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TO:	**CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON MARCH 5, 2012**
FROM:	**JOHN BRAAM, P.ENG. ACTING EXECUTIVE DIRECTOR, PLANNING, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER**
SUBJECT:	**CITY OF LONDON WATER DISTRIBUTION SYSTEM 2011 COMPLIANCE REPORT**

RECOMMENDATION

That, on the recommendation of the Acting Executive Director, Planning, Environmental and Engineering Services and City Engineer, the 2011 Compliance Report for the City of London Distribution System **BE RECEIVED** for information by Municipal Council.

PREVIOUS REPORTS PERTINENT TO THIS MATTER

- "City of London Water Supply and Distribution System 2010 Compliance Report" presented to ETC on March 28, 2011. Agenda Item #18;
- "City of London Water Supply and Distribution System 2009 Compliance Report" presented to ETC on March 22, 2010. Agenda Item #12;

BACKGROUND

Purpose:

O. Reg. 170/03 (Drinking Water Systems) requires the owner of a municipal drinking water system to ensure that an annual report is prepared which contains a description of the water system, a list of all treatment chemicals used, a summary of all required water test results, 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 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 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 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.

CONTEXT

The Safe Drinking Water Act, 2002 (SDWA) includes an important provision identifying a statutory duty and standard of care for those with ownership and oversight of municipal drinking water systems. Section 19 of the Act, identifying the standard of care, will apply to a range of parties that are involved in the supply and management of drinking water within the province and will come into force on December 31, 2012. The duty will attach to every person who, on behalf of the municipality, oversees the accredited operating authority of the system or exercises decision-making authority over the system. The standard of care that applies is

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twofold – to exercise the level of care, diligence and skill that a reasonably prudent person would be expected to exercise in a similar situation; and to act honestly, competently, and with integrity, with a view to ensuring the protection and safety of the users of the municipal drinking water system.

Section 19 of the SDWA resulted from Recommendation 45 of Part II of the Walkerton Report. Justice O'Connor explained the recommendation as follows:

> …in light of municipal ownership of water systems, municipal councils are responsible for ensuring the effective management and operation of their water systems. In some cases, councilors will assume this oversight responsibility directly; in others, they may delegate aspects of the oversight function. Given the importance of drinking water for public health, *those responsible for the discharging of the oversight function of the municipality (e.g. the council or a committee of council) should be held to a statutory standard of care that recognizes and formalizes their responsibilities.* These individuals should be required under the Safe Drinking Water Act to act honestly and in good faith with a view to the protection of the safety of the consumer, and to exercise the care, diligence, and skill that a reasonably prudent person would exercise in comparable circumstances. This standard of care is similar to the standard of care for directors or corporations under the various corporations' statutes.

Section 19 further states that a person shall not be considered to have failed to carry out a duty if the person relies in good faith on a report of an engineer, lawyer, accountant, or other person whose professional qualifications lend credibility to the report.

DISCUSSION

COMPLIANCE REPORT:

The 2011 Annual Compliance Report was submitted to the Ministry of Environment (MOE) on February 24, 2012. The overview text of the 2011 Annual Compliance Report can be found in Appendix 'A'. The comprehensive 2011 Annual Compliance Report, with full appendices, has been provided to members of Council in an electronic format. It contains a detailed analysis of all water samples taken in 2011, including those from the City's seven (7) emergency standby wells. Note that the standby wells did not provide any water to the City in the 2011 reporting year. Detailed analysis of samples taken from the distribution system can be found in pages 47 through to 60 of Appendix 'A' of the comprehensive report, provided to members of Council under separate cover. The report outlines water flows and sample results and confirms that high quality water consistently surpassing MOE standards was distributed throughout the City.

WATER SAMPLING:

During 2011, staff conducted water sampling from the distribution system which exceeded the MOE's minimum requirements. Staff take, on average, 180 samples monthly, from 57 standard locations across the City; testing for microbiological indicators and chlorine residuals. In addition, analysis is performed for up to 137 parameters, including organics, inorganics, pesticides and metals at 13 standard locations around the City. Chlorine residual is monitored continuously using in-line sampling probes at ten locations throughout the distribution system, while fluoride concentration is also monitored continuously at one location. In 2011, lab results were received for 9,642 separate analyses of distribution system water, and 1,475 analyses of raw (well) water. Staff also perform approximately 4,000 chlorine tests each year that are not included in the above numbers.

MOE INSPECTION:

The Ministry of Environment commenced an unannounced annual inspection of the City of London's water system on January 18, 2012. Operational and water quality records from December 1, 2010 through to December 31, 2011 were requested and made available to the MOE inspector. The inspection includes a review of operational procedures, records of water sample analyses, and a review of the status of the certification and training for all of the City's water operations staff. As of the writing of this report the MOE Inspection Report was not yet received. Administration will prepare and submit a report to Municipal Council upon receipt of

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the 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 Microbiologicals (E. coli and Total Coliform), Disinfection By-Products (Trihalomethane (THM), Haloacetic Acids (HAA)), Lead and Copper, and Emerging Pathogens and Chemicals.

In general, there are no immediate water quality concerns requiring process modification at the Regional Water Supply treatment facilities. It is anticipated that HAA sampling will be introduced in the near future. 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 http://www.watersupply.london.ca/reports.html .

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; an Act of the Provincial of Ontario 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 from the Lake Huron system at present and in the future, likely resulting in hundreds of millions of dollars to replace capacity that is otherwise available. Meetings with the Ministries appear to be 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.

