

Attachment C



**QUALITY MANAGEMENT SYSTEM
OPERATIONAL PLAN
MARKHAM DISTRIBUTION SYSTEM
REVISION 9.0**

TABLE OF CONTENTS

Table of Contents	1
Introduction	2
Element 1 – Quality Management System	3
Element 2 – Quality Management System Policy	4
Element 3 – Commitment and Endorsement	5
Element 4 – Quality Management System Representative	6
Element 5 – Document and Records Control	7
Element 6 – Drinking Water System	8
Element 7 – Risk Assessment	11
Element 8 – Risk Assessment Outcomes	12
Element 9 – Organizational Structure, Roles, Responsibilities and Authorities	13
Element 10 – Competencies	14
Element 11 – Personnel Coverage	15
Element 12 – Communications	16
Element 13 – Essential Supplies and Services	17
Element 14 – Review and Provision of Infrastructure	18
Element 15 – Infrastructure Maintenance, Rehabilitation and Renewal	19
Element 16 – Sampling, Testing and Monitoring	21
Element 17 – Measurement and Recording Equipment Calibration and Maintenance	22
Element 18 – Emergency Management	23
Element 19 – Internal Audits	25
Element 20 – Management Review	26
Element 21 – Continual Improvement	28
History of Changes	30

INTRODUCTION

PURPOSE

The purpose of this Operational Plan is to describe the comprehensive Quality Management System (QMS) developed and implemented by the City of Markham, Environmental Services Department for the operation and maintenance of its water distribution system.

This Operational Plan includes references to all components of the Drinking Water Quality Management Standard (DWQMS).

SCOPE

This Operational Plan covers the activities and personnel associated with all operational aspects of the drinking water system (distribution) for the City of Markham, Environmental Services Department.

This Operational Plan, the System Level Documents, Standard Operating Procedures, Work Instructions, and other DWQMS documentation that are referenced herein have been developed in accordance with the legislated requirements for the provision of safe drinking water in the Province of Ontario.

The scope of the water distribution system begins at the point where treated water enters the City of Markham watermains from the Region of York and/or City of Toronto pumping stations, storage facilities and/or trunk feeder mains. The water distribution system ends at the property lines of the consumers.

REFERENCES

Drinking Water Quality Management Standard (version 2.0)

Safe Drinking Water Act, 2002 and applicable regulations (Ontario)

Municipal Drinking Water Licence, Number 021-101

Drinking Water Works Permit, Number 021-201

Drinking Water System, Number 220004162

ACRONYMS

DWQMS – Drinking Water Quality Management Standard

DWS – Drinking Water System

MECP – Ministry of the Environment, Conservation and Parks

PD – Pressure District

PS – Pumping Station

QMS – Quality Management System

SCADA – Supervisory Control and Data Acquisition

SLD – System Level Document

SOP – Standard Operating Procedure

WTP – Water Treatment Plan

Draft

1. ELEMENT 1 – QUALITY MANAGEMENT SYSTEM

1.1 PURPOSE

The City of Markham is defined as both the Owner of the Markham Drinking Water System as represented by Council, and the Operating Authority, as represented by the Environmental Services Department. The City of Markham is required to attain conformance to the Drinking Water Quality Management Standard (DWQMS) developed by the Ministry of Environment, Conservation and Parks through the Municipal Drinking Water Licensing Program. This Operational Plan has been developed to represent the Operating Authority's Quality Management System (QMS) that conforms to the DWQMS.

1.2 DESCRIPTION

The Operational Plan applies to all activities, processes and practices related to the provision of safe drinking water by the City of Markham.

This Operational Plan was created by the Environmental Services Department to ensure that a trusted supply of safe and reliable drinking water for the customer of the City of Markham. It provides an understanding of the drinking water system, the responsibilities of both the Owner and the Operating Authority of the system, and a commitment to the provision of safe drinking water. The continual improvement of this Operational Plan and associated documents will ensure that all legislative and regulatory requirements are consistently being met and that consumers can be confident of the quality of their drinking water.

1.3 ASSOCIATED DOCUMENTS AND REFERENCES

Drinking Water Quality Management Standard

2. ELEMENT 2 - QUALITY MANAGEMENT SYSTEM POLICY

2.1 PURPOSE

The Quality Management System Policy establishes the principles and commitments of the City of Markham with regards to their QMS, as related to the drinking water system.

2.2 DESCRIPTION

The City of Markham's Quality Management System Policy is:

The City of Markham owns, operates and maintains the Markham Distribution System.

The City of Markham is committed to:

Trusted supply of safe and reliable drinking water for the customer

Achieve compliance with applicable legislation and regulations, while ensuring staff are trained and competent to perform their duties

Protect our drinking water and provide necessary resources for the maintenance and continual improvement of the quality management system.

2.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 2 – Quality Management System Policy

Quality Management System Policy

SOP 12 - Communications

3. ELEMENT 3 - COMMITMENT AND ENDORSEMENT

3.1 PURPOSE

To communicate the City of Markham's commitment to and endorsement of the QMS described in this Operational Plan.

