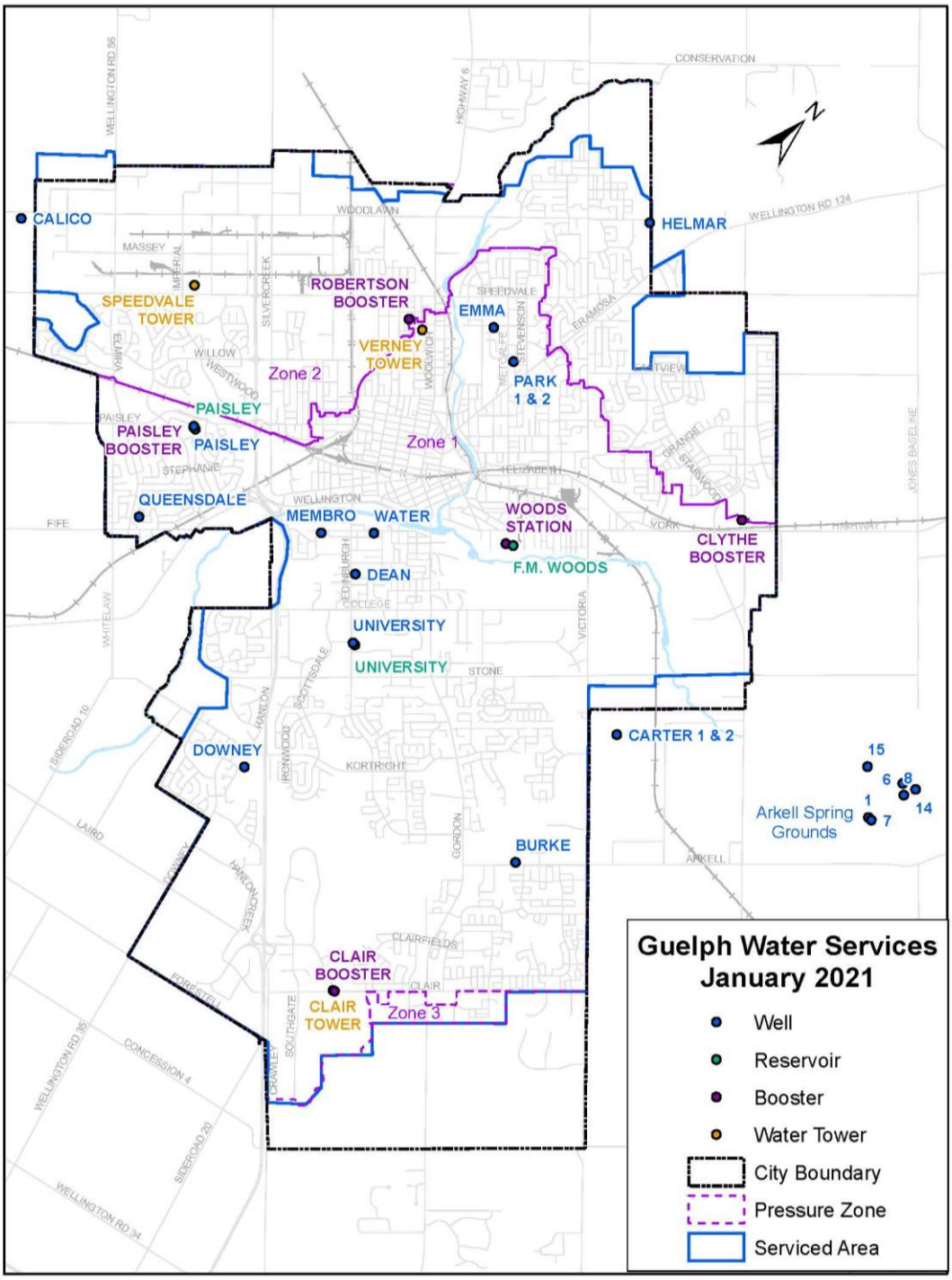
The Guelph Drinking Water System is defined as a large residential system operated under the regulatory requirements of the Safe Drinking Water Act and the Ontario Water Resources Act (accessed at Ontario e-laws). In 2020, the Guelph Drinking Water System operated under Municipal Drinking Water Licence (MDWL) 017-101, Issue numbers 12 and 13 and the Drinking Water Works Permit (DWWP) 017-201, Issue numbers 8 and 9.

The MDWL and the DWWP describe system-specific requirements that are supplementary to provincial regulations and act as licences for water supply and distribution operations. These documents outline specific conditions and requirements regarding operation, maintenance and upgrades that are required by the system and are considered regulatory in nature. These documents are available by request for viewing by emailing Water Services at waterservices@guelph.ca or by calling 519-837-5627.

[7] City of Guelph 2020 Asset Management Plan, page 132-133.

Figure 1: Guelph Drinking Water System shows the locations of the Guelph Drinking Water System facilities that were active in 2020.

Figure 1: Guelph Drinking Water System



Gazer Mooney Subdivision Distribution System

The Gazer Mooney Subdivision Distribution System is a Class 1 Distribution Subsystem that serves approximately 209[8] people, and is owned by the Township of Guelph/Eramosa. The system is operated by Guelph Water Services through a legal agreement that was signed by representatives of the City of Guelph and the Township of Guelph/Eramosa. The current agreement came into effect on March 1, 2019 and will continue until February 29, 2024 and will be automatically renewed and extended to February 28, 2029, unless terminated earlier.

All of the water for the Gazer Mooney Subdivision Distribution System is supplied from the Guelph Drinking Water System. All water is treated to provincial standards in the Guelph Drinking Water System and no further treatment chemicals are added to the Gazer Mooney Subdivision Distribution System.

All new distribution infrastructure components meet NSF 61 and NSF 372 requirements, or approved equivalents, and are installed and maintained in accordance with approved industry standards. The system is fully metered.

The Gazer Mooney Subdivision Distribution System is comprised of the following infrastructure:

- approximately 720 meters of 200mm diameter watermain;
- approximately 600 meters of 150mm diameter watermain;
- six watermain valves;
- six fire hydrants;
- one sampling station; and
- approximately 72 water services and water meters.

The cost of construction of the Gazer Mooney Subdivision Distribution System in 1980 was listed as $197,933.

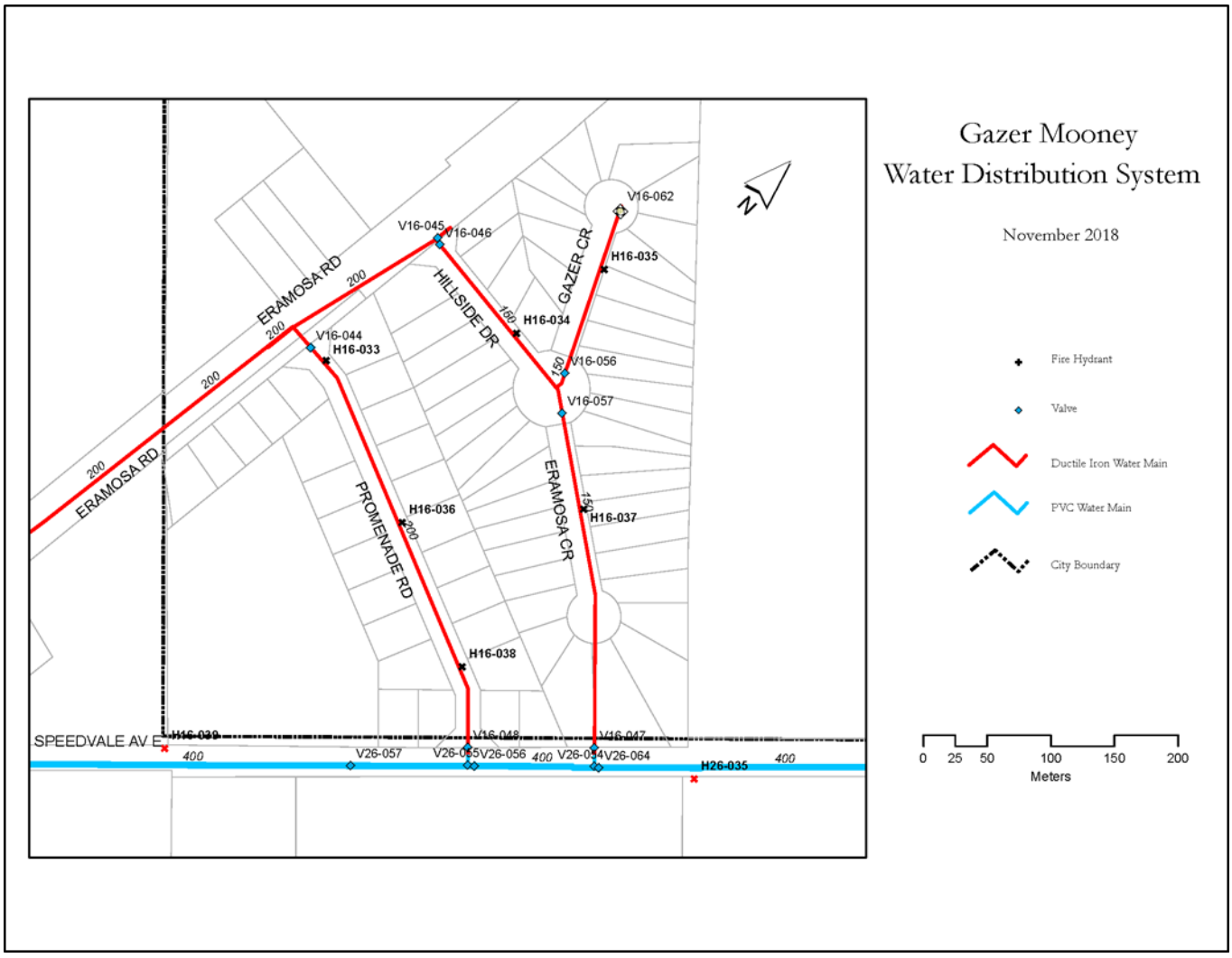
The Gazer Mooney Subdivision Distribution System is considered a small residential system and is operated under the regulatory requirements of the Safe Drinking Water Act and the Ontario Water Resources Act, which may be found at Ontario e-laws.

[8] Estimated, based on 72 water connections multiplied by 2.9 people per household (as per Statistics Canada for low density residential).

In 2020, the Gazer Mooney Subdivision Distribution System operated under Municipal Drinking Water Licence No. 104-103, Issue number 2 and 3; and Drinking Water Works Permit No. 104-203, Issue number 2 and 3. These documents are available by request for viewing by emailing Water Services at waterservices@guelph.ca or by calling 519-837-5627; and at the Township of Guelph/Eramosa by e-mailing general@get.on.ca or by calling 519-856-9596.

Figure 2: Gazer Mooney Water Distribution System shows the location of the Gazer Mooney Subdivision Distribution System.

Figure 2: Gazer Mooney Water Distribution System



a) Incidents of Regulatory Non-Compliance

This section describes all incidents of non-compliance.

As the Operating Authority for both the Guelph DWS and Gazer Mooney SDS, Guelph Water Services is annually inspected by the Ministry of the Environment, Conservation and Parks (MECP) for compliance with regulatory requirements.

Guelph Drinking Water System

Through the 2019-2020 MECP Inspection, Water Services received a 96.15% score for the Guelph DWS. There were three incidents of non-compliance associated with the Guelph Drinking Water System in 2020. The three incidents are described below:

1. A chlorine residual in the distribution system was found to be below 0.05 mg/L on June 30, 2020 which is discussed further in section b) Adverse Water Quality Incidents, item 2.
2. A chlorine residual in a dead-end of the distribution system was found to be below 0.05 mg/L on November 3, 2020 which is discussed further in section b) Adverse Water Quality Incidents, item 3.

Water Services is committed to ensuring that the minimum chlorine residual is maintained throughout the water distribution system. Through the root-cause analysis process, Water Services initiates continual improvement measures and implements new policies and procedures to prevent issues of non-compliance from re-occurring. In both of these instances, adjustments to the flushing program were made to ensure the minimum chlorine residual in the distribution system is maintained at all times.

3. A logbook was found to have entries out of chronological order.

Water Services is committed to ensuring logbook entries are made in chronological order to allow for a clear review of information that documents manual operations of a treatment subsystem. Subsequent to the root-cause analysis process, all Treatment Operators were re-trained on the logbook requirements of Regulation 128 by the Treatment Supervisor and an online course from the Walkerton Clean Water Centre (WCWC) was completed by the Operators.

Gazer Mooney Subdivision Distribution System

There were no incidents of non-compliance in the Gazer Mooney Subdivision Distribution System. A score of 100% was achieved in the 2019-2020 Ministry of the Environment, Conservation and Parks Annual Inspection Report for the Gazer Mooney Subdivision Distribution System.

b) Adverse Water Quality Incidents

This section describes all Adverse Water Quality Incidents (AWQI's). This term refers to any unusual test result from treated water that does not meet a provincial water quality standard, or a situation where disinfection of the water may be compromised. An adverse water quality incident indicates that on at least one occasion and at a certain instance in time, a water quality standard was not met. Many AWQI's have proven to be the result of water sampling and testing problems rather than poor water quality. False positive results can be caused by: contaminated sampling containers and equipment; improper sampling technique; handling and transportation; and sampling analysis errors. On average, there have been four to five AWQI's annually in the Guelph Drinking Water System. In 2020, there were three, as detailed below.

Please note: The City was granted regulatory relief from Schedule 15.1 of O. Reg. 170/03 in favour of a Guelph specific Lead Reduction Plan (LRP). Residential sample results collected under the LRP that have lead concentrations above 10 µg/L, are tracked and reported to Wellington-Dufferin-Guelph Public Health, the Ministry of the Environment, Conservation and Parks (as per MDWL 017-101, Schedule D) and the customer. See section g) Operational Performance and Statistics for more information on the Lead Reduction Plan.

Guelph Drinking Water System

In 2020, there were three adverse water quality incidents (AWQI's #149487, #150447 and #152817) and a summary of these are included in Table 1, below.

Gazer Mooney Subdivision Distribution System

There were no adverse water quality incidents in the Gazer Mooney Subdivision Distribution System in 2020.

Table 1: Guelph Drinking Water System Adverse Water Quality Incidents, 2020

#	Date	AWQI #	Location	Description	Corrective Action	Re-sample Results Good	Deviation from Critical Control Point[9]
1	Jan. 23	149487	Clythe Booster Pumping Station - Point Of Entry (POE) (S048)	Total Coliform result of 1 cfu at S048	Water Services was informed by the laboratory of a microbiological parameter exceedance. Wellington-Dufferin-Guelph Public Health (WDGPH), MECP, and Spills Action Centre (SAC) were notified. Re-samples were taken at the Clythe Booster Pumping Station as well as upstream and downstream of that location. All results were clear of *E.coli*, Total Coliform and background bacteria, confirming adequate disinfection. Resample results were communicated to the WDGPH and the AQWI was closed.	Yes	No

[9] Please see Section c) Deviations from Critical Control Point (CCP) Limits and Response Actions of this report for a description of "critical control points".

#	Date	AWQI #	Location	Description	Corrective Action	Re-sample Results Good	Deviation from Critical Control Point[9]
2	June 30	150447	Sample Station D0246	Distribution system chlorine residual below 0.05 mg/L	Sample Station D0246 was sampled on June 30 as part of the distribution subsystem microbiological sampling program and a chlorine residual of 0.04 mg/L was recorded. After 5 minutes of additional flushing, a residual of 0.09 mg/L was achieved. Wellington-Dufferin-Guelph Public Health (WDGPH), MECP, and Spills Action Centre (SAC) were notified. Hydrant H01-013 (adjacent to D0246) is now part of the regular flushing program and has scheduled flushings to maintain acceptable secondary disinfection free chlorine residuals. The AWQI is closed. Update: In consultation with the MECP Inspector, it was agreed that this section of watermain is considered a Hydrant Lead because there is only a hydrant and no water customers connected to the watermain. As such, flushing has been discontinued on this section of watermain, saving approximately 200m^3 of water per week and valuable staff time with no water quality concerns to consumers.	Yes	Yes

#	Date	AWQI #	Location	Description	Corrective Action	Re-sample Results Good	Deviation from Critical Control Point[9]
3	Nov. 03	152817	New City-side service pipe on College Ave., E. (U of G Turf Grass Institute)	Distribution system chlorine residual below 0.05 mg/L	This newly installed service pipe is not connected on the private-side, thereby creating a dead-end in the distribution system. It was recognized that this section of pipe requires scheduled flushing to maintain a chlorine residual. In order to determine the flushing frequency, the temporary dead-end was flushed and sampled on Nov. 3 (three days after commissioning of the new watermain), when a chlorine residual of 0.04 mg/L was recorded. After 25 minutes of additional flushing, a residual of 0.50 mg/L was achieved. Wellington-Dufferin-Guelph Public Health (WDGPH), MECP, and Spills Action Centre (SAC) were notified. The flushing schedule was adjusted to maintain acceptable residuals. The AWQI is closed.	Yes	Yes

c) Deviations from Critical Control Point (CCP) Limits and Response Actions

A critical control point in the drinking water system is where control can be applied to prevent or eliminate a drinking water hazard, or to reduce it to an acceptable level. Water Services utilizes three Critical Control Points (CCP) in the drinking water system:

1) Multi-Barrier Primary Disinfection - To remove or inactivate pathogens potentially present in the source water.
2) Secondary Disinfection - To ensure the maintenance of a disinfectant residual throughout the distribution system.
3) Backflow Prevention - To prevent cross-contamination that can result from the flowing back of or reversal of the normal direction of flow of water.

Any deviations from the CCPs are reported to both the Owners and Top Management, and are summarized in section b) Adverse Water Quality Incidents in this report.

There were two deviations from the Critical Control Points in 2020. The deviations were both related to secondary disinfection. Information about these incidents and actions taken to resolve the issues are outlined in section b) Adverse Water Quality Incidents under item numbers 2 and 3.

Additional information (e.g. critical control limits and response actions) is included in Appendix A: Summary of Critical Control Points and Critical Control Limits.

d) The Effectiveness of the Risk Assessment Process

This section confirms the occurrence of reviews of the risk assessment process. The risk assessment process determines the effectiveness of identifying and appropriately assessing the risk of hazards and hazardous events to the drinking water system. It also identifies the appropriate control measures; critical control points (CCPs); and related critical control limits (CCLs) related to the hazards and hazardous events. A description of the CCPs and CCLs are included in Appendix A: Summary of Critical Control Points and Critical Control Limits.

The annual risk assessment review was conducted by Water Services staff over several meetings between May 11 and May 14, 2020. The updated risk assessment outcomes was subsequently reviewed and approved at a management meeting on June 1, 2020. For water security reasons, the results of the Risk Assessment are not made available to the public,

but are made available to internal staff and the Guelph DWS and Gazer Mooney SDS Owners.

Through the risk assessment process, the following risks were added:

- Presence of nitrates in rural water sources
- Failure of large water meters (larger than 1")

e) Internal and Third-Party (External) Audit Results

Internal auditing and third-party (external) auditing is performed to fulfill the mandatory requirements of the DWQMS. The purpose of audits are to evaluate the level of conformance of Water Services to the DWQMS. Audits identify both conformance and non-conformance with the Standard, as well as, opportunities for improvement. Appendix B: Summary of Internal and External Audit Plans includes the past two years' internal and external audit plans and the plan for the upcoming year.

2020 Internal Audit

The internal audit was completed on March 2 to 5, 2020 and looked at 14 processes at Water Services using trained internal Water Services staff as auditors. Many strengths were identified during the internal audit, including emergency management, sampling scheduling, the compliance program, preventative maintenance programs and the risk assessment process. Participating staff at all levels are knowledgeable and aware of their duties as it relates to providing safe drinking water to the water consumers.

There was one minor non-conformance identified during these internal audits. Under Element 10 – Competencies of the DWQMS, it was identified that the on-the-job training forms were not being consistently used by staff whose duties directly affect drinking water quality. A root-cause-analysis was conducted and a corrective action plan was developed to ensure that this does not happen again.

Various opportunities for improvement, such as: improved document and records control; communications; essential services; competencies; and emergency management were also noted in the internal audit report. Water Services strives to promptly address issues identified in internal audits as part of continuous improvement of its procedures and processes. The next internal audit is scheduled to take place between March 22 and 26, 2021.

2020 External Audit

The third-party external verification audit was completed virtually between November 23 and November 25, 2020 by NSF International Strategic Registrations and looked at 23 processes at Water Services and included a virtual facility tour. Based on the results of the audit, accreditation to the DWQMS Version 2.0 was maintained.

The auditor noted that there continues to be strong evidence of ongoing commitment to the DWQMS at the City of Guelph. System strengths observed during the audit include:

- Staff engagement and participation in risk assessments, internal audit and infrastructure planning
- Root-cause-analysis process
- Training database improvements
- SCADA improvements
- Water Conservation initiatives and the large water meter inspection program
- DWQMS documentation: management review, risk assessments, internal audit
- Risk-based approach to our Operations
- Emergency response processes
- Calibration and verification program

There were two minor non-conformances identified during this audit. The first minor non-conformance is related to Communications (DWQMS Element 12). The auditor noted that: there was no evidence available to demonstrate that relevant aspects of the Quality Management System are consistently communicated between Top Management and suppliers that have been identified as essential, e.g., suppliers not under formal contracts with the City. Further, Purchase Orders did not reference AWWA and ANSI quality and safety criteria.

The second minor non-conformance related to Essential Supplies and Services (DWQMS Element 13). The auditor noted that there was no evidence available to demonstrate that stated quality requirements are confirmed for all service providers who are not under formal contract with the City.

In both minor non-conformances, a root-cause-analysis was completed to identify corrective and preventative actions to ensure that the issues will not occur again. In both minor non-conformances, the auditor accepted our corrective and preventative actions and the minor non-conformances are considered closed and will be evaluated for effectiveness during next year’s external audit.

Noted opportunities for improvement by the auditor were related to improving the following processes:

- Calibration and Verification Processes (DWQMS 17 – Measurement and Recording Equipment Calibration and Maintenance);
- DWQMS Documentation (DWQMS 5 – Document and Records Control); and
- Training Database (DWQMS 10 – Competencies).

Water Services maintains a culture of continual improvement and works towards implementing improvements suggested by the external auditor. The minor non-conformances and opportunities for improvement will be reviewed by the external auditor at the next on-site audit, scheduled between October 18 and 20, 2021.

f) Results of Emergency Response Testing

Emergency response testing is regularly completed as part of the Water Services' Quality Management System (QMS) to ensure that Water Services maintains a reasonable readiness to deal with emergencies and abnormal events. The ability to properly manage emergencies and unplanned failures is critical in demonstrating that Water Services has taken a diligent approach in its operations.

Feedback from emergency testing and from actual emergency events is gathered during debriefing sessions and improvement items are incorporated into the Water Services Emergency Response Plan, standard operating procedures and/or daily operations.

Water Services had two actual emergency events in 2020. The first incident occurred on March 11, 2020 when a contractor was working near the aqueduct to remove trees. During this incident, an old shallow groundwater collector lateral connected to the aqueduct was damaged. This resulted in elevated turbidity and an emergency response from the Water Treatment team. The damaged lateral was temporarily plugged with a pneumatic plug and was later replaced with a mechanical plug that was cemented in place. To prevent a similar issue from happening again, a second and third lateral were both plugged with a wing plug and cemented in place.

The second actual emergency is the ongoing Covid-19 pandemic. Water Services is still actively monitoring and planning for this emergency, in conjunction with the Corporate Emergency Operations Control Group. Policies and procedures have been updated to ensure the well-being of staff and visitors to Water Services based on recommendations from Wellington-Dufferin-Guelph Public Health and the provincial and federal governments.

Table 2 includes the dates of Completed Emergency Response Tests for the past three years and planned tests for 2021.

Table 2: Emergency Response Tests

Hazardous Event / Hazard[10]	2018	2019	2020	2021
Long-term impacts of climate change	Jan. 26 (2017 test)			
Source water supply shortfall			March 11 (Emergency)	Planned test
Extreme weather events (e.g. tornado, ice storm, flood)	Jan. 26 (2017 test)			
Sustained extreme temperatures (e.g. heat wave, deep freeze)	Jan. 26 (2017 test)			
Chemical spill impacting source water				Planned test
Sustained pressure loss	Nov. 23, 28-30 (2018 test)	Nov. 1, 6-8 (2019 test)		
Backflow / Cross-connection	Nov. 23, 28-30 (2018 test)			
Terrorist threat				Planned test
Vandalism				
Sudden changes to raw water characteristics (e.g. turbidity, pH)	Jan. 26 (2017 test)		March 11 (Emergency)	
Failure of equipment or process associated with primary disinfection (e.g. UV, chlorination)				

[10] The Hazardous Event / Hazard list reflects the MECP's mandated "Potential Hazardous Events for Municipal Residential Drinking Water Systems to Consider in the Risk Assessment" document.

Hazardous Event / Hazard[10]	2018	2019	2020	2021
Failure of equipment or process associated with secondary disinfection (e.g. chlorination)			(AWQI)	
Loss or contamination of treated water supply	Nov. 23, 28-30 (2018 test)	Nov. 1, 6-8 (2019 test) Sept. 13 and Nov. 30 (main breaks)		
Loss of monitoring system		Nov. 3 (AWQI)		
Pandemic			Covid-19	Covid-19

g) Operational Performance and Statistics

The following section describes Operational performance statistics within Water Services that includes:

- 2020 Totalized Pumpages as per the Municipal Drinking Water Licence and Permits to Take Water;
- 2020 Instantaneous Flows as per Permit to Take Water requirements;
- Water Production, Consumption and Population;
- Water Supply Capacity;
- System Maintenance and Major Expenditures;
- Backflow Prevention Program Updates; and
- Status of Ongoing Strategy and Plan Implementation.

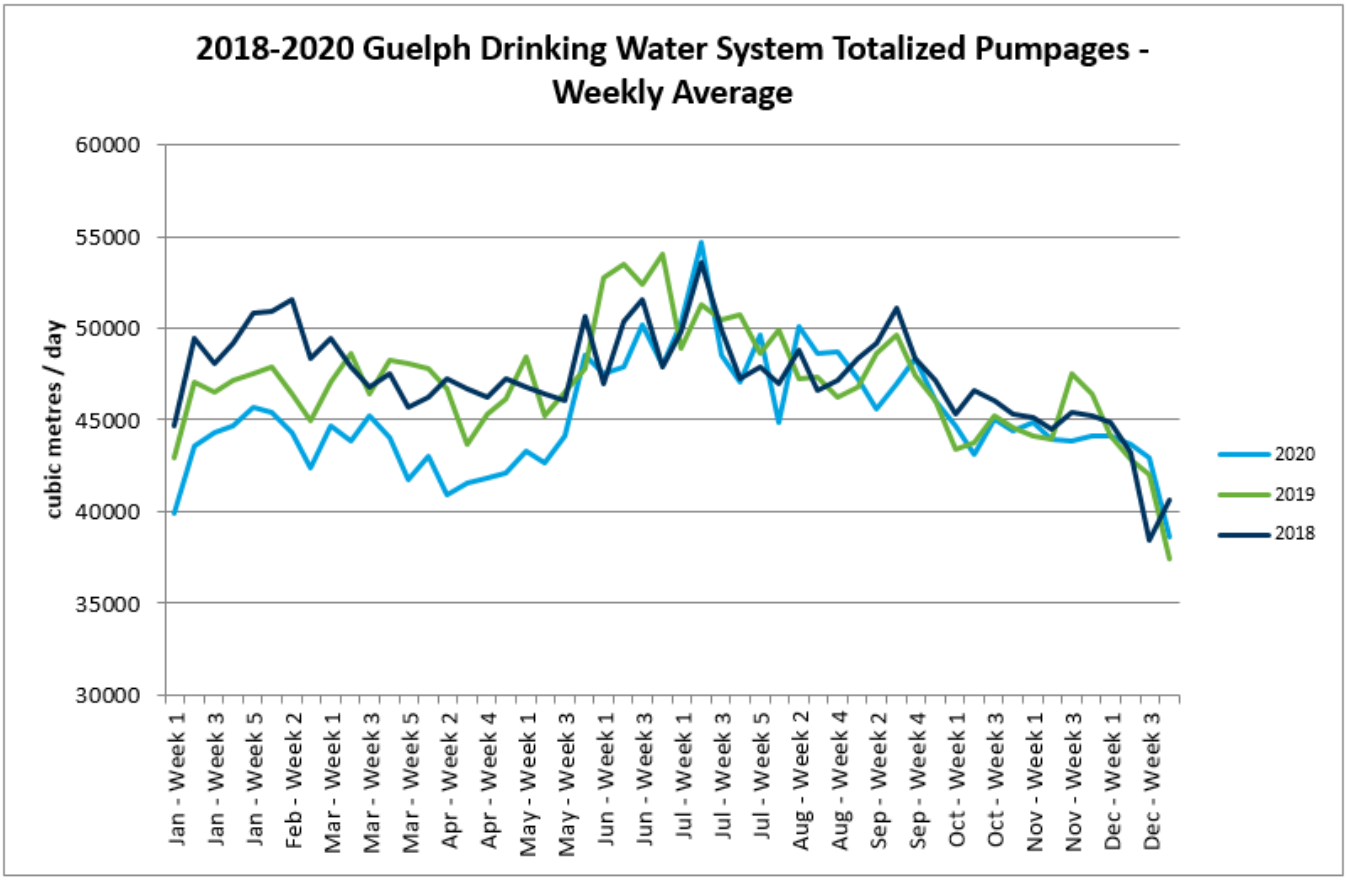
2020 Totalized Pumpages and Instantaneous Flows

The Safe Drinking Water Act and the Ontario Water Resources Act each require that operating authorities record and report both water takings as governed by Permits-to-Take-Water and water being supplied to the City of Guelph.

Summaries of total water pumped, instantaneous flows and capacity (flows and volumes compared to rated capacities) by the City of Guelph can be found in Appendix C: Total Water Pumped and Instantaneous Flows.

Figure 3 below, depicts the water pumpage rate in cubic metres per day (m^3/day) that is averaged each week.

Figure 3: Totalized Pumpages, 2018-2020



Water Services processed 16,533,166 cubic metres (16.5 billion litres) of water to the distribution system in 2020, equivalent to 6,613 Olympic-sized swimming pools. This represents 3.7 per cent less water being supplied to the distribution system in 2020 as compared to 2019 and 4.5 per cent less water than in 2018.

The 2020 average daily water demand was 45,173 cubic metres (45.1 million litres). The maximum daily production of water in 2020 was 60,728 cubic metres (60.7 million litres) and occurred on July 08, 2020. The minimum daily production of water in 2020 was 33,366 cubic metres (33.4 million litres) and occurred on December 25, 2020.

