

AUDITOR GENERAL

Halifax Regional Municipality



Halifax Water – Management of Drinking Water Safety

November 2017

November 10, 2017

Office of the Auditor General
Halifax Regional Municipality
Contract Management Audit

The following audit of **Halifax Water – Management of Drinking Water Safety**, completed under section 50(2) of the Halifax Regional Municipality Charter, is hereby submitted to the Audit and Finance Standing Committee of Regional Council.

Respectfully,

Original signed by

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Auditor General
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Summary

Conclusion

Overall, Halifax Water carries out day-to-day activities to address risks to drinking water safety. Improvements should be made to capture all risks in a central location so they can be tracked and prioritized by management. Halifax Water completes monitoring to comply with drinking water regulations but needs to clarify which samples must be reported to Nova Scotia Environment. Management also needs to monitor whether all scheduled water samples were completed. We found Halifax Water manages its drinking water infrastructure, but more work is needed on long-term capital projections.

Key Take-aways

- Halifax Water performs regular water quality testing and takes timely action to address risks to drinking water safety.
- Operations staff are knowledgeable about drinking water safety requirements and have up-to-date certifications.
- Internal processes could be improved to ensure:
 - compliance reporting to Nova Scotia Environment is complete; and
 - scheduled water quality sampling is monitored so samples are not missed.
- Three former employees still had access to make changes to a web-based system used to track and compare sample results to water quality parameters. Management removed this access once we informed them what we had found.
- Halifax Water does not centrally track corrective actions required by its regulator, Nova Scotia Environment. Key operational requirements could be missed.
- Halifax Water needs to complete a utility-wide risk framework to ensure all risks are managed.
- There are gaps in the information used to project long-term capital needs (up to 30 years), including for assets which support safe drinking water. Management needs to develop detailed plans to address these gaps.

What We Audited and Why

This audit looked at whether Halifax Water effectively manages risks to provide Halifax Regional Municipality with safe drinking water. The audit focused on Halifax Water's management of drinking water infrastructure and safety risks, as well as its management of compliance with drinking water safety regulations.

Compliance with drinking water safety regulations is important as it helps to ensure the water is safe for consumption. The management of drinking water infrastructure risk is also important to ensure Halifax Water maintains an acceptable level of service and delivers safe drinking water.

Recommendations and Management Responses

Recommendation 1:

Halifax Water should develop a utility-wide risk framework.

Management Response:

Halifax Water agrees with the recommendation. Halifax Water is in the process of developing an enterprise-wide risk framework to identify, assess, manage and monitor risks for all services offered by Halifax Water.

Recommendation 2:

Halifax Water should develop detailed plans with timelines to improve the information it uses to assess long-term capital needs to replace water infrastructure.

Management Response:

Halifax Water agrees with the recommendation. Halifax Water will continue to develop detailed plans and timelines for long term capital assessment. In that regard, several initiatives are in progress that will provide refined information in advance of our second Integrated Resource Plan scheduled for completion next fall. As an example, a study was recently commissioned for a Regional Infrastructure Plan that involves developing a water infrastructure servicing strategy based on growth, asset renewal and compliance needs over a long planning horizon.

Recommendation 3:

Halifax Water should clarify reporting requirements with Nova Scotia Environment for all samples not collected by Regulatory Services.

Management Response:

Halifax Water agrees with the recommendation. Halifax Water will undertake to clarify the reporting requirements within the next submission for Approval renewals.

Recommendation 4:

Halifax Water should compare all scheduled samples to recorded sample results in its system to identify missed samples on a timely basis.

Management Response:

Halifax Water agrees with the recommendation. In January 2017, with the discovery samples were missed, the tracking system was modified and the Compliance Inspectors are required to advise the Data Analysts if a sample was missed and the rationale. Staff are currently documenting this tracking system and developing a Standard Operating Procedure to ensure samples will not be missed in the future. The

Manager is reviewing the possibility of setting an alert in WaterTrax to advise of a missed sample during the sampling period.

Recommendation 5:

Halifax Water should have an independent staff person review annual compliance reports to Nova Scotia Environment to confirm the reports were prepared accurately.

Management Response:

Halifax Water agrees with the recommendation. Halifax Water will establish a process whereby the Data Analysts will review each other's reports for their respective regions and the Manager and Director will review all of the reports for consistency.

Recommendation 6:

Halifax Water should establish a process to ensure access to edit alert settings is limited to only those staff who require it. It should also review all those who currently have access to confirm if this access is needed for current job requirements.

Management Response:

Halifax Water agrees with the recommendation. Halifax Water's Information Technology (IT) group currently utilizes Active Directory, based on organizational based reporting structures, in establishing reporting and approval rights for access to software and system directories. Regulatory Services and Water Services will adopt the Active Directory framework in establishing levels for access to edit alert settings and overall access for inputting data based on position titles and roles within the respective groups.

Recommendation 7:

Halifax Water should establish a process to ensure access to the system is updated as employees move within the organization and removed on termination of employment.

