



**Quality Management System  
Operational Plan  
Markham Distribution System  
Revision 2.0**

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## Introduction

As required by the Drinking Water Quality Management Standard (DWQMS), documentation is required to outline all the processes within the Quality Management System (QMS). The following structure is implemented as the QMS documentation structure for the Town of Markham:

### QMS Documentation Structure



Implementation of the DWQMS is divided into three steps – PLAN/DO, CHECK and IMPROVE. For the PLAN/DO step, the development and implementation of an Operational Plan is required and then followed by the documentation of the System Level Documents, the Standard Operating Procedures and Work Instructions as necessary for each individual process as required by DWQMS.

The Operational Plan is the highest level documentation in the structure and therefore it only defines the approach, organization and responsibilities for each element of DWQMS. In the next level down, the System Level Documents explain the "Who, What, When and Where" of the DWQMS elements in more detail. Under the System Level Documents are the Standard Operating Procedures where the "How" of specific tasks is documented. If there is a need to further expand a Standard Operating Procedure then specific Work Instruction is developed for a specific task. Generally it is expected that there can be multiple Work Instructions coming out from one single Standard Operating Procedure. Lastly, records are maintained as the proof of activities listed in the above levels of documents.

# 1. Element 1 – Quality Management System

## 1.1 Purpose

The Town of Markham, as the Owner and Operating Authority of the drinking water distribution system, is required to attain conformance to the DWQMS (Drinking Water Quality Management Standard) developed by the Ministry of Environment. This Operational Plan has been developed to represent the Operating Authority's Quality Management System (QMS) that conforms to DWQMS.

## 1.2 Scope

The Quality Management System as described in this Operational Plan applies to all the requirements prescribed in the DWQMS.

## 1.3 Definitions

Not applicable

## 1.4 Description

The ultimate goal of achieving DWQMS compliance must be fully understood, and activities must strive to meet the requirements of the standard. An organization is a network of interdependent, value-adding processes, and improvement is achieved through understanding and changing these processes to enhance the total system. To facilitate long-term improvements, a mindset of continuous improvement that is fostered by preventive rather than corrective measures should be applied to eliminate the root causes of non-conformances. Decisions are made based upon measured data, internal and external comparisons, and an understanding of the cause and effect mechanisms at work, not simply on the basis of instinct, authority or anecdotal data. A focus on continuous improvement is the cornerstone for breakthrough thinking and innovation. No matter how much improvement has been accomplished, there are always practical and innovative ways of doing even better, and of providing improved water quality to the customer.

## 1.5 Associated System Level Document (SLD)

Not Applicable

## 1.6 References

Drinking Water Quality Management Standard (DWQMS)

## 2. Element 2 - Quality Management System Policy

### 2.1 Purpose

To state and communicate Town of Markham's Quality Management System Policy.

Justice Dennis R. O'Connor, in Part Two of the Report of the Walkerton Inquiry, recommended the adoption of a quality management system for the drinking-water system. It was also recommended that a standard, specifically designed for drinking-water system, be developed and implemented in Ontario - the Drinking Water Quality Management Standard (DWQMS). The DWQMS implemented by the Province complies with Justice O'Connor's recommendation.

The Markham Drinking Water System is a distribution subsystem of the Region of York Transmission and Distribution System. Markham is responsible to maintain the quality of the water once it has entered the distribution system. Supplied water is treated either by the City of Toronto or the Region of Peel.

### 2.2 Scope

This plan describes the commitment of the Town of Markham to establish, adopt and manage a quality management system as a means to deliver safe drinking water and to enhance customer confidence in the quality of the drinking water.

### 2.3 Definitions

Not applicable

## 2.4 Description

### **Quality Management System Policy**

The Town of Markham shall provide safe drinking water that is compliant with the Safe Drinking Water Act and applicable regulations and legislation, by:

- The maintenance and continual improvement of the Quality Management System for the Markham Water Distribution System by adhering to the requirements of the Drinking Water Quality Management Standard and the principles embodied in the Standard.
- Adopting the principles of Quality Management in the design, construction and operation of the Drinking Water System. Markham will strive to use the best available, cost-effective technology, materials, management and planning methodologies to ensure that the infrastructure is well operated, maintained and managed in support of the provision of safe drinking water.
- Building and maintaining a leading organization through emphasis on development of staff expertise and knowledge through targeted training programs and continuous employee development. Markham will ensure that all staff with duties that directly affect the drinking water quality is trained and competent to perform their duties.
- Markham will review and continually improve its practices affecting the provision of safe drinking water against industry best practices and industry standards. The performance of the system and the policy will be communicated to the Owner & Management of the Town's water system, as well as staff and customers.

## 2.5 Associated System Level Document (SLD)

Not Applicable

## 2.6 References

Operational Plan Element 12 Communications

### 3. Element 3 - Commitment & Endorsement

#### 3.1 Purpose

To communicate Top Management's commitment to and endorsement of the Quality Management System described in this Operational Plan.

#### 3.2 Scope

Commitment & Endorsement refers to the Quality Management System as described in the Operational Plan, for the Waterworks Division of the Town of Markham.