3.2 DESCRIPTION

The City of Markham is committed to ensuring that a QMS is developed and implemented according to the requirements of the DWQMS. Steps will be taken to ensure that the established QMS complies with all applicable legislation and regulations and all resources that are required for the maintenance and continual improvement of the system are identified and provided. QMS information shall also be communicated to relevant parties according to SOP 12 – Communications.

The Operational Plan for the QMS has been reviewed and approved for the City of Markham by Top Management and endorsed by Council as Owner of the drinking water system. The City of Markham further commits to ensuring that the QMS is regularly assessed and updated as required, to confirm its continued applicability and relevance.

Top Management demonstrates its commitment and endorsement of the Operational Plan through the preparation and approval of QMS Management Report to Council. Written commitment and endorsement by Council is provided in the form of a resolution from the Council Meeting.

3.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 3 – Commitment and Endorsement

SOP 3a – Legal Awareness

SOP 12 - Communications

QMS Management Review Reports to Owner

Council Resolutions

4. ELEMENT 4 - QMS REPRESENTATIVE

4.1 PURPOSE

To identify the QMS Representative for the City of Markham and outline the associated responsibilities and authorities as prescribed in the DWQMS.

4.2 DESCRIPTION

The City of Markham has appointed and authorized the Quality Management System Coordinator as the Quality Management System Representative, who, irrespective of other duties, has the following responsibilities:

- a) Ensuring that processes and procedures needed for the QMS are established and maintained,
- b) Reporting to Top Management on the performance of the QMS and any needed improvement,
- c) With the cooperation of all Operating Authority staff, ensuring that current versions of documents required by the QMS are easily identified, retrievable and being used at all times,
- d) With the cooperation of all Operating Authority staff, ensuring that personnel are aware of all applicable legislative and regulatory requirements that pertain to their duties for the operation of the Markham Distribution System;
- e) Promoting awareness of the QMS throughout the operating authority.

Detailed responsibilities and authorities of the QMS Coordinator are outlined in the Standard Operating Procedure 9 – Organizational Roles, Responsibilities and Authorities.

4.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 4 – Quality Management System Representative

SLD 5a – Control of Documents

SLD 5b – Control of Records

SOP 9 – Organizational Roles, Responsibilities and Authorities

SOP 12 – Communications

5. ELEMENT 5 - DOCUMENT AND RECORDS CONTROL

5.1 PURPOSE

These procedures outline and define the process for managing, maintaining and protecting all documents and records required for the conformance of the QMS.

5.2 DESCRIPTION

The system level document procedures, SLD 5a – Control of Documents and SLD 5b – Control of Records, describe how the QMS Operational Plan, documents and records are properly: identified, stored, protected, retained and disposed/discarded. The procedures also explain methods for ensuring legibility and irretrievability.

5.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 5 – Document and Records Control

SLD 5a – Control of Documents

SLD 5b – Control of Records

6. ELEMENT 6 - DRINKING WATER SYSTEM

6.1 PURPOSE

To provide an overview of the City of Markham's Drinking Water System.

6.2 DESCRIPTION

The Corporation of the City of Markham is defined as both the Owner of the Markham Drinking Water System as represented by Council, and the Operating Authority, as represented by the Environmental Services Department. The system supplies water to a population of approximately 353, 000 for residential, commercial, industrial, and institutional use. The drinking water system (DWS) is classified as a Class 2 Water Distribution System and the DWS number is 220004162. Information in the "Subject System Description Form – Schedule C" for the Markham Distribution System shall be kept current by the QMS Coordinator to meet the requirements of the Director's Directions for operational plans.

Water System Description

The Markham Drinking Water System is a distribution subsystem of the Region of York, with the Drinking Water System Owner and Operating Authority being the Region of York and the City of Toronto Transmission System, with the Drinking Water System Owner and Operating Authority being the City of Toronto.

Markham's distribution system connects to both the City of Toronto and the Region of York's water systems. The water distribution and transmission network in Markham is composed of watermains owned by Markham, the Region of York and the City of Toronto. Separate Operational Plans have been developed by the City of Toronto and the Region of York to describe their drinking water systems.

City of Markham purchases water from the Region of York and relies on the Region to ensure the provision of safe drinking water. Region of York has an agreement for purchase and supply of water with City of Toronto and the Region of Peel. Markham's local distribution watermains are fed from Region of York and Toronto Water trunk feeder mains connected between the pumping stations and storage facilities in the Region of York and City of Toronto. The City of Markham's distribution system is divided in three pressure districts (PDs): PD5, PD6, and PD7. The location of each PD is shown in Figure 1.

PD5 is integrated with the City of Toronto's water system south of Steeles Avenue and supplied directly by Toronto-owned pumping stations (PS) in Markham (Thornhill and Milliken PS's), Markham Reservoir and by supply points along Steeles Avenue. The supply points at McCowan and Steeles, and Woodbine and Steeles are directly fed from the City of Toronto (Kennedy PS). Two connections at Willowdale and Highland, and Yonge and Elgin usually outflow from Markham system to Toronto and Vaughan respectively. The pressure district 5M (PD5 modified) located at Kennedy and 14th Avenue is fed from Milliken PS and Milliken Tower.

