The City of London Water System

Quality Management System

Operational Plan

Revised July 30, 2015

NOTE

This is an uncontrolled copy of the City of London Water System QMS Operational Plan

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Schedule "C"

Subject System Description Form
Municipal Residential Drinking Water System

Owner of Municipal Residential Drinking Water System:[1] The Corporation of the City of London

Name of Municipal Residential Drinking Water System:[2] City of London Distribution System

Subject Systems

	Name of Operational Subsystems (if Applicable)[3]	Name of Operating Authority [5]	DWS Number(s)[6]
☐ Check here if the Municipal Residential Drinking Water System is operated by one operating authority. Enter the name of the operating authority in adjacent column [4]			
Operational Subsystem 1:	City of London Distribution System except #2 below	City of London	260004917
Operational Subsystem 2:	Elgin-Middlesex Pumping Station (London Portion)	Ontario Clean Water Agency	260004917
Operational Subsystem 3:			
Operational Subsystem 4:			

Add attachments if there are additional 'Operational Subystems'

Contact Information [7]

Name	Title	Phone Number	e-mail address
John Simon	Division Manager - Water Operations	519-630-6694	jsimon@london.ca
Dan Huggins	Water Quality Manager	519-854-0908	dhuggins@london.ca

The City of London Water System

Quality Management System Policy

The City of London owns and operates the City of London Distribution System and is committed to:

a) providing safe drinking water for all consumers supplied by its Water System

b) complying with all legislation and regulations applicable to the operation of its Water System

c) the maintenance and continual improvement of the Quality Management System for its Water System

The Corporation of the City of London (Owner) and the Top Management of the Operating Authority (as defined in QMS-09) are committed to the maintenance and continual improvement of a Quality Management System (QMS) that meets the requirements of Ontario's Drinking Water Quality Management Standard. The QMS for the drinking water system is documented in the Operational Plan. Endorsement by the Owner and Top Management acknowledges the need for, and supports the provision of, sufficient resources to maintain and continually improve the QMS.

The Owner endorses the Operational Plan through a Council Resolution. The Owner's commitment to an effective QMS is evidenced by the resources provided for maintenance and continual improvement of the QMS. The Operating Authority will request renewal of the Owner's endorsement following each municipal election, within one (1) year of the inaugural meeting of the newly elected Municipal Council, and/or when such changes are made to the Operational Plan as to require a significant increase in the resources required for the QMS.

Top Management's commitment to an effective QMS is evidenced by:

a) Ensuring that a QMS is in place that meets the requirements of the DWQMS,
b) Ensuring that Operating Authority staff are aware of all applicable legislative and regulatory requirements,
c) Communicating the QMS according to procedures (QMS-12), and
d) Determining, obtaining or providing the resources needed to maintain and continually improve the QMS.

Top Management's endorsement of the Operational Plan is renewed following any changes to the composition of Top Management, and is provided through the signatures below.

Date	Top Management (Signature & Title)
May 21, 2015	John Lucas, Water Director
May 21, 2015	John Simon, Division Manager, Water Operations
May 21, 2015	Roland Welker, Division Manager, Water Engineering

300 Dufferin Avenue
P.O. Box 5035
London, ON
N6A 4L9

London
CANADA

December 2, 2008

P. McNally
Acting General Manager of Environmental and Engineering Services and City Engineer

I hereby certify that the Municipal Council, at its session held on November 24, 2008 resolved:

13. That, on the recommendation of the Acting General Manager of Environment and Engineering Services and City Engineer, the following actions be taken with respect to Ontario's new Municipal Drinking Water Licensing Program and endorsement of the Operational Plan:

(a) the Operational Plan for the City of London Water System **BE ENDORSED** by the Municipal Council as per the requirements of O. Reg 188/07; it being noted that a companion Operational Plan for the London portion of the Elgin-Middlesex Pumping Station will be submitted at the December 8, 2008 meeting of the Environment and Transportation Committee;

(b) the Quality Management System **BE REPORTED** upon annually by the Civic Administration; and

(c) the Municipal Council **BE ADVISED** on a timely basis if there is anything of significance, by the Civic Administration.

it being noted that a verbal presentation was heard from the Acting General Manager of Environment and Engineering Services and City Engineer with respect to this matter. (2008-W13-00) (AS AMENDED) (13/19/ETC)

Kevin Bain
City Clerk

/jrg

cc: J. Braam, Division Manager, Water/Sewer Operations
R. Welker, Division Manager of Water Engineering
D. Huggins, Water Quality Manager

The Corporation of the City of London
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www.london.ca

1 PURPOSE

To identify a Quality Management System Representative and outline their specific responsibilities.

2 PROCEDURE

2.1 Procurement Process

2.1.1 Top Management appoints and provides authority to the Quality Management System Representative, irrespective of their other responsibilities. The authority, roles and responsibilities are provided in QMS-09.

2.1.2 A letter of appointment of the QMS Representative has been signed by Top Management and is included as Appendix 4-A.

3 REFERENCES

QMS-09 Organizational Structure, Roles, Responsibilities and Authorities

4 APPENDICES

Appendix 4-A Letter of Appointment of QMS Representative

NOTICE OF APPOINTMENT

QMS Representative

Top Management for the City of London Water System Operating Authority has appointed the Quality Management System Representative to be:

Dan Huggins, Water Quality Manager

The Quality Management System (QMS) Representative is the liaison between Top Management and 1) the Water/Sewer Operations Division, Water Operations Section, 2) the Water Engineering Division (collectively, the Operating Authority). The QMS Representative, irrespective of other responsibilities, shall:

a) administer the QMS by ensuring that processes and procedures needed for the QMS are established and maintained,
b) report to Top Management on the performance of the QMS and any need for improvement,
c) ensure that current versions of documents required by the QMS are being used at all times,
d) ensure that personnel are aware of all applicable legislative and regulatory requirements that pertain to their duties for the operation of the City of London's drinking water system, and
e) promote awareness of the QMS throughout 1) the Water/Sewer Operations Division, Water Operations Section, 2) the Water Engineering Division (collectively, the Operating Authority).

Water Director — Nov 17, 2008 Date

Division Manager of Water/Sewer Operations — Nov 17, 2008 Date

Division Manager of Water Engineering — Nov 17, 2008 Date

1 PURPOSE

To document a procedure that describes how: a) documents required by the QMS are kept current, legible, readily identifiable, retrievable; as well as stored, protected, retained and disposed of; and b) records are kept legible, readily identifiable, retrievable, as well as stored, protected, retained and disposed of.

2 PROCEDURE

2.1 Documents

2.1.1 The Operational Plan and its associated policies, procedures, forms, flowcharts or other documents that are subject to revision are controlled documents and are maintained on the Document Master List (Table 05-01).

2.1.2 Controlled documents (excluding drawings) of both internal (refers to documents created by the Operating Authority) or external origin are included on the Document Master List. The QMS Representative is responsible for maintaining the electronic list and ensuring that an updated copy is included in the Operational Plan.

2.1.3 All electronically controlled internal documents (excluding drawings) for the QMS are available to Operating Authority Personnel on a network drive. The network drive is backed up daily, with tape back-ups made monthly, by the Information Technology Services Division (ITS).

2.1.4 Documents have revision numbers and/or dates listed on them to identify the current version.

2.1.5 The electronic documents are “read-only” on the network drive. If a document is printed from a read-only file, then the document is considered uncontrolled and not subject to revision.

2.1.6 Documents that are only available in hard copy are kept in indoor locations, typically within file cabinets or desk drawers, to limit damage or deterioration.

2.2 Document Changes

2.2.1 Any employee of the Operating Authority may request the creation of, or a change to, a QMS document. Changes to documents can be a result of change in procedure, results of an audit or Management Review, or suggestion for improvement. Document change requests are to be directed to the QMS Representative either verbally or in writing.

2.2.2 The QMS Representative will evaluate the request in consultation with the appropriate management staff. The QMS Representative will be responsible for ensuring that any changes will not affect the integrity of the QMS.

2.2.3 The QMS Representative will make any required changes and will update the Document Master List (Table 05-01).

2.2.4 When a QMS document is superseded, the QMS Representative will send an e-mail explaining the changes in the document to all management affected by the change. Management are responsible for advising any staff affected by the change.

2.2.5 The QMS Representative ensures that all hard copies of the newly obsolete document are collected and disposed of by blue-box recycling.

2.2.6 Obsolete documents must be marked “Obsolete” if retained for historical purposes.

2.3 Records

2.3.1 The Records Master List (Table 05-02) identifies all of the records to which this procedure applies.

2.3.2 Electronic records associated with the QMS are maintained on the network drive which is backed up daily, with tape back-ups made monthly by ITS.

2.3.3 SCADA data is backed up daily with tape back-ups made monthly by Pollution Control Operations SCADA staff.

2.3.4 The person completing the record must ensure the record is legible, accurate and complete with regard to recording requirements.

2.3.5 The QMS Representative, in consultation with the Supervisors and Managers, determines the retention time for records.

2.3.6 Records may be electronic and/or hard copy.

2.3.7 Once the retention time has elapsed for a record, the person who maintains the QMS record (as identified in Form 05-F3) is responsible for disposing of that record.

2.4 Drawings

2.4.1 An electronic Water Information Management System (WIMS) is used to maintain network drawings. WIMS information is continually updated as changes are identified. The CityMap PC application is used to access WIMS information. Operators in the field have laptops with wireless access to CityMap. Each laptop has an interactive version of the WIMS information on the hard drive, to be used as a back-up if the network is not available. The local hard drive versions are updated annually for each Laptop.

2.4.2 Geomatics Division maintains original hard copies of as-built drawings but these are also available electronically through WIMS.

2.4.3 Water Operations maintain original hard copies of field annotated construction drawings.

3 REFERENCES

Table 05-01 Document Master List

Table 05-02 Records Master List

4 APPENDICES

Not Applicable

QMS Table 05-01
Revision Number: 006
2015-07-30

Document Master List

Internal Documents			
Document Title	Document Reference No.	Date of Last Revision	Location
QMS Policy	QMS-02	2014-07-04	Livelink – DWQMS Folder
Commitment & Endorsement	QMS-03	2015-05-21	Livelink – DWQMS Folder
QMS Representative	QMS-04	2008-11-17	Livelink – DWQMS Folder
Notice of Appointment - QMS Representative	QMS Appendix 4-A	2008-11-17	Livelink – DWQMS Folder
Document and Records Control	QMS-05	2015-05-21	Livelink – DWQMS Folder
Document Master List	QMS Table 05-01	2015-07-30	Livelink – DWQMS Folder
Record Master List	QMS Table 05-02	2015-07-07	Livelink – DWQMS Folder
Drinking Water System	QMS-06	2014-08-19	Livelink – DWQMS Folder
The City of London Water System Flow Chart	QMS Appendix 6-A	2014-08-19	Livelink – DWQMS Folder
Risk Assessment	QMS-07	2013-09-13	Livelink – DWQMS Folder
Risk Assessment Rating	QMS Table 07-01	2015-04-07	Livelink – DWQMS Folder
Risk Assessment Form	QMS Table 07-02	2015-04-07	Livelink – DWQMS Folder
Risk Assessment Outcomes	QMS-08	2013-09-13	Livelink – DWQMS Folder
Risk Assessment Outcomes Table	QMS Table 08-01	2015-07-30	Livelink – DWQMS Folder
Summary of Critical Control Points	QMS Table 08-02	2014-09-01	Livelink – DWQMS Folder
Organizational Structure, Roles, Responsibilities and Authorities	QMS-09	2015-04-07	Livelink – DWQMS Folder
Organizational Chart of the City of London Water System Operating Authority	QMS Appendix 9-A	2015-04-07	Livelink – DWQMS Folder

QMS Table 05-01
Revision Number: 006
2015-07-30

Document Master List

City of London Water System Key Operating Authority Roles	QMS Table 09-01	2015-04-07	Livelink – DWQMS Folder
City of London Water System QMS Roles, Responsibilities and Authorities	QMS Table 09-02	2015-04-07	Livelink – DWQMS Folder
Competencies	QMS-10	2015-04-07	Livelink – DWQMS Folder
Summary of Drinking-Water Related Staff Competencies	QMS Form 10-01	2015-04-07	Livelink – DWQMS Folder
Personnel Coverage	QMS-11	2015-04-07	Livelink – DWQMS Folder
Communications	QMS-12	2015-04-07	Livelink – DWQMS Folder
Essential Supplies and Services	QMS-13	2015-03-30	Livelink – DWQMS Folder
Essential Supplies and Services List	QMS Table 13-01	2015-03-30	Livelink – DWQMS Folder
Suppliers and Contracted Services List	QMS Table 13-02	2015-03-30	Livelink – DWQMS Folder
QMS Information for Contracts	QMS Appendix 13-A	2008-11-17	Livelink – DWQMS Folder
Review and Provision of Infrastructure	QMS-14	2015-03-30	Livelink – DWQMS Folder
Infrastructure Maintenance, Rehabilitation and Renewal	QMS-15	2015-03-30	Livelink – DWQMS Folder
Sampling Testing and Monitoring	QMS-16	2015-04-07	Livelink – DWQMS Folder
Measurement and Recording Equipment Calibration and Maintenance	QMS-17	2015-04-07	Livelink – DWQMS Folder
Measurement & Recording Equipment Calibration & Maintenance Schedule	QMS Table 17-01	2015-04-07	Livelink – DWQMS Folder
Emergency Management	QMS-18	2015-05-21	Livelink – DWQMS Folder
Internal Audits	QMS-19	2015-04-07	Livelink – DWQMS Folder
Internal Audit Schedule	QMS Form 19-01	2014-09-01	Livelink – DWQMS Folder

Document Master List

Internal Audit Checklist	QMS Form 19-02	2014-09-01	Livelink – DWQMS Folder
Internal Audit Report	QMS Form 19-03	2014-09-01	Livelink – DWQMS Folder
Management Review	QMS-20	2015-04-07	Livelink – DWQMS Folder
Management Review Agenda & Meeting Minutes	QMS Table 20-01	2008-11-17	Livelink – DWQMS Folder
Continual Improvement	QMS-21	2015-04-07	Livelink – DWQMS Folder
Waterworks Operation and Maintenance Manual	n/a	October, 2012	Livelink – DWQMS Folder
Water Maintenance and Construction Forms	n/a	See Individual Documents	Livelink – DWQMS Folder
Water Maintenance and Construction Staff Schedule	n/a	2014-08-19	Livelink – DWQMS Folder
Water Supply Forms	n/a	See Individual Documents	Livelink – DWQMS Folder
Water Supply Staff Schedule	n/a	2014-12-10	Livelink – DWQMS Folder

QMS Table 05-01
Revision Number: 006
2015-07-30

Document Master List

External Documents	
Document Title	Location
City of London Water By-law W-8	City of London Website – www.london.ca
City of London Purchasing and Materials Management Policy	City of London Website – www.london.ca
Ontario Regulation 170/03 - Drinking Water Systems	Province of Ontario Legislation Database www.e-laws.gov.on.ca
Ontario Regulation 128/04 Certification of Drinking Water System Operators and Water Quality Analysts	Province of Ontario Legislation Database www.e-laws.gov.on.ca
Ontario Regulation 169/03 – Ontario Drinking Water Quality Standards	Province of Ontario Legislation Database www.e-laws.gov.on.ca
American Water Works Association (AWWA) Standards	Water Operations Technologists Office

QMS Table 05-02
Revision Number: 004
2015-07-07

RECORD MASTER LIST

Record Name	Location	Minimum Retention Time	Maintained By
Water Valve Operation and Incident Reports	Water Operations Technologists Office	5 years	Water Operations Technologists
Waterworks Record Change Reports	Water Operations Technologists Office	5 years	Water Operations Technologists
Leading Waterworks Utility Worker Logbooks (Current Year)	Waterworks Crew Trucks	1 Year	Leading Waterworks Utility Workers
Leading Waterworks Utility Worker Logbooks (Past Years)	Water Operations Supervisors Office (Maintenance & Construction)	4 Years	Water Operations Supervisors (Maintenance & Construction)
Water Utility Worker Training Records and Copies of Training Certificates (Current Year)	Water Operations Supervisors Office (Maintenance & Construction)	1 Year	Water Operations Supervisor (Quality Assurance)
Water Utility Worker Training Records and Copies of Training Certificates (Past Years)	Water Quality Manager	4 Years	Water Quality Manager
Water Supply Operator Training Records	City of London Network Drive	5 Years	Water Operations Supervisor (Water Supply)/ITS
Copies of Water Supply Operator Training Certificates	Water Quality Manager's Office	5 Years	Water Quality Manager
Laboratory Reports	City of London Network Drive	15 Years	Water Operations Technologists/ITS
Notices of Adverse Test Results and Other Problems and Notices of Issue Resolution at Drinking Water Systems	City of London Network Drive	15 Years	Water Operations Technologists/ITS
Monthly City-Wide Chlorine Residual Test Results (Embedded in Lab Reports)	City of London Network Drive	15 Years	Water Operations Technologists/ITS
Water Supply Operator Daily Operational Records	City of London Network Drive	5 Years	Water Supply Operators/ITS
Pumping Station and Reservoir Logbooks	On-site at each Facility	5 Years	Water Supply Operators
Pumping Station and Reservoir Maintenance and Inspection Cards	On-site at each Facility	5 Years	Water Supply Operators
Pumping Station, Emergency Wells, and Reservoir Water Meter Calibration Records	City of London Network Drive	5 years	Water Operations Supervisor (Water Supply)/ITS
Analytical Device Calibration Records	Water Operations Supervisor Office (Water Supply) (Original Hard Copies) City of London Network Drive (Electronic)	5 years	Water Operations Supervisor (Water Supply)/ITS
SCADA Data	SCADA Drive and Tape Back-ups at Greenway PCP	5 years	Manager Operations - PCP Operations

RECORD MASTER LIST

Audit Results (Internal and External)	Livelink DWQMS Folder	5 years	Water Quality Manager/ITS
Management Review Meeting Minutes	Livelink DWQMS Folder	5 years	Water Quality Manager/ITS
Operational Plans that were the Subject of an Audit by an Auditor for the Accreditation Body	Livelink DWQMS Folder	10 Years	Water Quality Manager
Annual Reports as per Section 11 of Ontario Regulation 170/03	Livelink DWQMS Folder	6 Years	Water Operations Engineer/ITS
Summary Reports for Municipalities as per Schedule 22 of Ontario Regulation 170/03	Livelink DWQMS Folder	6 Years	Water Operations Engineer/ITS

1 PURPOSE

To document a description of the City of London Water System that includes 1) all treatment processes and distribution components, 2) the name of the Owner and Operating Authority, 3) a system flow chart, 4) a description of the water source(s), 5) a description of critical upstream and downstream processes relied upon to ensure the provision of safe drinking water, and 6) a summary description of other drinking water systems connected to the London system.