#### 3.3 Definitions

Corporate Top Management – Chief Administrative Officer, Commissioner of Community and Fire Services, Director of Operations, General Manager Waterworks

#### 3.4 Description

Town of Markham is committed to ensuring that a Quality Management System (QMS) is developed and implemented according to the requirements of the Drinking Water Quality Management Standard (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 that identified and provided.

The Operational Plan for the QMS has been reviewed and approved for the Town of Markham by the Corporate Top Management of the organization. Corporate Top Management, the Mayor and Council of the Corporation of the Town of Markham who are committed to endorsing the contents of the Operational Plan and demonstrating ongoing dedication to the success of the QMS program and continual improvement through the determination, obtaining or provision of resources necessary for maintaining and improving the QMS.

The Town of Markham further commit to ensuring that the QMS is regularly assessed to confirm its continued applicability and relevance.

Written endorsement by the Mayor and Council of the Corporation of the Town of Markham and Corporate Top Management is to be provided in the Resolution of Council Meeting for the Quality Management System Operational Plan Endorsement Report. To promote awareness and understanding of the QMS, this written endorsement of the Operational Plan will be communicated to relevant parties according to the Communications Procedure.

#### 3.5 Associated System Level Document (SLD)

Not Applicable

#### 3.6 References

Not Applicable

## 4. Element 4 - QMS Representative

### 4.1 Purpose

To identify the QMS Representative for the Town of Markham and outline the associated responsibilities.

### 4.2 Scope

This plan applies to the QMS Representative selected for the Town of Markham.

### 4.3 Definitions

Not applicable

### 4.4 Description

The QMS Controller has been appointed as the QMS Representative by the Town of Markham. The QMS Representative is authorized and responsible for administering all processes associated with the operation and performance of the QMS. This individual will also report on the performance of the QMS and the need for improvement to Top Management through regular management review meetings. Detailed roles and responsibilities of the QMS Controller are outlined in the System Level Document for Organizational Structure, Roles & Responsibilities.

Details on the performance of the QMS and needs for improvement will be identified through the established Continual Improvement Procedure. This information will be communicated to Top Management during management review meetings, which will be held at least once every twelve months.

The Town of Markham Waterworks Division's document control system will be used to ensure that all personnel have access to the most current versions of documentation used as part of the QMS. The currency of externally-controlled documents (e.g. annual reports, chain of custody) will also be managed through the records control process. These processes are outlined in the System Level Documents for Document Control and Records Control.

Section Managers will ensure that all personnel are aware of applicable legislative and regulatory requirements that apply to their responsibilities within the operation of the QMS. The availability of current documentation will be managed and documented using a formalized regulation management process.

The awareness of the QMS will be promoted to personnel through staff meetings, annual information meetings, internal audits, and to Corporate Top Management through management review meetings. A formal communications process will also be used to promote awareness throughout the Town of Markham.

### 4.5 Associated System Level Document (SLD)

Not applicable

## 4.6 References

SLD 5a – Control of Documents

SLD 5b – Control of Records

SLD 9 – Organizational Structure, Roles & Responsibilities

SOP – Regulation Tracking

SOP – Corrective Action

SOP – QMS Updates

## 5. Element 5 - Document & Records Control

### 5.1 Purpose

To ensure that all QMS related documents and records are maintained and controlled according to established protocols and procedures.

### 5.2 Scope

All documents and records related to the QMS, including internal and externally generated documents and records. QMS related documents and records are those as per required by the Drinking Water Quality Management Standard and for activities that will impact the quality and safety of the Town's Drinking Water.

All forms and types of media fall under the scope of this document and records control policy.

### 5.3 Definitions

**Documents** – Policies, System Level Documents, Standard Operating Procedures, Work Instructions, Forms, Regulations.

**Records** – Any documents that contain recorded data such as inspection sheets, time logs, training records, meeting minutes, internal auditing results, work orders, etc.

### 5.4 Description

A procedure for both documents and records control has been established to describe the methods and activities for ensuring that documents and records are properly:

- i) Identified
- ii) Stored
- iii) Protected
- iv) Retained
- v) Disposed/Discarded

The procedures also explain methods for ensuring legibility and irretrievability.

### 5.5 Associated System Level Document (SLD)

SLD 5a – Control of Documents

SLD 5b – Control of Records

### 5.6 References

Not Applicable

## 6. Element 6 - Drinking Water System

### 6.1 Purpose

This document describes the Town of Markham's drinking-water system. It presents an overview of the main components of Markham's water infrastructure, and provides details regarding its connections to Region of York's and City of Toronto's water transmission systems.

### 6.2 Scope

This description provides background information for the risk assessment documented in Elements 7 and 8.

### 6.3 Definitions

Not applicable

### 6.4 Description

#### *Water System Description*

The Markham Drinking Water System is a distribution subsystem of the Region of York and the City of Toronto Transmission System.

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.

Town of Markham purchases water from the Region of York, which in turn purchases it from the City of Toronto and the Region of Peel. Markham's local distribution watermains are fed from York Region and Toronto Water trunk feeder mains connected between the pumping stations and storage facilities in the Region of York and City of Toronto.