The pressure district PD6 is supplied by the Regional system through the North Markham Reservoir and Bayview PS. The western side of PD6 (west of Highway 404 and south of Highway 7- known as pressure district 6A) and the area corresponding to Buttonville (generally bounded by 16th Avenue, Warden Avenue, Highway 7, and Highway 404, to the north, east, south, and west, respectively – known as pressure

district 6RA) are supplied from the Bayview PS and Dufferin Reservoir. The PD6 reduced pressure district 6RC located at McCowan and 16th Avenue is fed from the North Markham Reservoir.

Bayview PS also supplies water to the Town of Richmond Hill PD 6 through the Region of York transmission line in Markham. North Markham Reservoir is also the supply source for the Town of Stouffville zone 2 through Zone 2 PS.

The pressure district PD7 is located north-east corner of Elgin Mills and Hwy 404. This pressure district is supplied by the Richmond Hill PD7 PS, East Vaughan PD7 PS and Richmond Hill North Reservoir.

Water Source Description

The City of Toronto treats water and then transmits this water to the Markham system via Toronto/Region's transmission mains. The City of Toronto owns and operates four water treatment plants (WTPs): the R.C. Harris, R.L. Clark, F.J. Horgan, and Island WTPs. City of Toronto's water treatment facilities are surface water treatment plants that treat water from Lake Ontario with chemically assisted sedimentation, filtration, primary disinfection with chlorine, fluoridation, and chloramination to maintain chlorine residual throughout the distribution system (secondary disinfection). Since the City of Toronto's water distribution system is an interconnected pipe network, the water received by the Region of York, and the City of Markham may have been treated at any of the four plants. However, water received in Markham is most likely treated at the R.C. Harris, F.J. Horgan, and Island WTP, with the majority coming from F.J. Horgan.

The water transmitted from the Region of Peel to the Region of York is treated at Peel's Lakeview Water Treatment Facility. Water from Lake Ontario is treated at this facility by a process that includes chemically assisted sedimentation, filtration, primary disinfection with chlorine, and fluoridation. The treated water is then chloraminated (ammonia is added to maintain chlorine residual levels for longer periods of time) at the Airport Road PS prior to being fed to the Region of York.

The quality of the water supplied to Markham is monitored and controlled by the City of Toronto, Region of York, and the Region of Peel. Toronto's and York's SCADA systems control and operate their facilities in Markham. Chlorine residual is monitored at the City of Toronto's Milliken elevated tower, Milliken and Bayview Reservoirs, and the Region of York's Markham and North Markham Reservoirs. Markham has access to the Region of York's SCADA system. Markham does not have access to the City of Toronto's SCADA system, but can get data/information on request.

The City of Markham relies on the Region of York for notification of water related events which may directly affect the quality of the water supplied to the customers of the Markham distribution system. Source water event driven fluctuations and operational challenges are as described in the Region of York and City of Toronto's Operational Plans.

Common event-driven fluctuations, operational challenges and threats may include:

