DRINKING WATER QUALITY REPORT

2018

Department of Infrastructure & Municipal Works
Environmental Services Division

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DRINKING WATER QUALITY REPORT

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- **LICENSE #: 176-101, issue 2**
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2018 Drinking Water Quality Report

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cornwall ONTARIO CANADA

2018 Drinking Water Quality Report

INTRODUCTION

In accordance with the *Ontario Drinking Water Regulation 170/03* under the *Safe Drinking Water Act*, the Environmental Services Division of the City of Cornwall is pleased to present the **Drinking Water Quality Report for 2018**.

This report confirms that the City of Cornwall has continued to deliver **safe**, **high quality drinking water** to the residents and businesses of our community from January 1st, 2018 to December 31st, 2018.

The quality of our drinking water is **continuously monitored** and **tested** by advanced on-line instrumentation and a modern and secure *Supervisory Control and Data Acquisition* (SCADA) system. Additionally, the system is operated and maintained by **highly qualified** City staff members who have successfully completed rigorous training and testing to become certified *Drinking Water Treatment & Distribution System Operators*.

"*The people living and working in Cornwall can rest easy knowing that the water produced by the City is always being tested and monitored to make sure that it's **fresh, clean**, and most importantly, **safe**.*"

-**Owen O'KEEFE**, C.Tech
SUPERVISOR of the WATER PURIFICATION PLANT

DRINKING WATER SYSTEM

The Corporation of the City of Cornwall owns and operates the *Cornwall Drinking Water System* (DWS #220001049).

Cornwall's system consists of the Raw Water Intake & Zebra Mussel Control Facilities located at the base of the R.H. Saunders Power Generating Station Dam, the Water Purification Plant (a class 3 water treatment facility located at 861 Second Street West), the Boundary Road Reservoir, and the Elevated Storage Tank on Tollgate Road.

The City of Cornwall also operates the City's Distribution System which is classified as a class 3 distribution system.

Cornwall's Drinking Water System is described as a "*Large Municipal Residential Drinking Water System*" under *Ontario Drinking Water Regulation 170/03*.

Over **11.5 billion** litres of fresh, clean water are pumped annually through over 272 kilometres of watermains to efficiently distribute the City's drinking water supply.

The water provided by the City of Cornwall is removed from the St. Lawrence River and treated according to standard surface water purification and treatment methods before being distributed to homes and businesses.

The Water Purification Plant uses chemically assisted coagulation and flocculation to remove particles suspended in the raw water. These particles clump together and are allowed to settle in tanks that are automatically cleaned at regular intervals. The water is then filtered through anthracite media and treated with UV light and chlorine to trap and disinfect any of the remaining harmful pathogens.

The system is **rigorously inspected** annually and has earned its **tenth consecutive 100%** compliance rating from the Ministry of the Environment, Conservation and Parks (MECP) in 2017.

Did you know?

In 2018, the Cornwall Water Purification Plant treated and distributed over **11.5 BILLION** litres of water.

That's enough to fill a swimming pool that's 4 kilometers long and 1.5 kilometers wide with almost to 2 meters of water!

The City of Cornwall Water Purification Plant SCADA Control and Plant Operations Centre, 2018

DRINKING WATER SOURCE

Lake St. Lawrence

Lake St. Lawrence is a stable and reliable source of water that is part of the *St. Lawrence River* system. The lake was formed on July 1st, 1958 through the intentional flooding of the area known as "*The Lost Villages*".

On June 17, 2013, the Ontario MECP issued the City of Cornwall its most recent *Permit to Take Water* (PTTW) from Lake St. Lawrence. This permit stipulates that the City is allowed to take a **maximum** of **100,000,000 litres** of water from Lake St. Lawrence **per day** for water treatment and distribution purposes.

In 2018, the City withdrew an average of 37,616,000 litres of water per day (see Table 1), and a **maximum** of **56,893,000 litres** was taken on July 9th.

The *turbidity*, or amount of solids suspended, in Cornwall's raw water (see Figure 2), averaged 0.74 Nephelometric Turbidity Units (NTU) and reached a maximum of 5.00 NTU on January 11th.

Testing results indicated that a monthly average of 8 *Colony-Forming Units* (CFU) of E.coli and 24 CFU of total coliform were found per every 100 ml of raw untreated water taken from Lake St. Lawrence in 2018.

Figure 2: Examples of Turbidity in water:

Note how the water becomes "cloudier" as the NTU's increase.

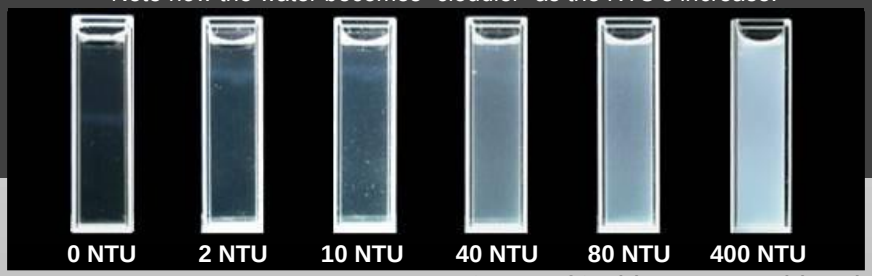
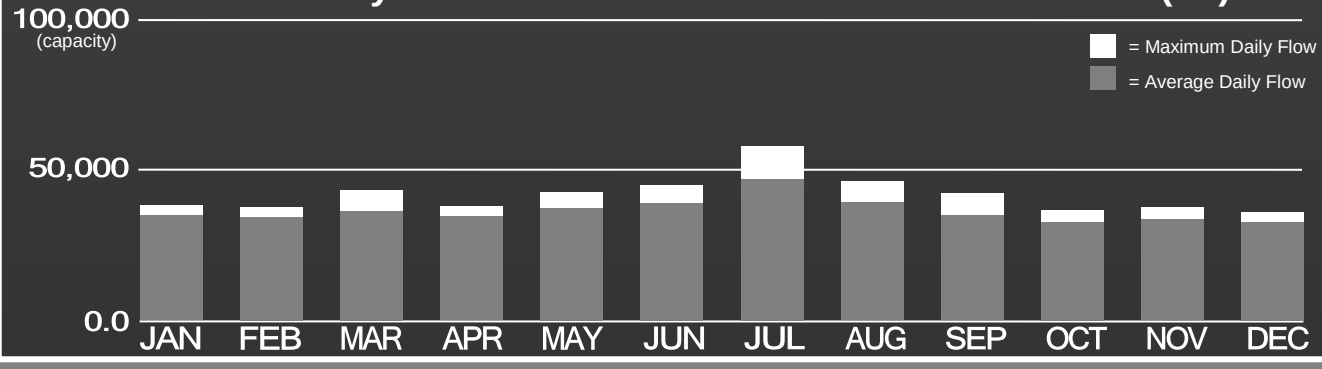


Image Courtesy of Camlab U.K., www.camlab.co.uk

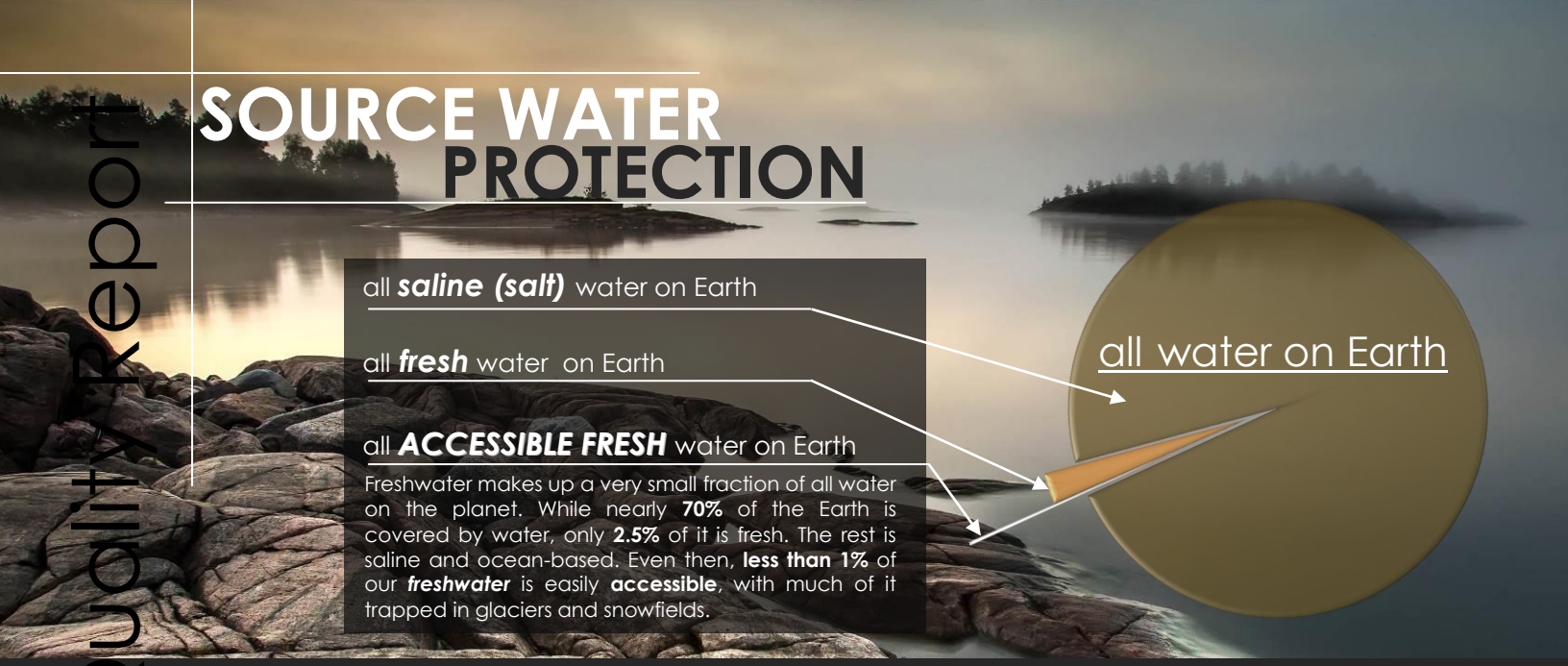
A total of **52** regularly scheduled raw water samples were taken and submitted to an MECP accredited laboratory for E-Coli and Total Coliform testing and analysis, as directed by the *Ontario Drinking Water Regulation 170/03*.