Safe Water and Conservation
Clean Water, Safe Drinking Water, and Water Opportunities and Conservation Legislation and Regulations are consuming staff resources and will continue to increase costs for water and wastewater operations, as well as Conservation Authorities. These costs are ultimately being passed on to municipalities and their citizens.

- Regulations surrounding licensing of drinking water systems will add additional cost to water utilities for internal and external auditing;
- A review of Regulations regarding lead testing should continue to be investigated to assess the benefit of such detailed and extensive testing when Corrosion Control Plans are being implemented and lead water services are being eliminated;
- Regulations to be developed under the Water Opportunities and Conservation Act should recognize the achievements in reducing water consumption to date and not be prescriptive as a percentage of current consumption. Likewise, significant skill will be required to establish meaningful Industrial, Commercial and Institutional sector targets and do not further disadvantage municipalities that have witnessed significant revenue declines either through existing conservation efforts or closing of businesses. Consideration should be given to measures to mitigate the impact of conservation related reduction of water consumption and revenue loss on the financial sustainability of our existing water infrastructure;
- Details surrounding the extent of new costs are not fully known although the impact will continue to be felt going forward.

There is a need for committed funding for municipal infrastructure programs that can be used at the discretion of municipalities to address long term planning needs and the infrastructure deficit. A sustainable, long-term, predictable infrastructure fund would ensure sound planning and cost effective solutions.

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Green Energy Act
Coming into effect January 1, 2012, the Ministry of the Environment has launched O.Reg. 397/11 – Energy Conservation and Demand Management Plans, which affects public agencies. Municipalities will be required to collect and submit annual energy consumption data and develop and implement energy conservation plans for designated facilities. This legislation will impact many facilities owned and operated by the City of London, which will include facilities within the Water Service Area. The Regulations has established a phased-in reporting requirement, which has set July 1, 2013 as the initial date for commencing to report energy consumption and greenhouse gas emissions. By, July 1, 2014, the City of London will be required to submit the first energy conservation and demand management plan. The Water Service Area will be a component of a larger, corporate wide effort. More information on this initiative and required activities by the various facilities affected will be provided by Administration to Municipal Council through preparation and submission of a future report.

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 has established a legal framework where any subscribing utility can call upon the assistance of other subscribing utilities, with the response being provided within the context of a mutual aid type of agreement, similar to other service areas, such as firefighting. This initiative will be reported to Municipal Council in more detail in a future report, noting that both the Lake Huron and Elgin Area Primary Water Supply System Boards of Management are also considering active participation in OnWARN.

SUMMARY

Receipt of Appendix 'A' of this report by members of Council fulfils the reporting requirements of O. Reg. 170/03, Schedule 22. The 2011 Compliance Report is available to members of the public through the Customer Relations & Compliance Division (8th Floor, City Hall) of Environmental and Engineering Services Department, and has been 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, in Water Operations Division; and Roland Welker, Division Manager-Water Engineering.

PREPARED BY:	RECOMMENDED BY:
JOHN SIMON, P.ENG. **DIVISION MANAGER, WATER OPERATIONS**	**JOHN BRAAM, P.ENG.** **ACTING EXECUTIVE DIRECTOR, PLANNING, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER**

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

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CITY OF LONDON
2011 DRINKING WATER COMPLIANCE & ANNUAL 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

Exterior of the Arva Pumping Station

System Rating: Water Distribution Subsystem Class IV
Water Treatment Subsystem Class II

Average Day Demand: 132.9 MLD
Peak Day Demand: 201.6 MLD (July 21, 2011)
Population Served: 362,000 (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

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Reporting Requirements

On February 24, 2012, a copy of the 2011 Annual Compliance Report for the City of London's water works was submitted to the local office of the MOE as a courtesy for information purposes.

The London-Elgin-Middlesex Booster Station (owned in part by the City of St. Thomas, the Town of Aylmer, and the City of London) was operated by American Water Canada Corporation (formerly American Water Services) from January 1, 2011 to December 31, 2011. The Joint Board of Management for the Elgin Area Primary Water Supply System (EAPWSS) submitted the Annual Compliance Report for this pumping station under separate cover.

Schedule 22-2 of O. Reg. 170/03 requires that the City of London prepare a summary report of its water works systems for the preceding calendar year and submit it to the members of the Municipal Council by March 31 of each year. The Annual Compliance report, submitted to members of Council on February 24, 2012 along with this report, presented to Municipal Council's Civic Works Committee on March 5, 2012 serves to fulfill that requirement.

Ministry of Environment Annual Inspection

The Ministry of Environment commenced an unannounced annual inspection of the City of London's water system on January 18, 2012. Operational and water quality records from December 1, 2010 through to December 31, 2011 were requested and made available to the MOE inspector. The inspection includes a review of operational procedures, records of water sample analyses, and a review of the status of the certification and training for all of the City's water operations staff.

Inspection Results:
As of the writing of this report the inspection results have not yet been received.

Water Operations Staff Complement and Training

In 2011, 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, and out of the Arva Pumping Station, 13966 Medway Road.

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.