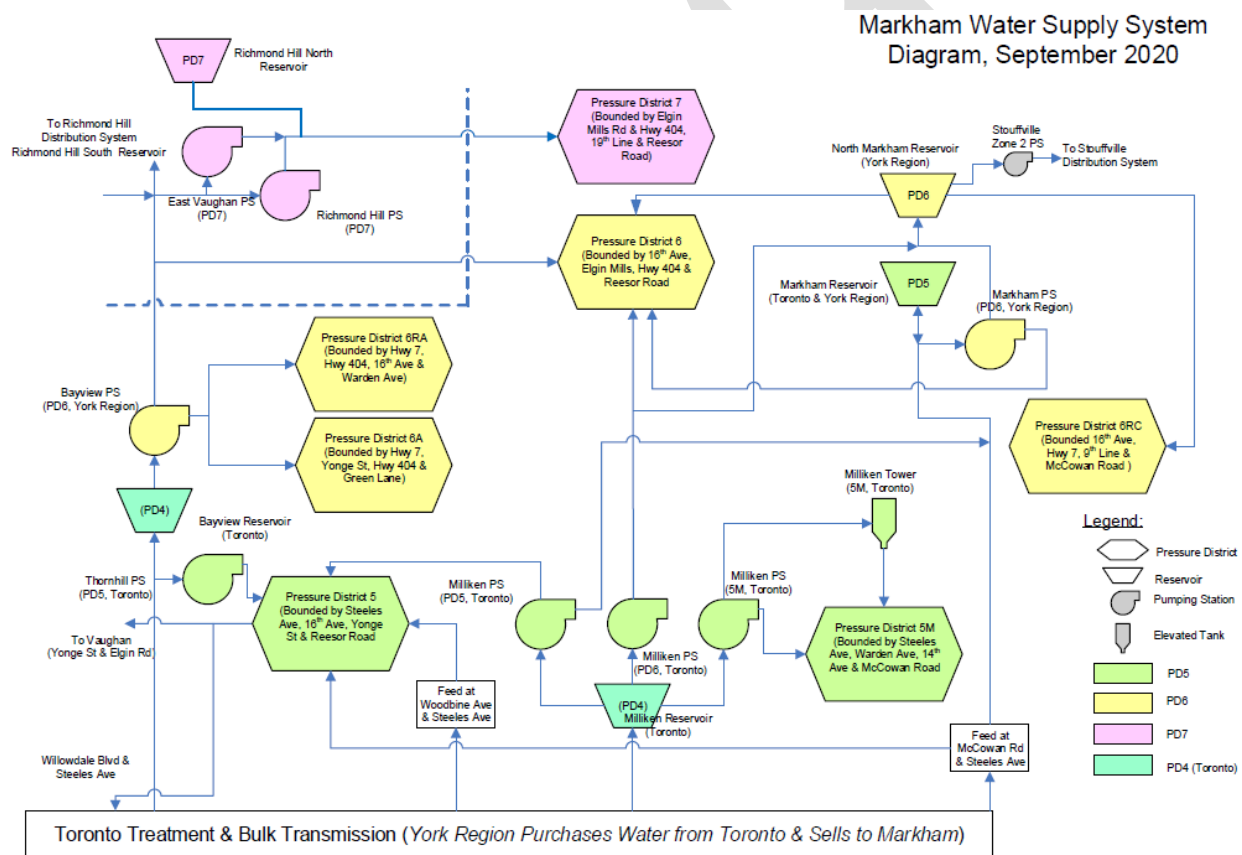
- Seasonal temperature changes which can impact settling and disinfection,
- Vertical lake turnover in spring and fall which can increase raw water turbidity,
- Algal blooms which can cause taste and odor issues, and
- Zebra mussels or debris which has the potential to block intakes.

System Infrastructure

The City of Markham operates and maintains its own watermain, valves, hydrants and water meters. In addition, in order to ensure the quality of the water, the City has a continuous chlorine analyzer, dead-end flushing stations and sampling stations throughout its distribution system.

The City of Markham has a dead-end flushing program to maintain disinfection residuals. The program includes manual flushing at hydrants and blow-offs; and auto flushing through auto flushing stations. The manual flushing targets and frequency was optimized to ensure water quality meets regulatory requirements through a managed program. Secondary disinfection residuals are also maintained through the watermain flushing program.

Figure 1



6.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 6 – Drinking Water System

Subject System Description Form – Schedule C

7. ELEMENT 7 - RISK ASSESSMENT

7.1 PURPOSE

To describe the method and approach taken by the City of Markham to identify, assess and where possible, mitigate and/or eliminate potential risks within the drinking water system. The focus of the assessment is on risks affecting the water quality and water quantity (capacity).

7.2 DESCRIPTION

A risk assessment process has been established to collectively identify, assess, rank, and prioritize potential drinking water related hazards and associated risks. This risk assessment process is conducted at least once every 36 months. The risk assessment considers the potential hazardous events and associated hazards, as identified in the Ministry of the Environment and Climate Change document titled *Potential Hazardous Events for Municipal Residential Drinking Water Systems* and its amendments.

The risk assessment also identifies additional potential hazardous events and associated hazards relevant to the City of Markham. A review is conducted at least once every calendar year to verify the currency of the risk assessment information and the validity of the assumptions used.

The methodology and approach taken to conduct the risk assessment is described in detail in SLD 7 – Water Risk Assessments.

7.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 7 – Risk Assessment

SLD 7 – Water Risk Assessments

Potential Hazardous Events for Municipal Residential Drinking Water Systems

8. ELEMENT 8 - RISK ASSESSMENT OUTCOMES

8.1 PURPOSE

To establish an effective and organized approach to conducting, assessing and improving hazard risks associated with the drinking water system.

8.2 DESCRIPTION

The risk assessment must be conducted as per SLD 7 – Water Risk Assessments. The results of the risk assessment are documented in SLD 8a – Water Risk Assessment Table. This table lists potential risks, their assessed values, control measures, critical control points and associated control limits. Responses to instances where control limits have been breached are identified in SOP 8a – Response to Deviations from Critical Control Points.

8.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 8 – Risk Assessment Outcomes

SLD 8a – Water Risk Assessment Table

SLD 8b – Markham Critical Control Point Table

SOP 8a – Response to Deviations from Critical Control Points

9. ELEMENT 9 - ORGANIZATIONAL STRUCTURE, ROLES, RESPONSIBILITIES AND AUTHORITIES

9.1 PURPOSE

To outline the organizational structure, as well as the roles, responsibilities, and authorities of personnel as it relates to the operation and performance of the City's QMS and Drinking Water System.

9.2 DESCRIPTION

The structure of the organization is depicted in the City of Markham's Organizational Chart.