2 OWNERSHIP AND OPERATING AUTHORITY

The City of London Water System is owned by the Corporation of the City of London. The City of London Water Engineering Division and the City of London Water Operations Division comprise the Operating Authority for the London water system; with the exception of the Elgin-Middlesex Pumping Station (London Portion). The Ontario Clean Water Agency (OCWA) is the contracted Operating Authority for this one component of the London water system.

3 SOURCE WATER

The City of London receives treated water from both the Lake Huron Primary Water Supply System (LHPWSS) and the Elgin Area Primary Water Supply System (EAPWSS). Approximately 85% of London's water demand is supplied by the LHPWSS with the remainder supplied by the EAPWSS. These two systems are responsible for providing safe drinking water, meeting all applicable standards, to the points of entry into the London water system. The Joint Boards of Management for the Lake Huron and Elgin Area Primary Water System own and govern the respective water systems. Both water systems are operated and maintained by the Ontario Clean Water Agency (OCWA) under contract to the respective Joint Board of Management.

4 CRITICAL UPSTREAM OR DOWNSTREAM PROCESSES

The supply of safe drinking water from the LHPWSS and the EAPWSS and the operation of the associated treatment and transmission facilities are critical upstream processes that the London water system relies upon to ensure the provision of safe drinking water.

5 SYSTEM DESCRIPTION

5.1 System Classification

The City of London Water System is registered with the MOECC as a Class 4 Water Distribution Subsystem. Due to its fluoridation processes and the primary disinfection performed at the Hyde Park and Fanshawe Wells, it is also registered as a Class 2 Water Treatment Subsystem.

5.2 Arva Pumping Station

The LHPWSS pumps treated water from the Grand Bend Treatment Facility to their 109,000 m^3 Arva Terminal Reservoir located approximately 1 km north of the City of London (near the Village of Arva). The City of London owns the Arva Pumping Station (Arva P.S.) which is located adjacent to the Arva Terminal Reservoir. The Arva P.S. draws water from the Arva

Terminal Reservoir and pumps into the London water system through two transmission mains, which connect with the network of water mains within the City of London.

The station consists of six fixed speed horizontal centrifugal pumps. Five pumps are equipped with are 522 kW (700 hp) electric motors, and one is equipped with a 671 kW (900 hp) motor. There are parallel East and West pumping systems, with Pumps 1, 2 and 3 discharging to the West Header and Pumps 4, 5 and 6 discharging to the East Header. There is a magnetic flowmeter on each discharge header.

A Water Supply Operator determines the desired daily station pumpage and enters corresponding start-time and stop-time set-points in the SCADA system (described below) for each pump. For example, an Operator may determine that a 522 kW pump should run for 13 hours and the 671 kW pump should run for 11 hours on a given day, in order to provide the desired daily pumpage.

Fluoridation is performed at the Arva P.S. through the addition of 25% Hydrofluorosilicic Acid (H_2SiF_6, HFSA). The HFSA is stored in two bulk storage tanks (12.2 m^3 each) and is pumped into two day tanks (0.7 m^3 each) for dosing into the drinking water.

On-line analysers continually monitor fluoride concentration, pH and free chlorine residual; although no chlorination is performed at this location.

A diesel-powered back-up generator provides emergency power for lighting, SCADA and on-line analysers. There is no back-up power for the station pumps. In the event of a long-term power outage, the Arva Terminal Reservoir can be bypassed by valve operations and the LHPWSS can pump water through the Arva P.S. to the London water system.

5.3 Elgin-Middlesex Pumping Station (London Portion) – (EMPS)

The EAPWSS pumps treated water from the Lake Erie Treatment Facility into two (2) 27,300 m^3 reservoirs at the EMPS facility located approximately 10 km south of the City of London. The EMPS facility and reservoirs are co-owned by the City of London, the City of St. Thomas and the Town of Aylmer. The City of London owns one constant-speed and two variable-speed high-lift pumps, which comprise the “London Portion” of the EMPS. Surge protection is provided by a hydro-pneumatic tank equipped with two air-compressors. The three “London pumps” are operated by OCWA under contract to the City of London. During typical operation, one pump is manually started each morning and the operator stops the pump when the total daily pumpage reaches 22,700 m^3, which typically occurs after 12 hours of operation.

Water is pumped from the EMPS to the City of London water system through transmission mains owned by the City of London, running north along Highbury Avenue. At the intersection of Highbury Ave. and Dingman Dr, the transmission main branches into two mains; with one running west along Dingman Dr and the other continuing north along Highbury Ave. Both transmission mains discharge water into London’s distribution mains through Pressure Regulating Valves (PRV’s) located in underground chambers. The PRV pressure set-points can be adjusted through the City of London SCADA system. The west transmission main terminates at the PRV located at Dingman Dr & Castleton Rd (PDC) and the north transmission main terminates at the PRV located at Commissioners Rd & Jackson Rd (PCJ).

5.4 Springbank Reservoirs No. 1, 2 and 3

Three (3) in-ground concrete reservoirs are located at the west end of Commissioners Rd. They are named Springbank Reservoirs No. 1, 2, and 3 because the City of London's first water supply system used reservoirs at this location (due to its elevation) and were supplied with spring water from Springbank Park. Reservoirs No. 1 and 3 each have a capacity of 81,800 m^3, and Reservoir No. 2 has a capacity of 45,400 m^3. Reservoirs No.1 and 2 are located on the north side of Commissioners Rd. and Reservoir No. 3 is located directly across Commissioners Rd on the south side.

During periods of interrupted water supply from the Arva P.S. and/or the EMPS (power failure, planned maintenance etc.), the elevation and volume of the Springbank Reservoirs provide sufficient operating pressure and flow for most of the London water system. Areas of higher elevation cannot be adequately pressurized by the elevated water in the reservoirs alone, and these "High Level Zones" are pressurized by High Level Pumping Stations (described below). The lower elevation regions within the London water system, that are not included within any of the High Level Zones, are collectively referred to as the "Low Level System".

During typical operation, the Springbank Reservoirs discharge water to the system during the daytime, when water consumption is higher. The reservoirs typically re-fill with water during the night, when water consumption is lower. The degree to which the reservoir water levels rise or fall depends upon the daily water consumption and the amount of water that is pumped into the water system. The Water Supply Operators consider the reservoir levels and the anticipated daily consumption when setting the Arva P.S. start-time and stop-time set-points.

5.5 Re-chlorination Facilities

Water within the Springbank Reservoirs experiences a decrease in free chlorine residual in relation to its residence time. The rate of residual decay increases with the seasonal increase in water temperature. The water discharged from the Springbank Reservoirs is therefore monitored for free chlorine residual, and re-chlorinated if required. There are three discharge points by which water can exit the Springbank Reservoirs and enter the water mains:

- North through a 1,200 mm concrete main in Reservoir Park to Hyde Park Rd
- East through a 900 mm concrete main on Commissioners Rd
- South via Springbank Pumping Station (described below)

Re-chlorination facilities are in place at each of these three discharge points:

1. Within the Reservoir No. 1 & 2 facility, for water discharged north into the 1,200 mm main (named SR1),
2. In a stand-alone building (named Springbank Meterhouse 4, or SM4), for water discharged east into the 900 mm main, and
3. Within Springbank Pumping Station (SPS).

On-line chlorine analysers monitor the free chlorine residual in the water at these points, and re-chlorination is initiated as required in order to maintain a free chlorine residual of 0.50

mg/L in the reservoir discharge water. Re-chlorination is controlled by compound-loop controllers using residual and flow data. The chlorinators at SR1 and SM4 utilize compressed chlorine gas from 68 kg cylinders. The SPS chlorination system uses liquid sodium hypochlorite injected by chemical metering pumps.

5.6 High Level Zones

Within the City of London, there are areas of higher elevation that cannot be adequately pressurized by the Arva P.S, the EMPS and/or the elevated water in the Springbank Reservoirs. Check valves and "normally-closed" valves are used to isolate four "High Level Zones" which are pressurized by High Level Pumping Stations. Set-points entered into the SCADA system control pump starting, stopping and speed in order to maintain the desired system pressure in each zone. Each High Level Pumping Station is equipped with a diesel back-up generator so that pumping can be maintained during power outages.

5.6.1 South London High Level Zone

The South London High Level Zone generally encompasses the area south of Commissioners Rd and north of Southdale Rd. Three pumping stations located along Commissioners Rd supply water to the South London High Level Zone:

- Springbank P.S., located adjacent to Springbank Reservoir No. 3
- Westmount P.S., located at Commissioners Rd and Wonderland Rd
- Pond Mills P.S., located on Commissioners Rd near Pond Mills Rd

Springbank P.S. is equipped with two (2) variable speed and two (2) fixed speed vertical turbine pumps; Westmount P.S. is equipped with four (4) variable speed vertical turbine pumps; and Pond Mills P.S. is equipped with three (3) fixed speed vertical turbine pumps.

5.6.2 Wickerson High Level Zone

The Wickerson High Level Zone is located in southwest London. Water pressure is maintained at the desired set-point by three (3) variable speed vertical turbine pumps within the Wickerson Pumping Station located on Wickerson Rd.

5.6.3 Hyde Park High Level Zone

The Hyde Park High Level Zone is located in northwest London. Water pressure is maintained at the desired set-point by three (3) variable speed vertical turbine pumps within the Hyde Park Pumping Station located on Hyde Park Rd.

5.6.4 Uplands High Level Zone

The Uplands High Level Zone is located in north central London. Water pressure is maintained at the desired set-point by three (3) variable speed vertical turbine pumps within the Uplands Pumping Station located on Sunningdale Rd.

5.7 Emergency Back-up Wells

The Lake Huron Primary Water Supply System began supplying water to the City of London in 1967. Prior to that, London's water was provided by a network of wells. Most of those wells have been de-commissioned, but seven (7) wells have been maintained for emergency use only, in the event of a long-term interruption of the Lake Huron Supply.

5.7.1. Fanshawe Wells

Six (6) wells comprise the Fanshawe well field. These wells have been classified as GUDI (Groundwater Under Direct Influence of surface water) with in-situ filtration, and may only be used in accordance with Schedule D of the Municipal Drinking Water Licence. Five wells are located on the City of London owned Fanshawe Golf Course; located in northeast London. The sixth well is located directly west of the other five, across Clarke Rd. All aspects of the well-field operation are controlled manually. A diesel-powered back-up generator provides emergency power for the Fanshawe Wells. The generator is capable of operating all six wells and the associated electrical equipment. All six wells pump into a common discharge main where disinfection is provided by a manually operated gas chlorinator. The well discharge main is normally not pressurized, and is isolated from the rest of the London water system by normally-closed gate valves.

5.7.2. Hyde Park Well

One well is maintained adjacent to Hyde Park Rd in west central London. This well is not GUDI, and may only be used in accordance with Schedule D of the Municipal Drinking Water Licence. The well is manually controlled and disinfection is provided by a manually operated gas chlorinator. The well discharge main is normally not pressurized, and is isolated from the rest of the London water system by normally-closed gate valves.

5.8 SCADA Control

A Supervisory Control and Data Acquisition system (SCADA) monitors the London water system, controlling pumping, fluoridation and re-chlorination, and storing system data. Field devices report through Programmable Logic Controllers (PLC's) interconnected to PC's and Servers. Water Supply operators interface with the SCADA system through PC's located in pumping stations and in the Water Supply office. The SCADA system continually monitors thousands of system parameters and generates text paging if any parameter exceeds an alarm limit. One Water Supply Operator is on stand-by duty at all times to receive and respond to alarm pages generated by SCADA. The on-call operator carries a laptop PC which can interface with the SCADA system using wireless communication.

6 CONNECTIONS TO OTHER DRINKING WATER SYSTEMS

Through metered connections, the villages of Arva (to the north), Ballymote (to the northeast) and Delaware (to the west) are supplied with drinking water from the London water system. These three systems are owned by the Municipality of Middlesex-Centre and American Water Canada Corp. is the Operating Authority for these systems.

7 REFERENCES

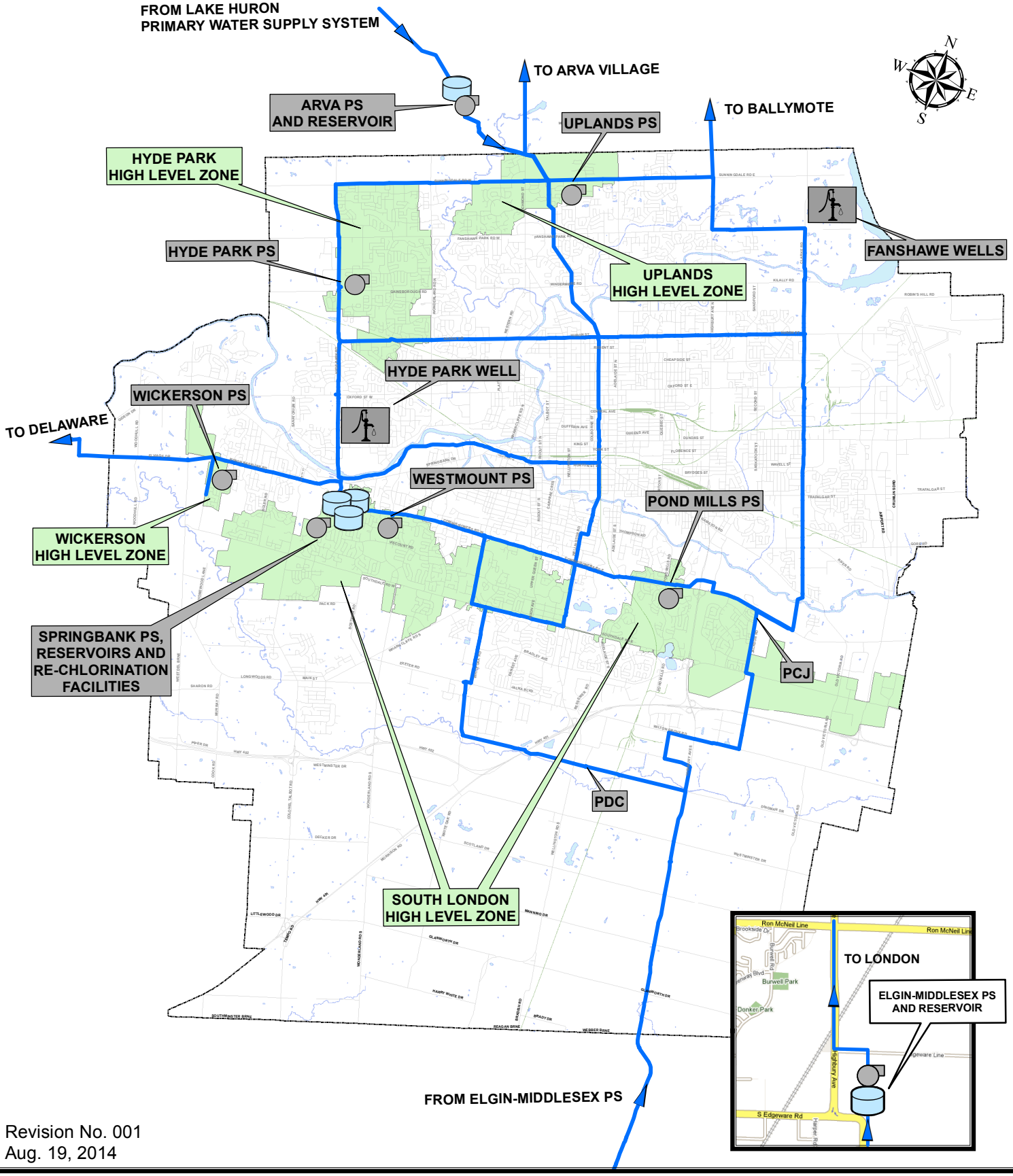
None

8 APPENDICES

Appendix 6-A System Flow Chart

Appendix 6-A

The City of London Water System Flow Chart



Revision No. 001
Aug. 19, 2014

1 PURPOSE

To document the procedure used to complete a risk assessment for the drinking water system. The risk assessment process will:

- identify potential hazardous events and associated hazards,
- assess and rank the risks associated with the hazards,
- identify control measures to address the hazards,
- identify Critical Control Points (CCPs) within the drinking water system,
- identify a method to verify the risk assessment validity and assumptions at least once a year,
- ensure a risk assessment is conducted at least once every three years, and
- consider the reliability and redundancy of the equipment.

