CITY OF LONDON
2018 DRINKING WATER SUMMARY REPORT

System Name: City of London Distribution System

Mailing Address: Corporation of the City of London
P.O. Box 5035, 300 Dufferin Ave.
London, ON N6A 4L9

System Rating:
Water Distribution Subsystem Class IV
Water Treatment Subsystem Class II
Average Day Demand: 129.244 MLD
Peak Day Demand: 170.735 MLD (June 17, 2018)
Population Served: 385,000 (approx.)
Source Water: Surface Water (Lake Huron, Lake Erie)
Drinking Water System Number: 260004917
Municipal Drinking Water Licence: 006-101

CONTACT INFO:
Owner:
Corporation of the City of London
300 Dufferin Avenue, London, Ontario N6A 4L9
Contact: Mr. John Simon, P.Eng. Division Manager Water Operations
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London CANADA

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Reporting Requirements

Ontario Regulation 170/03 requires that municipalities prepare a Summary Report for their drinking-water system for the preceding calendar year and submit it to the members of the Municipal Council by March 31 of each year. This report, presented to Municipal Council's Civic Works Committee on February 20, 2019 fulfills that requirement.

O. Reg 170/03 also requires the preparation of an Annual Report on the operation of the drinking-water system to be made available to members of the public.

Before February 28, 2019, a copy of the 2018 Annual Report and Summary Report for the City of London's water works will be provided to the local office of the Ministry of the Environment, Conservation and Parks (MECP) as a courtesy for information purposes.

The Elgin-Middlesex Pumping Station (EMPS) is jointly owned by the St. Thomas Secondary Water Supply System, the Aylmer Secondary Water Supply System, and the City of London. EMPS is operated by the Ontario Clean Water Agency (OCWA). As required, the Annual Report for the EMPS (London portion) is attached as an appendix to this report for members of Council.

Water Budget

The approved 2016-2019 operating and capital budgets represent financial sustainability for Londoners, whereby annual rate increases are approximately the average of the Consumer Price Index (CPI) and the Non-Residential Building Construction Price Index (NRBCPI). The 2016-2019 water operating and capital budgets support four core business objectives:

- Compliance
- Financial Management
- Customer Service
- Best Management Practices

The total Water budget for 2018 was $78.0 million, which includes long term infrastructure improvements. The Water Budget helps maintain London's Advantage of a safe, clean and secure water supply. The Water Service Area remains proactive in initiatives to ensure that this service continues to meet the demands and expectations of customers. Existing infrastructure requires ongoing renewal (replacement and rehabilitation) activities to manage the infrastructure gap, ensuring that future generations are not faced with a water system that is failing, unreliable, and expensive to maintain.

Notable Initiatives

Bulk Water System Replacement
The City of London has 8 bulk water filling station locations that allow commercial, residential, and bulk water contractors to obtain bulk water. These 8 locations are the only authorized locations where bulk filling is allowed in the City, and are situated and designed to help minimize the risk and attempts of theft of water from fire hydrants.

The previous system was over 12 years old, and antiquated given current technology. It required customers to go directly to City Hall to add value to their prepaid "smart card" so that they could then go to a bulk water station to obtain water. There was no reporting capabilities for customers, and consumption data had to be manually downloaded from each station, making it very basic and labour intensive.

In 2017, the City of London issued and awarded an RFP for a new system. In spring of 2018 the new system was installed and has been very successful, and well received. Our customers can now add value to their account any time of day by logging in, and have numerous reporting abilities to enhance their business functionality, providing the

"who, when and where" for water takings.

City staff now have the ability to easily report water consumption at each station, who is taking water, when the water is taken, and how much, right from the office environment. More importantly, the ability to transmit messages to various stations for users to see (for example, in the event a station needs to be closed for maintenance), or alternatively, shut down a station remotely so that water taking can be temporarily halted at that location. However, the biggest benefit has been the ability to assist our customers in real time when they encounter difficulties. We can see what is going on at any given station 24/7 without needing to go onsite. This major customer service improvement has invaluable.