The raw water enters into the purification system through the Raw Water Intake and Bar Screen that is built into the west side of the *R.H. Saunders Generating Station Dam* **15 metres below the surface of** Lake St. Lawrence.

Table 1: Daily Raw Water Flows for 2018 in Cubic Metres (m^3)



SOURCE WATER PROTECTION

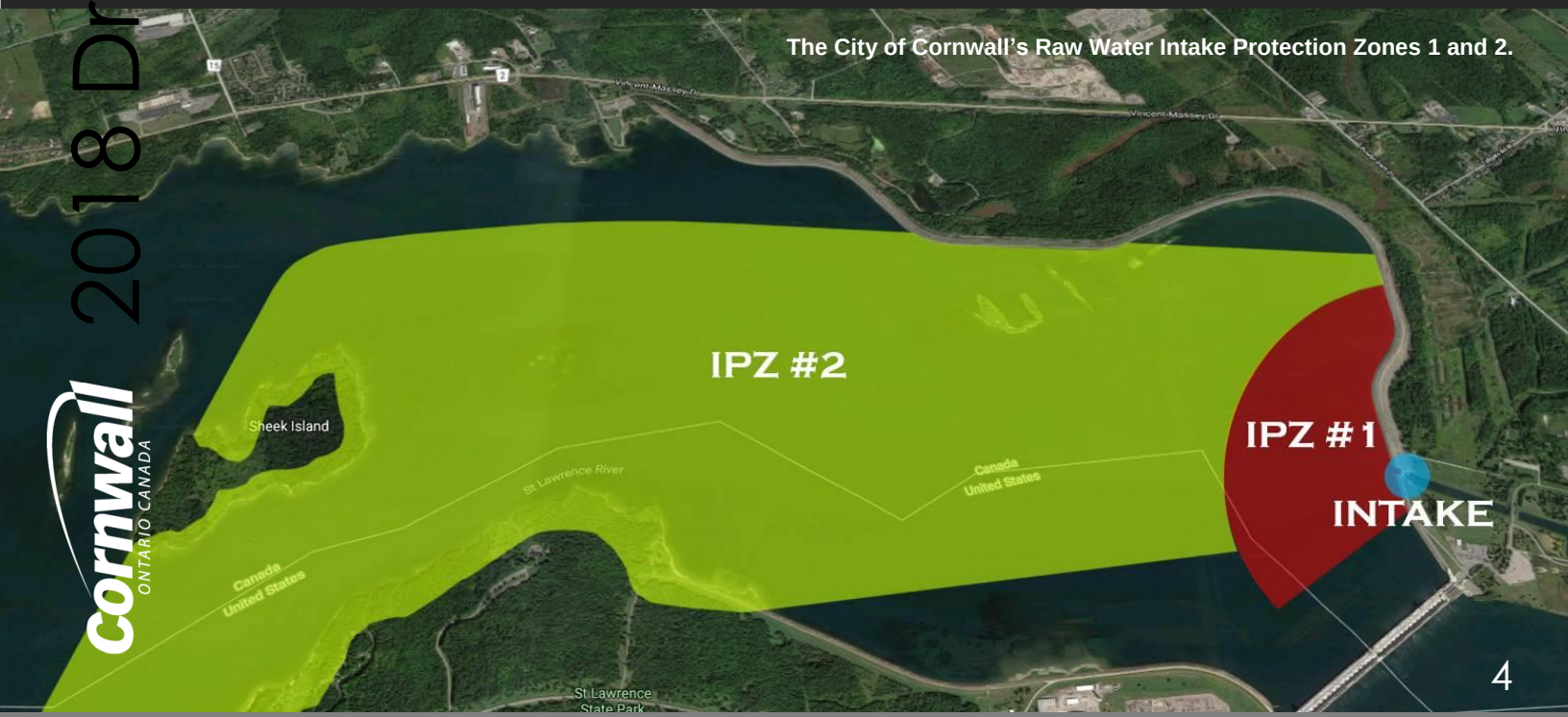


Our source water comes from the *St. Lawrence River System*, and to keep it as clean as possible a plan has been put into place through the *Ontario Clean Water Act*. To keep contaminants away from our raw water intake, an *Assessment Report* and *Source Water Protection Plan* was developed by the *Raisin - South Nation Source Protection Committee* and implemented in 2015

The *Assessment Report* identifies our Source Protection Area and the activities that could potentially pose a **threat** to either our raw water **quality** or **quantity**. Our Source Protection Area includes two *Intake Protection Zones* (IPZ). The two zones are classified by their **distance** from our raw water intake, and the **time** it would take for contaminated water to travel to it.

In 2015, we also developed a *Source Water Protection Implementation Guide* to ensure that we have the tools we need to meet all of the obligations of the *Ontario Clean Water Act.*

Protecting our source water is the most important thing we can do to keep our drinking water clean and safe.



The City of Cornwall's Raw Water Intake Protection Zones 1 and 2.

RAW WATER INTAKE & ZEBRA MUSSEL CONTROL

Cornwall's Raw Water Intake Bar Screen, 2010

The raw water enters the system through a coated steel Bar Screen equipped with 10 cm spacing designed to prevent logs or other large objects from entering the intake pipe and clogging it. The special coating helps to prevent the formation of frazil ice that could potentially clog the screen.

Inspections by specially trained and certified SCUBA Divers are completed on the intake system annually. The system was last inspected on September 12th, 2018 and both the Bar Screen and Raw Water Intake were found to be in excellent operating condition.

Once through the Bar Screen the raw water is pre-chlorinated by the Zebra Mussel Control System then passes through a normally open gate valve. The pre-chlorination of the raw water prevents the formation of Zebra Mussels that can grow inside of pipes and equipment, and cause severe clogging or jamming problems with the intake system, bar screen and gate valve.

The Zebra Mussel Control System is enclosed in a small facility located near the east side of R.H. Saunders Generating Station Dam.

The Zebra Mussel Control Facility consists of a raw water re-circulation pumping system, a raw water supply line, and gas chlorination equipment which include: chlorine gas cylinders, weight scales, a chlorine gas feeder, monitoring instrumentation, and an automated chlorine injection control system.

The chlorine gas is mixed with the raw water to create a hypochlorous acid solution which is effective in reducing the growth of zebra mussels.

The raw water intake screen is removed for its annual cleaning and inspection on September 12th, 2018.

In 2018 Cornwall pre-chlorinated its raw water at an average dose of 0.93 mg/l and maintained an average free chlorine residual of 0.23 mg/l in the Intake Pipe leading to the Water Purification Plant.

WATER PURIFICATION PLANT

After being pre-chlorinated, the raw water is fed by hydraulic pressure through nearly 3.7 kilometres of reinforced concrete pipe; then finally arrives at the Cornwall Water Purification Plant (WPP) to begin the treatment process.

Just before entering the plant the concrete pipe divides into two separate flow control lines which are individually controlled by motorized valves located in the WPP Flow Control Chamber.

These motorized valves modulate their position to adjust the flow of raw water streaming into the Water Purification Plant. The valve positions are controlled by the level signal provided by the WPP Settling Tank ultrasonic level sensors. This control is done in order to maintain a constant water level in the Settling Tanks.

Water Purification Plant, Flow Control Chamber, 2011

Also installed with the motorized valves are magnetic flow meters and indicating transmitters which are used to continuously monitor and record the Water Purification Plant's raw water flows.

One motorized valve and one flow meter is installed on a 600mm diameter flow control line that is generally used during normal operating conditions.

The other motorized valve & flow meter are installed on a 900mm diameter line which is used in situations where the City's water demands are significantly higher than usual or during the shut-down and maintenance of the 600mm flow control line.

Once the flow has been measured and recorded a chemical coagulant solution is injected against the flowing raw water in order to "flash mix" the coagulant solution with the water and begin the coagulation, flocculation and settling processes.

The raw water & coagulant solution then flows through a Motorized Traveling Screen where weeds, sticks, plastic bags, and other forms of debris which were able to pass through the Raw Water Intake's Bar Screen are removed from the water.

The Motorized Traveling Screen is automatically activated and cleans itself as it rotates. It is also inspected and manually activated by WPP staff once a day to ensure proper operation.

Water Purification Plant, Motorized Traveling Screen, 2011

Water Purification Plant, North Settling Tank, 2016

COAGULATION & FLOCCULATION

Once past the Motorized Traveling Screen the flowing raw water & coagulant mixture enters the Pre-mix Chamber then divides into two separate, yet identical hydraulic flocculation Mixing Chamber systems (North & South) which operate in parallel.

Each Mixing Chamber system consists of three compartments. The raw water & coagulant mixture enters a centre compartment where additional mixing is achieved. The water is then directed to the two outer compartments for final gentle mixing and to complete the flocculation process.

The water then flows from the flocculation compartments and into one of two corresponding Settling Tanks which also operate in parallel (North & South). The Settling Tanks are each equipped with a baffle to ensure that the proper settling of all flocculation particles is achieved before filtration.

In 2018, the Cornwall Water Purification Plan used an aluminum based coagulant solution to assist in the flocculation process at an average dosage of 12 mg/l.

The effectiveness of the coagulant solutions can vary (sometimes significantly) depending on the temperature of the water in which it is injected, particularly in low turbidity waters like those of Lake St. Lawrence. Cornwall's raw water temperature varied between 0.5º and 24.6º Celsius in 2018.

