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TO:	**CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON MARCH 3, 2014**
FROM:	**JOHN LUCAS, P.ENG. DIRECTOR – WATER & WASTEWATER**
SUBJECT:	**CITY OF LONDON 2013 DRINKING WATER ANNUAL REPORT AND SUMMARY REPORT**

RECOMMENDATION

That, on the recommendation of the Director, Water & Wastewater, the 2013 Drinking Water Annual Report and Summary Report for the City of London Distribution System **BE RECEIVED** for information by Municipal Council.

PREVIOUS REPORTS PERTINENT TO THIS MATTER

- Annual Ministry of Environment Inspection of the City of London Water Distribution System - 2012", presented to CWC on February 4, 2013, Agenda Item #2;
- "City of London 2012 Drinking Water Annual Report and Summary Report" presented to CWC on March 18, 2013. Agenda Item #2;
- "City of London Water Supply and Distribution System 2011 Compliance Report" presented to CWC on March 5, 2012. Agenda Item #8.

BACKGROUND

O. Reg. 170/03 (Drinking Water Systems) requires the owner of a municipal drinking water system to ensure that an Annual Report and a Summary Report be prepared, covering the period of January 1 through to December 31 of the previous year.

The Annual Report is to contain:

- A brief description of the drinking water system, including a list of water treatment chemicals used by the system;
- A summary of the results of required tests;
- A summary of any adverse test results reported and corrective actions taken; and
- A description of any major expenses incurred to install, repair or replace required equipment.

O. Reg. 170/03 further stipulates that:

a) The Owner shall ensure that a copy of the Annual Report is given without charge to every person who requests a copy;
b) Effective steps are taken to advise users of water from the system that copies of the Annual Report are available, without charge, and of how a copy may be obtained;
c) The Owner of a large municipal residential system serving more than 10,000 people is required to post a copy of the Annual Report to the municipality's web site; and,
d) A Summary Report is to be prepared and presented to the members of the Municipal Council by no later than March 31 of the following year.

The Summary Report is to contain:

- A list of any regulatory requirements applicable to the system that were not met at any time during the period covered by the report, the duration of the failure, and the measures that were taken to correct the failure; and,
- 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 compared to the rated capacity of the system.

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Due to the large number of pages, the 2013 Drinking Water Summary Report for the City of London Distribution System has been provided to members of Council in electronic format, with the 2013 Annual Report attached as an appendix. The Summary Report (without appendices) is attached as Appendix 'A' to this report.

SUMMARY

Receipt of Appendix 'A' of this report by members of Council fulfils the reporting requirements of O. Reg. 170/03, Schedule 22. The 2013 Drinking Water Summary Report is available to members of the public through the Water and Engineering Review Division (8th Floor, City Hall), and will be posted on the City's web site.

Acknowledgements:

This report has been prepared with input from Scott Koshowski, P. Eng. - Environmental Services Engineer, and Dan Huggins - Water Quality Manager, both in Water Operations Division.

PREPARED BY:	**RECOMMENDED BY:**
JOHN SIMON, P.ENG. **DIVISION MANAGER, WATER OPERATIONS**	**JOHN LUCAS, P.ENG.** **DIRECTOR – WATER & WASTEWATER**
CONCURRED BY:	
JOHN BRAAM, P.ENG. **MANAGING DIRECTOR – ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER**	

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c.c. Cathy Saunders - City Clerk
Roland Welker - Division Manager – Water Engineering
Andrew Henry - Division Manager – Regional Water Supply
Dan Huggins - Water Quality Manager
Dr. Bryna Warshawsky - Associate Medical Officer of Health – Middlesex-London Health Unit

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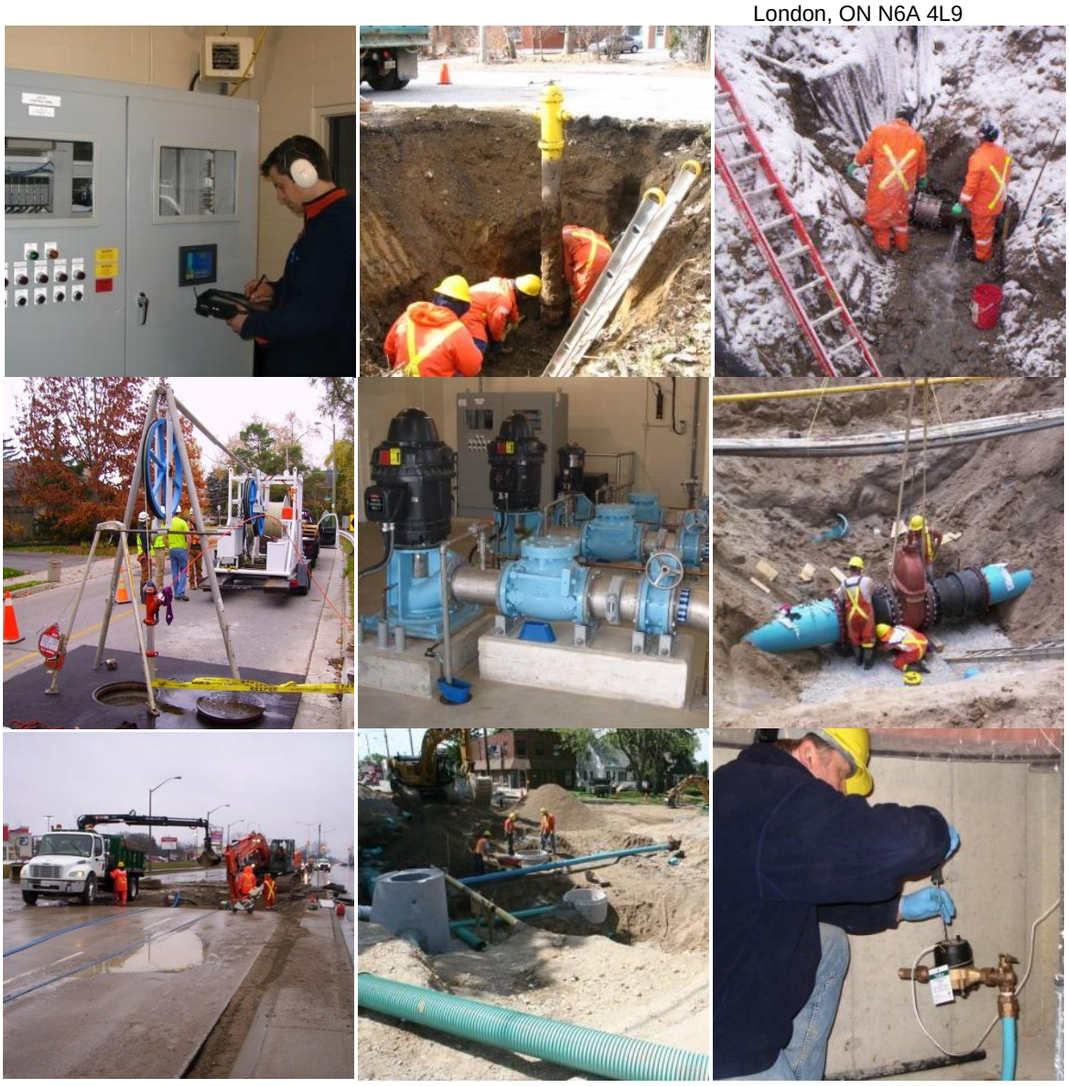
CITY OF LONDON
2013 DRINKING WATER SUMMARY REPORT