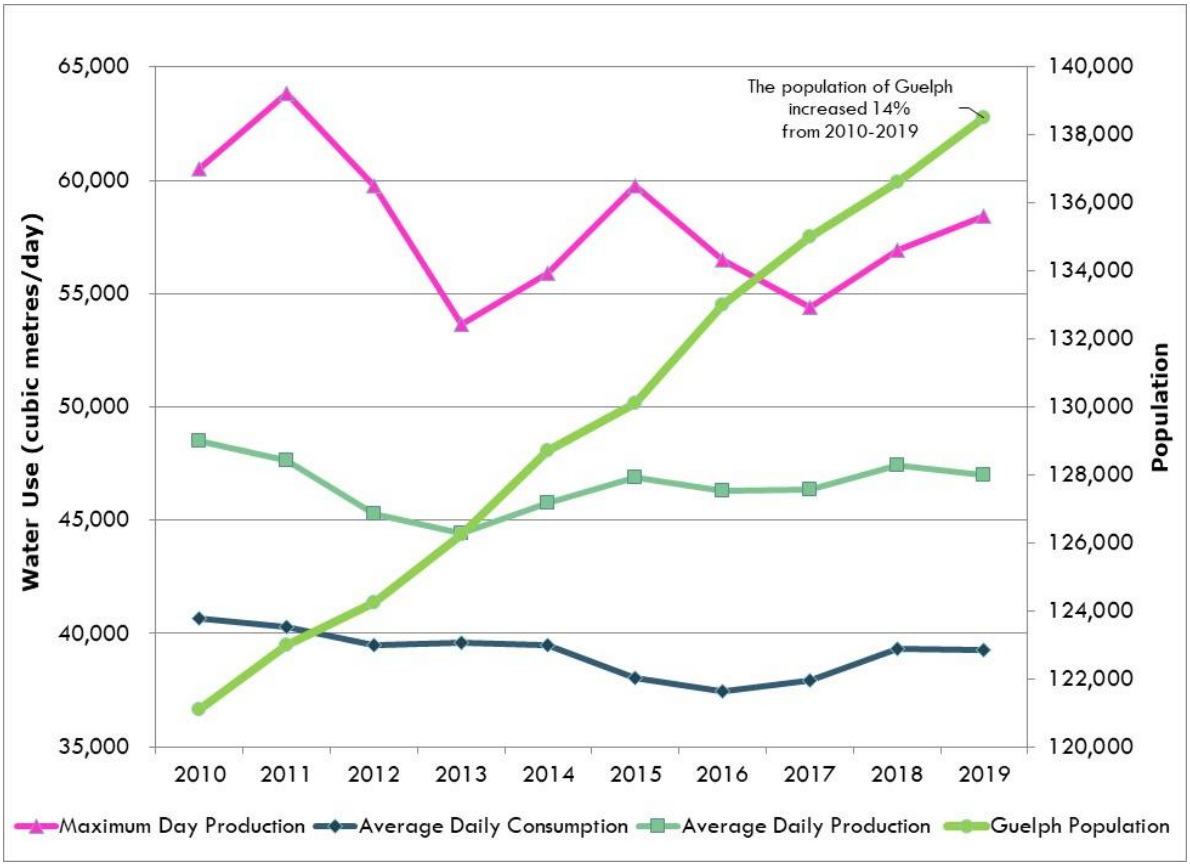
Water Production, Consumption and Population

Figure 4, below, shows the City of Guelph's annual average daily water production, annual average daily consumption, annual peak day demand, and population from 2010 to 2019. Consumption data for 2020 was not available at the time of publication.

During this time, the City of Guelph's population increased 14 per cent while at the same time annual average daily water production and consumption decreased 3 per cent.

Fluctuation in water production and consumption is anticipated to occur, year to year, based on a number of factors, including seasonal temperatures and annual precipitation, system demands (including planned and unplanned maintenance) and steady population growth; however, the steady to reduced water consumption (and production) rates year over year are attributed to Guelph's Water Efficiency Strategy, Water Loss Management Plan, and resulting programming, as described later in this section.

Figure 4: Guelph Water Production vs. Water Consumption vs. Population, 2010-2019



Water Supply Capacity

In order to more accurately address the questions of system firm capacity, Water Services staff annually review the operational water demand data for water supply facilities under maximum demands. Values used for permitted pumping rate and firm capacity calculations by well are provided below in Table 3. The permitted pumping rate is the rate of pumping allowed as identified in the Permits to Take Water. The firm capacity rate is the actual rate of pumping that can be sustainably achieved at each well.

Table 3: Permitted Rates and Point of Entry Firm Capacities of Water Supply Wells

Well Name	Permitted Daily Maximum (m3/day)	Permitted Rate (L/s)	Point of Entry Firm Capacity11 (m3/day)	Point of Entry Firm Capacity (L/s)
Arkell 1	3,273	37.9	1,640	19.0
Arkell Springs Wellfield[12]	28,800	333.3	28,800	333.3
Arkell Infiltration Gallery (Glen Collector)	25,000	290	7,011	81
Burke	6,546	75.8	5,790	67.0
Carter 1 and Carter 2	7,855	75.8	5,184	60.0
Membro	6,050	78.0	3,200	37.0
Water St.	3,400	44.4	2,500	28.9
Dean	2,300	34.6	1,500	17.4

[11] The firm capacity rate is the actual rate of pumping that can be achieved at each well.
[12] The Arkell Springs Wellfield consists of five (5) municipal drinking water production wells: Arkell 6, Arkell 7, Arkell 8, Arkell 14 and Arkell 15. All of the aforementioned Arkell Wells are contained within the same Permit to Take Water (No. 5061-9ZKKWV). Notwithstanding the specified maximum permitted taken per day, any combination of these wells can be used to obtain the permitted rate.

Well Name	Permitted Daily Maximum (m3/day)	Permitted Rate (L/s)	Point of Entry Firm Capacity11 (m3/day)	Point of Entry Firm Capacity (L/s)
University	3,300	38.2	2,400	27.8
Downey	5,237	60.6	5,000	57.9
Park 1 and Park 2	10,300	119.2	9,500	110.0
Emma	3,100	35.9	2,330	27.0
Helmar	3,273	37.9	1,300	15.0
Paisley	3,200	37.0	1,300	15.0
Calico	5,237	60.6	1,040	12.0
Queensdale	5,237	60.6	1,210	14.0

Water Services staff use the calculated firm capacity values in order to aid planning of scheduled shutdowns and maintenance of the water supply wells. Staff hold monthly meetings to review project and programming activities that affect firm capacity. The purpose of the monthly meetings are to ensure adequate servicing capacity is available to meet the City's water demands while maintenance and capital upgrades are undertaken to maintain the system in a fit state of repair.

System Maintenance and Major Expenditures

The tables that follow summarize Water Services' maintenance work for Water Distribution (Table 4), Water Treatment (Table 5) and SCADA and Security (Table 6).

Table 4: Water Distribution Maintenance Program Activity, 2020

Program	Results
Flushing Program	64 flushing points in the system regularly flushed to maintain chlorine residual in the distribution subsystem.

Program	Results
Frozen Services Program	The low trigger amount of -400°C (cumulative temperature total from first frost) was not hit in 2020. The lowest temperature recorded for the season was on February 14, which was -27.5°C. There was no frost in the ground and no frozen calls were received during the season.
Hydrant Inspection and Maintenance Program	All 2,809 hydrants inspected; 5 hydrants repaired, 10 hydrants replaced.
Leak Detection Program	11 leaks discovered and repaired.
Locates Program	6,612 infrastructure locates performed.
Valve Program	21% of total system valves turned, 8 valves repaired, 18 valves replaced, 6 new valves installed.
Water Meter Program	287 new meters installed, 443 meters replaced. 7,417 meters replaced through the Water Meter Replacement Program.
Water Service Maintenance	7 services replaced/upgraded, 230 services repaired.
Watermain Cleaning	77.67 km of watermain cleaned in the fall watermain cleaning program.
Watermain Maintenance	44 watermain breaks repaired, down from 58 in 2019.

The next table (Table 5) includes Water Treatment-related maintenance activities and expenditures.

Table 5: Water Treatment Maintenance Program Activity, 2020

Maintenance Activity	Location
Below Grade Well Inspections	Carter 2, Emma, Park 2, and University
Contact Chamber/Reservoir Inspections	Clythe, Helmar, Membro, University
Electrical and Instrumentation Upgrades	Various Sites
Facility Lighting Upgrades	Various Sites

Maintenance Activity	Location
Facility Repairs and Maintenance	Various Sites – Roofing Repairs
Fencing and Security Upgrades	Arkell
Process and Monitoring Equipment Upgrades	Various Sites
Pump Replacements	Park and University
Well Rehabilitations	Park 2 and University

Table 6, below, provides a summary of improvements to SCADA and Security undertaken in 2020. The Supervisory Control and Data Acquisition (SCADA) system is the computerized control system that monitors and automatically controls the pumps, valves, water towers and online instrumentation at the various water facilities located throughout the drinking water system. The SCADA system also monitors 50 flowmeters and pressure transmitters located throughout the water distribution system. The SCADA system logs process data and is also configured to automatically shut down facilities and/or notify an on-call operator in the case of abnormal process conditions. In 2020, SCADA system availability was over 99.9995 per cent, other than 2 hours of planned down time associated with planned server and network upgrades.

Table 6: SCADA and Security Maintenance Program Activity, 2020

SCADA / Security Maintenance Activities	Location
Additional SCADA data-logging redundancy (with secondary data-loggers)	Various Sites
Process flow diagrams and piping & instrumentation diagrams (P&ID's) updates, and equipment layout drawings updates	All Sites
Equipment layout drawings updates	All Sites
Facility electrical drawings updates	Various Sites
SCADA Input / Output Lists and standardized connection diagram updates	All Sites
New standardized PLC Panel design templates	All Sites
SCADA backup server upgrades	Various Sites
SCADA server hardware replacements	Various Sites

SCADA / Security Maintenance Activities	Location
Replacement of Woods Main SCADA Server Rack, Router and Firewalls	Woods Station
Updates to SCADA design and programming guidelines for capital projects	All Sites
SCADA programming standards updates	All Sites
SCADA software code updates (multi-year program)	Various Sites
Upgrades to SCADA revision control servers for programming code, screens and equipment configurations	All sites
New SCADA Communications programming, monitoring tools, status screens, and loss-of-communications alarms to assist with troubleshooting SCADA connectivity issues	All sites
Operator display screen updates to use high performance HMI (human machine interface) concepts	Various Sites
Alarm Management Program to remove and/or update legacy alarms that are no longer needed.	All Sites
Addition of a secure reporting server and secure remote read-only flow/pressure data link that can be used by external hydraulic modelling consultants for updating the Water Servicing Master Plan	All Sites
Upgraded Dashboard Displays for District Metered Area (DMA) flow/pressure data from the water distribution system	Woods Station
Security systems upgrades	All Sites

Drinking Water Works Permit Form 1s, Form 2s and Form 3s

Form 1s and 2s are required by the MECP to document significant changes to the drinking water system. Engineering Services staff complete the Form 1 – Record of Watermains Authorized as a Future Alteration. Water Services' staff complete the Form 2- Record of Minor Modification or Replacements to the Drinking Water System. Form 3s are associated with the addition of Emergency Stand-by Power. Water Services' staff complete the Form 3 – Record of Addition, Modification or Replacement of Equipment Discharging a Contaminant of Concern to the Atmosphere.

The modifications or additions to the drinking water system by both Water Services and Engineering and Transportation Services are described in the following three tables.

Table 7: Modifications or Additions to the Drinking Water System by Water Services, 2020

Form Type	Description of Modification or Addition to the Drinking Water System
2	Nine new valves were added to the Distribution System.
2	The re-chlorination system was removed at the Clythe Booster Pumping Station as it was not being used.
2	The booster pump at Queensdale Well was replaced with a pump that has a reduced design flow rate, which is more appropriate for the well capacity and would lead to energy savings.
3	One portable diesel generator was installed at Arkell 8.

Table 8: Modifications or Additions to the Drinking Water System by Engineering and Transportation Services – New Subdivision Projects

New Subdivision Projects	Length of new Watermain (m)	# of new hydrants	# of new valves	# of new residential water services
Victoria Park Village = Phase 1B	1206.7	15	13	158
Harts Village – Phase 2	481.6	6	7	55
NiMa Trails – Phase 1B	373.92	5	5	38

Table 9: Modifications or Additions to the Drinking Water System by Engineering and Transportation Services – Design and Construction Projects

Design and Construction Projects	Length of Watermain replaced/ installed (m)	# of new hydrants	# of new valves
York Trunk Sewer and Paisley-Clythe Watermain Phase 2B	959	2	3
Stevenson St N Reconstruction, Bennett Ave. to Eramosa Rd.	365	4	6
College Ave. E. to Victoria Rd. S. – Turf Grass Institute Relocation	287	3	5
York Road Reconstruction – Phase II – Ontario St. to Stevenson St.	160	2	6
Arthur Trunk Phase V	140	2	5
Paisley Feedermain – Phase II – Silvercreek Pkwy. to Paisley Reservoir	1,016	1	9

Backflow Prevention Program Updates

Preservation of drinking water quality within Guelph's infrastructure is supported by the City of Guelph's Building Services Division through administration of the Guelph Backflow Prevention Program and By-law (By-law Number 2016 - 20028). As defined under the By-law, backflow means the flowing back or reversal of the normal direction of water flow. The By-law requires that no connections are made to the City's water supply where a private premise risk may exist without the installation of an approved backflow prevention device to isolate premises, sources, and zones to prevent cross-connections in every building or structure where a City water supply or other potable water supply exists.

Table 10 describes the types of backflow devices and the number of devices as of December 31, 2020.

Table 10: Backflow Devices Installed by Type in 2020

Devices Installed by Type	# of Devices
New Backflow Permits	34
Total Number of New Devices Installed	**125**
New Properties	35
Active Properties	2,761
Inactive Properties	171
Total Properties with Backflow Prevention Devices	**2,932**
Active Buildings with Premise Isolation	1,964
Active Buildings without Premise Isolation	1,034
Total Active Backflow Prevention Devices	**6,644**
Number of water services disconnected for non-compliance with the By-Law	**0**

Status of Ongoing Water Services Strategies and Plans

This includes summaries and updates related to the implementation of the:

- 2016 Water Efficiency Strategy;
- Water Loss Management Plan;
- Source Water Protection Plan;
- Water Supply Master Plan updates; and
- Lead Reduction Plan.

Water Efficiency Strategy

The City of Guelph is a municipal leader in water conservation and efficiency. As one of Canada's largest communities reliant on a finite groundwater source for drinking water supply, the City's ability to reclaim water- and wastewater-serving capacity through conservation, efficiency and system optimization offers numerous benefits to the community and local ecosystem. Appendix I: Water Efficiency Program – 2020 Annual Progress Report

presents the annual achievements and progress made for the period of January 1 to December 31 in the implementation of the 2016 Water Efficiency Strategy.

For more information please review the Water Efficiency Strategy webpage.

Water Loss Management Plan

Committed to continuous improvement and reclaiming treated water supply capacity, the City commenced the process of formalizing a Water Loss Management Plan. The development of this plan, which commenced in 2020, is in alignment with the Water Supply Master Plan and seeks to build off the annual Water Audit/Balance exercise, evaluating both revenue and non-revenue water lost within the system. Further, the various program and project initiatives being undertaken by groups within Water Services (Distribution, Meters, Water Efficiency) are being evaluated with the intention to establish a ten-year operational plan.

Appendix I: Water Efficiency Program – 2020 Annual Progress Report presents a summary of the current effort and progress made to formalize the City's efforts.

Source Water Protection Plan

The City of Guelph is committed to drinking water source protection and in 2016, Council appointed risk management staff to implement the Source Water Protection plan.

Appendix K: Source Water Protection includes a highlight of the progress made for the period of January 1 to December 31, 2020 in the implementation of the City of Guelph's Source Water Protection plan. This annual report summarizes information requested from the Risk Management Official by the Source Protection Authorities, as required under Section 81 of the Clean Water Act, 2006 (CWA).

For more information on Guelph's Source Water Protection Program, visit guelph.ca/sourcewater.

Water Supply Master Plan update

The 2014 Water Supply Master Plan (WSMP) reviewed the City's existing water supply capacity and set out a strategy for meeting future demand to 2041. It is prudent to update, with some regularity, the water demand forecast, the existing water system capacity and the status of ongoing projects, in order to review the plan and make adjustments as required. As such, in 2019, the City initiated a Municipal Class Environmental Assessment

(EA) in order to update the existing WSMP with newly defined targets for water demands through 2051. This update will re-examine Guelph's water supply and demand and will make recommendations on how best to meet the community's water needs in the future.

On February 13, 2020, the first of two public open houses was conducted to discuss and gather feedback on the WSMP update, including estimates of our future water supply requirements based on Guelph's population growth (as dictated by the Places to Grow Act), challenges Guelph is facing and proposed water supply alternative solutions and evaluation criteria.

With this first phase of the EA completed, the phase two update is now being completed, which includes identifying alternative solutions and evaluating each. The City will be reaching out to the community in early 2021 with more information and additional engagement opportunities, including the second community open house.

Additional information and project status can be viewed on the Water Supply Master Plan website.

Lead Reduction Plan

The City has been working proactively to address the presence of lead service lines (LSLs) in Guelph since 2007 through identification and replacement of both the private and public portions of LSLs. Full LSL replacement has demonstrated to be effective in reducing lead concentrations and achieving regulatory compliance as measured at the point of water consumption.

The City of Guelph's Lead Reduction Plan (LRP) was developed in lieu of a Corrosion Control Plan (as outlined in Ontario Regulation 170/03 Schedule 15.1) and was formally approved by the MECP on March 21, 2012. The LRP focuses on physical lead service line replacement through verification sampling, financial incentives and public outreach.

As per the City of Guelph MDWL 017-101 - Schedule D, the City is required to submit all lead sampling data every 6 months and an annual Evaluation Report to assess the effectiveness of the Lead Reduction Plan.

Lead Sampling in the Guelph Drinking Water System

The following table presents summary results for lead sampling in the Guelph Drinking Water System as per Schedule D for the period of January 1 to December 31, 2020. Due to the impact of COVID-19, sampling inside of homes was suspended for the majority of 2020.

All samples were below the Ontario Drinking Water Quality Standards (ODWQS) for lead of 0.01 mg/L.

Table 11: Lead Reduction Plan Lead Sampling - Guelph Drinking Water System, 2020[13]

Number of Locations	Location Type	Number of Samples	Lead Range* (mg/L)
25	Plumbing that Serves Private Property	35	0.0000 – 0.0075
10	Distribution System	20	< 0.0005

***The Ontario Drinking Water Quality Standard for lead is 0.01 mg/L.**

Lead Sampling in the Gazer Mooney Subdivision Distribution System

In the Gazer Mooney Subdivision Distribution System, all samples were below the ODWQS for lead of 0.01 mg/L, as presented in the following table.

Table 12: Lead Reduction Plan – Gazer Mooney Subdivision Distribution System, 2020

Number of Locations	Location Type	Number of Samples	Lead Range (mg/L)	pH Range	Alkalinity Range (mg/L)
1	Distribution	3	<0.0005	7.76-8.09	260 – 270

Lead Sampling to Identify Lead Service Lines

Over 5,000 homes/businesses have been sampled for lead to identify the presence of LSLs and to monitor lead levels following a LSL replacement. For the period of January 1 to December 31, 2020, 19 private plumbing locations were sampled for the purposes of verifying the presence of a LSL. Of these locations, 1 location was above 0.005 mg/L indicating presence of a lead service line and no samples exceeded the ODWQS of 0.01 mg/L.

[13] Includes all samples as required by the MDWL or Lead Reduction Plan.

Lead Service Line Replacements

Since 2007, there has been a total of 715 lead service lines replaced in the City. As a result, 91 per cent of these homes are now considered to be 'lead-free' service lines (i.e. either a full replacement or a partial replacement that connected to a non-lead material). There were 10 LSL replacements undertaken in the City between January 1 to December 31, 2020. Of these, there was 1 LSL replacement on City property (connected to copper on private property) and 2 LSL replacements on both City and private property by coordinating the work with the homeowner. There were 7 LSLs replaced on private property by the homeowner (where City side was copper).

Since 2010, the City has had financial incentive programs to encourage replacement of privately-owned LSL by reducing the financial burden to property owners. The grants cover, on average, 75 per cent of the LSL replacement cost for homeowners. Since 2010, there have been 237 privately owned lead service lines replaced through the grant program.

h) Raw and Treated Water Quality and Drinking Water Quality Trends

Guelph Drinking Water System

This section describes the water quality monitoring, both regulatory and operational, that has been completed in 2020.

Water Quality Review – Guelph Drinking Water System

Under the Safe Drinking Water Act, municipalities are required to monitor both the raw and treated quality of the source water supplied. This monitoring is performed for both regulatory compliance and due diligence and is expected to identify any changes within the treated water, as well as, in raw source waters.

A note about all tables included in this section:

4. All regulated chemicals detected in the City of Guelph's treated water sources that are above the lab's MDL (minimum detection limit) are underlined indicating a hyperlink to an Excel Workbook in Guelph's electronic document management system (EDMS). The workbook contains a definition of the parameter and an Excel worksheet for each treated source where the parameter has been detected with values for all sample results from January 1, 2007 to December 31, 2020. This database is used to closely

track the instances of the identified chemical parameters and therefore provide time for planning and budgeting if treatment or an alternative supply is eventually required due to the presence of a given parameter. The database is updated annually.

5. Tabulated data is from the best available information at the time of table creation.
6. If sampling for a particular schedule's parameters (e.g. Schedule 23 and 24) did not occur within the calendar year of the report, then the most recent values are included in the report for reference.
7. All acronyms and initials included in tables are described in Appendix L: Glossary.
8. Please note that some hyperlinks in the tables are linked to Guelph's electronic document management system (EDMS). Note: EDMS is available for internal use only.

The following table summarizes Distribution free chlorine residual test results (January 1 to December 31, 2020) required by O. Reg. 170/03 Schedule 7-2, where secondary disinfection is provided. Please note that the City of Guelph takes additional operational daily Distribution samples and tests for free chlorine residual in order to better monitor the free residual in the Distribution System and respond accordingly.

Table 13: O. Reg. 170/03 Schedule 7-2, City of Guelph - Distribution Manual Free Chlorine Residual Summary, 2020

Parameter	ODWQS Acceptable Range	Total Analyses	Total Samples above Detection Limit	Total Outside ODWQS Range	Range (mg/L)
Free Chlorine Residual – Zone One	0.05 – 4.0	402	402	0	0.35 – 1.48
Free Chlorine Residual – Zone Two	0.05 – 4.0	304	304	0	0.34 – 1.07

Table 14 below summarizes raw (source) bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10-4, including investigative re-sampling for the period of January 1 to December 31, 2020. There were a total of 886 raw water samples taken and 2,658 raw water analyses conducted.

Table 14: O. Reg. 170/03 Schedule 10-4, City of Guelph - Raw Water Bacteriological Sampling Summary, 2020

Parameter	ODWQS Acceptable Range	Total Analyses	Total Outside ODWQS Range	Range (cfu/100 mL)
Raw - *E. coli*	n/a	886	n/a	0 – 1
Raw - Total Coliform	n/a	886	n/a	0 – 6
Raw - Background	n/a	886	n/a	0 – 340

Table 15 summarizes treated water bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10-3 and 6-3 including investigative re-sampling for 2020.

- Number of POE[14] samples taken: 525
- Number of POE analyses: 2,099
- Number of Distribution samples taken: 1,600
- Number of Distribution analyses: 7,492

Table 15: O. Reg. 170/03 Schedule 10-2, 10-3 and 6-3, City of Guelph - Treated Water Bacteriological Sampling Summary, 2020

Parameter	ODWQS Acceptable Range	Total Analyses	Total Outside ODWQS Range	Range	Units
POE - *E. coli*	0	525	0	0	cfu /100 mL
POE - Total Coliform	0	525	0	0	cfu /100 mL
POE – HPC	n/a	524	n/a	0 – 65	cfu /mL
POE – Background	n/a	525	n/a	0 – 1	cfu /100 mL

[14] Point of Entry - the point at or near which treated water enters the distribution system.

Parameter	ODWQS Acceptable Range	Total Analyses	Total Outside ODWQS Range	Range	Units
POE – Free Chlorine Residual	0.05 - 4.0	526[15]	0	0.60 – 1.50	mg/L
Distribution - *E. coli*	0	1,600	0	0	cfu /100 mL
Distribution - Total Coliform	0	1,600	1	1	cfu /100 mL
Distribution – HPC	n/a	767	n/a	0 – 190	cfu /mL
Distribution – Background	n/a	1,600	n/a	0 – 110	cfu /100 mL
Distribution – Free Chlorine Residual	0.05 - 4.0	1,925	0	0.30 – 1.48	mg/L

Table 16 summarizes raw source turbidity sampling and test results required by O. Reg. 170/03 Schedule 7-3 for the period of January 1 to December 31, 2020. Schedule 7-3 requires monthly raw source turbidity sampling, but the City of Guelph samples and measures all raw sources for turbidity on a weekly basis to better track this aspect of raw water quality.

Table 16: O. Reg. 170/03 Schedule 7-3, City of Guelph - Raw Source Turbidity Sampling Summary, 2020

Parameter	ODWQS Acceptable Range	Total Analyses	Total Outside ODWQS Range	Range (ntu)
Raw Source Turbidity	n/a	950	n/a	0.04– 0.52

[15] Total number of samples used specifically to satisfy the requirements of O. Reg. 170/03 Schedule 10-3 and 6-3 (Treated Source samples taken for Operational purposes are not included).

Table 17 summarizes raw source Ultraviolet Transmittance (UVT) sampling and test results required by the City's Municipal Drinking Water Licence (MDWL) where UV for primary disinfection is used, for the period of January 1 to December 31, 2020. The MDWL requires a UVT test to be conducted and recorded on a weekly sampling schedule.

Table 17: O. Reg. 170/03 Schedule 7-3, City of Guelph - Raw Ultraviolet Transmittance Sampling Summary, 2020

Parameter	MDWL Criteria (% UVT)	Total Analyses	Total Outside MDWL Criteria	Range (% UVT)
Raw UVT F.M. Woods Station	93.5	52	0	94.9 – 99.9
Raw UVT Membro Well	90.0	0[16]	0	n/a

Microparticulate Analysis

As a part of the Guelph Drinking Water System's Municipal Drinking Water Licence, Guelph Water Services is required three times annually to assess, using microparticulate analysis (MPA), the Arkell Springs Glen Collector System, which is characterized as groundwater under the influence of surface water with effective in situ filtration (GUDI-WEF). The purpose of the assessment is to ensure that the source continues to meet the GUDI-WEF source water characteristics as outlined by the MECP. MPA sampling was performed on this water source in the spring, summer and fall of 2020. The source continues to meet the GUDI-WEF source water characteristics.

Treated Water Quality Statistics – Guelph Drinking Water System

O. Reg. 170/03 Schedule 6-5 - Continuous Monitoring Results Summary

Water Services utilizes over forty regulatory and operational continuous monitoring devices to measure water quality. Each regulatory device has controls associated with it such that in the event that the device detects that a measured value is outside the acceptable parameters for that location, the device causes an alarm to be sent to an Operator for

[16] Membro Well did not run to system in 2020 and as such, UVT analyses were not required.

immediate response (24 hours per day, seven days per week) and either automatically shuts down the station or activates a second alarm for immediate Operator response.

Both the minimum allowable levels (if applicable) and the target values for Water Services regulatory continuous monitoring devices are listed in Table 18. The target values represent a safety margin to ensure that regulatory requirements are satisfied at all times. Continuous monitoring values all fell within acceptable regulatory standards in 2020.

Table 18: O. Reg. 170/03 Schedule 6-5, Continuous Monitoring Results Summary, 2020

Parameter	ODWQS or Regulatory Minimum	Target Range	Units
Point of Entry Free Chlorine Residual	0.05 mg/L	Greater than 0.4	mg/L
UV Dose F.M. Woods Station	40 mJ/cm^2	Greater than 40	mJ/cm^2
UV Dose Membro Well	20 mJ/cm^2	Greater than 40	mJ/cm^2

O. Reg. 170/03 Schedule 13-6 and 13-7, "Three Month" Sampling Results Summary

In 2020, all operational Treated Sources were sampled and analyzed for Schedule 13-6, 13-16.1 and 13-7 parameters as per O. Reg. 170/03.

Regulation 170/03, Schedule 13-6 requires a minimum of one distribution sample taken from the Distribution System where THM's (trihalomethanes) are most likely to develop (locations with high retention times and source water disinfection by-product precursors). Water Services uses the Edinburgh South, Beaver Meadow and Poppy Drive Sample Stations as well as Clair Tower for this purpose in the Guelph Drinking Water System. The Maximum Allowable Concentration (MAC) for THM's is 0.1 mg/L. However, for this parameter, the MAC uses a running annual average of quarterly samples.

The results of the running annual average value for THMs for all related Distribution System samples in each quarter of 2020 (Jan. 01 to Dec. 31) is below the half of the maximum allowable concentration (½ MAC): Q1 = 0.041 mg/L; Q2 = 0.039 mg/L; Q3 = 0.035 mg/L and Q4 = 0.034 mg/L.

Regulation 170/03, Schedule 13-6.1 requires a minimum of one distribution sample taken from the Distribution System where HAAs (haloacetic acids) are most likely to develop. Water Services uses the Edinburgh South, Beaver Meadow and Poppy Drive Sample Stations as well as Clair Tower for this purpose in the Guelph Drinking Water System. The Maximum Allowable Concentration (MAC) for HAAs is 0.08 mg/L. However, for this parameter, the MAC uses a running annual average of quarterly samples.

The results of the running annual average value for HAAs for all related Distribution System samples in each quarter of 2020 (Jan. 01 to Dec. 31) is below the half of the maximum allowable concentration (½ MAC): Q1 = 0.024 mg/L; Q2 = 0.023 mg/L; Q3 = 0.021 mg/L and Q4 = 0.019 mg/L.

All operational Treated Sources were sampled and analyzed for Nitrates and Nitrites as per Regulation 170/03, Schedule 13-7. There was no instance of an adverse result in 2020. Raw sampling results are also presented in Table 19.

Table 19: O. Reg. 170/03 Schedule 13-6 and 13-7, City of Guelph – "Three Month" Sampling Results Summary, 2020

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average[17] (mg/L)
Trihalomethanes	0.100[18]	n/a	16	16	0	0.0177	0.0533	0.0390
Haloacetic Acids	0.08[19]	n/a	16	15	0	< 0.005	0.029	0.0188
Nitrate + Nitrite (as nitrogen)	10	5	36	18	0	< 0.10	2.87	1.12
Nitrate + Nitrite (as nitrogen) - Woods' Raw Sources (Operational Sampling)	n/a	n/a	7	0	n/a	< 0.10	< 0.10	n/a
Nitrate + Nitrite (as nitrogen) - University Raw Source (MDWL Sampling)	10	5	3	3	0	0.27	0.46	0.35
Nitrate + Nitrite (as nitrogen) - Paisley Raw Source (MDWL Sampling)	10	5	4	4	0	1.87	2.19	2.06

[17] This is the average of values above the lab detection limit.
[18] This standard is expressed as a running annual average.
[19] This standard is expressed as a running annual average.