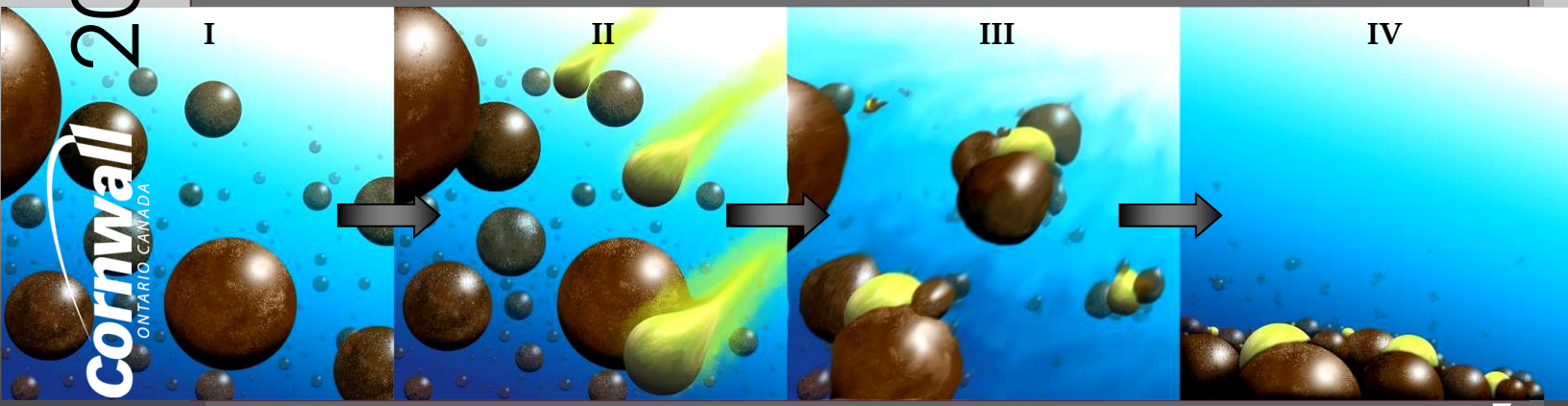
Each Settling Tank is automatically cleaned every two days by an automated sludge collection & removal system. This system is used to remove the flocculation sludge that accumulates at the bottom of the tanks.

During these cleanings the wastewater and accumulated sludge that's created by the settling process is directed to the sanitary sewer system.

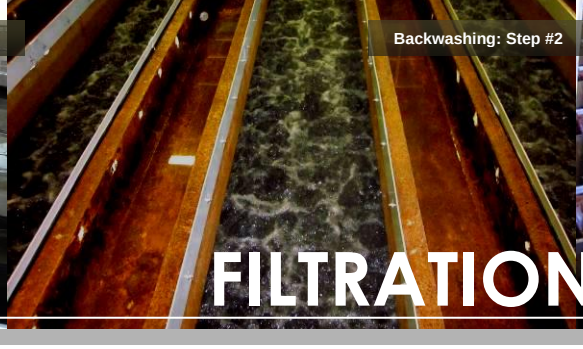
What is Flocculation?

As shown below in Figure 3, flocculation is the process of (I) removing particles suspended in water by (II) injecting a coagulant solution into the water then (III) properly mixing the water so the particles to clump together and (IV) settle to the bottom of a holding tank.

Figure 3: Coagulation, Flocculation & Settling




Backwashing: Step #1


Backwashing: Step #2


Backwashing: Step #3

FILTRATION

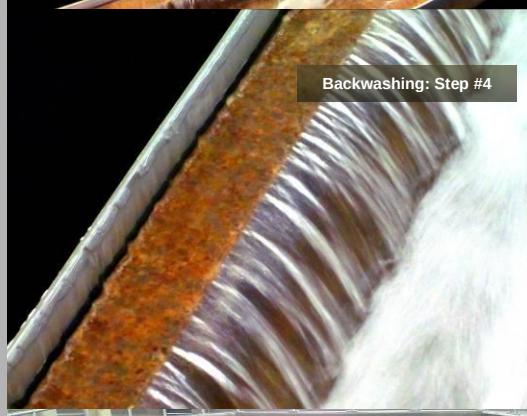
After passing through the Settling Tanks the two separate water streams (North & South) re-combine into a single Settled Water Conduit which directs the water to the Filter Bed System.

The Filter Bed System is comprised of four (4) conventional Filters Beds that have a surface area of 82m² each, and which operate completely independently from one another.

The settled water enters the Filter Beds through horizontal troughs that run across the filters.

The water then travels down into the filter and through porous anthracite to trap & remove any remaining particulate matter that may still be suspended in the water. In 2018, coagulation, settling and filtration reduced the average turbidity in the water from 0.74 NTU to 0.04 NTU.

All four of the Filter Beds have been upgraded in recent years and are equipped with anthracite media, improved lateral under-drain systems, and air-scouring capabilities which significantly increases the effectiveness of the backwash process.


Backwashing: Step #4


Backwashing: Step #5


Backwashing: Step #6

BACKWASHING

The individual filters are cleaned after every 24 hours of operation by means of backwashing. As shown in the photos above the highlights of the backwashing process includes:

1. Taking a filter offline so that it no longer directs filtered water to the Clearwell.
2. Draining the filter to the appropriate level then agitating the filter media with air scouring in order to break up trapped materials and media which may have clumped together.
3. Reversing the flow of water through the filter to remove materials trapped in the media.
4. Increasing the reverse flow to a high flow rate to ensure adequate cleaning is achieved.
5. Directing the wastewater created by the backwash through the filter troughs and into the sanitary sewer system.
6. Finally, allowing the filter media to settle for a short time before bringing the filter back into service.

UV DISINFECTION

Once the water has passed through a filter it's discharged into a corresponding Filter Header (#1, #2, #3, or #4) located in the Water Purification Plant's Pipe Gallery.

The Filter Headers direct the water to either the Clearwell, the Reservoir, or to waste (the sewer system), and each header is equipped with multiple sensing devices designed to monitor the performance of the filter and the quality & quantity of water (i.e. turbidimeters, differential pressure transmitters, magnetic flow meters, and UV transmittance sensors).

The Filter Headers are also where the water is disinfected with Ultra Violet (UV) radiation at an average dose of **188mJ/cm²** (millijoules per square centimeter) in 2018.

UV light at wavelengths between 200 & 300 nm (nanometers) and delivered in doses over **40mJ/cm²** are proven to be extremely effective at inactivating waterborne pathogens including viruses, bacteria, and protozoa without creating any known harmful by-products. UV light is particularly effective at disinfecting chlorine resistant micro-organisms.

TASTE AND ODOUR CONTROL

During the late summer and early fall algae blooms in Lake St. Lawrence begin to die off, and as they decompose they release chemical contaminants like geosmin and 2-methylisoborneol (2-MIB) into the lake & river. Even after filtration these completely harmless chemicals will cause treated water to taste and smell earthy or musty.

To help eliminate these taste and odour (T&O) chemicals, the Water Purification Plant's UV reactors (which normally operate at 30% power in disinfection mode) are ramped up to full power (100%) and Hydrogen Peroxide (H_2O_2) is injected into the filtered water just prior to them. As shown in Figure 4, this supplemental treatment process reduces the levels of T&O chemicals in the filtered water to near, or below, their detectable limit which is nearly **15 parts per trillion**.

The City of Cornwall's Water Purification Plant was the first water treatment facility in the world to implement this cutting-edge Advanced Oxidation technology for T&O control on a full scale.

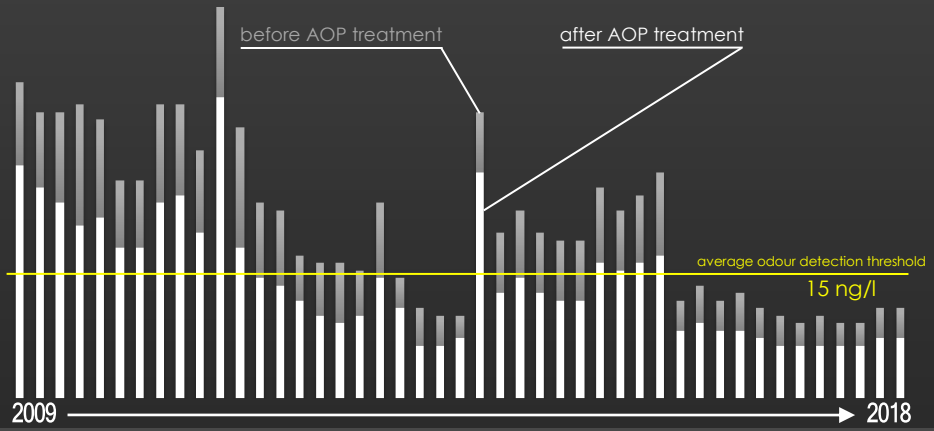
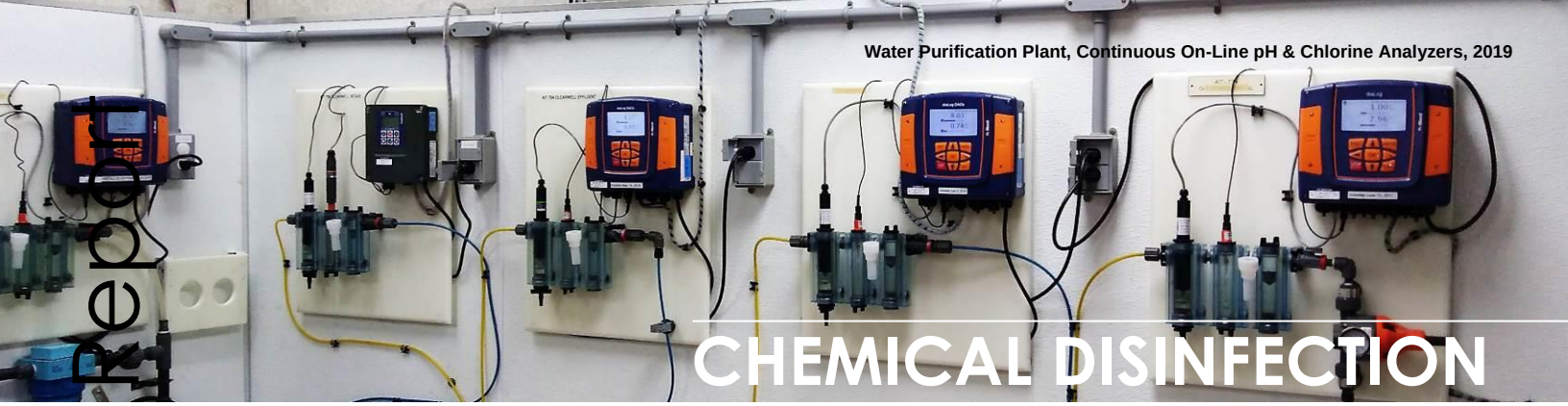


Table 4: Advanced Oxidation Process Effectiveness

This graph shows the effectiveness of our **advanced oxidation process** (AOP) on *Geosmin* (a taste and odour causing compound). 45 samples were taken at our water purification plant between 2009 and 2018.