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: 125.7 MLD
Peak Day Demand: 165.5 MLD (July 18, 2013)
Population Served: 366,000 (est.)
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
519-661-2500 ext. 4938

London
CANADA

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Reporting Requirements

Schedule 22-2 of O. Reg. 170/03 requires that the City of London prepare a Summary Report for its water works 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 March 3, 2013 serves to fulfill that requirement.

On February 14, 2014, a copy of the 2013 Annual Report for the City of London's water works was submitted to the local office of the Ministry of Environment (MOE) as a courtesy for information purposes. A copy of this Summary Report for the City of London Distribution System will also be submitted, as a courtesy, to the local office of the MOE by March 31, 2013.

The Elgin-Middlesex Pumping Station (EMPS) (owned in part by the City of St. Thomas, the Town of Aylmer, and the City of London) was operated by the Ontario Clean Water Agency between January 1, 2013 and December 31, 2013. The Annual Report for the EMPS (London portion) is attached to this Summary Report as Appendix B.

Ministry of Environment Annual Inspection

MOE inspections can be in the form of comprehensive inspections, or focused inspections. The MOE reported that London's Water Distribution System was chosen for a focused inspection because:

"…inspection findings over the past three years were such that the number of violations were minimal or non-existent, there were few or no orders issued to you that were of significance in the maintenance of water potability and there were no deficiencies as defined in O. Reg. 172/03."

The MOE inspection included staff interviews and facility inspections, as well as a review of operating procedures, water analysis reports, operational records, and staff certification and training records. The inspection covered all components of London's water system, including the London portion of the Elgin-Middlesex Pumping Station, which is operated by the Ontario Clean Water Agency under contract to the City of London.

On November 27, 2013, the MOE issued the City of London Water Distribution System Inspection Report. The report summarizes all of the inspection findings, and lists any incidents of non-compliance with regulatory requirements.

Only one incident of non-compliance was identified, which the MOE reported as follows:

"During the physical inspection, it was noted that pencil was used to record information in the logbook at the Springbank Reservoirs."

The MOE requires that logbook entries be made using ink.

This incident occurred on September 11, 2013. An electrical storm had caused power outages throughout London, and many electronic components of the water infrastructure were adversely impacted. City staff attended several locations that evening to resolve the problems. At the Springbank Reservoirs, staff worked from 9:30 pm to 11:30 pm to resolve issues related to damaged circuitry of a large electronic flow-meter. Before leaving the site, the Technologist realized that he had left his pen at the previous work location that evening. Rather than make no logbook entry, he proceeded to record a summary of his work activities in pencil.

This incident of non-compliance does not reflect a drinking water quality hazard, but is indicative of the highly regulated nature of municipal drinking water systems in Ontario. It also serves to illustrate the level of diligence and scrutiny employed by MOE Inspectors when reviewing water system operations.

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The results of the annual MOE Inspections are used to generate *Ministry of the Environment Drinking Water System Inspection Rating Records*. Each year these rating records (or "report cards") for Ontario drinking water systems are compiled and made available to the public. The rating records were developed to encourage continuous improvement by drinking water system operators.

Despite the one incident of non-compliance, The City of London received a Final Inspection Rating of 100% for 2013.

A report on this MOE Inspection was made to the Civic Works Committee on December 9, 2013. For more information about this inspection or to review the report, it can be found at http://sire.london.ca/mtgviewer.aspx?meetid=602&doctype=AGENDA .

Water Operations Staff Complement and Training

In 2013, the distribution system was operated and maintained by four (4) Water Supply staff, thirty-one (31) Operations and Maintenance staff, three (3) Water Works Inspectors, nine (9) Meter Shop staff, five (5) Supervisors, two (2) Technologists, two (2) Administrative staff, and four (4) Management staff. This complement does not include senior administrative staff that work in the Water Service Area. The majority of the City of London's operational and maintenance staff are based at the A.J. Tyler Operations Centre, located at 663 Bathurst Street. Water Supply staff are based out of the London Hydro building at 111 Horton Street.

All employees with Drinking Water Operator Certificates receive a minimum of 14 hours of Director-approved training and an additional 36 hours of practical, on-the-job training each year, as mandated by Regulation.