Water Meter Replacement Program

In 2008, assessment of London's long term water meter and meter reading strategy involved investigation and evaluation of alternatives ranging from the "status quo" to implementation of the highest "state of the art system". Evaluation criteria included review of London Hydro's "Smart Metering" and meter upgrade requirements, the current relationship between London Hydro and the City, customer care and service, ease of implementation, capital cost, operating costs, meter readability, system reliability, system needs and benefits. Upon completion of the evaluation, the City opted for the Itron Encoder Receiver Transmitter (ERT) based radio read system as it best met our needs for meter reading, customer service, capital cost, minimized operating cost, and utilized existing encoder meter infrastructure, allowing for a more cost effective upgrade. This technology retained the option and opportunity to expand on meter data gathering, or to merge into an Advanced Metering Infrastructure (AMI) system in the future.

Starting in 2009, the City implemented the Water Meter Replacement Program, in which 10,000 to 12,000 water meters were to be targeted for replacement each year, over a ten year period, in order to complete the transition from a manual walk-by meter reading system to a full radio-read drive-by meter reading system. Other benefits of this meter replacement program would be the virtual elimination of estimated monthly meter reads for customers, increased customer service, and less disruption to customers for meter reading as there would no longer be the need to entry the premises or yards of customers to obtain the readings.

As of the end of 2018, the Water Meter Replacement Program has been completed, with nearly all of our 118,000 water meters being converted over to radio read meters, with the exception of less than 300 difficult-to-access accounts. London Hydro, our contracted water meter reading and billing contractor, initiated full drive-by meter reading for the City of London water meters in January 2019.

Downtown Leak Detection Fixed Network

The City consists of over 1,600 km of water main and associated hydrants, water service connections, and other appurtenances. London experiences, on average, 120 water main breaks a year, although the last several years have been below this. London's water loss level is relatively low (less than 10%; or an internationally recognized Infrastructure Leakage Index (ILI) factor of around 2.0), placing us amongst the best municipalities in North America.

Permanent leakage monitoring is a practice that has been popular in Europe and the Middle East for numerous years. Recently, it has been gaining popularity in North America, and London had been considering it for several years. In 2018, the Water Service Area deployed Acoustic Leak Loggers on our metallic watermains in the core downtown area. They log noise levels nightly (during a quiet period), and through automatic software analysis of this data the system provides the probability of leakage based on the level and consistency of the noise. If a high leak probability is found, the data is correlated and the leak location is pin-pointed. The data is displayed on a map, and colour codes depict the probability and locations of leaks. All of this is done prior to anyone going out to the field to investigate.

To date, this system has pin-pointed with high accuracy 1 watermain break, and 9 leaks

(on services, hydrants or valves). The early detection of these failures allowed repair efforts to be coordinated as non-emergency events during normal working hours, minimizing both the financial, and public impact.

Sampling & Water Quality Monitoring

In 2018, the MECP required large municipal drinking water systems to test for 70 different organic, inorganic and chemical parameters. The City of London's water sampling regime includes monthly testing for microbiological indicators and chlorine residuals from 57 standard locations across the City, as well as nearly 2,350 random grab samples. Analysis is also performed for up to 117 parameters, including organics, inorganics, chemicals, pesticides and metals at 13 standard locations around the City. This level of testing far exceeds the MECP's minimum sampling requirements.

London also has 10 locations throughout the City where continuous in-line sampling of chlorine residual and pH is monitored. Staff also perform approximately 4,000 additional chlorine tests each year related to construction and maintenance activities. All of these efforts help ensure that the water within the distribution system is always of high quality and completely safe to consume.

2018 Water Quality Sampling Summary

Parameter	Ontario Maximum Acceptable Concentration (MAC)	Units	Lab's Method Detection Limit (MDL)	Measured Concentrations 2018	MAC Exceedance (Y/N)
REGULATED INORGANICS					
Antimony	6	ug/L	0.02	**0.11 - 0.16**	No
Arsenic	25	ug/L	0.2	**0.3 - 0.4**	No
Barium	1000	ug/L	0.02	**13.8 - 22.1**	No
Boron	5000	ug/L	2	**15 - 23**	No
Cadmium	5	ug/L	0.003	**0.047 - 0.073**	No
Chromium	50	ug/L	0.03	**0.09 - 0.16**	No
Fluoride	1.5	mg/L	0.06	**0.13 - 0.87**	No
Free Chlorine Residual	--	mg/L		**0.1 - 3.00**	No
Lead	10	ug/L	0.01	**<MDL**	No
Mercury	1	ug/L	0.01	**0.02 - 0.03**	No
Selenium	10	ug/L	0.04	**0.13 - 0.18**	No
Sodium	*20	mg/L	0.01	**8.52 - 17.2**	No
Uranium	20	ug/L	0.002	**0.029 - 0.056**	No

