The City of London Water System

Quality Management System

Operational Plan

Revised November 11, 2019

Table of Contents

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 (the 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 (DWQMS). 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 the 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 after 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 the Operating Authority staff are aware of all applicable legislative and regulatory requirements,
c) Communicating the QMS according to the procedures prescribed in 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 when renewal of the Owner's endorsement is requested. Top Management's endorsement of the Operational Plan is provided through the signatures below.

Date	Top Management Endorsement
November 11, 2019	Scott Mathers, Water Director
November 11, 2019	John Simon, Division Manager, Water Operations
November 11, 2019	Aaron Rozentals, Division Manager, Water Engineering

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

November 11, 2015

J. Lucas
Director, Water and Wastewater

I hereby certify that the Municipal Council, at its meeting held on November 10, 2015 resolved:

17. That, on the recommendation of the Director, Water and Wastewater, the following actions be taken with respect to the Revised Operational Plan for London's Drinking Water System:

a) the staff report dated November 3, 2015 BE RECEIVED for information; and,

b) the current Operational Plan for the City of London Water System BE ENDORSED by Council as per the requirements of O. Reg. 188/07. (2015-E05) (17/15/CWC)

C. Saunders
City Clerk

cc. A. Zuidema, City Manager
J. Braam, Managing Director, Environmental and Engineering Services and City Engineer
R. Welker, Manager, Water Engineering
J. Simon, Division Manager, Water Operations
D. Huggins, Water Quality Manager

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

1. Purpose

To identify a Quality Management System Representative and outline his/her specific responsibilities and authorities.

2. Procedure

2.1. Top Management appoints the Quality Management System Representative. The responsibilities and authorities of the position are outlined in QMS-09.

2.2. Top Management signs a letter of appointment identifying the QMS Representative, which 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

QMS Appendix 4-A

Notice of Appointment - QMS Representative

Top Management for the City of London Water System Operating Authority has appointed

Dan Huggins, Water Quality Manager

to be the Quality Management System Representative for the City of London Water System.

The Quality Management System (QMS) Representative is the liaison between Top Management and 1) the Water Operations Division, and 2) the Water Engineering Division (collectively, the Operating Authority). The QMS Representative 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 Water System, and
e) promote awareness of the QMS throughout 1) the Water Operations Division, and 2) the Water Engineering Division (collectively, the Operating Authority).

Date	Top Management Endorsement
September 5, 2017	Scott Mathers, Water Director
September 5, 2017	John Simon, Division Manager, Water Operations
September 5, 2017	Aaron Rozentals, Division Manager, Water Engineering

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.

2.1.7. The QMS Representative will ensure that all Water Operations Standard Operating Procedures (SOPs) are reviewed at least once every three (3) years to ensure that the SOPs are kept current and applicable. The Water Quality Manager will include the appropriate Water Operations Supervisor(s) in the review process.

2.1.8. The Water Operations Supervisor (Water Supply) will ensure that all Water Supply Work Instructions are reviewed annually by all Water Supply Operators to ensure that they are kept current and applicable.

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 staff affected by the change. Management staff are responsible for advising any staff affected by the change.

2.2.5. The QMS Representative ensures that all hard copies of newly obsolete documents 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, and in accordance with applicable regulatory requirements, determines the retention time for records.

2.3.6. Records may be electronic and/or hard copy.

2.3.7. Once the minimum retention time has elapsed for a record, the person who maintains that QMS record (as identified in Table 05-02) is responsible for deciding whether to dispose of the record at that time, and for disposing of the record if disposal is warranted.

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” application is used to access WIMS information. Operators in the field have wireless devices to access to CityMap. Geomatics

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

2.4.2. Water Operations maintains original hard copies of field annotated construction drawings.

3. References

Table 05-01 Document Master List

Table 05-02 Records Master List

QMS Table 05-01
Revision Number: 027
2019-11-11

Document Master List

PRINTED COPIES OF THIS DOCUMENT ARE UNCONTROLLED AND MAY NOT BE CURRENT

Internal Documents			
Document Title	Document Reference No.	Date of Last Revision	Location
QMS Policy	QMS-02	2014-07-04	CityHub/DWQMS/QMS Records/Operational Plan
Commitment & Endorsement	QMS-03	2019-11-11	CityHub/DWQMS/QMS Records/Operational Plan
QMS Representative	QMS-04	2008-11-17	CityHub/DWQMS/QMS Records/Operational Plan
Notice of Appointment - QMS Representative	QMS Appendix 4-A	2017-09-05	CityHub/DWQMS/QMS Records/Operational Plan
Document and Records Control	QMS-05	2016-06-07	CityHub/DWQMS/QMS Records/Operational Plan
Document Master List	QMS Table 05-01	2019-11-11	CityHub/DWQMS/QMS Records/Operational Plan
Record Master List	QMS Table 05-02	2019-11-11	CityHub/DWQMS/QMS Records/Operational Plan
Drinking Water System	QMS-06	2019-11-11	CityHub/DWQMS/QMS Records/Operational Plan
The City of London Water System Flow Chart	QMS Appendix 6-A	2018-01-19	CityHub/DWQMS/QMS Records/Operational Plan
Risk Assessment	QMS-07	2019-06-18	CityHub/DWQMS/QMS Records/Operational Plan
Risk Assessment Rating	QMS Table 07-01	2015-04-07	CityHub/DWQMS/QMS Records/Operational Plan
Risk Assessment Form	QMS Table 07-02	2015-04-07	CityHub/DWQMS/QMS Records/Operational Plan
Risk Assessment Outcomes	QMS-08	2019-06-18	CityHub/DWQMS/QMS Records/Operational Plan
Risk Assessment Outcomes Table	QMS Table 08-01	2019-04-26	CityHub/DWQMS/QMS Records
Summary of Critical Control Points	QMS Table 08-02	2018-01-19	CityHub/DWQMS/QMS Records
Organizational Structure, Roles, Responsibilities and Authorities	QMS-09	2015-04-07	CityHub/DWQMS/QMS Records/Operational Plan
Organizational Chart of the City of London Water System Operating Authority	QMS Appendix 9-A	2019-06-18	CityHub/DWQMS/QMS Records/Operational Plan