O. Reg. 170/03 Schedule 23 Results Summary

In 2019, all operational treated sources were sampled and analyzed for Schedule 23 parameters as per O. Reg. 170/03. All of the City of Guelph's treated ground water sources are on a three year sampling schedule. F.M. Woods' Station is the exception and is sampled on the annual surface water schedule due to the fact that five of the nine sources that supply F.M. Woods are GUDI-WEF sources (the Carter Well 1 and 2, Arkell 1, Arkell 15 and the Arkell Springs Glen Collectors). Please refer to Table 38 included in Appendix D: Treated Water Quality Statistics for 2019 data.

The 2020 results of the Annual Schedule 23 inorganic parameter analysis for F.M. Woods' Station, presented in Table 20 below, were all under half of the maximum allowable concentration (½ MAC) and the majority were under the laboratory's MDL (minimum detection level).

Table 20: O. Reg. 170/03 Schedule 23, 13-2a, City of Guelph – F.M. Woods' Annual Schedule 23 Sampling Results Summary, 2020

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Antimony	0.014	0.007	1	0	0	< 0.0005	n/a	n/a
Arsenic	0.025	0.0125	1	0	0	< 0.001	< 0.001	n/a
Barium	1.0	0.5	1	1	0	0.048	0.048	0.048
Boron	5.0	2.5	1	1	0	0.011	0.011	0.011
Cadmium	0.005	0.0025	1	1	0	0.00013	0.00013	0.00013
Chromium	0.05	0.025	1	0	0	< 0.005	< 0.005	n/a
Mercury	0.001	0.0005	1	0	0	< 0.0001	< 0.0001	n/a
Selenium	0.01	0.005	1	0	0	< 0.002	< 0.002	n/a
Uranium	0.02	0.01	1	1	0	0.00061	0.00061	0.00061

O. Reg. 170/03 Schedule 24 Results Summary

In 2019, all operational Treated Sources were sampled and analyzed for Schedule 24 parameters as per O. Reg. 170/03. All of the City of Guelph's treated ground water sources are on a three year sampling schedule. F.M. Woods' Station is the exception and is sampled on the annual surface water schedule due to the fact that five of the nine sources that supply F.M. Woods' are GUDI-WEF sources (the Carter Well field, Arkell 1, Arkell 14 and the Arkell Springs Glen Collectors). Please refer to Table 39 included in Appendix D: Treated Water Quality Statistics for 2019 data.

It should be noted that, before 2012, values for TCE (trichloroethylene) at Membro and Emma occasionally crested the ½ MAC value of 0.0025 mg/L and as a result Water Services' increased the frequency of sampling where TCE has been detected to better establish TCE value trends. Currently, TCE in treated water samples, is above the MDL but below the ½ MAC at the Membro, Water Street, Emma and Park wells. Please refer to Table 40: Operational VOC Scan Results Summary, included in Appendix D: Treated Water Quality Statistics for 2020 data.

The 2020 results of the Annual Schedule 24 organic parameter analysis for F.M. Woods' Station, presented in Table 21 below, were all under half of the maximum allowable concentration (½ MAC) and the majority were under the laboratory's MDL (minimum detection level).

Table 21: O. Reg. 170/03 Schedule 24, 13-4a, City of Guelph – F.M. Woods' Annual Schedule 24 Sampling Results Summary, 2020

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Alachlor	0.005	0.0025	1	0	0	< 0.0005	< 0.0005	n/a
Atrazine + N-dealkylated metabolites	0.005	0.0025	1	0	0	< 0.001	< 0.001	n/a
Azinphos-methyl	0.02	0.01	1	0	0	< 0.002	< 0.002	n/a
Benzene	0.005	0.0025	5	0	0	< 0.0001	< 0.0001	n/a
Benzo(a)pyrene	0.00001	0.000005	1	0	0	< 0.000005	< 0.000005	n/a
Bromoxynil	0.005	0.0025	1	0	0	< 0.0005	< 0.0005	n/a
Carbaryl	0.09	0.045	1	0	0	< 0.005	< 0.005	n/a
Carbofuran	0.09	0.045	1	0	0	< 0.005	< 0.005	n/a
Carbon Tetrachloride	0.005	0.0025	5	0	0	< 0.0001	< 0.0001	n/a
Chlorpyrifos	0.09	0.045	1	0	0	< 0.001	< 0.001	n/a
Diazinon	0.02	0.01	1	0	0	< 0.001	< 0.001	n/a
Dicamba	0.12	0.06	1	0	0	< 0.001	< 0.001	n/a

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
1,2-Dichlorobenzene	0.2	0.1	5	0	0	< 0.0002	< 0.0002	n/a
1,4-Dichlorobenzene	0.005	0.0025	5	0	0	< 0.0002	< 0.0002	n/a
1,2-Dichloroethane	0.005	0.0025	5	0	0	< 0.0002	< 0.0002	n/a
1,1-Dichloroethylene	0.014	0.007	5	0	0	< 0.0001	< 0.0001	n/a
Dichloromethane	0.05	0.025	5	0	0	< 0.0005	< 0.0005	n/a
2,4-Dichlorophenol	0.9	0.45	1	0	0	< 0.00025	< 0.00025	n/a
2,4-Dichlorophenoxy-acetic acid (2,4-D)	0.1	0.05	1	0	0	< 0.001	< 0.001	n/a
Diclofop-methyl	0.009	0.0045	1	0	0	< 0.0009	< 0.0009	n/a
Dimethoate	0.02	0.01	1	0	0	< 0.0025	< 0.0025	n/a
Diquat	0.07	0.0035	1	0	0	< 0.007	< 0.007	n/a
Diuron	0.15	0.075	1	0	0	< 0.01	< 0.01	n/a
Glyphosate	0.28	0.14	1	0	0	< 0.01	< 0.01	n/a
Malathion	0.19	0.095	1	0	0	< 0.005	< 0.005	n/a

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
2-Methyl-4-chlorophenoxyacetic acid	0.1	0.05	1	0	0	< 0.01	< 0.01	n/a
Metolachlor	0.05	0.025	1	0	0	< 0.0005	< 0.0005	n/a
Metribuzin	0.08	0.04	1	0	0	< 0.005	< 0.005	n/a
Chlorobenzene	0.08	0.04	5	0	0	< 0.0001	< 0.0001	n/a
Paraquat	0.01	0.005	1	0	0	< 0.001	< 0.001	n/a
Pentachlorophenol (PCP)	0.06	0.03	1	0	0	< 0.0005	< 0.0005	n/a
Phorate	0.002	0.001	1	0	0	< 0.0005	< 0.0005	n/a
Picloram	0.19	0.095	1	0	0	< 0.005	< 0.005	n/a
Polychlorinated Biphenyls (PCB)	0.003	0.0015	1	0	0	< 0.00005	< 0.00005	n/a
Prometryn	0.001	0.0005	1	0	0	< 0.00025	< 0.00025	n/a
Simazine	0.01	0.005	1	0	0	< 0.001	< 0.001	n/a
Terbufos	0.001	0.0005	1	0	0	< 0.0005	< 0.0005	n/a
Tetrachloroethylene (PCE)	0.03	0.015	5	0	0	< 0.0001	< 0.0001	n/a

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
2,3,4,6-Tetrachlorophenol	0.1	0.05	1	0	0	< 0.0005	< 0.0005	n/a
Triallate	0.23	0.115	1	0	0	< 0.001	< 0.001	n/a
Trichloroethylene	0.005	0.0025	5	0	0	< 0.0001	< 0.0001	n/a
2,4,6-Trichlorophenol	0.005	0.0025	1	0	0	< 0.0005	< 0.0005	n/a
Trifluralin	0.045	0.0225	1	0	0	< 0.001	< 0.001	n/a
Vinyl Chloride	0.002	0.001	5	0	0	< 0.0002	< 0.0002	n/a

O. Reg. 170/03 Schedule 13-8 and 13-9, "Five Year" Sampling Results Summary

In 2019, all operational Treated Sources were sampled and analyzed for the Schedule 13-9 Fluoride parameter as per O. Reg. 170/03. In 2019, Fluoride (naturally present and not added as part of the treatment process) was detected at all treated sources; the analytical results were all under the maximum allowable concentration (MAC). The values in Table 22 reflect the 2019, Schedule 13-9 sampling regime.

In 2019, all operational Treated Sources were sampled and analyzed for the Schedule 13-8 Sodium parameter as per O. Reg. 170/03. All Sodium results for 2019 were above the lower reportable limit of 20 mg/L. This data is provided to Wellington-Dufferin-Guelph Public Health, as part of the AWQI notification process. The values in Table 22 reflect the 2019, Schedule 13-9 sampling regime.

Also, Sodium is sampled on a more frequent basis (annually) than the Schedule 13-8 requirement in order to better establish sodium value trends. For 2020 sodium data, please refer to Table 23: City of Guelph General Chemistry Selected Results Summary, 2020.

Table 22: O. Reg. 170/03 Schedule 13-8 and 13-9, City of Guelph – "Five Year" Sampling Results Summary, 2019

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Sodium	20 and 200[20]	n/a	38	38	38	23	170	91.0
Fluoride	1.5 and 2.4[21]	n/a	12	11	0	<0.10	0.73	0.33

[20] The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

[21] Where supplies contain naturally occurring fluoride at levels higher than 1.5 mg/L but less than 2.4 mg/L, the Ministry of Health and Long Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources.

General Chemistry Results Summary

Water Services has initiated an "Annual General Chemistry" sampling event through RCAp (Rapid Chemical Analysis Package). This body of data can be used to answer customer inquiries, as well as, inquiries from Water Services staff and consultants in terms of treatment upgrades.

In 2020, all operational Raw Sources were sampled and analyzed for general chemistry parameters. Please refer to Table 41: General Chemistry Results Summary, 2020 in Appendix D: Treated Water Quality Statistics for the full list of parameters.

Table 23 highlights specific parameters due to their presence / significance within the water supply.

Table 23: City of Guelph General Chemistry Selected Results Summary, 2020

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	Total Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Ammonia-N	n/a	n/a	n/a	18	4	n/a	< 0.05	0.23	0.108
Chloride	n/a	250	n/a	18	18	n/a	33	330	131
Hardness (Calculated as CaCO3)	n/a	n/a	80-100	18	18	18	320	580	426
Iron	n/a	0.3	n/a	30	15	0	< 0.005	0.25	0.124
Lead	0.01	n/a	n/a	18	2	0	<0.0005	0.00065	0.00058
Manganese	n/a	0.05	n/a	30	22	4	<0.002	0.0556	0.0325
Sodium	n/a	20 and 200	n/a	18	18	16	18	160	73

Gazer Mooney Subdivision Distribution System

This section describes the regulatory water quality monitoring that has been collected in the Gazer Mooney Subdivision Distribution System in 2020. For regulatory sampling schedules that do not occur in 2020 related to the Gazer Mooney System, the most recent historical data is listed.

Water Quality Review - Gazer Mooney Subdivision Distribution System

Under the Safe Drinking Water Act, municipalities are required to monitor both the raw and treated quality of the source water supplied. This monitoring is performed for both regulatory compliance and due diligence and is expected to identify any changes within the treated water as well as in the raw source waters.

A note about all tables included in this section

1. All regulated chemical parameters where values above the lab's MDL (minimum detection limit) have been detected in the City of Guelph's treated water sources are underlined indicating a hyperlink to an Excel Workbook in Guelph's EDMS. The workbook contains a definition of the parameter, an Excel worksheet for each treated source where the parameter has been detected with values for all sample results from January 1, 2007 to December 31, 2020. This database is used to closely track the instances of the identified chemical parameters and therefore provide time for planning and budgeting if treatment or an alternative supply is eventually required due to the presence of a given parameter. The database is updated quarterly.
2. Tabulated values are from best available information at the time of table creation. While the values documented here satisfy the regulatory minimum regulatory requirements, Water Services performs many additional operational tests not listed in this report.
3. All acronyms and initialisms included in tables are described in Appendix L: Glossary.
4. Please note that some hyperlinks in the tables are linked to Guelph's electronic document management system (EDMS) which is available for internal City use only.

Table 24 summarizes daily Distribution free chlorine residual test results required by O. Reg. 170/03 Schedule 7-2 for the period of January 1 to December 31, 2020. There was no instance of an adverse result in 2020.

Table 24: O. Reg. 170/03 Schedule 7-2, Gazer Mooney - Distribution Manual Free Chlorine Residual Summary, 2020

Parameter	ODWQS Range	Total Samples	Total Samples Outside of ODWQS Range	Min (mg/L)	Max (mg/L)	Average (mg/L)
Free Chlorine Residual	0.05 – 4.0	107	0	0.79	1.08	0.93

Table 25 summarizes bacteriological sampling and test results required by O. Reg. 170/03 Schedule 10 for the period of January 1 to December 31, 2020. There was no instance of an exceedance for a Regulatory microbiological parameter in 2020. There were 52 Distribution samples taken and 315 Distribution analyses completed in 2020.

Table 25: O. Reg. 170/03 Schedule 10-2, Gazer Mooney Treated Bacteriological Sampling Summary, 2020

Parameter	ODWQS Criteria	Total Analyses	Total Outside ODWQS Criteria	Range	Units
Distribution - *E. coli*	0	52	0	0	cfu/100 mL
Distribution - Total Coliform	0	52	0	0	cfu/100 mL
Distribution – HPC	n/a	52	n/a	0 - 1	cfu/mL
Distribution – Background	n/a	52	n/a	0	cfu/100 mL
Distribution– Free Chlorine Residual	0.05 – 4.0	107	0	0.79 – 1.08	mg/L

Treated Water Quality Statistics – Gazer Mooney Subdivision Distribution System

O. Reg. 170/03 Schedule 13-6, "Three Month" Sampling Results Summary

In 2020, Gazer Mooney Subdivision Distribution System was sampled and analyzed for Schedule 13-6 and 13-6.1 parameters as per O. Reg. 170/03. Regulation 170/03, Schedule 13-6 requires a minimum of one distribution sample taken from the Distribution System where THMs (trihalomethanes) are most likely to develop (points with high retention times). The MAC for THMs is 0.1 mg/L. However, for this parameter the MAC uses a running annual average of quarterly samples. These results are presented in Table 26.

The results of the running annual average value for THMs in the Gazer Mooney Subdivision Distribution System samples in 2020 were below the half maximum allowable concentration (½ MAC): Q1 = 0.019 mg/L; Q2 = 0.019 mg/L; Q3 = 0.017 mg/L and Q4 = 0.017 mg/L.

Regulation 170/03, Schedule 13-6.1 requires a minimum of one distribution sample taken from the Distribution System where HAAs (haloacetic acids) are most likely to develop. The MAC for HAAs is 0.08 mg/L. However, for this parameter the MAC uses a running annual average of quarterly samples.

The results of the running annual average value for HAAs in the Gazer Mooney Subdivision Distribution System samples in 2020 is below the half maximum allowable concentration (½ MAC): Q1 = not detected; Q2 = not detected; Q3 = not detected and Q4 = not detected.

O. Reg. 170/03 Schedule 13-8 and 13-9, "Five Year" Sampling Results Summary

In 2019, Gazer Mooney Subdivision Distribution System was sampled and analyzed for the Schedule 13-9 Fluoride parameter as per O. Reg. 170/03. In 2019, Fluoride (naturally present and not added as part of the treatment process) was detected; the analytical result was under the maximum allowable concentration (MAC). The values in Table 27 reflect the 2019, Schedule 13-9 sampling regime.

In 2019, Gazer Mooney Subdivision Distribution System was sampled and analyzed for the Schedule 13-8 Sodium parameter as per O. Reg. 170/03. Sodium was detected; the analytical result was above the lower reportable limit of 20 mg/L. This data is provided to

Wellington-Dufferin-Guelph Public Health, as part of the AWQI notification process. The values in Table 22 reflect the 2019, Schedule 13-9 sampling regime.

Also, Sodium is sampled on a more frequent basis (annually) than the Schedule 13-8 requirement in order to better establish sodium value trends. For 2020 sodium data, please refer to Table 23: City of Guelph General Chemistry Selected Results Summary, 2020.

General Chemistry Results Summary

In addition to the regulatory sampling and analysis required for the operation of the Gazer Mooney Subdivision, Water Services samples for parameters as listed in Table 28 in order to gather additional data and answer common inquiries from the public.

Table 26: O. Reg. 170/03 Schedule 13-6, Gazer Mooney - "Three Month" Sampling Results Summary, 2020

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Trihalomethanes	0.100[22]	n/a	4	4	0	0.014	0.020	0.018
Haloacetic Acids	0.08[23]	n/a	4	0	0	<0.005	<0.005	n/a

Table 27: O. Reg. 170/03 Schedule 13-8 and 13-9, Gazer Mooney - "Five Year" Sampling Results Summary, 2019

Parameter	ODWQS MAC	½ MAC	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Sodium	20 and 200[24]	n/a	2	2	2	24	26	25
Fluoride	1.5 and 2.4[25]	n/a	1	1	0	0.17	0.17	0.17

[22] This standard is expressed as a running annual average.

[23] This standard is expressed as a running annual average.

[24] The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

[25] Where supplies contain naturally occurring fluoride at levels higher than 1.5 mg/L but less than 2.4 mg/L, the Ministry of Health and Long Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources.

Table 28: Gazer Mooney General Chemistry Results Summary, 2020

Parameter	ODWQS MAC mg/L	ODWQS AO	½ MAC mg/L	Total Samples	Samples Above MDL	Total Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Sodium	20 and 200[26]	n/a	n/a	1	1	1	25	25	25
Chloride	n/a	250	n/a	1	1	0	45	45	45

[26] The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

i) Follow-up on Action Items from Previous Management Reviews

Management Review meetings were held on January 29, 2020 and January 18, 2021. The following is a summary of results of the management review. Appendix F: Action Items from Management Review includes the action items from the meetings. Items 1-5 are from the January 30, 2020 Management Review meeting and items 6-9 are from the January 18, 2021 Management Review Meeting.

Results of the Management Review, the identified deficiencies, decisions and action items

The summary below includes identified deficiencies and decisions from the meeting held on January 18, 2021.

Deficiencies

- There were two identified non-compliance issued in 2020 in the Guelph Drinking Water System. Both of these instances involved low chlorine residual in the distribution system. Through the Root-Cause Analysis program, Water Services has adjusted the flushing program to ensure that these incidents do not reoccur. Final MECP Inspection results have not been made available at the time of report publication.
- There were three AWQIs in 2020 in the Guelph Drinking Water System, and none in the Gazer Mooney Subdivision Distribution System. One AWQI was related to a TC exceedance and the other two were related to the low secondary chlorine residuals noted above.
- There were two deviations from the Critical Control Points (CCPs) in 2020, both relating to the low chlorine residuals in the distribution system.
- There were two minor non-conformances identified in the 2020 accreditation (external) audit. A corrective plan for both minor non-conformances was sent to the accreditation body and was accepted on December 27, 2020.

Decisions

- In order to resolve the two low chlorine residuals in the distribution system that resulted in non-compliances, AWQIs and deviations from our CCPs, adjustments to the flushing program were made to ensure that this issue does not reoccur. WDGPH and the MECP were satisfied with the corrective actions taken by Water Services.
- In order to resolve the two minor non-conformances identified in the audit, the process for communicating with our Essential Suppliers was updated to include an annual mail out which includes information about our Quality Management System. A

Supplier Approval Form was also developed to ensure that our Essential Suppliers meet our quality expectations.
- See section d) The Effectiveness of the Risk Assessment Process regarding decisions made in the 2020 Risk Assessment.

Action Items

- Conduct a debrief of the pandemic in 2021 to determine if any improvements can be made in our emergency response planning. In this, look at the other division's pandemic response.
- Add Pandemic to Table 2.
- Include a Table for Form 1s, 2s, and 3s (with Engineering) to describe any modifications or additions to the drinking water system.
- Investigate whether customer complaints can be mapped in GIS to facilitate tracking of issues (for example, water quality calls).

j) The Status of Management Action Items Identified Between Management Reviews

Water Services is committed to continually improving the drinking water system, including improving on existing programs and processes. Throughout the year, continual improvement items (management action items) can be generated throughout many different activities, such as: audits, debrief sessions, root-cause analysis meetings, etc. These items are logged into Water Services' Continual Improvement Database and the appropriate teams meet every other month to update on the status of these items.

Appendix G: Status of Management Action Items Identified between Reviews is a list of continual improvement items identified in 2020 for management follow-up.

k) Changes that Could Affect the Drinking Water System and the Quality Management System

Appendix E: Legal and Other Requirements Table includes a summary of legislative and regulatory updates from January 1 to December 31, 2020 that could affect the Drinking Water System and/or the Quality Management System.

Changes Affecting the Drinking Water System (DWS) - Licence Approvals and Amendments

Municipal Drinking Water Licence (MDWL)

The Municipal Drinking Water Licence was renewed in 2019 and expires in 2024. Table 29 below includes Licence documents' dates of issue and expiry. Copies of the documents listed in Table 29 are available by contacting Water Services at waterservices@guelph.ca or calling 519-837-5627.

As part of the MDWL renewal, the updated Financial Plan was submitted to Council for approval in March 2019 and the Operational Plan was endorsed by Council in January 2019.

Table 29: Municipal Drinking Water Licensing Documents

Document	Issue Date (yyyy-mm-dd)	Expiry (yyyy-mm-dd)
Municipal Drinking Water Licence (#017-101)	2019-07-26	2024-07-24
Drinking Water Works Permit (#017-201)	2019-07-26	2024-07-24
Municipal Long Range Financial Plan (#017-301)	2019-02	2024-07-24
DWQMS Certificate of Registration - Guelph Drinking Water System (017-OA1)	2018-12-20	2021-11-25
Operational Plan Re-endorsement Guelph Drinking Water System (resolution)	2019-01-14	2023-10-31
Agreement Regarding Water Services for the Gazer-Mooney Subdivision	2019-03-01	2029-02-28
Gazer Mooney Municipal Drinking Water Licence (#104-103)	2020-18-18	2025-12-17
Gazer Mooney Drinking Water Works Permit (#017-203)	2020-12-18	2025-12-17
Operational Plan Re-endorsement Gazer Mooney Subdivision Dist. System (resolution)	2019-09-16	2023-10-31
DWQMS Certificate of Registration - Gazer Mooney (104-OA2)	2018-12-20	2021-11-25

Permits to Take Water (PTTW) Renewals

The Arkell Bedrock PTTW was renewed in 2020 and expires in 2030.

The Emma/Park and Carter PTTW are scheduled for renewal in 2021. Both permits expire on May 31, 2021.

Sentry Monitoring Wells

A consultant was retained in 2015 to develop a groundwater monitoring network in the areas of the Membro and Emma Production Wells. These particular wells were categorized as having detections of Trichloroethylene (TCE), a volatile organic compound (VOC) under the Clean Water Act. The source(s) of the VOCs is (are) unknown but there are potential sources in the vicinity of each well.

The main objective of this project was to review the potential contaminant sources and install monitoring wells (i.e. Sentry Wells) between the potential VOC sources and the municipal wells that will be monitored and used to document changes in groundwater quality. These wells can provide an early warning of potential contamination moving toward the production well and also track changes in existing groundwater quality.

As such, a sampling plan was created to regularly collect water quality samples from each of the eight (8) Sentry Wells, within their respective vertically discrete sampling intervals. Review of the initial data collected was completed by the retained consultant and the following conclusions were arrived at in a report for this project in early 2020.

Membro Area

- TCE concentrations at the Membro Well peaked at almost 4 ug/L in 2001 and following the installation of a liner in the well in 2004, the TCE concentrations have generally been declining. Since 2015, the TCE concentrations have been less than 2 ug/L and are below the ODWQS for TCE of 5 ug/L.
- Based on the monitoring data collected, there is a source of TCE to the northwest of the production well.
- Concentrations of TCE and the breakdown product cis-1,2 dichloroethylene (DCE) are showing a decreasing trend.

Emma Area

- TCE concentrations at the Emma Well peaked in 2010 and have generally been on a declining trend since that time with current TCE concentrations less than 0.5 ug/L. A liner was installed in the well in 2001, however, the installation of the liner did not seem to influence the TCE concentrations in the well.
- A number of potential contaminant sources were also identified around the Emma well that could be potential sources of TCE observed at the production well. The results from the monitoring wells show that the plume observed in the Gasport Formation originating from the Woolwich Street source extends further east towards the Emma well and is likely the main source and only source identified to be impacting the municipal well.

- TCE concentrations at the Emma well show a decreasing trend with values less than 0.5 ug/L and DCE concentrations show an increasing trend with values less than 2.5 ug/L.

In their report, the retained consultant recommended the City continue to sample all ports in the Sentry Wells for VOCs to inform the future sampling plan but ultimately provide early warning of contaminant mobilization around these municipal wells.

Following the sampling program in 2021, the laboratory results from the sampling plan will be summarized in this annual report.

Lead Guidelines – Proposed Changes to the Drinking Water Quality Standard

"In March 2019, Health Canada announced an update to the Guidelines for Canadian Drinking Water Quality, reducing the guideline for the maximum acceptable concentration of lead in drinking water from ten to five micrograms per litre. Ontario's standard for lead in drinking water is currently ten micrograms per litre. The ministry recognizes that lead in drinking water is an important issue for parents and the public and is committed to the protection of children and families. The ministry will be consulting with Ontarians on whether and how to adopt Health Canada's reduced guideline for lead in drinking water, proposed enhancements to Ontario's already stringent lead protection framework, and increasing transparency in lead testing results. The ministry expects to begin this consultation process in early 2021." (Minister's Annual Report on Drinking Water, 2020)

Haloacetic Acids (HAAs)

Haloacetic Acids (HAAs) are disinfection by products formed when chlorine reacts with organic matter that may be present in the treated water. There is a concern that long-term exposures to elevated levels of HAAs may pose a risk to health.

On January 1, 2020 a new water quality standard came into effect for HAAs. The standard is 0.080 mg/L based on a running annual average of quarterly sample results. The sampling results for HAAs for both the Guelph Drinking Water System and the Gazer Mooney Subdivision Distribution System can be found in section h) Raw and Treated Water Quality and Drinking Water Quality Trends, under the "Three Month" Sampling Results Summary.

Staff Certification

The following table describes all Water Services staff with various classes of provincial Drinking Water Operator Certificates, as of December 31, 2020.

Table 30: Water Services Drinking Water Operator Certificates as of December 31, 2020

Certificate Class	Water Treatment	Water Distribution	Water Distribution & Supply
Operator in Training	2	2	0
Class I	12	2	1
Class II	3	1	2
Class III	1	0	3
Class IV	0	1	14
Total Employees with Drinking Water Certificates	**18**	**6**	**20**

Changes Affecting the Quality Management System (QMS)

Quality Management System Implementation

Guelph Water Services strives for continual improvement in all of its programs and processes. Improvements made to the drinking water system and its process are evaluated through: internal and external audits; staff suggestions; risk assessments; emergency training and testing; consumer feedback; and through the management review process.

Water Services at the City of Guelph is committed to providing consumers with a safe, consistent supply of high quality drinking water while meeting or exceeding, and continually improving on legal, operational and quality management system requirements.

Throughout 2021, we will continue with a proactive approach to the DWQMS by:

- Maintaining accreditation to the DWQMS 2.0;
- Identifying ways to improve the drinking water system and its related processes;
- Expanding knowledge and involvement of staff for collaboration and integration of the quality management system;
- Through the Root Cause Analysis process, ensuring that any deficiencies identified are responded to and corrected quickly and efforts are taken to ensure that the problem does not reoccur;

- Collaborating with other municipalities to ensure that we are enhancing our performance standards and operating practices; and
- Continuing advancements to emergency prevention and preparedness, including the risk assessment process.

l) Consumer Feedback

Table 31 below represents the number of all customer calls received, but do not necessarily reflect the number of individual issues (as more than one call could relate to a single issue).

Table 31: Number of Customer Calls Received, 2018-2020

Type of Call	# Calls 2018	# Calls 2019	# Calls 2020
Discoloured Water (Appearance)	116	132	119
Frozen Services	51	54	1
Hydrant - Accident Report	5	1	2
Hydrant – Investigation	25	27	20
Hydrant Out-of-Service	98	133	118
Meter Issues	9	29	22
Other	64	38	22
Pressure Issues	102	74	61
Private Plumbing Issues	12	14	3
Service Box Repairs	212	220	221
Service Line Leak	73	57	62
Valve (Road valve issues)	28	26	18
Water Quality (Smell/Taste)	62	36	38
Watermain Break Investigation	107	93	61
Watermain Cleaning Program	44	4[27]	10
Watermain Inquiries	5	3	3
Well Interference Inquiries	5	0	2

[27] The 2019 Watermain Cleaning Program was cancelled.

m) The Resources Needed to Maintain the Drinking Water System and Quality Management System

Water Services currently has one full-time Quality Management Specialist, who is also the Quality Management System Representative. Everyone at Water Services plays a role in ensuring the success of the Quality Management System. Beyond the work of all staff, the Quality Management Specialist has access to a Water Compliance Specialist; five Water Services Technicians; a Customer Service Clerk; and a seasonal Records Management Assistant to ensure that reporting and documentation requirements of the QMS are met.

Operational challenges in the drinking water system continue to drive the need for additional resources, such as:

- A changing staff profile, with experienced staff that have retired or are due to retire in the next few years;
- Aging city infrastructure requiring increased capital budget considerations;
- Increased water supply in order to meet future water demands for future growth (including considerations of drought and contamination scenarios) requiring increased capital project and budget considerations;
- Distribution system issues (e.g. dead ends in the distribution system, frozen city-side infrastructure, larger infrastructure failures, aging water meter infrastructure, aging watermains, watermains located on easements, etc.); and
- Private property issues (e.g. substandard water services), such as water services prone to freezing or lead services on the private side.

n) Results of Infrastructure Review

The identification of water infrastructure requirements are achieved by reviewing the needs of existing and new infrastructure through the completion of asset management plans both at Water Services and corporately. The following projects are approved by Council through the annual budget process.

Distribution Infrastructure Needs

Distribution infrastructure needs are outlined in the Corporate Asset Management Plan, which is developed using industry best management practices and completed by the Corporate Asset Management group in the Engineering and Transportation Service Division (Engineering Services). This linear plan is reviewed by Water Services who then assists in developing a priority sequence for project completion.