The Operating Authority is led by a Top Management team composed of the Water Director, Manager of Water Operations and Manager of Water Engineering. The Quality Management Representative is our Water Quality Manager. An Overall Responsible Operator is always available. The duties are rotated through three positions that have the qualifications: City Engineer, Water Quality Manager and Water Operations Supervisor.

Water Budget

After 2 consecutive years of 0% increases, the 2013 Water Operating Budget had an effective overall increase of 8%. This represents an increase of $2.9 million over that of the 2012 budget. The total Water budget for 2013 was $62.6 million, which includes long term infrastructure renewal and replacement plans. Administration believed that the operating budget had been reduced to a point where continued operating targets of 0% would begin to impact service levels.

For 2014 Water Rates increased by 8%, and are projected to increase by 7% in 2015. These increases will enable the Water Service Area to reach financial sustainability in 2016, 2 years earlier than previously anticipated.

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 significant renewal (replacement and rehabilitation) work to close the infrastructure gap ensuring future generations and businesses are not faced with a water system that is failing, unreliable, and expensive to maintain.

For more information regarding the 2013 Water Budget, please refer to the 2013 Water Service Area Business Plan. In addition, further information on the future direction of the Water Service Area is provided in the 2014 Business Plan and 2014 Budget Document.

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Ongoing Initiatives & Undertakings

Drinking Water Quality Management System (DWQMS) Audit – Quality Management Systems (QMSs) can be defined as sets of interrelated elements (e.g. policies and procedures) that direct and control the way a facility operates with regard to quality. A QMS is a way of formally ensuring that an organization is consistently in control of the quality of the product or services that it supplies.

Following the Walkerton tragedy of May 2000, Justice Dennis O'Connor recommended that *"the MOE should initiate the development of a drinking water quality management standard for Ontario."* The Ministry of the Environment (MOE) led the development of a Drinking Water Quality Management Standard (DWQMS) which combined elements of existing ISO 9001 and HAACP standards. Through a new Municipal Drinking Water Licensing Program, the MOE mandated that municipal drinking water systems develop and implement Quality Management Systems that met the requirements of Ontario's DWQMS. Through external audits to ensure compliance, London's Water Operations and Water Engineering Divisions would then become the "accredited operating authority" for the London's water system.

In addition, Section 19 of the *Safe Drinking Water Act, 2012* imposes a statutory standard of care on the "owner of a municipal drinking water system, and every person who, on behalf of the municipality, oversees the accredited operating authority of the system or exercises decision making authority over the system". In recommending the Standard of Care provision, Justice O'Connor stated that "*the fact that a municipality has an accredited operating agency will do much to satisfy the standard of care."*

In June, 2013, the first On-Site Verification Audit was completed for the Quality Management System of London's drinking water system. The auditor reported that London's *QMS "has been established and maintained according to the DWQMS standard and internal requirements as documented in the Operational Plan"* and that "*The result of the audit indicates that the Corporation of the City of London QMS was effectively implemented."* In addition, five nonconformities were identified, which were subsequently addressed to the satisfaction of the auditor. This process identified the need to commit additional resources toward the maintenance of London's Drinking Water Quality Management System. This recommendation was included in, and subsequently approved by the Municipal Council as part of the 2014 Water Budget .

As a result of the audit, the City of London has been fully accredited as the operating authority for London's drinking water system under Ontario's Municipal Drinking Water Licensing Program.

Lead Mitigation Strategy – In 2006, the City of London implemented a program that allows Londoners to have lead concentrations in their tap water analyzed at no charge. Since that time, nearly 13,000 homes and businesses have had their water sampled for lead. There are approximately 112,000 water service pipes in London. Prior to 1953, lead was a commonly used material for water service pipes, and in 2007 it was estimated that 9,000 London water services were fully, or partially, composed of lead. The City of London's lead service replacement programs have reduced this number to just under 5,200 at the end of 2013.

The City of London developed a three-pronged strategy for lead mitigation:

1. *Education and Awareness*: In addition to free lead testing, the City of London continues to provide information to Londoners regarding lead service pipes and the risks associated with lead.
2. *Water Chemistry Changes*: In conjunction with the Lake Huron and Elgin Area Primary Water Supply Systems, the City of London has investigated and initiated water

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chemistry changes that have reduced the uptake of lead. Increasing the pH of the water has reduced "at the tap" lead concentrations by nearly 50% from 2007 levels.

3. *Replacement of Lead Service Pipes:* London's overall goal is the replacement of all lead services. This is an 18-year program the will see the majority of lead services replaced through the Capital Watermain Replacement Program. The remainder will occur through the Watermain Relining Programs and one-off replacements through the City's Lead Service Extension Replacement Program.

Water Reliability: Large Diameter Concrete Pressure Pipe Watermain Inspection Program - Concrete Pressure Pipe (CPP) is a composite pipe manufactured using a thin steel cylinder wrapped in high tension wires, and coated internally and externally with cement mortar.

Over time the protective mortar can break down, exposing the steel cylinder and the prestressed wires to corrosion. As the pre-stressed wires corrode, some may break. If enough wires break, the pipe section may fail.

Significant failures of the Lake Huron Pipeline occurred In August 1983, June 1988, March 2010, and May 2012 which threatened London's water supply. Fortunately the failures occurred outside of densely populated areas and were repaired by City crews in a timely fashion. There have never been any major failures of large concrete or concrete pressure pipes within the City of London; however, the age and construction practices for these watermains are similar to the Lake Huron Pipeline.