The Town 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 Ave. and supplied directly by Toronto-owned pumping stations in Markham (Thornhill and Milliken PS's) and by supply points along Steeles Avenue. The supply points at McCowan & Steeles and Woodbine & Steeles are directly fed from Toronto (PD4, Kennedy PS). Two connections at Willowdale & Highland and Yonge & Elgin usually outflow from Markham system to Toronto and Vaughan respectively. The pressure district 5M (PD5 modified) located at Kennedy & 14<sup>th</sup> Ave is fed from Milliken PS and Milliken Tower.

The pressure district PD6 is supplied by the Regional system through the Markham PD6 PS, Markham Reservoir, 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 16<sup>th</sup> Ave., Warden Ave., 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 & 16<sup>th</sup> Ave is fed from Markham PS, North Markham reservoir and Wooten Way Tower.

The pressure district PD7 is located north-east corner of Elgin Mills & Hwy 404. This pressure district is supplied by the Richmond Hill PD7 PS from the water main on Elgin Mills Road.

### *Water Source Description*

The City of Toronto treats water from Lake Ontario 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 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 Town 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.

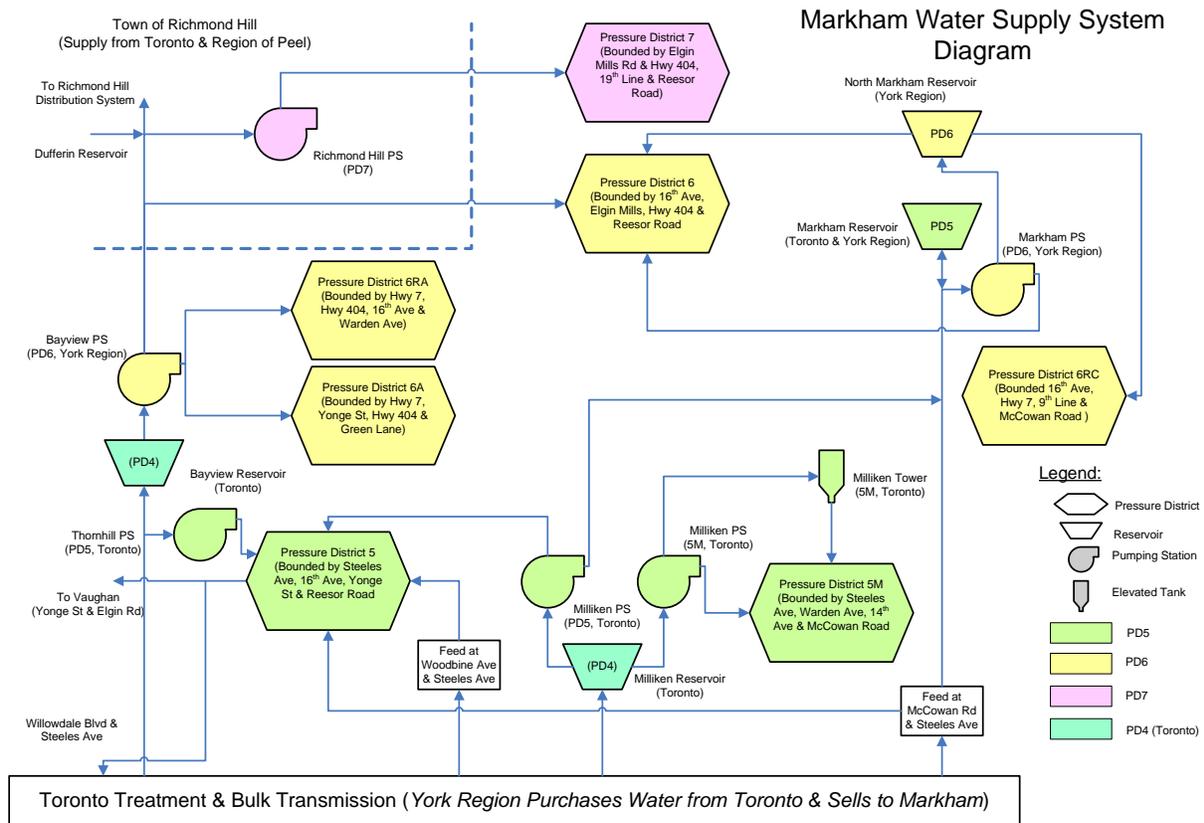
The water transmitted from the Region of Peel to the Region of York is treated at Peel's Lakeview Water Treatment Facility. Lake Ontario water is treated at this facility by a process that includes chemically assisted filtration, primary disinfection with chlorine, and fluoridation. The treated water 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 and Bayview reservoirs, and the Region of York's Markham and North Markham reservoirs. Markham does not have real-time access to York's/Toronto's SCADA systems, but can get data/information on request.

### *System Infrastructure*

The Town of Markham operates and maintains its own watermains, valves, hydrants and water meters. In addition, in order to ensure the quality of the water, the Town has dead-end flushing stations and sampling stations throughout its distribution system. Figure 1 below shows the main components of Markham's water distribution system.

Figure 1



## 6.5 Associated System Level Document (SLD)

Not Applicable

## 6.6 References

Not Applicable

## 7. Element 7 - Risk Assessments

### 7.1 Purpose

To describe the methods and approaches taken by the Town of Markham to identify, assess and where possible, mitigate and/or eliminate potential risks within the drinking-water system.