Water Budget

The 2011 Water Operating Budget had a 0% increase over that of 2010. In conjunction with lower forecasted water demands, the overall budget decreased approximately $1 million to $56.7 million, which includes long term infrastructure renewal and replacement plans. The Water Operating Budget helps maintain *London's Advantage* of a safe, clean and secure water supply for current and future generations of Londoners. London's aging water system infrastructure requires continuous renewal. In an effort to minimize

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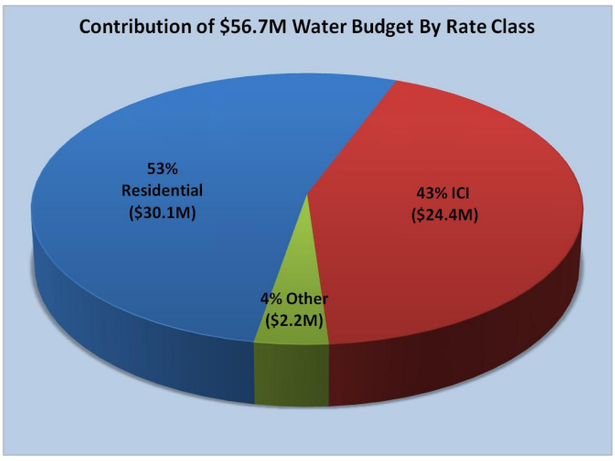
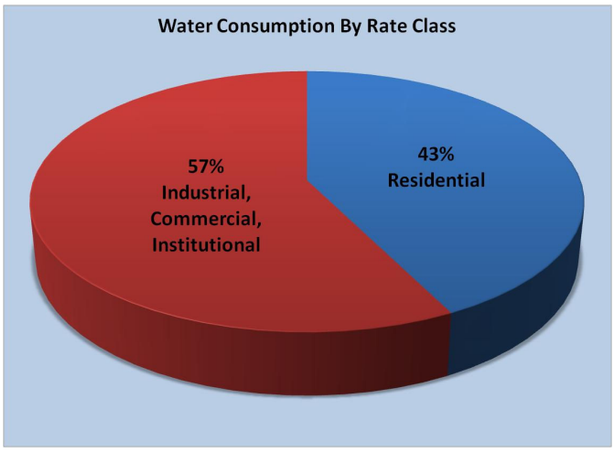
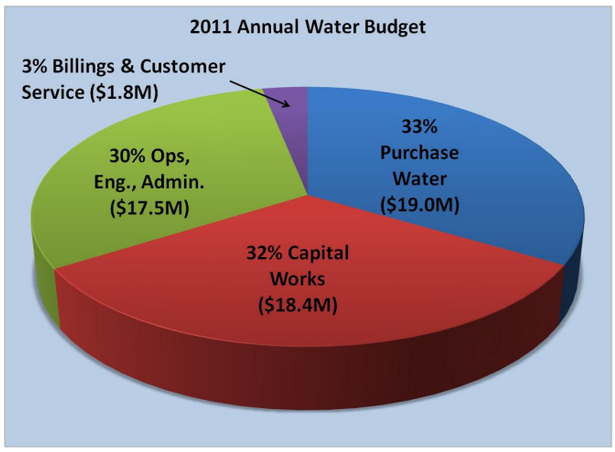
financial impacts, recent investments have been directed towards new approaches and trenchless technologies, to ensure continued reliability of the water supply at an economical cost.

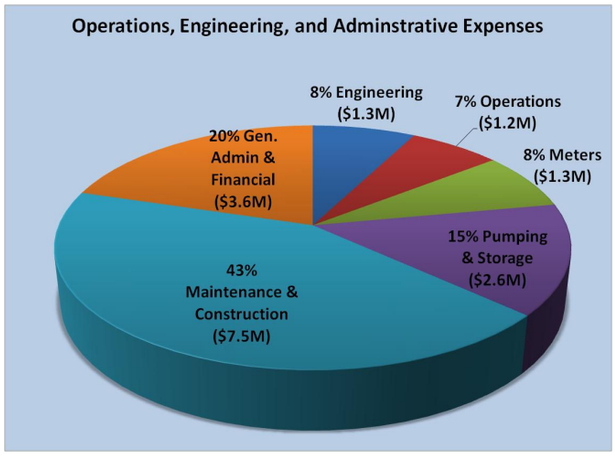


The 2011 average residential water consumption reduced to 185 cubic metres, translating to a cost for water of approximately $23.19 per month, or about 76 cents per day. This is a decrease of nearly $2.75 per month over 2010. At this low cost, Londoners had access to a reliable, high quality supply of water to satisfy all their water needs (drinking, food preparation, sanitation, showers, laundry, dishwashing, etc.). Public health, fire protection, economic development and convenience further enhance *London's* Advantage through the provision of this essential service.



Average household water usage in London has declined more than 24% since 2001. There are a number of factors responsible for this trend; and although this results in a negative impact on water revenues, the overall impact of water conservation is a positive trend towards *Conserving the Future*, and should be encouraged.





Some capital work projects needed to be delayed to future years in order to meet the 0% water rate increase for 2011. Working within these limitations, the operational and capital work utilized a balanced approach, as best as possible, toward the installation of new infrastructure in conjunction with the Growth Management Implementation Strategy, and the investment and renewal required to sustain the existing infrastructure. Reliable infrastructure and water system performance are not only key elements for economic development but also for quality-of-life and safety in the community. It is essential that proper funding of the water system is achieved and sustained in order to ensure that future generations are provided the same opportunity to a safe, clean and secure water supply.

Regulations, increasing standards and legislative obligations continued to require major investments in terms of staff time and financial resources. Staying abreast of regulatory

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developments and providing early input remains a key strategy in helping shape broader direction and control long term costs.

London's Water Service Area has maintained a relatively good financial position and continues to place London in the position of *Setting the Standard* as a utility with a secure and stable supply of high quality water. In the next few years, the water reserve funds are projected to be drawn down to a lower than normally acceptable level, and some debt is projected.