Water Purification Plant, Continuous On-Line pH & Chlorine Analyzers, 2019

CHEMICAL DISINFECTION

In addition to U.V. light, the Water Purification Plant also uses chlorine in the form of Sodium Hypochlorite (NaOCl) for primary chlorination and to provide secondary disinfection as well.

Primary chlorination and U.V. disinfection ensures the destruction or inactivation of harmful pathogens which are too small to be removed by coagulation, settling and filtration.

Secondary chlorine disinfection provides a residual concentration of free chlorine in the City's Distribution System in order to prevent bacterial re-growth and to provide a measurable way to quickly detect unexpected changes in the Distribution System's water quality.

Once the water has traveled through the Filter Headers it is (under normal operating conditions) directed to the Clearwell where the water is injected with an average dose of approximately 1.23 mg (milligrams) of chlorine per liter of filtered water.

The Clearwell is a 1,515,000 litre baffled water storage chamber which allows the chlorine to come into contact with the filtered water for a period of time.

The chlorine contact time in conjunction with the water's pH, temperature, and free chlorine residual allow plant operators to accurately predict the effectiveness of the chlorine disinfection process in a concept known as CT.

The treated water then moves from the Clearwell to a baffled 3,030,000 litre buried Reservoir where additional chlorine contact time is achieved before the water is allowed to be discharged into the Distribution System by the High Lift Pumping System.

Chlorine residual levels at the Water Purification Plant are continuously monitored and recorded by five chlorine analyzers which constantly sample & test water from strategic locations within the plant's process stream.

The City received an amended Drinking Water Works Permit (176-201, issue: 5) from the Ministry of Environment, Conservation and Parks on June 13th, 2016.

CHLORINE

According to Health Canada's *Guidelines for Canadian Drinking Water Quality – Chlorine Guideline Technical Document* (HC Publication#: 4188, *June 2009*) chlorine is classified as a safe and effective disinfectant that is low in toxicity and is unlikely to be carcinogenic to humans.

Water Purification Plant, Sodium Hypochlorite Injection System, 2018

The Health Canada guidelines cited studies that were performed on laboratory animals and humans which indicated that no adverse health effects were observed or recorded, even when chlorine was ingested in doses of up to 50 mg/l over a short period of time. (*Chlorine Guideline Technical Document - Section 2.1 Health Effects*)

Water Purification Plant, High Lift Pump #3, 2011

HIGH LIFT PUMPING and DISTRIBUTION

Once the water has been treated and is ready to be consumed it is lifted from a water conduit that is fed from the Reservoir (the conduit can also be fed from the Clearwell when required) and pumped into a common discharge ring main located in the basement of the Water Purification Plant. This pumping is done by one or more of the Water Purification Plant's five (5) High Lift Discharge pumps (see Table 5).

From the ring main the water is directed to the East and South Discharge Lines where the individual flows are monitored and recorded as the water is discharged into the Distribution System. Other discharge water quality parameters are also continuously monitored and recorded such as: the discharge water pressure, the turbidity, and the post (or secondary) chlorine residuals.

In 2018 the Water Purification Plant discharged a total of 11,565,090,000 litres of water at an average rate of 31,628,000 litres of treated water per day (see Table 6 on the following page). An average discharge chlorine residual of 1.02 mg/l was also maintained.

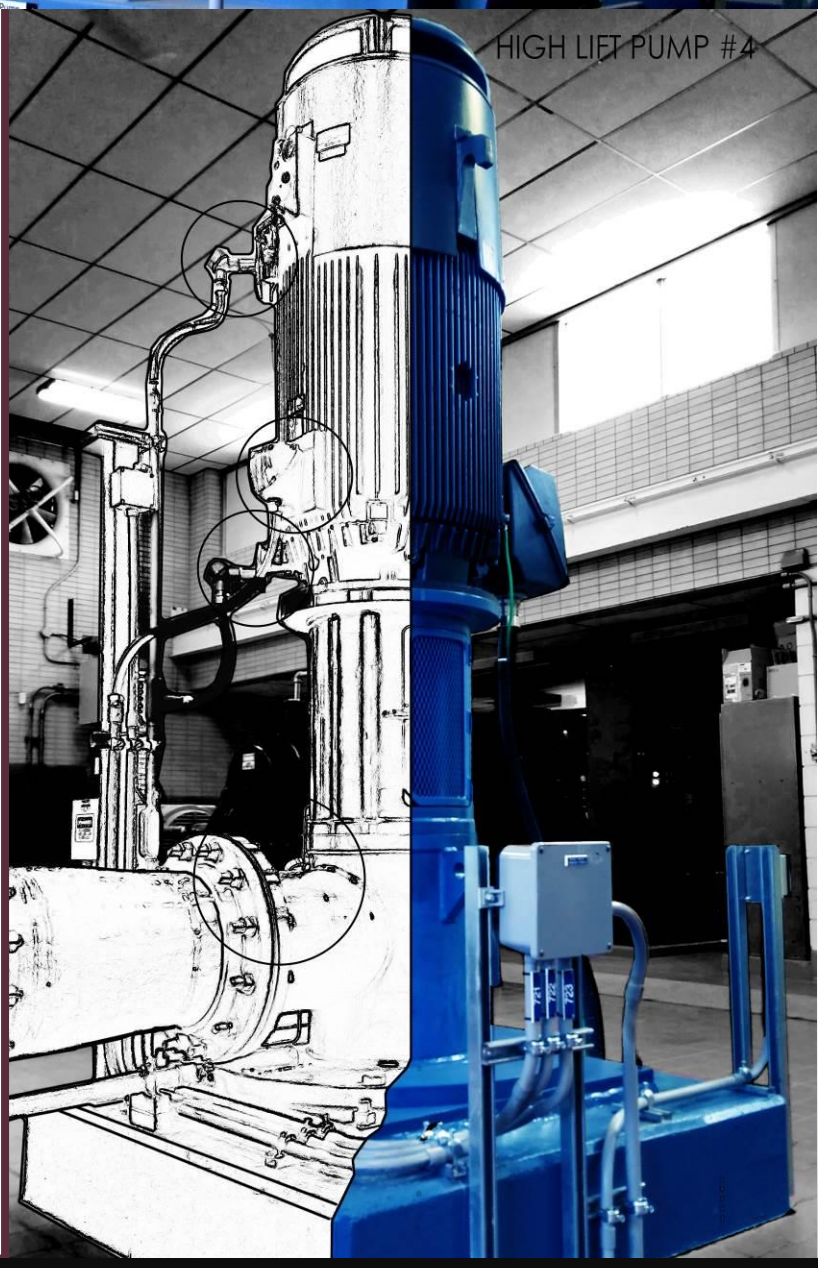
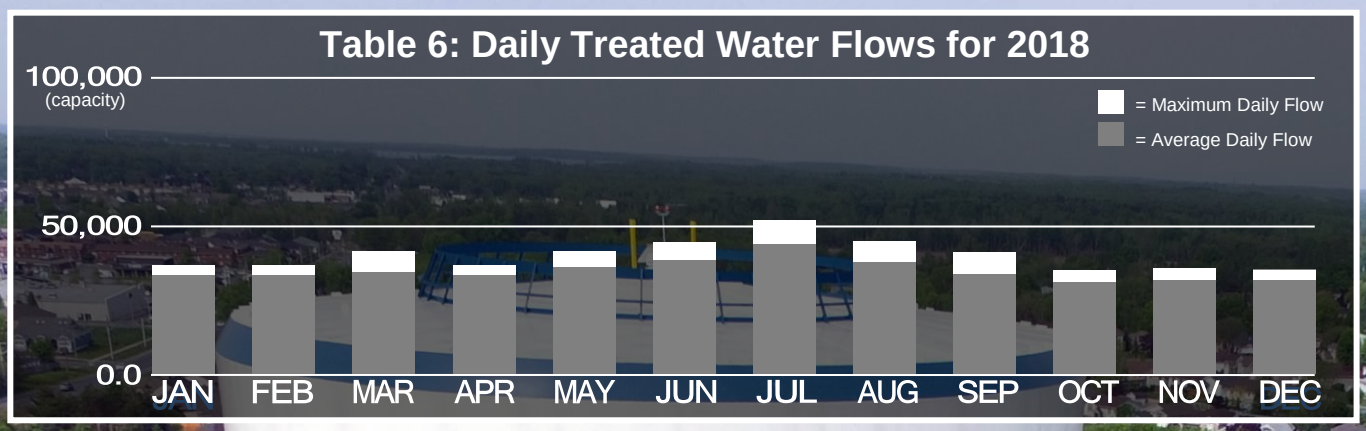


Table 5: High Lift Pump Details

PUMP NAME:	POWER SOURCE:	PUMPING CAPACITY:
High Lift Pump #1	400 Horse Power Electric Motor	421 Litres per Second @ 49 meters total dynamic head
High Lift Pump #2	300 Horse Power Electric Motor	263 Litres per Second @ 49 meters total dynamic head
High Lift Pump #3	300 Horse Power Electric Motor	263 Litres per Second @ 49 meters total dynamic head
High Lift Pump #4	250 Horse Power Electric VFD Motor	180 to 263 Litres per Second @ 49 meters total dynamic head
High Lift Pump #5	400 Horse Power Electric Motor	421 Litres per Second @ 49 meters total dynamic head

All high lift pumps are powered by the Water Purification Plant's 1,250 kW Stand-By Diesel Generator during utility power disruptions.



ELEVATED STORAGE TANK

The drinking water pumped from the Water Purification Plant enters the Distribution System and flows to the Elevated Storage Tank located at 401 Tollgate Road, between McConnell Avenue and Pitt Street in Cornwall.

The Elevated Storage Tank is a composite tower comprised of a steel bell with the capacity to hold 4,550,000 litres of treated water, secured to the top of a 26.5 metre tall concrete base.

The City commissioned the Elevated Storage Tank in 1991 to act as an emergency reservoir, and to help maintain and balance the pressure in the City's Distribution System.

The tank's safety features were upgraded and its exterior and portions of the interior were recoated in 2015.

The tank level is constantly monitored and recorded by a Level Indicating Transmitter.

Its level varies during the day depending on the City's demand; however a minimum operating level is maintained and additional High Lift Pumps are automatically activated if the tank level drops too low.