Within London, there are 160 km of large diameter concrete transmission mains moving millions of litres of water around the City. Some of these mains were constructed in the 1950's and 1960's and detailed inspection records outlining installation techniques and pipe integrity do not exist. The 19 km concrete watermain that connects the Arva Pumping Station with the Springbank Reservoirs is one of the most critical links in London's water system, and serves the majority of homes and businesses in London. In the summer and fall of 2007, three different inspections were undertaken on this pipe, as detailed below:

1. Leak Detection - provided a current condition of the pipe by determining if there are any leaks in the system.
2. Electromagnetic Inspection - provided a scientific analysis of the internal condition of the pre-stressed wires.
3. Visual Internal Inspection - determined if there is any breakdown in the internal concrete layer.

In addition, through a multi-year project, a fibre optic cable was installed inside nearly all of the 19 km from the Arva Pumping Station to the Springbank Reservoirs, providing the capability to continuously monitor the pre-stressed steel wires. The fibre optic cable registers an acoustic signature when a wire breaks, and immediate notification is sent to City staff. This real-time information received from the fibre will give staff the ability to react immediately, and prevent a potentially catastrophic pipe failure.

Water Efficiency: Computerized Maintenance Management System (CMMS) - The City's critical infrastructure continues to grow in magnitude and complexity. High expectations are placed on the gatekeepers of these complex systems. Accurate data management relating to assigned and completed work, full cost accounting, tangible capital asset reporting, strategic asset management planning and budget challenges are just a few elements that have added to the complexity of ownership and maintenance management. It is become evident that current practices are unsustainable and that the demands associated with infrastructure ownership must be managed through a formal work order system that enables staff to develop sound, strategic work plans, and to implement, record and store data effectively, efficiently and economically.

CMMS will help manage the ever-increasing complexities associated with being the custodian of the City's water infrastructure assets. In order to comply with stringent legislative requirements and to meet or exceed current service levels provided to the City's constituents, the CMMS will allow the Operating divisions to plan and schedule work, visualize locations of crews in real-time

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using Automated Vehicle Location (AVL) technology, conduct analysis on asset performance and provide information on asset condition for financial and operations reporting.

Currently, the City is working with ESRI Canada to develop a full Scope of Work for the implementation of a GIS-centric CMMS. Once completed and approved, the proposed CMMS system will become the nucleus of the City's day-to-day water operations, enabling staff to deliver a strategic, timely, effective, efficient and economical service to its valued customers. Further, a computerized maintenance management system will have the capability of providing critical information to support the Corporate Asset Management program. Effectively managing the City's ever growing, complex infrastructure and meeting the associated legislative requirements and becoming eligible for future infrastructure funding programs are the primary drivers behind this project. The purchase of a CMMS will bring the City of London up to par with most of London's comparable municipalities in the application of this technology.

Benefits of a CMMS include:

- Improved citizen response:
  - All complaints and requests for service are recorded in real time.
  - Staff members receiving calls have access to complete information.
  - Work requirements for customer complaints/requests are tracked.
- Improve efficiency in the use of available resources:
  - CMMS provides a means of developing more strategic plans with consideration for time, labour, equipment and material requirements.
  - Outstanding work can be prioritized.
  - Original work schedules can be amended easily to accommodate unplanned events.
  - Duplication of work can be avoided.
- Improved focus for maintenance activities:
  - The ability to track maintenance requests, production, history, and specific information.
  - The ability to track problems through regular inspections, resulting in an efficient ratio of proactive to reactive work and determining the appropriate balance of risk.
  - Correlating completed work with asset type, specific structures, and geographical areas leads to optimization of maintenance programs for minor, major and rehabilitation projects.
- Improved response to government / legal and MFIPPA requests:
  - A CMMS can generate accurate information required to satisfy government/ legal information requests and MFIPPA requests.
- Improve information sharing with other departments and/or divisions:
  - Provide legislated Tangible Capital Asset (TCA) information regarding asset condition, increase life (betterment) or decreased life (write-down).
  - Feeding accurate information up to the Corporate level to support an overall Asset Management Plan and a State of the Infrastructure Report.

Emerging Trends in Water Treatment & Regulations

Water Treatment: The City of London purchases its treated drinking water from the Joint Boards of Management (Lake Huron and Elgin Area Primary Water Supply Systems). The Joint Boards of Management, through the Regional Water Supply Division, stay abreast of emerging trends in water treatment and monitor upcoming Regulations. Current areas of interest include Microbiological (E. coli and Total Coliform), Disinfection By-Products (Trihalomethane (THM), Haloacetic Acids (HAA)), Lead and Copper, and Emerging Pathogens and Chemicals).

Currently, there are no water quality concerns requiring process modification at the Regional Water Supply treatment facilities. The area of emerging contaminants including pharmaceuticals and personal care products (PPCP's) and endocrine disruptors (EDC's) will be the focus of much research in the coming decades. At this time, there is no evidence to suggest that the Joint Board of Management should conduct further investigations into the implementation of advanced or enhanced treatment processes at either the Lake Huron or Elgin Area Treatment Plants.

For further information on emerging trends in water treatment and Regulations, please refer to the Lake Huron and Elgin Area Water Supply Systems Master Plans, which can be found at

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http://www.watersupply.london.ca/reports.html .

Standard of Care Provision in Ontario's Safe Drinking Water Act, 2002: On December 31, 2012, Section 19 of the *Safe Drinking Water Act, 2002* came into force. It imposed a statutory standard of care on the "owner of a municipal drinking water system, and every person who, on behalf of the municipality, oversees the accredited operating authority of the system or exercises decision-making authority over the system". This standard of care requires that such persons (a) exercise the level of care, diligence and skill in respect of a municipal drinking water system that a reasonably prudent person would be expected to exercise in a similar situation; and (b) act honestly, competently and with integrity, with a view to ensuring the protection and safety of the users of the municipal drinking water system.

Actions that can be taken to satisfy the standard of care requirement include: obtaining and following proper expert advice, and ensuring that the water system is operated by an accredited operating authority. As has been previously reported to Council, the City of London Water Operations and Water Engineering Divisions have been recognized as an accredited operating authority for the City of London Water System.