2 PROCEDURE

2.1 Annual Review Process

2.1.1 At least once per year, or following a major process change, the QMS Representative facilitates a review of the currency of the information and validity of the assumptions used in the risk assessment process for the drinking water system. This is undertaken by a team comprised of (at a minimum) the QMS Representative, Manager of Water Operations and the Water Operations Supervisor (Water Supply).

2.1.2 When reviewing the currency of the risk assessment information, the following may be considered:

- process changes
- reliability and redundancy of equipment
- emergency situations
- Critical Control Point deviations
- QMS non-conformances related to standard operating procedures

2.1.3 The risk assessment is completed by filling out the Risk Assessment Form 07-02. The previous year's completed form is used as a template during the annual review. Newly identified hazards are inserted into the previous year's form and removed hazards are deleted. The columns are filled out as described below.

Column in Risk Assessment Form	Information in Column
A – System Components	Column A contains the components that comprise the City of London Water System. At least annually, the information in this column is reviewed to ensure that all of the drinking water system components have been accurately identified.
B – Description of Hazardous Event/Hazard	Column B contains general descriptions of the hazardous events/hazards that may affect the corresponding system component listed in Column A. These descriptions are used to provide understanding of the hazardous events/hazards and are not used for the determination of risk.
C – Potential Result of Hazard	Column C details the potential adverse impacts on drinking water quality associated with the corresponding hazardous events/hazards listed in Column B.
D – Control Measures	Column D lists control measures that may 1) reduce the likelihood of a hazardous event occurring, 2) limit the severity of the associated hazards, or 3) increase the detectability of the hazardous event/hazard
E, F, G – Likelihood, Severity, Detectability	The Likelihood, Severity and Detectability of the hazardous event/hazard occurring are assessed using the Risk Assessment Rating Table 07-01 as a guide. Using this methodology, a higher value indicates a higher Likelihood or Severity, and a lower Detectability.
H – Risk	The Risk is then calculated for each hazardous event/hazard by adding the Likelihood, Severity and Detectability. The maximum Risk value is fifteen (15).
I – CCP	A Risk value of 8 or higher (greater than 50% of the maximum value) identifies a Critical Control Point (CCP). Recommended Minimum CCPs are assigned for hazardous events/hazards associated with maintaining a secondary disinfectant residual and are deemed to be critical despite the calculated Risk. Hazardous events/hazards that have a calculated Risk value greater than the threshold value of 8 are deemed not to be CCPs if there is no control that can be applied by an operator at that point.

2.1.5 The outcome of the Risk Assessment is a completed Risk Assessment Form 07-02, named Table 08-01 Risk Assessment Outcomes.

Three-Year Review Process

2.1.6 Every three years, the annual review entails a more comprehensive examination of the drinking water system risk assessment process. This is used as an opportunity to review the risk assessment process and outcomes. To undertake this review, the QMS Representative facilitates a team comprised of (at a minimum) the Manager of Water

Operations, the Water Operations Supervisor (Water Supply) and one additional Water Operations Supervisor.

2.2 Document and Records Management

2.2.1 The completed Risk Assessment Form 08-01 is forwarded to the Division Manager of Water Operations for review.

2.2.2 The QMS Representative is responsible for ensuring that minutes are taken during the annual and three-year review meetings and that these are maintained as per QMS-05 Document and Records Control.

2.2.3 The QMS Representative is responsible for maintaining and making any necessary changes/updates to the Risk Assessment Form as per QMS-05 Document and Records Control.

2.2.4 The QMS Representative is responsible for ensuring that any necessary changes are made to the training requirements, standard operating procedures, system procedures or other parts of the QMS resulting from changes to the Risk Assessment.

3 REFERENCES

Table 07-01 Risk Assessment Rating
Table 07-02 Risk Assessment Form
QMS-05 Document and Records Control
Table 08-01 Risk Assessment Outcomes

4 APPENDICES

None

City of London Water System
Risk Assessment Rating

07-01.1 Likelihood of Hazardous Events

Description	Likelihood of Hazardous Event Occurring	Rating
Highly Unlikely	May occur in exceptional circumstances and has not occurred in the past.	1
Unlikely	Could occur at some time, and has historically occurred less than once every 10 years.	2
Probable	Has occurred, or is likely to occur, once every 5 to 10 years.	3
Likely	Has occurred, or is likely to occur, once every 1 to 5 years.	4
Very Likely	Regularly occurs more than once per year.	5

07-01.2 Severity of Hazardous Event Occurring

Description	Severity of Hazardous Event Occurring	Rating
Insignificant	Insignificant impact, little public exposure, little or no health risk.	1
Minor	Minor public exposure and minor health risk.	2
Moderate	Moderate public exposure and moderate health risk.	3
Major	Large public exposure and probable health risk.	4
Catastrophic	Major health risk to large population.	5

07-01.3 Detectability of Hazardous Event

Description	Detectability of Hazardous Event Occurring	Rating
Highly Detectable	Immediately detectable by visual means or by monitoring equipment/alarms	1
Very Detectable	Detectable through inspection and inspected daily, **or** likely to be reported within 24 hours by others (general public, other utilities, etc.)	2
Normally Detectable	Detectable through inspection and inspected weekly, **or** likely to be reported within 7 days by others (general public, other utilities, etc.)	3
Moderately Detectable	Detectable through inspection but not inspected on a regular basis and not likely to be reported by others.	4
Poorly Detectable	Extremely difficult to detect.	5

QMS Table 07-02
Revision Number: 001
2015-04-07

City of London Water System Risk Assessment Form

A	B	C	D	E	F	G	H	I
System Component	Description of Hazardous Event/Hazard	Potential Result of Hazardous Event/Hazard	Control Measure(s)	Likelihood	Severity	Detectability	Risk =(a+b+c)	CCP? Threshold = 8

1 PURPOSE

To document the Risk Assessment Outcomes identified by QMS-07, including:

- the identified potential hazardous events and associated hazards,
- the assessed risks associated with the occurrence of hazardous events,
- the ranked hazardous events,
- the identified control measures to address the potential hazards and hazardous events,
- the identified critical control points and their respective critical control limits,
- procedures and/or processes to monitor the critical control limits,
- procedures to respond to deviations from the critical control limits, and
- procedures for reporting and recording deviations from the critical control limits.

2 PROCEDURE

2.1 Risk Assessment Outcomes

2.1.1 The Risk Assessment Outcomes generated by QMS-07 Risk Assessment Procedure are documented in Table 08-T1 Risk Assessment Outcomes. The table includes the identified potential hazardous events and associated hazards, the assessed risks associated with the occurrence of hazardous events, the ranked hazardous events, the identified control measures to address the potential hazards and hazardous events and the identified critical control points.

2.1.2 Table 08-T2 Summary of Critical Control Points documents the identified CCPs, the associated Critical Control Limits and the processes to monitor the CCPs.

2.2 Procedure to Respond to Critical Control Limit Deviation Alarms

2.2.1 There are multiple factors, both known and previously not experienced, that can result in a deviation from the established Critical Control Limits. The steps taken in response to an alarm require some discretion on the part of the Operator and reliance on the Operator's practical experience, depending on the circumstance.

2.2.2 It should be noted that Springbank re-chlorination facilities are in place to elevate the chlorine residual in the water that is discharged from the Springbank Reservoirs. The water in the Springbank Reservoirs is not static; it is constantly being either discharged or replenished. The recharge water has been chlorinated at the water treatment plant and typically has a free chlorine residual in the range of 0.5 to 0.9 mg/L. As a result of this constant turnover, the free chlorine residual of the water in the reservoirs does not typically fall below the low alarm limit. Therefore, even a complete failure of the re-chlorination equipment would not result in critically low free chlorine residual in the water being discharged from the reservoirs under typical conditions. The re-chlorination facilities are programmed to maintain a margin of safety by boosting the free chlorine residual to 0.50 mg/L, which ensures an acceptable level of chlorine at all points in the distribution system.

2.2.3 Upon receiving notice of a deviation from the Critical Control Limits (via a SCADA generated pager notice) during regular business hours, the operator may proceed to the site of the alarm, or notify the Water Operations Supervisor (Water Supply) who may assign another (closer) operator to respond. If the alarm notice is received after regular hours, the On-call Operator will proceed to the site of the alarm, and may interface with SCADA through the Laptop PC to ascertain more information regarding the alarm situation.

2.2.4 Upon arriving at the site of the alarm, the operator will investigate whether the chlorine analyser is functioning properly by testing water samples for chlorine residual using a portable DPD Chlorine Test Kit. If necessary, the operator will calibrate the analyser.

2.2.5 If the analyser is not functioning properly, the Operator will repair the analyser (e.g. replace electrolyte, replace membrane tip, replace probe) and may be required to call the Electrical Supervisor if an electrician's assistance is required. If the problem occurs after regular hours, the Operator may page the On-call electrician for assistance. If necessary, a chlorine analyser can be transferred from one of several monitoring sites where chlorination is not performed.

2.2.6 If the analyser is functioning properly, the operator will investigate whether the chlorination equipment is functioning properly.

2.2.7 If the chlorination equipment is not functioning properly, the operator will investigate the cause of the problem and either make repairs or activate the stand-by chlorination equipment. The Operator may be required to call the Electrical Supervisor if an electrician's assistance is required. If the problem occurs after regular hours, the Operator may page the On-call electrician for assistance. The Operation and Instruction Manuals for the chlorination equipment are kept on-site and may be used as a reference.

2.2.8 Water with a free chlorine residual of less than 0.10 mg/L must not be allowed to discharge from the reservoirs past the re-chlorination facilities. If water is discharged from the reservoirs past the re-chlorination facilities with a free chlorine residual of less than 0.05 mg/L, the Operator will initiate the proper Reporting and Corrective Action procedures as per O.Reg 170/03. If the chlorination equipment is not functioning properly, and re-chlorination cannot be restored in a reasonable time, the Operator will contact the ORO and a decision may be made to make operational changes that would not allow water to be discharged from the reservoirs past the affected re-chlorination point. The operational changes to restrict water flow would be implemented as follows:

- For the re-chlorination facilities at Springbank Pumping Station, the Station Pumps would be removed from SCADA control and stopped by Operator command. The Operator would ensure that the SCADA system compensates for the changes by increasing the pump output at Westmount and Pond Mills Pumping Stations. The Springbank PS pumps would be electrically locked-out and tagged to prevent operation until the re-chlorination equipment is restored to normal operation.

- For the re-chlorination facilities at SM4, Electric Valve FCV-04 would be closed and the electrical breaker would be locked-out and tagged to prevent operation until the re-chlorination equipment is restored to normal operation.
- For the re-chlorination facilities at SR1, Electric Valves FCV-07 and FCV-06 would be closed and the electrical breakers would be locked-out and tagged to prevent operation until the re-chlorination equipment is restored to normal operation.

2.2.9 If the chlorination equipment is functioning properly, at maximum output, and the chlorine residual is still below the Critical Control Limit, reservoir contamination may be occurring. The Operator will contact the ORO and begin further investigation to determine if the problem is limited to a particular reservoir or reservoirs (e.g. by taking chlorine grab samples from the individual reservoirs). If the low chlorine level is determined to be limited to a particular reservoir or reservoirs, the affected reservoir will be isolated from the water system as soon as possible using the following Reservoir Isolation Procedures:

- For Reservoir No. 1, close, lock-out and tag Electric Valve FCV-02 and the 36" manual valve at the north end of Reservoir No. 1 in the basement of the Reservoir complex (west valve)
- For Reservoir No. 2, close, lock-out and tag Electric Valve FCV-03 and the 36" manual valve at the north end of Reservoir No. 2 in the basement of the Reservoir complex (east valve)
- For Reservoir No. 3, close, lock-out and tag Electric Valve FCV-01

2.2.10 If all three reservoirs appear to be contaminated, the ORO will contact the On-call Public Health Inspector of the Middlesex-London Health Unit as the Medical Officer of Health may be required to issue drinking water advisories.

2.2.11 If reservoir contamination appears to be occurring, the causes will be investigated and remediation will be planned based upon the results of the investigation.

2.3 Procedure to Respond to Reservoir Infiltration

2.3.1 If there is any indication that rainwater/groundwater infiltration is occurring at any of Springbank Reservoirs No. 1, 2 or 3, the affected Reservoir is to be isolated from the Water System as soon as possible using the applicable Reservoir Isolation Procedure (above) regardless of the measured chlorine levels.

2.4 Recording and Reporting

2.4.1 Any deviations from the critical control limits and actions taken in response must be recorded by the Operator in the facility log-book and reported to the Water Operations Supervisor (Water Supply).

3 REFERENCES

QMS-05 Procedure Document and Records Control
QMS-07 Risk Assessment

4 APPENDICES

Table 08-T1 Risk Assessment Outcomes
Table 08-T2 Summary of Critical Control Points

QMS Table 08-01 Risk Assessment Outcomes

A	B	C	D	E	F	G	H	I
System Component	Description of Hazardous Event/Hazard	Potential Result of Hazardous Event/Hazard	Control Measure(s)	Likelihood	Severity	Detectability	Risk =(a+b+c)	CCP? Threshold = 8
Arva Pumping Station	Terrorism	1) Chemical, biological or radiological contamination 2) Loss of ability to pump water - lower distribution system pressure - possible backflow contamination	Property fenced with locked gate - monitored, regularly tested audible alarms on all doors - twice daily visual inspections	1	5	1	**7**	**No**
	Vandalism	Loss of ability to pump water - lower distribution system pressure - possible backflow contamination	Property fenced with locked gate - monitored, regularly tested audible alarms on all doors - twice daily visual inspections	1	1	1	**3**	**No**
	Mechanical failure of pumps/pipes/electrical equipment	Loss of ability to pump water - lower distribution system pressure - possible backflow contamination	Redundant pumps/pipes/electrical equipment - preventive maintenance programs	1	1	1	**3**	**No**
	Long term power outage (24 hours or more)	Loss of ability to pump water - lower distribution system pressure - possible backflow contamination	Monitored, regularly tested power failure alarms - ability to bypass Arva Terminal Reservoir and pump water directly into London DS from LHPWSS	1	4	1	**6**	**No**
	Failure of monitoring equipment and/or alarms	Possible fluoride overdosing	Daily visual inspections and analyser checks - regular alarm checks - remote monitoring of communications - regularly tested backflow prevention devices - preventive maintenance programs	1	2	1	**4**	**No**
Springbank Reservoir No. 1 or No. 2 or No. 3	Terrorism	Chemical, biological or radiological contamination	Fence and locked gate at Reservoir #2 - monitored, regularly tested audible alarms on doors and Reservoir #1 access hatch - daily visual inspections	1	5	1	**7**	**No**
	Vandalism	Biological contamination	Fence and locked gate at Reservoir #2 - monitored, regularly tested audible alarms on doors and Reservoir #1 access hatch - daily visual inspections	1	2	1	**4**	**No**
	Intrusion by Rodents or Birds	Biological contamination	Concrete construction, sealed hatches, robust screens over ventilation ports - Daily visual inspections at reservoir facilities - Bi-annual inspection of ventilation screens - On-line chlorine analysers on reservoir discharge pipes	1	1	3	**5**	**No**
	Biofilm development, build-up of sediment in reservoir, rapid deterioration of chlorine residual	Biological contamination	On-line chlorine analysers on reservoir discharge pipes - Reservoirs inspected every 5 years	1	2	1	**4**	**No**
	Infiltration of groundwater at Reservoirs # 1 and 3	Biological contamination	On-line chlorine analysers on reservoir discharge pipes - Reservoirs # 1 and 3 underside of permanent covers inspected every 5 years - Reservoir isolation valves regularly tested and maintained	1	3	4	**8**	**Yes**
	Infiltration of accumulated rainwater at Reservoir #2	Biological contamination	On-line chlorine analysers control re-chlorination of reservoir discharge - excess rainwater pumped from top of floating cover by float controlled pump - weekly visual inspection of cover and underwater inspection by divers every 5 years - periodic repair or replacement of cover - reservoir isolation valves regularly tested and maintained - bacteriological, clostridium and trihalomethane testing performed after winter isolation - bacteriological testing performed when reservoir is in service	2	3	4	**9**	**Yes**
Re-chlorination Facilities at SM4 and Reservoirs No. 1 and 2	Terrorism	Loss of ability to re-chlorinate reservoir outflow	Monitored, regularly tested audible alarms on all doors - daily visual inspections	1	3	1	**5**	**No**
	Vandalism	Loss of ability to re-chlorinate reservoir outflow	Monitored, regularly tested audible alarms on all doors - daily visual inspections	1	1	1	**3**	**No**
	Power outage	Loss of ability to re-chlorinate reservoir outflow	Monitored, regularly tested power failure alarms - regulary tested stand-by generator	3	1	1	**5**	**No**
	Chlorination equipment failure	Over-dosing or under-dosing of reservoir outflow	On-line chlorine analysers - monitored, regularly tested alarms - preventive maintenance programs - Standby portable chlorinator maintained and readily available	1	3	1	**5**	**Yes (Minimum CCP)**
	Failure of monitoring equipment and/or alarms	Over-dosing or under-dosing of reservoir outflow	Daily visual inspections and analyser checks - regular alarms checks - remote monitoring of communications - preventive maintenance programs	1	1	1	**3**	**No**
	Chlorine gas leak	Damage to equipment - loss of ability to re-chlorinate reservoir outflow - public exposure to chlorine gas	Monitored, regularly tested chlorine leak detection equipment - Staff training is maintained for use of SCBA and chlorine cylinder leak repair kit	1	3	1	**5**	**No**