Parameter	Ontario Maximum Acceptable Concentration (MAC)	Units	Lab's Method Detection Limit (MDL)	Measured Concentrations	MAC Exceedance (Y/N)
				2018	
REGULATED ORGANICS					
Atrazine	--	ug/L	0.01	**0.01 - 0.05**	No
Atrazine + N-dealkylated metabolites	5	ug/L	0.01	**0.02 - 0.07**	No
De-ethylated Atrazine	--	ug/L	0.01	**<MDL**	No
Azinphos-methyl	20	ug/L	0.05	**<MDL**	No
Benzene	5	ug/L	0.32	**<MDL**	No
Benzo(a)pyrene	0.01	ug/L	0.004	**<MDL**	No
Bromoxynil	5	ug/L	0.33	**<MDL**	No
Carbaryl	90	ug/L	0.05	**<MDL**	No
Carbofuran	90	ug/L	0.01	**<MDL**	No
Carbon tetrachloride	5	ug/L	0.16	**<MDL**	No
Chlorpyrifos	90	ug/L	0.02	**<MDL**	No
Diazinon	20	ug/L	0.02	**<MDL**	No
Dicamba	120	ug/L	0.2	**<MDL**	No
1,2-Dichlorobenzene	200	ug/L	0.41	**<MDL**	No
1,4-Dichlorobenzene	5	ug/L	0.36	**<MDL**	No
1,2-Dichloroethane	5	ug/L	0.35	**<MDL**	No
Dichloromethane	50	ug/L	0.35	**<MDL**	No
2,4-dichlorophenol	900	ug/L	0.15	**<MDL**	No
2,4-dichlorophenoxyacetic acid (2,4-D)	100	ug/L	0.19	**<MDL**	No
Diclofop-methyl	9	ug/L	0.4	**<MDL**	No
Dimethoate	20	ug/L	0.03	**<MDL**	No
Diquat	70	ug/L	1	**<MDL**	No
Diuron	150	ug/L	0.03	**<MDL**	No
Glyphosate	280	ug/L	1	**<MDL**	No
Malathion	190	ug/L	0.02	**<MDL**	No
MCPA	--	mg/L	0.00012	**<MDL**	No

Parameter	Ontario Maximum Acceptable Concentration (MAC)	Units	Lab's Method Detection Limit (MDL)	Measured Concentrations	MAC Exceedance (Y/N)
				<MDL	
REGULATED ORGANICS CON'T					
Metolachlor	50	ug/L	0.01	**<MDL**	No
Metribuzin	80	ug/L	0.02	**<MDL**	No
Monochlorobenzene	80	ug/L	0.3	**<MDL**	No
Paraquat	10	ug/L	1	**<MDL**	No
Pentachlorophenol	--	ug/L	0.15	**<MDL**	No
Phorate	2	ug/L	0.01	**<MDL**	No
Picloram	190	ug/L	1	**<MDL**	No
Polychlorinated Biphenyls (PCBs)	3	ug/L	0.04	**<MDL**	No
Prometryne	1	ug/L	0.03	**<MDL**	No
Simazine	10	ug/L	0.01	**<MDL**	No
Terbufos	1	ug/L	0.01	**<MDL**	No
2,3,4,6-tetrachlorophenol	100	ug/L	0.2	**<MDL**	No
Triallate	230	ug/L	0.01	**<MDL**	No
Trichloroethylene	50	ug/L	0.44	**<MDL**	No
2,4,6-trichlorophenol	5	ug/L	0.25	**<MDL**	No
Trifluralin	45	ug/L	0.02	**<MDL**	No
Vinyl Chloride	2	ug/L	0.17	**<MDL**	No