During the annual budget preparation process, Engineering and Water Services review infrastructure conditions, inventory age, CAPS (capital asset prioritization system), system criticality and the risk assessment outcomes. From this evaluation, Engineering and Water Services finalize the list of priority projects that also considers the priorities of wastewater and road reconstruction projects so that these projects can share the costs of excavation and rehabilitation. New linear infrastructure reviews are primarily driven by Engineering Services.

Annual summaries of road reconstruction, sewer and watermain projects are identified on a capital project infrastructure map that is released by Engineering and Transportation Services early spring each year.

Water Supply and Treatment Facilities Infrastructure Needs

On July 28, 2014 Guelph City Council unanimously approved the Water Supply Master Plan update, defining preferred water supply servicing alternatives in meeting the needs of existing customers and future community growth.

In concert with the Water Supply Master Plan Update, the City's Engineering and Transportation Services Division completed an update to the linear water distribution network model as part of the 2014 Development Charges Background Study to define water distribution improvements needed for growth servicing.

As part of the above mentioned studies, a number of system upgrades have been identified including: additional water supply sources; new pumping stations; storage facilities; and new water distribution mains. To help integrate these complex works, the City completed the Pressure Zone 1 and 2 studies in 2015 and 2017, respectively. These studies support the implementation of capital projects as outlined in the Water and Wastewater Capital Budget deliberations.

In 2017, Water Services completed the Water Facility and Property Asset Management Plan. This Plan identifies and prioritizes capital projects and land acquisitions required to maintain and renew its existing facility assets and associated operations over a 25 year planning horizon in accordance with asset management industry best management practices as well as current codes, guidelines and standards. A 10-year capital forecast for Facility and Water Plant Upgrades was presented to and endorsed by Council as part of the 2020 Capital Budget deliberations to address a backlog in infrastructure investment required to sustain operation of the City's critical water supply facilities and processes.

As a result of the above noted studies, key capital projects have been initiated/completed in 2020. The following provides the project name with a brief description of these key projects.

F.M. Woods Station Upgrades and Engine House and Pumping Station Building Retrofit

In 2018, works were initiated on the F.M Woods Station Upgrades to address critical infrastructure upgrades and renovate the Engine House and Pumping Station Building (Heritage Building) to provide office space for staff. Works completed in 2020 included the contractor award and commencement of construction in the Heritage Building, approving the preliminary floorplan for the F.M. Woods Upgrades, F.M. Woods site preparation and completion of several studies in support of the F.M. Woods Upgrade including pumping station hydraulic modelling, site geotechnical investigation, and replacement reservoir isolation valve design. The Heritage Building renovation and F.M. Woods Upgrade detailed design and tendering are scheduled for completion in 2021, with the F.M. Woods Upgrades being completed in 2024.

Verney Feedermain Valve Repairs

The Verney Feedermain (FM) is a critical artery within Guelph's water distribution network. The 600 mm Concrete Pressure Pipe FM was originally constructed in 1963 and contains approximately 35 valve chambers housing various isolation, interconnection (branch) air and drain valves, which are largely original. An assessment of the chambers, which included valve, coupling and chamber inspections, was conducted in 2020. Based on the assessment, recommended repairs were proposed to address aging infrastructure and minimize the risk of infrastructure failure. Repairs will commence in 2021 and continue into 2022.

Clythe Well Treatment Upgrades and Zone 2 East Water Storage Study

The Environmental Assessment (EA) was completed for the Clythe Well station in 2018. As a result, the City purchased a parcel of land in their preferred location, which will house the new Water Treatment Plant. Design of this treatment plant will be initiated in 2021 after the completion of the Zone 2 East Water Storage Study, which began in 2018. Within the Storage Study, existing Zone 2 system constraints were evaluated with the assistance of hydraulic modelling, and recommendations for system optimization have been provided. The Zone 2 East Water Storage Study will conclude in 2021 with recommended future considerations for Zone 2 storage which will inform the Clythe Well Treatment Upgrades project and may include additional storage at the Clythe Well facility.

Paisley Pumping Station Upgrades

Upgrades to the Paisley Pumping Station were initiated in 2018 and will be completed in 2023 to ensure asset life is maintained. The scope of this project includes re-alignment of the yard piping to improve operational flexibility and redundancy, pump and process piping

upgrades to increase overall capacity and replacement of aging and outdated SCADA and electrical systems. Work is also being completed in preparation for the new Paisley Road Feeder Main Engineering Project, which will promote redundancy in water distribution to the west side of the City and provide redundancy in supply to the Paisley station. Design of the new pumping station will wrap up in 2021, with construction commencing in early 2022. A structural analysis of the reservoir roof completed in 2020 found that the roof is in poor condition with extensive cracking in the beams and roof deck. Replacement of the reservoir roof was recommended and will occur within the next 5-10 years.

Middle Reach of the Aqueduct

The middle reach of the aqueduct is the last circa 1965 portion of the aqueduct. In 2018, preliminary projects were completed in preparation for the condition assessment and potential maintenance of the middle reach of the aqueduct. Studies included completion of an Environmental Impact Study and key contingency planning for unplanned changes in water quality including operational responses. Meetings were also held with various stakeholders including the Township of Puslinch, site neighbours, the Health Unit and the MECP. In 2020, a new laneway was constructed to provide operational access to the middle reach. Following this, a camera inspection of the middle reach was conducted and found the aqueduct to be in good condition with only minor maintenance required. This maintenance will be conducted in 2021 along with the installation of additional security measures along the middle reach of the aqueduct.

Calico Well Upgrades

The Calico Well was taken out of service in August 2018 for scheduled contact chamber cleaning and inspection. During the cleaning process, the well casing that extends through the contact chamber was found to be damaged due to material corrosion and the well was subsequently removed from service. As a result of this source being off-line, a section of the feedermain between the station and the City’s distribution system was isolated and taken out of service. The City intends to drill a replacement well in 2021 on the Calico Well site. Following the construction of the new replacement well, hydraulic performance testing will be conducted along with water quality testing, geophysical logging and a private well survey. The design of well house building upgrades, including tie in of the new well and electrical upgrades is also scheduled to commence in 2021.

Membro Well Upgrades

Upgrades to the Membro Well station were initiated in 2019 to bring the new replacement well online after receiving the final Permit to Take Water from the MECP in October 2019. In the spring of 2020, a pumping test was completed on the replacement well to confirm

pumping capacity and to inform the upgrades. Design of the facility upgrades were initiated in late 2019 with completion expected in Q1 2021. Upgrades consist of a building expansion to the back of the well house, equipping the new replacement well with pump and instrumentation, replacement of the existing booster pump, process piping modifications and energy upgrades, including installation of VFDs and LED lighting. Construction will occur in 2021.

Guelph South Groundwater Supply Feasibility Assessment

In 2019, the City retained a consultant to undertake a feasibility study at the Guelph South test well (GSTW1-20) in order to assess the feasibility of developing the test well into a municipal production well, as identified in the Water Supply Master Plan. In 2020, a 30-day pumping test was conducted at the test well to estimate the potential production rate from the well and to investigate potential impacts to the environment and local water users. Further, the City also partnered with the University of Guelph G360 Institute on this project to gain further insight into interactions between the shallow groundwater aquifer and surface water in the area. Data collected during the field testing component of the project are currently being assessed, with final reporting to be completed in 2021.

Logan Well Feasibility Study

In 2019, the City retained a licensed well contractor to perform some maintenance and rehabilitation work on the Logan Test Well in preparation to initiate a feasibility study aimed at evaluating the potential availability of new water supply, as identified in the Water Supply Master Plan. Additional works onsite included tree clearing and maintenance of the access laneway in 2019. Preliminary tests of the well were conducted in 2020 to determine the condition of the well and found the casing and the annular space of the well had degraded. Due to the degradation, the City will complete a well reconstruction to address the current deficiency. The well reconstruction, in addition to hydraulic performance testing and water quality testing will be completed in 2021 at the test well.

o) Operational Plan Currency, Content and Updates

On an ongoing basis, the Operational Plan is updated by the Quality Management Specialist with the help of additional Water Services Staff. The Operational Plan was presented to Council on January 14, 2019 for endorsement. Updates to the Operational Plan were communicated to Water Services management and staff via email on November 18, 2020.

Notable updates include:

- Element 2 – Quality Management System Policy

    - Updated with new members of Water Services Top Management.
- Element 3 – Commitment and Endorsement
    - Updated with new members of Water Services Top Management.
- Element 5 – Document and Records Control
    - QMS 05-04 Table of Essential Documents: New Arkell PTTW
- QMS 06 – Drinking Water System
    - QMS 06 and QMS 06-01: Updated to remove re-chlorination system at Clythe station.
    - QMS 06-03: Updated with new contact information for new Community Emergency Management Coordinator for Wellington County.
    - QMS 06-04: Updated the list of Water Services Programs.
- QMS 07 – Risk Assessment
    - QMS 07: Updated the responsibilities and procedures section to clearly define what is done during the annual risk assessment.
    - QMS 07-01: Updated the responsibilities and procedures section to clearly define what is done during the annual risk assessment.
- QMS 08 – Risk Assessment Outcome
    - Updated based on 2020 Risk Assessment.
- QMS 09 – Organizational Structure, Roles, Responsibilities and Authorities
    - Updated to reflect current staff and roles.
- QMS 10 – Competencies
    - Updated section 1.3 – re: OITs: cannot sign-off on logged data for compliance purposes, unless authorized by the Owner, the Operating Authority, the ORO or an Operator in Charge.
    - Updated Section 3 to include issuing of QMS 10 forms by the Certification Specialist and tracking of the progress and filing the records by the Certification Specialist.
- QMS 11 – Personnel Coverage
    - Updated to identify that there may be a separate ORO for Treatment and Distribution.
    - Added information about OnWARN and the Wellington County Mutual Service Agreement and that we can utilize their personnel in an emergency.
- QMS 12 – Communications
    - QMS 12: Added a new procedure around how we will communicate the relevant aspects of the Quality Management System with our Essential Suppliers, as listed in QMS 13-01.
    - QMS 12-01: Updated the Owner Rep section to add the Director of Public Works for GET. Removed CAO for Guelph, as the GM Environmental Services is the designated Owner Representative.

- QMS 13 – Essential Supplies and Services
  - Updated the procedure for ensuring the quality of essential supplies and services.
  - Updated QMS 13-01 to better reflect our Essential Supplies and Services.
- QMS 15 – Infrastructure Maintenance, Rehabilitation and Renewal
  - QMS 15: Updated the table to list the priority capital projects for 2020-2021.
- QMS 16 – Sampling, Testing and Monitoring
  - Updated to reflect current sampling locations.
- QMS 17 – Measurement and Recording Equipment Calibration and Maintenance
  - Updated the procedure for handheld colorimeter verification and calibration.
- QMS 18 – Emergency Management
  - Added that Emergency Testing may not occur if an actual emergency has happened that year.
- QMS 21 – Continual Improvement
  - Updated to reflect current practices for Continual Improvement.

p) Staff Suggestions

Staff suggestions are identified during: staff and operational meetings; internal and external audits; debriefs and are taken into account during annual budget processes and continual improvement meetings. Appendix H: Summary of Staff Suggestions includes a listing of various improvement items that were presented by staff from January 1 to December 31, 2020.

q) New or Other Business

There is no further new or other business to report on for 2020.

Appendix A: Summary of Critical Control Points and Critical Control Limits

A critical control point is an essential step or point in the subject system at which control can be applied by the operating authority to prevent or eliminate a drinking water health hazard or to reduce it to an acceptable level. A critical control limit is the point at which a critical control point response procedure is initiated.

Water Services has identified three critical control points: multi-barrier primary disinfection, secondary disinfection and backflow prevention. Their critical control points and limits are described below.

1. Multi-Barrier Primary Disinfection

To remove or inactivate pathogens potentially present in the source water.

Hazard Descriptions and Critical Control Limits

a) Low Chlorine Dosage

- Chlorination system failure (e.g. pump, line, fitting, power, PLC, flow meter)
- Failure of analyzers (POE or process) to alarm
- Poor chemical quality

Critical Control Limits

- Low Low and High High alarm limit range for all stations: 0.40 to 1.9 mg/L
- Programmed auto shutdown range for all stations: 0.40 to 2.5 mg/L

b) High Turbidity

- Sudden changes to raw water quality characteristics
- Failure of aqueduct infrastructure

Critical Control Limits

- Turbidity alarm ranges for all stations that monitor turbidity: 0.3 to 0.8 ntu
- Auto diversion at the Glen Diversion Chamber based on turbidity: 0.15 ntu

c) Inadequate UV Dosage

- UV Treatment system failure (e.g. UV, UVT and turbidity analyzers, high flow, reactor, PLC, power, flow meters)
- High turbidity event

Critical Control Limits

- UV Dose auto shutdown alarm setpoints
- FM Woods
    - (alarm only, does not shutdown) <40mJ/cm^2
- Water Street Well

    - <45mJ/cm^2 (Trojan controller programmed low)
    - 42mJ/cm^2 (redundant PLC programmed low)
- Membro Well
    - <25 mJ/cm^2 (Trojan controller programmed low)
    - <22 mJ/cm^2 (redundant PLC programmed low)

d) Operating a Station in Manual

- Inadequate CT (Concentration x Time)
- Low reservoir level
- Insufficient chlorine residual
- Low contact time due to POE pump flow rate

Critical Control Limits

- Manual calculations must show that the minimum CT achieved is 4

2. Secondary Disinfection

To ensure the maintenance of a disinfectant residual throughout the distribution system.

Hazard Descriptions and Critical Control Limits

a) Deterioration of Chlorine Residual

- Reduced water flows based on demand, pipe size, etc.
- Occurrence of dead ends and District Metered Areas
- Increased water temperature (temporary mains)
- Reaction with organic matter in watermains
- Water age in the distribution system
- Water age in storage facilities

Critical Control Limits

- Free Chlorine
- Target residual in the distribution system: >0.20 mg/L (operational minimum)
- Reportable under the Safe Drinking Water Act: 0.05 mg/L
- Consumer Complaints
- Related to water quality characteristics (taste, odour, colour, other)

3. Backflow Prevention

To prevent cross-contamination that can result from the flowing back of, or reversal of the normal direction of flow of water.

Hazard Descriptions and Critical Control Limits

a) System contamination from negative or reduced pressure

- Lack of backflow prevention device (including unauthorized connections)
- Main breaks or blowouts
- Large services (high usage causing reduced pressure)
- Temporary connections
- Firefighting connections
- Depressurization from residential usage
- Pipe failure (deterioration)

Critical Control Limits

- System pressure
- Alarm set point ranges for pressure: 210 to 900 kPa
- Consumer Complaints
- Related to system pressure or water quality characteristics (taste, odour, colour, other)

Appendix B: Summary of Internal and External Audit Plans

Table 32: Summary of Internal and External Audit Plans, 2019-2021

Guelph Water Services Process or Program	'19	'19	'20	'20	'21	'21
	I[28]	E[29]	I	E	I	E
Source Water – Source Water Protection Program	X	X				
Source Water – Outdoor Water Use Program						X
Source Water – Tap Water Promotion, Education & Outreach		X			X	
Source Water – Water Smart Business Program			X			
Water Supply – Source & Treated Water Sampling, Testing, Monitoring		X	X	X	X	
Water Supply – Operational Control: Disinfection, Minimum Storage, SCADA / Security	X			X		
Water Supply – SCADA Design, Maintenance & Upgrades			X	X		
Water Supply – Water Supply Master Plan Program (new water sources)	X					X
Maintenance – Instrumentation Calibration / Verification	X	X		X		X
Maintenance – Well Inspection & Rehabilitation Program			X	X		
Maintenance – Preventative & Reactive Maintenance Program	X	X			X	X
Maintenance – Infrastructure (facility and tower) Inspections Program			X	X		
Distribution Construction – Watermain Maintenance & Service Connections Improvement		X			X	X

[28] I = Internal Audit

[29] E = External Audit

Guelph Water Services Process or Program	'19	'19	'20	'20	'21	'21
	I[28]	E[29]	I	E	I	E
Distribution Construction – Leak Detection & Water Loss Management		X				
Distribution Construction – No Water Response (e.g. frozen pipes)				X		
Distribution Construction – New Watermain Construction & Reconstruction	X	X			X	
Distribution Construction – Temporary Watermains & Service Connections					X	X
Distribution Appurtenance Maintenance –Hydrant Inspection Program		X				
Distribution Appurtenance Maintenance – Watermain Flushing & Swabbing Program			X	X		
Distribution Appurtenance Maintenance – Valve Turning Program	X	X				
Distribution Appurtenance Maintenance – DMAs		X				
Distribution Appurtenance Maintenance – Water Meter Program			X	X		
Distribution Appurtenance Maintenance – Infrastructure Locates Program	X	X				
Infrastructure Programs – Tech Services: New Facility Construction					X	X
Infrastructure Programs – Tech Services: Major Facility Upgrades			X	X		
Infrastructure Programs – Engineering: Infrastructure Planning				X		
Infrastructure Programs – Engineering: Water Asset Planning & Condition Assessments					X	X
Infrastructure Programs – Engineering/Water: Review of Infrastructure and Specifications		X				

Guelph Water Services Process or Program	'19	'19	'20	'20	'21	'21
	I[28]	E[29]	I	E	I	E
Infrastructure Programs – Engineering: Infrastructure Reconstruction & Planning	X	X	X			
Infrastructure Programs – Engineering: New Construction (new subdivisions)		X				
Infrastructure Programs – Building Services: Backflow Prevention Program				X		
Management – Compliance Program			X	X		
Management – Certification Program		X	X		X	X
Management – Owner Standard of Care		X				
Management – Customer Services (Administration, Distribution & Supply)	X	X			X	X
Management – Human Resources & Supplier		X		X		X
Management – Communications		X		X	X	X
Management – Review and Provision of Infrastructure		X		X		X
QMS – Internal Audit Program	X	X		X	X	X
QMS – Risk Assessments	X	X	X	X		X
QMS – Continual Improvement	X	X	X	X		X
QMS – Emergency Management	X	X	X	X		X
QMS – Management Review	X	X		X		X
QMS – Document & Records Control	X	X	X	X	X	X
QMS – Drinking Water System				X		X

Appendix C: Total Water Pumped and Instantaneous Flows

This section summarizes the amount of water pumped and instantaneous flows in 2020.

Capacity is calculated by comparing the average pumped or flow value against the MDWL allowable volume or PTTW flow. Capacity is representative of the conditions of pumping for that year which may be influenced by other testing programs, maintenance or special operational conditions. Additionally, the actual capacity of the source may not be achievable with current infrastructure. Optimization efforts are included as a component of the Water Supply Master Plan with the intent to match the actual capacity of the water source with the appropriate infrastructure. Section g) Water Supply Capacity describes capacity in further detail.

City of Guelph Water Services – Pumpages to System, January 1 – December 31, 2020

Table 33 below shows the amount of water pumped to system from each facility in 2020 in cubic meters.

Table 33: Pumpages (Discharge) to System, January 1 to December 31, 2020

	Facility	Burke	Calico	Dean	Downey	Emma	Helmar	Membro	Paisley Net	Park	Queensdale	University Net	Water Street	F.M. Woods	Total System Discharge
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory Limit	6,546	5,237	2,300	5,237	3,100	3,273	6,050	13,738)	10,300	5,273	5,108	3,400	65,000	n/a
Jan	Average	6,153	0	1,317	3,133	2,565	731	0	1,048	901	654	0	1,816	25,607	43,926
	Maximum	6,242	0	1,396	4,457	2,610	739	0	1,051	2,708	678	0	2,001	30,332	47,506
	Total	**190749**	**0**	**40,835**	**97,135**	**79,528**	**22,648**	**1**	**32,497**	**27,933**	**20,265**	**0**	**56,301**	**793,813**	**1,361,705**
Feb	Average	6,173	0	1,389	2,863	2,540	807	0	1,040	889	631	0	858	27,094	44,283
	Maximum	6,253	0	1,397	3,072	2,647	840	0	1,047	1,650	653	0	1,851	29,421	46,849
	Total	**172,840**	**0**	**38,895**	**80,163**	**71,133**	**22,584**	**0**	**29,131**	**24,882**	**17,656**	**0**	**24,015**	**758,635**	**1,239,933**
Mar	Average	6,149	0	1,294	2,893	2,529	817	0	1,035	322	624	0	836	27,213	43,712
	Maximum	6,227	0	1,393	4,130	2,654	832	0	1,038	2,863	648	0	1,807	36,181	52,855
	Total	**190,634**	**0**	**40,126**	**89,683**	**78,386**	**25,327**	**0**	**32,091**	**9,975**	**19,357**	**0**	**25,912**	**843,595**	**1,355,085**
Apr	Average	6,144	0	1,083	2,392	1,725	773	0	1,035	859	494	0	1,195	25,080	41,613
	Maximum	6,233	0	1,387	3,399	2,658	801	0	1,038	3,364	661	0	1,766	28,197	43,733
	Total	**184,306**	**0**	**32,487**	**71,759**	**76,746**	**23,182**	**0**	**31,060**	**25,761**	**14,827**	**0**	**35,852**	**752,398**	**1,248,377**
May	Average	6,141	0	137	2,913	2,296	746	0	1,034	6,107	0	0	159	24,938	44,470
	Maximum	6,201	0	1,384	4,416	2,554	774	0	1,035	9,201	0	0	1,869	29,763	54,274
	Total	**190,358**	**0**	**4,243**	**90,314**	**71,177**	**23,130**	**0**	**32,053**	**189,312**	**0**	**0**	**4,928**	**773,067**	**1,378,581**
Jun	Average	6,071	0	1,321	2,860	2,180	708	0	1,024	5,427	0	938	1,780	26,209	48,518
	Maximum	6,153	0	1,394	3,133	2,527	724	0	1,033	6,206	0	2,097	1,905	30,916	53,869
	Total	**182,131**	**0**	**39,622**	**85,798**	**65,397**	**21,228**	**0**	**30,722**	**162,813**	**0**	**28,136**	**53,414**	**786,265**	**1,455,526**
Jul	Average	6,072	0	1,349	2,938	2,363	647	0	1,022	4,747	235	1,569	1,855	27,635	50,433
	Maximum	6,132	0	1,411	4,388	2,580	726	0	1,027	6,898	768	2,075	1,893	36,221	60,728
	Total	**188,239**	**0**	**41,809**	**91,086**	**73,267**	**20,051**	**0**	**31,682**	**147,147**	**7,300**	**48,644**	**57,510**	**856,697**	**1,563,433**

	Facility	Burke	Calico	Dean	Downey	Emma	Helmar	Membro	Paisley Net	Park	Queensdale	University Net	Water Street	F.M. Woods	Total System Discharge
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory Limit	6,546	5,237	2,300	5,237	3,100	3,273	6,050	13,738)	10,300	5,273	5,108	3,400	65,000	n/a
Aug	Average	5,715	0	1,355	2,780	2,197	707	0	1,018	3,961	649	1,599	1,739	26,126	47,846
	Maximum	6,121	0	1,399	3,034	2,611	719	0	1,031	6,346	746	2,124	1,911	32,227	53,687
	Total	**177,166**	**0**	**42,012**	**86,174**	**68,117**	**21,922**	**0**	**31,544**	**122,783**	**20,109**	**49,573**	**53,903**	**809,912**	**1,483,215**
Sep	Average	6,030	0	1,339	2,760	2,463	376	0	1,016	3,621	672	1,698	1,777	25,313	47,063
	Maximum	6,073	0	1,387	4,031	2,579	847	0	1,023	5,306	754	2,122	1,882	30,299	52,250
	Total	**180,886**	**0**	**40,162**	**82,793**	**73,885**	**11,269**	**0**	**30,490**	**108,623**	**20,152**	**50,946**	**53,299**	**759,385**	**1,411,891**
Oct	Average	5,916	0	1,374	3,477	1,008	670	0	1,006	1,989	658	1,688	1,723	24,920	44,428
	Maximum	6,051	0	1,383	4,275	2,576	780	0	1,016	4,236	707	2,078	1,884	29,375	47,677
	Total	**183,381**	**0**	**42,605**	**107,786**	**31,246**	**20,764**	**0**	**31,185**	**61,645**	**20,384**	**52,340**	**53,418**	**772,521**	**1,377,275**
Nov	Average	5,957	0	1,310	4,190	1,839	635	0	967	1,763	636	1,478	1,769	23,603	44,148
	Maximum	6,020	0	1,435	4,433	2,664	815	0	1,056	5,436	683	2,041	1,925	27,624	47,745
	Total	**178,720**	**0**	**39,314**	**125,703**	**55,168**	**19,058**	**0**	**28,998**	**52,902**	**19,092**	**44,339**	**53,075**	**708,080**	**1,324,447**
Dec	Average	5,619	0	1,375	3,914	1,994	616	0	1,009	2,091	593	1,645	1,385	21,399	41,641
	Maximum	5,980	0	1,384	4,291	2,604	732	0	1,033	5,081	613	1,920	1,860	26,531	48,908
	Total	**174,189**	**0**	**42,620**	**121,340**	**61,821**	**19,097**	**0**	**31,268**	**64,833**	**18,396**	**51,006**	**42,931**	**663,374**	**1,290,875**
2020 Year	Average	6,012	0	1,220	3,093	2,142	686	0	1,021	2,723	487	885	1,408	25,428	45,173
	Maximum	6,253	0	1,435	4,457	2,664	847	0	1,056	9,201	768	2,124	2,001	36,221	60,728
	Total	**2,193,600**	**0**	**444,730**	**1,129,734**	**805,872**	**250,260**	**0**	**372,719**	**998,607**	**177,539**	**324,985**	**514,557**	**9,277,741**	**16,490,343**
	Average Process Capacity	**92%**	**0%**	**53%**	**59%**	**71%**	**21%**	**0%**	**n/a**	**27%**	**9%**	**n/a**	**41%**	**39%**	**n/a**

City of Guelph Water Services – Permit to Take Water Pumpages, January 1 – December 31, 2020

Table 34 and Table 35 presented below, outline the Permit to Take Water Pumpages for 2020. Table 34 includes the following sources: Arkell Well 1, Arkell Well 6, Arkell Well 7, Arkell Well 8, Arkell Well 14, Arkell Well 15, Arkell Recharge Pump, Arkell Springs Glen Collector System, Burke Well, Calico Well, and Carter Well 1 and 2. Admiral Well and Clythe Well are not included, as they are not in operation. Table 35 includes the following sources: Dean Well, Downey Well, Edinburgh Well, Emma Well, Helmar Well, Membro Well, Paisley Well, Park Wells 1 and 2, Queensdale Well, Sacco Well, Smallfield Well, University Well and Water Street Well

Table 34: City of Guelph Permit to Take Water Pumpages, 2020

	Facility	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell Wellfield (#6, 7, 8, 14, 15) Total	Arkell - Recharge Pump	Arkell Springs Glen Collector System	Burke Well	Calico Well	Carter Wells #1 and #2
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory limit	3,273	9,600	9,600	9,600	9,600	9,600	28,800	9,092	25,000	6,546	5,237	6,547
Jan	Average	41	4,423	7,614	1,345	4,480	846	18,709	0	7,724	6,327	0	0
	Maximum	262	7,340	7,796	5,919	7,022	3,245	26,711	0	8,796	6,410	0	0
	Total	**1,286**	**137,101**	**236,049**	**41,709**	**138,890**	**26,221**	**579,970**	**0**	**239,430**	**196,126**	**0**	**0**
Feb	Average	97	5,631	6,833	196	4,605	753	18,018	0	9,073	6,351	0	0
	Maximum	688	7,700	7,676	2,256	6,286	2,121	20,414	0	9,271	6,428	0	0
	Total	**2,721**	**157,669**	**191,332**	**5,484**	**128,928**	**21,088**	**504,501**	**0**	**254,035**	**177,816**	**0**	**0**
Mar	Average	597	7,003	5,369	774	3,558	1,253	17,957	0	9,570	6,340	0	0
	Maximum	1,125	8,249	7,631	5,170	7,369	4,333	26,811	0	10,049	6,403	0	0
	Total	**18,509**	**217,088**	**166,440**	**23,988**	**110,305**	**38,854**	**556,674**	**0**	**296,684**	**196,541**	**0**	**0**
Apr	Average	1,138	8,196	2,805	126	1,221	795	13,142	4,031	11,193	6,326	0	0
	Maximum	1,158	8,261	5,510	1,763	3,955	3,729	16,934	8,438	13,438	6,409	0	0
	Total	**34,146**	**245,874**	**84,135**	**3,781**	**36,620**	**23,860**	**394,271**	**120,939**	**335,791**	**189,768**	**0**	**0**
May	Average	1,132	7,924	7,341	458	4,907	3,151	23,780	913	13,262	6,329	0	0
	Maximum	1,151	8,093	7,613	4,458	7,469	6,260	28,602	8,436	13,263	6,383	0	0
	Total	**35,078**	**245,642**	**227,563**	**14,207**	**152,111**	**97,670**	**737,193**	**28,300**	**411,137**	**196,185**	**0**	**0**
Jun	Average	1,121	8,056	5,893	68	1,184	827	16,029	0	9,406	6,263	0	0
	Maximum	1,131	8,119	7,805	1,299	7,640	5,346	23,042	0	12,020	6,339	0	0
	Total	**33,639**	**241,685**	**176,795**	**2,051**	**35,527**	**24,800**	**480,856**	**0**	**282,182**	**187,886**	**0**	**0**