Document Master List

City of London Water System Key Operating Authority Roles	QMS Table 09-01	2015-04-07	CityHub/DWQMS/QMS Records/Operational Plan
City of London Water System QMS Roles, Responsibilities and Authorities	QMS Table 09-02	2019-03-13	CityHub/DWQMS/QMS Records/Operational Plan
Competencies	QMS-10	2015-04-07	CityHub/DWQMS/QMS Records/Operational Plan
Summary of Drinking-Water Related Staff Competencies	QMS Table 10-01	2018-03-19	CityHub/DWQMS/QMS Records/Operational Plan
Personnel Coverage	QMS-11	2018-03-19	CityHub/DWQMS/QMS Records/Operational Plan
Communications	QMS-12	2018-11-26	CityHub/DWQMS/QMS Records/Operational Plan
Essential Supplies and Services	QMS-13	2019-06-18	CityHub/DWQMS/QMS Records/Operational Plan
Essential Supplies and Services List	QMS Table 13-01	2018-11-26	CityHub/DWQMS/QMS Records/Operational Plan
Review and Provision of Infrastructure	QMS-14	2018-11-26	CityHub/DWQMS/QMS Records/Operational Plan
Infrastructure Maintenance, Rehabilitation and Renewal	QMS-15	2019-06-18	CityHub/DWQMS/QMS Records/Operational Plan
Sampling Testing and Monitoring	QMS-16	2018-03-30	CityHub/DWQMS/QMS Records/Operational Plan
Measurement and Recording Equipment Calibration and Maintenance	QMS-17	2015-04-07	CityHub/DWQMS/QMS Records/Operational Plan
Measurement & Recording Equipment Calibration & Maintenance Schedule	QMS Table 17-01	2019-03-13	CityHub/DWQMS/QMS Records/Operational Plan
Emergency Management	QMS-18	2018-01-19	CityHub/DWQMS/QMS Records/Operational Plan
Internal Audits	QMS-19	2018-11-26	CityHub/DWQMS/QMS Records/Operational Plan
Internal Audit Schedule	QMS Form 19-01	2014-09-01	CityHub/DWQMS/QMS Records/Operational Plan
Internal Audit Checklist	QMS Form 19-02	2014-09-01	CityHub/DWQMS/QMS Records/Operational Plan
Internal Audit Report	QMS Form 19-03	2014-09-01	CityHub/DWQMS/QMS Records/Operational Plan

Document Master List

Management Review	QMS-20	2018-11-26	CityHub/DWQMS/QMS Records/Operational Plan
Management Review Agenda & Meeting Minutes	QMS Table 20-01	2008-11-17	CityHub/DWQMS/QMS Records/Operational Plan
Continual Improvement	QMS-21	2019-11-11	CityHub/DWQMS/QMS Records/Operational Plan
Waterworks Operation and Maintenance Manual	n/a	See Each Section	CityHub/Waterworks Operation & Maintenance Manual
Overall Responsible Operator Schedule	n/a	2018-12-19	CityHub/DWQMS/Staff Scheduling
Water Maintenance and Construction Forms	n/a	See Each Document	CityHub/Water Maintenance & Construction/ Forms & Templates
Waterworks Standby Schedule	n/a	2018-08-17	CityHub/Water Maintenance & Construction/ Staff Scheduling
Water Supply Forms	n/a	See Each Document	CityHub/Water Supply/Forms & Templates
Water Supply Staff Schedule	n/a	2019-05-29	CityHub/Water Supply/Staff Scheduling
Water Supply Sampling Schedule	n/a	2018-09-18	CityHub/Water Supply/Procedures & Guidelines/Sampling
Water Supply Sampling Locations Map	n/a	2018-11-29	CityHub/Water Supply/Procedures & Guidelines/Sampling

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 Procurement of Goods and Services 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	CityHub/Water Engineering/AWWA Standards

Record Master List

Record Name	Location	Minimum Retention Time	Maintained By
Water Operations Activity Report	Water Operations Technologists Office	5 years	Water Operations Technologists
Waterworks Record Change Reports	Water Operations Technologists Office	5 years	Water Operations Technologists
Hydrant Inspection Records	Enterprise GIS Database	10 years	Water Operations Technologists
Leading Water Distribution Operator Logbooks (Current Year)	Waterworks Crew Trucks	1 Year	Leading Water Distribution Operators
Leading Water Distribution Operator Logbooks (Past Years)	Water Operations Supervisors Office (Maintenance & Construction)	4 Years	Water Operations Supervisors (Maintenance & Construction)
Water Distribution Operator Training Records and Copies of Training Certificates (Current Year)	Water Operations Supervisors Office (Maintenance & Construction)	1 Year	Water Operations Supervisor (Quality Assurance)
Water Distribution Operator Training Records and Copies of Training Certificates (Past Years)	Water Quality Manager's Office	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 Reports	City of London Network Drive	5 Years	Water Supply Operators/ITS
Pumping Station/Reservoir/Sampling Station Weekly/Monthly Log Sheets	On-site at each Facility	5 Years	Water Supply Operators
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
Critical Control Limit Deviations	City of London Network Drive	5 Years	Water Supply Operators
Pumping Station and Reservoir Water Meter Calibration Records	City of London Network Drive	5 years	Water Operations Supervisor (Water Supply)/ITS