Parameter	Ontario Maximum Acceptable Concentration (MAC)	Units	Lab's Method Detection Limit (MDL)	Measured Concentrations	MAC Exceedance (Y/N)
				2018	
NON-REGULATED INORGANICS/ORGANICS					
Alkalinity	--	mg/L as CaCO3	2	**79 - 93**	No
Aluminum	--	ug/L	0.3	**20.2 - 38.6**	No
Ammonia+Ammonium (N)	--	mg/L	0.04	**<MDL**	No
Calcium	--	mg/L	0.01	**27.1 - 34.4**	No
Chloride	--	mg/L	0.04	**8.8 - 19**	No
Cobalt	--	ug/L	0.004	**0.021 - 0.057**	No
Colour	--	TCU	3	**<MDL**	No
Conductivity	--	uS/cm	2	**224 - 300**	No
Copper	--	ug/L	0.02	**0.71 - 1.44**	No
Cyanide	0.2	mg/L	0.002	**<MDL**	No
1,1-Dichloroethylene (vinylidene chloride)	14	ug/L	0.33	**<MDL**	No
Dissolved Organic Carbon	--	mg/L	1	**1 - 2**	No
Ethylbenzene	--	ug/L	0.33	**<MDL**	No
Hardness	--	mg/L as CaCO3	0.05	**99.9 - 122**	No
Iron	--	ug/L	7	**<MDL**	No
Langelier's Index	--	#N/A	--	**<MDL**	No
Magnesium	--	mg/L	0.001	**7.82 - 8.77**	No
Manganese	--	ug/L	0.01	**<MDL**	No
Nickel	--	ug/L	0.1	**0.1 - 0.4**	No
Nitrogen-Kjeldahl (N)	--	mg/L	0.05	**0.06 - 0.09**	No
Organic Nitrogen	--	mg/L	0.05	**0.05 - 0.07**	No
pH	--	no unit	0.05	**7.85 - 8.07**	No
Phosphorus	--	mg/L	0.003	**<MDL**	No
Potassium	--	mg/L	0.003	**0.99 - 1.7**	No

Parameter	Ontario Maximum Acceptable Concentration (MAC)	Units	Lab's Method Detection Limit (MDL)	Measured Concentrations	MAC Exceedance (Y/N)
				<MDL	
NON-REGULATED INORGANICS/ORGANICS CON'T					
Silicon	--	ug/L	20	**503 - 822**	No
Silicon; reactive silicate	--	mg/L	0.02	**1.17 - 1.4**	No
Silver	--	ug/L	0.002	**0.002 - 0.007**	No
Solids (Total Dissolved)	--	mg/L	30	**131 - 163**	No
Sulphate	--	mg/L	0.04	**24 - 33**	No
Sulphide	--	mg/L	0.006	**<MDL**	No
Surr 1,2-Dichloroethane-d4	--	Surr Rec %	--	**101 - 103**	No
Surr 4-Bromofluorobenzene	--	Surr Rec %	--	**93**	No
Surr Decachlorobiphenyl	--	%	--	**88 - 93**	No
Tetrachloroethylene (perchloroethylene)	30	ug/L	0.35	**<MDL**	No
Toluene	--	ug/L	0.36	**<MDL**	No
Total Chlorine-Field	--	mg/L	--	**0.8 - 1.18**	No
2,4,5-TP (Silvex)	--	ug/L	0.18	**<MDL**	No
Turbidity	1	NTU	0.1	**0.24 - 0.38**	No
Xylene (Total)	--	ug/L	0.43	**<MDL**	No
m/p-xylene	--	ug/L	0.43	**<MDL**	No
o-xylene	--	ug/L	0.17	**<MDL**	No
Zinc	--	ug/L	2	**1 - 2**	No