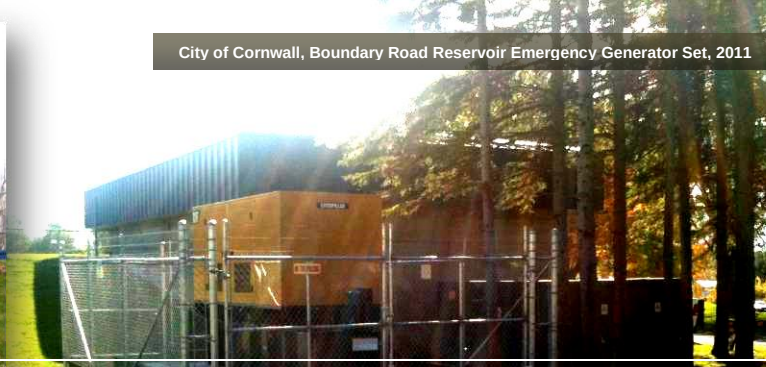
The tank is also equipped with a Pressure Indicating Transmitter which monitors and records the Distribution System water pressure in the north end of the City.

Free chlorine residual levels in the Elevated Storage Tank are constantly monitored by the Elevated Tank Chlorine Injection and Monitoring System. This system is comprised of a combination of pH and chlorine analyzing probes, a transmitter, and an automated Sodium Hypochlorite injection system which maintains the free chlorine residuals at approximately 0.75mg/l.

To maintain uniform free chlorine residuals, the water contained in the Elevated Storage Tank is in constant circulation with the help of a re-circulation pumping and flow monitoring system.

City of Cornwall, Elevated Storage Tank, 2017

City of Cornwall, Boundary Road Reservoir, 2011



City of Cornwall, Boundary Road Reservoir Emergency Generator Set, 2011

BOUNDARY ROAD RESERVOIR

Water from the Distribution System is also stored in the Boundary Road Reservoir located at 560 Boundary Road in Cornwall.

The Boundary Road reservoir was commissioned in 1973 to act as an additional water storage facility in the event of fire related emergencies and to augment the Distribution System's water pressure in the eastern portion of the City.

The Boundary Road Reservoir has the capacity to store a total of 9,100,000 litres of water in two separate underground chambers.

The Boundary Road Reservoir also serves as a water pressure booster pumping station. It is equipped with three centrifugal Booster Pumps each capable of transferring approximately 110 litres of water per second from the Boundary Road Reservoir and into the Distribution System.

In order to maintain free chlorine residuals, the water in the Boundary Road Reservoir is "turned-over" daily.

Turning-over the Boundary Road Reservoir involves two steps:

The first step is an automated process that occurs at nighttime and which deactivates the Booster Pumps and opens the Inlet Valve to allow water from the Distribution System to fill the Boundary Road Reservoir.

The second step occurs during the daytime when the Inlet Valve allowing water into the reservoir is automatically closed and one or more Booster Pumps are activated to reduce the volume of water stored in the Boundary Road Reservoir.

The constant draining and re-filling of the reservoir ensures that the free chlorine residuals are sufficient to prevent the growth of algae or bacteria.

Free chlorine residual levels in the Boundary Road Reservoir are also constantly monitored by the Boundary Road Chlorine Injection and Monitoring System.

The system is comprised of one combination pH and chlorine analyzing transmitter which samples and monitors the free chlorine residuals of the Distribution System water as it enters the reservoir, another combination pH and chlorine analyzing transmitter which samples and monitors the water as it is pumped out of the reservoir, and an automated chlorine injection system which maintains the chlorine residuals of the water discharged from the reservoir at approximately 0.80 mg/l.

In the event of a utility power failure, the Boundary Road Reservoir is equipped with a 300 kW diesel generator set which provides emergency power. The generator set was installed in 2010.

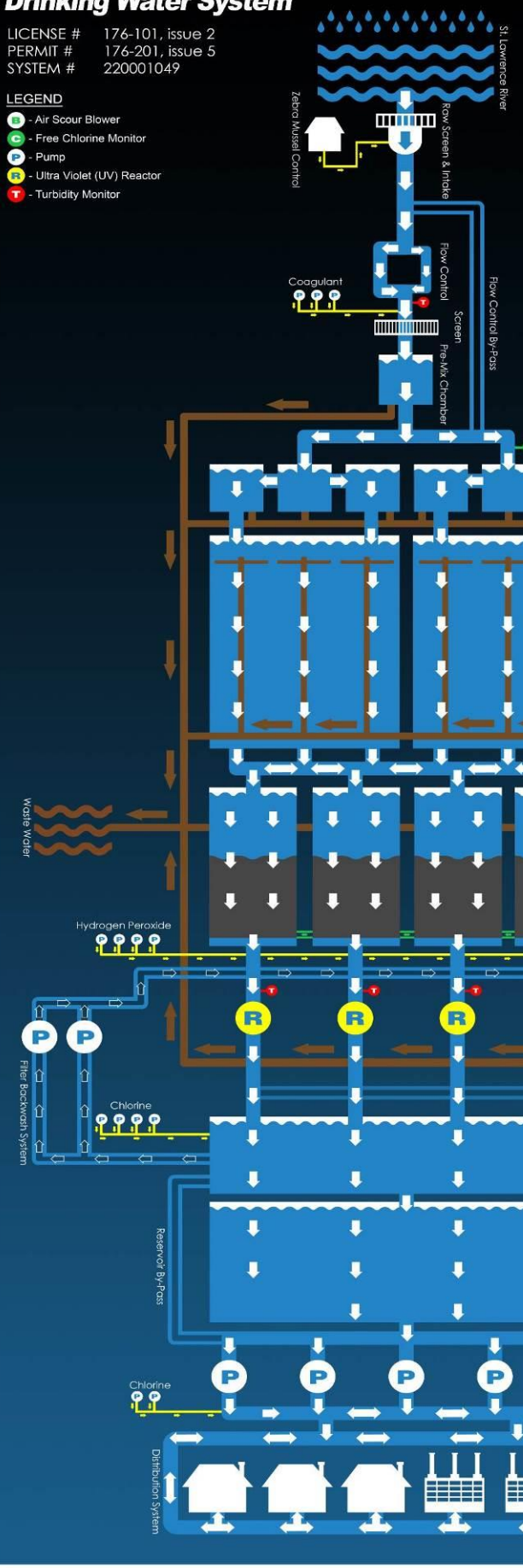
City of Cornwall, Boundary Road Reservoir Booster Pumping Station, 2011

PROCESS DIAGRAM

Cornwall Drinking Water System

LICENSE # 176-101, issue 2
PERMIT # 176-201, issue 5
SYSTEM # 220001049

LEGEND
- B - Air Scour Blower
- C - Free Chlorine Monitor
- P - Pump
- R - Ultra Violet (UV) Reactor
- T - Turbidity Monitor



The Corporation of the City of Cornwall owns and operates the ***Cornwall Drinking Water System***, *a Large Municipal Residential system.*

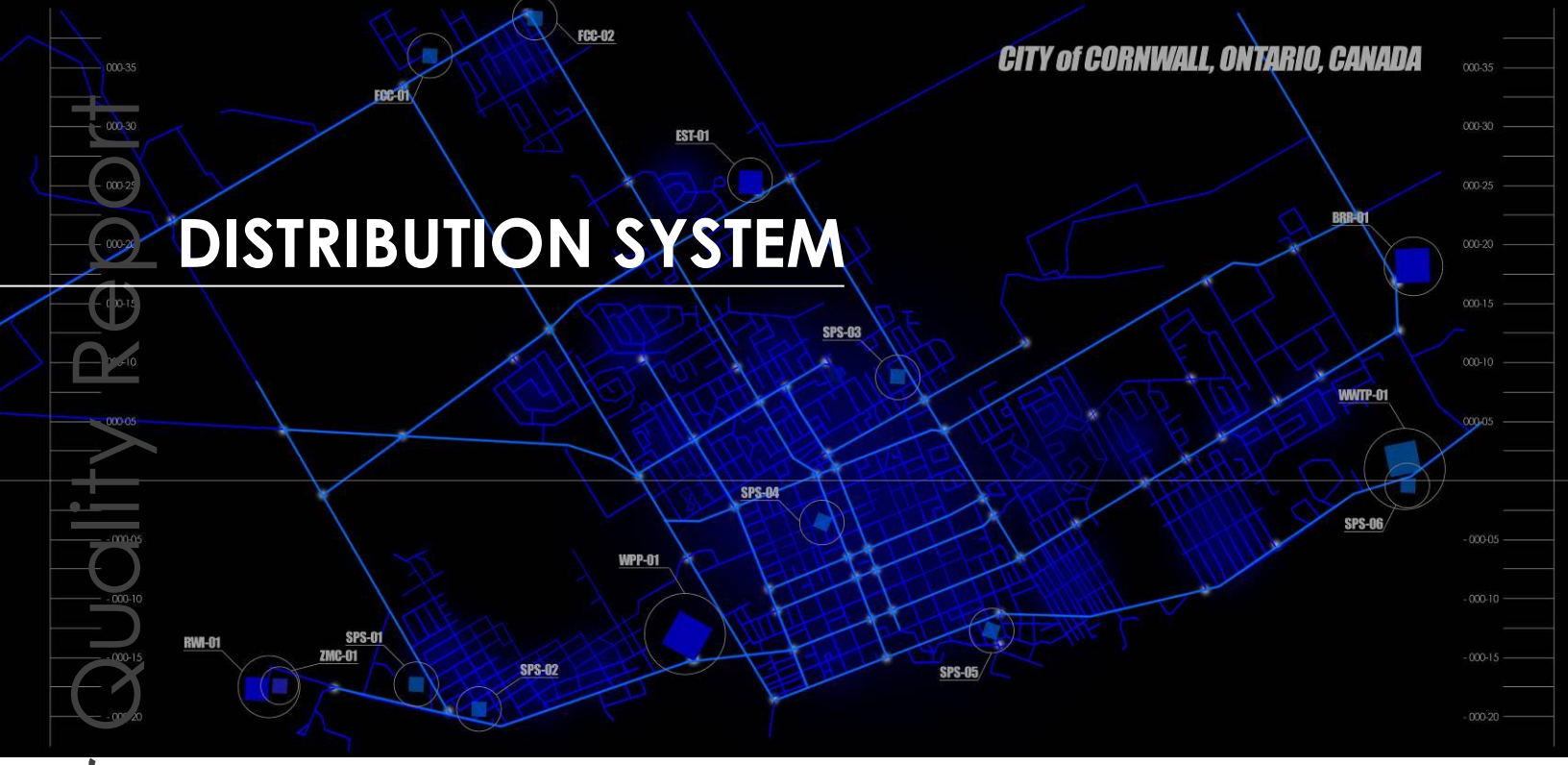
It is made up of the *Raw Water Intake and Zebra Mussel Control Facility* located at the base of the R.H. Saunders Power Generating Station, *the* **class III** *Water Purification Plant* located at 861 Second St. West, the *Boundary Road Reservoir, the Elevated Storage Tank* located on Tollgate Road, and the City's **class III** *Distribution System.*

Water is taken from the *St. Lawrence River* and treated according to **standard surface water treatment** methods before it's distributed to homes and businesses.