The City of Markham is defined as both Owner of the Markham Drinking Water System as represented by Council, and the Operating Authority, as represented by the Environmental Services Department. Top Management is the management level in the Operating Authority responsible for conducting Management Reviews as outlined in QMS Element 20 – Management Review.

Top Management is represented by:

- Chief Administrative Officer,
- Commissioner, Community Services, and
- Director, Environmental Services

Roles, responsibilities and authorities of personnel as they relate to drinking water quality are summarized in SOP 9 – Organizational Roles, Responsibilities and Authorities.

9.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 9 – Organizational Structure, Roles, Responsibilities and Authorities

City of Markham Organizational Chart (located on Employee Intranet site)

Environmental Services Department Organizational Chart (located on Employee Intranet site)

SOP 9 – Organizational Roles, Responsibilities, and Authorities

10. ELEMENT 10 - COMPETENCIES

10.1 PURPOSE

To determine the competencies required for personnel performing duties directly affecting drinking water quality, and to identify the activities to develop and maintain competencies, and ensuring personnel are aware of the relevance of their duties and how they affect safe drinking water.

10.2 DESCRIPTION

SOP 10a – Competencies describes the process for identifying, developing and maintaining required competencies for personnel performing duties directly affecting drinking water quality. Additionally, it describes activities to ensure personnel are aware of their duties. Employee and training records show evidence of activities to meet and maintain the competencies described in the procedure, and to ensure personnel awareness.

10.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 10 - Competencies

SOP 9 – Organizational Structure, Roles, Responsibilities and Authorities

SLD 10 – Competencies

SOP 10a – Competencies

Training records

Performance & Development Reviews

11. ELEMENT 11 - PERSONNEL COVERAGE

11.1 PURPOSE

To identify how the City of Markham ensures that competent individuals are available to fulfill the responsibilities needed for the ongoing operation of the Markham Drinking Water System.

11.2 DESCRIPTION

The City of Markham will ensure that competent personnel are available at all times to fulfill duties that affect drinking water quality.

Competent personnel are available during normal hours of operation to perform work and on stand-by after hours to perform work and respond to emergencies.

The City of Markham shall ensure that all personnel included in the coverage schedules have the necessary skills and knowledge to perform the required responsibilities.

11.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 11 – Personnel Coverage

SLD 11 – Personnel Coverage

Personnel Coverage / Stand-by Schedule

12. ELEMENT 12 - COMMUNICATIONS

12.1 PURPOSE

To identify the process for communicating information related to the QMS Operational Plan to appropriate internal and external parties, and outline the method for receiving and processing related communication.

12.2 DESCRIPTION

Internal Communication

The QMS Operational Plan will be made available to all staff of the City of Markham. Access to the Operational Plan will be provided through the employee intranet.

For Environmental Services new hires, a QMS orientation will be provided by the QMS Representative. Existing Environmental Services staff will be notified of changes to the QMS. Internal training sessions will also be organized to review applicable information with required personnel.

Communication between the Operating Authority and the Owner will be managed by the Director of Environmental Services as part of Top Management. Information documented as a result of Management Review Meetings will be provided to the Owner in the form of a report.

External Communication

The QMS Policy and the QMS Operational Plan will be communicated to the public via the City of Markham's website as the principle method. Relevant aspects of the QMS will be communicated to all suppliers of essential supplies and services under *Element 13 – Essential Supplies and Services*. Information will be communicated during the formal tender process or request for proposal.

12.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 12 - Communications

SOP 12 - Communications

SLD 13 – Essential Supplies & Services

Quality Management System Policy

Environmental Services Staff Orientation Handbook

13. ELEMENT 13 - ESSENTIAL SUPPLIES AND SERVICES

13.1 PURPOSE

To describe the approach taken by the City of Markham through the Environmental Services Department to ensure that all supplies and services deemed essential for the delivery of safe drinking water are available and provided for when and where required.

13.2 DESCRIPTION

Environmental Services maintains a list of Essential Supplies & Services which describes and/or references methods for:

- i) procurement of essential supplies and services,
- ii) establishing and communicating quality expectations, and
- iii) ensuring quality expectations are met accordingly.

For all supplies and services listed, Environmental Services attempts, where possible, to multi-source and have an established, pre-approved supplier on call in cases of emergency.

In addition to the Essential Supplies and Services list, Environmental Services is also subject to the policies and procedures set forth in the City of Markham Purchasing By-law.

13.3 ASSOCIATED DOCUMENTS AND REFERENCES

City of Markham Purchasing By-law

DWQMS Element 13 – Essential Supplies and Services

SLD 13 – Essential Supplies and Services

SOP 13 – Essential Supplies and Services

SOP 13a – Essential Supplies, Equipment and Services Table

SOP 13b – Approved Material List

SOP 13c – Product Approval Procedure

14. ELEMENT 14 - REVIEW AND PROVISION OF INFRASTRUCTURE

14.1 PURPOSE

To identify the processes for the Environmental Services Department to review the adequacy of the infrastructure needed for the efficient operation and maintenance of its drinking water system and ensure the provision of this infrastructure.