QMS Table 08-01 Risk Assessment Outcomes

A	B	C	D	E	F	G	H	I
System Component	Description of Hazardous Event/Hazard	Potential Result of Hazardous Event/Hazard	Control Measure(s)	Likelihood	Severity	Detectability	Risk =(a+b+c)	CCP? Threshold = 8
Re-chlorination Facilities at Springbank Pumping Station	Terrorism	Loss of ability to re-chlorinate Springbank Pumping Station outflow	Monitored, regularly tested audible alarms on all doors - twice daily visual inspections	1	1	1	**3**	**No**
	Vandalism	Loss of ability to re-chlorinate Springbank Pumping Station outflow	Monitored, regularly tested audible alarms on all doors - twice daily visual inspections	1	1	1	**3**	**No**
	Power outage	Loss of ability to re-chlorinate Springbank Pumping Station outflow	Monitored, regularly tested power failure alarms - stand by generators	3	1	1	**5**	**No**
	Chlorination equipment failure	Over or under-dosing of Springbank Pumping Station outflow	On-line chlorine analysers - monitored, regularly tested alarms - preventive maintenance programs - redundant metering pumps	1	3	1	**5**	**Yes (Minimum CCP)**
	Failure of monitoring equipment and/or alarms	Over or under-dosing of Springbank Pumping Station outflow	Daily visual inspections and analyser checks - regular alarms checks - remote monitoring of communications - preventive maintenance programs	1	1	1	**3**	**No**
Springbank Pumping Station or Westmount Pumping Station or Pond Mills Pumping Station	Terrorism	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Monitored, regularly tested audible alarms on all doors - daily visual inspections - interconnected pumping stations	1	2	1	**4**	**No**
	Vandalism	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Monitored, regularly tested audible alarms on all doors - daily visual inspections - interconnected pumping stations	1	1	1	**3**	**No**
	Power outage	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Monitored, regularly tested power failure alarms - regulary tested stand-by generators - interconnected pumping stations	3	1	1	**5**	**No**
	Mechanical failure of pumps/pipes/electrical equipment	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Redundant pumps/pipes/electrical equipment - preventive maintenance programs - interconnected pumping stations	1	1	1	**3**	**No**
	Failure of monitoring equipment and/or alarms	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Daily visual inspections - regular alarms checks - remote monitoring of communications - preventive maintenance programs - interconnected pumping stations	1	1	1	**3**	**No**
Hyde Park Pumping Station or Uplands High Pumping Station or Wickerson Pumping Station	Terrorism	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Monitored, regularly tested audible alarms on all doors - daily visual inspections	1	2	1	**4**	**No**
	Vandalism	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Monitored, regularly tested audible alarms on all doors - daily visual inspections	1	1	1	**3**	**No**
	Power outage	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Monitored, regularly tested power failure alarms - regulary tested stand-by generators	3	1	1	**5**	**No**
	Mechanical failure of pumps/pipes/electrical equipment	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Redundant pumps/pipes/electrical equipment - preventive maintenance programs	1	1	1	**3**	**No**
	Failure of monitoring equipment and/or alarms	Loss of ability to pump water - lower pressure in affected zone - possible backflow contamination	Daily visual inspections - regular alarm checks - remote monitoring of communications - preventive maintenance programs	1	1	1	**3**	**No**

QMS Table 08-01 Risk Assessment Outcomes

A	B	C	D	E	F	G	H	I
System Component	Description of Hazardous Event/Hazard	Potential Result of Hazardous Event/Hazard	Control Measure(s)	Likelihood	Severity	Detectability	Risk =(a+b+c)	CCP? Threshold = 8
Fanshawe Emergency Wells	Terrorism	Inability to use emergency well supply	Monitored, regularly tested alarms on all generator enclosure and electrical room doors - weekly visual inspections	1	1	3	**5**	**No**
	Vandalism	Inability to use emergency well supply	Monitored, regularly tested alarms on all generator enclosure and electrical room doors - weekly visual inspections	1	1	3	**5**	**No**
	Power outage	Inability to use emergency well supply	Monitored, regularly tested power failure alarms - regulary tested stand-by generator	5	1	1	**7**	**No**
	Source water chemical contamination	Inability to use emergency well supply	Quarterly sampling for analytical analysis	1	1	4	**6**	**No**
	Mechanical failure of pumps/pipes/electrical equipment	Inability to use emergency well supply	Quarterly exercising - preventive maintenance programs	1	1	4	**6**	**No**
	Chlorination equipment failure	Over-dosing or under-dosing of well-field ouflow	Regular grab sampling when in operation - preventive maintenance programs - DWWP requires a Boil Water Advisory to be issued when wells are in operation	1	2	2	**5**	**No**
Hyde Park Emergency Well	Terrorism	Inability to use emergency well supply	Weekly visual inspections	1	1	3	**5**	**No**
	Vandalism	Inability to use emergency well supply	Weekly visual inspections	1	1	3	**5**	**No**
	Power outage	Inability to use emergency well supply	Weekly visual inspections	5	1	1	**7**	**No**
	Source water chemical contamination	Inability to use emergency well supply	Quarterly sampling for analytical analysis	1	1	4	**6**	**No**
	Mechanical failure of pumps/pipes/electrical equipment	Inability to use emergency well supply	Quarterly exercising - preventive maintenance programs	1	1	4	**6**	**No**
	Chlorination equipment failure	Over-dosing or under-dosing of well ouflow	Regular grab sampling when in operation - preventive maintenance programs	1	2	2	**5**	**No**

QMS Table 08-01 Risk Assessment Outcomes

A	B	C	D	E	F	G	H	I
System Component	Description of Hazardous Event/Hazard	Potential Result of Hazardous Event/Hazard	Control Measure(s)	Likelihood	Severity	Detectability	Risk =(a+b+c)	CCP? Threshold = 8
Distribution Mains and Appurtenances	Distribution system contamination resulting from failure of primary water main (24" diameter or greater)	Lower distribution system pressure - possible backflow contamination	Distribution system designed and operated to maintain adequate pressure until failed section is isolated - water main isolation and repair procedures - water main replacement and re-habilitation programs - Acoustic Fibre-Optic continuous monitoring system to detect impending pipe failures	1	3	2	6	No
	Distribution system contamination resulting from failure of secondary water main (less than 24" diameter)	Lower distribution system pressure - possible backflow contamination	Distribution system designed and operated to maintain adequate pressure until failed section is isolated - water main isolation and repair procedures - water main replacement and re-habilitation programs - District Metered Area leak detection program	1	2	1	4	No
	Distribution system contamination resulting from failure of service water main to critical customer (hospital, school, large industry, etc)	Loss of pressure in internal plumbing - possible backflow contamination	Distribution system designed and operated to maintain adequate pressure until failed section is isolated - City of London Water Bylaw Backflow Prevention requirements - water main isolation and repair procedures - bypass piping may be used to provide temporary service	3	2	1	6	No
	Loss of chlorine residual in distribution system	Biofilm develoment and bacterial regrowth	Hydraulic model identifies areas of greatest water age - Water main replacement and re-lining programs - Dead-end water main replacement programs - regular chlorine testing throughout system - additional chlorine testing following repairs - prompt investigation of taste/odour complaints - water main flushing as required	2	2	3	7	No
	Contamination of water in temporary water service lines used in conjunction with water main rehabilitation/replacement projects	Biological contamination	Temporary water service line installation, and disinfection procedures - backflow preventers on connection to existing system; operating procedures	1	2	3	6	No
	Distribution system contamination resulting from commissioning of new water mains	Biological contamination	Water main disinfection procedures	1	3	2	6	No
	Distribution system contamination resulting from construction activities on private property water infrastructure	Biological contamination	Distribution system designed and operated to maintain pressure - Ontario Building Code requirements, including plumbing inspection - perimeter isolation at high risk sites, e.g. hospitals, Western University	1	2	5	8	No (No control at this point)
	Distribution system contamination resulting from failure of backflow prevention device on private property	Biological and/or chemical contamination	Distribution system designed and operated to maintain pressure to the inlet of backflow prevention devices - annual Backflow Prevention Device testing and reporting required by City of London Water Bylaw	1	4	3	8	No (No control at this point)
	Distribution system contamination resulting from failure of air relief valve in a chamber that could be infiltrated by surface water	Biological contamination	Distribution system designed and operated to maintain pressure - air valve inspection and maintenance program	1	2	4	7	No
	Distribution system contamination resulting from improper connections to fire hydrants	Biological and/or chemical contamination	Anti-Theft Devices (ATD's) on high risk hydrants - enforcement of Water Bylaw restricting hydrant use	1	3	5	9	No (No control at this point)
	Distribution system contamination due to pipe or gasket failure resulting from chemical contamination of soil surrounding water mains	Biological and/or chemical contamination	Distribution system designed and operated to maintain pressure until failed section is isolated - water main isolation and repair procedures	1	3	2	6	No
	Distribution system contamination resulting from backflow at City of London Bulk Water Filling Station	Biological and/or chemical contamination	Distribution system designed and operated to maintain pressure to the inlet of backflow prevention devices - annually tested backflow prevention devices	1	3	5	9	No (No control at this point)
	Leaching of lead into water from lead service pipes and/or lead-bearing plumbing materials	Lead levels in excess of provincial standard in drinking water	Ministry approved Corrosion Control Plan in place, including public education and awareness initiatives, pH adjustment, and Lead Service Replacement Programs	5	2	4	11	No (No control at this point)

City of London Water System
QMS Table 08-02 Summary of Critical Control Points

System Component	Hazardous Event/Hazard	Critical Control Limits	Monitoring Processes
Re-chlorination Facilities at SM4	Chlorination Equipment Failure	Chlorine Analyser Reading < 0.25 mg/L: Lo Alarm Chlorine Analyser Reading < 0.20 mg/L: LoLo Alarm Chlorine Analyser Reading > 1.20 mg/L: Hi Alarm Chlorine Analyser Reading > 1.50 mg/L: HiHi Alarm	On-line chlorine analysers are monitored by SCADA which generates alarms to the operator's pager. The operator has SCADA access 24 hours per day through Laptop PC. Visual equipment inspections and analyser accuracy checks are performed by operators daily.
Re-chlorination Facilities at Reservoirs No. 1 and 2	Chlorination Equipment Failure	Chlorine Analyser Reading < 0.25 mg/L: Lo Alarm Chlorine Analyser Reading < 0.20 mg/L: LoLo Alarm Chlorine Analyser Reading > 1.20 mg/L: Hi Alarm Chlorine Analyser Reading > 1.50 mg/L: HiHi Alarm	On-line chlorine analysers are monitored by SCADA which generates alarms to the operator's pager. The operator has SCADA access 24 hours per day through Laptop PC. Visual equipment inspections and analyser accuracy checks are performed by operators daily.
Re-chlorination Facilities at Springbank Pumping Station	Chlorination Equipment Failure	Chlorine Analyser Reading < 0.25 mg/L: Lo Alarm Chlorine Analyser Reading < 0.20 mg/L: LoLo Alarm Chlorine Analyser Reading > 1.20 mg/L: Hi Alarm Chlorine Analyser Reading > 1.50 mg/L: HiHi Alarm	On-line chlorine analysers are monitored by SCADA which generates alarms to the operator's pager. The operator has SCADA access 24 hours per day through Laptop PC. Visual equipment inspections and analyser accuracy checks are performed by operators daily.
Springbank Reservoir No. 1 or 3	Infiltration of Groundwater through Roof Structure	Chlorine Analyser Reading < 0.25 mg/L: Lo Alarm Chlorine Analyser Reading < 0.20 mg/L: LoLo Alarm	On-line chlorine analysers are monitored by SCADA which generates alarms to the operator's pager. The operator has SCADA access 24 hours per day through Laptop PC. Visual equipment inspections and analyser accuracy checks are performed by operators daily. Comprehensive, videotaped inspections of the underside of the roof structures are completed every 5 years (minimum). Periodic inspection of perimeter drains to detect leaks from reservoir walls/floors.
Springbank Reservoir No. 2	Infiltration of Accumulated Rainwater through Floating Cover	Chlorine Analyser Reading < 0.25 mg/L: Lo Alarm Chlorine Analyser Reading < 0.20 mg/L: LoLo Alarm	On-line chlorine analysers are monitored by SCADA which generates alarms to the operator's pager. The operator has SCADA access 24 hours per day through Laptop PC. Visual equipment inspections and analyser accuracy checks are performed by operators daily. Operators perform weekly visual inspections of the exterior of the floating cover. Comprehensive, videotaped inspections of the underside of the floating cover are completed every 5 years (minimum) by contracted divers. Periodic inspection of perimeter drains to detect leaks from reservoir walls/floor.

1 PURPOSE

To document the organizational structure of the Operating Authority, ensuring that the Owner, Operating Authority and Top Management are defined, and the roles, responsibilities and authorities of Top Management and key positions within the Operating Authority are identified.

2 PROCEDURE

2.1 Identifying Key QMS Roles

2.1.1 The members of Top Management (within the Operating Authority), the Owner and the Operating Authority of the drinking water system are defined in Table 09-01.

2.1.2 Top Management (as defined in Table 09-01) is responsible for conducting management reviews as outlined in QMS-20.

2.2 Organizational Structure

2.2.1 The organizational structure of the Operating Authority is outlined in Appendix 9-A QMS Organizational Chart.

2.3 Organizational Roles, Responsibilities and Authorities

2.3.1 Specific responsibilities and authorities for positions with key roles in the Drinking Water Quality Management System are detailed in the various system procedures and standard operating procedures that form the Operational Plan.

2.3.2 Table 09-02 provides a summary of the overall roles, responsibilities, and authorities related to the provision of safe drinking water in the drinking water system. The specific roles, responsibilities, and authorities are outlined in the Job Descriptions for the key water related functions within the Operating Authority.

3 REFERENCES

QMS-20	Management Review
Appendix 9-A	QMS Organizational Structure
Table 09-01	Key QMS Roles
Table 09-02	QMS Roles, Responsibilities and Authorities

4 APPENDICES

Not Applicable

QMS Appendix 9-A: Organizational Chart of the City of London Water System Operating Authority

Owner
The Corporation of the City of London

Operating Authority

Top Management

- Water Director
  - Division Manager Water Engineering
    - Environmental Services Engineer (2)
      - Senior Technologist (2)
      - Technologist II (3)
    - Engineer-in-Training
    - Water Demand Manager
      - Water Demand Technologist
  - Division Manager Water Operations
    - Environmental Services Engineer
      - Technologist II (2)
    - Manager Water Operations
      - Water Operations Supervisor (Water Meters)
        - Water Meter Servicer (6)
        - Water Operations Plumber (2)
      - Water Operations Supervisor (Water Mains)
        - Waterworks Inspector (3)
        - Water Utility Worker II (Equipment Maintenance & Inventory)
        - Leading Water Utility Worker (1)
          - Water Utility Worker II (2) Water/Sewer Utility Workers
        - Leading Water Utility Worker (1)
          - Water Utility Worker II (2) Water/Sewer Utility Workers
      - Water Operations Supervisor (Quality Assurance)
        - Leading Water Utility Worker (1)
          - Water Utility Worker II (2) Water/Sewer Utility Workers
        - Leading Water Utility Worker (1)
          - Water Utility Worker II (2) Water/Sewer Utility Workers
      - Water Operations Supervisor (Water Services)
        - Leading Water Utility Worker (1)
          - Water Utility Worker II (2) Water/Sewer Utility Workers
        - Leading Water Utility Worker (1)
          - Water Utility Worker II (2) Water/Sewer Utility Workers
        - Water Utility Worker II (Clam Truck Operation)
    - Water Quality Manager (QMS Representative)
      - Water Operations Supervisor (Water Supply)
        - Water Supply Operator (4)
        - Waterworks Communications Coordinator (2)

QMS Table 09-01
Revision Number: 001
2015-04-07

City of London Water System
Key QMS Roles

Owner – The Corporation of the City of London (London City Council acts on its behalf)

Operating Authority – Water Engineering Division and Water Operations Division
(Divisions of the Environmental and Engineering Services Department)

Top Management (within the Operating Authority):

- Water Director
- Division Manager of Water Engineering
- Division Manager of Water Operations

QMS Representative – Water Quality Manager

QMS Table 09-02
Revision Number: 001
2015-04-07

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
Owner	- Ensures the provision of safe drinking water to the City of London - Monitors the QMS and the need for resources to support the QMS - Submits and maintains an Operational Plan with the Operating Authority - Endorses the contents of the Operational Plan - Ensures the drinking water system is operated by an Accredited Operating Authority - Ensures compliance with regulations and the terms and conditions of the Municipal Drinking-Water Licence and Drinking-Water Works Permit	- Financial, administrative authority related to the provision of safe drinking water - Allocate necessary resources for the safe operation of the system based on recommendations from the Operating Authority - Delegates management of Utility assets - Review and approve proposed and existing bylaws, expenditures, water rates and charges - Review and approve administrative policies
Top Management	- Appoints QMS Representative - Reports to Owner on the performance of the QMS - Holds management review meetings of the QMS - Makes recommendations related to necessary resources for QMS - Maintains Operational Plan (with Owner) - Ensures compliance with regulations and the terms and conditions of the Municipal Drinking-Water Licence and Drinking-Water Works Permit	- Makes recommendations on improvements to QMS - Provides and obtains resources for the QMS and necessary infrastructure to operate and maintain the drinking water system safely and effectively - Makes decisions on system-specific aspects of the QMS
QMS Representative	- Administers the QMS by ensuring that processes and procedures needed for the QMS are established and maintained - Reports to Top Management on the performance of the QMS and any need for improvement - Ensures that current versions of documents required by the QMS are being used at all times - Ensures that personnel are aware of all applicable legislative and regulatory requirements that pertain to their duties for the operation of the drinking water system	- Makes necessary changes to the QMS and system procedures in the Operational Plan