Ongoing Initiatives

Lead Mitigation Strategy – For some time, London has had a program that allows homeowners to have lead concentrations in their tap water sampled and analyzed for no charge. In 2007, subsequent to media attention regarding London's lead testing program, the MOE made regulatory changes to Ontario Regulation 170/03 as it relates to lead in drinking water. Since that time, over 10,000 homes and businesses had their water sampled for lead. Initially, it was estimated that of the 106,000 water services within London, 9,000 were fully, or partially, composed of lead. As of the end of 2011 the City has removed more than 3,000 lead services, putting the estimated number of lead services remaining at less than 6,000.

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

1. *Education and Awareness*: The City of London continues to provide information to Londoners regarding lead service pipes and the risks associated with lead. Enviroworks flyers (inserted with London Hydro/City of London Water bills) have been dedicated to lead awareness, a detailed brochure was prepared and delivered in conjunction with the Middlesex-London Health Unit, multiple press releases dating back to 2006, and an informative website are all employed to communicate with Londoners regarding this important topic.

2. *Water Chemistry Changes*: London has investigated and initiated water chemistry changes that will minimize the uptake of lead. Increasing the pH of the water has reduced "at the tap" lead concentrations by nearly 50% from 2007 levels. It is anticipated that this program will continue to reduce lead levels in drinking water over the long term while providing other benefits to system operations.

3. *Replacement of Lead Service Pipes:* London's overall goal is the replacement of all lead services. This is an 18-year program which anticipates replacement of approximately 500 lead services per year. The majority of these service replacements will occur 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 Meter Replacement Program – The public water system in the City of London has been fully metered since the 1920's when there were approximately 20,000 customers. There are currently over 110,000 customers with water meters installed in their homes and/or businesses. Meters are mechanical devices, and will wear-out as they register consumption. The more consumption they measure, the less accurate they become over

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time. During the summer of 2008, randomly selected water meters, with varying amounts of measured consumption, were subjected to accuracy testing at low, medium and high flow consumption rates as per *AWWA Standard C700* and *AWWA Manual M6, Water Meters*. The results of the meter accuracy testing indicated that the life expectancy of a residential water meter was between 9 and 13 years (or 2,400 m^3 of consumption). This evaluation identified 51,000 water meters that were past due for replacement. It is estimated that older meters are costing the Water and Sewer Service Areas $630,000 per annum in unrealized revenue.

The Water Meter Replacement Program (WMRP) was initiated in 2009 after Council approval in December 2008. Typically, 5,000 water meters were replaced or installed in any given year. With the new strategy in place, the Water Service Area has been exceeding its target of 10,000 replaced and installed. For the last three years (2009 – 2011), meter installations and replacements totalled 11,574, 11,070, and 11,057 respectively.

Through the deployment of new water metering technology and transitioning to a more automated system, the Water Service Area is reducing the meter reading costs. At the same time, customer's needs and requests are better met by:

- Allowing the City flexibility to select the best and most cost effective solution;
- Improving customer satisfaction through access to water usage data to handle billing disputes and customer inquiries;
- Improving the quality of our billing data with accurate and timely meter readings;
- Performing meter "right sizing" to ensure that the meter isn't over or under-sized, thus reducing metering inaccuracies and lost revenue;
- Reducing theft and revenue loss due to meter tampering;
- Effectively managing water conservation programs; and
- Decreasing water losses with proactive leak detection.

Water Efficiency: Large Diameter Concrete Pressure Pipe Watermain Inspection Program - Concrete Pressure Pipe (CPP) is a composite pipe manufactured using a thin steel cylinder with an inner liner of concrete a few centimetres thick. After the initial curing of the inner liner a high strength pre-stressed wire is spirally wound around the outer steel cylinder. A mortar liner is then placed on the outside of the steel cylinder which encases the pre-stressed wire and the steel cylinder providing a protective outer layer of cement mortar. The integrity of the composite pipe construction is highly dependent on the pre-stressed wire keeping the concrete core in compression.

Over time the protective mortar can breakdown and expose the steel cylinder and the pre-stressed wires to corrosion. As the pre-stressed wires corrode, some may break. If enough wires break, the pipe section may fail. Due to the age of theses pipes, it is possible that there are some broken wires.

Significant failures of the Lake Huron Pipeline occurred In August 1983, June 1988, and March 2010, which threatened to leave the City without water. 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 160km of large diameter concrete transmission mains moving millions of litres of water a day 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. In the summer and fall of 2007, three different inspections were undertaken on our Yr.-1965 CPP that links the 19km of watermain from Arva Reservoir to the Springbank Reservoir:

1. Leak Detection - provided a current condition of the pipe by determining if there are any leaks in the system.

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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, a fibre optic cable was floated inside 7.5km of the 19km, providing the capability to continuously monitor the pre-stressed steel wires wrapped around the pipe and embedded in concrete that provides its strength. By the end of 2012, the entire 19km length of large diameter watermain will have fibre optic cable within it. The fibre optic cable registers an acoustical signature when a wire breaks and a notification is sent to City staff to warn them of a potential watermain break so that Operations crews can possibly mitigate a catastrophic failure. The fibre optic line will provide the City with real time acoustic data of any wire breaks that occur. Information received from the fibre will give the City the ability to react immediately to prevent a possible break.