For more information regarding the Standard of Care provision, a full report was presented to Civic Works Committee on October 22, 2012. To assist municipal Councillor's in understanding their responsibilities under the Safe Drinking Water Act, the Ontario Ministry of the Environment (MOE) have developed a guidance document titled "Taking Care of Your Drinking Water – A Guide for Members of Municipal Councils" which is available online at: http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/std01_086811.pdf . Hard copies of this guide were provided to Council members in conjunction with the October 22, 2012 report. Also, an afternoon training session on the Standard of Care was offered on December 12, 2012.

Safeguarding and Sustaining Ontario's Water Act: We continue to work with the Ontario Ministries of Environment and Natural Resources in the development of Regulations under the Safeguarding and Sustaining Ontario's Water Act, which addresses the obligations of the Great Lakes & St. Lawrence River Basin Water Resources Agreement with eight US States and the Provinces of Ontario and Quebec. In particular, Regulations with respect to intra-basin transfers have the potential to significantly and negatively impact a large area of southwestern Ontario by potentially limiting the amount of water which can be supplied to London from the Lake Huron system at present and in the future, likely resulting in the expenditure of hundreds of millions of dollars to replace capacity that is currently available. Meetings with the Ministries appear to have been fruitful in that current policy discussions and drafting of Regulations may allow London and area municipalities the ability to continue to utilize existing infrastructure to its full permitted capacity.

Algal Blooms in the Great Lakes: Algal blooms usually occur in the late summer and early fall. A bloom is a large mass of algae that is formed as a result of a number of ecosystem changes. These changes are brought about by an elevated presence of nutrients, invasive species such as quagga mussels, or light and temperature conditions that are favourable for the algae to multiply quickly.

There is more than one variety of algae. When alive they provide food for a variety of fish. When algae blooms die, some of the varieties release odorous chemicals into the water that can affect the taste and/or smell of our drinking water. Others, such as some types of blue-green algae (cyanobacteria), release toxins that can cause health issues for humans and animals. As such, algae blooms have the potential to negatively impact drinking water quality, recreational activities, tourism, commercial fisheries and lakeshore property values.

The Ministry of Environment has a protocol in place for responding to occurrences of blue-green algal blooms in Ontario lakes. MOE staff work closely with the local Medical Officers of Health to ensure that timely, appropriate action is taken. Local Medical Officers of Health address public health concerns with respect to blue-green algal blooms, and communicate with consumers and drinking water system owners within their area.

A survey conducted by ministry staff for cyanobacterial toxins at 18 drinking water facilities from 2004 to 2010, suggests that water treatment plants have been effective at removing or inactivating these toxins in drinking water.

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The recurrence of algal blooms in certain areas of the Great Lakes, such as Lake Erie, has prompted discussions with the International Joint Commission, federal, state and other Provincial governments as well as non-government bodies to improve the ecological conditions of our Great Lakes.

London staff are members of the Urban and Rural Municipal Programs Task Group that will support the development of nutrient control targets for Lake Erie as part of the 2013 Great Lakes Water Quality Agreement. Nutrient loading of the Thames River is also a topic of the London led Thames Clear Water Revival through the development of a Water Management Plan for the Thames River. The goal is to improve the health of the Thames River, Lake St. Clair and Lake Erie though a comprehensive set of partnerships

OnWARN: Ontario Water/Wastewater Agency Response Network: This initiative, based upon the principle of "*Utilities helping Utilities*", has gained momentum throughout the water utility sector in Ontario, Canada and the United States, as a means of providing voluntary mutual-aid to similar utilities within a region. The OnWARN program establishes a legal framework whereby any subscribing utility can call upon the assistance of other subscribing utilities, with the response being provided within the context of a blanket "mutual aid" type of agreement. The blanket agreement covers all aspects of legal liability, availability of response and the provision of services, and health and safety requirements, to name a few.

Participation in the OnWARN program does not specifically require a subscribing municipality to respond to any and all calls for assistance, nor does it obligate a subscribing municipality to call upon all subscribers for assistance in the event of an emergency. It also does not require a municipality to formally declare a state of emergency, only that the water or wastewater related circumstance is beyond the capabilities of the municipality.

Recognizing the significant benefit of joining OnWARN and improving emergency preparedness for the City's water and wastewater services, the City of London received its membership certificate on September 11, 2013. More information can be found from the February 25, 2013 Civic Works Committee Report (Item #14).

Sampling & Water Quality Monitoring

During 2013, staff conducted water sampling from the distribution system which exceeded the MOE's minimum requirements. Staff take monthly samples from 57 standard locations across the City, testing for microbiological indicators and chlorine residuals. In addition, analysis is performed for up to 121 parameters, including organics, inorganics, pesticides and metals at 13 standard locations around the City. 8,205 routine grab samples were taken from the distribution system, 795 samples taken from the stand-by wells, as well as over 2,750 chlorine residual tests conducted by London staff. London also has 10 locations throughout the City where continuous in-line sampling of chlorine residual is monitored. Staff also perform approximately 4,000 chlorine tests (on the Distribution System and for Construction Projects and Bacteriological sampling upon repairs undertaken) each year that are not included in the above numbers. All of these efforts help ensure that the water within the distribution system is always of high quality.

Below is the historical range (since 2000) of sample results for London's drinking water.