	Facility	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell Wellfield (#6, 7, 8, 14, 15) Total	Arkell - Recharge Pump	Arkell Springs Glen Collector System	Burke Well	Calico Well	Carter Wells #1 and #2
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory limit	3,273	9,600	9,600	9,600	9,600	9,600	28,800	9,092	25,000	6,546	5,237	6,547
Jul	Average	1,105	7,877	4,720	549	3,088	2,035	18,269	1,834	8,386	6,268	0	3
	Maximum	1,155	8,146	7,557	4,070	7,688	7,945	26,840	8,437	9,561	6,328	0	92
	Total	**34,248**	**244,190**	**146,316**	**17,008**	**95,730**	**63,085**	**566,330**	**56,840**	**259,973**	**194,307**	**0**	**92**
Aug	Average	655	6,510	3,932	445	4,342	1,263	16,492	3,054	9,091	5,904	0	1,213
	Maximum	1,157	8,150	7,865	2,633	7,624	4,606	23,285	8,420	10,124	6,323	0	4,558
	Total	**20,290**	**201,801**	**121,905**	**13,794**	**134,593**	**39,144**	**511,237**	**94,671**	**281,835**	**183,025**	**0**	**37,601**
Sep	Average	13	7,815	2,903	1,522	3,119	1,928	17,287	4,220	9,204	6,233	0	2,422
	Maximum	183	8,145	7,424	6,989	7,149	6,040	27,741	8,321	10,191	6,272	0	5,089
	Total	**388**	**234,443**	**87,099**	**45,647**	**93,579**	**57,849**	**518,616**	**126,600**	**276,120**	**186,993**	**0**	**72,669**
Oct	Average	554	6,876	3,835	911	1,644	2,088	15,355	7,695	9,381	6,119	0	0
	Maximum	1,071	8,142	7,721	4,355	4,636	5,692	22,628	8,119	9,616	6,241	0	0
	Total	**17,180**	**213,162**	**118,896**	**28,234**	**50,969**	**64,734**	**475,995**	**238,532**	**290,821**	**189,703**	**0**	**0**
Nov	Average	29	5,412	5,726	458	2,555	1,438	15,588	2,984	8,606	6,167	0	0
	Maximum	292	8,075	7,791	3,411	5,478	4,892	20,487	7,770	9,968	6,230	0	0
	Total	**868**	**162,355**	**171,777**	**13,746**	**76,642**	**43,125**	**467,645**	**89,516**	**258,186**	**184,997**	**0**	**0**
Dec	Average	61	4,346	7,585	887	2,362	990	16,170	0	6,540	6,356	0	0
	Maximum	359	6,824	7,820	5,100	5,900	5,039	21,177	0	6,811	6,427	0	0
	Total	**1,893**	**134,724**	**235,127**	**27,502**	**73,229**	**30,695**	**501,278**	**0**	**202,733**	**197,032**	**0**	**0**
2020 Year	Average	544	6,616	5,352	677	3,235	1,407	17,288	2,061	9,232	6,204	0	303
	Maximum	1,158	8,261	7,865	6,989	7,688	7,945	28,602	8,438	13,438	6,428	0	5,089
	Total	**199,944**	**2,414,762**	**1,953,160**	**249,254**	**1,181,696**	**516,180**	**6,315,052**	**755,398**	**3,368,707**	**2,263,842**	**0**	**110,362**
	Average Pumped	**17%**	**69%**	**56%**	**7%**	**34%**	**15%**	**60%**	**7%**	**32%**	**95%**	**0%**	**5%**

Table 35: City of Guelph Permit to Take Water Pumpages, 2020 – Continued

	Facility	Dean Well	Downey Well	Emma Well	Helmar Well	Membro Well	Paisley Well	Park Wells #1 and #2	Queensdale Well	University Well	Water Street Well
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory limit	2,300	5,273	3,100	3,273	6,050	3,200	10,300	5,237	3,300	3,400
Jan	Average	1,350	3,238	2,565	712	608	1,048	892	652	0	1,816
	Maximum	1,435	4,600	2,610	721	5,718	1,051	2,687	703	0	2,001
	Total	**41,863**	**100,370**	**79,528**	**22,075**	**18,834**	**32,497**	**27,664**	**20,216**	**0**	**56,301**
Feb	Average	1,426	2,957	2,540	792	4,981	1,040	879	630	0	859
	Maximum	1,465	3,173	2,647	822	5,735	1,047	1,637	672	0	1,851
	Total	**39,921**	**82,800**	**71,133**	**22,168**	**139,466**	**29,131**	**24,622**	**17,651**	**0**	**24,040**
Mar	Average	1,321	2,988	2,529	798	5,083	1,035	141	623	0	839
	Maximum	1,454	4,277	2,654	818	5,584	1,038	1,094	670	0	1,807
	Total	**40,966**	**92,627**	**78,399**	**24,737**	**157,560**	**32,091**	**4,385**	**19,315**	**0**	**26,012**
Apr	Average	1,097	2,471	2,558	753	4,570	1,035	878	491	0	1,195
	Maximum	1,446	3,512	2,658	792	5,724	1,038	3,335	686	0	1,766
	Total	**32,905**	**74,132**	**76,746**	**22,603**	**137,109**	**31,060**	**26,344**	**14,728**	**0**	**35,849**
May	Average	142	3,009	2,296	727	4,082	1,034	6,065	0	0	159
	Maximum	1,444	4,558	2,554	769	5,243	1,035	9,186	0	0	1,869
	Total	**4,401**	**93,275**	**71,177**	**22,533**	**126,532**	**32,053**	**188,020**	**0**	**0**	**4,916**
Jun	Average	1,332	2,956	2,183	708	0	1,024	5,389	0	938	1,785
	Maximum	1,451	3,234	2,527	724	0	1,033	6,210	0	2,097	1,905
	Total	**39,972**	**88,668**	**65,501**	**21,228**	**0**	**30,722**	**161,666**	**0**	**28,136**	**53,558**
Jul	Average	1,351	3,080	2,367	647	0	1,022	4,711	244	1,569	1,855
	Maximum	1,415	4,532	2,581	726	0	1,027	6,706	783	2,075	1,893
	Total	**41,871**	**95,495**	**73,366**	**20,051**	**0**	**31,682**	**146,049**	**7,574**	**48,644**	**57,516**

	Facility	Dean Well	Downey Well	Emma Well	Helmar Well	Membro Well	Paisley Well	Park Wells #1 and #2	Queensdale Well	University Well	Water Street Well
	Units	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
	Regulatory limit	2,300	5,273	3,100	3,273	6,050	3,200	10,300	5,237	3,300	3,400
Aug	Average	1,363	2,922	2,197	689	22	1,018	3,932	634	1,599	1,739
	Maximum	1,430	3,177	2,611	705	496	1,031	6,298	794	2,124	1,911
	Total	**42,257**	**90,591**	**68,117**	**21,347**	**696**	**31,544**	**121,883**	**19,651**	**49,573**	**53,903**
Sep	Average	1,363	2,902	2,463	372	4	1,016	3,594	651	1,698	1,777
	Maximum	1,435	4,187	2,579	838	76	1,023	5,265	767	2,122	1,882
	Total	**40,893**	**87,061**	**73,885**	**11,155**	**130**	**30,490**	**107,830**	**19,532**	**50,946**	**53,299**
Oct	Average	1,395	3,622	1,008	655	5	1,006	1,974	650	1,688	1,723
	Maximum	1,447	4,423	2,576	750	50	1,016	4,202	686	2,078	1,884
	Total	**43,233**	**112,270**	**31,246**	**20,306**	**164**	**31,185**	**61,206**	**20,163**	**52,340**	**53,418**
Nov	Average	1,318	4,334	1,839	623	0	967	1,750	641	1,478	1,769
	Maximum	1,457	4,585	2,664	781	0	1,056	5,262	699	2,041	1,925
	Total	**39,534**	**130,023**	**55,168**	**18,680**	**0**	**28,998**	**52,515**	**19,230**	**44,339**	**53,075**
Dec	Average	1,390	4,051	1,994	605	1	1,009	2,073	599	1,645	1,385
	Maximum	1,434	4,429	2,604	731	18	1,033	5,031	671	1,920	1,860
	Total	**43,098**	**125,573**	**61,821**	**18,746**	**46**	**31,268**	**64,276**	**18,570**	**51,006**	**42,931**
2020 Year	Average	1,390	4,051	1,994	605	1	1,009	2,073	599	1,645	1,385
	Maximum	1,434	4,429	2,604	731	18	1,033	5,031	671	1,920	1,860
	Total	**43,098**	**125,573**	**61,821**	**18,746**	**46**	**31,268**	**64,276**	**18,570**	**51,006**	**42,931**
	Average Pumped	**54%**	**61%**	**71%**	**21%**	**26%**	**32%**	**26%**	**9%**	**27%**	**41%**

City of Guelph Water Services – Instantaneous Flows Summary (PTTW), January 1 – December 31, 2020

Table 36 and Table 37 presented below, outline the Instantaneous Flow Summary for 2020. Table 36 includes the following sources: Arkell Well 1, Arkell Well 6, Arkell Well 7, Arkell Well 8, Arkell Well 14, Arkell Well 15, Arkell Recharge Pump, Arkell Springs Glen Collector System, Burke Well, Calico Well, Carter Wells 1 and 2. Admiral Well and Clythe Well are not included as they are not operational. Table 37 includes the following sources: Dean Well, Downey Well, Emma Well, Helmar Well, Membro Well, Paisley Well, Park Wells 1 and 2, Queensdale Well, University Well and Water Street Well.

Table 36: City of Guelph - Instantaneous Flow Summary, 2020

	Facility	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell - Recharge System	Arkell Springs Glen Collector System	Burke Well	Calico Well	Carter Wells
	Units	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s
	Regulatory limit	37.8	111.0	111.0	111.0	111.0	111.0	157.8	289.3	83.7	60.6	90.9
Jan	Average	0.5	51.2	88.5	15.6	51.9	9.8	0.0	80.7	73.2	0.0	0.0
	Maximum	13.4	91.5	91.5	85.2	100.5	98.3	0.0	104.9	75.2	0.0	0.0
Feb	Average	1.1	65.5	79.8	2.2	53.2	8.4	0.0	105.1	73.5	0.0	0.0
	Maximum	13.4	95.2	91.9	87.3	100.4	98.0	0.0	110.3	75.4	0.0	0.0
Mar	Average	7.0	80.8	62.4	8.9	41.2	14.5	0.0	104.2	73.4	0.0	0.0
	Maximum	13.4	97.1	92.0	89.1	98.0	100.1	0.0	117.1	75.2	0.0	0.0
Apr	Average	13.2	94.7	32.4	1.4	14.1	9.2	46.5	125.8	73.2	0.0	0.0
	Maximum	13.5	97.3	93.3	89.0	98.5	100.5	112.7	160.3	75.2	0.0	0.0
May	Average	13.2	91.1	85.2	5.3	56.8	36.4	12.8	153.5	73.2	0.0	0.0
	Maximum	13.4	95.2	93.2	86.8	94.2	97.5	150.0	153.5	75.2	0.0	0.0
Jun	Average	13.1	93.3	68.5	0.8	13.7	9.6	0.0	105.3	72.5	0.0	0.1
	Maximum	13.3	95.8	93.2	87.9	95.7	97.8	0.0	118.2	74.8	0.0	50.1
Jul	Average	12.9	91.1	54.7	6.4	35.8	23.5	21.2	96.7	72.6	0.0	0.0
	Maximum	13.4	95.8	102.4	87.7	94.0	96.3	97.9	113.6	74.7	0.0	26.1

	Facility	Arkell Well #1	Arkell Well #6	Arkell Well #7	Arkell Well #8	Arkell Well #14	Arkell Well #15	Arkell - Recharge System	Arkell Springs Glen Collector System	Burke Well	Calico Well	Carter Wells
	Units	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s
	Regulatory limit	37.8	111.0	111.0	111.0	111.0	111.0	157.8	289.3	83.7	60.6	90.9
Aug	Average	7.6	75.1	45.6	5.2	50.3	14.6	36.6	105.2	68.3	0.0	14.0
	Maximum	13.7	96.3	92.8	88.1	96.5	96.6	97.6	119.9	74.3	0.0	70.8
Sep	Average	0.1	90.4	33.6	17.6	36.1	22.3	48.8	94.1	72.1	0.0	28.0
	Maximum	12.9	95.4	92.8	87.9	95.4	96.6	96.8	120.3	73.9	0.0	60.8
Oct	Average	6.4	79.6	44.7	10.5	19.0	24.2	89.1	105.7	70.3	0.0	0.0
	Maximum	12.6	95.3	94.4	88.2	95.5	96.6	94.5	114.2	73.8	0.0	0.0
Nov	Average	0.3	62.5	66.6	5.3	29.6	16.6	34.4	93.9	71.4	0.0	0.0
	Maximum	12.4	96.0	94.8	88.8	95.3	95.3	88.3	114.2	73.4	0.0	0.0
Dec	Average	0.6	42.5	84.6	14.8	47.7	5.9	0.0	53.6	67.4	0.0	0.0
	Maximum	12.2	94.8	92.4	88.8	95.6	95.7	0.0	79.7	72.9	0.0	0.0

Table 37: Instantaneous Flow Summary, 2020 – Continued

	Facility	Dean Well	Downey Well	Emma Well	Helmar Well	Membro Well	Paisley Well	Park Wells	Queensdale Well	University Well	Water Street Well
	Units	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s
	Regulatory limit	34.6	60.6	40.8	37.8	78.0	42.0	127.2	60.6	46.2	44.4
Jan	Average	15.4	38.3	30.0	8.4	0.0	12.1	10.3	9.6	0.0	21.1
	Maximum	20.0	58.9	32.1	11.7	0.0	12.2	118.7	13.5	0.0	31.9
Feb	Average	16.3	34.8	29.6	9.3	58.5	12.1	10.2	9.2	0.0	9.6
	Maximum	19.6	59.4	32.2	18.8	69.1	12.1	118.4	12.2	0.0	25.7
Mar	Average	15.2	35.3	29.5	9.4	58.9	12.0	1.6	9.2	0.0	9.7
	Maximum	19.7	62.4	32.9	10.9	65.0	12.1	118.4	12.3	0.0	28.4
Apr	Average	12.7	29.2	29.7	8.9	52.9	12.0	10.1	7.2	0.0	13.8
	Maximum	19.5	57.3	32.2	13.0	70.9	13.0	180.4*	11.7	0.0	24.6
May	Average	1.6	35.5	26.6	8.6	47.3	12.0	70.2	0.0	0.0	1.8
	Maximum	20.1	60.6	31.2	13.2	61.0	12.1	119.9	0.0	0.0	25.8
Jun	Average	15.4	35.0	25.3	8.4	0.0	11.8	62.4	0.0	10.8	20.7
	Maximum	19.6	55.3	32.1	13.0	0.0	12.1	119.0	0.0	25.3	29.0
Jul	Average	15.8	36.5	27.4	7.7	0.0	11.8	54.5	2.8	18.2	21.6
	Maximum	19.3	63.2	32.8	13.2	0.0	13.0	118.4	12.5	25.1	29.8
Aug	Average	15.9	34.7	25.5	8.2	0.3	11.8	45.5	7.3	18.5	20.2
	Maximum	20.5	60.5	32.0	13.3	30.3	12.3	118.4	10.6	25.4	30.4
Sep	Average	15.7	34.5	28.6	4.4	0.0	11.8	41.6	7.6	19.7	20.6
	Maximum	21.8	59.8	31.4	21.2	30.5	12.6	117.1	9.6	28.5	30.2

	Facility	Dean Well	Downey Well	Emma Well	Helmar Well	Membro Well	Paisley Well	Park Wells	Queensdale Well	University Well	Water Street Well
	Units	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s
	Regulatory limit	34.6	60.6	40.8	37.8	78.0	42.0	127.2	60.6	46.2	44.4
Oct	Average	16.1	43.1	11.7	7.8	0.1	11.7	22.8	7.6	19.5	20.0
	Maximum	21.9	60.2	31.4	12.7	30.5	12.3	120.2	10.6	24.9	30.4
Nov	Average	15.4	51.5	21.4	7.4	0.0	11.2	20.2	7.4	17.1	20.5
	Maximum	22.1	61.5	33.0	12.7	29.3	13.0	120.1	10.8	24.9	27.4
Dec	Average	16.1	48.2	22.2	7.2	0.0	11.7	24.0	6.9	19.0	16.1
	Maximum	21.9	62.7	33.3	11.6	29.7	13.0	119.3	13.0	24.2	30.8

*PTTW exceedance – a Root-Cause-Analysis under the QMS was completed and the risk of reoccurrence mitigated.

Appendix D: Treated Water Quality Statistics

O. Reg. 170/03 Schedule 23, 13-2b – "Three Year" Results Summary (Jan. 1 – Dec. 31, 2019)

Table 38: O. Reg. 170/03 Schedule 23, 13-2b - "Three Year" Results Summary, 2019

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Antimony	0.014	0.007	24	5	0	< 0.0001	0.00092	0.00065
Arsenic	0.025	0.0125	24	5	0	< 0.0002	0.0043	0.002
Barium	1.0	0.5	24	24	0	0.035	0.11	0.0672
Boron	5.0	2.5	24	24	0	0.014	0.043	0.028
Cadmium	0.005	0.0025	24	5	0	0.00009	0.00013	0.00011
Chromium	0.05	0.025	24	2	0	0.008	0.015	0.0079
Mercury	0.001	0.0005	12	0	0	< 0.0001	< 0.0001	n/a
Selenium	0.01	0.005	24	0	0	< 0.002	< 0.002	n/a
Uranium	0.02	0.01	24	22	0	< 0.00010	0.0017	0.00107

O. Reg. 170/03 Schedule 24, 13-4b – "Three Year" Results Summary (Jan. 1 – Dec. 31, 2019)

Table 39: O. Reg. 170/03 Schedule 24, 13-4b - "Three Year" Results Summary, 2019

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Alachlor	0.005	0.0025	12	0	0	< 0.0005	< 0.0005	n/a
Atrazine + N-dealkylated metabolites	0.005	0.0025	12	0	0	< 0.001	< 0.001	n/a
Azinphos-methyl	0.02	0.01	12	0	0	< 0.002	< 0.002	n/a
Benzene	0.005	0.0025	66	0	0	< 0.0001	< 0.0001	n/a
Benzo(a)pyrene	0.00001	0.000005	12	0	0	< 0.000005	< 0.000005	n/a
Bromoxynil	0.005	0.0025	12	0	0	< 0.0005	< 0.0005	n/a
Carbaryl	0.09	0.045	12	0	0	< 0.005	< 0.005	n/a
Carbofuran	0.09	0.045	12	0	0	< 0.005	< 0.005	n/a
Carbon Tetrachloride	0.005	0.0025	66	0	0	< 0.0001	< 0.0001	n/a
Chlorpyrifos	0.09	0.045	12	0	0	< 0.001	< 0.001	n/a
Diazinon	0.02	0.01	12	0	0	< 0.001	< 0.001	n/a
Dicamba	0.12	0.06	12	0	0	< 0.001	< 0.001	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
1,2-Dichlorobenzene	0.2	0.1	66	0	0	< 0.0002	< 0.0002	n/a
1,4-Dichlorobenzene	0.005	0.0025	66	0	0	< 0.0002	< 0.0002	n/a
1,2-Dichloroethane	0.005	0.0025	66	0	0	< 0.0002	< 0.0002	n/a
1,1-Dichloroethylene	0.014	0.007	66	0	0	< 0.0001	< 0.0001	n/a
Dichloromethane	0.05	0.025	66	0	0	< 0.0005	< 0.0005	n/a
2,4-Dichlorophenol	0.9	0.45	12	0	0	< 0.00025	< 0.00025	n/a
2,4-Dichlorophenoxy-acetic acid (2,4-D)	0.1	0.05	12	0	0	< 0.0001	< 0.0001	n/a
Diclofop-methyl	0.009	0.0045	12	0	0	< 0.0009	< 0.0009	n/a
Dimethoate	0.02	0.01	12	0	0	< 0.0025	< 0.0025	n/a
Diquat	0.07	0.0035	12	0	0	< 0.007	< 0.007	n/a
Diuron	0.15	0.075	12	0	0	< 0.01	< 0.01	n/a
Glyphosate	0.28	0.14	12	0	0	< 0.01	< 0.01	n/a
Malathion	0.19	0.095	12	0	0	< 0.005	< 0.005	n/a
2-Methyl-4-chlorophenoxyacetic acid	0.1	0.05	12	0	0	< 0.00012	< 0.00012	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Metolachlor	0.05	0.025	12	0	0	< 0.0005	< 0.0005	n/a
Metribuzin	0.08	0.04	12	0	0	< 0.005	< 0.005	n/a
Chlorobenzene	0.08	0.04	66	0	0	< 0.0001	< 0.0001	n/a
Paraquat	0.01	0.005	12	0	0	< 0.001	< 0.001	n/a
Pentachlorophenol (PCP)	0.06	0.03	12	0	0	< 0.0005	< 0.0005	n/a
Phorate	0.002	0.001	12	0	0	< 0.0005	< 0.0005	n/a
Picloram	0.19	0.095	12	0	0	< 0.005	< 0.005	n/a
Polychlorinated Biphenyls (PCB)	0.003	0.0015	12	0	0	< 0.00005	< 0.00005	n/a
Prometryn	0.001	0.0005	12	0	0	< 0.00025	< 0.00025	n/a
Simazine	0.01	0.005	12	0	0	< 0.001	< 0.001	n/a
Terbufos	0.001	0.0005	12	0	0	< 0.0005	< 0.0005	n/a
Tetrachloroethylene (PCE)	0.03	0.015	66	0	0	< 0.0001	< 0.0001	n/a
2,3,4,6-Tetrachlorophenol	0.1	0.05	12	0	0	< 0.0005	< 0.0005	n/a
Triallate	0.23	0.115	12	0	0	< 0.001	< 0.001	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Trichloroethylene	0.005	0.0025	66	24	0	< 0.0001	0.00167	0.00046
2,4,6-Trichlorophenol	0.005	0.0025	12	0	0	< 0.0005	< 0.0005	n/a
Trifluralin	0.045	0.0225	12	0	0	< 0.001	< 0.001	n/a
Vinyl Chloride	0.002	0.001	66	0	0	< 0.0002	< 0.0002	n/a

Operational VOC Scan Results Summary (Jan. 1 – Dec. 31, 2020)

Table 40: Operational VOC Scan Results Summary, 2020

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
1,1-Dichloroethane	n/a	n/a	36	0	n/a	< 0.0001	< 0.0001	n/a
1,1-Dichloroethylene	0.014	0.007	37	0	0	< 0.0001	< 0.0001	n/a
1,1,1-Trichloroethane	n/a	n/a	36	0	n/a	< 0.0001	< 0.0001	n/a
1,1,2-Trichloroethane	n/a	n/a	36	0	n/a	< 0.0002	< 0.0002	n/a
1,1,2,2-Tetrachloroethane	n/a	n/a	36	0	n/a	< 0.0001	< 0.0001	n/a
Ethylene Dibromide	n/a	n/a	36	0	n/a	< 0.0002	< 0.0002	n/a
1,2-Dichlorobenzene	0.2	0.1	37	0	0	< 0.0002	< 0.0002	n/a
Cis-1,2-Dichloroethylene	n/a	n/a	36	10	n/a	< 0.0001	0.00418	0.0014
Trans-1,2-Dichloroethylene	n/a	n/a	36	0	n/a	< 0.0001	< 0.0001	n/a
1,2-Dichloropropane	n/a	n/a	36	0	n/a	< 0.0001	< 0.0001	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
1,3-Dichlorobenzene	n/a	n/a	36	0	n/a	< 0.0002	< 0.0002	n/a
1,4-Dichlorobenzene	0.005	0.0025	37	0	0	< 0.0002	< 0.0002	n/a
Acetone	n/a	n/a	36	0	n/a	< 0. 01	< 0. 01	n/a
Benzene	0.005	0.0025	37	0	0	< 0.0001	< 0.0001	n/a
Bromodichloromethane	0.1	0.05	36	34	0	< 0.0001	0.0105	0.00305
Bromoform	0.1	0.05	36	36	0	< 0.0002	0.0049	0.00097
Carbon Tetrachloride	0.005	0.0025	37	0	0	< 0.0001	< 0.0001	n/a
Chloroethane	n/a	n/a	36	0	n/a	< 0.0002	< 0.0002	n/a
Chloroform	0.1	0.05	36	32	0	< 0.0001	0.0102	0.00288
Dibromochloromethane	0.1	0.05	36	36	0	0.00034	0.0105	0.00340
Dichloromethane	0.05	0.025	37	0	0	< 0.0005	< 0.0005	n/a
Ethylbenzene	0.0024	n/a	37	0	0	< 0.0001	< 0.0001	n/a

Parameter	ODWQS MAC mg/L	½ MAC mg/L	Total Samples	Samples Above MDL	# Above ODWQS Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Methyl Ethyl Ketone	n/a	n/a	36	0	n/a	< 0.0005	< 0.0005	n/a
Styrene	n/a	n/a	36	0	n/a	< 0.0002	< 0.0002	n/a
Tetrachloroethylene (PCE)	0.03	0.015	37	2	0	< 0.0001	0.00011	n/a
Tolulene	0.024	n/a	37	0	0	< 0.0002	< 0.0002	n/a
Trichloroethylene	0.005	0.0025	37	10	0	< 0.0001	0.00042	0.00028
Trichlorofluoromethane	n/a	n/a	36	0	0	< 0.0002	< 0.0002	n/a
Vinyl Chloride	n/a	n/a	37	0	0	< 0.0002	< 0.0002	n/a
o-Xylene	n/a	n/a	37	0	0	< 0.0001	< 0.0001	n/a
m- + p- Xylene	n/a	n/a	37	0	0	< 0.0001	< 0.0001	n/a
Total Xylene	0.09	n/a	36	0	0	< 0.0001	< 0.0001	n/a
Trihalomethanes	0.100	n/a	36	36	0	0.00063	0.0314	0.0098

General Chemistry Results Summary (Jan. 1 – Dec. 31, 2020)

Table 41: General Chemistry Results Summary, 2020

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Aluminum	n/a	n/a	0.1	18	0	0	< 0.005	< 0.005	n/a
Alkalinity (as $CaCO_3$)	n/a	n/a	30-500	18	18	0	250	360	289
Ammonia-N	n/a	n/a	n/a	18	4	n/a	< 0.05	0.23	0.108
Anion Sum	n/a	n/a	n/a	18	18	n/a	7.14[30]	17.1[29]	11.47[29]
Antimony	0.014	n/a	n/a	18	5	0	<0.0005	0.00096	0.00074
Arsenic	0.025	n/a	n/a	18	2	0	<0.001	0.0012	0.0012
Barium	1.0	n/a	n/a	18	18	0	0.027	0.11	0.062
Beryllium	n/a	n/a	n/a	18	0	n/a	<0.0005	<0.0005	n/a
Boron	5.0	n/a	n/a	18	12	0	<0.01	0.047	0.028
Cadmium	0.005	n/a	n/a	18	7	0	0.00009	0.00015	0.00011
Calcium	n/a	n/a	n/a	18	18	n/a	83	160	114.1
Cation Sum	n/a	n/a	n/a	18	18	n/a	7.20[29]	18.0[29]	11.75[29]

[30] Units in Milliequivalents Per Litre (mEq/L)

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Chloride	n/a	250	n/a	18	18	0	33	330	131
Chromium	0.05	n/a	n/a	18	0	0	<0.0005	0.0005	n/a
Cobalt	n/a	n/a	n/a	18	6	n/a	<0.0005	0.0022	0.00156
Copper	n/a	1	n/a	18	9	0	< 0.0009	0.0053	0.00221
Dissolved Organic Carbon (DOC)	n/a	5	n/a	18	18	0	0.59	2.4	1.19
Hardness (Calculated as $CaCO_3$)	n/a	n/a	80-100	18	18	18	320	580	426
Ion Balance (% difference)	n/a	n/a	n/a	18	18	n/a	0.02[31]	4.84[30]	1.198[30]
Iron	n/a	0.3	n/a	30	15	0	0.078	0.25	0.124
Langalier's Index at 4°C	n/a	n/a	n/a	18	18	n/a	0.505[32]	0.849[31]	0.696[31]
Langalier's Index at 20°C	n/a	n/a	n/a	18	18	n/a	0.752[31]	1.10[31]	0.944[31]
Lead	0.01	n/a	n/a	18	2	0	<0.00050	0.00065	0.00058

[31] Units in %

[32] Units in Langalier's Index

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Magnesium	n/a	n/a	n/a	18	18	n/a	26	51	34.167
Manganese	n/a	0.05	n/a	30	22	0	<0.0020	0.0556	0.0325
Molybdenum	n/a	n/a	n/a	18	15	n/a	<0.0005	0.0041	0.00174
Nickel	n/a	n/a	n/a	18	15	n/a	<0.001	0.011	0.0053
o-Phosphate	n/a	n/a	n/a	18	0	n/a	<0.01	<0.01	n/a
pH	n/a	n/a	6.5-8.5	30	30	0	7.33	8.11	7.73
Phosphorus	n/a	n/a	n/a	18	0	n/a	<0.1	<0.1	n/a
Potassium	n/a	n/a	n/a	18	18	n/a	1.3	2.9	2.033
Saturation pH at 4°C	n/a	n/a	n/a	18	18	n/a	7.09	7.32	7.23
Saturation pH at 20°C	n/a	n/a	n/a	18	18	n/a	6.84	7.07	6.98
Selenium	0.01	n/a	n/a	18	0	0	<0.002	<0.002	n/a
Silicon	n/a	n/a	n/a	18	18	n/a	3.2	7.3	4.8
Silver	n/a	n/a	n/a	18	0	n/a	<0.00009	<0.00009	n/a
Sodium	n/a	20 and 200	n/a	18	18	16	18	160	73
Strontium	n/a	n/a	n/a	18	18	n/a	0.130	6.1	2.149
Sulphate	n/a	550	n/a	18	18	0	20	210	92

Parameter	ODWQS MAC	ODWQS AO	ODWQS OG	Total Samples	Samples Above MDL	# Above Criteria	Min (mg/L)	Max (mg/L)	Average (mg/L)
Thallium	n/a	n/a	n/a	18	7	n/a	<0.00005	0.000081	0.000064
Titanium	n/a	n/a	n/a	18	0	n/a	<0.005	<0.005	n/a
Total Dissolved Solids	n/a	n/a	n/a	18	18	n/a	370	960	636
Uranium	0.02	n/a	n/a	18	17	0	<0.0001	0.0017	0.00095
Vanadium	n/a	n/a	n/a	18	0	n/a	<0.0005	<0.0005	n/a
Zinc	n/a	5	n/a	18	17	0	<0.005	0.22	0.1003

Appendix E: Legal and Other Requirements Table

Table 42: Legal and Other Updates that Could Affect the Drinking Water System or the Quality Management System, 2020