Management Response:

Halifax Water agrees with the recommendation. Further to the response to recommendation 6, Human Resources currently notifies IT when an employee leaves the organization or moves within the organization. IT currently disables or modifies access rights to corporate software based on this notification. A standard operating procedure will be developed to expand this process whereby IT will identify a responsible person, based on position title, for other software. With respect to WaterTrax, the responsible person will be the Manager of Regulatory Compliance. IT will notify the Manager of Regulatory Compliance, who will then adjust the WaterTrax access rights based on position title.

Recommendation 8:

Halifax Water should periodically review settings for all automated alerts (those internal to Halifax Water and those sent to Nova Scotia Environment) to confirm the settings are accurate.

Management Response:

Halifax Water agrees with the recommendation. Further to the proposed standard operating procedures noted in recommendations 6 and 7, Regulatory Services and Water Services will establish levels for the automated alerts within the two groups and liaise with NSE to establish the appropriate personnel for notification. When the quarterly reports are submitted, the automated alerts will be reviewed to ensure the identified NSE personnel are still responsible for the respective Approvals.

Recommendation 9:

Halifax Water should centrally track the status of action items required by Nova Scotia Environment for regulatory compliance.

Management Response:

Halifax Water agrees with the recommendation. Halifax Water will request that the outcomes of all NSE audits and correspondence pertaining to Approvals be directed to the Manager of Regulatory Compliance and copied to the Director of Regulatory Services. The Manager of Regulatory Compliance will be responsible for tracking the corrective actions or outcomes from the Audits and communicating with the appropriate facility Superintendent and/or Director. The Manager of Regulatory Compliance will be responsible for submitting the requested documentation to NSE.

Audit Results

Overall, Halifax Water carries out day-to-day activities to address drinking water safety risk

Halifax Water completes the water quality sampling required by the Nova Scotia Department of Environment. We examined 30 scheduled water samples and all were completed as planned. Water sampling staff immediately notify appropriate operations staff when sampling results indicate a possible water quality issue so that corrective action can be taken if required.

During our work, we became aware of a small number of samples which had not been completed that were not part of the 30 we had examined. Based on our audit work, we believe the missed samples were isolated instances.

We found Halifax Water staff are knowledgeable about water quality requirements. There are processes to help ensure staff certifications and training are up-to-date. We examined operator certifications for 10 staff and all had the appropriate certifications for their job duties.

Halifax Water completes risk assessments and develops programs to address water safety risks but needs a utility-wide risk framework

While Halifax Water considers risk, and develops programs to address water safety risk, it does not have an organization-wide risk framework that considers all threats, prioritizes resources based on the most significant areas, and helps ensure there are no gaps.

Halifax Water has a multi-barrier approach to safe drinking water which considers risks to source water, the water treatment process, and the distribution system.

Halifax Water uses external and internal experts to assess day-to-day security risk, such as a specific treatment plant or key infrastructure. Higher risk areas, such as security and environmental compliance, are managed by steering committees which include Halifax Water staff, management, and its Board of Commissioners.

In addition, Halifax Water has water quality and research programs to identify possible challenges, such as natural changes in lake water, which may mean future changes to water treatment plants; or to address threats to water quality, such as lead service lines.

Halifax Water also manages risks to water safety through other activities, including:

- Exercising emergency procedures
- Developing actions to address identified risks to source water

- Requiring operations staff to read and acknowledge updates to operating procedures

However, Halifax Water does not maintain a central inventory of identified risks so that responses to manage the risks can be tracked. An organization-wide risk framework would help prioritize programs and resources based on risk and help prevent any gaps from being overlooked.

Management and the board have recently completed risk management training. Halifax Water management told us they have plans to create a utility-wide risk framework in 2017-18.

Recommendation 1

Halifax Water should develop a utility-wide risk framework.

Management Response

Halifax Water agrees with the recommendation. Halifax Water is in the process of developing an enterprise-wide risk framework to identify, assess, manage and monitor risks for all services offered by Halifax Water.

Process to identify short-term capital needs reasonable, long-term projections need more work

Halifax Water has a reasonable process to identify short-term drinking water infrastructure projects for the next five years. However, management needs to better plan for long-term projections (30 years) of capital needs.

Halifax Water identifies drinking water infrastructure needs through discussions among internal experts and departments, as well as periodic assessments by external consultants. This process is reasonable to identify short-term capital needs, as operations and engineering staff would have direct knowledge to identify and bring forward capital needs.

Management reviews and prioritizes potential capital projects. Halifax Water plans capital work to help ensure value-for-money. During the capital budgeting process, it coordinates projects with planned HRM roadwork, when possible. In addition, Halifax Water identifies future projects that could be submitted for consideration if external funding (such as government grants) became available.

Halifax Water's projection of long-term capital requirements for the next 30 years needs work. Currently, Halifax Water considers the impact of HRM growth, changing compliance requirements, and future repair or replacement of aging assets. However, the need to replace assets is estimated using assumptions, such as an asset's age, as indicators of condition. Management told us they would like to use available information on asset

condition and get asset-specific maintenance data to create a more complete assessment of both short and long-term needs.