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Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2013	Units	Measured Concentrations 2013	MAC Exceedence in 2013 (Y/N)	Historical Measured Concentration Range[2]
REGULATED INORGANICS						
Antimony	6	0.02	µg/L	**0.100 - 0.200**	No	0.020 - 1.200
Arsenic	25	0.2	µg/L	**0.500 - 0.700**	No	0.001 - 2.000
Barium	1000	0.05	µg/L	**14.000 - 25.000**	No	0.015 - 25.000
Boron	5000	1	µg/L	**13.000 - 20.000**	No	0.020 - 40.000
Cadmium	5	0.003	µg/L	**0.020 - 0.020**	No	0.002 - 0.100
Chromium	50	0.5	µg/L	**2.000 - 2.000**	No	0.004 - 3.000
Fluoride	1.5	0.06	mg/L	**0.070 - 0.800**	No	0.030 - 1.390
Free Chlorine Residual	--	--	mg/L	**0.080 - 1.990**	No	0.000 - 2.200
Lead	10	0.02	µg/L	**N/A - N/A**	N/A	0.002 - 1.070
Mercury	1	0.02	µg/L	**0.020 - 0.020**	No	0.000 - 0.100
Selenium	10	1	µg/L	**1.000 - 1.000**	No	0.005 - 3.000
Sodium[3]	20	0.01	mg/L	**10.700 - 20.300**	Yes	1.000 - 20.300
Uranium	20	0.001	µg/L	**0.050 - 0.050**	No	0.001 - 9.700

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Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2013	Units	Measured Concentrations 2013	MAC Exceedence in 2013 (Y/N)	Historical Measured Concentration Range[2]
REGULATED ORGANICS						
Alachlor	5	0.020	µg/L	**0.300 <MDL**	No	0.002 - 0.300
Aldicarb	9	0.010	µg/L	**3.000 <MDL**	No	0.005 - 5.000
Aldrin + Dieldrin	0.7	0.010	µg/L	**0.020 <MDL**	No	0.000 - 0.067
(Aldrin)	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.060
(Dieldrin)	--	0.010	µg/L	**N/A - N/A**	N/A	0.001 - 0.067
Atrazine	--	0.020	µg/L	**N/A - N/A**	N/A	0.020 - 0.130
Atrazine + N-dealkylated metabolites	5	0.040	µg/L	**0.500 <MDL**	No	0.003 - 0.500
Azinphos-methyl	20	0.020	µg/L	**1.000 <MDL**	No	0.010 - 1.000
Bendiocarb	40	0.010	µg/L	**3.000 <MDL**	No	0.010 - 3.000
Benzene	5	0.32	µg/L	**0.500 <MDL**	No	0.005 - 0.500
Benzo(a)pyrene	0.01	0.004	µg/L	**0.005 <MDL**	No	0.000 - 0.009
Bromoxynil	5	0.300	µg/L	**0.300 <MDL**	No	0.003 - 0.330
Carbaryl	90	0.010	µg/L	**3.000 <MDL**	No	0.010 - 3.000
Carbofuran	90	0.010	µg/L	**1.000 <MDL**	No	0.005 - 5.000
Carbon tetrachloride	5	0.16	µg/L	**0.200 <MDL**	No	0.005 - 0.410
Chlordane (Total)	7	0.010	µg/L	**0.040 <MDL**	No	0.000 - 0.200
(a-chlordane)	--	0.010	µg/L	**N/A - N/A**	N/A	0.007 - 0.200
(g-chlordane)	--	0.010	µg/L	**N/A - N/A**	N/A	0.007 - 0.200
(oxychlordane)	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.360
Chlorpyrifos	90	0.020	µg/L	**0.500 <MDL**	No	0.008 - 5.000
Cyanazine	10	0.030	µg/L	**0.500 <MDL**	No	0.008 - 0.500
Diazinon	20	0.020	µg/L	**1.000 <MDL**	No	0.002 - 2.000
Dicamba	120	0.20	µg/L	**5.000 <MDL**	No	0.050 - 10.000
1,2-Dichlorobenzene	200	0.100	µg/L	**0.100 <MDL**	No	0.003 - 1.000
1,4-Dichlorobenzene	5	0.200	µg/L	**0.200 <MDL**	No	0.001 - 0.400
DDT + Metabolites	30	0.010	µg/L	**0.010 <MDL**	No	0.005 - 0.500
(op-DDT)	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.500
(pp-DDD)	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.500
(pp-DDE)	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.500
(pp-DDT)	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.500
1,2-Dichloroethane	5	0.100	µg/L	**0.100 <MDL**	No	0.005 - 0.430
1,1-Dichloroethylene	14	0.100	µg/L	**0.100 <MDL**	No	0.005 - 0.520
Dichloromethane	50	0.300	µg/L	**0.300 <MDL**	No	0.005 - 3.000
2,4-dichlorophenol	900	0.100	µg/L	**0.100 <MDL**	No	0.000 - 0.150
2,4-D	100	0.19	µg/L	**5.000 <MDL**	No	0.044 - 5.000
Diclofop-methyl	9	0.40	µg/L	**0.500 <MDL**	No	0.005 - 0.840
Dimethoate	20	0.030	µg/L	**1.000 <MDL**	No	0.005 - 1.000
Dinoseb	10	0.36	µg/L	**0.500 <MDL**	No	0.005 - 0.500
Diquat	70	1	µg/L	**5.000 <MDL**	No	1.000 - 70.000
Diuron	150	0.030	µg/L	**5.000 <MDL**	No	0.030 - 5.000
Glyphosate	280	6	µg/L	**25.000 <MDL**	No	0.010 - 25.000
Heptachlor + Heptachlor Epoxide	3	0.010	µg/L	**0.100 <MDL**	No	0.001 - 0.300
(heptachlor)	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.300
(heptachlor epoxide)	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.300
Lindane (Total)	4	0.010	µg/L	**0.100 <MDL**	No	0.002 - 0.200
Malathion	190	0.020	µg/L	**5.000 <MDL**	No	0.020 - 5.000
Methoxychlor	900	0.010	µg/L	**0.100 <MDL**	No	0.010 - 5.000
Metolachlor	50	0.020	µg/L	**3.000 <MDL**	No	0.008 - 5.000
Metribuzin	80	0.020	µg/L	**3.000 <MDL**	No	0.020 - 5.000
Monochlorobenzene	80	0.200	µg/L	**0.200 <MDL**	No	0.005 - 5.000
Paraquat	10	1	µg/L	**1.000 <MDL**	No	0.010 - 9.000
Parathion	50	0.020	µg/L	**3.000 <MDL**	No	0.020 - 3.000
Pentachlorophenol	60	0.100	µg/L	**0.100 <MDL**	No	0.001 - 1.000