The ***Water Purification Plant*** uses *chemically assisted coagulation* and *flocculation* to remove particles suspended in the raw water. The water is then *filtered* and treated with *UV light* and *chlorine* for **disinfection.**

The system is rigorously inspected annually and in 2018 earned its **TENTH** consecutive **100%** compliance rating from the *Ministry of the Environment and Climate Change.*

100% 10 YEARS



DISTRIBUTION SYSTEM

The drinking water from Cornwall's Distribution System travels to residences, industrial, commercial, and institutional facilities through approximately 272 km of underground watermains.

The location of all 3,202 watermain pipes, 1,984 isolation gate valves, and 1,281 fire hydrants are recorded and continuously updated in the City's Geographic Information System (GIS) which provides City staff with accurate information regarding the layout of the Distribution System, as well as detailed asset and infrastructure information such as piping age and construction material.

The City's Municipal Works Department has implemented a Distribution System Flushing Program which ensures that chlorine residual levels in the Distribution System are being adequately maintained. This is accomplished by allowing distribution water to be discharged from fire hydrants and blow-offs for a specific amount of time then testing the water for free chlorine residual levels.

The flushing activities are carried out by Municipal Works staff and automated flushing systems in regularly scheduled intervals at strategic locations throughout the City.

The communities of St. Andrews and Rosedale Terrace in the Township of South Stormont were connected to the City's Distribution System in 1991.

St. Andrews' water is supplied by a connection in an underground valve chamber located at the intersection of Cornwall Centre Road and Highway 138, and Rosedale Terrace is supplied by a connection located beneath the intersection of Mack Street and Cornwall Centre Road.

Holy Trinity Catholic School in the Township of South Glengarry is also connected to the Cornwall Distribution System.

"*Our entire water system is a **critical** piece of **infrastructure** and we take great pride in having achieved a **perfect** inspection rating for **ten years in a row**.*"

-Shawn O'BRIEN
WATER DISTRIBUTION and WASTEWATER COLLECTION SUPERVISOR

City of Cornwall, Water Purification Plant Laboratory, 2011

SAMPLING and TESTING

In order to ensure Cornwall's water is clean and safe, distribution samples are regularly taken and laboratory tested for various parameters.

The sampling and testing parameters which apply to Cornwall's Drinking Water System are outlined in **Schedules 10, 13, 15** (see Lead Sampling & Testing Program)**, 23,** and **24** of O.Reg.170/03 under the Safe Drinking Water Act of 2002.

Schedule 10 requires that one (1) raw water sample and one (1) treated water sample be tested per week for Escherichia coli (E.coli) and total coliforms, and that a minimum of 55 samples per month be taken from at least 8 different locations in the Distribution System and be tested for the same parameters.

Water Purification Plant staff collected weekly samples from 15 different locations throughout the City in 2018 (see Figure 8) and submitted them to an accredited laboratory for testing.

The testing results of all 52 treated water samples and all of the 772 distribution water samples collected in 2018 indicated that there was no trace of E.coli or total coliforms in the City's drinking water.

Schedule 10 also requires that the general bacteria population of one treated water sample and 25% of the weekly distribution samples be tested and expressed in Heterotrophic Plate Count (HPC).

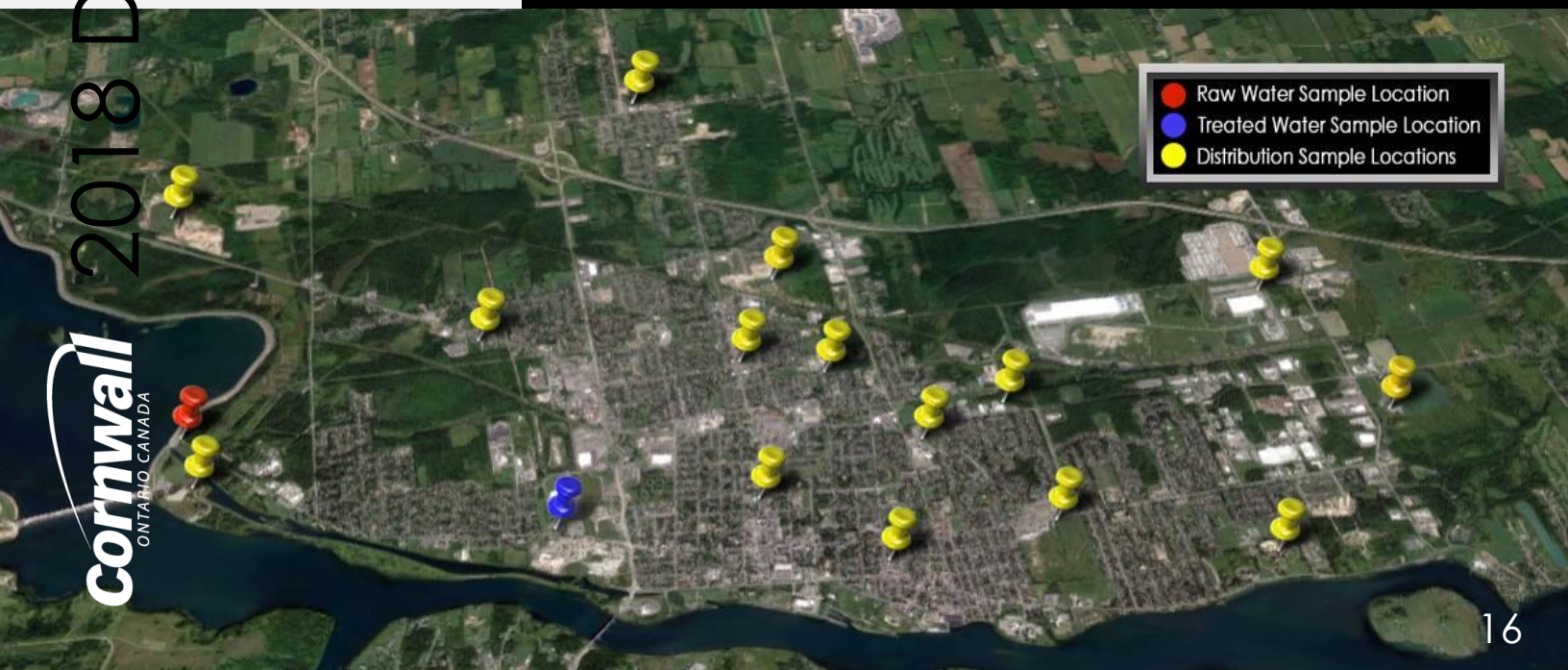
In 2018, 52 treated water samples and 260 Distribution System water samples were submitted to an accredited laboratory for HPC testing.

All HPC testing results indicated that Cornwall's drinking water is of excellent quality and is safe for consumption.

Schedule 13 of O.Reg.170/03 requires that the City's drinking water be sampled and tested for trihalomethane (THM), haloacetic acid (HAA), nitrate & nitrite levels once every three months, and that sodium levels be sampled and tested annually.

Laboratory results for 2018 indicate that the concentration levels of all parameters listed were below their respective allowable concentration limits.

Figure 8: City of Cornwall Weekly Microbiological Sampling Locations



SAMPLING and TESTING

As outlined in O.Reg.170/03, **Schedule 23 & 24** parameters are generally sampled and tested every three months; however due to the excellent quality of the City's drinking water, Cornwall is entitled to operate a *reduced frequency sampling program* under Schedule 13.5, which only requires the sampling and testing of the following parameters on an annual basis:

SCHEDULE 23
Inorganics Sampled Annually:

- Antimony
- Arsenic
- Barium
- Boron
- Cadmium
- Chromium
- Mercury
- Selenium
- Uranium

SCHEDULE 24
Organics Sampled Annually:

- Alachlor
- Atrazine + N-dealkylated metabolites
- Azinphos-methyl
- Benzene
- Benzo(a)pyrene
- Bromoxynil
- Carbaryl
- Carbofuran
- Carbon Tetrachloride
- Chlorpyrifos
- Diazinon
- Dicamba
- 1,2-Dichlorobenzene
- 1,4-Dichlorobenzene
- 1,2-Dichloroethane
- 1,1-Dichloroethylene
- Dichloromethane
- 2,4-Dichlorophenol
- 2,4-Dichlorophenoxy Acetic Acid
- Diclofop-methyl
- Dimethoate
- Diquat
- Diuron
- Glyphosate
- Malathion
- 2-Methyl-4-chlorophenoxyacetic acid
- Metolachlor
- Metribuzin
- Monochlorobenzene
- Paraquat
- Pentachlorophenol
- Phorate
- Picloram
- Polychlorinated Biphenyls
- Prometryne
- Simazine
- Terbufos
- Tetrachloroethylene
- 2,3,4,6-Tetrachlorophenol
- Triallate
- Trichloroethylene
- 2,4,6-Trichlorophenol
- Trifluralin
- Vinyl chloride

In the event that a tested sample from Schedule 23 or 24 indicates that the water contains one-half (50%) or more of the allowable concentration limit of a certain parameter, the City would be required to test for that parameter every three months. The requirement ceases to apply once the test results have shown that the water contains less than half of the allowable concentration limit of that parameter for four consecutive three-month periods.