14.2 DESCRIPTION

Infrastructure Review

The Environmental Services Department shall review the adequacy of the infrastructure necessary to operate and maintain the water distribution system at least once every calendar year. The review process will consider risk assessment outcomes as documented under Element 8, SLD 8a – Water Risk Assessment Table. Relevant information from the review will be captured in the report to Top Management.

The appropriate personnel will monitor trends in the performance of existing drinking water system infrastructure in order to create a plan for infrastructure management. Other inputs for review may include:

- Performance Measures such as adverse water quality incidents, hydrant and valve inspections, water loss and watermain breaks.
- Engineering consultant reports
- MECP inspection reports
- Staff and public suggestions
- Planned maintenance on roads and sewers

The objectives of the infrastructure review are to make recommendations for repair or replacement through the budget process.

Infrastructure Provision

The mechanisms by which repair or replacement recommendations are communicated to Council are:

- The capital and operating budget process
- A one-time funding request (for immediate needs)

Capital infrastructure projects are managed by City of Markham personnel and may be designed, constructed and/or inspected in house or contracted to engineering consultants and/or construction contractors.

14.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 14 – Review and Provision of Infrastructure

SLD 8a – Water Risk Assessment Table

SLD 14 – Review of Water & Wastewater Assets Infrastructure and Budget Process

SOP 14a – Infrastructure Review

SOP 14b – Annual Project Budget Development

Environmental Services Department Operating and Capital Budget Requests
Infrastructure Studies and Master Plans (as required)

Draft

15. ELEMENT 15 - INFRASTRUCTURE MAINTENANCE, REHABILITATION AND RENEWAL

15.1 PURPOSE

To identify current maintenance, rehabilitation, and renewal programs Environmental Services Department has in place for the drinking water system infrastructure. The long term forecast of infrastructure program activities will also be identified.

15.2 DESCRIPTION

Maintenance

The City of Markham's infrastructure maintenance program includes both preventive maintenance as well as corrective maintenance.

Preventive Maintenance

The Operations and Maintenance Section is responsible for planning and administering the planned maintenance programs related to the City of Markham's Drinking Water System.

The nature and frequency of planned preventive maintenance conducted for each area of infrastructure is based, where appropriate, on manufacturer's recommendations, industry standards, best practices and equipment manuals.

Corrective Maintenance

The Operations & Maintenance Section is responsible for ensuring that unscheduled maintenance work is done in reaction to system failure and/or reported or identified deficiencies.

Rehabilitation and Renewal Program

The Infrastructure Division is responsible for managing the rehabilitation and renewal programs and is also responsible for planning and budgeting.

The Infrastructure Division refers to the Water Assets Life Cycle Reserve Study and determines the capital budget needs for rehabilitation and/or renewal of infrastructure

Components of infrastructure renewal programs include:

- Watermain Cement Lining (One-Time Program),
- Cathodic Protection (20 year lifespan),
- Renewal of Watermains,
- Renewal of Appurtenances, Service Connections, Valves, Hydrants, etc., and
- Water System Condition Assessment.

Long Term Forecast

The long term forecast of major infrastructure maintenance, rehabilitation and renewal activities will be documented and reviewed as part of the Water Assets Life Cycle Reserve Study updated at least once every calendar year by the Infrastructure Division.

Maintenance Program Effectiveness

Data collected through the computerized maintenance management system is extracted to analyze the performance of the maintenance program. This is the responsibility of the Operations and Maintenance Section.

Regular review of the maintenance program is conducted on a monthly basis between the Operations and Maintenance Sr, Manager and the Waterworks Supervisors and/or designates. Action items are generated to address any identified issues.

Communication to Owner

Findings are communicated to the Owner through reports to council.

15.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 15 – Infrastructure Maintenance, Rehabilitation and Renewal

SOP 15a – Maintenance

SOP 15b – Rehabilitation and Renewal Programs

Operations and Maintenance Section Maintenance Schedule

Equipment Manuals

Water Assets Life Cycle Reserve Study

16. ELEMENT 16 - SAMPLING, TESTING AND MONITORING

16.1 PURPOSE

To describe the sampling, testing and monitoring program for drinking water quality within the City of Markham Drinking Water System.

16.2 DESCRIPTION

The City of Markham, Environmental Services Department is responsible for establishing and maintaining the sampling, testing and monitoring program that, at a minimum, meets regulatory requirements.

Regulatory Sampling, Testing and Reporting

There are sampling stations located throughout the distribution system where water samples are collected.

Frequency and location of sampling is determined to comply with regulatory requirements by designated Waterworks staff.

The samples are sent to an accredited laboratory for testing.

System Chlorine Residual Testing

System chlorine residual samples are collected and analyzed by certified operators to comply with regulatory requirements at designated locations throughout the City.

Regulatory Sampling, Testing and Reporting for System Interruption

The City of Markham, Environmental Services Department is responsible for provision of testing in special circumstances such as:

- Emergency Repairs, and
- Scheduled Repairs.

The samples are sent to an accredited laboratory for testing.