Water Efficiency: Leak Detection/District Metered Areas (DMA's) - The November 24, 2008 Environment and Transportation Committee report titled: *Establishment of an Efficient Water Use Program Including a Municipal Drinking Water Awareness Plan* identified the need for a water efficiency plan as part of the Permit to Take Water process. The report established a dedicated water efficiency strategy and program at a cost of $350,000 per year over 10 years paid for by revenues received through water rates. At the end of the program it is estimated that there will be an approximate reduction of 3.5 million litres per day in water consumption.

The Water Opportunities and Conservation Act will require Ontario municipalities to establish individual local water reduction goals and develop water sustainability plans to meet Provincial reduction targets. The sustainability plan currently includes five elements requiring the municipality to submit an asset management plan, a financial plan, a water conservation plan, an assessment of risks that may interfere with municipal service delivery including those associated with climate change, and strategies for maintaining and improving municipal service. The City of London has already developed many of the components of the water sustainability plan but needs a water conservation plan or water efficiency strategy.

An effective water efficiency strategy creates a unique dilemma as the conservation component effectively reduces the amount of water sold, and consequently the revenue from reduced volume of product sold. London is similar to most Canadian cities in that it has seen a significant reduction in the average water use by its residents over the past 10 years. The average household in London uses 24% less water than they did in 2001.

The development of an active leak detection program using District Meter Areas (DMAs) will form part of the City of London's ongoing water loss management program. The AWWA M36 Manual "Water Audits and Loss Control Programs" recommends using DMA's for active leak detection, which is considered to be a North American Best Management Practice (BMP).

For London, measuring the difference between the amount of water pumped into the system and that of which is consumed and recorded through London's 110,000+ water meters is the first step in reducing leaks. The average municipality in Ontario reports a non revenue water of approximately 12.3%, whereas London's water system is one of the most efficient in the Province boasting a non-revenue water loss of approximately 7.5% since 2004. Some of this water is used for flushing watermains, construction sites, or fire fighting. The remaining portion of that percentage can be attributed to leakage.

By isolating sections of the City at night and attaching flow and pressure data loggers to the watermains, staff can determine whether water loss is occurring through leakage. A priority project will be to establish DMA's in several portions of the City, including Oakridge, Summerside, Uplands, and Pondmills areas. The development of these DMA's will enable staff to proactively monitor to assist in finding and repairing leaks prior

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to watermain failures, reduce water loss, lower repair costs, and minimize social and business disruption.

Sampling & Water Quality Monitoring

The City of London provides sampling analysis and monitoring beyond the Ministry of Environment (MOE) regulated requirements, as specified in Ontario Regulation 170/03. Through routine grab samples there were 9,642 samples taken from the distribution system, 1,475 samples taken from the emergency wells, as well as over 4,000 chlorine residual tests taken by London staff. London also has 10 locations throughout the city in which continuous online sampling of chlorine residual is monitored. All of these efforts help ensure that the water within the distribution system is always of high quality. In all, the drinking water in London is sampled for 137 different organic, inorganic, microbiological, and chemical parameters. All samples are collected by certified city personnel and submitted to an accredited laboratory for analysis in accordance with the Safe Drinking Water Act, 2002. Below is the historical range (since 2000) of sample results for London's drinking water.

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL)	Units	Measured Concentrations	MAC Exceedence in 2011 (Y/N)	Historical Measured Concentration Range[2]
		2011		2011		
REGULATED INORGANICS						
Antimony	6	0.02	µg/L	**0.130 - 0.150**	No	0.020 - 1.200
Arsenic	25	0.2	µg/L	**0.600 - 0.800**	No	0.001 - 2.000
Barium	1000	0.05	µg/L	**13.400 - 21.900**	No	0.015 - 25.000
Boron	5000	1	µg/L	**21.000 - 21.000**	No	0.020 - 40.000
Cadmium	5	0.003	µg/L	**0.004 - 0.015**	No	0.002 - 0.100
Chromium	50	0.5	µg/L	**0.500 <MDL**	No	0.004 - 3.000
Fluoride	1.5	0.06	mg/L	**0.510 - 0.850**	No	0.030 - 1.390
Free Chlorine Residual	--	--	mg/L	**0.470 - 1.050**	No	0.000 - 1.860
Lead	10	0.02	µg/L	**0.020 <MDL**	No	0.002 - 1.070
Mercury	1	0.02	µg/L	**0.020 <MDL**	No	0.000 - 0.100
Selenium	10	1	µg/L	**1.000 - 3.000**	No	0.005 - 3.000
Sodium[3]	20*	0.01	mg/L	**8.570 - 11.600**	No	3.900 - 12.000
Uranium	20	0.001	µg/L	**0.023 - 0.058**	No	0.001 - 0.110