The laboratory results for the samples taken from the City of Cornwall's water supply in 2018 indicate that the concentration levels of all of the parameters listed under Schedule 23 & 24 of O.Reg.170/03 under the Safe Drinking Water Act of 2002, were below one-half of their respective allowable concentration limits.

For more detailed Schedule 10, 13, 15, 23 and 24 laboratory results please see the 2018 Summary Report to the Ministry of the Environment attached to this report as Appendix A.

LEAD TESTING

Lead is a metal that was commonly used for indoor household plumbing until 1952. It has since been proven that the ingestion of, or exposure to small amounts of lead can cause severe detrimental effects to people's health, especially among young children and pregnant women.

As is specified in **Schedule 15** of Ontario Regulation 170/03, the City of Cornwall had already completed several rounds of lead testing in many volunteer private residences and distribution sampling points throughout the City in 2009 and 2010.

Based on those sampling test results the City is entitled to operate a *reduced lead sampling program* as prescribed under schedule 15.1-5 of Ontario Regulation 170/03; which states that we have satisfied the residential lead testing requirements and are therefore no longer required to sample residences for lead.

However, the City was required to collect four Distribution System samples in both the first and second halves of 2018 and have them tested for lead, pH and alkalinity.

All the samples were collected and tested and a maximum of 0.00158 mg/l of lead was detected. Alkalinity ranged between 88 and 114 mEq/L, and the average pH was 8.08. According to the regulations, the water must contain less than 0.01 mg/l of lead.

Two key pillars of the City's Strategic Plan are: "Healthy Quality of Life" and "Sustainable and Efficient Services". To address this in a water context, the City has adopted "Blueprint" as an urban water awareness and action brand. From a water supply and distribution perspective, Demand Management is a comprehensive approach within the Blueprint which includes water conservation. As part of this effort, the City has implemented a volunteer water meter installation program.

To date, over 1,880 water meters have been installed free-of-charge in single and multi-residential units providing residents with an opportunity to monitor and adapt to more water conserving habits. The City is also monitoring water consumption data.

Although the flat rate water billing framework has not changed, even for those with voluntary water meter installations, the City administration is currently reviewing policy, water consumption and the financial aspects, as part of the ***Blueprint*** of a comprehensive Demand Management approach.

BLUEprint

DRINKING WATER

Quality Management System

NSF-ISR

The City of Cornwall is committed to:

C*ontinually providing safe and clean drinking-water to City customers;*

L*egislative compliance with the Safe Drinking Water Act and related regulations;*

E*stablishing, maintaining, and continually improving its Drinking Water Quality Management System;*

A*cting to resolve any issues relating to drinking-water quality; and*

R*eviewing and improving its drinking-water system infrastructure.*

In the interest of better protecting the safety and quality of Ontario's drinking water systems, the Government of Ontario has incorporated new regulations (O.Reg.) into Ontario legislation under the Safe Drinking Water Act (SDWA, 2002).

These regulations provide in detail the requirements necessary for the safe and legal operation of a drinking water system, the requirements for completing testing services, the water quality testing parameters and standards, the drinking water quality analyst and drinking water system operator training and certification requirements, as well as procedures which outline the compliance and enforcement of all applicable regulations.

O.Reg. 188/07 states that in order to obtain a Drinking Water System License and operate a Municipal Drinking Water System, owners and operating authorities are required to incorporate the concept of quality management into the operations of their drinking water systems.

In short, an accredited Drinking Water Quality Management System (DWQMS) must be created and maintained in order to satisfy the new regulations.

The City of Cornwall underwent its fourth external audit conducted by NSF-ISR on June 28th, 2018 as part of maintaining our accreditation.

The City of Cornwall received entire full scope NSF-ISR accreditation for the City of Cornwall Drinking Water Quality Management System on July 25th, 2013.

On December 12th, 2016, the City received its most recent Drinking Water Works Permit (176-201, issue: 5), and on April 15th, 2016 received its second Municipal Drinking Water Licence (176-101, issue: 2) from the MECP.

OTHER EVENTS in 2018

MECP Annual Inspection Results for 2017:

On January 31st, 2018 a focused and unannounced inspection covering the operation of the entire Cornwall Drinking Water System between January 1st and December 31st, 2017 was completed by the MECP's Safe Drinking Water Branch (Inspection number: 1-FM9NH).

The inspection focused primarily on Water Purification Plant treatment processes, drinking water treatment & distribution operator training and certification, water quality monitoring, instrumentation & device calibration, and data logging & reporting. For the **tenth** consecutive year Cornwall has received a perfect rating of **100%** compliance.

New Variable Speed High Lift Pump

$550,000 was invested at the Water Purification Plant with the installation and commissioning of a new High Lift Distribution pump and associated flow, pressure, vibration, and temperature monitoring equipment. The new pump is equipped with a variable frequency drive that gives operators better control of the discharge flows while helping to reduce the plant's energy consumption.

Settling Tank Valve Replacement

$80,000 was invested to replace multiple valves in the Water Purification Plant's Settling Tank area.

Engineering Services for Multiple Projects

$80,000 was invested to provide engineering for the design of 8 projects related to the Water Purification Plant and its ancillary sites:

- WPP Travelling Screen Replacement
- Raw Water Intake Isolation Valve Upgrades
- WPP Roof Fall Arrest System Design
- WPP Motor Control Centre Replacement
- WPP Stand-by Generator Upgrades
- Temporary Raw Water Supply Line and Connection Design
- SCADA Hardware and Network Upgrades
- Ancillary Site Chemical Injection System Upgrades

Instrumentation Replacement and Upgrades:

$35,000 was also invested to purchase new calibration equipment and replace and upgrade various sensing devices throughout the Water Purification System including:

- Turbidity Monitoring Transmitters
- Free Chlorine & pH Analyzing Transmitters
- Level Monitoring Transmitters

Water Distribution Infrastructure:

Over $661,435 was invested on the City's water distribution infrastructure. This includes $489,932 for the rehabilitation and relining of multiple watermains throughout numerous portions of the City, $83,452 in the installation of new watermains for the Lemay Street extension project, and $88,050 for the replacement of watermains on a portion of Westmooreland Avenue in Riverdale.

TREATED WATER SUMMARY

	TOTAL VOLUME	MAXIMUM FLOW	MINIMUM FLOW	AVERAGE FLOW	PRODUCTION CAPACITY
JANUARY	944,520 m³	22,666 l/m	19,279 l/m	21,158 l/m	30.4 %
FEBRUARY	850,271 m³	22,136 l/m	20,191 l/m	21,088 l/m	30.3 %
MARCH	1,048,676 m³	27,421 l/m	20,354 l/m	23,492 l/m	33.8 %
APRIL	965,355 m³	23,909 l/m	21,513 l/m	22,347 l/m	32.2 %
MAY	1,071,176 m³	27,261 l/m	21,335 l/m	23,995 l/m	34.6 %
JUNE	1,081,133 m³	28,396 l/m	22,393 l/m	25,026 l/m	36.0 %
JULY	1,366,745 m³	36,647 l/m	23,954 l/m	30,617 l/m	44.1 %
AUGUST	1,045,435 m³	29,446 l/m	18,202 l/m	23,419 l/m	33.7 %
SEPTEMBER	847,228 m³	23,038 l/m	18,026 l/m	19,612 l/m	28.2 %
OCTOBER	805,436 m³	18,927 l/m	17,218 l/m	18,043 l/m	26.0 %
NOVEMBER	762,659 m³	18,881 l/m	16,513 l/m	17,654 l/m	25.4 %
DECEMBER	776,456 m³	18,136 l/m	16,577 l/m	17,393 l/m	25.0 %
TOTAL:	11,565,090m²		AVERAGE:	21,964 l/m or 31.6%	

Our Water Purification Plant has the capacity to produce and distribute a volume of 100,000, cubic meters per day (m³) at a maximum flow rate of 70,000 litres per minute (l/m).

inquiries

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Please Think Before You Print

Disclaimer:

Unless otherwise specifically stated, the information contained herein is made available to the public by the Environmental Services Department of the City of Cornwall for use as general information only. The intent of this annual report is to inform the public of the performance of the City of Cornwall's Drinking Water System for the year 2018.

Reference herein to any specific commercial product, process, service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement, recommendation, or favoring by the Corporation of the City of Cornwall or any entities thereof.

The views and opinions of the originators expressed therein do not necessarily state or reflect those of the Corporation of the City of Cornwall or any agency or entities thereof.

Cornwall
ONTARIO CANADA

DRINKING WATER QUALITY REPORT: APPENDIX

MECP ANNUAL SUMMARY REPORT

2018

Department of Infrastructure & Municipal Works
Environmental Services Division

Ontario **Drinking-Water Systems Regulation O. Reg. 170/03**

Drinking-Water System Number:	22001049
Drinking-Water System Name:	Cornwall Water Treatment Plant
Drinking-Water System Owner:	Corporation Of The City Of Cornwall
Drinking-Water System Category:	Large Municipal Residential
Period being reported:	January 1, 2018 – December 31, 2018

Complete if your Category is Large Municipal Residential or Small Municipal Residential	***Complete for all other Categories.***
Does your Drinking-Water System serve more than 10,000 people? Yes [x] No [ ] **Is your annual report available to the public at no charge on a web site on the Internet?** **Yes [x] No [ ]** **Location where Summary Report required under O. Reg. 170/03 Schedule 22 will be available for inspection.** City of Cornwall Water Purification Plant 861 Second Street West Cornwall, Ontario Telephone: (613) 932-2235	**Number of Designated Facilities served:** **Did you provide a copy of your annual report to all Designated Facilities you serve?** **Yes [ ] No [ ]** **Number of Interested Authorities you report to:** **Did you provide a copy of your annual report to all Interested Authorities you report to for each Designated Facility?** **Yes [ ] No [ ]**

List all Drinking-Water Systems (if any), which receive all of their drinking water from your system:

Drinking Water System Name	Drinking Water System Number
St. Andrews West/Rosedale Distribution System	260001250

Did you provide a copy of your annual report to all Drinking-Water System owners that are connected to you and to whom you provide all of its drinking water?

Yes [X] No [ ]

Indicate how you notified system users that your annual report is available, and is free of charge.