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
	- Promotes awareness of the QMS throughout the Operating Authority - Liaison for internal and external auditing process	
Water Director	- See Top Management requirements - Responsible for ensuring all facets of maintenance, operations, engineering, development and renewal of the water systems infrastructure - Plans, develops, recommends and implements strategies and goals to address service needs levels/standards of the City related to the drinking water system - Provides long-range maintenance operational and productivity objectives - Liaises with staff, public and external agencies - Prepares Committee and Council reports, studies, technical reports and correspondence - Attends Committee, Council, general public, external agencies, other levels of government, etc. meetings as required	- Makes recommendations on improvements to QMS - Reviews and approves Operational Plan system maintenance and operations procedures and identifies system needs and expansion - Monitors expenditures and financial performance, ensuring cost effective service, maintenance management programs, technical studies and system expansion programs - Budget preparation and administration - Manages Operating Authority staff
Division Manager Water Operations	- See Top Management requirements - Oversees all aspects of Water Operations activities - Provides long and short range maintenance, operational and productivity objectives - Prepares, manages and administers budgets and staff related to Water Operations - Administers or directs research and reports on alternative operation and maintenance practices, procedures and methods to enhance customer service and operational effectiveness and efficiencies	- Makes recommendations on improvements to QMS - Makes recommendations on resources for the QMS - Administers the maintenance and operations requirements to maintain and operate the drinking water system safely and effectively - Makes recommendations on necessary infrastructure for QMS - Makes decisions on system-specific aspects of the QMS - Develops recommends and implements technical and operational policy, strategy and procedures

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
	- Monitors regulatory environment and provides Director with updates, response and recommendation on changes to legislation and regulations affecting water system - acts as a source of Maintenance and Operations expertise, involving attendance at various Committees of Council, Divisional and interdepartmental meetings, design reviews	- Evaluates and prioritizes long term rehabilitation and upgrading needs - Communicates with regulatory agencies, public, and owner on issues of water system operations and maintenance - Manages Management and Union staff
Division Manager Water Engineering	- See Top Management requirements - Plans, organizes, directs staff and functions of the Water Engineering Division - Coordinates Engineering Planning, prepares and administers current and capital budgets and specifications for the work related to the drinking water system infrastructure - Advises on matters relating to water supply and distribution and administers related design and construction programs and other engineering initiatives - Reviews and recommends revisions to policies and by-laws pertaining to the Division's affairs - Directs the preparation of reports and recommendations and acts as a source of engineering expertise, involving attendance at various Committees of Council, Divisional and interdepartmental meetings, design reviews	- Makes recommendations on improvements to QMS - Makes recommendations on resources for the QMS and necessary infrastructure to sustain and develop the drinking water system safely and effectively - Evaluate and select contractors and construction materials - Evaluate and prioritize long term rehabilitation and upgrading needs - Makes decisions on system-specific aspects of the QMS - Develop, recommend and implement administrative and technical policy - Communicate with regulatory agencies, public and owner on issues of water systems design - Manages Management and Union staff
Water Quality Manager	- Acts as Operator in Charge - See QMS representative requirements - Assumes Overall Responsible Operator Duties on a regular, rotating basis - Compliance Officer under Safe Drinking Water Act - Prepares and maintains associated records, reports and paperwork	- Makes recommendations on improvements to QMS - Undertakes inspections with MOECC and is key liaison person with MOECC for water quality and QMS related issues - Oversees Operator Certification training and Certificate renewals - Develops, recommends, and implements technical and

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
	- Reviews and evaluates applicable training programs and advises Top Management of any deficiencies - Maintains awareness of provincial and federal policies and initiatives related to drinking water quality - Participates in the preparation of reports for Committees and Council related to water quality issues	operational policy, strategy and procedures - Communicates with regulatory agencies, public and owner on issues of water systems quality control - Participates in the process of hiring, disciplining, or terminating the employment of Union staff.
Manager of Water Operations	- Acts as Operator in Charge - Manages activities for Water Distribution Operations and formulates, monitors, evaluates and implements maintenance, operations and renewal programs - Ensures efficient delivery of services in compliance with appropriate legislation, regulations and municipal policies - Recommends policies, procedures and construction standards - Develops and maintains maintenance management information systems - Develops and maintains standard and emergency operating procedures for the distribution system components.	- Makes recommendations on improvements to QMS - Reviews and approves changes to Standard Operating Procedures - Maintains awareness of legislation and ensures compliance - oversees the management and effectiveness of maintenance, construction and operation of the distribution system - Evaluate and select contractors, construction materials and maintenance equipment - Participates in the process of hiring, disciplining, or terminating the employment of Union staff.
Water Operations Supervisor (Water Supply)	- Assumes Overall Responsible Operator Duties on a regular, rotating basis - Acts as Operator in Charge - Supervises Water Supply staff for maintenance and operations of well supply, treatment and secondary chlorination facilities, pumping stations, reservoirs, water quality monitoring and customer support - Develops and maintains records for the effective operations of above-noted supply and distribution components	- Makes recommendations on improvements to QMS - Reviews and approves changes to Standard Operating Procedures - Oversees field operations including assisting with prioritizing and implementing approved operational and preventative maintenance programs applied to the water distribution infrastructure - Supervises work (quality and safety) of operators and on-site contractors

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
	- Develops and maintains standard operating procedures and maintenance management information systems for above noted system components. - Coordinates operations and maintenance of electrical systems components and the SCADA system.	- Instructs operators to make necessary process adjustments - Orders equipment, services and materials to ensure continued safe operations to ensure a compliant and reliable water system - Participates in the process of hiring, disciplining, or terminating the employment of Union staff.
Environmental Services Engineer - Water Ops. Environmental Services Engineer - Water Eng.	- Directs technical and operating staff in the planning, design, contract preparation and construction of water system projects and operations - Assists in the preparation of the water capital and operating budget and its administration - Assists in the determination of capital project schedule and manpower requirements - Develops master plans for the system and related financial sources of funding (rates, development charges etc.) - Determines project design and construction requirements and prepares and recommends design criteria - Conducts research and develops reports on operation and maintenance practices, procedures and methods to enhance customer service and operational effectiveness and efficiencies	- Makes recommendations on improvements to QMS - Reviews and approves changes to Standard Operating Procedures - Assists with prioritizing and implementing approved programs procedures applied to the water supply and distribution infrastructure - Orders equipment, services and materials to ensure continued operations and development of a compliant reliable water system - Evaluate and select contractors/consultants - Approve payment for goods and services received - Review and revise O& M Manuals, SOPs, and PM Programs
Water Operations Supervisor (Water Mains, Water Services, and Quality Assurance)	- Acts as Operator in Charge - Supervises Distribution Operators for maintenance, operations, repair, construction and quality assurance of the distribution system infrastructure - Develops, maintains and reports on maintenance management for related distribution systems components - Monitors Water Distribution Operations and evaluates and implements maintenance,	- Makes recommendations on improvements to QMS - Reviews and advises on changes to Standard Operating Procedures - Oversees field operations including assisting with prioritizing and implementing approved operational and preventative maintenance programs applied to the water distribution infrastructure

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
	operations and renewal programs - Ensures efficient delivery of services in compliance with appropriate legislation, regulations and municipal policies - Assists in development and maintenance of standards and emergency, and operating procedures for the distribution system components. - Assists in the development of Construction standards	- Supervises work (quality and safety) of operators and on-site contractors - Orders equipment, services and materials to ensure continued safe operations of a compliant and reliable water system - Participates in the process of hiring, disciplining, or terminating the employment of Union staff.
Water Operations Supervisor (Meter Shop Supervisor)	- Acts as Operator in Charge - Supervises Water Meter Servicers and Plumbers for installation and replacement water meters, quality assurance, customer support and emergency maintenance. - Supervises and administers maintenance requirements in a cost effective and efficient manner. - Assists with development of maintenance and reporting for distribution system components. - develops, maintains and reports on maintenance management for related meter and distribution systems components - Ensures efficient delivery of services in compliance with appropriate legislation, regulations and municipal policies - Assists in development and maintenance of standards, emergency, and operating procedures for the distribution and transmission system components.	- Makes recommendations on improvements to QMS - Reviews and advises on changes to Standard Operating Procedures - Oversees field operations - Supervises work (quality and safety) of operators and on-site contractors - Orders equipment, services and materials to ensure continued safe operations to ensure a compliant and reliable water system
Waterworks Communications Coordinator	- Coordinates communications with customers and staff and inputs information for customer service system, meter maintenance management system and water system repairs.	- Makes recommendations on improvements to QMS - Coordinates distribution system emergency and standard work requirements - Coordinates customer care requests

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
	- Performs tasks consisting of communications, work order coordination, scheduling functions for services related to water complaints and operations. - Coordinates with other operations staff in dealing with customer enquiries, complaints and emergency calls, requests for service and general information requests	
Water Operations Plumber	- Installs, repairs, maintains and constructs plumbing process piping and auxiliary equipment - Works to solve problems related to waterworks such as water outages investigation of leaks, low pressure, abnormal consumption, non-consumption and water quality issues - Responds to customer inquiries related to water system operating concerns and complaints - Installs and services industrial and residential water meters	- Makes recommendations on improvements to QMS - Provides input on changes to Standard Operating Procedures
Water Meter Servicer	- Performs all functions related to the installation and removal of water meters having inlets and outlets that are equal to or less than 25 mm in diameter - Works to solve problems related to waterworks such as water outages investigation of leaks, low pressure, abnormal consumption, non-consumption and water quality issues	- Makes recommendations on improvements to QMS - Provides input on changes to Standard Operating Procedures
Water Technologist II (Water Engineering Division)	- Conducts technical reviews and prepares engineering responses on water distribution requirements resulting from Planning Act Applications - Administers capital works projects and establishes watermain replacement priorities - Directs pressure and flow testing of water distribution system - Review, assesses for compliance and recommends acceptance of various technical studies, computer analyses, etc.	- Makes recommendations on improvements to QMS - Accesses and collect operational maintenance data required for document preparation or summary reports to managers

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
Leading Waterworks Utility Worker	- Acts as Operator in Charge - Directs and assists in all functions related to construction, maintenance and repair of the waterworks infrastructure (i.e., mains, reservoirs, valves, chambers, etc.) including specialized work such as tapping of all types and sizes of watermains, leak detection and commissioning of watermains (i.e., flow tests, pressure tests, swabbing, chlorination and bacti testing)	- Makes recommendations on improvements to QMS - Instructs and assigns duties to other operators - Supervises work (quality and safety) of operators and on-site contractors - Makes operational records in log books and standard forms - Reports incidents of non-compliance to management and appropriate regulatory authorities - Provides input on changes to Standard Operating Procedures
Waterworks Utility Worker II	- Carries out all functions related to construction, maintenance and repair of the waterworks infrastructure (i.e., mains, reservoirs, valves, chambers, etc.) including specialized work such as tapping of all types and sizes of watermains, leak detection and commissioning of watermains (i.e., flow tests, pressure tests, swabbing, chlorination and bacti testing)	- Makes recommendations on improvements to QMS - Provides input on changes to Standard Operating Procedures
Water/Sewer Utility Worker	- Assists in the repair and maintenance of waterworks infrastructure (i.e., tapping watermains, valve and SCB programs, valve box and hydrant maintenance	- Makes recommendations on improvements to QMS - Provides input on changes to Standard Operating Procedures
Waterworks Inspector	- Acts as Operator in Charge during applicable shift (50% of the time) - Carries out all functions related to inspection of new and replacement waterworks infrastructure (i.e., mains, valves, chambers, hydrants, etc.), including specialized work such as tapping of all types and sizes of watermains, leak detection and commissioning of watermains (i.e., flow test, pressure tests, swabbing, chlorination flushing, chlorine residual tests, and bacti testing)	- Makes recommendations on improvements to QMS - Inspects and approves in-ground water infrastructure installations and repairs - Reports incidents of non-compliance to management and appropriate regulatory authorities - Makes operational records in log books and standard forms

City of London Water System
QMS Roles, Responsibilities and Authorities

Roles	Responsibilities	Authorities
Water Supply Operator	- Acts as Operator in Charge during operating shift (new Water Supply Operators holding OIT certificates in Distribution and/or Treatment can perform the operating shift, but cannot perform as OIC during operating shift) - Operates the system pumping stations, electric valves and reservoirs - Investigates and rectifies water quality complaints - Transports chlorine gas, disinfects new water mains and de-chlorinates discharge solution - Collects distribution and well system water samples , conducts chemical analysis for system operation, equipment calibration - Uses and assists in the maintenance of the water SCADA system	- Makes recommendations on improvements to QMS - Makes process adjustments based on policies and professional judgment to maintain compliance with legislation and achieve performance goals - Collects samples and performs routine laboratory analysis - Reports incidences of non-compliance to management and appropriate regulatory authorities - Makes operational records in log books and standard forms

1 PURPOSE

To document:

a) competencies required for personnel performing duties directly affecting drinking water quality,
b) activities to develop and maintain competencies for personnel performing duties directly affecting drinking water quality, and
c) activities to ensure that personnel are aware of the relevance of their duties and how they affect safe drinking water.

2 PROCEDURE

2.1 COMPETENCIES

2.1.1 The Water Quality Manager and the Water Operations management staff are responsible for identifying required competencies for employees performing duties directly affecting drinking water quality. The minimum levels of competency required for personnel with duties affecting drinking water quality are identified in job descriptions and are summarized in QMS Table 10-01 Summary of Drinking-Water Related Staff Competencies.

2.1.2 Job descriptions identify main duties, educational qualifications and specialized training and licenses for each position.

2.1.3 Competency is demonstrated by having appropriate education, certification, training, skills, and experience required for each relevant position.

2.1.4 There is a probationary period for new or transferred employees, and at the end of the probationary period the Supervisor evaluates the employee's competency.

2.1.5 Competency for management positions is reviewed at least annually during performance reviews conducted by the employee's manager.

2.2 TRAINING NEEDS IDENTIFICATION

2.2.1 The Water Quality Manager, the Water Operations Supervisors identify training needs and ensure that competencies are maintained for employees performing duties directly affecting drinking water quality.

2.2.2 The Water Quality Manager and the Water Operations Supervisors look at the various courses offered and the training requirements of staff, and then discuss to determine training opportunities for their staff.

2.2.3 The need for training to ensure competency may also be determined based on the following:

- Comparison of the employee's skills and abilities with the requirements of the job description and qualifications, in particular for new, temporary and transferred employees;
- Corrective action (e.g., resulting from internal audits or non-conformances) if the need for training is found to be a root cause (QMS-21);

- Changes due to updates to the risk assessment outcomes (QMS-08); and
- Changes in legislative/regulatory requirements.

2.3 TRAINING PLAN

2.3.1 The Water Quality Manager and the Water Operations Supervisors meet throughout each year to plan the training for various positions affecting drinking water quality. Meetings are held as course calendars and training opportunities are publicized. They refer to the required competencies, the completed training from previous years, and currently available courses to develop the training plan for the year.

2.3.2 The Water Quality Manager and the Water Operations Supervisors review the training schedule throughout each year to determine additional requirements (e.g., CEU's, on-the-job training, mandatory courses, etc.) and to assist in monitoring the required training hours for positions with duties directly affecting the drinking water quality.

2.3.3 The Water Operations Supervisors record the completed training hours in the Training Record Template for each employee. Training Records and copies of certificates issued from training are maintained as per QMS-05 Document and Records Control.

2.4 EMPLOYEE DWQMS TRAINING

2.4.1 The Water Quality Manager along with the Water Operations Supervisors ensure that a Drinking Water Quality Management Standard (DWQMS) awareness session is provided to new or transferred employees. The following types of information are included in the DWQMS awareness session:

- introduction to management systems and QMS Representative;
- review of pertinent procedures and the City of London Water System Operational Plan; and
- review of QMS policy, ensuring that personnel are aware of the relevance of their duties and how they affect safe drinking water.

2.5 TRAINING METHODS

2.5.1 Competency requirements can be satisfied through the use of in-house (Training Division), off-site, or on-line training, attendance at seminars/conferences, presentations by subject matter experts, crew meetings, internal training sessions related to emergency and/or standard operating procedures, or on-the-job training.

2.5.2 On-the-job training is coordinated by the Supervisors, including where employees should be assigned and who they should work with in order to learn how to perform the various job duties associated with their position.

2.6 EFFECTIVENESS OF TRAINING

2.6.1 When external trainers conduct courses, the trainer may review and verify training effectiveness though various means (e.g., mini quiz or mini workshops are undertaken for CEU courses). If the employee is knowledgeable and able to

demonstrate the skills, then the external trainer often issues a certificate to indicate that the training was effective.

2.6.2 When internal training courses are conducted, the Water Quality Manager and/or Supervisors talk with staff following completion of the course to determine the effectiveness of the training. In addition, they may ask the instructor to provide feedback on the trainee's understanding of the information.

2.6.3 Training needs may be identified through the Continual Improvement process (Element 21). For these training needs, the QMS Representative and the employee's Supervisor are responsible for ensuring that the training is completed and competency is achieved.

2.6.4 On-the-job training is provided to employees by Supervisors and fellow employees. The Supervisor determines the effectiveness of the training by observation, by discussions with the trainee, and by discussions with other employees assisting in the training.