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Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2011	Units	Measured Concentrations 2011	MAC Exceedence in 2011 (Y/N)	Historical Measured Concentration Range[2]
REGULATED ORGANICS						
Alachlor	5	0.020	µg/L	**0.020 <MDL**	No	0.002 - 0.200
Aldicarb	9	0.010	µg/L	**0.010 <MDL**	No	0.005 - 5.000
Aldrin + Dieldrin	0.7	0.010	µg/L	**0.010 <MDL**	No	0.000 - 0.067
(Aldrin)	--	0.010	µg/L	**0.010 <MDL**	No	0.010 - 0.060
(Dieldrin)	--	0.010	µg/L	**0.010 <MDL**	No	0.001 - 0.067
Atrazine	--	0.020	µg/L	**0.030 - 0.060**	No	0.020 - 0.130
Atrazine + N-dealkylated metabolites	5	0.040	µg/L	**0.040 - 0.090**	No	0.003 - 0.500
Azinphos-methyl	20	0.020	µg/L	**0.020 <MDL**	No	0.010 - 1.000
Bendiocarb	40	0.010	µg/L	**0.010 <MDL**	No	0.010 - 1.000
Benzene	5	0.32	µg/L	**0.320 <MDL**	No	0.005 - 0.400
Benzo(a)pyrene	0.01	0.004	µg/L	**0.004 <MDL**	No	0.000 - 0.009
Bromoxynil	5	0.33	µg/L	**0.330 <MDL**	No	0.003 - 0.330
Carbaryl	90	0.010	µg/L	**0.010 <MDL**	No	0.010 - 1.000
Carbofuran	90	0.010	µg/L	**0.010 <MDL**	No	0.005 - 5.000
Carbon tetrachloride	5	0.16	µg/L	**0.004 - 0.160**	No	0.005 - 0.410
Chlordane (Total)	7	0.010	µg/L	**0.010 <MDL**	No	0.000 - 0.200
(a-chlordane)	--	0.010	µg/L	**0.010 <MDL**	No	0.007 - 0.200
(g-chlordane)	--	0.010	µg/L	**0.010 <MDL**	No	0.007 - 0.200
(oxychlordane)	--	0.010	µg/L	**0.010 <MDL**	No	0.010 - 0.360
Chlorpyrifos	90	0.020	µg/L	**0.020 <MDL**	No	0.008 - 5.000
Cyanazine	10	0.030	µg/L	**0.030 <MDL**	No	0.008 - 0.500
Diazinon	20	0.020	µg/L	**0.020 <MDL**	No	0.002 - 2.000
Dicamba	120	0.20	µg/L	**0.200 <MDL**	No	0.050 - 10.000
1,2-Dichlorobenzene	200	0.41	µg/L	**0.410 <MDL**	No	0.003 - 1.000
1,4-Dichlorobenzene	5	0.36	µg/L	**0.360 <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	**0.010 <MDL**	No	0.010 - 0.500
(pp-DDD)	--	0.010	µg/L	**0.010 <MDL**	No	0.010 - 0.500
(pp-DDE)	--	0.010	µg/L	**0.010 <MDL**	No	0.010 - 0.500
(pp-DDT)	--	0.010	µg/L	**0.010 <MDL**	No	0.010 - 0.500
1,2-Dichloroethane	5	0.35	µg/L	**0.350 <MDL**	No	0.005 - 0.430
1,1-Dichloroethylene	14	0.33	µg/L	**0.330 <MDL**	No	0.005 - 0.520
Dichloromethane	50	0.35	µg/L	**0.350 <MDL**	No	0.005 - 3.000
2,4-dichlorophenol	900	0.15	µg/L	**0.150 <MDL**	No	0.000 - 0.150
2,4-D	100	0.19	µg/L	**0.190 <MDL**	No	0.044 - 5.000
Diclofop-methyl	9	0.40	µg/L	**0.400 <MDL**	No	0.005 - 0.840
Dimethoate	20	0.030	µg/L	**0.030 <MDL**	No	0.005 - 1.000
Dinoseb	10	0.36	µg/L	**0.360 <MDL**	No	0.005 - 0.500
Diquat	70	1	µg/L	**1.000 <MDL**	No	1.000 - 70.000
Diuron	150	0.030	µg/L	**0.030 <MDL**	No	0.030 - 0.660
Glyphosate	280	6	µg/L	**6.000 <MDL**	No	0.010 - 10.000
Heptachlor + Heptachlor Epoxide	3	0.010	µg/L	**0.010 <MDL**	No	0.001 - 0.300
(heptachlor)	--	0.010	µg/L	**0.010 <MDL**	No	0.010 - 0.300
(heptachlor epoxide)	--	0.010	µg/L	**0.010 <MDL**	No	0.010 - 0.300
Lindane (Total)	4	0.010	µg/L	**0.010 <MDL**	No	0.002 - 0.200
Malathion	190	0.020	µg/L	**0.020 <MDL**	No	0.020 - 5.000
Methoxychlor	900	0.010	µg/L	**0.010 <MDL**	No	0.010 - 5.000
Metolachlor	50	0.020	µg/L	**0.020 <MDL**	No	0.008 - 5.000
Metribuzin	80	0.020	µg/L	**0.020 <MDL**	No	0.020 - 5.000
Monochlorobenzene	80	0.30	µg/L	**0.300 <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	**0.020 <MDL**	No	0.020 - 1.200
Pentachlorophenol	60	0.15	µg/L	**0.150 <MDL**	No	0.001 - 1.000

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Parameter	ODWS[1] Maximum Acceptable Concentration	Lab's Method Detection Limit (MDL) 2011	Units	Measured Concentrations 2011	MAC Exceedence in 2011 (Y/N)	Historical Measured Concentration Range[2]
REGULATED ORGANICS CONTINUED						
Phorate	2	0.010	µg/L	**0.010 <MDL**	No	0.001 - 0.730
Picloram	190	0.25	µg/L	**0.250 <MDL**	No	0.043 - 5.000
Polychlorinated Biphenyls (PCBs)	3	0.04	µg/L	**0.040 <MDL**	No	0.001 - 0.100
Prometryne	1	0.030	µg/L	**0.030 <MDL**	No	0.001 - 0.230
Simazine	10	0.010	µg/L	**0.010 <MDL**	No	0.005 - 0.500
Temephos	280	0.010	µg/L	**0.010 <MDL**	No	0.010 - 15.000
Terbufos	1	0.010	µg/L	**0.010 <MDL**	No	0.001 - 0.730
Tetrachloroethylene	30	0.35	µg/L	**0.350 <MDL**	No	0.005 - 1.000
2,3,4,6-tetrachlorophenol	100	0.14	µg/L	**0.140 <MDL**	No	0.001 - 0.500
Triallate	230	0.10	µg/L	**0.010 <MDL**	No	0.010 - 5.000
Trichloroethylene	50	0.43	µg/L	**0.430 <MDL**	No	0.005 - 1.000
2,4,6-trichlorophenol	5	0.25	µg/L	**0.250 - 0.320**	No	0.001 - 0.890
2,4,5-T	280	0.22	µg/L	**0.220 <MDL**	No	0.005 - 5.000
Trifluralin	45	0.020	µg/L	**0.020 <MDL**	No	0.020 - 1.000
Vinyl Chloride	2	0.17	µg/L	**0.170 <MDL**	No	0.002 - 0.170