### 7.2 Scope

This plan and associated procedures apply to the entire drinking water distribution system within the Town of Markham. It also includes risks that relate to connecting systems.

The risk assessment process considers, but is not limited to, hazard categories such as:

1. Biological
2. Chemical
3. Radiological
4. Physical

### 7.3 Description

A risk assessment team is established to collectively identify, assess, rank and prioritize potential drinking water related hazards and related risks. This risk assessment process is conducted at least once every 3 years.

The related Risk Assessment and Risk Assessment Outcome procedures describe in detail the methodologies and approaches taken to conduct these assessments and related activities.

Where appropriate, the team identifies critical control points and establishes control measures to help mitigate or eliminate identified risks.

The risk assessment team meets at least once per year to ascertain the currency and validity of the risk assessments and their associated assumptions.

### 7.4 Associated System Level Document (SLD)

SLD 7 – Risk Assessment

### 7.5 References

Not Applicable

## 8. Element 8 - Risk Assessment Outcomes

### 8.1 Purpose

To describe the approach taken by the Town of Markham to document the outcomes of the risk assessment activities undertaken as per Risk Assessment procedures.

### 8.2 Scope

This plan and associated procedures apply to the risk assessments conducted per Element 7 – Risk Assessments.

### 8.3 Description

The results of the risk assessments are documented on the Risk Assessment Spreadsheet that can be maintained manually or online. This table lists all risks, their assessed values, control measures, critical control points and associated control limits and responses to instances where control limits have been breached.

### 8.4 Associated System Level Document (SLD)

SLD 8 – Risk Assessment Outcomes

SLD 8a – Markham Distribution System Risk Assessment Table

SLD 8b – Markham Critical Control Point Table

### 8.5 References

Not applicable

## 9. Element 9 - Organizational Structure, Roles, Responsibilities and Authorities

### 9.1 Purpose

To outline the organizational structure of Waterworks and associated departments, Commissioners and Owners as well as their associated roles, responsibilities, and authorities that relate to the operation and performance of its Quality Management System (QMS).

### 9.2 Scope

This policy and associated procedures apply to all personnel of Waterworks and associated departments.

### 9.3 Definitions

Not applicable

### 9.4 Description

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

The Corporation of the Town of Markham is identified as the Owner of the QMS that is operated by the Waterworks Division. Authority for this system is defined corporate-wide.

In the context of DWQMS/QMS responsibilities and authorities, the following function(s) represent Corporate Top Management:

- Chief Administrative Officer (CAO), Commissioner of Community & Fire Services; Director of Operations, and the General Manager of Waterworks.

Roles and responsibilities of Waterworks personnel, as they relate to drinking water quality, are summarized in the System Level Document for Organizational Structure, Roles & Responsibilities.

Management Review is undertaken with the inclusion of the following functions, at a minimum:

- General Manager of Waterworks, QMS Representative and Section Leads

### 9.5 Associated System Level Document (SLD)

SLD 9 – Organizational Structure, Roles & Responsibilities

### 9.6 References

Waterworks Organizational Chart

## 10. Element 10 - Competencies

### 10.1 Purpose

To identify how the Town of Markham ensures that personnel whose roles and responsibilities affect drinking-water quality remain competent in order to ensure the ongoing operation of its Quality Management System (QMS).

### 10.2 Scope

This plan and associated procedures apply to the performance and management of all personnel of the Town of Markham.

### 10.3 Definitions

Not Applicable

### 10.4 Description

The Town of Markham Waterworks Training Section has developed a Training Model to identify and manage the knowledge, skills, and abilities of personnel responsible for operating the drinking water system. This Training Model is based on the organization's Functional Structure Chart, which provides an outline of the activities and tasks related to a particular area and position within the department. The tools used as part of the Training Model (i.e. Position Profiles, Staff Profiles, Performance Management Reviews, Employee Skill Assessments, Skill Dictionaries, and Learning and Development Plans) allow the organization to collect data that can be used to determine the required skill levels and assess personnel training needs.

Data collected through the risk assessment process, which is outlined in the Risk Assessment and Risk Assessment Outcomes Plan, will also be used to develop and maintain competencies for Waterworks personnel. This information will be used to ensure that personnel have the required level of knowledge, skills, and abilities to perform their responsibilities. The QMS Controller will ensure that the appropriate risk assessment outcomes are used to develop the training session in conjunction to Waterworks Training Section and Operational Top Management for the purpose of implementing the training.

As a result of the Training Model, appropriate training and development opportunities will be provided. Training may be provided internally or by an external agency, as appropriate. Evidence of personnel competencies will be documented as a result of training activities and may include session evaluations or attendance sign-in sheets.

Performance Reviews serve as input into assessing competencies, and completed Performance Reviews are being kept by the corresponding Sectional Manager.

The ongoing maintenance of personnel competencies and training that demonstrates employee skills and knowledge will be recorded and tracked through the use of documentation that supports the Training Model including Position Profiles, Staff

Profiles, Performance Management Reviews, Employee Skill Assessments, Skills Dictionary, and Learning and Development Plans.