3 REFERENCES

QMS Table 10-01 Summary of Drinking-Water Related Staff Competencies
QMS-05 Document and Records Control
QMS-08 Risk Assessment Outcomes
QMS-21 Continual Improvement
Training Record Templates
Job Descriptions

4 APPENDICES

Not Applicable

QMS Table 10-01
Revision Number: 001
2015-04-07

Summary of Drinking-Water Related Staff Competencies

"0" Indicates competency not required "1" Indicates basic level of competence "2" Indicates intermediate level of competence "3" Indicates advanced level of competence For Ontario Drinking Water Operator Certificates, the Class of the required Certificate is indicated	Division Manager - Water Operations	Manager of Water Operations	Water Operations Engineer	Water Quality Manager	Water Operations Supervisor (Supply)	Water Operations Supervisor (Water Mains)	Water Operations Supervisor (Quality Assurance	Water Operations Supervisor (Water Service	Water Operations Supervisor (Water Meters)	Water Technologist II	Leading Waterworks Utility Worker	Waterworks Utility Worker II	Water/Sewer Utility Worker	Waterworks Inspector	Waterworks Communications Coordina	Water Meter Servicer	Water Operations Plumber	Water Supply Operator
Ontario Drinking-Water Operator Certificate - Water Distribution	0	4	0	4	4	4	4	4	4	0	3	2	1	2	0	2	2	3
Ontario Drinking-Water Operator Certificate - Water Treatment	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Administrative / Interactive																		
Supervisory Skills	3	3	1	1	3	3	3	3	3	0	3	1	0	1	0	0	0	1
Personnel Training	2	2	0	2	3	3	3	3	3	0	3	2	0	0	0	1	1	2
Customer Service & Public Relations	3	2	2	3	3	2	2	2	3	2	2	1	1	1	3	2	2	2
Basic Computer Skills	3	2	3	2	2	1	1	1	2	3	1	1	1	1	2	1	1	2
Verbal Communications	3	3	3	3	3	3	3	3	3	2	2	2	1	3	3	1	1	2
Written Communications	3	3	3	3	2	2	2	2	2	2	1	0	0	2	2	0	0	1
Report Writing (e.g. Council Reports)	3	3	3	3	2	2	2	2	2	2	1	0	0	1	0	0	0	1
Planning / Budget																		
Budget Preparation/Analysis	3	3	2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Operations Planning/Scheduling	3	3	2	2	3	3	3	3	2	0	1	0	0	1	1	0	0	1
Scheduling Daily Activities	2	2	1	1	3	3	3	3	3	0	1	0	0	3	3	0	0	1
Record Keeping	3	3	3	3	3	3	3	3	3	3	2	1	1	3	3	1	1	3
Technical																		
Regulatory Requirements	3	3	3	3	3	2	2	2	2	0	2	1	1	3	0	1	1	2
Emergency Procedures	3	3	3	3	3	3	3	3	3	0	2	1	1	1	2	1	1	3
SCADA/Process Control	3	0	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Distribution System Knowledge	3	3	3	3	3	3	3	3	2	3	3	2	1	2	1	2	2	3
Process Troubleshooting	3	3	3	3	3	3	3	3	3	1	3	2	1	2	1	1	1	3
Sampling	2	1	1	3	3	2	2	2	2	0	2	2	1	2	0	2	2	3
Equipment Maintenance	1	1	1	1	3	3	3	3	3	2	3	3	2	1	0	3	3	3
Analytical Instruments	1	1	1	1	3	1	1	1	1	0	1	1	1	1	0	1	1	3

1 PURPOSE

To document a procedure for ensuring that sufficient personnel (meeting competency requirements) are available for duties directly affecting drinking water quality.

2 PROCEDURE

2.1 Overall Responsible Operator (ORO)

2.1.1 Coverage for ORO is rotated on a monthly basis between the City Engineer, the Water Quality Manager, and the Water Operations Supervisor (Water Supply).

2.1.2 A yearly ORO Schedule is generated by the Water Quality Manager prior to the start of each calendar year and is posted on staff bulletin boards and is available on Livelink.

2.1.3 The ORO is available 24 hours per day by pager. If for any reason the scheduled ORO cannot be available, he/she must make arrangements for an alternate ORO to ensure that coverage requirements will be met.

2.2 Regular Hours

2.2.1 Certified operators are available during regular business hours as follows:

- 7:00 am - 3:00 pm, 7 days per week for Water Supply operations
- 7:30 am - 3:30 pm, Monday to Friday except statutory holidays for Water Maintenance & Construction operations

2.2.2 During regular business hours, Waterworks Communications Coordinators respond to telephone calls and forward the information to the appropriate Water Operations Supervisor. Customers calling after hours are forwarded to the London Hydro Control Room if they are calling to report an emergency.

2.3 On-Call Hours

2.3.1 One Water Supply Operator is always on-call, and is available by pager. The SCADA system uses the same pager to contact the operator in case of alarm. A yearly Water Supply Operator Schedule is generated by the Water Operations Supervisor (Water Supply) prior to the start of each calendar year and is posted on staff bulletin boards and is available on Livelink. Hard copies are also provided to each Water Supply Operator.

2.3.2 One Water Operations Supervisor (or Acting Supervisor), one Utility Person, and one Backhoe Operator are always on-call. From December to March, an additional Standby Crew is on-call to deal with the increased numbers of water system leaks that are encountered in winter months. From April to November, one Standby Crew is on-call on Statutory Holidays and the associated week-ends. These staff are responsible for providing their Supervisors with up-to-date contact phone numbers so that they can be contacted when needed. Each summer, the Water Operations Manager generates a “Waterworks Standby Schedule” for these positions that covers the period from

September to the following September, and which is posted on staff bulletin boards and is available on Livelink.

2.3.3 London Hydro Control Room provides a 24-hour answering service which is used when the Waterworks Communications Coordinators are not available. This is generally after hours and on statutory holidays. London Hydro is supplied with a copy of the Waterworks Standby Schedule and they are notified weekly by a Water Operations Supervisor of any changes.

2.3.4 London Hydro Control Room receives off-hours reports of potential problems (e.g. broken water mains, leaking water meters, etc.) and contacts the Standby Utility Person, who investigates.

2.3.5 The Utility Person resolves the problem or contacts the on-call Water Supply Operator or the on-call Water Operations Supervisor if required.

2.3.6 The on-call Water Supply Operator or the on-call Supervisor determine whether the ORO needs to be contacted, which is based on the complexity of the situation and the need for additional resources outside of the Water Operations Division.

2.3.7 During the winter standby season (generally December to March) and on Statutory Holiday week-ends, there is a full crew on stand-by that the on-call Supervisor can contact. If additional crews are needed the on-call Supervisor will call staff from the Waterworks Call-in Phone List.

2.4 Work Stoppage / Strike Situation

2.4.1 In case of a work stoppage, precautions have been established in the Waterworks Operations and Maintenance Manual to mitigate disruptions in the water system operations. A Corporate Strike Action Plan has also been developed to ensure continuing operations.

2.4.2 The non-union Water Operations Manager, Water Quality Manager and the five (5) Water Operations Supervisors will perform the day-to-day operations that must be performed by certified Drinking Water Operators. Other management staff may assist in system operations and maintenance under the direction of the management staff who maintain current Drinking Water Operator Certification.

3 REFERENCES

None

4 APPENDICES

Not Applicable

1 PURPOSE

To document the procedure for describing how the Quality Management System is communicated between Top Management and the following:

1) Owner; 2) Operating Authority Personnel; 3) Suppliers; and 4) Public.

2 PROCEDURE

2.1.1 The Quality Management System is communicated between Top Management and the owner, operating authority personnel, suppliers and public/consumers through various methods, such as: reports, meetings (formal and informal), e-mails, telephone calls, website postings, log books, memos, continual improvement forms, etc. The communication between each group varies and is described below.

2.1.2 The Quality Policy is made available to all Operating Authority personnel and the public as it is posted on the City of London website and is available to the public upon request.

2.2 Owner:

2.2.1 Communication from Top Management to the Owner occurs through the use of staff reports, presentations, memos, and the annual budget process. Staff reports are first presented to the appropriate Council Standing Committee, and are then presented to Council. During emergency situations, communications may be made directly between Top Management and the Mayor.

2.2.2 Communication from the Owner to Top Management occurs through Committee minutes/reports and Council minutes/reports and/or resolutions or directions through the City Engineer and/or Water Director to Operating Authority staff.

2.3 Operating Authority Personnel:

2.3.1 Communication (both to and from Top Management) is through regular Operations meetings (generally on a bi-weekly basis) as well as e-mails, phone calls, scheduled and unscheduled meetings, bulletin boards, intranet (corporate wide), regular training sessions (including for legislation changes, new SOPs, Health & Safety issues), crew meetings (between supervisors and crews) and other training sessions and seminars.

2.3.2 Top Management has an “open door” policy for Operating Authority personnel.

2.4 Suppliers:

2.4.1 Communication is addressed in the purchasing procedures described in Procedure QMS-13. Examples of the means of communication include purchase orders, contracts and tenders. As well, communication occurs through the Water Engineering Division through engineering specifications (included in purchase orders and contracts), material specifications, and construction specifications.

2.4.2 Suppliers can contact Operating Authority personnel directly regarding the provision of supplies, through e-mails or phone calls. Issues with Suppliers are generally dealt with directly through contact with Purchasing and then Purchasing notifies

Water Operations for their input on the issue. Water Operations staff may contact contractors and suppliers directly if issues arise.

2.4.3 The City of London's water is supplied by the Lake Huron Primary Supply System (LHPWSS) and the Elgin Area Primary Water Supply System (EAPWSS). Communication between operators of the London system and both primary systems occurs daily via telephone, to exchange analytical data and pumping schedules. Each primary system is managed by a Joint Board of Management representing the municipalities that receive water from the respective systems; with London being a member of both Boards. Communication between representatives of the municipalities in each Joint Board of Management occurs through quarterly Board meetings. The City of London acts as the Administering Municipality for the Joint Boards of Management, providing all associated administrative and management services in the form of an office known as the Regional Water Supply (RWS). Communication between the City of London and RWS occurs through meetings, e-mails, and telephone calls.

2.4.4 Communication may be through London's website, media releases, newspaper ads, water bill inserts (EnviroWorks which is issued 6 times per year), directly mailings, direct notification (e.g., door-to-door the day before work is to be performed or by door tags left on door handles), and public meetings.

2.4.5 Members of the public may call Water Operations through the Waterworks Communications Coordinators for water-related concerns. The City of London website also provides contact information for the appropriate Water Operations or Water Engineering staff member for specific water-related issues. The public can also communicate with the City via e-mails, letters, faxes, attendance at public meetings, and by requesting delegation status to speak at meetings of Council Standing Committees.

3 REFERENCES

QMS-13 Essential Supplies and Services

4 APPENDICES

None

1 PURPOSE

To document a procedure ensuring the quality of essential supplies and services that may affect drinking water quality. The procedure shall include identification of these supplies and services and a means to ensure their procurement.

2 PROCEDURE

2.1 Procurement Process

2.1.1 The acquisition of goods and services related to the provision of drinking water is addressed by the Purchasing By-Law and the Purchasing and Materials Management Policy which are administered by the Purchasing Department.

2.1.2 The Purchasing Department obtains specifications and/or certification of product requirements for supplies and services from the Operating Authority prior to issuance of new and/or renewal of tenders, RFPs, contracts, etc.

2.1.3 If required, the Operating authority ensures that Standard Operating Procedures are developed and provided to establish conduct/specifications of suppliers and contractors.

2.1.4 Prior to issuance, the Purchasing Department forwards Tender Documents, Requests for Proposals, Requests for Quotations, and other bid documents to the Operating Authority for review.

2.1.5 The Purchasing and Materials Management Policy has price thresholds and thus some supplies (below the threshold) may be purchased directly by Water Operations from local sources.

2.1.6 A copy of the relevant procedures/specifications, a copy of the Quality Policy and general information regarding the presence of a QMS (QMS Appendix 13-A) are included in the appropriate contract.

2.1.7 Water Operations typically performs all maintenance and repairs to the water infrastructure, however there are contractors on-call for the City, if required. For the provision of supplies and/or services during emergency situations the ORO can contact these contractors and, if they are unavailable, other contractors on the list of suppliers and contractors may be contacted.

2.1.8 Where applicable, supplies must meet AWWA and NSF/ANSI standards. Water treatment chemicals are verified against the order requisition when received.

2.1.9 A list of suppliers and contractors (Table 13-02) has been developed by Water Operations for essential drinking water related supplies and services.

2.1.10 The list is updated as changes are made, and is reviewed annually by the Water Quality Manager, Water Operations Supervisor (Supply) and the Water Operations Manager to ensure that the information is up-to-date.

2.2 City Stores and Water Operations Inventory

2.2.1 Supplies that are kept in stock (e.g., repair clamps, pipes, fittings, etc.) are maintained

by either City Stores or Water Operations. Large supplies (e.g., large pipe) are kept in an outdoor compound.

2.2.2 City Stores and the Water Operations Materials Area are manned during regular business hours. Staff may come in and pick up appropriate material, which are tracked by the Stores Clerks or by the Water Utility Worker II (Maintenance and Inventory) through staff signing out material.

2.2.3 After hours, staff may come in, sign out, and pick up necessary material.

2.2.4 For stock that is in inventory, minimum/maximum reports are run regularly by the Stores Clerk to ensure that adequate supplies are available.

2.2.5 Contracts for inventory items are subject to tender as per the Purchasing and Materials Management Policy.

2.2.6 The Product Approval Committee (which includes representatives from Water Operations and water Engineering) looks at new product requests. The Water Operations Manager forwards new product requests to the Committee for consideration.

2.3 Identification of Supplies & Services and Requirements

2.3.1 Table 13-01 Essential Supplies and Services List for drinking water identifies the essential supplies and services critical to the provision of safe drinking water.

2.3.2 The table provides a description of the Procurement of Supplies or Services including:

- how availability is ensured, when required (daily operations & emergencies)

2.3.3 The table also includes identification of the Quality Requirements:

- what requirements are needed related to quality of supply or service (e.g., product/service quality; performance of supplier/service provider; method of delivery; on-site activities)
- definition of how they make sure they are met

2.4 Monitoring Supplies and Services

2.4.1 Water Operations ensures that the supplies and services meet the requirements and/or specifications identified in the documentation.

2.4.2 Any problems that are encountered with respect to the supplies and/or services are documented and forwarded to Purchasing Department (generally by e-mail). Supervisors and Managers may contact suppliers or contractors directly if problems arise. Significant problems may result in an immediate discontinuation of the use of supplies and/or services.

2.4.3 Problems with suppliers or contractors may result in the Purchasing Department preventing them from bidding for up to 3 years.

3 REFERENCES

Table 13-01 Essential Supplies and Services
Table 13-02 Suppliers and Contractors
Purchasing By-Law
Purchasing and Materials Management Policy

4 APPENDICES

Appendix 13-A QMS Information for Contracts

Essential Supplies and Services

Essential Supply or Service	Procurement of Supplies or Services - Availability Assurance	Quality Assurance
Water Main and Service Pipes, Appurtenances (Valves, Hydrants etc.) and Fittings	Contract with local supplier includes guarantee clause and after-hours availability	NSF approved/AWWA specifications applicable
Aggregate (e.g., gravel & sand)	Tender (includes 24 hr access)	Contract Specifications
Vehicles & Heavy Equipment	Fleet and Facilities Division tenders	Contract Specifications
Contracted Services (e.g. Excavators, Backhoes, Dump Trucks)	Tenders, contracts	Contract Specifications (e.g. equipment operator licences)
Diesel Fuel	Contract with Fleet and Facilities Division and includes guarantee clause for continual provision of fuel	Contract Specifications
Chemical - Sodium Hypochlorite	Purchased directly by Water Operations	NSF approved/AWWA specifications applicable
Chemical - Chlorine (gas)	Contract with Water Operations and includes guarantee clause for continual provision of chemical	NSF approved/AWWA specifications applicable
Chemical - Hydrofluorosilicic Acid	Contract with Water Operations and includes guarantee clause for continual provision of chemical	NSF approved/AWWA specifications applicable - Certificate of Analysis provided with each shipment
Laboratory Services (microbiological, analytical, physical, chemical)	Contract(s) with accredited lab(s) for the specified lab services	Accreditation information supplied as a condition of contract
Water Sampling Containers	Provided by contracted laboratory	Contract Specifications (e.g. QA/QC provisions)

QMS Table 13-02
Revision Number: 002
2015-03-30

Suppliers and Contracted Services

Supply or Service	Supplier	Contact	Phone Numbers
Chlorine Gas, Fluoride (H_2SiF_6)	Brenntag Canada	Service Desk	1-800-268-0358
Sodium Hypochlorite and Dechlorination Chemicals	Anchem	Service Desk	519-451-1614
Analytical Equipment, Supplies, Reagents	Hach Service	Jay Hamilton	1-905-877-2629
Analytical Equipment, Supplies, Reagents	Metcon	Service Desk	1-905-738-2355
Analytical Equipment, Supplies, Reagents	Cleartech (Hach Supplier)	Service Desk	1-905-612-0566
Analytical Equipment, Supplies, Reagents	Evoqua Water Technologies	Service Desk	1-905-944-2800
Analytical Equipment, Supplies, Reagents	Pure Water	Amy Hartley	1-519-737-6850 ext 24
Microbiology Lab Services	SGS Research	Emily Matlock	519-672-4500
Analytical Lab Services	SGS Research	Carrie Greenlaw	1-705-652-2116
Divers (Reservoir Inspection)	Watech Services	Greg Pritchard	519-289-5678
Generator Service	Gencare	Service Desk	519-785-1247
Plumbing Services	Westminister Mechanical	Ed Rinas	519-455-9460
Plumbing Services	Besterd Plumbing	Dave Goyette	519-672-8454
Magnetic Flowmeter Calibration	Flowmetrix	Stacey Nichol	519-870-3569
Water Main Pipe & Appurtenances	Emco Supply	Jason Carpenter Al Simpson	519-868-3642 519-868-2536
Water Main Pipe & Appurtenances	Corix	Service Desk	519-652-5555
Bulk Water Transport	Poole Water Supply	Henry Poole	519-652-6490
Excavation Contractor	L-82 Construction	Scott Hutchenson	519-649-1082 519-521-1007 (Cell)
Excavation Contractor	Blue-Con Construction	Brandon Haasen	519-659-2400 519-808-1541
Excavation Contractor	Bre-Ex	Curtis Breckleman	519-521-4038
Construction Equipment Rental	Battlefield Rental Equipment	Larry Hennigar	519-453-3000 519-668-9729 (Cell)
Construction Equipment Rental	Centre-Line Equipment Rental	Tom Smith	519-652-4500 519-808-2510
Construction Equipment Rental	CRS Rental	Kevin Roberts	519-652-0003 519-615-4149 (Cell)
Aggregates (Gravel Pit)	Brent-Reg Construction	Marty Smith	519-808-6489

QMS Appendix 13-A QMS Information for Contracts

The City of London has a Quality Management System for the provision of safe drinking water that meets the requirements of the Drinking Water Quality Management Standard. There is a Quality Management System Policy that must be adhered to, and is attached for reference. For essential supplies and services related to the provision of safe drinking water, specific procedures may apply. If required, these will be provided separately by the Operating Authority for the City of London Water System.