16.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 16 – Sampling, Testing and Monitoring

SLD 16a – Sampling

SLD 16b – Testing

SLD 16c – Monitoring

SOP 16a – Community Lead Testing Program

SOP 16b – Response to Adverse Water Quality Test Results

Safe Drinking Water Act, 2002 (Ontario)

Ontario Regulation 169/03 – Ontario Drinking Water Quality Standards

Ontario Regulation 170/03 – Drinking Water Systems

17. ELEMENT 17 - MEASUREMENT AND RECORDING EQUIPMENT CALIBRATION AND MAINTENANCE

17.1 PURPOSE

To describe the calibration program for all water sampling, monitoring and/or testing equipment and devices used by the City of Markham's, Environmental Services Department staff.

17.2 DESCRIPTION

Environmental Services uses the following list of equipment for sampling and testing activities:

- i. Colorimeter
- ii. pH Meter
- iii. Turbidity meter
- iv. Fluoride Meter
- v. Continuous chlorine analyzer

Equipment is uniquely identified by a serial number either on the item itself or on its container.

Equipment is subject to formal calibration and testing where appropriate. The calibration methods are unique to each item and performed as per manufacturer's recommendation and based on the Sampling and Testing Equipment chart in SLD 17– Calibration and Maintenance of Measurement and Recording Equipment.

17.5 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 17 – Measurement and Recording Equipment Calibration and Maintenance

SLD 17 – Calibration and Maintenance of Measurement and Recording Equipment

Manufacturers Maintenance Instructions

Calibration certificates

Calibration records

18. ELEMENT 18 - EMERGENCY MANAGEMENT

18.1 PURPOSE

To describe the process used by the City of Markham, Environmental Services Department to identify emergency situations and to manage its response to these events.

18.2 DESCRIPTION

The City of Markham will use the risk assessment process to identify potential emergencies and consider specific emergency preparedness activities.

SLD 18 – Emergency Management outlines the emergency preparation process and includes the following:

- a) Potential emergency situations or service interruptions
- b) Emergency response and recovery procedures,
- c) Emergency response training and testing requirements,
- d) Responsibilities of the Owner and Operating Authority personnel,
- e) How emergency response interacts with City of Markham Corporate planning,
- f) Emergency communication protocol and an up-to-date list of emergency contacts.

Employee training is conducted at least once per calendar year to ensure that the emergency response is well-understood by those responsible for carrying out response activities. Training is in the form of information sessions, desktop exercises, and where possible, mock emergency situation exercises.

18.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 18 – Emergency Management

SLD 8a – Water Risk Assessment Table

SOP 9 – Organization, Roles and Responsibilities and Authorities

SOP 11c – Calling Additional Resources and Operators

SLD 18 – Emergency Management

SOP 18a – Level 1 Emergency Response

SOP 18b – Level 2 Emergency Response

SOP 18c – Level 3 Emergency Response

SOP 18d – Level 4 Emergency Response

Environmental Services Business Continuity Plan

City of Markham Corporate Emergency Management Plan

19. ELEMENT 19 - INTERNAL AUDITS

19.1 PURPOSE

To describe the method for performing internal audits of the City of Markham's QMS to ensure that it has been properly implemented and conforms to the requirements of the DWQMS.

19.2 DESCRIPTION

The City of Markham shall conduct an internal audit at least once per calendar year to ensure that it is in conformance with established policies and objectives. The audit purpose is to evaluate the performance of the QMS against the specific requirements of the DWQMS.

Details of the internal audit program are described in SLD 19 – Internal Audits.

19.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 19 – Internal Audits

SLD 19 – Internal Audits

20. ELEMENT 20 - MANAGEMENT REVIEW

20.1 PURPOSE

To identify the process by which the City of Markham periodically reviews the performance of the QMS.

20.2 DESCRIPTION

At a minimum, one Management Review Meeting, covering the minimum agenda items, will be conducted at least once every calendar year to provide Top Management with the information required to review and evaluate the continued suitability, adequacy, and effectiveness of the QMS. Top Management members consists of the Chief Administrative Officer, Commissioner of Community Service and the Director of Environmental Services. Top Management conducts management reviews and quorum is met when at least two Top Management members are present.

The QMS Representative is responsible for coordinating the Management Review and to ensure each agenda item is covered. The required attendees of the Management Review include: Top Management, the QMS Representative, and applicable Environmental Services Managers or designated Section Leads.

Management Review Meeting Agenda

The following Management Review agenda must be addressed, and the groups responsible for each agenda item are listed in bracket below:

- a) Incidents of non-compliance with applicable regulations (System Engineering);
- b) Incidents of adverse drinking-water tests (System Engineering);
- c) Deviations from critical control point limits and corresponding actions taken (System Engineering, Operations & Maintenance);
- d) The effectiveness of the risk assessment process (System Engineering, Business Administration);
- e) Findings from internal and external audits (Business Administration);
- f) Emergency preparedness and response based on annual mock emergencies (Business Administration);
- g) Operational performance (Operations & Maintenance);
- h) Raw water supply and drinking water quality trends (System Engineering);
- i) Previous Management Review meeting action items (Business Administration);
- j) Updates on action items identified between Management Review meetings (Business Administration);
- k) Changes to services, activities, regulations, etc. that could impact the QMS (Business Administration);
- l) Consumer feedback (Information Management System & Capital Planning);
- m) Resources needed for QMS maintenance (Director of Environmental Services);
- n) Results of the infrastructure review (Infrastructure);
- o) The currency of the Operational Plan (Business Administration) and ;
- p) Comments and suggestions made by personnel (Business Administration).