A document outlining competency expectations for external parties including personnel in other departments of the Town of Markham will be included as a separate section in the Training Model.

Awareness of the importance of employee responsibilities and its impact on drinking-water quality will be promoted through the following activities:

- a) Communication of relevant legislative and regulatory requirements
- b) Communication of roles and responsibilities (as outlined in the Organizational Structure, Roles, Responsibilities and Authorities Procedure)
- c) Regular review and updates of relevant policies and procedures
- d) Communication and Review of the Training Model

The Waterworks Training Section is responsible for:

- The design, communication, implementation and updating of the Training Model

Section Managers are responsible for:

- Development and maintenance of the Functional Structure Chart in coordination with Section Lead
- Providing accurate and up-to-date information for the development and maintenance of the Functional Structure Chart
- Ensure use of the Training Model is conducted

The QMS Controller will be responsible for:

- Providing inputs to the Training Section on the risk assessment training session
- Ensuring that a review of the Training Model is performed annually by the Training Section

## 10.5 Associated System Level Document (SLD)

SLD 10 – Competencies

## 10.6 References

Training Model

## 11. Element 11 - Personnel Coverage

### 11.1 Purpose

To identify how the Town of Markham ensures that competent individuals are available to fulfill the responsibilities needed for the ongoing operation of its Quality Management System (QMS).

### 11.2 Scope

This plan and associated procedures apply to all Waterworks personnel.

### 11.3 Definitions

Not Applicable

### 11.4 Description

The Town of Markham will ensure that competent personnel are available at all times to fulfill duties that affect drinking-water quality. Town of Markham Waterworks has developed a back-up system in order to ensure that all positions are adequately supported. Some employees, therefore, fulfill multiple roles within the Waterworks Division.

It is the responsibility of Section Managers to manage personnel coverage. This includes ensuring that positions requiring back-up personnel have an appropriate number of qualified and competent replacements. It is also their responsibility to determine which replacement will fill in when the primary employee is unavailable. Section Managers must notify the replacement and ensure that the employee has access to all tools and resources needed to perform the role.

The Town of Markham utilizes one shift of Operators to maintain the drinking-water system. Competent personnel are available on stand-by to perform work after hours.

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

### 11.5 Associated System Level Document (SLD)

SLD 11 – Personnel Coverage

### 11.6 References

Personnel Coverage / Standby 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 Scope

This plan and applicable procedures apply to all internal and external communication related to the Town of Markham's QMS.

### 12.3 Definitions

#### ***Owner and Operating Authority***

The Owner and the Operating Authority of the Town of Markham's Drinking Water System is the Council of the Corporation of the Town of Markham.

### 12.4 Description

#### Internal Communication

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

For Waterworks new hires, QMS awareness training will be provided by the QMS Representative. Existing Waterworks staff will be notified of changes to the QMS.

Internal training sessions will also be organized to identify and review all applicable QMS documentation and ensure that required personnel understand the content. Attendance will be documented through sign-in record.

Communication between the Operating Authority and the Owner will be managed by the QMS Representative. Information documented as a result of Management Review Meetings will be forwarded to the Owner in the form of a formal report that includes details such as updates on progress and actions taken.

#### External Communication

The QMS Policy and Statement of Commitment and Endorsement will be communicated to the public via the Town of Markham's website, or by other means. The QMS Policy will also be communicated to all suppliers and service providers during the formal tender process.

#### Responsibility

The QMS Representative will be responsible for ensuring that QMS related information is communicated to the appropriate internal and external parties.

## 12.5 Associated System Level Document (SLD)

Not Applicable

## 12.6 References

Operational Plan Section 2 – Quality Management System Policy

SLD 13 – Essential Supplies & Services

Town of Markham Emergency Management Plan

## 13. Element 13 - Essential Supplies & Services

### 13.1 Purpose

To describe the approach taken by the Town of Markham 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 Scope

This plan and associated procedures apply to all supplies and services considered essential to the supply of safe drinking water through Waterworks.

### 13.3 Definitions

Suppliers:

Externally sourced vendors providing products or services, including sub-contracted services, related to drinking water safety and quality. The terms 'Vendors' and 'Suppliers' are used interchangeably within this document.

Quality Expectations/Specifications:

Any characteristic of essential supplies and services, including its timely delivery, deemed critical by the user department, for the provision of safe drinking water.

### 13.4 Description

Waterworks 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
- iii) ensuring quality expectations are met accordingly

For all supplies and services listed, Waterworks 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, Waterworks is also subject to the policies and procedures set forth in the Town of Markham Purchasing Manual.

### 13.5 Associated System Level Document (SLD)

SLD 13 – Essential Supplies and Services

### 13.6 References

Town of Markham Purchasing Manual

## 14. Element 14 - Review and Provision of Infrastructure

### 14.1 Purpose

To identify the processes for the Waterworks Division to annually review the adequacy of the existing and planned infrastructure needed to ensure the ongoing supply of safe drinking water as per the Quality Management System.

### 14.2 Scope

This policy and procedure applies to the Town of Markham's water distribution system.