Record Master List

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
Audit Reports (Internal and External)	CityHub DWQMS Folder	5 years	Water Quality Manager/ITS
QMS Table 21-01 NC and OFI Tracking Sheet	CityHub DWQMS Folder	5 years	Water Quality Manager/ITS
Best Management Practices Review Meeting Minutes	CityHub DWQMS Folder	5 years	Water Quality Manager/ITS
Management Review Meeting Minutes	CityHub DWQMS Folder	5 years	Water Quality Manager/ITS
Operational Plan Document Changes Tracking Sheet	CityHub DWQMS Folder	5 years	Water Quality Manager/ITS
Management Review and Management Meeting Action Items Tracking Sheet	CityHub DWQMS Folder	5 years	Water Quality Manager/ITS
Annual Risk Assessment Review Minutes	CityHub DWQMS Folder	5 years	Water Quality Manager/ITS
Operational Plans that were the Subject of an Audit by an Auditor for the Accreditation Body	CityHub DWQMS Folder	10 Years	Water Quality Manager
Annual Reports as per Section 11 of Ontario Regulation 170/03	CityHub DWQMS Folder	6 Years	Water Operations Engineer/ITS
Summary Reports for Municipalities as per Schedule 22 of Ontario Regulation 170/03	CityHub DWQMS Folder	6 Years	Water Operations Engineer/ITS

1. Purpose

To document a description of the City of London Water System that includes 1) the name of the Owner and Operating Authority, 2) all treatment processes and distribution components, 3) a system flow chart, 4) a description of the water sources, and 5) 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 80-85% 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. If, at any time, one of these systems is incapable of providing water that meets Ontario's Drinking Water Quality Standards (O. Reg. 169/03) the supply of water from that system can be halted and the supply from the other system can be increased.

The Joint Boards of Management for the Lake Huron and Elgin Area Primary Water Supply Systems own and govern the respective systems. Both systems are operated and maintained by the Ontario Clean Water Agency (OCWA) under contract to the respective Joint Board of Management. The water supplied by the EAPWSS is fluoridated at the treatment plant. London receives un-fluoridated water from the LHPWSS, with fluoridation performed by London Operators at the Arva Pumping Station.

4. System Description

4.1. System Classification

The City of London Water System is classified as a Water Distribution Subsystem - Class 4. Due to its fluoridation and rechlorination processes, it is also classified as a Water Treatment Subsystem - Class 2.

4.2. Arva Pumping Station

The LHPWSS pumps treated water from the Grand Bend Treatment Facility to its 109,000 m^3 Arva Terminal Reservoir located approximately 1 km north of the City of London on Medway Rd, east of Wonderland Rd (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 system pumpage (pumpage from Arva P.S. plus pumpage from SERPS) for the next 24 hour period based on the expected daily consumption and the current water levels in the Springbank Reservoirs. The pumpage from the Southeast Reservoir and Pumping Station (SERPS) is set at 22.7 MLD. The Water Supply Operator enters start-time and stop-time set-points in the SCADA system (described below) for each Arva pump to achieve the desired station pumpage. 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.

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 in coordination with LHPWSS operators by valve operations, and the LHPWSS can pump water through the Arva P.S. to the London water system.

4.3. Elgin-Middlesex Pumping Station (London Portion) – (EMPS)

The EAPWSS pumps treated water from the Lake Erie Treatment Facility into two 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 three constant-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 evening 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 EMPS to the City of London’s Southeast Reservoir and Pumping Station through transmission mains owned by the City of London, running north along Highbury Avenue.

4.4. Southeast Reservoir and Pumping Station (SERPS)

The Southeast Reservoir and Pumping Station is located in London on Highbury Ave, south of Westminster Dr. Water is pumped from EMPS into a single, 113,000 m^3, dual-celled reservoir.

The pumping station consists of six variable speed horizontal centrifugal pumps. Four pumps are equipped with 373 kW (500 hp) electric motors, and two pumps are equipped with 112 kW (150 hp) motors. Water Supply Operators enter start-time and stop-time set-points in the SCADA system (described below) for each SERPS pump to achieve the desired station pumpage of 22.7 MLD. Water is pumped from the reservoir into a transmission main running north on Highbury Ave, supplying the Southeast Pressure Zone detailed below.

Rechlorination can be performed on the reservoir inlet piping or the station discharge piping or both, as detailed below. On-line analysers continually monitor inlet and outlet pH and free chlorine residual.

A diesel-powered, back-up generator provides emergency power for all electrical requirements including the station pumps.

If SERPS is unable to pump water for any reason, valve operations can be performed to bypass SERPS, allowing EMPS to pump directly into the London water system.

4.5. 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.

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 elevation of the 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 Low Level 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.

4.6. High Level Zones

Within the City of London are areas of higher elevation that cannot be adequately pressurized by the Arva P.S and the elevated water in the Springbank Reservoirs. These High Level Zones are pressurized by High Level Pumping Stations as detailed below. Each High Level Pumping Station is equipped with a diesel back-up generator so that pumping can be maintained during power outages.

4.6.1. Southeast Pressure Zone

SERPS serves a dual purpose; it transfers water from the EAPWSS into the London system, and it pressurizes the Southeast Pressure Zone. The Southeast Pressure Zone begins with the discharge water main from SERPS and extends northward along Highbury Ave. At the intersection of Highbury Ave. and Dingman Dr, the water main branches into two mains; with one running west along Dingman Dr to a Pressure Sustaining/Pressure Reducing Valve (PRV) at Dingman Dr and Castleton Rd, named PDC. The other branch continues north, eventually branching at the intersection of Commissioners Rd and Jackson Rd. One branch terminates in a second PRV in the intersection named PCJ, with the other branch continuing east along Commissioners Rd to a third PRV named PCE. The three PRVs maintain upstream pressure in the Southeast Pressure Zone, while allowing excess water to pass into the Low Level System.