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2011	Units	Measured Concentrations 2011	MAC Exceedence in 2011 (Y/N)	Historical Measured Concentration Range[2]
NITRATES						
Nitrate (as nitrogen)	10	0.013	mg/L	**0.078 - 0.710**	No	0.078 - 1.700
Nitrate + Nitrite (as nitrogen)	10	0.013	mg/L	**0.078 - 0.710**	No	0.040 - 1.700
Nitrite (as nitrogen)	1	0.005	mg/L	**0.005 <MDL**	No	0.005 - 0.060

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2011	Units	Measured Concentrations 2011	MAC Exceedence in 2011 (Y/N)	Historical Measured Concentration Range[2]
TRIHALOMETHANES						
Trihalomethanes (total)	100	0.37	µg/L	**14.000 - 57.000**	No	0.010 - 57.000
Bromoform	--	0.34	µg/L	**0.340 - 0.470**	No	0.002 - 2.000
Chloroform	--	0.29	µg/L	**6.600 - 39.000**	No	0.002 - 39.000
Dibromochloromethane	--	0.37	µg/L	**2.200 - 5.400**	No	0.002 - 5.400
Bromodichloromethane	--	0.26	µg/L	**4.400 - 12.000**	No	0.002 - 12.000

Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2011	Units	Measured Concentrations 2011	MAC Exceedence in 2011 (Y/N)	Historical Measured Concentration Range[2]
MICROBIOLOGICAL						
E. Coli	0	0	CFU/100mL	**0 - 0**	No	0 - 0
Total Coliform	0	0	CFU/100mL	**0 - 26**	Yes	0 - 40
Heterotrophic Plate Count	--	10	cfu/1mL	**10 - 2000**	No	10 - 2000

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Parameter	ODWS[1] Maximum Acceptable Concentration (MAC)	Lab's Method Detection Limit (MDL) 2011	Units	Measured Concentrations 2011	MAC Exceedence in 2011 (Y/N)	Historical Measured Concentration Range[2]
NON-REGULATED INORGANICS/ORGANICS[4]						
Alkalinity	--	2	mg/L as CaCO3	**72.000 - 72.000**	No	61.000 - 90.000
Aluminum	--	0.2	µg/L	**18.600 - 30.800**	No	0.030 - 436.0
Ammonia+Ammonium (N)	--	0.04	mg/L	**0.040 - 0.050**	No	0.040 - 0.400
Calcium	--	0.03	mg/L	**25.800 - 32.800**	No	25.800 - 38.000
Chloride	--	0.03	mg/L	**8.300 - 17.000**	No	7.200 - 36.100
Cobalt	--	0.002	µg/L	**0.085 - 0.119**	No	0.004 - 0.300
Colour	--	3	TCU	**3.000 <MDL**	No	3.000 - 13.000
Conductivity	--	1	uS/cm	**249.0 - 290.0**	No	205.0 - 313.0
Copper	--	0.5	µg/L	**1.700 - 3.300**	No	1.300 - 64.000
Cyanide	0.2	0.002	mg/L	**0.002 <MDL**	No	0.002 - 0.010
De-ethylated atrazine	--	0.010	µg/L	**0.010 - 0.030**	No	0.010 - 0.140
Dissolved Organic Carbon	--	0.2	mg/L	**0.900 - 1.900**	No	0.400 - 2.200
Ethylbenzene	--	0.33	µg/L	**0.330 <MDL**	No	0.002 - 1.000
Field pH	--	--	units	**6.670 - 8.330**	No	6.660 - 8.600
Gross Alpha	--	0.100	Bq/l	**0.100 <MDL**	No	0.100 - 0.100
Gross Beta	--	0.100	Bq/l	**0.100 <MDL**	No	0.100 - 0.100
Hardness	--	0.1	mg/L as CaCO3	**95 - 116.0**	No	95.000 - 133.0
Iron	--	2.000	µg/L	**2.000 <MDL**	No	2.000 - 90.000
Langelier's Index	--	0.000	@ 20 C	**-0.690 - -0.340**	No	-1.070 - -0.130
m/ p-xylene	--	0.39	µg/L	**0.390 <MDL**	No	0.390 - 5.000
Magnesium	--	0.003	mg/L	**7.520 - 8.390**	No	7.150 - 9.400
Manganese	--	0.01	µg/L	**0.230 - 0.300**	No	0.001 - 168.0
Nickel	--	0.1	µg/L	**0.500 - 0.800**	No	0.3 - 1.4
Nitrogen-Kjeldahl (N)	--	0.05	mg/L	**0.050 <MDL**	No	0.050 - 0.500
Organic Nitrogen	--	0.05	mg/L	**0.050 <MDL**	No	0.040 - 0.340
o-xylene	--	0.17	µg/L	**0.170 <MDL**	No	0.170 - 5.000
pH	--	0.05	no unit	**7.550 - 7.990**	No	7.050 - 8.110
Potassium	--	0.01	mg/L	**1.060 - 1.480**	No	0.940 - 1.910
Silica	--	0.01	mg/L	**1.290 - 1.510**	No	0.590 - 2.1
Silver	--	0.01	µg/L	**0.010 <MDL**	No	0.003 - 0.100
Solids (Total Dissolved)	--	30	mg/L	**123.0 - 200.0**	No	1.460 - 208.0
Sulphate	--	0.06	mg/L	**31.000 - 38.000**	No	27.000 - 55.000
Sulphide	--	0.004	mg/L	**0.004 <MDL**	No	0.004 - 4.000
Toluene	--	0.36	µg/L	**0.360 <MDL**	No	0.005 - 1.000
Total Chlorine	--	0.550	mg/L	**1.020 - 1.310**	No	0.520 - 1.800
Total Phosphorus	--	0.02	mg/L	**0.020 - 0.030**	No	0.020 - 0.070
Toxaphene	--	5.000	µg/L	**5.000 <MDL**	No	0.010 - 5.000
2,4,5-TP (Silvex)	--	0.130	µg/L	**0.130 <MDL**	No	0.010 - 5.000
Tritium	7000	15.0	Bq/l	**15.0 <MDL**	No	15 - 15
Turbidity	1	0.13	NTU	**0.130 <MDL**	No	0.030 - 0.500
Xylene; total	--	0.39	µg/L	**0.390 <MDL**	No	0.005 - 5.000
Zinc	--	1	µg/L	**2.000 - 4.000**	No	0.300 - 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