### 14.3 Definitions

Not Applicable

### 14.4 Description

The review of the adequacy of existing infrastructure to supply safe drinking water for the Town of Markham's drinking water distribution system is conducted as a four-tiered process

- i. The first review level is conducted in conjunction with the Region of York and the Town of Markham, including Waterworks.
- ii. The second review level is conducted in conjunction with Waterworks, Engineering and Planning Departments, which includes a review of servicing plans and growth site plans
- iii. The third review level is considered the Annual Review where capacity, life-cycles, conditions and general adequacy are examined. This is conducted by members of Waterworks
- iv. The fourth review level considers ancillary infrastructure adequacy including the review of vehicles/fleet, workspace, computer servers, etc.

Analyses and reports from the activities related to the maintenance, rehabilitation and renewal programs referenced in Element 15 serve as input into these regular reviews. The results and corresponding recommendations of these reviews are communicated to Owners through the Management Review process.

### 14.5 Associated System Level Document (SLD)

SLD 14 – Review and Provision of Infrastructure

### 14.6 References

Not Applicable

## 15. Element 15 - Infrastructure Maintenance, Rehabilitation and Renewal

### 15.1 Purpose

This policy and associated procedures identify the maintenance, rehabilitation, and renewal programs that the Town of Markham has in place for its drinking-water system infrastructure.

### 15.2 Scope

This policy and procedure applies to the Town of Markham's existing and planned water distribution system infrastructure.

### 15.3 Definitions

**Preventive Maintenance (PM)** – Planned, scheduled maintenance

**Rehabilitation** – The process of repairing or refurbishing an infrastructure element

**Renewal** – The process of replacing the infrastructure element with new elements

**KPI** – Key Performance Indicator

### 15.4 Description

The Town of Markham's infrastructure maintenance program includes both preventive maintenance activity as well as unscheduled maintenance.

#### Planned Preventive Maintenance

The Operations & Maintenance Manager is responsible for ensuring that planned maintenance work is carried out according to this and associated standard operating procedures and/or work-instructions.

Operations & Maintenance Supervisors are responsible for planning and administering the programs related to the Town of Markham's Water Distribution System

The areas of inspection & preventive maintenance and corresponding frequencies are identified in the chart below for infrastructure that affects water quality:

Area of Infrastructure	Maintenance Frequency
Mainline valve	every 5 years
Air release valve	annually
Check valve	annually
Pressure reducing valve	annually

The instructions and methods for this PM and Inspection program can be found in the corresponding procedures.

The nature and frequency of maintenance conducted for each area of infrastructure is based, where appropriate, on manufacturer's recommendations, industry standards, equipment manuals and output from KPI analysis.

The adequacy and effectiveness of the preventive maintenance program is assessed at the annual Review of Infrastructure, where KPI's are reviewed and analyzed. KPI's are analyzed from data recorded in the Computerized Maintenance Management System. The Operations & Maintenance Manager is responsible for the collection and analysis of data.

### **Corrective Maintenance**

The Operations & Maintenance section is responsible for ensuring that unscheduled maintenance work is carried out according to the Operational Plan, associated system level documents, standard operating procedures and/or work instructions.

Corrective Maintenance is done in reaction to system failure and/or reported or identified deficiencies.

Operations & Maintenance Supervisors are responsible for arranging unscheduled maintenance work.

Unscheduled maintenance is monitored for trends (KPI's) and assessed during the annual Infrastructure Review.

### **Rehabilitation & Renewal Program**

The Waterworks Infrastructure Section is responsible for managing the rehabilitation and renewal programs and is also responsible for planning, budgeting and ensuring rehabilitation and renewal work.

The Waterworks Infrastructure Section utilizes the Water Reserve study that identifies plans and capital requirements for a 25 year time horizon/model. Waterworks prioritizes requirements and determines the capital budget needs for rehabilitation and/or renewal of infrastructure, primarily based on this study.

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.

### **Maintenance Program Effectiveness**

Data collected through the Hansen system are extracted to analyze KPI's of the maintenance program. This is the responsibility of the Operations & Maintenance Manager.

At a minimum, annual reports are generated summarizing KPI performance.

KPI's for maintenance program effectiveness include: Number of Corrective Maintenance Work Orders

- Main Breaks
- Valves (All Types)

Results that indicate a lack of effectiveness and efficiency in the programs will be addressed through the Continuous Improvement process.

### **Communication to Owners**

The General Manager of Waterworks will communicate these findings to the Owner as per procedures outlined in the Management Review.

## **15.5 Associated System Level Document (SLD)**

Not applicable

## **15.6 References**

Water Reserve Study

## 16. Element 16 - Sampling, Testing & Monitoring

### 16.1 Purpose

To describe the sampling, testing and monitoring program for drinking water quality.

### 16.2 Scope

These procedures apply to all sampling and testing, conducted either internally or by third party accredited laboratory.

The categories of sampling and monitoring activities in the Town are:

- Regulatory Sampling, Testing & Reporting
- Chlorine Residual Testing
- Regulatory Sampling, Testing and Reporting for System Interruption

### 16.3 Definitions

Not applicable

### 16.4 Description

The Town of Markham Waterworks is responsible for establishing and maintaining sampling, testing and monitoring program that, at a minimum, meets regulatory requirements.

#### Regulatory Sampling, Testing & 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 to comply with regulatory requirements at designated locations throughout the Town.