4.6.2. 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 variable speed and two fixed speed vertical turbine pumps; Westmount P.S. is equipped with four variable speed vertical turbine pumps; and Pond Mills P.S. is equipped with three variable speed vertical turbine pumps. Water pressure set-points are programmed into the SCADA system, which maintains the desired pressure through automatic changes in pump speeds and duties.

4.6.3. Wickerson High Level Zone

The Wickerson High Level Zone is located in west London. The SCADA system maintains water pressure at the desired set-point using three variable speed vertical turbine pumps within the Wickerson Pumping Station located on Wickerson Rd.

4.6.4. Hyde Park High Level Zone

The Hyde Park High Level Zone is located in northwest London. The SCADA system maintains water pressure at the desired set-point using three variable speed vertical turbine pumps within the Hyde Park Pumping Station located on Hyde Park Rd.

4.6.5. Uplands High Level Zone

The Uplands High Level Zone is located in north central London. The SCADA system maintains water pressure at the desired set-point using four variable speed vertical turbine pumps within the Uplands Pumping Station located on Sunningdale Rd.

4.7. Rechlorination Facilities

4.7.1. Southeast Reservoir and Pumping Station

The water in the Southeast Reservoir has a residence time of approximately five days under normal operating conditions, during which time there is a decrease in free chlorine residual. Rechlorination is controlled by compound-loop controllers using residual and flow data. The water can be chlorinated as it enters the reservoir, or as it is discharged from the pumping station, or both. On-line chlorine analysers monitor the free chlorine residual in the water at these points, and rechlorination is initiated as required. The chlorinators at SERPS utilize compressed chlorine gas from 68 kg cylinders.

4.7.2. Springbank Reservoirs

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 rechlorinated if required. There are three discharge points by which water can exit the Springbank Reservoirs and enter the water mains; (1) north through a 1,200 mm concrete main in Reservoir Park to Hyde Park Rd, (2) east through a 900 mm concrete main on Commissioners Rd, and (3) south via Springbank Pumping Station (described below).

Rechlorination facilities are in place at each of these three discharge points:

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

On-line chlorine analysers monitor the free chlorine residual in the water at these points, and rechlorination is initiated as required in order to maintain a free chlorine residual of 0.50 mg/L in the reservoir discharge water. Rechlorination 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.

4.8. SCADA Control

A Supervisory Control and Data Acquisition system (SCADA) monitors the London water system, controlling pumping, fluoridation and rechlorination, 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 alarms generated by SCADA. The on-call operator carries a wireless device which can interface with the SCADA system.

4.9. Bulk Water Filling Stations

Bulk water haulers can access water to fill their tankers through any of eight (8) Bulk Water Filling Stations distributed throughout London. The stations are operated using customer access cards, which are provided by the City when customer accounts are registered. Customers can access their accounts on-line to pre-purchase additional water. Each station is equipped with a Reduced-Pressure-Principle Backflow Preventer to prevent contamination of the distribution system.

5. 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. The Municipality of Middlesex-Centre is both the Owner and the Operating Authority for these subsystems.

6. System Flow Chart

QMS Appendix 6-A (The City of London Water System Flow Chart) provides a visual overview of the major components and water flow through the City of London Water System. The SCADA system provides schematic representations of the process flow for each of the major system components (Pumping Stations, Reservoirs, Rechlorination facilities, etc.) A detailed Process and Instrumentation Diagram (P&ID) is maintained for the Water System by Water Operations Technologists. Hard copies of relevant portions of the P&ID are posted at each pumping station and reservoir.