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Jan. 2	Environ-mental Registry of Ontario (ERO)	A decision was made to proceed with the amendments to the Wells Regulation. The amending regulation was filed with the Registrar of Regulations on December 19, 2019 and came into force on January 1, 2020.	Notice sent to Water Compliance Specialist, Hydrogeologist and Supervisor of Water Treatment.
Jan. 2	ERO	The Ministry of the Environment, Conservation and Parks (MECP) is delivering their Made-in-Ontario Environment Plan commitment to hold polluters accountable by moving forward with the use of administrative monetary penalties. The changes will introduce, expand and/or clarify the government's authority to issue penalties for environmental contraventions under the Nutrient Management Act, Ontario Water Resources Act, Pesticides Act and the Safe Drinking Water Act.	Notice sent to the Water Services Management Team.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Jan. 2	ERO	A proposal to amend the Environmental Compliance Approval for Owens Corning Composite Materials Canada GP Inc. was submitted to the ERO.	Notice sent to the Division Manager and the Health and Safety Specialist for information.
Jan. 18	CBC	Residents in Shannon Quebec are eligible for compensation for a water contamination that some say gave them deadly cancer. Trichloroethylene (TCE) was discovered to have leached into the drinking water supply in 1997.	News story sent to the Water Services Management Team and Water Compliance Specialist for information.
Feb. 11	MECP	A newly created Municipal Water and Wastewater Section within the Environmental Permissions Branch is dedicated to serving the permissions needs in the area of drinking water, wastewater and stormwater.	Manager of Technical Services forwarded the posting to the Quality Management Specialist and the Water Compliance Specialist.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Feb. 11	Ontario Water Works Association (OWWA)	The MECP is updating the list of operational duties found in Ministry guides to help clarify what is considered operating functions. A survey was circulated through the OWWA to get feedback from municipalities.	Manager of Technical Services forwarded the survey to the Water Certification Specialist, Water Compliance Specialist and the Quality Management Specialist.
Feb. 12	ERO	The Ministry of Natural Resources and Forestry has posted proposed amendments to Ontario Regulation 244/97 and the Aggregate Resources of Ontario Provincial Standards under the Aggregate Resources Act.	Notice sent to Manager of Technical Services, Source Water Protection Program Manager and Water Supply Program Manger.
Feb. 12	Orangeville .com	Council for the Town of Orangeville has approved a new water rate structure where a higher cost per cubic meter of water used will kick in once customers reach a monthly consumption rate of 20 cubic meters, in place of the existing threshold of 50 cubic meters.	News story forwarded to the Division Manager, Manager of Technical Services and the Supervisor of Water Efficiency for information.
Feb. 20	Guelph.ca	Proposed solution to address City's concerns with Dolime Quarry goes to Committee of the Whole on March 2.	No further action required.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Mar. 4	Guelph.ca	All water meters installed for new construction within the City of Guelph shall be inspected by Building Services.	No further action required.
Mar. 10	Guelph.ca	The City expands Blue Built Home program to include units in new multi-residential buildings.	No further action required.
Mar. 24	E-laws	The Emergency Management and Civil Protection Act was updated today to include O. Reg. 75/20, which speaks to Drinking Water Systems and Sewage Works during the Provincial Emergency declaration.	New regulation sent to the Water Services Management Team.
Mar. 29	Ministry of Labour	The Ministry of Labour has release a Guideline for Construction site health and safety during COVID-19.	Guideline sent to the Health and Safety Specialist.
Apr. 7	Canadian Gazette	Health Canada, in collaboration with the Federal-Provincial-Territorial Committee on Drinking Water, is proposing to withdraw the existing Guidelines for Canadian Drinking Water Quality (GCDWQ) for 18 chemical substances, including 14 pesticides, as it was determined that GCDWQ are no longer required since these contaminants are unlikely to be found in Canadian drinking water at levels that may pose a risk to human health.	Notice sent to the Water Compliance Specialist, the Manager of Technical Services and the Supervisor of Water Treatment.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Apr. 23	ERO	Species-specific policies (government response statements) have been finalized outlining actions to protect and recover eight Species at Risk in Ontario.	Notice sent to the Manager of Technical Services and Water Services Project Managers.
Apr. 28	ERO	An application has been submitted for a Permit to Take Water for construction dewatering purposes at 19 and 59 Lowes Road West, Guelph.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services for information.
May 29	ERO	The province is proposing government response statements that outline actions the government is taking and supports to protect and recover nine Species at Risk in Ontario.	Notice sent to Water Services' Project Managers and the Manager of Technical Services.
June 1	Health Canada	The following documents have been updated: Final guideline for Canadian drinking water quality for barium Final guideline for Canadian drinking water quality for chloramines Final guideline for Canadian drinking water quality for Escherichia coli	Guidelines sent to the Water Compliance Specialist, Operations Manager and Supervisor of Water Treatment.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
June 5	ERO	Approval to further protect sources of drinking water in the Grand River Source Protection Area The amended assessment report and source protection plan for the Grand River Source Protection area has been approved in accordance with section 34 of the Clean Water Act, 2006. The amendments update the water quality protection zones around 28 municipal residential drinking water systems, and include some new policies and revisions to previous policies to further protect drinking water sources.	Notice sent to the Management Team, Source Water Protection Program Manager, Hydrogeologist, Water Supply Program Manager, and Water Compliance Specialist.
June 18	MECP Email	Updating Ontario's Water Quantity Management Framework The Ontario government is seeking public input on its water quantity management proposal. The proposal aims to protect the long-term sustainability of surface water and groundwater and ensure these important resources are responsibly managed and safeguarded now and into the future, as committed in the province's Made-in-Ontario Environment Plan. The proposal would also give municipalities a greater say in allowing companies to withdraw groundwater in their communities for bottled water.	Notice sent to the Water Services Management Team, the Water Compliance Specialist, Hydrogeologist, Source Water Protection Program Manager and Water Supply Program Manager.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
June 19	ERO	Discussion paper on modernizing hazardous waste reporting in Ontario Proposed changes to Regulation 347, the Registration Guidance Manual for Generators of Liquid Industrial and Hazardous Waste and recommendations on a new regulation under the Resource Recovery and Circular Economy Act.	Notice sent to the Water Services Management Team, Technicians, Hydrogeologist and Water Compliance Specialist.
June 20	Canada Gazette	Final guideline for Canadian drinking water quality for total coliforms Pursuant to subsection 55(3) of the Canadian Environmental Protection Act, 1999, the Minister of Health hereby gives notice of a final guideline for Canadian drinking water quality for total coliforms. The technical document for this guideline is available on the Water Quality website. This document underwent a public consultation period of 60 days in 2019 and was updated to take into consideration the comments received.	Notice sent to the Water Services Management Team, Water Compliance Specialist and Water Treatment Technicians.
June 26	Canada Gazette	Guidance on the use of Enterococci as an Indicator in Canadian Drinking Water Supplies Pursuant to subsection 55(3) of the Canadian Environmental Protection Act, 1999, the Minister of Health hereby gives notice of the Final Drinking Water Guidance on Enterococci as an Indicator in Canadian Drinking Water Supplies.	Notice sent to the Water Compliance Specialist, the Manager of Operations and Water Treatment Technicians.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
July 3	Canada Gazette	Pursuant to subsection 55(3) of the Canadian Environmental Protection Act, 1999, the Minister of Health hereby gives notice of a proposed Guideline for Canadian Drinking Water Quality for Diquat. A maximum acceptable concentration (MAC) of 0.05 mg/L (50 µg/L) is proposed for diquat (measured as the cation) in drinking water.	Notice sent to the Water Services Managers, Water Compliance Specialist and Water Treatment Technicians.
July 8	ERO	Proposed Environmental Assessment Act amendments in the COVID 19 – Economic Recovery Act These amendments will enable next steps in modernizing Ontario's environmental assessment program, helping to ensure strong environmental oversight while getting critical infrastructure projects off the ground quicker.	Notice sent to the Project Managers, Hydrogeologist, Program Managers, Water Compliance Specialist and the Water Services Management Team.
July 17	Canada Gazette	Health Canada has issued a proposed Guidance on Monitoring the Biological Stability of Drinking Water in Distribution Systems. The proposed guideline is available from July 17, 2020 to October 16, 2020.	Notice sent to the Water Compliance Specialist, Manager of Operations and Distribution Supervisors.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
July 17	EBR	The MECP **did not** adopt the following Canadian Water Quality Guidelines as a Provincial Water Quality Objectives: Cadmium Arsenic Nitrate Ion Sulfolane Methoprene Mercury or Methylmercury Diisopropanolamine Further, the MECP **did not** adopt Health Canada's guidance document Corrosion Control in Drinking Water Distribution Systems.	Notice sent to the Water Compliance Specialist and the Water Treatment Technicians.
July 25	Canada Gazette	Health Canada has issued a Final Guidance on Natural Organic Matter in Drinking Water. The intent of this document is to provide provinces, territories, other government departments and stakeholders (such as water system owners, consultants, equipment suppliers and laboratories) with guidance on the impacts of NOM on the overall quality of drinking water, including its potential effects on drinking water treatment processes and consequently on the safety of drinking water.	Notice sent to the Water Compliance Specialist, Manager of Operations and Water Operations Technicians.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Aug. 7	Canada Gazette	Proposed guideline technical document for 2,4- Dichlorophenoxyacetic Acid (2,4-D) in drinking water.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services, Division Manager and Compliance Specialist for information.
Aug. 11	ERO	Proposed amendments to the Director's Technical Rules made under section 107 of the Clean Water Act, 2006 We are proposing updates to the technical rules for assessing source water protection vulnerability and risk under the Clean Water Act to ensure that the quality of Ontario's drinking water continues to be protected and that source protection efforts are supported by current science.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services, Division Manager and Compliance Specialist for information.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Aug. 14	Ontario News	Ontario Launches First-Ever Climate Change Impact Assessment Toronto — The Ontario government has selected a consulting team led by the Climate Risk Institute to conduct the province's first-ever multi-sector climate change impact assessment. The study will use the best science and information to better understand where and how climate change is likely to affect communities, critical infrastructure, economies and the natural environment, while helping to strengthen the province's resilience to the impacts of climate change.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services, Division Manager and Compliance Specialist for information.
Aug. 18	ERO	Environmental assessment modernization: amendment proposals for Class Environmental Assessments We are modernizing the environmental assessment program by working with proponents of Class Environmental Assessments (Class EA) to propose changes that would ensure strong environmental oversight, while aligning assessment requirements with environmental impact, reducing duplication and increasing efficiency of the Class EA process.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services and Division Manager for information.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Aug. 28	ERO	Proposal to extend the current moratorium on water bottling permits We are proposing to extend the current moratorium on new or increased permits to take groundwater to produce bottled water for up to 6 months, to April 1, 2021.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services and Division Manager for information.
Sept. 2	ERO	University of Guelph - Permit to take water This proposal is to renew Permit To Take Water No. 3347-84VQV5 for aquaculture purposes for the University of Guelph. Water will be taken from six (6) wells to operate the Alma Aquaculture Research Station located on a land legally described as Lot 3, Concession 5, in Centre Wellington, Ontario.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services for information.
Sept. 9	ERO	Suncor Energy Inc. - Certificate of property use A Certificate of Property Use was issued to Suncor Energy Inc. and Suncor Energy Products Partnership for the property located at 288 and 290 Woolwich Street, Guelph, Ontario.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services for information.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Sept. 16	ERO	Proposal for a new Permit to Take Water to be issued to Reid's Heritage Homes Ltd. for construction dewatering purposes at 19 to 59 Lowes Road West, in the City of Guelph. A decision for this proposal has been published as a Bulletin under ERO 019-2428 on September 16, 2020.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services for information.
Sept. 21	ERO	Polymer Distribution Inc. Guelph. Decision on ECA (waste). Issued an approval for an increase in the daily receiving rate and site storage limit, from 400 to 600 cubic metres, for an existing liquid industrial and hazardous waste transfer site located in Guelph, Ontario.	Notice sent to the Hydrogeologist, Water Supply Program Manager, Risk Management Official and the Manager of Technical Services for information.
Oct. 13	Ontario News	Worker Struck by Exploding Cap, $70,000 Fine for City of London	Notice sent to the Health & Safety Specialist and the Management Team for information.
Oct. 17	Ontario Gazette	Section 7 of Ontario Regulation 463/16 is amended by striking out "October 1, 2020" at the end and substituting "April 1, 2021".	No action required.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Oct. 24	Canada Gazette	Pursuant to subsection 55(3) of the Canadian Environmental Protection Act, 1999, the Minister of Health hereby gives notice of proposed guidelines for dicamba in drinking water. A maximum acceptable concentration (MAC) of 0.11 mg/L (110 µg/L) is proposed for dicamba in drinking water.	Notice sent to the Water Compliance Specialist.
Nov. 5	ERO	The MECP is amending the Conservation Authorities Act to improve transparency and consistency in conservation authority operations, strengthen municipal and provincial oversight and streamline conservation authority roles in permitting and land use planning.	Forwarded to Source Water Protection Program Manager, Technical Services Coordinator and Hydrogeologist for information.
Nov. 13	Ontario News	Water Treatment Operator fined $30,000 for Safe Drinking Water Act Violation Drinking Water System Owner fined $9,000 for Safe Drinking Water Act Violations	Forwarded to all Water Services staff for information.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Dec. 8	MECP Email	Proposed Implementation of Updates to Ontario's Water Quantity Management Framework We're seeking input on draft guidance to help manage water taking in areas where water quantity is a concern and where there are competing demands for water. We are also proposing to revoke the interim guidance once updates to Ontario's water taking program are in place, aligned with the end of the bottled water moratorium on April 1, 2021.	Notice sent to Water Services Management, Source Water Protection Program Manager, Hydrogeologist and Water Supply Program Manager.
Dec. 14	MECP Email	The Ministry is proposing administrative updates to the Director's Directions – Minimum Requirements for Operational Plans. The Director's Directions govern the minimum requirements for preparation and content of operational plans that are developed for municipal residential drinking water systems.	Notice sent to Water Services Management and the Water Compliance Specialist.
Dec. 16	Ontario News	Ontario announces working group to better focus Conservation Authorities. Input will lead to improved conservation and protection of the province's water, land and natural resources.	Notice sent to Source Water Protection Program Manager, Hydrogeologist, Water Supply Program Manger, Manager of Technical Services and Supervisor of Water Efficiency.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Dec. 18	ERO	Proposal to require municipal support for new or increased bottled water takings The Ontario Government is moving forward with changes to the Ontario Water Resources Act to require water bottling companies to have the support of their local host municipality for a new or increased groundwater taking in their community.	Notice sent to Water Services Management Team, the Water Compliance Specialist, Hydrogeologist, Source Water Protection Program Manager and Water Supply Program Manager.
Dec. 21	MECP Email	The Minister of the Environment, Conservation and Parks has released their 2020 annual report on the work Ontario is doing to protect our drinking water and water resources in the province. Today, the ministry also released the Chief Drinking Water Inspector's Annual Report, which provides an overview of the ministry's progress during 2019-20 and includes in-depth information on the performance of Ontario's drinking water systems and licensed laboratories.	Email send to all of Water Services for information.
Dec. 21	ERO	Extending Grandfathering for Infrastructure Projects and Providing Additional Flexibility for Excess Soil Reuse The MECP has amended several regulations related to excess soil under the Environmental Protection Act, and related documents.	Posting sent to Water Services Management Team, Water Compliance Specialist, Project Managers and Hydrogeologist.

Date - 2020	Source	Title of Legal & Other Requirement Highlights of posting	Action and Status Update
Dec. 31	ERO	Permit to Take Water Proposal This proposal is to amend Permit to Take Water No. 5500-BQTPGN for the addition of a source of water taking for dewatering purposes. Water will be taken from two wells related to construction activities, located in the City of Guelph, County of Wellington, Ontario.	Proposal sent to Water Supply Program Manager, Hydrogeologist, Source Water Protection Program Manager, Division Manager and Manager of Technical Services.

Appendix F: Action Items from Management Review

Table 43: Action Items from the 2020 (Items 1-5) and 2021 (Items 6-9) Management Review Meetings

Item #	Status	Description
1	CIR #1089 Closed: 2020-05-25	Investigate using J-Plugs on the drop tubes in the production wells.
2	CIR #1090 Closed: 2020-11-10	Consider adding water loss data to the Annual and Summary Report for 2020.
3	CIR #1091 Closed: 2020-11-10	Perform additional analysis on the frozen services program, specifically the running tap program, and how it relates to water consumption and water production.
4	CIR #1092 Closed: 2020-05-26	Look at adding a line for performance testing to Table 6 for next year's annual report.
5	CIR #1093 Closed: 2020-06-03	Have the SCADA group provide C3 Water with copies of facility P&ID, PFD and equipment layout drawings so that the hydraulic model can be adjusted to take into account pipe friction factors within treatment facilities.
6	CIR #1206	Conduct a debrief of the pandemic in 2021 to determine if any improvements can be made in our emergency response planning. In this, look at the other division's pandemic response.
7	CIR #1207 Closed: 2021-01-18	Add Pandemic to Table 2.

Item #	Status	Description
8	CIR #1208 Closed: 2021-01-22	Include a Table for Form 1s, 2s, and 3s (with Engineering) to describe any modifications or additions to the drinking water system.
9	CIR #1209	Investigate whether customer complaints can be mapped in GIS to facilitate tracking of issues (for example, water quality calls).

Appendix G: Status of Management Action Items Identified between Reviews

Action items identified through best management practices, emergency debriefs, external audits, internal audits, and root-cause analysis meetings are described below.

Table 44: Management Action Items Identified Between Management Review Meetings, 2020

Item #	Status	Description
		Best Management Practices Action Items
1	CIR #1170	Consider keeping a 72-hour food kit in the emergency cabinet, similar to what Dufferin County Emergency Management does. (Stock-pile of non-perishable food - kept to close to expiry then donated to food bank.)
2	CIR #1106 Closed: 2020-03-24	It is recommended that this inspection (University Well) be set as a priority in 2020 due to the fact that this well is located in the Water Street Wellfield, the well pump has had to be replaced twice since 2004 and it is an older drilled well (drilled in 1965 and lined in 2003 due to cascading and aerated water which was causing problems with the operation and damage to the pump).

Item #	Status	Description
3	CIR #1105 Closed: 2020-05-26	It is recommended that during the University Station upgrades, the City consider adding a chlorine residual sampling point at the end of the contact chamber, similar to the set up at the Paisley Station. If possible, a treated water sampling point should also be considered before any University Well water is mixed with distribution water. A treated water tap located closer to where CT is achieved and before it is mixed with distribution water would be a much more representative microbiological treated water sample than its current location. This would also eliminate the need to have regulatory relief from taking treated water chemical sampling in lieu of taking raw chemical sampling in the MDWL.
4	CIR # 1104 Closed: 2020-06-03	It is recommended that during the next MDWL amendment, the City should request that this table clearly indicate that the sampling is not required if the UV system is not in operation.
5	CIR #1103 Closed: 2020-05-26	It is recommended that the City develop a procedure for operators to check the gaskets and seals on the hatches on a regular basis to ensure they are completely covered and watertight to prevent contamination from entering the chamber.
		Emergency Debrief Action Items
1	CIR #1188 Closed: 2021-02-01	To ensure the security of our facilities, add a security section (checking locks, skylights, etc.) to the commissioning plan and the Project Management Process Map.
2	CIR #1187	Look at getting temporary signs made up for the spring grounds (trails closed, property closed, etc.).
3	CIR #1186 Closed: 2021-01-26	Determine if any further tree work needs to be done along the hydro corridor in the spring grounds.

Item #	Status	Description
4	CIR #1185	Look at the draw line for the sample pump at the Glen Diversion Chamber to see if it can be adjusted so the pump doesn't lose prime as often during power flickers or outages.
5	CIR #1184	Contact City's Emergency Coordinator and Hydro One to determine if a better line of communication can be established between Water Services and Hydro One. Further, discuss what notifications (e.g. timelines for response from hydro) can be done during an outage.
6	CIR #1183	Investigate the feasibility of having remote access to SCADA for Operators (bringing a laptop home). Have a follow-up meeting to discuss this further.
7	CIR #1182	Add calculated run time based on load to the SCADA screens for the generators.
8	CIR #1181	Install fuel level transmitters for the generators.
9	CIR #1164 Closed: 2020-06-03	Review the risk of the dump trucks from the gravel pit driving over the aqueduct.
10	CIR #1163 Closed: 2020-05-26	The T-SOP Aqueduct Diversion and Elevated Turbidity Response needs to be reviewed and updated. As part of this review and update, a section on starting the UV system after a diversion needs to be created. How to calculate how much head pressure is needed in the aqueduct for the UV to start and add this to the SOP. Or start the UV reactor in manual so it doesn't go off on low flow.
11	CIR #1162	Locate the forth lateral and decommission it. This could be verified at the time of remote camera work and plugged from the inside. If it can't be found, in the interim, the general area should be fenced off to protect it from being damaged.

Item #	Status	Description
		External Audit Action Items
1	CIR #1197 Closed: 2021-01-05	The Operational Plan shall: a) identify all supplies and services essential for the delivery of safe drinking water and shall state, for each supply or service, the means to ensure its procurement b) Include a procedure by which the Operating Authority ensures the quality of essential supplies and services… There is no evidence available to demonstrate that stated quality requirements are consistently confirmed for all service providers who are not under formal contract with the City. E.g. Misco (Verney Tower inspection)
2	CIR #1196 Closed: 2021-01-05	The Operational Plan shall document a procedure for communications that describes how the relevant aspects of the Quality Management System are communicated between Top Management and: ...c) Suppliers that have been identified as essential... Also City of Guelph Operational Plan QMS 12 Communications (Rev. 2020-03-10): 3. Communication to and from Suppliers 3.1 Communication to Suppliers is done through Top Management, staff and Purchasing Department personnel through the issuance of tenders, contracts, purchase orders or directly with suppliers 1. There is no evidence available to demonstrate that relevant aspects of the Quality Management System are consistently communicated between Top Management and suppliers that have been identified as essential, e.g. suppliers not under formal contracts with the City. 2. There is no evidence available to demonstrate that City of Guelph Purchase Orders consistently reference AWWA and ANSI quality and safety criteria.

Item #	Status	Description
3	CIR #1205	Training / competency processes were found to be effectively implemented. Consideration could be given to tracking completion of assigned training within the training database, e.g. mandatory DWQMS course.
4	CIR #1204	Consideration could be given to: expanding scope of D-WI Services - No Water Calls to include other customer concerns, e.g. discoloured water.
5	CIR #1203	Consideration could be given to: clarifying use of worksheets (D-SOP Mains Flushing).
6	CIR #1202	Consideration could be given to: developing a mechanism for electronically signing documents.
7	CIR #1201	Consideration could be given to: implementing a consistent format for SOPs, e.g. if section is not applicable, state N/A (hazards, reference documents, etc.).
8	CIR #1200 Closed: 2021-01-26	Consideration could be given to: clarifying flow of records relating to quarterly colorimeter verifications at treatment facilities (WS-SOP Calibration / Verification of Handheld Colorimeters).
9	CIR #1199 Closed: 2021-01-26	Consideration could be given to: consistently updating 'bench mark' template in CMMS when instrument calibration / verification month changes.
10	CIR #1198	Consideration could be given to: reviewing calibration history / frequency when 'as found' condition is out of tolerance.

Item #	Status	Description
		Internal Audit Action Items
1	CIR #1088 Closed: 2020-01-23	A procedure needs to be developed to determine how to deal with a situation where a backflow device failed or a backflow event occurred. Who would be informed, what information would be required, how best to respond to the situation.
2	CIR #1128	An opportunity exists to ensure that contractors and other service providers working for Water Services complete the Corporate Health and Safety Training Program for Contractors. In this, we could include a slide (or more) about the QMS and our quality requirements.
3	CIR #1127 Closed: 2020-05-08	An opportunity exists to update the Element 19 section of the Operational Plan to include the audit finding process done by the Internal Audit Team.
4	CIR #1126 Closed: 2020-07-27	An opportunity exists to re-evaluate the min/max system used in maintenance, including the number of critical parts or equipment kept on site and the process for communicating when parts or equipment are used.
5	CIR #1125 Closed: 2020-07-28	Establish a Form 2 process to satisfy requirements under 4.1.2 and 4.1.3 in our DWWP. This could be incorporated into the "Accounting for Minor Modifications and Replacements in the DWS" work flow document.
6	CIR #1124 Closed: 2020-06-3	There is a strong knowledge of critical supplies and inventory. It is recommended that a formal inventory, including a min/max system, be created with location of where supplies are stored or where they can be sourced for SCADA.

Item #	Status	Description
7	CIR #1123 Closed: 2020-10-05	Information in the training database appears to need some updating. For example, the supervisor identified for one of the Distribution Operators was no longer accurate. There is a need for a process for updating information based on updates to the organizational structure, which may affect how reports are generated and communicated to supervisors regarding their employee's certification.
8	CIR #1122 Closed: 2020-10-05	When a renewal application is submitted, the entire package submitted including all supporting certificates and fax confirmation should be scanned, entered into the database AND sent to the Operator for their reference as well. This will provide confirmation to the Operator when paperwork was submitted and what was submitted in the event there is an issue with the application.
9	CIR #1121	The training database is a great tool and can create reports for each operator or by group. It would be beneficial for regular reports (i.e. at the end of each quarter) to be generated for each Operator and Supervisor so they are aware of training hours obtained and planned. This would also allow Operators to validate that the Certification Specialist has a copy of all training certificates and the information is accurate.
10	CIR #1120 Closed: 2020-06-03	An opportunity exists to include the QMS 10 On-the-Job Training forms with the annual SOP review process tracked by the Technicians to ensure these are annually reviewed and updated.
11	CIR #1119 Closed: 2020-11-16	Consideration could be given to putting a Water Quality Poster in the meter shop to promote knowledge and awareness of the policy.

Item #	Status	Description
12	CIR #1118 Closed: 2020-10-23	As identified in the 2019 External Audit, clarification of the process of dealing with continual improvement items past a certain date needs to be determined to avoid a potential non-conformance. An opportunity exists to report old CIRs to managers for them to follow up with their Supervisors. Perhaps this could be tied to PDP requirements.
13	CIR #1117 Closed: 2020-06-03	An opportunity exists to better inform staff of the continual improvement items that have been closed. This could be accomplished by ensuring they are put on the QMS Board and communicated that they have been updated in the full staff meeting, or by emailing a report from the database of all closed items to all staff.
14	CIR #1116	Distribution Staff need clarification/training on the Priority Customer process. It is unclear who is responsible for notifying priority customers and what happens during day-to-day work.
15	CIR #1115	An opportunity exists to consider using a logbook to compliment the daily summary email to track flushing and swabbing activities. It would be beneficial for future reference to have all flushing and swabbing activities documented in one place. This could be customized like the on-call logbook. Consideration could also be given to sending the daily summary email to the administration team so they are better prepared to handle incoming calls.
16	CIR #1114	Consolidate work instructions into Compliance Handbook and upload to EDMS.
17	CIR #1113 Closed: 2020-05-26	Consideration could be given to changing the title of the RD – Ensuring Adequate Equipment and Supplies to Deal with Emergencies to something more meaningful (Emergency Contact List, or similar) so that staff have an easier time finding it.

Item #	Status	Description
18	CIR #1112	An opportunity exists to define the procedure to ensure that emergency staff contact information is kept updated, including who is responsible for maintaining and updating the list and at what frequency, as well as who has access to the information. Consider adding the preferred after hours phone number for staff, for example personal cell phones instead of City cell phones.
19	CIR #1111	An opportunity exists to communicate to staff about the emergency sheds and their purpose. A spot audit has been done of the shed at the Secondary Muster Point and it was determined that it has not been stocked with essential supplies. The emergency shed at the Primary Muster Point is inaccessible due to snow being piled around it. These sheds should be clearly marked as Emergency Sheds.
20	CIR #1110 Closed: 2020-11-23	An opportunity exists to check the emergency sheds located at each muster point at Water Services for essential supplies needed during an evacuation. This should be added to the monthly Health and Safety inspection checklist.
21	CIR #1109 Closed: 2020-10-23	Communications at Water Services is generally good. An opportunity exists to keep staff better informed of emergencies/issues happening at Water Services. Consideration could be given to sending the Incident Notification Form to all staff. Staff are often notified of issues through news releases; mainbreaks for example.
22	CIR #1108 Closed: 2020-05-26	An opportunity exists for Technicians to review EDMS for old out of date documents that can be archived/expired.

Item #	Status	Description
23	CIR # 1107 Closed: 2020-05-08	Investigate whether EDMS can "tag" a document to appear during keyword searches for words that don't appear in the title. For example, staff trying to search for "Emergency Contacts" instead of "Ensuring Adequate Equipment and Materials to deal with Emergencies."
		Root-Cause Analysis Action Items
1	CIR #1094 Closed: 2020-05-26	Review and revise Inspection Checklist for clarity.
2	CIR #1095 Closed: 2020-10-06	Conduct a training session for Treatment staff on how to properly inspect hatches and what to look for. Include in this a site visit to a well house and complete a hands-on inspection."
3	CIR #1096 Closed: 2020-10-06	Ensure that we are purchasing the proper weather stripping and caulking for hatches (industrial grade, NSF certified, etc.). Ensure staff are properly trained on how to properly apply these materials.
4	CIR #1097 Closed: 2020-04-02	Isolate the dead-end section of the watermain that the AWQI occurred in from the distribution system. As per the Watermain Disinfection Procedure, the watermain will have to be flushed and a bacti sample taken to confirm water quality prior to recommissioning that watermain.
5	CIR #1098 Closed: 2020-11-17	Add a line item to the Commissioning Plan (checklist) to identify any dead-ends created as part of the new construction process (until services are connected), or isolate that section of watermain.
6	CIR #1099 Closed: 2020-11-17	Ensure that the Commissioning Plan Checklist is a controlled document and filed in EDMS.

Item #	Status	Description
7	CIR #1100 Closed: 2020-03-19	Create a project management checklist that includes completing a Form 1. Consideration should be given to the review process of the checklist.
8	CIR #1101 Closed: 2020-11-18	Review the Form 1 process at Water Services. The Form 1 could be reviewed by the ORO. Determine who is the Owner Representative (who signs the form). Create a SOP for this process.
9	CIR #1102	Create a checklist for the Inspectors to ensure everything is in place before a project moves forward before construction starts.
10	CIR #1156 Closed: 2020-08-28	All of the QMS 10 forms need to be reviewed and updated - Treatment, Distribution, Admin, Meters, Locates.
11	CIR #1157 Closed: 2020-08-14	Review and sign off on the updated QMS 10 forms to ensure that they are meeting the Standard.
12	CIR #1158 Closed: 2020-11-06	It needs to be determined who will own the process (QMS 10 forms) - who will ensure that these forms are filled out and filed.
13	CIR #1166	Update/Create a Form 2 process (WI) to assess if the work will impact Water Quality.
14	CIR #1167 Closed: 2020-08-28	Add Form 1 and 2 Review as a standing agenda item to the weekly Operations Supervisor Meetings.
15	CIR #1171 Closed: 2021-01-26	Add a line item to the T-WI-Returning Wells, Treatment & Storage Sites to Service to verify the well flow on start-up and train staff on the changes.