#### Regulatory Sampling, Testing and Reporting for System Interruption

Town of Markham Waterworks staff are responsible for provision of testing in special circumstances such as:

- i. Emergency Repairs
- ii. Scheduled Repairs

The specific tests for each special circumstance are detailed in the Region of York Standard Water Operating Procedures (1.3, and 2.0).

## 16.5 Associated System Level Document (SLD)

SLD 16a – Sampling

SLD 16b – Monitoring

SLD 16c – Testing

## 16.6 References

The Region of York Standard Water Operating Procedures

Community Lead sampling Program Procedure

## 17. Element 17 - Calibration of Sampling, Testing and Monitoring Equipment

### 17.1 Purpose

To describe the calibration program for all water sampling, monitoring and/or testing equipment and devices.

### 17.2 Scope

These procedures apply to all devices, tools or equipment used by Town of Markham's Waterworks staff for water quality samples and testing.

### 17.3 Definitions

Not Applicable

### 17.4 Description

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

- i. Colorimeter
- ii. pH Meter
- iii. Thermometer

Equipment used for sampling and testing are listed on the Sampling & Testing Equipment Chart below. Each 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. For some equipment, testing is done to ascertain the equipment usability and in cases where the equipment fails the test, in lieu of calibration, the device is discarded and replaced. The methods and frequencies of calibration are unique to each item and described below.

Equipment	Calibration Frequency/Method	Performed by
Colorimeter	Weekly tested against the testing solution	Waterworks staff
	Annual Manufacturer Calibration	Manufacturer
pH Meter	Daily Calibration	Waterworks staff
	Annual Calibration	Manufacturer
Thermometer	Monthly	Waterworks staff
Master Thermometer	Annual Calibration	Manufacturer

### 17.5 Associated System Level Document (SLD)

SLD 17 – Calibration & Maintenance of Measurement and Recording Equipment

### 17.6 References

Manufacturers Maintenance Instructions

## 18. Element 18 - Emergency Management

### 18.1 Purpose

To describe the process used by the Town of Markham Waterworks to identify emergency situations and to manage its response to these events.

### 18.2 Scope

The program relates to emergencies that directly relate to the safety of drinking water and the drinking water distribution system.

Reference is also made to the Town of Markham's Emergency Management Plan.

### 18.3 Definitions

Not Applicable

### 18.4 Description

The Town of Markham will use the risk assessment process to identify potential emergencies and consider specific emergency preparedness activities. By assessing "abnormal" risks against process or practice, instances exceeding an acceptable risk threshold will be identified, thereby indicating the need for appropriate controls and an emergency preparedness plan. These assessments will be reviewed on an annual basis and reassessed every three years.

The information and activities prescribed in the Town of Markham's Emergency Management Plan are also considered when identifying and preparing for Emergencies within Waterworks.

The Waterworks Emergency Preparedness program is structured using a multi-level-emergency approach.

For each potential emergency identified, the appropriate Emergency Level Rating is assigned.

Each Emergency Level Rating requires a prescribed response protocol including the identification of roles and responsibilities. These protocols and responsibilities are detailed in the Emergency Management SLD / Process Flow Chart.

Employee training is conducted on a yearly basis to ensure that the Emergency Preparedness program is well-understood by those responsible for carrying out response activities. Through this training, the Town of Markham Waterworks will ensure that all Waterworks staff are aware of:

- a) Individual roles and responsibilities;
- b) All relevant procedures
- c) Existing threats and hazards, and associated protective actions; and
- d) Details and location of emergency equipment.

Training is in the form of desktop exercises, and where possible, mock emergency situation exercises.

In the event of an actual emergency, the results of the response will be reviewed through the Management Review process. This review will supersede the requirement of completing a desktop or mock emergency exercise.

An emergency contact list has been developed as part of the Town of Markham's Emergency Management Plan to ensure that the appropriate individuals will be contacted in the event of an emergency and that the necessary actions are taken to respond to the situation. This list is reviewed on a yearly basis to ensure that it remains current.

## **18.5 Associated System Level Document (SLD)**

SLD 18 – Emergency Management

## **18.6 References**

Town of Markham's Emergency Management Plan

## 19. Element 19 - Internal Audits

### 19.1 Purpose

This plan outlines the methods for performing internal audits of the Town of Markham's Quality Management System (QMS) to ensure that it has been properly implemented and conform to the requirements of the DWQMS.

### 19.2 Scope

This plan applies to all 21 elements of the Town of Markham's QMS.

### 19.3 Definitions

**System Non-Conformance** is determined:

- When a procedure is not being followed as prescribed
- Where objective evidence is not sufficient to support a claim that a procedure is followed accordingly
- Where the Operational Plan does not meet the requirements of the DWQMS.

### 19.4 Description

The Town of Markham conducts internal audits on a regular basis to ensure that it complies with established policies and objectives. The audit purpose is to evaluate the performance of the QMS against the specific requirements of DWQMS.