7. References

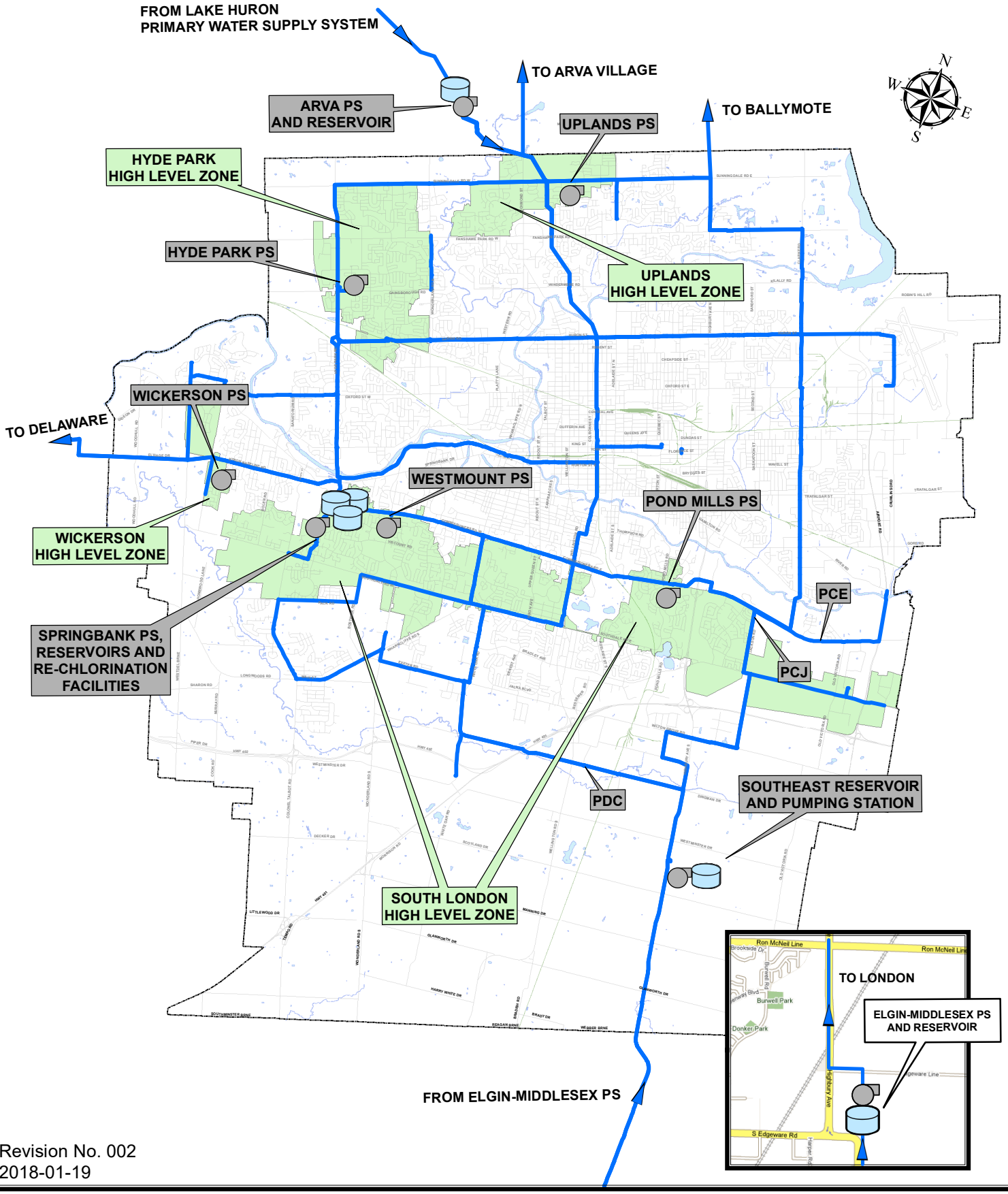
None

8. Appendices

QMS Appendix 6-A System Flow Chart

QMS Appendix 6-A

The City of London Water System Flow Chart



Revision No. 002
2018-01-19

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, including those specifically identified by the regulating provincial Ministry
- assess and rank the risks associated with the occurrence those hazardous events,
- identify control measures to address the potential hazards and hazardous events,
- identify Critical Control Points (CCPs) within the drinking water system,
- identify a method to verify the currency of the information and the validity of the assumptions used in the risk assessment at least once every calendar year,
- ensure that a risk assessment is conducted at least once every thirty-six months, and consider the reliability and redundancy of the equipment.

2. Procedure

For the purpose of London's Risk Assessment Reviews, a "Source water supply shortfall" shall be defined as a shortfall in excess of three (3) days, and a "Sustained pressure loss" shall be defined as a system pressure loss in excess of twenty-four (24) hours. In addition the Long Term Impacts of Climate Change are defined as:

- Increased average temperatures
- Increased annual precipitation
- Decreased annual precipitation
- Increased intensity of precipitation events

2.1. Annual Review Process

2.1.1. At least once every calendar year, or following a major process change, the QMS Representative will facilitate a review of the currency of the information and validity of the assumptions used in the risk assessment process. This is undertaken by a team comprised of (at a minimum) the QMS Representative, the Manager of Water Operations and the Water Operations Supervisor (Water Supply). In conjunction with this meeting, a review of the list of emergency situations or service interruptions is completed as per section 2.1.1 of QMS-18.

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 that have occurred
- Critical Control Point deviations
- QMS non-conformances related to standard operating procedures

2.1.3. The risk assessment is completed using Risk Assessment Form 07-02. The previous year's completed form is used as a template during the review. Newly identified system components, hazardous events/hazards, potential results of hazards, and control measures are inserted into the previous year's form and removed items are deleted. Where changes are made to the previous year's completed form, the Likelihood, Severity and Detectability ratings are re-evaluated. 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 score 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), which is a system component or process at which (1) the Operating Authority can apply and measure the effect of control measures to prevent or reduce adverse impacts on drinking water quality, and (2) there exists an elevated risk of adverse impacts to drinking water quality due to identified potential hazards/hazardous events. Recommended Minimum CCPs are assigned for hazardous events/hazards associated with maintaining a secondary disinfectant residual and are deemed to be critical regardless of the calculated Risk value. 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.

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

Triennial Review Process

2.1.5. At least once every thirty-six months, 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 QMS Representative, the Manager of Water Operations, the Water Operations Supervisor (Water Supply) and one additional Water Operations Supervisor. The triennial review encompasses the same process as the annual review but, in addition, the Likelihood, Severity, and Detectability ratings are re-evaluated for each hazardous event/hazard for each system component.

2.2. Document and Records Management

2.2.1. The QMS Representative is responsible for ensuring that minutes are taken during the annual and triennial review meetings, and that the minutes are maintained as per QMS-05 Document and Records Control.

2.2.2. The QMS Representative is responsible for maintaining and making any necessary changes/updates to Table 08-01 Risk Assessment Outcomes as per QMS-05 Document and Records Control.

2.2.3. The QMS Representative is responsible for communicating any changes/updates to Table 08-01 Risk Assessment Outcomes to the Division Manager of Water Engineering for consideration in the review and provision of infrastructure (QMS-14).

2.2.4. The QMS Representative is responsible for ensuring that any necessary changes are made to the training requirements, operating 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
QMS-18	Emergency Management

City of London Water System
Risk Assessment Rating Table

Likelihood Ratings for 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

Severity Ratings for 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

Detectability Ratings for 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

City of London Water System Risk Assessment Form

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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. Risk Assessment Outcomes

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.

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

3. Procedures and Processes

The Water Operations Division Standard Operating Procedure titled "*Critical Control Limit Deviation Response*" outlines the processes and procedures to monitor the critical control limits, as well as the procedures to respond to deviations from the critical control limits, and to report and record such deviations.