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APPENDIX 'A'
CITY OF LONDON 2013 DRINKING WATER SUMMARY REPORT

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2013	Units	Measured Concentrations 2013	MAC Exceedence in 2013 (Y/N)	Historical Measured Concentration Range[2]
REGULATED ORGANICS CONTINUED						
Phorate	2	0.010	µg/L	**0.300 <MDL**	No	0.001 - 0.730
Picloram	190	0.25	µg/L	**5.000 <MDL**	No	0.043 - 5.000
Polychlorinated Biphenyls (PCBs)	3	0.04	µg/L	**0.050 <MDL**	No	0.001 - 0.100
Prometryne	1	0.030	µg/L	**0.100 <MDL**	No	0.001 - 0.230
Simazine	10	0.010	µg/L	**0.500 <MDL**	No	0.005 - 0.500
Temephos	280	0.010	µg/L	**10.000 <MDL**	No	0.010 - 15.000
Terbufos	1	0.010	µg/L	**0.300 <MDL**	No	0.001 - 0.730
Tetrachloroethylene	30	0.200	µg/L	**0.200 <MDL**	No	0.005 - 1.000
2,3,4,6-tetrachlorophenol	100	0.100	µg/L	**0.100 <MDL**	No	0.001 - 0.500
Triallate	230	0.10	µg/L	**10.000 <MDL**	No	0.010 - 10.000
Trichloroethylene	50	0.100	µg/L	**0.100 <MDL**	No	0.005 - 1.000
2,4,6-trichlorophenol	5	0.100	µg/L	**0.100 <MDL**	No	0.001 - 0.890
2,4,5-T	280	0.22	µg/L	**10.000 <MDL**	No	0.005 - 10.000
Trifluralin	45	0.020	µg/L	**0.500 <MDL**	No	0.020 - 1.000
Vinyl Chloride	2	0.17	µg/L	**0.200 <MDL**	No	0.002 - 0.200

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2013	Units	Measured Concentrations 2013	MAC Exceedence in 2013 (Y/N)	Historical Measured Concentration Range[2]
NITRATES						
Nitrate (as nitrogen)	10	0.013	mg/L	**0.190 - 0.800**	No	0.005 - 1.700
Nitrate + Nitrite (as nitrogen)	10	0.013	mg/L	**0.190 - 0.000**	No	0.005 - 1.700
Nitrite (as nitrogen)	1	0.005	mg/L	**0.050 - 0.100**	No	0.005 - 0.129

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2013	Units	Measured Concentrations 2013	MAC Exceedence in 2013 (Y/N)	Historical Measured Concentration Range[2]
TRIHALOMETHANES						
Trihalomethanes (total)	100	0.37	µg/L	**13.400 - 37.100**	No	0.010 - 57.000
Bromoform	--	0.100	µg/L	**0.100 - 0.400**	No	0.002 - 2.000
Chloroform	--	0.29	µg/L	**8.100 - 23.200**	No	0.002 - 39.000
Dibromochloromethane	--	0.37	µg/L	**1.100 - 4.400**	No	0.002 - 5.400
Bromodichloromethane	--	0.26	µg/L	**4.200 - 10.100**	No	0.002 - 12.000

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2013	Units	Measured Concentrations 2013	MAC Exceedence in 2013 (Y/N)	Historical Measured Concentration Range[2]
MICROBIOLOGICAL						
E. Coli	0	0	CFU/100mL	**0 - 0**	No	0 - 1
Total Coliform	0	0	CFU/100mL	**0 - 9**	Yes	0 - 41
Heterotrophic Plate Count	--	10	cfu/1mL	**10 - 2000**	No	10 - 2000