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There were six adverse microbiological results out of 2,261 samples taken; all due to unacceptable levels of Total Coliform bacteria. 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 six 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 0.34 to 0.96 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 staff error, despite the specific procedures and precautions adhered to.

There was one incident of an inorganic adverse on May 25, 2011. During planned maintenance activities at the Arva Pumping Station, the fluoride injection system was turned off for several hours and the piping associated with the fluoridation system was drained. During this process, some concentrated fluoride was inadvertently introduced into a pipe connected to the station's main suction header. During the maintenance activities, water continued to be pumped to the London system without adding fluoride.

After the maintenance activities were completed and normal pumping resumed, the concentrated fluoride mentioned above was introduced into the suction header and was then pumped into the station's main discharge pipes. This caused the fluoride concentration in the water leaving the station to briefly climb above the Ontario standard before settling back to the normal level.

London fluoridates to a target value of 0.7 mg/L, and the Ontario standard for fluoride is 1.5 mg/L; though several municipalities around London have naturally occurring fluoride levels over 2 mg/L. When normal pumping resumed, the fluoride concentration in the water increased above 1.5 mg/L for 2 minutes, 30 seconds, reaching a maximum concentration of 2.5 mg/L.

City staff on-site monitored this brief increase in fluoride concentration and allowed this water to be pumped to the distribution system. This decision was made with the knowledge that water leaving the Arva Pumping Station would mix with the non-fluoridated water within the large transmission mains for several kilometres prior to reaching any customer connection. The water in these transmission mains had no fluoride added for several hours during the maintenance activities. The "higher fluoride water" had a total volume of 130 m^3, and the non-fluoridated water that it was mixed into had a total volume of 15,780 m^3.

Even though the water would be well mixed before reaching any customers, staff reported this as an adverse incident, given that the fluoride level leaving the pumping station was above 1.5 mg/L for 2-½ minutes before it began mixing into the non-fluoridated water in the transmission mains. Staff reported the incident to the MOE, including procedures which were followed. The MOE concurred with the City's response.

Following the incident, staff reviewed the events that lead to the unplanned increase in fluoride concentration. It was determined that the pipe isolation procedures should be amended to require additional valve closures that would prevent such an occurrence during future maintenance activities of this nature. As an additional safeguard, new backflow prevention devices were installed on the system piping which would also positively prevent such an event from occurring, regardless of the pipe isolation procedures.

System Statistics and Major Events

During the period from January 1, 2011 through to December 31, 2011 a total of 48,772,214,000 litres of water were purchased from the Joint Water Boards and subsequently pumped into London via the Arva Pumping Station and the London-Elgin-Middlesex Pumping Station. Average day demand was 132,908,040 litres. Peak day pumpage of 201,553,000 litres occurred on July 21, 2011.

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A summary of system pumpage can be found in the PDF version of this report that is being provided to members of Council. 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. As shown, there have been no occurrences of flow rate exceedances during the specified time period.

Listed below are some 2011 statistics for the City of London Distribution System.

Approximate Replacement Value of Drinking Water System	**$1,800,000,000**
Number of Pumping Stations	**7**
Number of Fire Hydrants	**8,502**
Number of Watermain Valves	**11,090**
Total Number of Water Services	**110,485**
ICI Water Services	9,748
Residential Water Services	100,737
Length of Watermain	**1,563 km**
Length of New Watermain Installed	11 km
Length of Watermain Replaced	7 km
Length of Watermain Rehabilitated	5 km
Number of Watermain Breaks	**119**
Number of Water Quality Complaints	**176**

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 2011. The Municipality of Middlesex Centre has been provided a copy of the Annual Compliance Report as per subsection (4) of Schedule 22-2.

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