4. References

QMS-05 Document and Records Control
QMS-07 Risk Assessment
Water Operations Division SOP - Critical Control Limit Deviation Response

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

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 (3)
      - Senior Technologist (2)
      - Technologist II (4)
    - Engineer-in-Training
    - Water Demand Manager
      - Water Demand Technologist (2)
    - Divisional Administrative Assistant
  - Division Manager Water Operations
    - Environmental Services Engineer
      - Technologist II (2)
    - Manager Water Operations
      - Water Operations Supervisor (Capital Inspection)
        - Waterworks Inspector (4)
      - Water Operations Supervisor (Water Mains)
        - Leading Water Distribution (2)
        - Water Distribution Operator 2 (5)
        - Water Distribution Operator 1 (3)
      - Water Operations Supervisor (Training/Hydrants)
        - Leading Water Distribution (2)
        - Water Distribution Operator 2 (5)
        - Water Distribution Operator 1 (4)
      - Water Operations Supervisor (Water Services)
        - Leading Water Distribution (2)
        - Water Distribution Operator 2 (5)
        - Water Distribution Operator 1 (3)
      - Water Operations Supervisor (Water Meters)
        - Water Meter Servicer (6)
        - Water Operations Plumber (2)
    - Water Quality Manager (QMS Representative)
      - Water Operations Supervisor (Water Supply)
        - Water Supply Operator (5)
        - Waterworks Communications Coordinator (2)

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

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

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

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	operational policy, strategy and procedures - 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 for both the Distribution and Treatment Systems - See QMS representative requirements - Assumes Overall Responsible Operator duties (ORO) on a regular, rotating basis	- Makes recommendations on improvements to QMS - Undertakes inspections with MECP and is key liaison person with MECP for water quality and QMS related issues - Oversees Operator Certification training and Certificate renewals

Roles	Responsibilities	Authorities
	- Compliance Officer under Safe Drinking Water Act - Prepares and maintains associated records, reports and paperwork - 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	- Develops, recommends, and implements technical and 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 for the Distribution System - 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 (ORO) duties on a regular, rotating basis - Acts as Operator in Charge for both the Distribution and Treatment Systems - Supervises Water Supply staff for maintenance and operations of treatment and secondary	- 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

Roles	Responsibilities	Authorities
	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 - 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.	preventative maintenance programs applied to the water distribution infrastructure - Supervises work (quality and safety) of operators and on-site contractors - 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 Operations Environmental Services Engineer - Water Engineering	- 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, Training/Hydrants, and Capital Inspection)	- Acts as Operator in Charge for the Distribution System - Supervises Distribution Operators for maintenance, operations, repair, construction	- Makes recommendations on improvements to QMS - Reviews and advises on changes to Standard Operating Procedures

Roles	Responsibilities	Authorities
	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, 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	- 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 - 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 (Water Meter Shop)	- Acts as Operator in Charge for the Distribution System - 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,	- 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

Roles	Responsibilities	Authorities
	emergency, and operating procedures for the distribution and transmission system components.	
Waterworks Communications Coordinator	- Coordinates communications with customers and staff and inputs information for customer service system, meter maintenance management system and water system repairs. - 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	- Makes recommendations on improvements to QMS - Coordinates distribution system emergency and standard work requirements - Coordinates customer care 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	- Conducts technical reviews and prepares engineering responses	- Makes recommendations on improvements to QMS

Roles	Responsibilities	Authorities
(Water Engineering Division)	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.	- Accesses and collect operational maintenance data required for document preparation or summary reports to managers
Leading Water Distribution Operator	- 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
Water Distribution Operator 2	- 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 - Makes operational records in log books and standard forms
Water Distribution Operator 1	- 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 - Makes operational records in log books and standard forms
Waterworks Inspector	- Acts as Operator in Charge for the Distribution System - Carries out all functions related to inspection of new and	- Makes recommendations on improvements to QMS

Roles	Responsibilities	Authorities
	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)	- 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
Water Supply Operator	- Acts as Operator in Charge for both the Distribution and Treatment Systems (new Water Supply Operators holding OIT certificates in Distribution and/or Treatment 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 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

QMS Table 10-01
Revision Number: 002
2018-03-19

Summary of Drinking-Water Related Staff Competencies

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"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 Services)	Water Operations Supervisor (Water Meters)	Water Technologist II	Leading Water Distribution Operator	Water Distribution Operator 2	Water Distribution Operator 1	Waterworks Inspector	Waterworks Communications Coordinator	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 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 CityHub.

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 as per Section 2.3.

2.3 Outside Regular 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 CityHub. Hard copies are also provided to each Water Supply Operator.

2.3.2 One Water Operations Supervisor (or Acting Supervisor), one Operator, 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 CityHub.

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 are notified weekly by a Water Operations Supervisor of any changes.

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

2.3.5 The Standby Operator 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.

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) Essential Suppliers (as identified in QMS-13); and 4) Public.

2 PROCEDURE

2.1.1 Relevant aspects of the Quality Management System are communicated between Top Management and the owner, operating authority personnel, essential 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 Management System Policy is made available to all Operating Authority personnel electronically and is posted in Operating Authority worksites. The policy is available to the public on the City of London website and is available in hard copy 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 meetings (generally on a monthly basis) as well as e-mails, phone calls, ad hoc 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 Essential 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 in person or through e-mails or phone calls. Suppliers can communicate issues through contact with the Purchasing Division, whereupon Purchasing communicates with Operating Authority staff 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.

2.5 Public:

2.5.1 Communication may be through London's website, media releases, newspaper ads, water bill inserts (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.

2.5.2 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

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 Procurement of Goods and Services Policy which are administered by the City of London Purchasing and Supply Division.

2.1.2 The Purchasing and Supply Division 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 Prior to issuance, the Purchasing and Supply Division forwards Tender Documents, Requests for Proposals, Requests for Quotations, and other bid documents to the Operating Authority for review.

2.1.4 The Procurement of Goods and Services Policy has price thresholds and thus some supplies (below the threshold) may be purchased directly by Water Operations from local sources.