Item #	Status	Description
16	CIR #1172 Closed: 2021-01-26	Conduct a training session with Operators to review the PTTWs, legislation requirements, where PTTWs can be found, etc. Also include the new enabled alarms.
17	CIR #1173 Closed: 2021-01-26	Evaluate the numbers on the SCADA screen and determine what the alarm limits should be for well flows. Ensure alarms are enabled.
18	CIR #1174	Determine what delay there should be on the high flow alarms to prevent nuisance alarms on start-up and add the appropriate time delay.
19	CIR #1175	Take a look at the commissioning records and see how much the residual had dropped in the distribution system AWQI. It was 0.55 mg/L at sampling.
20	CIR #1176	Put together a working group to look at the flushing program holistically. Consider providing flushing data to a consultant to review and make recommendations.
21	CIR #1177 Closed: 2021-01-26	Continue modelling exercises to look at the dead-end flushing program, perhaps by utilizing a consultant and looking at higher water-age locations through the model with C3 Water.
22	CIR #1178 Closed: 2021-01-26	Have a meeting to further discuss the immediate actions required for the flushing program ASAP (next week), including a decision around automatic flushing devices for Bishop Ct.
23	CIR #1179	Purchase an automatic flushing box.
24	CIR #1180	Look at creating an electronic form for Procedure Reviews that would allow for electronic signatures. This would also need to be available on cell phones.

Item #	Status	Description
25	CIR #1189 Closed: 2020-12-22	Create a communication piece that could be mailed out every January to the essential suppliers.
26	CIR #1190 Closed: 2020-12-22	Update the Operational Plan to remove the PO language in QMS 13.
27	CIR #1191 Closed: 2020-12-22	Create a sub-group to go through the Essential Suppliers Table (QMS 13-01) to determine what is actually an essential supplier. Determine which suppliers need communication on the QMS in the future."
28	CIR #1192 Closed: 2020-12-22	Add the QMS Communication Document to the QMS 05-04 Essential Documents table to ensure that a reminder is given to complete the annual mailout.
29	CIR #1193 Closed: 2020-12-22	Create a vendor approval form, including that communication of the QMS has been done (as a checkbox).
30	CIR #1194 Closed: 2021-01-26	Technicians and Supervisors: Complete the vendor approval form for each essential supplier listed in WS-RD Ensuring Adequate Equipment…
31	CIR #1195 Closed: 2020-12-22	Update Element 13 of the Operational Plan to reflect the new process.

Appendix H: Summary of Staff Suggestions

Table 45: Suggestions Provided by Staff, 2020 that are considered and implemented by Water Services, where possible.

Item #	Description of Staff Suggestion
1	Complete a sectoral analysis for the Water Smart Business Program. This would include comparing or benchmarking industries, for example: food and beverage sector as a whole; breweries versus breweries; all data within the automotive sector; to identify anomalies and opportunities for process improvements.
2	Update QMS 18 in regards to emergency contact updates information after the process for updating employee contact information is reviewed.
3	Add extended power outage scenario to draft Emergency Plan (exists in Operational Plan).
4	Look at creating an Emergency Management Folio that includes the Emergency Plan, Emergency Contact Lists, OnWARN agreement, etc.
5	Ensure that Operators are included in Emergency Debriefs in the future. There should be a quorum for Operators involved in the incident for the debrief to proceed.
6	Field access to enter water quality and sampling data electronically would be beneficial.
7	Based on the increased involvement in Capital Projects and accumulated vacation time for senior Operators, an opportunity exists to examine the need for additional dedicated full-time Treatment staff.
8	To promote staff awareness and knowledge, consider sending the Annual Inspection Report to all staff.

Item #	Description of Staff Suggestion
9	Recommend uploading monthly compliance audits completed by the Water Compliance Specialist to EDMS when complete, rather than annually.
10	In-field access to the work management system would be beneficial to Operators.
11	Look into implementing an expanded residential flushing program during the day (Waterloo's program as an example).
12	Consider having admin handle the customer calls related to flushing and swabbing if this program moves to regular work hours.
13	Consideration could be given to buying our own equipment for swabbing, similar to the setup that Corix uses.
14	Record regular valve checks during regular operations so that staff know which valves are already done before the program begins. Staff are requesting that the valve collector app is brought back into use.
15	Consideration could be given to better explain to staff how the DWQMS affects their work directly. Perhaps customized training for specific work areas (meter shop, admin, etc.).
16	Ensure that people who present at the full staff meetings aren't using acronyms or jargon, as staff who aren't familiar with them have a hard time understanding and can get confused.
17	Specific in-depth training for Mocha Soft (hydro database), AMANDA and WAM would be beneficial for meter shop employees.
18	Recommended that SCADA and Treatment Supervisor implement regular update meetings to plan work and share information. Improved communication channels with Operations group would assist SCADA upgrades, maintenance, policy/procedures, scheduling and administrative changes.

Item #	Description of Staff Suggestion
19	Consider looking into getting a gas fitter licence for someone in maintenance to help with maintenance of the natural gas generator.
20	Consider including 1 electrician and 1 millwright in the annual risk assessment process.
21	A dedicated maintenance shop with storage and inventory control is needed with the Woods upgrade.
22	Investigate if there are training opportunities for pump vibration analysis, for example, informational training, seminars, or online.
23	Update Element 21 of the Operational Plan to include the file location of the Continual Improvement Database.
24	In the WS-SOP Procedure Creation, Update and Review, remove the need for a Table of Contents and update that to Folio.
25	Consider staff shortage for a pandemic event such as COVID-19.
26	Consider communication/poster of top risk by area, to help keep staff informed.
27	Consider quick cross reference of root cause investigation for major events prior to risk assessment to help inform the process.
28	Review and verify “Storage Update” screen for accuracy and ensure “Usable Storage” field is properly defined. For example, is storage calculated from low level shut off to hi/hi level alarm or is it total volume or reservoir/tank. A little more detail would be helpful here when determining actual storage volumes.
29	Add the identification of the ORO position(s) to the weekly On-Call Schedule. It is necessary that the current ORO for both the Distribution and Treatment Subsystems be documented.

Appendix I: Water Efficiency Program – 2020 Annual Progress Report

Background

Water servicing capacity reclaimed through conservation and efficiency continued to be a top priority in achieving a sustainable and cost effective community water supply. In July 2014, Guelph City Council endorsed the updated Water Supply Master Plan (WSMP). The WSMP established a new reduction target of 9,147 cubic metres in average daily production by 2038 to guide the City's water efficiency programming. In support of the new reduction target, Guelph City Council approved the 2016 Water Efficiency Strategy (WES), which defined programs, policies and resources to assist the City in achieving the WSMP reduction targets.

The following sections provide an update of the water efficiency and optimization goals achieved from the Water Efficiency Strategy for the period of January 1 to December 31, 2020.

Water Reduction Target Progress

Building off the data analysis completed for the WSMP, the WES identified a ten-year water savings goal of 6,265 cubic metres per day between 2017 and 2026. The updated Strategy anticipates a considerable amount of supply capacity can be reclaimed through water loss management (i.e. leak detection and district metered areas) and efficiencies realized within the industrial, commercial and institutional sector.

Based on community uptake and participation in new and enhanced water efficiency programs, the total water savings achieved for 2020 was 98.18 cubic metres per day. Based on reductions in energy needed for water treatment and distribution, it is anticipated that 12.9 tonnes of greenhouse gas emissions and over $5,900 in electricity costs will be avoided through this year's water savings. Since the implementation of the 2016 WES, the cumulative water savings achieved to date is 1,889 cubic metres per day.

Figure 5 presents the projected volumetric production values as presented in the 2014 Water Supply Master Plan and the 2016 Water Efficiency Strategy, as well as that of the actual average daily production. The City continues to experience lower average daily production volumes than those projected through the Water Supply Master Plan. This is due,

in part, to the successful implementation of the 2016 WES and 2009 Water Conservation and Efficiency Strategy Update.

Figure 5: Water Supply Master Plan (2014) and Water Efficiency Strategy (2016) Production Rates

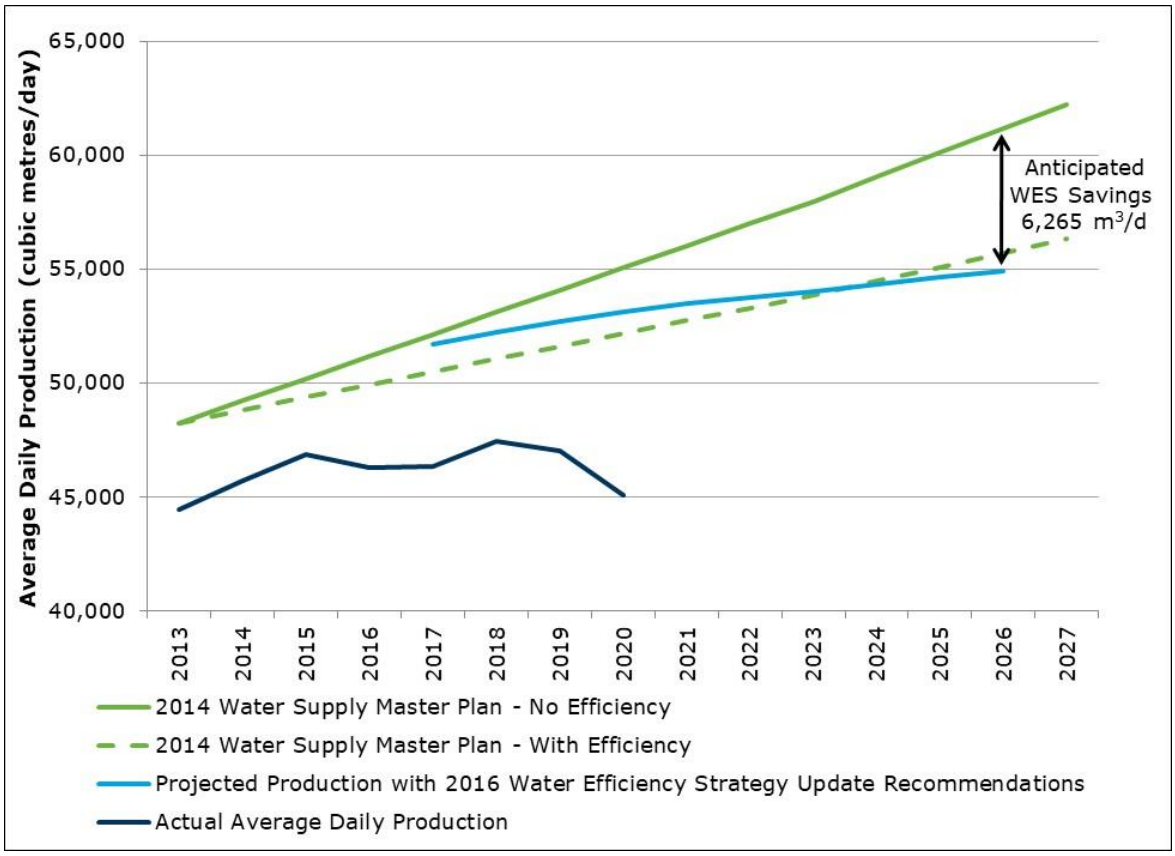
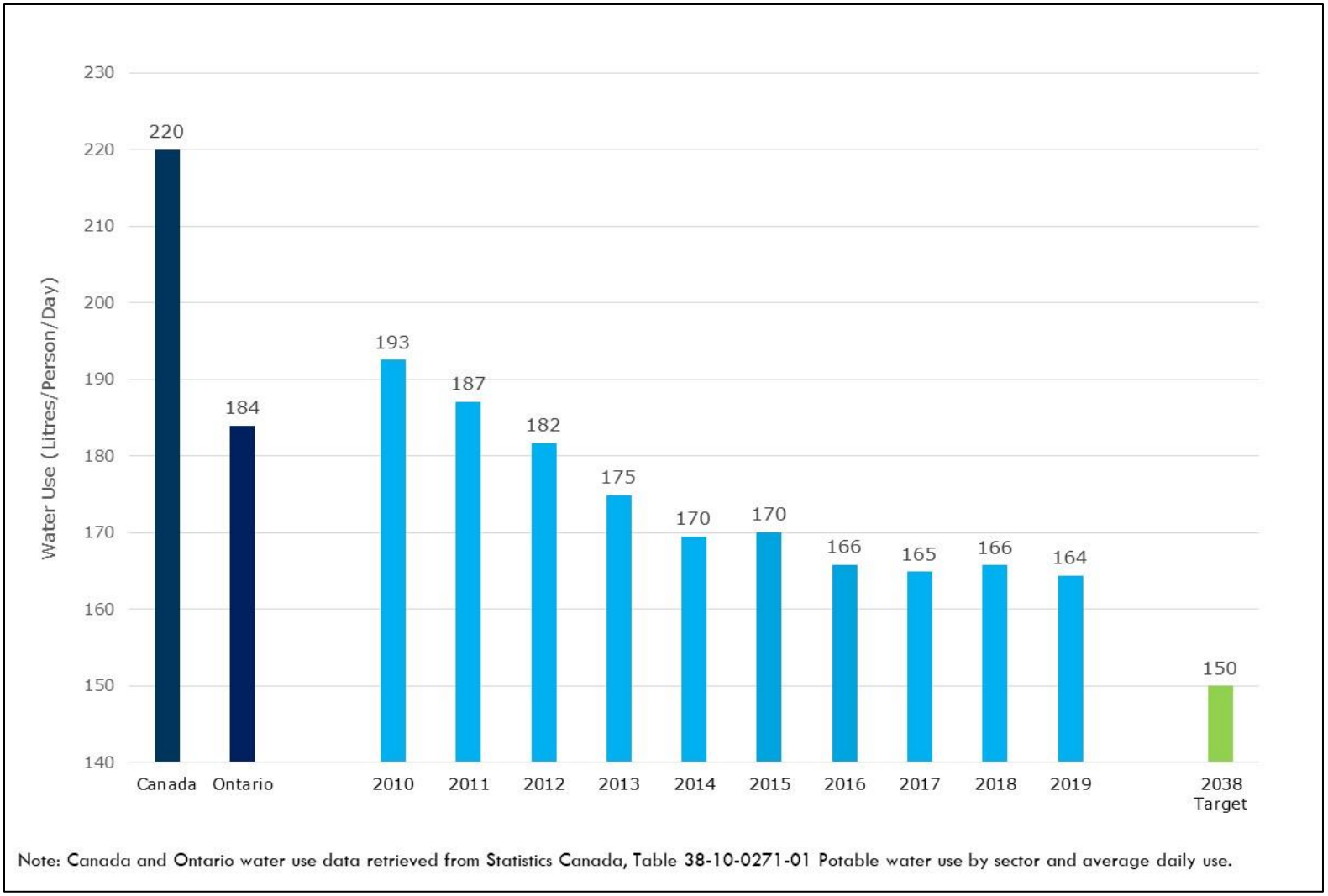


Figure 6 presents the City of Guelph's residential water use between 2010 and 2019, calculated using the volumetric consumption of water of all residential properties – low, medium and high density. During this period the City of Guelph's residential water use has been on a downwards trend, at an approximate rate of 3.1 litres less per person per day annually. That is enough water to fill 60 Olympic-sized swimming pools each year.

Average daily residential water use in Guelph continues to remain below the provincial and national averages. In 2019, the average water use was 164 litres per person per day, whereas the most recently published average for Ontario is 184 and Canada is 220 litres per person per day. This year's review successfully linked all account addresses that did not match those listed in the Municipal Property Assessment Corporation's (MPAC) records to assign the corresponding property classification (i.e. residential, non-residential), resulting in a more accurate representation of customer consumption.

Figure 6: Residential Water Use



Note: Canada and Ontario water use data retrieved from Statistics Canada, Table 38-10-0271-01 Potable water use by sector and average daily use.

The following sections outline the individual program successes for 2020, as identified in the 2016 WES.

Water Efficiency Incentive and Rebate Programs

During 2020, all rebate and information programs were put on hold for a period of time during the COVID-19 pandemic when staff were placed on emergency leave and following this, some staff temporarily reallocated to other divisions. The Water Smart Business Program remains on hold. However, programs that resumed still achieved considerable participation and savings, despite falling 68 cubic metres per day short of the combined savings goal of 1,959 cubic metres per day for the period of 2017 to 2020, as projected through the WES.

In 2020, 535 rebate applications and audits were completed through the City's residential rebate programs. An additional 12 incentives for municipal and business upgrades were processed. For more information on the individual water efficiency programs available, visit guelph.ca/rebates.

Table 46: Water Efficiency Strategy Update Program Progress

Water Efficiency Program	WES Target, 2020: Average Daily Water Savings (m^3/day)	Achieved Average Daily Water Savings (m^3/d), 2020	Number of Rebates/ Audits, 2020	WES Combined Target, 2017-2020: Average Daily Water Savings (m^3/day)	Achieved Average Daily Water Savings (m^3/day), 2017-2020	Number of Rebates/ Audits, 2017-2020
Royal Flush	22	19	510	108	132	2,911
Blue Built Home	2	3	6	9	11	30
Home Visits, Audit	13	1	11	52	18	730
Multi-Residential Audit	8	18	6	46	63	19
Residential Sub-metering	1	0.25	2	4	9	22
Water Smart Business	150	7	1	600	73	4
Municipal Facility Upgrades	22	0	0	88	38	5
Water Loss Management	381	50	11	1,052	1,547	59
Totals	**599**	**98.25**	**547**	**1,959**	**1,891**	**3,780**

Direct Water Savings Programs

Residential Sector

Summary of the individual residential sector programs can be found in the 2016 Water Efficiency Strategy section 13.1.1.1 located at https://guelph.ca/plans-and-strategies/water-efficiency-strategy/#documents. The following is a summary of relevant updates, program achievements and challenges experienced in 2020.

Royal Flush Toilet Rebate Program

The 2016 Water Efficiency Strategy continued with the ever-popular Royal Flush Toilet Rebate program. There was less uptake of the program this year overall compared to previous years, which may attributed to minimized promotion for the program in 2020 throughout the COVID-19 pandemic. Applications were still received and the program resumed in July. Advertising will resume in 2021. Participation rates and savings are summarized in Table 46.

Blue Built Home Water Efficiency Standards and Rebate Program

The 2016 Water Efficiency Strategy updated identified the Blue Built Home Program as a means to achieve direct water savings. The program looked to build on 2019 achievements. In 2020, staff officially launched the Blue Built Home program for new build multi-residential properties. Progress was affected as the program was placed on pause in late April through July due to COVID-19. Advertising for the program will resume in 2021. In total, two new multi-residential properties were Blue Built Home certified, along with four single-family homes (one new build and three retrofits). Together, single-family homes achieved a savings of 0.23 cubic metres per day (84 cubic metres per year). The multi-residential properties achieved an additional savings of 2.7 cubic metres per day (991 cubic metres per year). Participation rates and savings are summarized in Table 46.

Water Use Home Visit and Audit Program

In 2020, the City contracted eMERGE Guelph, a private consultant, to conduct in-home water audits as part of our Water Use Home Visit and Audit Program. Prior to the pandemic, the eMERGE Home Tune-Up program engaged eleven single-family households. Due to the pandemic, all in-home visits were put on pause for the remainder of the year. During this time, eMERGE pivoted to a virtual Home Tune-Up platform which is scheduled to launch in January 2021. However, the organization is considering a return to in-person audits with proper safety precautions.

While there were very few Home Tune-Ups conducted in 2020, considerable combined savings, estimated between 377 and 504 cubic metres of water per year, were realized through on-site replacement of faucet aerators and showerheads, and verified subsequent action of the resident to correct an above normal average of leaking toilets. Participation rates and savings are summarized in Table 46.

Further in 2020, eMERGE opted for a series of online events to engage the public by different means. City staff participated in an eMERGE event entitled: Salty Softener, Salty Rivers. The event focused on salt use from traditional household water softeners and its impact on local waterways. In total, the webinar attracted 102 registrants.

Multi-Residential Sector

Summary of the individual multi-residential sector programs can be found in the 2016 Water Efficiency Strategy section 13.1.1.2 located at https://guelph.ca/plans-and-strategies/water-efficiency-strategy/#documents. The following is a summary of relevant updates, program achievements and challenges experienced in 2020.

Multi-Residential Water Audit Program

This year the Multi-Residential Water Audit Program had six participants. This was a decrease from the previous year, due to the COVID-19 pandemic. Several property managers have expressed interest and intend to complete audits in 2021, when entering owner/tenant space is perceived as safer than in the current climate.

The main findings from all audits performed in 2020 were as follows:

Leaks

- Detected in 67 per cent of buildings audited
- Accounted for 5.7 to 28.2 per cent of buildings' total water use
- 3,995 cubic metres of water attributed to leaks were detected collectively in 2020
- Estimate 11 cubic metres per day in water savings would result from implementation of audit recommendations

Water Savings Opportunities (including leaks)

- Account for 30.7 to 59.6 per cent of total building water use
- 22,214 cubic metres of water savings potential was identified across six participating properties in 2020
- Estimate 61.0 cubic metres per day in water savings would result from implementation of audit recommendations

Staff have taken a conservative approach to estimating savings associated with 2020 program participants. Assuming a ten per cent decrease in water use (as per the WES), 17.5 cubic metres of water per day have been reclaimed through 2020 participation. This provides a combined water savings of 62.7 cubic metres per day since launch of the program in 2018. Participation rates and savings are summarized in Table 46.

Residential Sub-Water Meter Rebate Program

This program is open to all residential sectors in the City of Guelph, both single family and multi-family applications.

Participation rates and savings for the year are summarized in Table 46.

In 2020, staff executed a direct-mail promotion utilizing two differing messages to promote the sub-water meter rebate program. Based on web analytics, staff concluded that direct messaging resulted in a meaningful increase in web traffic. Messaging linked directly to money (costs and savings) were more popular for people navigating to the rebate website than messaging linked to leaks and Guelph's water supply.

Industrial, Commercial and Institutional Sector

Summary of the individual industrial, commercial and institutional sector programs can be found in the 2016 Water Efficiency Strategy section 13.1.1.3 found at https://guelph.ca/plans-and-strategies/water-efficiency-strategy/#documents. The following is a summary of relevant updates, program achievements and challenges experienced in 2020.

Water Smart Business Program

As noted previously, the Water Smart Business Program was placed on pause in April and remained so through the conclusion of 2020 due to the COVID-19 pandemic. Program resumption is anticipated within Q1 of 2021.

In early 2020, one program participant completed an audit and retrofit accounting for 2,429 cubic metres of water savings per year – or 6.7 cubic metres per day. Of these savings, 1,397 cubic metres (3.8 cubic metres per day) was achieved through identifying and remediating a leak. The remaining 1,032 cubic metres (2.8 cubic metres per day) was achieved by replacing a steam boiler with a more efficient model (the participant was issued an incentive through the program). Participation rates and savings are summarized in Table 46.

While the program remains on pause, staff fielded several inquiries in 2020 in support of resuming programming from past participants or relationships with the industrial, commercial, and institutional (ICI) sector contacts previously established. Of the known projects, an estimated 90 cubic metres per day of water savings are anticipated to be achieved through projects that will proceed in 2021. This includes interest from an "Our Food Future" project in support of the circular food economy. Staff fielded additional calls from possible new participants, which indicates the appetite to resume the program is there.

Municipal Operations

Summary of the individual municipal operation initiatives can be found in the 2016 Water Efficiency Strategy section 13.1.1.4 found at https://guelph.ca/plans-and-strategies/water-efficiency-strategy/#documents. The following is a summary of relevant updates, program achievements and challenges experienced in 2020.

Municipal Facility Water Efficiency Upgrades

In support of the Water Efficiency Strategy, the City continues to lead by example with water efficiency within its own facilities. Recreation centre and facility managers and maintainers participated with staff in seven water use reviews, audits and capital infrastructure upgrades to improve the efficiency of their buildings.

Due to the pandemic, new projects did not occur within the year in this regard. Staff consulted on the plans for the South End Recreation Centre, and engaged with the Corporate Energy Office in support of projects proceeding in 2021.

Water Loss Management Program

Water Loss Management Strategy

Staff began in 2020 formalizing a Water Loss Management Plan as part of our commitment to continuous improvement and reclaiming treated water supply capacity. The annual Water Audit/Balance exercise, which benchmarks and evaluates both revenue and non-revenue water lost to the system, was the starting point for the Water Loss Management Plan. While many projects and programs are undertaken by groups within Water Services (Distribution, Meters, Water Efficiency) to address water loss deficiencies (both apparent and real) in the system, evaluating industry best practice while considering cost burden to inform direction is necessary. As such, in 2020 an inventory and summary was completed to assess current and proposed water loss-related projects and programs:

Apparent Losses: (i) Residential Meter Replacement Program, (ii) Automatic Meter Reading/Infrastructure, (iii) Industrial, Commercial and Institutional and Large Residential Maintenance and Replacement Program, and (iv) Construction Development Water Use.

Real Losses: (i) Leak Detection Program (details on annual program outlined below), (ii) District Metered Area Program (details on annual program outlined below), other Real Losses (i.e., private-side fire hydrant audit program, retroactive first suppression metering).

This effort made it clear that in order to effectively address water loss, a cost-benefit evaluation should be completed on the Water Balance. This would confirm Guelph's economic leakage loss, and if found to be fruitful, assess and provide the City with recommendations around industry best practices for reducing water loss (programs, projects). This initial evaluation is slated to be completed in Q1, 2021.

Leak Detection Program

The City's leak detection program started in the spring of 2011 and aims to reduce the amount of water lost between the point of treatment and delivery to customers. The 2020 Leak Detection Program included sounding and correlation of all 342 kilometers of metallic watermains within the City's distribution system. In total, eleven possible leaks were identified through this survey, including six main breaks and the rest consisting of hydrant, service, or valve repair/replacements. The average daily volume of servicing capacity reclaimed through the location and remediation of these leaks equate to approximately 50 cubic metres per day in 2020. Savings attributed to reclaimed water supply capacity (production) are summarized in Table 46.

District Metered Areas

It is anticipated that further recoveries in reclaimed treated water lost to the distribution system will be achieved with the continued optimization of the City's district metered areas (DMAs). The objective of the DMA program is to enhance operational understanding of water demand patterns and to recognize water demand changes early to address non-revenue water loss in the water distribution system. In recognition of the benefits offered through continuous water demand monitoring as proactive water loss management, staff will be continuing to refine the DMAs and develop associated trend analysis tools through 2021. A software automation tool is now in the final stages of development to correlate the DMA flow data with the customer consumption records. The product will integrate the datasets to perform a water balance within the DMA. This will report the variance between the volume provided and consumed, in order to identify and recover non-revenue water loss within the distribution system.

Indirect Water Savings Programs

Education is a fundamentally important tool to engage and motivate action. The commitment to increasing local water literacy is a complimentary piece to changing toilets, completing water audits, and installing water meters, to ensure the wise use of the resource. Staff continue to offer a variety of very successful programs (including pivoting the in-school programming to a virtual model in 2020) to increase awareness, influence people's attitudes and habits regarding water use, and inform public on how the City invests their rate dollars. Investment in Guelph's water future includes education and outreach programming. Summary of the individual indirect water savings programs can be found in the 2016 Water Efficiency Strategy section 13.1.2 located at https://guelph.ca/plans-and-strategies/water-efficiency-strategy/#documents. The following is a summary of relevant updates, program achievements and challenges experienced in 2020.

Peak Season Water Demand Management Initiatives

Reduction of peak season (summer) water demand continues to be a primary objective of the City's water efficiency programming. The ability to reduce or minimize variations in seasonal water use limits the impact on our finite groundwater supply during times of environmental stress and creates operational efficiencies.

Summary of the outside water use initiatives that result in indirect savings can be found in the 2016 Water Efficiency Strategy section 13.1.2.1 found at https://guelph.ca/plans-and-strategies/water-efficiency-strategy/#documents. The following is a summary of relevant updates, program achievements and challenges experienced in 2020.

Outside Water Use Program

This program is driven by the City's Outside Water Use Bylaw – which restricts certain outdoor water-using activities during peak demand, when conditions such as dry, hot weather and river flows warrant restrictions.

The Outside Water Use Program ran between May and October 2020, as is typical for this program. With a very hot and dry spring, paired with the third hottest July on record, the City elevated the Outside Water Use Program level from Level 1 – Blue to Level 2 – Yellow on July 8. The remainder of the summer remained hot and dry. The fall finally saw some average precipitation numbers.

Due to COVID the annual rain barrel sale was cancelled.

Healthy Landscapes

The Healthy Landscapes Program continues to offer various resources to residents on preferred landscape management tools and techniques that result in desired yard aesthetics and minimize impact on water resources.

Due to the impact of COVID-19, the annual Healthy Landscapes Speaker Series was rescheduled to the fall and went virtual for the first time to great success. It featured numerous free talks on time–of–year-appropriate outdoor water conservation topics including water efficient landscape design, plant selection, and proactive maintenance best practices to manage the impact of drought and common turf pests. There was an average of 300 participants at each of the four sessions.

Due to the impact of COVID-19 and impacts to staff resources, the Healthy Landscapes visit program was cancelled for this year. Staff have since developed a plan that takes into considerations the restrictions of interactions while COVID-19 remains, and visits will recommence for the 2021 spring and summer season.

Water Efficient Landscaping Incentives - Raingarden Rebate

In 2020, Water Services again collaborated with Stormwater Engineering to run a pilot residential Raingarden Rebate program. While COVID-19 paused the program from running through the spring, resumption of staff and programming permitted for the program to proceed with another year of success.

Two workshops were organized that required participants to attend as the first step to qualify for the rebate. Seventy-two participants attended the workshops; 27 residents qualified for the next step - a raingarden visit with a professional landscape consultant. With this site visit, a resident could determine how best to install their own raingarden. Once the raingarden was completed, final verification completed by the landscape consultant, residents could apply for their one-time rebate. Of the 27 residents, 12 completed the installation of a rain garden and received their rebates. This resulted in:

- a combined capacity of over 28.6 cubic metres of stormwater captured with an average raingarden capacity of approximately 2.4 cubic metres per location;
- over $15,000 in rebates provided with an average rebate of $1,300 per location.

It is anticipated that this joint initiative will be offered again in 2021.

Public Outreach and Education Programs

Summary of the public outreach and education program initiatives can be found in the 2016 Water Efficiency Strategy section 13.1.2.2 located at https://guelph.ca/plans-and-strategies/water-efficiency-strategy/#documents. The following is a summary of relevant updates, program achievements or challenges experienced in 2020.

Curriculum-Linked Education Programming

The City's curriculum-based Grade 2 and Grade 8 in-class, water conservation programming continues to be a popular resource for local educators in both the Upper Grand District School Board and the Wellington Catholic District School Board. School closures due to COVID-19 required a pivot to virtual presentations. With this new format, staff provided 18 interactive school presentations, engaging 405 students. With the new format, demand for presentations is expected to return to normal in 2021.

In addition to in-class presentations, Water Services typically hosts more than 30 class tours of F.M. Woods Water Treatment Plant. Staff were unable to complete tours in 2020 due to COVID-19.

Planet Protectors Academy

Since 2016, Water Services has partnered with Engineering and Transportation Services and the Office of Climate Change to offer a curriculum-focused, interactive and activity-based online program called Planet Protectors. In 2020, Planet Protectors decoupled the water-related programming from their general modules to create a water-focused program: H2Whoa! This program focused on the value of water, individual's connection to the resource, and the actions conservation and efficient use to sustain the resource.