For each agenda item, reports are generated and presented to Top Management. Minutes of the Management Reviews are documented, and shall include, at a minimum, the:

- List of attendees,
- Summary of agenda items discussed, decisions made, any identified deficiencies, and
- Record of action items including an indication of responsibility and proposed timeline.

An information report outlining the results of the Management Review meeting and any deficiencies will be submitted to the Owner by Top Management or designate.

20.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 20 – Management Review

Management Review – Meeting Agenda

Management Review – Meeting Minutes

General Committee Reports

21. ELEMENT 21 - CONTINUAL IMPROVEMENT

21.1 PURPOSE

Outline how the City of Markham will track and measure its efforts to continually improve the effectiveness of its QMS system. The City will seek continual improvement through best management practices, corrective actions and preventative actions.

21.2 DESCRIPTION

1. Best Management Practices

The City will review and consider applicable best management practices from the MECP or other sources at least once every 36 months.

2. Corrective Action

A process has been established to identify and manage QMS corrective actions that includes:

- i. Investigating the cause(s) of an identified non-conformity,
- ii. Documenting the actions(s) that will be taken to correct the non-conformity and prevent the non-conformity from re-occurring, and
- iii. Reviewing the action(s) taken to correct the non-conformity, verifying that they are implemented and are effective in correcting and preventing the re-occurrence of the non-conformity.

3. Preventive Action

A process has been established to identify and implement preventive actions to eliminate the occurrence of potential non-conformities in the QMS that includes:

- i. Reviewing potential non-conformities that are identified to determine if preventative actions may be necessary,
- ii. Documenting the outcome of the review, including the action(s), if any, that will be taken to prevent a non-conformity from occurring, and
- iii. Reviewing the action(s) taken to prevent a non-conformity, verifying that they are implemented and are effective in preventing the occurrence of the non-conformity.

21.3 ASSOCIATED DOCUMENTS AND REFERENCES

DWQMS Element 21 – Continual Improvement

SOP 21a – Continual Improvement

SOP 21b – QMS Updates

SOP 21c – Staff Suggestions

HISTORY OF CHANGES

Revision	Date of Issue	Descriptions
1.0	April 16, 2008	Original issue
2.0	July 3, 2009	Changes in all sections of the Operational Plan to address: (1) Recommendations made from an audit in Feb. 2009, to provide better linkage of the Operational Plan and the System Level Documents (2) To clarify weak areas in the Operational Plan (3) Modify wordings used throughout the Operational Plan to make the document flow better
3.0	November 8, 2011	Changes to relevant sections of the Operational Plan to address: (1) Organizational Change in August, 2011. (2) Corrective Actions and Opportunities for Improvement provided by CGSB for the 2010 Surveillance Audit. (3) Opportunity for Improvement from the Mock QMS Audit and Annual Document Review
4.0	December 18, 2012	Changes to relevant sections of the Operational Plan to address: (1) Element 3 – Edited & Summarized information. (2) Corrective Actions provided by CGSB for the 2011 Surveillance Audit. (3) Organizational name change on July 1, 2012. (4) Opportunity for Improvement from the Mock QMS Audit and Annual Document Review.
5.0	April 28, 2015	Changes to relevant sections of the Operational Plan to address: (1) Opportunity for Improvement provided by NSF for the 2014 Surveillance Audit. (2) Opportunity for Improvement from the Full Scope DWQMS Audit, Internal Audits and Annual Document Review.
6.0	September 30, 2015	Changes to relevant sections of the Operational Plan to address: (1) Opportunity for Improvement from Internal Audits and Annual Document Review.
7.0	March 17, 2016	Changes to relevant sections of the Operational Plan to address: (1) Corrective Actions and Opportunities for Improvement provided by SAI Global for the 2015 Accreditation Audit. (2) Corrective Action and Opportunities for Improvement from Internal Audits and Annual Document Review.
8.0	November 27, 2018	Changes to relevant sections of the Operational Plan to address: (1) The new DWQMS 2.0 Standard released.
9.0		Changes to relevant section of the Operational Plan to address: (1) Introduction – updated references and acronyms (2) Element 3 – clarified Top Management's endorsement (3) Element 6 – updated the system description

Revision	Date of Issue	Descriptions
		(4) Element 12 – clarified methods for communication and re-worded the reference to essential supplies (5) Element 18 – elaborated on the emergency management description (6) Element 20 – identified Top Management positions and the quorum required for Management Review meetings

Draft