2.1.5 Information regarding relevant procedures/specifications are included in the appropriate contract.

2.1.6 Water Operations typically performs all maintenance and repairs to the water infrastructure, however for the provision of services during emergency situations, the Operating Authority can engage local contractors that perform new water infrastructure installations each year in the City of London. In such cases, maintenance and repairs would be overseen by Operating Authority staff (e.g. Water Operations Supervisors, Waterworks Inspectors).

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

2.1.8 A list of suppliers and contracted services (Waterworks Operations & Maintenance Manual - Appendix B – Suppliers and Contracted Services) has been developed by Water Operations for essential drinking water related supplies and services.

2.1.9 The list is updated as changes are made, and the QMS Representative ensures that the list is reviewed at least once per calendar year by the Water Operations Supervisors 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 Distribution Operator 2 (Maintenance and Inventory) through staff signing out material.

2.2.3 After hours, staff may sign out 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 Procurement of Goods and Services 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 identifies the essential supplies and services critical to the provision of safe drinking water. The table provides a description of the method of procurement of the supplies or services, and the method by which the quality of the supply or service is ensured, in as much as they may affect drinking water quality.

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 and Supply Division (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 and Supply Division preventing them from bidding for up to 3 years.

3 REFERENCES

Table 13-01 Essential Supplies and Services
Waterworks Operations & Mtce. Manual-Appendix B – Suppliers and Contracted Services
Purchasing By-Law
Procurement of Goods and Services Policy

Essential Supplies and Services List

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
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	NSF approved/AWWA specifications applicable - Certificate of Analysis provided with each shipment
Laboratory Services (microbiological, analytical, physical, chemical)	Contract with accredited lab 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)

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 watermain 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 watermains and services in the system. An in-house software package known as the Watermain Condition Assessment Program (WCAP) assigns weighted point values to each section of watermain 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 watermain 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 and steel trunk watermains.

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

2.1.5 The outcomes of the annual Risk Assessment Reviews (QMS-08) are also considered for infrastructure evaluation and project consideration, wherein specific infrastructure improvements or replacements may reduce the likelihood or impact of a hazard or hazardous event.

2.1.6 The priority list of water projects is reviewed and Water Engineering coordinates with other infrastructure 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.

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

2.1.8 A yearly Capital Works budget is developed and provided to Council each calendar year. 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.

2.1.9 Water Engineering identifies 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 projects are put back onto the priority list for the following year.

2.1.10 Operating budgets are also used to address infrastructure needs and maintenance. Budgets can be increased if new initiatives are identified and implemented.

2.1.11 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.

3 REFERENCES

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

1 PURPOSE

To document a summary of the infrastructure maintenance, rehabilitation, and renewal programs for the drinking water system, including long-term forecasting of major infrastructure maintenance activities. 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 LONG-TERM FORECASTING OF MAJOR INFRASTRUCTURE MAINTENANCE ACTIVITIES

2.1.1 As detailed in QMS-14, planning for infrastructure 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.

2.2 PREVENTIVE MAINTENANCE – WATERMAINS

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

2.2.2 Watermain 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 watermain 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 devices 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 (Watermains), who dispatches a repair crew.

2.3 PREVENTIVE MAINTENANCE – FACILITIES

2.3.1 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.

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

2.3.3 Maintenance is tracked electronically and in station log books and worksheets.

2.3.4 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.

2.3.5 The work is assigned to a team consisting of a Water Supply Operator and the appropriate Electrical Operations staff.

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

2.3.7 The work is scheduled by the Mechanical Maintenance Manager using a Computerized Maintenance Management System, and is assigned to a team of Mechanical Maintenance staff.

2.3.8 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.

2.4 UNPLANNED MAINTENANCE – FACILITIES

2.4.1 Maintenance work may be identified by Operators during regular visits to the facilities. The Operator notifies 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.

2.4.2 The Water Operations Supervisor (Water Supply) arranges for the necessary maintenance to be completed.

2.5 UNPLANNED MAINTENANCE (WATER MAINS AND APPURTENANCES)

2.5.1 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.

2.5.2 Reports received by the Waterworks Communications Coordinators are recorded in the

CRM (Customer Relationship Management) 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 CRM entry when the repairs are completed.

2.6 REPLACEMENT & REHABILITATION (CAPITAL PROJECTS)

2.6.1 Watermain 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.

2.6.2 Watermain replacement projects (watermain, 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 Distribution Operators.

2.7 EFFECTIVENESS OF MAINTENANCE

2.7.1 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.

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

2.7.3 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 watermains. 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

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 Ministry 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 re-chlorination facilities (Springbank Reservoirs and Southeast Reservoir and Pumping Station), 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 for 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)

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

Measurement & Recording Equipment Calibration & Maintenance Schedule

Equipment Description	Location	Calibration/Maintenance Frequency	Calibrated By
On-line pH Analyzers	Arva P.S. (pre and post fluoridation) and Southeast Reservoir and Pumping Station (SERPS) in Meter Room	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., Springbank P.S., SM4, SR1, SERPS (Inlet Room & Pump Room)	Checked Monthly – Calibrated as required based on monthly checks	Water Supply Operators
Portable pH Analyzer	Arva P.S. and SERPS	Weekly	Water Supply Operators
Portable pH Analyzers	Water Supply Shop	Prior to use and weekly if in continuous use	Water Supply Operators
Magnetic Flow Meters	Arva P.S. (2), Hyde Park P.S., Wickerson P.S., Uplands P.S., Pond Mills P.S., Westmount P.S., Springbank P.S., SM4, SR1, SERPS (3)	Yearly	Contracted Specialists
Insertion Flow Meter	SERPS	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,SERPS	Yearly	City Instrumentation Technologists
Reservoir Level Indicators	Springbank Reservoirs No. 1, 2 and 3 and SERPS	Yearly	City Instrumentation Technologists
Portable Fluoride Test Kits	Arva P.S. and SERPS	Quarterly	Water Supply Operators
On-line Fluoride Analyzer	Arva P.S. and SERPS	Checked daily against bench tester – Calibrated as required based on checks	Water Supply Operators
On-line Chlorine Analyzers	Arva P.S. (2), Hyde Park P.S., Wickerson P.S., Uplands P.S., Pond Mills P.S., Westmount P.S., Springbank P.S., SM4, SR1, SERPS (6)	Checked daily against DPD kits – 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
Portable Alkalinity Test Kits	Arva P.S. and SERPS	Prior to use	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 facilitates a review of the list of emergency situations or service interruptions that have been identified, and an examination of current operations to determine if additional emergency situations or service interruptions should be added to the list. This review is conducted as part of the annual Risk Assessment review meeting (QMS-07).