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APPENDIX 'A'
CITY OF LONDON 2013 DRINKING WATER SUMMARY REPORT

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2013	Units	Measured Concentrations 2013	MAC Exceedence in 2013 (Y/N)	Historical Measured Concentration Range[2]
NON-REGULATED INORGANICS/ORGANICS[4]						
Alkalinity	--	2	mg/L as CaCO3	**78.0 - 103.0**	No	61.0 - 103.0
Aluminum	--	0.040	µg/L	**0.040 - 0.070**	No	0.030 - 436.0
Ammonia+Ammonium (N)	--	0.010	mg/L	**0.010 - 0.010**	No	0.010 - 0.400
Calcium	--	0.03	mg/L	**25.600 - 33.700**	No	25.600 - 38.000
Chloride	--	0.03	mg/L	**8.300 - 16.800**	No	7.200 - 36.100
Cobalt	--	0.002	µg/L	**0.005 - 0.005**	No	0.004 - 0.300
Colour	--	3	TCU	**N/A - N/A**	N/A	3.000 - 13.000
Conductivity	--	1	uS/cm	**251.0 - 341.0**	No	205.0 - 341.0
Copper	--	0.5	µg/L	**N/A - N/A**	N/A	0.002 - 64.000
Cyanide	0.2	0.002	mg/L	**0.005 - 0.005**	No	0.002 - 0.010
De-ethylated atrazine	--	0.010	µg/L	**N/A - N/A**	N/A	0.010 - 0.140
Dissolved Organic Carbon	--	0.2	mg/L	**1.600 - 2.300**	No	0.400 - 2.300
Ethylbenzene	--	0.33	µg/L	**0.500 - 0.500**	No	0.002 - 1.000
Field pH	--	--	units	**N/A - N/A**	N/A	6.660 - 8.600
Gross Alpha	--	0.100	Bq/l	**N/A - N/A**	N/A	0.100 - 0.100
Gross Beta	--	0.100	Bq/l	**N/A - N/A**	N/A	0.100 - 0.100
Hardness	--	0.1	mg/L as CaCO3	**95 - 119.0**	No	95.000 - 133.0
Iron	--	0.005	µg/L	**0.005 - 0.005**	No	0.005 - 90.000
Langolier's Index	--	0.000	@ 20 C	**-0.152 - 0.086**	No	-1.070 - -0.130
m/ p-xylene	--	0.39	µg/L	**1.000 - 1.000**	No	0.390 - 5.000
Magnesium	--	0.003	mg/L	**7.640 - 8.570**	No	7.150 - 9.400
Manganese	--	0.001	µg/L	**0.001 - 0.001**	No	0.001 - 168.0
Nickel	--	0.010	µg/L	**0.010 - 0.010**	No	0.01 - 1.4
Nitrogen-Kjeldahl (N)	--	0.05	mg/L	**0.050 - 0.050**	No	0.050 - 0.500
Organic Nitrogen	--	0.05	mg/L	**0.050 - 0.050**	No	0.040 - 0.340
o-xylene	--	0.17	µg/L	**0.500 - 0.500**	No	0.170 - 5.000
pH	--	0.05	no unit	**7.930 - 7.960**	No	7.050 - 8.110
Potassium	--	0.01	mg/L	**0.800 - 1.300**	No	0.800 - 1.910
Silica	--	0.01	mg/L	**0.730 - 1.660**	No	0.590 - 2.1
Silver	--	0.00002	µg/L	**0.000 - 0.000**	No	0.000 - 0.100
Solids (Total Dissolved)	--	30	mg/L	**131.0 - 180.0**	No	1.460 - 208.0
Sulphate	--	0.06	mg/L	**29.000 - 37.000**	No	27.000 - 55.000
Sulphide	--	0.004	mg/L	**0.010 - 0.010**	No	0.004 - 4.000
Surr 1,2-Dichloroethane-d4	--	--	mg/L	**N/A - N/A**	N/A	104.00 - 105.00
Surr 4-Bromofluorobenzene	--	--	Surr Rec %	**N/A - N/A**	N/A	97.000 - 99.000
Surr Decachlorobiphenyl	--	--	%	**N/A - N/A**	N/A	94.000 - 95.000
Toluene	--	0.36	µg/L	**0.500 - 0.500**	No	0.005 - 1.000
Total Chlorine	--	0.550	mg/L	**N/A - N/A**	N/A	0.520 - 1.800
Total Phosphorus	--	0.010	mg/L	**0.010 - 0.010**	No	0.010 - 0.070
Toxaphene	--	5.000	µg/L	**N/A - N/A**	N/A	0.010 - 5.000
2,4,5-TP (Silvex)	--	0.130	µg/L	**N/A - N/A**	N/A	0.010 - 5.000
Tritium	7000	15.0	Bq/l	**N/A - N/A**	N/A	15 - 15
Turbidity	1	0.13	NTU	**0.300 - 0.300**	No	0.030 - 0.500
Xylene; total	--	0.39	µg/L	**1.100 - 1.100**	No	0.005 - 5.000
Zinc	--	1	µg/L	**0.005 - 0.005**	No	0.005 - 100.0

[1]ODWS - Ontario Drinking Water Standards

[2]Historical range goes back to 2000

[3]Sodium is regulated to be tested every 60 months

[4]The City of London consistently goes beyond the minimum testing requirements of the ODWS and samples these parameters as well

There were eight (8) adverse microbiological results out of 2,735 samples taken; all due to unacceptable levels of Total Coliform bacteria (ranging from 1 to 9 cfu/100 mL). In each case, standard response procedures were enacted. All sites were re-sampled immediately, and the re-sample results revealed no adverse indicators.

It is highly unlikely that there were 'actual' water quality issues at these sites, as the eight 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 0.26 to 1.13 mg/L). 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 adhered to.

There was one (1) incident of an inorganic adverse. Sodium levels entering the London Water Distribution System from the Elgin Area Primary Water Supply System were elevated. Our sampling indicated a level of 20.3 mg/L. Although there is no actual Maximum Acceptable Level for sodium concentration in drinking water (there is an Aesthetic Objective Level, which is to target less than 200 mg/L) there is a threshold for sodium at which the local Health Unit must be notified. This mandatory reporting limit is 20 mg/L, and if it is exceeded, an adverse water quality indicator is triggered. This occurred on June 25, 2013 and notices were published on August 8, 2013.

System Statistics and Major Events

During the period from January 1, 2013 through to December 31, 2013 a total of 45,888,044,000 litres of water were purchased from the Joint Water Boards and subsequently pumped into London via the Arva Pumping Station and EMPS. Average day demand was 125,720,670 litres. Peak day pumpage of 165,464,000 litres occurred on July 18, 2013.

A summary of system pumpage can be found in Appendix 'C'. 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 2013 statistics for the City of London Distribution System.

Approximate Replacement Value of Drinking Water System	**$2,600,000,000**
Number of Pumping Stations	**7**
Number of Fire Hydrants	**8,799**
Number of Watermain Valves	**12,647**
Total Number of Water Services	**113,627**
ICI Water Services	9,667
Residential Water Services	103,960
Length of Watermain	**1,560 km**
Length of New Watermain Installed	3.6 km
Length of Watermain Replaced	4.2 km
Length of Watermain Rehabilitated	8.5 km
Number of Watermain Breaks	**148**

Municipalities Receiving London Water

In the Municipality of Middlesex Centre, Arva Village, Ballymote, and Delaware continued to receive their drinking water under contract from the City of London during 2013. 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.