The 2019/20 school-year witnessed a reduction in participation in large part due to COVID-19 and the impact to staff resources. The program host was able to adapt quickly to offer virtual options for the program. In all, the program reached 77 students.

Staff have witnessed this program stagnate over the last two years. The 2019/20 program will be the final year the City funds this program, as value per dollar spent is not effective.

In 2021, staff from Water, Wastewater, Solid Waste, Engineering and Transportation, Corporate Energy and Office of Climate change will look to build on existing relationships with both the Upper Grand and Wellington Catholic District School Boards to help guide

investments in educational programs more effectively, in a way that receives more buy-in from the school boards as advocates.

Water Related Events

Staff coordinate notable events during the spring of each year, all of which were cancelled in 2020 due to the impacts of the pandemic on large public gatherings. These events included:

- H2Awesome – the award-winning water event that engages 500-600 Grade 8 students across Guelph – typically hosted in late May.
- Wacky Water Week – engaging children in water related educational activities at the Guelph Public Library through March Break.
- H2O Go Festival – a community celebration of water, hosting a variety of educational and interactive displays aimed at connecting audiences of all ages with water – typically hosted in late March.
- Environmental Services Open House – an annual event previously hosted by Water Services, 2020 was scheduled to be hosted at Wastewater Services, continuing the tradition of expanding scope to profile all groups from Environmental Services, and Stormwater Engineering. This event typically includes the annual rain barrel sale. This annual event normally occurs during Public Works Week in March, and is tied to other events that occurring at other City locations - Operations Yard and Guelph Transit – with City buses transporting participants.
- Waterloo-Wellington Children's Groundwater Festival – featuring fun and interactive activities designed to inform students of the importance of water value, protection and conservation in their daily lives – typically hosted the last week of May.

Most of these events may not be able to run once again in 2021 due to restrictions in larger gatherings related to COVID-19, however, virtual options are being explored for H2Awesome.

Guelph Water Wagon

In support of the City's 2009 Public Promotion Action Plan for City Drinking Water Consumption, the Guelph Water Wagon has been providing tap water to attendees of large, outdoor community events during the summer months for seven years.

Due to the restrictions of large gatherings related to COVID-19, the Guelph Water Wagon service did not operate in 2020. Service is currently planned to be resumed in 2021, a decision made with the City's Recreation Services, Special Events department and upon direction from the City's Executive Team.

Research Programs

Summary of the outside water use initiatives can be found in the 2016 Water Efficiency Strategy section 13.1.3 found at https://guelph.ca/plans-and-strategies/water-efficiency-strategy/#documents. The following is a summary of relevant updates, program achievements or challenges experienced in 2020.

Peak Season Water Demand Research

Staff continue to pursue collaborative research opportunities where resources can be leveraged to garner greater products. Started in 2019, staff collaborated with the University of Guelph in a three-year research project to evaluate alternative groundcovers and varieties of turf grass to determine their water use requirements and suitability for use in local urban lawns. The first season of research results were inconclusive due to weed encroachment, low germination rate of some species, and not having a rain-out shelter (blocking precipitation from reaching a portion of the plot) in time for the growing season.

The project was paused in 2020, but researchers did complete some limited testing and the rainout shelter was built. Initial data shows that all ground covers did well this year, with some having a competitive edge over others. This research project is intended to continue until 2022, the results of which are intended to inform peak season demand programming, such as the Healthy Landscapes visits, speaker series and garden design course.

Industrial, Commercial, Institutional Irrigation and Landscaping

The City's 2018 Natural Heritage Action Plan included a recommendation to explore the merit of extending the Healthy Landscape visit program to businesses. It recommends alignment with the Urban Forest Management plan to promote increasing forest canopy, habitat creations and protecting source water within corporate grounds.

Furthermore, the 2016 WES recommended that consideration be given to optimizing automatic irrigations systems in 2022. Based on research completed to date, irrigation systems are most prevalent in the business sector. A program to address this is recommended to commence following the update of the Water Efficiency Strategy (scheduled for completion in 2022).

In 2020, staff assessed consumption data to evaluate the impact of peak season demand increases attributed to business landscape needs, including whether an irrigation audit and replacement program is warranted. Results were promising and indicated further consideration of this was warranted.

In 2021, staff will complete a program review of other similar municipal approaches and define stakeholder partnerships with other City departments and external organizations to address both a program for ICI Healthy Landscape visits and irrigation audit/controller upgrade program. Based on updated timelines related to delays associated with the COVID-19 emergency staff layoffs, the implementation plan would not proceed until 2023.

Cooling Tower Research

The 2016 Water Efficiency Strategy recommended City staff assess participation, cost and water savings associated with a cooling tower audit, conductivity censor and meter rebate pilot. A sample size of at least five buildings are recommended to be studied in order to verify savings and costs effectiveness of the program.

The 2016 Water Efficiency Strategy includes a proposed multi-year budget to establish the parameters of a program as well as fund the completion of cooling tower audits and offer an incentive for upgrading. This will be further evaluated based on the update to the Water Efficiency Strategy scheduled to commence in 2021.

In 2017, the Alliance for Water Efficiency (AWE) commenced a multi-year Cooling Tower Research project. Thirteen municipalities and utilities from across North America have signed on including Denver Water, Southern Nevada Water Authority and San Antonio Water System in this multi-tasked project. The overall purpose of this study is to gain foundational knowledge needed to create an effective, targeted, and appealing incentive and outreach program to achieve greater efficiency in industrial cooling systems.

The results of this research will provide the framework for the proposed cooling tower audit and rebate program. While the timeline has been accelerated from that outlined in the WES, the City's total investment of $28,000 in this leading North American research project will provide a well-researched, value-for-dollar scope for local programming (a total project budget of $530,000 CAD; $400,000 USD). Due to issues in sourcing a research facility to complete the work, this project is in line with the WES update. Completion of this research is scheduled for completion for mid-2021 and will inform the technical memo series required to support the WES update.

Water-Energy Nexus Research

In 2019, Water Services began to apply the water-energy nexus concept to communicate associated water, energy and cost savings as identified in the Water Efficiency Strategy. The intent in doing so could lead to further decreases in water use.

Further to this, staff commenced the practical assessment of renewable energy applications to the infrastructure related to pumping, treating and distributing water, in alignment with the City's Community Energy Initiative. Renewable energy applications for water infrastructure are rapidly evolving and have the potential to reduce the water sector's dependency on fossil fuel–based electricity use.

As a continuation from the 2018 work, Water Services continued to assess energy optimization opportunities within the drinking water system. For example, the FM Woods Upgrade project includes a Carbon Net Zero phase. During the design phase, consultants are completing an Energy Study using energy modeling and a life-cycle assessment to provide input into assessing renewable energy usage options for the project. Further, Variable Frequency Drive (VFD) pumps, which are more energy efficient than fixed-speed pumps, are being incorporated into well station upgrades at Membro and Paisley.

Water Softener, Alternatives and Impact of Sodium Chlorides

In 2020 staff took part in a webinar hosted by eMERGE Guelph Sustainability entitled: Salty Softeners, Salty Rivers. The topics discussed in the webinar included salt concentrations in our local waterways from winter road salting, but primarily focused on salt from residential water softener recharge. The webinar included a discussion on best practices and alternatives to traditional water softeners – primarily NAC/TAC technology. In all, the webinar attracted 102 registrants.

With high levels of naturally occurring hardness in the City's groundwater source, the use of residential ion-exchange (salt-based) water softener technologies is quite common amongst Guelph households. It is estimated that approximately 77 per cent of local households, as part of a 2009 residential call survey, use a water softener.

The Region of Waterloo and the City of Guelph financed ground-breaking research in 2015 to assess the performance of alternative to ion-exchange softening technologies that treats hard water without the need for salt and recharge water. These technologies, referred to as salt and water free technologies, included the following: media induced crystallization (nucleation assisted crystallization (NAC) and template assisted crystallization (TAC)); electromagnetic water treatment (MWT); chemical conditioning with complexing; and chelating agents. Salt and water free technologies employs a combination of processes to prevent scale buildup in household water heaters and appliances. However, these technologies do not allow for the same lathering effect as salt-based water softeners provide.

In June 2017, the City of Guelph again collaborated with the Region of Waterloo to continue the research, trialling the NAC/TAC technology in real life scenarios. The aim of this study was to assess the field performance and user benefits associated with salt and water free residential water softener treatment technology.

Through this study, social research in both communities were completed (phone surveys, focus groups) to generate a technology test group of 18 homes, who installed a single technology in their home for testing of user experience.

The final report was completed in September. The results of the Water Conditioner Study were posted to the joint website, watersoftenerfacts.ca in November. The results of the study will be used to inform the update to the Water Efficiency Strategy moving forward.

In collaboration with our Source Protection Program, a working group is convening at the beginning of 2021 to develop a sodium and chloride monitoring program to better understand the water quality trends and potential impacts to our drinking water system. This is in an effort to proactively mitigate sodium and chloride-contributing activities to our source water such as: sewage systems; the storage of snow; and the application, handling and storage of road salt.

Appendix J: Water Services Committees

Water Conservation and Efficiency Public Advisory Committee – Annual Report

The Water Conservation and Efficiency Public Advisory Committee (WCEPAC) – a Guelph Committee of Council – continues to provide an opportunity for community consultation and participation in the implementation of the City's Water Efficiency Strategy. Since the committee formation in 2009, the WCEPAC has contributed valuable insights on opportunities for continued enhancement of current and developing water conservation programming, policy and education, engagement and outreach resources. The feedback and recommendations received from the WCEPAC have helped with the successful implementation of the Water Efficiency Strategy since it was updated in 2016. Visit the Water Conservation and Efficiency Public Advisory Committee webpage for a full list of the WCEPAC members, meeting minutes and agendas.

In alignment with Council reporting requirements outlined in the committee's Terms of Reference, this Annual Report details activities of the WCEPAC within 2020.

The WCEPAC is expected to meet four times annually. Despite the challenges and limitations brought by the COVID-19 pandemic, WCEPAC was able to meet two times in 2020 - February 5 for an in-person meeting and September 16 online. The scheduled meetings for July and December had to be cancelled due to the unexpected circumstances that resulted in decreased staffing levels and a pause in deliverables and programming.

During 2020, the Water Conservation and Efficiency Public Advisory Committee continued to provide thoughtful insight and recommendations to enhance the City of Guelph's water efficiency program, including:

- Discussion around barriers and benefits on water efficiency programs being developed or updated to align with the 2016 Water Efficiency Strategy. Specifically, the recommended Irrigation Audit, Rebate Program (to be aligned with current outdoor water use programs), Industrial, Commercial and Institutional Healthy Landscapes Visit Program, and Industrial, Commercial and Institutional Sub-metering Program.
- Comments received for incorporation into several Master Plan updates. Specifically, the Water Supply Master Plan Update, Wastewater Treatment and Biosolids Management Master Plan, Water and Wastewater Servicing Master Plan, and the Stormwater Management Master Plan.

- Presentations on advancements and updates based on input received from the WCEPAC during 2020, summary of current state and adaptations done to the Water Efficiency outreach and education programs. This included Fix-a Leak and Wacky Water Week, the H2O Go festival, the eMERGE EcoMarket, school presentations and other outreach activities that were cancelled or modified to align with social distancing restrictions and online formatting.
- Updates on COVID-19 impacts. Staff time and program delivery were impacted, resulting in timelines revaluation, programs cancellations or adjusted to online versions.

The WCEPAC possesses no annual budget. Funding for the City's Water Efficiency Program is provided within the Council-approved Non-Tax Supported Water and Wastewater Services Capital and Operating Budgets as well as through Development Charges.

Well Interference Committee

The Well Interference Committee is a specially arranged—or ad hoc—committee that is brought together to address well interference complaints resulting from the City's water takings.

The committee was established in 2004 to address concerns voiced during the City's Class Environmental Assessment for the Arkell Springs Ground Water Supply Strategy. During the Environmental Assessment, private well owners expressed concern that City water taking may interfere with or reduce the amount of water available for their wells.

No complaints have gone to the Well Interference Committee since it was established. It is worth nothing that the Committee convened on May 29, 2019 in order to facilitate an overview of the City's Well Interference Standard Operating Procedure, Permit to Take Water Requirements, upcoming water supply projects and the Terms of Reference for the Committee. The purpose of the review was to inform new members who may not have been familiar with the duties or function of the Committee as these members were recently elected to council.

Visit the Well Interference Committee webpage for more information.

Appendix K: Source Water Protection

This fourth annual report summarizes information requested by the Source Protection Authorities, as required under section 81 of the Clean Water Act, 2006 (CWA). This annual report (known as "EAR" – Electronic Annual Report) documents the activities undertaken by the City of Guelph in 2020 to protect municipal drinking water sources. Source Protection is one component of the multi-barrier approach to ensure clean safe drinking water.

The Lake Erie Source Protection Region is one of 19 watershed-based source protection areas in Ontario created to implement drinking water source protection planning under the Clean Water Act, 2006. The region includes four watersheds, called Source Protection Areas (SPAs) in the Act:

- Catfish Creek
- Grand River
- Kettle Creek
- Long Point Region

The City of Guelph is part of the Grand River SPA and has a representative who sits on the 24 member Lake Erie Region Source Protection Committee (SPC). The SPC meets about four times a year to discuss and implement matters related to program implementation. The City of Guelph is an active participant along with other municipal representatives who have a stake in drinking water issues. The RMO (Risk Management Official) represents the City of Guelph as a municipal member of the Grand River Source Protection Committee.

The Grand River Source Protection Authority will receive this information in the format they have requested by February 1, 2020. This information will be relayed by the Source Protection Authority to the Director of the Ministry of Environment, Conservation and Parks (MECP).

The RMO, Peter Rider, was appointed under subsection 47(6) of the Clean Water Act on May 27, 2016. The RMI (Risk Management Inspector) Kristin Pressey, was appointed on December 19, 2017. Due to staffing changes, Peter Rider handled the duties of RMO and RMI from December 2019 to August, 2020. Abby Spielmacher carried out the duties of the Program Coordinator and RMI from August 2020 to December 2020.

Risk Management Official Update

City staff continue to develop Risk Management Plans (RMPs) for sites with threats, including evaluating existing practices and identifying potential missing gaps in drinking

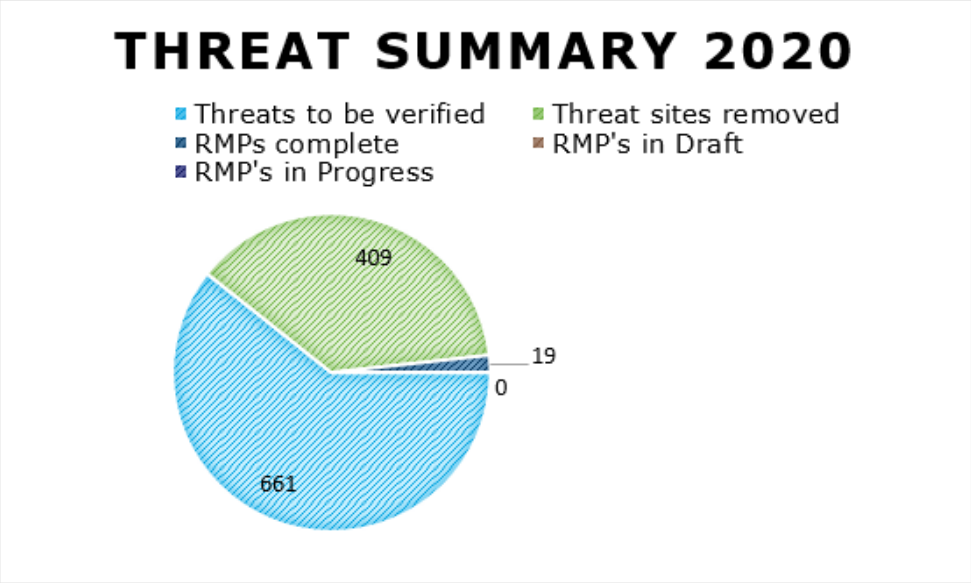
water protection. A template developed by the City was used to make the Risk Management Plan negotiation process less onerous for business and property owners.

Information related to the Source Protection Program is managed in the Local Source Water Information Management System (LSWIMs), a data management system. This program is used by several other municipalities in southern Ontario to manage data associated with the Source Protection Program. The application is being updated regularly with additional functionality as requested by the collaborating partners.

Threat Verification and Negotiating Risk Management Plans

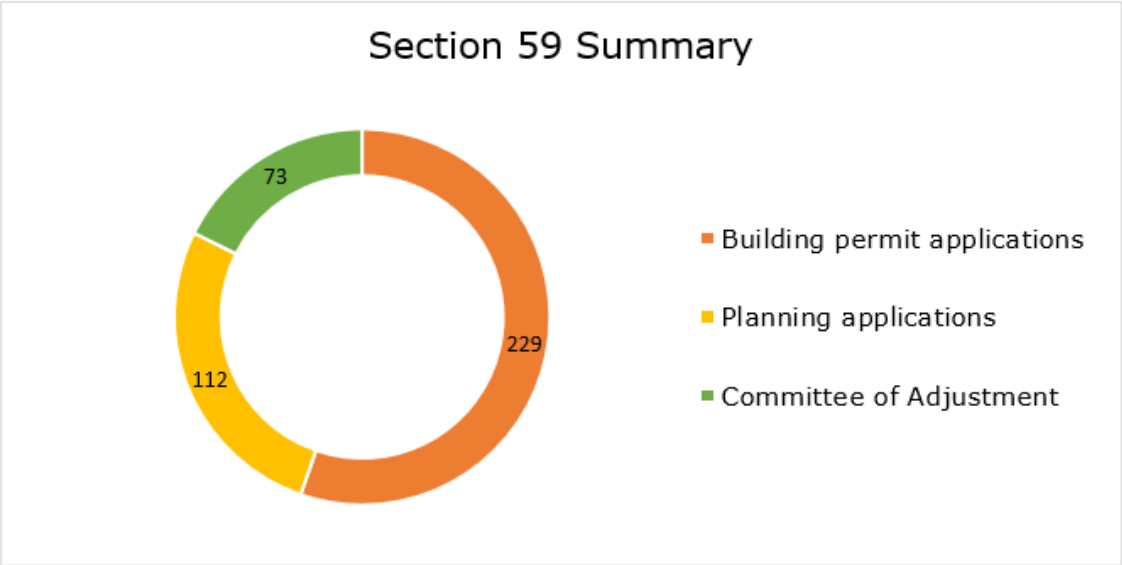
The City of Guelph continued to work with a number of property owners and businesses to verify and manage threat activities at their sites. Threats identified in the 2010 Approved Assessment Report total 942 within the City of Guelph. Threat verification has been completed for 409 sites, resulting in the completion of 19 Risk Management Plans (RMPs).

Figure 7: Risk Management Official Summary, 2020



The CWA requires a Section 59 Notice for development applications that are located within the Wellhead Protection Areas (WHPAs) if the application has or will have activities that could be a potential drinking water threat. A notice is required before planning and building applications can be deemed complete. In 2020, Source Water Protection staff reviewed 414 applications and issued 8 Section 59 Notices.

Figure 8: Clean Water Act, Section 59 Summary, 2020



Policy Implementation

The City of Guelph is the implementing body responsible for a range of Source Protection Policies, from prohibition to negotiating Risk Management Plans (RMPs) and providing education and outreach. There are 72 policies in the City of Guelph's section of the Grand River Source Protection Plan. Of these, 48 are identified as the City's responsibility to implement. As of January 2021, we currently have 28 policies fully implemented and 18 that are being progressed. Efforts are underway to implement the remaining policies, however, there are certain triggers required (e.g. upon the next Official Plan update) which will determine the pace at which some of the policies will be implemented.

Protecting Water Quantity

The City of Guelph is working closely with the MECP, Townships and staff from the Lake Erie Region Source Protection Authority to develop a set of water quantity threat policies. Meetings are ongoing and it is anticipated that public consultation will be completed by the end of 2021. The draft policies will then be submitted to the Minister of Environment, Conservation and Parks for approval. Once approved, the policies will have an effective date upon which the policies must be implemented.

Education and Outreach

In the second half of 2019 moving into 2020, Source Water started an ad campaign to bring awareness to the program. The campaign consisted of Guelph Transit advertisements: both on the back and side of the bus; along with posters up at various bus shelters throughout the City. Advertisements were also posted through various social media sites and the Guelph Chamber of Commerce. Figure 9 below is an example of source water public communication.

Figure 9: Source Water Protection Advertisement to Reduce Your Winter Salt Use

Staff from the Sourcewater Protection Team have worked collaboratively with the City of Guelph Operations department staff to sponsor and support the purchase of new and enhanced road salting equipment. The goal of this initiative is to improve the management of road salt application within the City and to obtain a better understanding of how much road salt is being applied throughout the City. The purchase of this state-of–the-art equipment will allow the Operations department to develop more accurate records. This will greatly assist both departments in developing a better understanding of water quality trends and potential impacts to our drinking water system as a direct result of road salt use.

Staff from the Source Water Protection Team have also been actively involved in providing input to a joint committee lead by Ontario Good Roads Association and Conservation Ontario, whose mandate is to raise awareness at the provincial level of the increasing chloride trends in groundwater and the need to evaluate the effectiveness of current legislation and best practices for winter maintenance.

Private Well and Septic System Decommissioning and Sanitary Sewer Connection Grant Program

A primary objective of City of Guelph's Source Water Protection Program is to protect our existing and future municipal drinking water supplies. There are several threats to drinking

water that can be managed; however, unused water wells and septic systems can act as conduits for contaminants to migrate to deeper aquifers that supply water to the community.

The goal of this program is to provide eligible residents with grant funding to offset the costs of decommissioning unused wells and septic systems on their property. There are several benefits to initiating such a program, including the reduction of risk that contaminants can enter such infrastructure and move downwards and impair or contaminate drinking water supplies.

The grant program is comprised of two parts: A well decommissioning grant component and a septic system decommissioning grant component. This program is intended for private domestic residential wells and septic systems. Developers are not eligible for the grant. Residents are welcome to apply for one or both programs depending upon their situation. All applicants must complete and submit a Decommissioning Grant Application Form. City staff will arrange to inspect the well or septic system before decommissioning and approve any work to be eligible for the grant. Property owners can apply for rebates that would include $1,500 per private well (to a maximum of two per property) and $15,000[33] per septic system decommissioned.

The Grant Program was approved by Council and initiated in the summer of 2019. Program uptake was voluntary and dependent on citizens taking the initiative to inquire about funding and eligibility. To date, uptake has been minimal (no rebates issued in 2020) with only one septic system and one well decommissioned at two separate properties since program inception. More information on this program is available for reference at the Well and Septic Decommissioning Rebate Program webpage.

ICI Threat Inventory Update Program

In the fourth quarter of 2020, the City of Guelph retained an environmental consultant to carry out a threat inventory update of all Industrial, Commercial and Institutional properties within the City. The goal of this project is to update the inventory that was completed in 2010 for the Assessment Report and flag any properties that will require Risk Management

[33] Includes a provision for a sanitary connection to existing sanitary sewer (if construction and installation costs are greater than $15,000, the property owner will be responsible for additional costs).

Plans, under the Clean Water Act. The inventory work is expected to continue throughout 2021.

Geothermal Energy Projects

Siting a geothermal system within a wellhead protection area can potentially put a municipal drinking water well at risk from potential transport pathways that may be generated from the geothermal boreholes. Following inter-departmental consultations, Source Protection staff developed an evaluation framework for geothermal systems within the City. The framework was developed and introduced in accordance with the "protecting existing and future drinking water supplies" objectives of the Clean Water Act, 2006. The resultant policy has been integrated into the development planning process and provides a staged approach to assessing the feasibility of geothermal earth energy systems on a case-by-case basis.

Moving Forward in 2021

Efforts will continue to develop Risk Management Plans and carry out threat verifications, as required. We anticipate ramping up efforts to educate the public about road salting and how everyone can play a part in reducing the amount of salt that is applied to hard surfaces.

The Source Water Protection team will continue to pursue opportunities to educate the public and various stakeholders on the benefits of protecting our water resources. This will be accomplished through meetings, seminars and conferences when opportunities present themselves.be accomplished through meetings, seminars and conferences when opportunities present themselves.

Appendix L: Glossary

Included below is an index of terms used throughout this report.

Term	Description
<	Less than (used in reference: less than lower detection limit shown)
µg/L	Micrograms per litre = 1 part per billion
½ MAC	half of the maximum allowable concentration
Above Detection Limit	Means the result can be detected using the current level of technology.
AO	Aesthetic Objective
AODA	Accessibility for Ontarians with Disabilities Act
AWE	Alliance for Water Efficiency
AWQI	Adverse Water Quality Incident
AWWA	American Water Works Association
Background	Indicator bacteria group used to monitor general water quality (non - regulatory)
$CaC0_3$	Calcium Carbonate - A measurement of the level of water hardness.
CAO	Chief Administrative Officer
CAPS	Capital Asset Prioritization System
CCL	Critical Control Limit. The point at which a Critical Control Point response procedure is initiated.
CCP	Critical Control Point. An essential step or point in the Subject System at which control can be applied by the Operating Authority to prevent or eliminate a Drinking Water Health Hazard or to reduce it to an acceptable level.
CIR #	Continual Improvement Report Number. Refers to the number assigned to an item in the Continual Improvement Database.
cfu	colony forming unit
CT	Concentration x Time. A CT value is the product of the concentration of a disinfectant (e.g. free chlorine) and the contact time with the water being disinfected.

Term	Description
Cubic metre (m^3)	1 Cubic metre = 1,000 litres water
CWA	Clean Water Act, 2006.
Distribution Samples	Samples taken within the distribution system, post primary disinfection.
Distribution System	The part of a drinking water system that is used in the distribution, storage or supply of water and that is not part of a treatment system.
DMA	District Metered Area
Drinking Water System	A system of works, excluding plumbing, that is established for the purpose of providing users of the system with drinking water and includes, (a) any thing used for the collection, production, treatment, storage, supply or distribution of water, (b) any thing related to the management of residue from the treatment process or the management of the discharge of a substance into the natural environment from the treatment system, and (c) a well or intake that serves as the source or entry point of raw water supply for the system.
DWQMS	Drinking Water Quality Management Standard
DWS	Drinking Water System
DWWP	Drinking Water Works Permit
E. coli	Escherichia coli, indicator bacteria used to determine the presence of fecal contamination.
EDMS	Electronic Document Management System
ERO or EBR	Environmental Registry of Ontario
Form 1	Form 1 – Record of Watermains Authorized as a Future Alteration
Form 2	Form 2 – Record of Minor Modification or Replacements to the Drinking Water System
Form 3	Form 3 - Record of Addition, Modification or Replacement of Equipment Discharging a Contaminant of Concern to the Atmosphere

Term	Description
Free Chlorine Residual	Free chlorine, in the form of hypochlorous acid, is considered a powerful disinfectant that is effective against a very broad range of pathogens. The free chlorine residual from primary disinfection may also be used to maintain a persistent residual within the water distribution system (secondary disinfection).
GET	Guelph/Eramosa Township
GUDI-WEF	Groundwater Under the Direct Influence of surface water – With Effective Filtration
HAAs	Haloacetic acids (HAAs) are a type of chlorination disinfection by-product that are formed when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter in water.
HPC	Heterotrophic Plate Count, indicator bacteria group used to monitor general water quality (non-regulatory).
ICI	Industrial, Commercial, Institutional
In-situ filtration	Refers to the filtration achieved as river water migrates through the ground and into the Arkell Springs Glen Collector System.
km	Kilometre
LRP	Lead Reduction Plan
LSL	Lead Service Lines
LSWIMs	Local Source Water Information Management System
L/s	Litres per second
m	Metres
m^3	Cubic metres = 1 m^3 = 1,000 litres water
m^3/day	Cubic metres per day = 1 m^3/day = 1,000 litres per day
MAC	Maximum Allowable Concentration
MCC	Motor Control Centre
MDL	Minimum Detection Limit
MDWL	Municipal Drinking Water Licence
MECP	Ontario Ministry of the Environment, Conservation and Parks
mEq/L	Milliequivalents Per Litre

Term	Description
mg/L	Milligrams per litre = 1 part per million
mJ/cm^2	Milli Joules per square centimeter. A measurement of UV dose.
MWT	Electromagnetic Water Treatment
n/a	Not Applicable
NAC	Nucleation Assisted Crystallization
N/O	Non-Operational
NSF 60	NSF/ANSI Standard 60: Drinking Water Treatment Chemicals – Health Effects
NSF 61	NSF/ANSI Standard 61: Drinking Water System Components – Health Effects
NSF 372	NSF/ANSI Standard 372: Drinking Water System Components – Lead Content
ntu	nepholometric turbidity unit
O. Reg. 170/03	Ontario Regulation 170/03 Drinking Water Systems
ODWQS	O. Reg. 169/03 Ontario Drinking Water Quality Standards
ORO	Overall Responsible Operator
P&IDs	Piping and Instrumentation Diagrams
PLC	Programmable Logic Controller
POE	Point of Entry, the point at or near which treated water enters the distribution system.
ppm	Parts per million (mg/L)
ppb	Parts per billion (µg/L)
PTTW	Permit to Take Water
Q1	Quarter One (aka first quarter), Q2 (second quarter), etc.
QMS	Quality Management System
Raw water	Water in its natural state, prior to any treatment for drinking.
RMI	Risk Management Inspector
RMO	Risk Management Official

Term	Description
RMPs	Risk Management Plans
RCAp	Rapid Chemical Analysis Package
SAC	Spills Action Centre
SCADA	Supervisory Control and Data Acquisition
SDS	Subdivision Distribution System (as in Gazer Mooney SDS)
SDWA	Safe Drinking Water Act, 2002
SPC	Source Protection Committee
TAC	Template Assisted Crystallization
TCE	Trichloroethylene
THM	Trihalomethane
Total Coliform	Indicator bacteria group used to determine presence of contamination.
Treated	Refers to samples that have received disinfection, for example treated sources.
Turbidity	A measurement used to assess the cloudiness of water caused by suspended particles such as clay, silt, finely divided organic and inorganic matter, plankton and other microscopic organisms.
UV	Ultraviolet
UVT	Ultraviolet Transmittance - the per cent of UV light passing through the water over a specified distance, usually 1 cm. UV light is absorbed by the lamp sleeves, reactor walls, and substances in the water, such as iron, manganese, natural organic matter etc. If UV light is absorbed, it is no longer available to inactivate pathogens. UVT of filtered water is commonly between 85 and 90 per cent.
VOC	Volatile Organic Compound
WCEPAC	Water Conservation and Efficiency Public Advisory Committee
WDGPH	Wellington-Dufferin-Guelph Public Health
WES	Water Efficiency Strategy
WHPA	Wellhead Protection Area
WSMP	Water Supply Master Plan