1 PURPOSE

To document the annual review procedure that results in the provision of drinking water infrastructure. The objective is to annually review the infrastructure that is necessary to operate and maintain the drinking water system and to determine if that infrastructure is in place as needed. The procedure also describes the process by which the findings of the review are communicated to the Owner.

2 PROCEDURE

Review and provision of the City of London's drinking water infrastructure needs are achieved through two different means, depending on whether the infrastructure currently exists, or is being planned to address growth needs.

2.1 Review of Existing Infrastructure

2.1.1 Planning for water main rehabilitation/replacement is captured through a 5 year plan and a 20 year forecast. Specific elements of the plan and forecast are updated annually as new information becomes available.

2.1.2 Water Operations continually updates the Geographical Information System (GIS) based Water Information Management System (WIMS) with field information to maintain an up-to-date record of the water mains and services in the system. An in-house software package known as the Water main Condition Assessment Program (WCAP) assigns weighted point values to each section of water main in the system using input data such as pipe age, material, hydraulic capacity (diameter, C-Factor), break frequency, water quality complaints and the presence of lead water services. The resultant point values are used by Water Engineering to generate a project list of water main rehabilitation or renewal projects for the annual budget and the 20 year forecast. Prioritization of projects can be modified by field observations provided by Water Operations staff e.g. deteriorating chlorine residuals etc.

2.1.3 Leak detection and condition assessment projects are also undertaken on a case by case basis, e.g. "Smart-Ball" or "Pipe Diver" analysis of concrete transmission mains.

2.1.4 Reservoir and pumping station infrastructure condition is assessed by Water Operations through inspection, maintenance, and repair reports; and this information is also provided to Water Engineering for infrastructure evaluation and project consideration.

2.1.5 The priority list of water projects is reviewed and Water Engineering coordinates with other infrastructure need projects (e.g., roads, wastewater) to determine where replacement of existing infrastructure may occur in a coordinated fashion to maximize efficiency while reducing social impacts.

2.1.6 Water Engineering develops the list of priority coordinated projects for the annual budget and works with the Finance Department to ensure funding is available for the projects. Water Engineering carries the project list forward through the Capital Works budget process.

2.1.7 The Capital Works budget is provided to Council annually. The 20 year forecast is used within the EESD to develop the annual list of projects and undertake financial forecasting required to establish water charges and reserve funds in conjunction with the Finance

Department. Council receives a 10 year consolidation for their review. Engineering is notified if any of the projects on the priority list are removed or adjusted through the budget approval process.

2.1.8 Water Engineering will identify projects that were on the priority list but did not receive budget approval or received approval but were not constructed during a specific year. These are put back onto the priority list of projects for the following year.

2.1.9 Annual operating budgets are also used to provide infrastructure needs and maintenance. Budgets can be increased if new initiatives (e.g., lead testing) occur. Changes in Provincial regulations are the main factor driving increases in operating budgets from the previous year.

2.1.10 Following budget approval projects are tendered for construction by private contractors or constructed by Water Operations.

2.2 New Infrastructure

2.2.1 The review process for new infrastructure is primarily driven by Water Engineering.

2.2.2 New infrastructure must meet the current standards listed below.

2.2.3 The results of the growth related drinking water infrastructure needs review is documented in the following:

- Official Plan
- Master Plan Study and Growth Management Implementation Strategy
- Site Plans / Draft Plans of Subdivision

2.2.4 Long term planning for growth related infrastructure starts with the development and updating of the ***Official Plan (OP)***, which provides the policy framework to guide the provision of infrastructure within the City of London. The OP focuses on population projections, land use and infrastructure development policies.

2.2.5 A ***Master Plan Study*** is completed through Environmental Engineering and Services Department (EESD) in order to determine the specific needs and timing for drinking water infrastructure to support the specific serviced area. This study is coordinated with the ***Growth Management Implementation Strategy*** to ensure growth takes place in readily serviceable areas of the City.

2.2.6 The development of the Master Plan Study and GMIS provides projections over 20 years for new development projects. The plans are updated every 5 years including the 20 year forecast. Before projects are committed for construction, needs are assessed annually based on development activity within the City.

2.2.7 Detailed Site Plan designs and draft Plans of Subdivision are brought forward by the development community. These designs and plans are to be based on London design standards and are signed off by Development Services, a sister Division to Water Engineering and Water Operations within Development and Compliance Services. Procedures followed by Development Services are not currently covered by the DWQMS but will be considered in future “continual improvement steps”.

3 REFERENCES

QMS-05 Document and Records Control QMS System Procedure
City of London Draft Official Plan

4 APPENDICES

Not Applicable

1 PURPOSE

To document a summary of the infrastructure maintenance, rehabilitation and replacement programs for the drinking water system. This is a continuation from the review and provision of infrastructure and is a summary of the infrastructure rehabilitation, replacement and maintenance programs and activities that are undertaken.

2 PROCEDURE

2.1 PREVENTIVE MAINTENANCE – WATER MAINS

2.1.1 Preventative maintenance for water mains largely consists of replacement or rehabilitation of water mains before their condition deteriorates beyond an acceptable level. This process is described in section 2.4 below.

2.1.2 Water main flushing is performed in to improve water quality (chlorine residual and aesthetic parameters) and remove sediment that may have accumulated through the tuberculation process. Flushing is performed on an as-required basis to address identified water quality concerns such as discoloured water that is often the result of abnormal flow conditions, e.g. due to water main breaks or hydrant usage.

Hydrants: Hydrant maintenance is comprised of two components: 1) Annual Maintenance, and 2) Frost Checks. Annual Maintenance is performed yearly and Frost Checks are performed at least twice per year (in winter months) for each hydrant in the system. Within the GIS Hydrant Maintenance Module, the water system is divided into geographic areas containing approximately 200 hydrants each. The Water Operations Supervisor (Quality Assurance) assigns an area to an operator for either Annual Maintenance or Frost Checks. The operators use wireless laptops in the field to access the Hydrant Maintenance Module. Using the module, the operators plan their daily routes and record maintenance performed. If repairs are required, the operators log this information and the module generates a repair request which is sent to the Water Operation Supervisor via E-mail. The supervisor and operators can track hydrant maintenance visually via mapping through the GIS interface. When the maintenance in an assigned area is completed, the supervisor assigns the next area, from the sequential area list. When the required maintenance has been completed in all areas, the cycle repeats.

Valves: Valve exercising is a manually directed program focussing on areas of planned maintenance and construction. Valve deficiencies noted through valve exercising or through daily operations are noted on a “Trouble Slip” that is given to the Water Operations Supervisor (Water Mains), who dispatches a repair crew.

2.2 PREVENTIVE MAINTENANCE – FACILITIES

2.2.1 The Water Operations Supervisor (Water Supply) maintains a Master Maintenance Checklist, which is a spreadsheet for the preventive maintenance that needs to be performed at each location, each year.

2.2.2 The Water Operations Supervisor (Water Supply) schedules the required maintenance to be performed by Water Supply Operators.

2.2.3 Maintenance is tracked by the use of a maintenance card system. The cards are kept at the facilities and the Operators completing the work are responsible for updating the cards

2.2.4 The SCADA system equipment undergoes life cycle maintenance based on manufacturers' specifications or as required by the regulations. The Water Operations Supervisor (Water Supply) and the Electrical Supervisor coordinate operations to ensure that the maintenance is performed.

2.2.5 The work is assigned to a team consisting of a Water Supply Operator and the appropriate Electrical Operations staff. The maintenance cards are completed at each location for the electrical maintenance work performed.

2.2.6 The station pumps undergo life cycle maintenance based on manufacturers' specifications or as required by the regulations. The Water Operations Supervisor (Water Supply) and the Mechanical Maintenance Supervisor coordinate operations to ensure that the maintenance is performed.

2.2.7 The work is assigned to a team consisting of a Water Supply Operator and the appropriate Mechanical Maintenance staff. The maintenance cards are completed at each location for mechanical maintenance work performed.

2.2.8 Reservoir inspections are performed by contracted divers, at a minimum of every 5 years. The integrity of the floating cover on Springbank Reservoir No. 2 and the condition of the undersides of the permanent roofs on Springbank Reservoir No. 1 & 3 are also assessed during these inspections. Any noted deficiencies (cracks, leaks, spalling etc.) are detailed in a report and repairs/maintenance are planned based upon the inspection outcomes.

2.3 UNPLANNED MAINTENANCE – FACILITIES

2.3.1 Maintenance work may be identified by Operators during regular visits to the facilities. The Operator details the noted deficiency in a "Trouble Slip" which is given to the Water Operations Supervisor (Water Supply). If the Operator believes that it is necessary, they may Lock-out and Tag the equipment affected by the noted deficiency.

2.3.2 The Water Operations Supervisor (Water Supply) responds to the Trouble Slip by arranging for the necessary maintenance to be completed.

2.4 UNPLANNED MAINTENANCE (WATER MAINS AND APPURTENANCES)

2.4.1 Unplanned maintenance typically consists of repairing leaks or other deficiencies (e.g. damaged hydrants) that are reported by the public, other utilities, London staff etc.

2.4.2 Reports received by the Utility Communications Coordinators are recorded in the AMANDA database and forwarded to the appropriate Water Operations Supervisor who assesses the situation and assigns staff to make the necessary repairs. The Supervisor completes the AMANDA entry when the repairs are completed.

2.5 REPLACEMENT & REHABILITATION (CAPITAL PROJECTS)

2.5.1 Water main rehabilitation (cleaning, re-lining, hydrant and valve replacement, lead service replacement) projects are carried out each spring and summer by contractors

monitored by Water Operations Inspectors, and by staff as needed. Updated system information is recorded by Water Operations in WIMS (Water Information Management System) from as-built drawings or Engineering Drawings that have had changes marked in the field by Water Operations Inspectors.

2.5.2 Water main replacement projects (water main, water service, hydrant and valve replacements) are carried out each year by 1) contractors monitored by Water Operations Inspectors, and 2) by Water Operations staff. Updated system information is recorded by Water Operations in WIMS from as-built drawings or Engineering Drawings that have had changes marked in the field by Water Operations Inspectors, or by Leading Water Utility Workers.

2.6 EFFECTIVENESS OF MAINTENANCE

2.6.1 The effectiveness of hydrant maintenance is tracked through the GIS Hydrant Maintenance Module. If the desired level of maintenance is not being achieved, more resources are assigned. The GIS Valve Maintenance Module (being developed) will provide similar functionality.

2.6.2 The WIMS and WCAP software provide a continually updated assessment of water main condition throughout the system. Effectiveness of maintenance is tracked by comparison of condition assessments over time to ensure that replacement or rehabilitation of water mains is completed before water main conditions deteriorate beyond acceptable levels.

2.6.3 Heterotrophic Plate Count (HPC) testing and free chlorine testing is performed on every water sample taken for bacteriological testing. Water Supply staff maintain spreadsheets that track HPCs and free chlorine residuals over time at each sample location. Trends toward increasing HPCs and/or decreasing free chlorine residuals indicate deterioration in water quality, often due to biofilm development in water mains. Any identified trends are provided to Water Engineering for the assessment of rehabilitation/replacement projects.

3 REFERENCES

QMS-05 Document and Records Control
Waterworks Operations & Maintenance Manual Procedures

4 APPENDICES

Not Applicable

1 PURPOSE

To document a procedure for sampling, testing and monitoring activities completed for finished drinking water quality, including any requirements for sampling and monitoring at the conditions most challenging to the drinking water system. The procedure describes how the sampling, testing and monitoring results are recorded and shared with the Owner, where applicable.

2 PROCEDURE

General

Sampling, testing and monitoring is performed to:

- provide Operators with knowledge required to proactively operate the drinking water system, especially at Critical Control Points (CCPs);
- verify the finished water quality;
- ensure that water quality is maintained as water travels through the distribution system, and
- ensure compliance with applicable regulations, licences and permits

For the purposes of this procedure, ***"sampling"*** is defined as the process of collecting water samples for analysis, and ***"testing"*** is considered to be laboratory or field analysis; ***"monitoring"*** consists of on-site data collection (e.g., using online analyzers, bench-top or hand-held equipment) and analysis.

2.1 Sampling and Testing

Water Quality Sampling Program

2.1.1 Samples are collected from various sample points throughout the drinking water system. Sample analysis and frequencies are outlined in the *Water Supply Sampling Schedule*. Random samples are also collected as required by water main maintenance and repair activities.

2.1.2 Regular sampling locations are selected to represent all extents of the water system, and are listed in the *Water Supply Sampling Schedule* and are illustrated on the on the *Water Supply Sampling Location* Map within the Water Supply Procedures.

2.1.3 The protocols for collecting and handling water samples are provided within the current version of the MOECC document "*Practices for the Collection and Handling of Drinking Water Samples*", as well as within the City of London's *Water Sampling Procedures*.

2.1.4 The Water Quality Manager is responsible for reviewing the water quality sampling program, including the *Water Supply Sampling Schedule* and *Water Supply Sampling Location Map* for changes required to the water quality parameters, sampling frequency and sampling locations based on changes in the regulatory framework or as part of continual improvement initiatives.

2.1.5 The Water Quality Manager is responsible for updating the *Water Supply Sampling Schedule* and *Water Supply Sampling Location Map* based on this review.

Sampling and Testing Results

2.1.6 Analytical results are compared to the Ontario Drinking Water Quality Standards (ODWQS) as specified in O. Reg 169/03 and other applicable drinking water standards as outlined in O. Reg 170/03.

2.1.7 The analytical results are compiled annually and listed along with the Ontario Drinking Water Quality Standards, with the minimum and maximum values listed for each parameter tested.

2.1.8 All laboratory results are reviewed by the Water Quality Manger and are uploaded into a network database.

2.1.9 Adverse water quality incidents are identified through lab notifications. All adverse water quality incidents are reported as per O. Reg. 170/03 through Standard Operating Procedures.

2.1.10 Sampling and testing records are maintained and stored in accordance with QMS-05 Document and Records Control.

2.2 Monitoring

2.2.1 On-line analyzers, bench-top equipment and handheld equipment are used to monitor drinking water quality. On-line analyzers are used to monitor process control at the three re-chlorination facilities (Springbank Reservoirs), and at the point of fluoridation (Arva P.S.), as well as at various locations throughout the system.

2.2.2 Daily reports are made by the operators at each site where monitoring is performed, comparing analyser readings against bench-top and handheld equipment readings. The data are also recorded manually on log sheets at each station.

2.2.3 Monitoring results from on-line analyzers are also maintained on the SCADA system server.

2.3 Reporting to the Owner

2.3.1 The Environmental Services Engineer (Water Operations) is responsible developing an Annual Report for City Council that includes, but is not limited to, a summary of all test results and corrective actions taken, as detailed in Section 11 of O. Reg. 170/03.

3 REFERENCES

QMS-05 Document and Records Control
Water Supply Sampling Schedule
Water Supply Sampling Location Map
City of London's Water Sampling Procedures
Ontario Drinking Water Quality Standards (O. Reg 169/03)

4 APPENDICES

Not Applicable

1 PURPOSE

To document the calibration and maintenance of measurement and recording equipment related to the provision of safe drinking water.

2 PROCEDURE

2.1 Calibration and Maintenance Frequency and Schedule

2.1.1 Measurement and recording equipment is maintained and calibrated as per equipment manufacturer's specifications or as required by regulations, licences, or permits, whichever is more frequent.

2.1.2 The frequency and responsibility for calibration and maintenance of each equipment type is summarized on QMS Table 17-01.

2.1.3 The Water Operations Supervisor (Water Supply) is responsible for ensuring that the calibration is undertaken and that calibration records are completed by staff (for in-house calibration and maintenance).

2.1.4 If an operator suspects that a device may be out of calibration, as a result of operational checks or observations, they may calibrate the device or notify their Supervisor so that calibration can be performed ahead of the next scheduled calibration.

2.1.5 Equipment calibration records are maintained by the Water Operations Supervisor (Water Supply) as per QMS-05 Document and Records Control Procedure.

2.2 Review

2.2.1 The QMS Representative is responsible for reviewing the calibration records to ensure that the information is being updated.