[X] Public access/notice via the web
[ ] Public access/notice via Government Office
[ ] Public access/notice via a newspaper
[X]Public access/notice via Public Request
[ ] Public access/notice via a Public Library
[ ] Public access/notice via other method _____

Describe your Drinking-Water System

Source water is Lake St. Lawrence with pre-chlorination for zebra mussel control. Water Purification Plant is a conventional water treatment plant with chemically assisted filtration, Ultra-Violet disinfection, sodium hypochlorite disinfection, and advanced oxidation with hydrogen peroxide. The Water Purification Plant has a capacity of 100, 000 cubic metres per day, treats and distributes approximately 11.5 million cubic metres annually of potable water through 272 kilometres of distribution pipes.

List all water treatment chemicals used over this reporting period

Chlorine Liquefied Gas,
Polyaluminum Chloride Coagulant,
Sodium Hypochlorite,

Were any significant expenses incurred to?

[X] Install required equipment
[X] Repair required equipment
[X] Replace required equipment

Please provide a brief description and a breakdown of monetary expenses incurred

- Water Main Relining ($490,000)
- Water Main Replacement ($88,900)
- Water Main Addition ($83,000)
- High Lift Pump Replacement ($550,000)
- Settling Tank Valve Replacement ($80,000)
- Water Plant Engineering Services ($80,000)
- Instrumentation Equipment ($35,000)

Provide details on the notices submitted in accordance with subsection 18(1) of the Safe Drinking-Water Act or section 16-4 of Schedule 16 of O.Reg.170/03 and reported to Spills Action Centre

Incident Date	Parameter	Result	Unit of Measure	Corrective Action	Corrective Action Date
None					

Microbiological testing done under the Schedule 10, 11 or 12 of Regulation 170/03, during this reporting period.

	Number of Samples	Range of E.Coli Or Fecal Results (min #)-(max #)	Range of Total Coliform Results (min #)-(max #)	Number of HPC Samples	Range of HPC Results (min #)-(max #)
Raw	52	0 - 51	<2 – 110	N/A	N/A
Treated	52	0 - 0	0 - 0	52	<2 - 2
Distribution	772	0 - 0	0 - 0	260	<2 - 84

Operational testing done under Schedule 7, 8 or 9 of Regulation 170/03 during the period covered by this Annual Report.

	Number of Grab Samples	Range of Results (min #)-(max #)
Turbidity	8760	0.04 - 0.50 NTU
Chlorine	8760	0.66– 4.80 mg/L
Fluoride (If the DWS provides fluoridation)	N/A	N/A

***NOTE**: For continuous monitors use 8760 as the number of samples.*

Summary of additional testing and sampling carried out in accordance with the requirement of an approval, order or other legal instrument.

Date of legal instrument issued	Parameter	Date Sampled	Result	Unit of Measure
None				

Summary of parameters tested during this reporting period or the most recent sample results

Parameter	Sample Date	Result Value	Unit of Measure	Exceedance
Antimony	08/01/18	<0.0001	mg/L	no
Arsenic	08/01/18	0.0004	mg/L	no
Barium	08/01/18	0.020	mg/L	no
Boron	08/01/18	0.023	mg/L	no
Cadmium	08/01/18	<0.00002	mg/L	no
Chromium	08/01/18	<0.002	mg/L	no
Mercury	08/01/18	<0.00002	mg/L	no
Selenium	08/01/18	<0.001	mg/L	no
Sodium	08/01/18	14.9	mg/L	no
Uranium	08/01/18	<0.00005	mg/L	no
Fluoride	08/01/18	<0.1	mg/L	no

Nitrite	08/01/18	<0.1	mg/L	no
	09/04/18	<0.1	mg/L	no
	09/07/18	<0.1	mg/L	no
	09/10/18	<0.1	mg/L	no
Nitrate	08/01/18	0.3	mg/L	no
	09/04/18	0.4	mg/L	no
	09/07/18	0.2	mg/L	no
	09/10/18	0.2	mg/L	no

Summary of lead testing under Schedule 15.1 during this reporting period
(applicable to the following drinking water systems; large municipal residential systems, small
municipal residential systems, and non-municipal year-round residential systems)

Location Type	Number of Samples	Range of Lead Results (min#) – (max #)	Number of Exceedances
Plumbing	N/A	N/A	0
Distribution	8	0.00009 mg/L - 0.00158 mg/L	0

* On reduced monitoring schedule as per Schedule 15.1 distribution samples collected for lead, pH and alkalinity in 2018.

Summary of parameters sampled during this reporting period or the most recent sample results

Parameter	Sample Date	Result Value	Unit of Measure	Exceedance
Alachlor	**08/01/18**	<0.3	µg/L	no
Atrazine + N-dealkylated metobolites	**08/01/18**	<0.5	µg/L	no
Azinphos-methyl	**08/01/18**	<1	µg/L	no
Benzene	**08/01/18**	<0.5	µg/L	no
Benzo(a)pyrene	**08/01/18**	<0.005	µg/L	no
Bromoxynil	**08/01/18**	<0.3	µg/L	no
Carbaryl	**08/01/18**	<3	µg/L	no
Carbofuran	**08/01/18**	<1	µg/L	no
Carbon Tetrachloride	**08/01/18**	<0.2	µg/L	no
Chlorpyrifos	**08/01/18**	<0.5	µg/L	no
Diazinon	**08/01/18**	<1	µg/L	no
Dicamba	**08/01/18**	<5	µg/L	no
1,2-Dichlorobenzene	**08/01/18**	<0.1	µg/L	no
1,4-Dichlorobenzene	**08/01/18**	<0.2	µg/L	no
1,2-Dichloroethane	**08/01/18**	<0.1	µg/L	no
1,1-Dichloroethylene (vinylidene chloride)	**08/01/18**	<0.1	µg/L	no
Dichloromethane	**08/01/18**	<0.3	µg/L	no
2-4 Dichlorophenol	**08/01/18**	<0.1	µg/L	no
2,4-Dichlorophenoxy acetic acid (2,4-D)	**08/01/18**	<5	µg/L	no
Diclofop-methyl	**08/01/18**	<0.5	µg/L	no

Dimethoate	**08/01/18**	<1	µg/L	no
Diquat	**08/01/18**	<5	µg/L	no
Diuron	**08/01/18**	<5	µg/L	no
Glyphosate	**08/01/18**	<25	µg/L	no
Malathion	**08/01/18**	<5	µg/L	no
2 methyl-4-chlorophenoxyacetic acid (MCPA)	**08/01/18**	<0.10	µg/L	no
Metolachlor	**08/01/18**	<3	µg/L	no
Metribuzin	**08/01/18**	<3	µg/L	no
Monochlorobenzene	**08/01/18**	<0.2	µg/L	no
Paraquat	**08/01/18**	<1	µg/L	no
Pentachlorophenol	**08/01/18**	<0.1	µg/L	no
Phorate	**08/01/18**	<0.3	µg/L	no
Picloram	**08/01/18**	<5	µg/L	no
Polychlorinated Biphenyls(PCB)	**08/01/18**	<0.05	µg/L	no
Prometryne	**08/01/18**	<0.1	µg/L	no
Simazine	**08/01/18**	<0.5	µg/L	no
THM **(NOTE: show latest annual average)**	**08/01/18** **09/04/18** **09/07/18** **09/10/18** **2018 Avg**	21.1 35.4 55.3 42.6 38.7	µg/L µg/L µg/L µg/L µg/L	no no no no no
Terbufos	**08/01/18**	<0.3	µg/L	no
Tetrachloroethylene	**08/01/18**	<0.2	µg/L	no
2,3,4,6-Tetrachlorophenol	**08/01/18**	<0.1	µg/L	no
Triallate	**08/01/18**	<10	µg/L	no
Trichloroethylene	**08/01/18**	<0.1	µg/L	no
2,4,6-Trichlorophenol	**08/01/18**	<0.1	µg/L	no
Trifluralin	**08/01/18**	<0.5	µg/L	no
Vinyl Chloride	**08/01/18**	<0.2	µg/L	no
Chloroform (Distribution)	**08/01/18** **09/04/18** **09/07/18** **09/10/18**	11.6 22.3 33.3 23.1	µg/L µg/L µg/L µg/L	no no no no
Bromoform (Distribution)	**08/01/18** **09/04/18** **09/07/18** **09/10/18**	<0.1 <0.1 <0.1 <0.1	µg/L µg/L µg/L µg/L	no no no no
Dibromochloromethane (Distribution)	**08/01/18** **09/04/18** **09/07/18** **09/10/18**	2.6 2.9 6.7 6.7	µg/L µg/L µg/L µg/L	no no no no
Bromodichloromethane (Distribution)	**08/01/18** **09/04/18** **09/07/18** **09/10/18**	6.9 10.2 15.3 12.8	µg/L µg/L µg/L µg/L	no no no no

Haloacetic Acids (Distribution)	**08/01/18**	12.5	µg/L	no
	16/04/18	16.4	µg/L	no
	09/07/18	18.9	µg/L	no
	09/10/18	14.5	µg/L	no
(NOTE: show latest annual average)	**2018 Avg**	15.6	µg/L	no
Chloroacetic Acids (Distribution)	**08/01/18**	<4.7	µg/L	no
	16/04/18	<4.7	µg/L	no
	09/07/18	<4.7	µg/L	no
	09/10/18	<2.0	µg/L	no
Bromoacetic Acid (Distribution)	**08/01/18**	<2.9	µg/L	no
	16/04/18	<2.9	µg/L	no
	09/07/18	<2.9	µg/L	no
	09/10/18	<2.0	µg/L	no
Dichloroacetic Acid (Distribution)	**08/01/18**	6.9	µg/L	no
	16/04/18	7.8	µg/L	no
	09/07/18	13.0	µg/L	no
	09/10/18	8.9	µg/L	no
Dibromoacetic Acid (Distribution)	**08/01/18**	<2.0	µg/L	no
	16/04/18	<2.0	µg/L	no
	09/07/18	<2.0	µg/L	no
	09/10/18	<2.0	µg/L	no
Trichloroacetic Acid (Distribution)	**08/01/18**	5.6	µg/L	no
	16/04/18	8.6	µg/L	no
	09/07/18	5.9	µg/L	no
	09/10/18	3.3	µg/L	no

List any Inorganic or Organic parameter(s) that exceeded half the standard prescribed in Schedule 2 of Ontario Drinking Water Quality Standards.

Parameter	Result Value	Unit of Measure	Date of Sample
None			