Parameter	Ontario Maximum Acceptable Concentration (MAC)	Units	Lab's Method Detection Limit (MDL)	Measured Concentrations 2018	MAC Exceedance (Y/N)
TRIHALOMETHANES & HALOACETIC ACIDS					
Total Haloacetic Acids	--	ug/L	5.3	**5.3 - 28.7**	No
Dibromoacetic Acid	--	ug/L	2.9	**<MDL**	No
Dichloroacetic Acid	--	ug/L	4.7	**4.9 - 20.1**	No
Monobromoacetic acid	--	ug/L	2.9	**<MDL**	No
Monochloroacetic Acid	--	ug/L	4.7	**<MDL**	No
Trichloroacetic Acid	--	ug/L	5.3	**5.3 - 12.9**	No
Trihalomethanes (total)	--	ug/L	0.37	**17 - 51**	No
Bromodichloromethane	--	ug/L	0.26	**5.6 - 12**	No
Bromoform	--	ug/L	0.34	**0.34 - 0.41**	No
Chloroform	--	ug/L	0.29	**8.9 - 33**	No
Dibromochloromethane	--	ug/L	0.37	**2 - 4.7**	No

Parameter	Ontario Maximum Acceptable Concentration (MAC)	Units	Lab's Method Detection Limit (MDL)	Measured Concentrations 2018	MAC Exceedance (Y/N)
NITRATES					
Nitrate (as nitrogen)	--	mg/L	0.006	**0.105 - 0.826**	No
Nitrate + Nitrite (as nitrogen)	--	mg/L	0.006	**0.105 - 0.826**	No
Nitrite (as nitrogen)	--	mg/L	0.003	**0.005 - 1.7**	No

Parameter	Ontario Maximum Acceptable Concentration (MAC)	Units	Lab's Method Detection Limit (MDL)	Measured Concentrations 2018	MAC Exceedance (Y/N)
MICROBIOLOGICAL					
E. coli	0	cfu/100 mL	0	**0 - 0**	No
Total Coliform	0	cfu/100 mL	0	**0 - 16**	Yes
Heterotrophic Plate Count	N/A	cfu/1 mL	10	**10 - 900**	No

In 2018, there were eight (8) adverse microbiological results out of 2,347 samples taken. All involved the detection of Total Coliform bacteria (ranging from 1 to 16 cfu/100 mL). In each case, staff implemented the mandatory adverse response procedure, which included notifying the MECP and the Middlesex-London Health Unit, and immediately re-sampled at each location. The re-sample results revealed no adverse indicators.

In all instances it is highly unlikely that there were ‘actual’ water quality issues at these sites, as all adverse samples were identified as having free chlorine residuals which were well above the minimum acceptable level at the time of the sampling (ranging between 0.30 to 1.11 mg/L). E. coli and Coliform bacteria cannot survive in chlorinated water; therefore, it is suspected that post-sampling contamination occurred. The re-sampling results support this conclusion. The microbiological testing procedure is extremely sensitive; accidental sample contamination can occur through operator or laboratory error, despite the specific procedures and precautions being adhered to while processing samples.

System Statistics and Major Events

During the period from January 1, 2018 through to December 31, 2018 a total of 47,501,265,000 litres of water were purchased, at a cost of more than $25,665,000, from the Joint Water Boards and subsequently pumped into London via the Arva

Pumping Station and EMPS. Average day demand was 129,244,000 litres. Peak day consumption of 170,735,000 litres occurred on June 17, 2018.

A summary of system pumpage can be found starting on page 32. The data includes monthly average and maximum daily flows. These values are also compared to the rated flow rate capacities identified in London's Municipal Drinking Water Licence. There were no occurrences of flow rate exceedance during the specified time period.

Listed below are some 2018 statistics for the City of London Distribution System:

Approximate Replacement Value of Drinking Water System	**$4,500,000,000**
Number of Pumping Stations	**8**
Number of Fire Hydrants	**9,455**
Number of Watermain Valves	**13,629**
Total Number of Water Services	**116,211**
Length of Watermain	**1,601 km**
Number of Watermain Breaks	**98**
Number of Water Service Leaks	**228**

Municipalities Receiving London Water

In the Municipality of Middlesex Centre, the villages of Arva, Ballymote, and Delaware continued to receive their drinking water under contract from the City of London during 2018. The Municipality of Middlesex Centre has been provided a copy of the Annual Report as per O. Reg 170/03.

Several residences within Central Elgin also continued to receive drinking water from the transmission watermain that supplies the City of London from the EMPS. For this reason, Central Elgin has also been provided a copy of the report.