The Lead Auditor is the QMS Representative or designate, is responsible for ensuring that these procedures are followed accordingly, and specifically:

- An annual Internal Audit Schedule is created and maintained
- Ensuring an Internal Audit team is trained, competent and readily available to conduct audits
- Ensuring that the General Manager of Waterworks is informed if additional internal auditing resources are required
- Overseeing that system non-conformances are addressed, followed up and closed out in a timely manner by the internal audit team

Details of Internal Audits program are described in the System Level Document of Internal Audits.

### 19.5 Associated System Level Document (SLD)

SLD 19 – Internal Audits

### 19.6 References

Drinking Water Quality Management Standard

## 20. Element 20 - Management Review

### 20.1 Purpose

To identify the process by which the Town of Markham periodically reviews the performance of the Quality Management System (QMS).

### 20.2 Scope

This policy and associated procedures apply to all Management Review meetings conducted by the Town of Markham and any documentation associated with these meetings.

### 20.3 Definitions

SE – System Engineering Section  
QMS – Quality Management System Section  
O&M – Operations & Maintenance Section  
IMS – Information Management System Section  
INF – Infrastructure Section  
TRN – Training Section

### 20.4 Description

Management Review is the process where Top Management considers various indicators within the QMS. The Management Review shall provide Top Management with appropriate and sufficient data to make decisions about the QMS, and record decisions or action items to prompt changes and improvements in the QMS.

At a minimum, one Management Review Meeting, covering the minimum agenda items (see below), will be conducted every twelve months to provide Corporate Top Management of the Town of Markham with the information required to review and evaluate the continued suitability, adequacy, and effectiveness of its QMS.

The QMS Controller is responsible for scheduling and coordinating the Management Review and to ensure each agenda item (see below) is covered. The required attendees of the Management Review are the QMS Controller, General Manager of Waterworks and all Section Leads.

#### **Management Review Meeting Agenda**

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

1. Incidents of non-compliance with applicable regulations (SE);
2. Incidents of adverse drinking-water tests (SE);
3. Deviations from critical control point limits and corresponding actions taken (SE, O&M);
4. The effectiveness of the risk assessment process (QMS);

5. Findings from internal and external audits (QMS);
6. Emergency preparedness and response based on annual mock emergencies (TRN);
7. Operational performance (O&M & IMS);
8. Trends in the quality of raw water supply and drinking-water (SE);
9. Previous Management Review meeting action items (QMS);
10. Updates on action items identified between Management Review meetings (QMS);
11. Changes to services, activities, regulations, etc. that could impact the QMS (QMS);
12. Consumer feedback (IMS);
13. Resources needed for QMS maintenance (QMS);
14. Results of the infrastructure review (INF);
15. The currency of the Operational Plan (QMS);
16. Comments and suggestions made by personnel (QMS)

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

- List of attendees;
- Summary of issues discussed and decisions made; and
- Record of new and outstanding action items including an indication of responsibility and proposed timeline.

An information report outlining the results of the Management Review process will be submitted to Corporate Top Management and to the Owner by the QMS Controller, or designate.

## 20.5 Associated System Level Document (SLD)

Not Applicable

## 20.6 References

Not Applicable

## 21. Element 21 - Continuous Improvement

### 21.1 Purpose

To outline the processes by which the Town of Markham identifies, develops, and implements improvements to the Quality Management System (QMS).

### 21.2 Scope

The components of continuous improvement are :

1. Corrective & Preventive Actions
2. Opportunities for Improvement

The entire QMS is subject to Continuous Improvement Procedures.

### 21.3 Definitions

***Non-Conformance:***

An instance where an aspect of the QMS has not been met according to specified standards and/or procedures.

***Corrective Action:***

Actions taken to identify the root cause of a problem and apply actions to fix the identified problem

***Preventive Action:***

Actions taken to identify the root cause of a problem and apply action to prevent the problem from recurring

***Opportunities for Improvement:***

Ideas, suggestions or programs that serve to improve upon a process that has had a history of stability with few or no identified non-conformances

### 21.4 Description

#### 1. Corrective & Preventive Actions

Non-conformances can be identified outside the scope of the internal audit process (ref. Internal Audits).

All Town of Markham Waterworks staff have the responsibility and authority to report when a QMS non-conformance has been identified.

When a non-conformance has been found, a Corrective Action Request (CAR) is issued by the person (or the person's supervisor) who identified the problem, or the QMS Controller is informed to issue the CAR. The CAR describes the problem and identifies the staff responsible to address the problem.

Upon receiving a CAR, the staff responsible for addressing the problem shall first validate the existence of the problem.

Root cause analysis is conducted to identify why the problem occurred. This is done using a team-approach, including any staff member that could have insight as to the problem's root cause. The root cause is recorded on the CAR.

Once the root cause has been identified, both *corrective* and *preventive actions* and measures are identified, documented and implemented by the team.

## **2. Opportunities for Improvement**

All personnel are also empowered to offer suggestions and identify opportunities for improvement to the QMS and its performance. Ideas and suggestions can be generated and reviewed through the following methods:

1. After-Action Reviews
2. Waterworks Staff Suggestion

### **21.5 Associated System Level Document (SLD)**

Not Applicable

### **21.6 References**

SOP – Corrective Action

SOP – Waterworks Staff Suggestions

WI – After Action Review

## History of Changes

<b>Revision</b>	<b>Date of Issue</b>	<b>Descriptions</b>
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