2.1.2 In addition, during the risk assessment process (including the annual and triennial 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, work stoppage, etc.
- 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)
- 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 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 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.

2.3.5 The QMS Representative will ensure that modifications are made to the procedures where required based on the review, testing, and/or debriefing following emergency situations.

3 REFERENCES

QMS-07 Risk Assessment

QMS-08 Risk Assessment Outcomes

QMS-10 Competencies

Standard Operating Procedures

Emergency Response Protocol

City of London Emergency Plan

1 PURPOSE

To document a procedure for internal audits that:

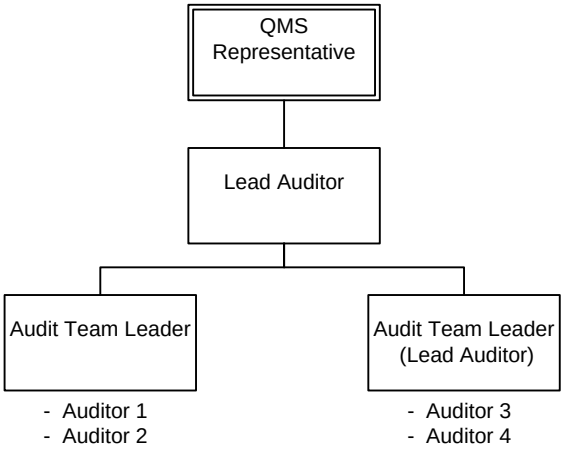
- Evaluates conformity of the QMS with the requirements of the DWQMS,
- Identifies internal audit criteria, frequency, scope, methodology and record keeping requirements,
- Considers previous internal and external audit results, and
- Describes how the QMS corrective actions are identified and initiated.

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 at least once every calendar 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

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**				
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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 every calendar 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 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

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

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 track and measure continual improvement of its Quality Management System (QMS).

2. Procedure

Continual improvement involves (a) reviewing and considering applicable Best Management Practices (BMPs), including any that may be published by the regulating provincial Ministry, (b) identifying and managing Corrective Actions for identified non-conformities in the QMS, and (c) identifying and implementing preventive actions to eliminate the occurrence of potential non-conformities in the QMS.

2.1. Applicable Best Management Practices

2.1.1. At least once every thirty-six months, the QMS Representative will facilitate a meeting to review applicable BMPs. This is undertaken by a team comprised of (at a minimum) the QMS Representative, the Division Manager of Water Operations, and the Manager of Water Operations. Prior to the meeting, the QMS Representative will prepare an agenda of BMPs to be reviewed.

2.1.2. The QMS Representative is responsible for ensuring that minutes are taken during the BMP Review Meetings, and that the minutes are maintained as per QMS-05 Document and Records Control.

2.1.3. The QMS Representative is responsible for ensuring that any necessary changes are made to the training requirements, operating procedures, or other parts of the QMS resulting from changes implemented as a result of a BMP Review Meeting.

2.1.4. BMPs may include, but are not limited to:

- drinking-water industry published standards (e.g. AWWA Standards)
- BMPs published by the regulating provincial Ministry
- practices adopted by other municipal drinking-water systems.

2.1.5. The Operating Authority will strive to have representatives attend local and provincial conferences and workshops to gain awareness of current practices in other municipal drinking-water systems and consider their potential application in the City of London drinking-water system.

2.2. Corrective Actions

2.2.1. QMS non-conformities may be identified as a result of the following:

- Internal and/or external audits
- Ministry Inspections
- Management Review / Management meetings
- Debriefing follow emergency situations
- Operational checks

2.2.2. The QMS Representative will consult with the appropriate Management staff to investigate the root cause(s) of the non-conformity, and identify the action(s) to be taken to correct the non-conformity and prevent its reoccurrence. The investigation may also include input from Operators or other Operating Authority staff.

2.2.3. The QMS Representative will document the corrective action investigation and implementation using QMS Table 21-01 NC and OFI Tracking Sheet.

2.2.4. The effectiveness of the corrective action(s) will be monitored by the QMS Representative on an ongoing basis, verified during subsequent internal QMS audits, and reviewed during the annual Management Review.

2.3. Preventive Actions

2.3.1. Preventive actions may be identified as Opportunities for Improvement (OFI) to the QMS as result of the following:

- Internal and/or external audits
- Ministry Inspections
- BMP Review Meetings
- Management Review
- Management meetings
- Customer complaints
- Debriefing follow emergency situations
- Staff suggestions
- Sharing of information with other members of the water industry during conferences, training, tradeshows, and directly from suppliers.

2.3.2. The QMS Representative will consult with the appropriate Management staff to consider whether an identified OFI is warranted as a preventive action. If a decision is

made to implement the preventive action, the responsibility for implementation will be assigned to the appropriate staff and a target completion date will be identified.

2.3.3. The QMS Representative will document the implementation of the preventive action using QMS Table 21-01 NC and OFI Tracking Sheet.

2.3.4. The effectiveness of the preventive action(s) will be monitored by the QMS Representative on an ongoing basis, verified during subsequent internal QMS audits, and reviewed during the annual Management Review.

3. References

QMS Table 21-01 NC and OFI Tracking Sheet