3 REFERENCES

QMS-05	Document and Records Control
QMS Table 17-01	Measurement & Recording Equipment Calibration & Maintenance Schedule

4 APPENDICES

Not Applicable

QMS Table 17-01
Revision Number: 001
2015-04-07

MEASUREMENT & RECORDING EQUIPMENT CALIBRATION & MAINTENANCE SCHEDULE

Equipment Description	Location	Calibration/Maintenance Frequency	Calibrated By *(In-house or Third Party)*
On-line pH Analyzers	Arva P.S. (pre and post fluoridation)	Checked Daily – Calibrated as required based on daily checks	Water Supply Operators
On-line pH Analyzers	Hyde Park P.S., Wickerson P.S., Uplands P.S., Pond Mills P.S., Westmount P.S., Chamber 13	Checked Monthly – Calibrated as required based on monthly checks	Water Supply Operators
Portable pH Analyzer	Arva P.S.	Weekly	Water Supply Operators
Portable pH Analyzers	Water Supply Shop	Prior to use and weekly if in continuous use	Water Supply Operators
Displacement Flow Meters	Hyde Park Well ,Fanshawe Wells	Yearly	Water Meter Staff
Magnetic Flow Meters	Arva P.S., Hyde Park P.S., Wickerson P.S., Uplands P.S., Pond Mills P.S., Westmount P.S., Springbank P.S., SM4, SR1	Yearly	Contracted Specialists
System Pressure Transducers	Arva P.S., Hyde Park P.S., Wickerson P.S., Uplands P.S., Pond Mills P.S., Westmount P.S., Springbank P.S., C01, C01A, C09, C09A, C13, CCH, CHM, CYM, CCC, PCJ, PDC, PBJ, PIP	Yearly	City Electricians
Reservoir Level Indicators	Springbank Reservoirs No. 1, 2 and 3	Yearly	City Electricians
On-line Fluoride Analyzer	Arva P.S.	Checked daily against bench tester – Calibrated as required based on checks	Water Supply Operators
On-line Chlorine Analyzers	Arva P.S., Hyde Park P.S., Wickerson P.S., Uplands P.S., Pond Mills P.S., Westmount P.S., Springbank P.S., SM4, SR1	Checked Daily against DPD kits or titrators – Calibrated as required based on daily checks – Maintenance performed monthly or quarterly depending upon model	Water Supply Operators
DPD Chlorine Test Kits (Maintenance and Construction)	Operators' Vehicles	Yearly	Water Supply Operators
DPD Chlorine Test Kits (Water Supply)	Operators' Vehicles	Quarterly	Water Supply Operators

1 PURPOSE

To document a procedure to maintain a state of emergency preparedness, including:

a) a list of potential emergency situations or service interruptions,
b) processes for emergency response & recovery,
c) emergency response training & testing requirements,
d) Owner & Operating Authority responsibilities during emergency situations,
e) references to municipal emergency planning measures, and
f) emergency communication protocol and up-to-date list of emergency contacts.

2 PROCEDURE

2.1 Identification of Emergency Situations or Service Interruptions

2.1.1 On an annual basis the QMS Representative, Water Operations Manager, Water Operations Engineer and the Water Operations Supervisor (Water Supply) meet to review the list of emergency situations or service interruptions that have been identified and to examine current operations to determine if additional emergency situations or service interruptions should be added to the list.

2.1.2 In addition, during the risk assessment process (including the annual and three year reviews) the outcomes (QMS-08) are identified, which include some emergency situations or service interruptions. Emergency situations or service interruptions identified through this process are reviewed to determine whether they should be added to the list mentioned above.

2.1.3 The Water Operations Engineer is responsible for maintaining and updating the potential emergency situations or service interruptions list in the Waterworks Operations and Maintenance Manual. There is also an emergency contact list that is maintained in the manual.

2.1.4 The types of emergencies that have been identified, and for which procedures have been developed, include:

- General emergencies - storms, power outages, flooding, fires and sabotage, vandalism and work stoppage
- Major service disruption
- Valve Operation – fires, broken mains, broken hydrants, meter change or repair, reservoir or pumping station problems
- Lake Huron Primary Water Supply System pipeline break
- Elgin Area Primary Water Supply System pipeline break
- Arva Terminal Reservoir and Pumping Station emergency bypass procedure
- Backflow procedure (London to Elgin-Middlesex)
- Well start and operation
- Water Contamination

2.2 Process for Emergency Response and Recovery

2.2.1 Based on the emergencies identified, the Water Operations Engineer is responsible for ensuring that Standard Operating Procedures (SOP) are developed and maintained.

2.2.2 The SOPs outline the roles and responsibilities for various staff, and the activities related to the response and recovery from the emergency situation or service interruption.

2.2.3 The City of London has a Corporate Emergency Response Plan that outlines communication procedures during emergency situations that have both potential Water Operations and Corporate level impacts. The plan also outlines the roles and responsibilities of the Owner and appropriate Water Operations staff, depending on the level of emergency.

2.3 Emergency Response Training and Testing Requirements

2.3.1 The Water Quality Manager and Water Operations Supervisors are responsible for ensuring that training is provided in order to adequately prepare staff for the duties that they will be expected to perform in response to emergency situations. Training is provided as identified in QMS-10 Competencies and is generally through on-the-job training (e.g., alarm response, SOPs) and by Staff maintaining their competency.

2.3.2 The training is tracked for staff as per QMS-10 Competencies.

2.3.3 In addition, a debriefing after major events will be undertaken by the QMS Representative, the Division Manager - Water Operations, the Water Operations Manager, the Water Operations Engineer and the appropriate Water Operations Supervisor(s) and other applicable staff. Significant events/responses may be reported to the Owner through a Council report, which will detail the event and the response, including any shortcomings.

2.3.4 At least every 2 years the QMS Representative, Water Operations Engineer and the Division Manager of Water Operations will meet to review the emergency procedures (response and recovery) and to ensure that modifications are made to the procedures where required based on the review, testing, and/or debriefing following emergency situations.

2.3.5 The QMS Representative will ensure that an emergency response exercise is conducted at least once in each calendar year to test one or more emergency response processes.

3 REFERENCES

QMS-10 Competencies

Standard Operating Procedures

Emergency Response Protocol

City of London Emergency Plan

4 APPENDICES

Not Applicable

1 PURPOSE

To document a procedure for internal audits that:

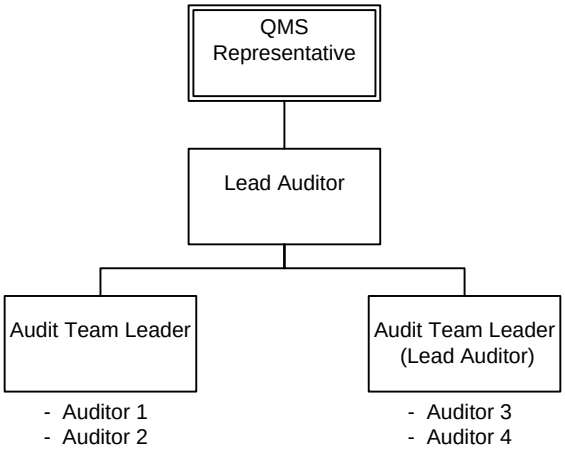
- Evaluates conformity of the QMS with the requirements of the DWQMS,
- Identifies internal audit criteria, frequency, scope, methodology and record keeping requirements,
- Considers previous internal and external audit results, and
- Describes how the QMS corrective actions are identified and initiated.

2 PROCEDURE

Internal audits may be conducted using City of London staff, or by contracting the services of a consultant with expertise in management system auditing, and with specific expertise related to Ontario's DWQMS. When contracted auditors are used, the audit schedule, process and reporting format shall be the responsibility of the auditing consultant. When internal audits are conducted by City of London staff, the following procedure shall be used.

2.1 AUDIT TEAM STRUCTURE AND ROLES

Example structure for an Audit conducted using City of London staff:



The audit team roles are as follows.

- The ***QMS Representative*** acts as a liaison between the audit team (through the Lead Auditor) and the auditees.
- The ***Lead Auditor(s)*** is responsible for overseeing the internal audit process and ensuring that qualified auditors conduct internal audits.
- The ***Audit Team Leader*** is the auditor responsible for managing the internal audit of a specified element or process. The Lead Auditor can also act as an Audit Team Leader.
- ***Auditors*** work with the Audit Team Leader to prepare for and conduct internal audits.

2.2 AUDITOR QUALIFICATIONS AND SELECTION

The Lead Auditor(s) and Auditors must meet the following criteria:

- have knowledge of the DWQMS and London's drinking water QMS;
- be independent of the work that is going to be audited;
- have the ability to make objective observations and record the results;
- have successfully completed an auditing course.

The Lead Auditor(s) along with the QMS Representative will select several internal auditors and assign Team Audit Leaders for each audit.

2.3 AUDIT PROCESS

2.3.1 Schedule

Each element of the QMS for the drinking water system must be audited a minimum of once per year. Additional audits can be scheduled based on the importance of the process or area, or in response to previous audit results (internal and external). Typically, the internal audit focuses on the previous calendar year.

The Lead Auditor(s) creates an Annual Internal Audit Schedule using Form 19-01, with assistance from the QMS Representative. The Lead Auditor(s) appoints an Audit Team Leader and Auditor(s) for each element or process and ensures that Auditors do not audit their own work. The Lead Auditor or QMS Representative forwards the Audit Schedule to the Managers and Supervisors.

The Audit Schedule will be communicated to staff by the QMS Representative and to the Managers and Supervisors in advance of the audit.

2.3.2 Checklist

The Audit Team Leader works with the QMS Representative and other Auditor(s) to prepare an Internal Audit Checklist Form 19-02 or other similar document that records questions asked and points verified. The checklist defines the scope (i.e., applicable area of the QMS, time period to be audited, organizational unit and/or facility) and audit criteria (i.e., applicable manuals and standards).

The checklist reflects the current policies and procedures of the area that are being audited. A copy of the procedures with the points highlighted that are going to be checked can be attached to the checklist and referenced for the audit.

2.3.3 Audit

The audit is performed by the auditing team using the Internal Audit Checklist Form 19-02 or similar document. Observations that provide evidence of conformance or non-conformance are noted on the Internal Audit Checklist.

2.3.4 Audit Findings

The results of the audit are reviewed by the Audit Team. Agreement is reached under the leadership of the Audit Team Leader. The Auditors complete the summary of findings on the Audit Report Form 19-03 or similar document.

2.3.5 Closing Meeting

The results of the audit are presented by the auditors at the closing meeting. The QMS Representative, Top Management, and the other management staff of the Operating Authority are requested to attend where possible.

The closing meeting will include the following:

- a review of the commendable features
- a review of documented observations – what is effective, what needs improvement and what is unsatisfactory
- agreement on an appropriate action plan to rectify each identified non-conformance
- agreement on a response date for each identified non-conformance – typically 90 days or less

The QMS Representative will record the agreed upon action plans and response dates for each identified non-conformance.

2.4 AUDIT REPORT

The Auditors finalize an Internal Audit Report Form 19-03. The report must be signed by the Lead Auditor.

A copy of the report is given to the QMS Representative; the original is kept by the Lead Auditor(s) and used for follow up. The report is filed according to QMS-05 Procedure Document and Records Control.

2.5 AUDIT RESPONSE

The QMS Representative tracks the internal audit non-conformances and recommendations, and ensures that each non-conformance is addressed according to the agreed upon action plans and response dates.

The results of the internal audits and the audit responses are reviewed by management at the annual Management Review meeting as per QMS-20 (Management Review) or more frequently, if required.

3 REFERENCES

Form 19-01 Annual Internal Audit Schedule
Form 19-02 Internal Audit Checklist
Form 19-03 Internal Audit Report
QMS-05 Document and Records Control
QMS-20 Management Review

4 APPENDICES

Not Applicable

INTERNAL AUDIT SCHEDULE

City of London Water System Internal Audit (mm/dd/yr)

																										Team Number:	1	1		2	2
							DWQMS ELEMENT TO AUDIT																				Auditors				
Audit Team	Auditee (Position Title)	Auditee (Name)	Date	Time Req'd (hrs)	Start Time	Location	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21					
																														LA	
																														LA	
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1 & 2	**Auditor Meeting**																													LA	
1 & 2	***CLOSING MEETING***	*all interested*																												LA	

LA = Lead Auditor

QMS Form 19-02
Revision Number: 002
2014-09-01

CITY OF LONDON WATER SYSTEM QMS INTERNAL AUDIT CHECKLIST

Position Being Audited:	
Name of Auditee:	Time Period Audited:
Audit Criteria: (*e.g. QMS, internal SOPs*)	
Auditor:	Date of Audit:
Lead Auditor:	
Audit Team Leader:	

OK = Satisfactory Response
U = Unsatisfactory Response (may result in non-conformance report or corrective action)
NI = Needs improvement – observation or suggestion

Element	Procedure/Question	OK	U	NI	Comments

QMS Form 19-03
Revision Number: 001
2014-09-01

INTERNAL AUDIT REPORT

Procedure Section	Audit Report #	Date of Audit
Audit Scope & Objectives		
Lead Auditor	Person Responsible for Area Audited	
Audit Team Leader and Audit Team Members		
Attended Closing Meeting (if applicable)		

Commendations – summary of activity that is in conformance or other points that are well done.
Summary of Audit Findings
Non-Conformances and Corrective Action Reports Issued
Suggestion for next audit
Result of Audit ( ) OK ( ) Not OK - if not OK state date of follow up audit:
Result of Follow Up Audit (if applicable) ( ) OK ( ) Not OK – state action to be taken

_____ _____

Lead Auditor Date

Distributed to: _____

1 PURPOSE

To document a procedure for a Management Review that evaluates the continuing suitability, adequacy and effectiveness of the QMS. To ensure the necessary information is collected for Top Management to review and to provide review output of any decisions and actions related to the QMS and maintain records of the reviews.

2 PROCEDURE

2.1 Management Review

2.1.1 A Management Review will be held at least once per year by Top Management to evaluate the overall suitability, adequacy and effectiveness of the QMS.

2.1.2 The QMS Representative is responsible for:

- establishing the date for both the Annual Management Review meeting,
- forwarding notification of the meeting to participants, and
- forwarding the agenda for the meeting to the participants.

2.2 Management Review Input

2.2.1 Management will review information in the agenda on Form 20-01, where applicable on:

a) Incidents of regulatory non-compliance
b) Incidents of adverse drinking water tests
c) Deviations from critical control point limits and response actions
d) Efficacy of the risk assessment process
e) Results of audits (internal and external)
f) Results of relevant emergency response testing
g) Operational performance
h) Drinking water quality trends
i) Follow-up action items from previous management reviews
j) Status of management action items identified between reviews
k) Changes that could affect the QMS
l) Summary of consumer feedback
m) Resources needed to maintain the QMS
n) Results of the infrastructure review
o) Operational Plan currency, content and updates
p) Summary of staff suggestions

2.3 Management Review Output

2.3.1 Management review outputs will include identification of specific actions items to address deficiencies, personnel responsible for delivering those action items and proposed implementation timelines. During Management Review, Top Management will provide a record of any decisions and actions related to:

- Improvement of the QMS and related procedures
- Improvement of the Operating Authority's ability to implement consistently the QMS

- Human and financial resource needs

2.4 Recording of Management Review

2.4.1 Minutes of the meeting will be recorded on Form 20-01 and maintained as per QMS-05 Document and Records Control. Copies of the minutes are distributed to Top Management by the QMS Representative.

2.4.2 The QMS Representative will ensure that the results of the Management Review, including the identified deficiencies, decisions and action items, are conveyed to the Owner.

3 REFERENCES

QMS-05 Document and Records Control
Form 20-01 Management Review Agenda & Meeting Minutes

4 APPENDICES

Not Applicable

QMS Table 20-01
2008-11-17
Revision Number: 000

Management Review Agenda & Meeting Minutes

Date of last meeting (This meeting must be held a minimum of once per year): _____

Today's Date: _____

Attendance:

Meeting Time: _____

Agenda Item	Decision/Action	Responsible	Date Due
a) Incidents of regulatory non-compliance			
b) Incidents of adverse drinking water tests			
c) Deviations from critical control point limits and response actions			
d) Efficacy of the risk assessment process			
e) Results of audits (internal and external)			
f) Results of relevant emergency response testing			
g) Operational performance			
h) Drinking water quality trends			
i) Follow-up action items from previous management reviews			

Management Review Agenda & Meeting Minutes

Agenda Item	Decision/Action	Responsible	Date Due
j) Status of management action items identified between reviews			
k) Changes that could affect the QMS			
l) Summary of consumer feedback			
m) Resources needed to maintain the QMS			
n) Results of the infrastructure review			
o) Operational Plan currency, content and updates			
p) Summary of staff suggestions			
q) New Business - Other issues that impact on the quality management system. Specify for agenda.			
r) Tentative Date of Next Meeting			

Minutes distributed to attendees and the following people:

1 PURPOSE

To document the methods used by the Operating Authority to strive to continually improve the effectiveness of its Quality Management System.

2 PROCEDURE

2.1.1 Continual improvement involves documenting and addressing identified opportunities for improvement and taking measures to eliminate the causes of identified quality problems, or potential problems, to ensure that the problems do not occur in the future.

2.1.2 Opportunities for improvements to the QMS may be identified as a result of the following:

- Internal audits
- External audits
- Management Review
- Management meetings
- Customer complaints
- Debriefing follow emergency situations
- Staff suggestions

2.1.3 Non-Conformances identified in Internal Audits are addressed as per QMS 19 Internal Audits.

2.1.4 Non-Conformances identified in External Audits are addressed through the completion of Non-conformance Reports issued by the external auditor.

2.1.5 Opportunities for improvement (OFIs) identified in Internal and External audits, and by other means, are recorded by the QMS Representative, who also records actions taken to address the OFIs.

3 REFERENCES

Not Applicable

4 APPENDICES

Not Applicable