In 2012, Halifax Water presented its 30-year plan to the Utility and Review Board for the first time. The Utility and Review Board suggested Halifax Water address gaps in its data and update long-term capital requirements as soon as possible. Halifax Water is reviewing its processes to help develop more accurate long-term projections. Management told us they expect to identify performance indicators to measure level of service to determine capital reinvestment needs. However, management has not developed detailed plans or set specific goals to achieve this.

Recommendation 2

Halifax Water should develop detailed plans, with timelines, to improve the information it uses to assess long-term capital needs to replace water infrastructure.

Management Response

Halifax Water agrees with the recommendation. Halifax Water will continue to develop detailed plans and timelines for long term capital assessment. In that regard, several initiatives are in progress that will provide refined information in advance of our second Integrated Resource Plan scheduled for completion next fall. As an example, a study was recently commissioned for a Regional Infrastructure Plan that involves developing a water infrastructure servicing strategy based on growth, asset renewal and compliance needs over a long planning horizon.

Timely action taken when possible water quality issues were identified but reporting to Nova Scotia Environment needs clarification

Halifax Water has a division, Regulatory Services, which is responsible for collecting water samples to meet regulatory requirements and reporting the results to Nova Scotia Environment. Another division, Water Services, also collects samples for a variety of operational purposes; however, these sample results are not reported to Environment.

We looked at 66 water sample results which fell outside acceptable limits from both Regulatory Services and Water Services. All 54 water sample results from Regulatory Services were reported to Nova Scotia Environment. Water Services did not report any of the 12 water samples we selected to Nova Scotia Environment. We found Halifax Water took timely action to address these results in all cases. We note a water quality sample result that falls outside acceptable limits is only an indicator that there is a potential issue; however, reporting these results to Nova Scotia Environment is required.

Halifax Water management believes samples collected for operational purposes do not need to be reported. The operating permits issued by Nova Scotia Environment do not make this distinction:

“If the chlorine residual in the water distribution system is less than 0.20 mg/L free chlorine, the Approval Holder shall notify the Department immediately and take immediate action to obtain the required residual... The annual report shall contain...All incidents of free chlorine residual below 0.20 mg/L in the water distribution system shall be detailed with a description of any actions taken.”

The water in the distribution system is treated water that is en route to customer’s homes from the treatment plant. Nova Scotia Environment requires that chlorine residual be kept at a minimum level throughout the distribution system to ensure the water is adequately disinfected throughout the network. It also requires the utility to immediately report sampling results that indicate a level below the minimum required as it indicates a possible issue with water disinfection.

Recommendation 3

Halifax Water should clarify reporting requirements with Nova Scotia Environment for all samples not collected by Regulatory Services.

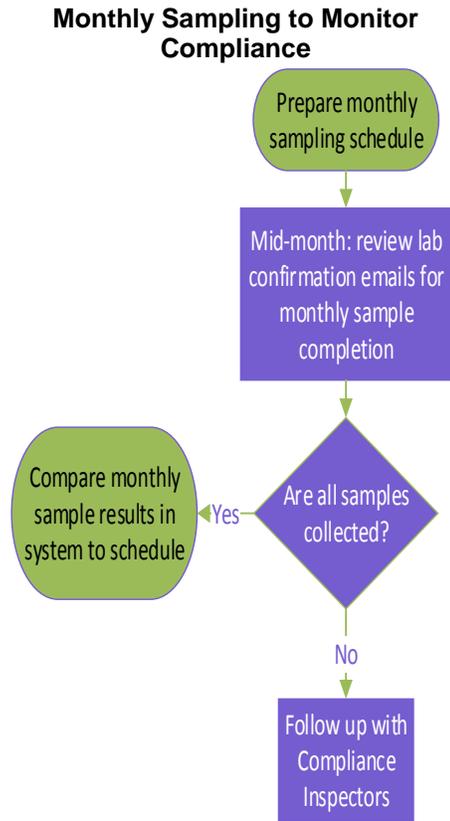
Management Response

Halifax Water agrees with the recommendation. Halifax Water will undertake to clarify the reporting requirements within the next submission for Approval renewals.

Halifax Water does not confirm all scheduled water quality monitoring was completed

Halifax Water has a process to confirm all scheduled water quality samples were completed for yearly, monthly and quarterly sampling. However, it does not confirm that scheduled weekly water quality samples were completed.

We assessed 30 scheduled water quality samples and found all were completed as scheduled. We also examined annual water quality compliance reporting submitted to Nova Scotia Environment and found a group of samples were missing from the report for 2016. Management told us the samples had not been completed. However, they could not determine why this was not identified through monitoring activities. They told us monitoring of water samples was informal before January 2017. Since January, scheduled monthly, quarterly and yearly samples are compared to recorded results. However, this is not done for scheduled weekly samples, meaning a sample could be missed and go undetected. Performing water quality sampling as scheduled is important to detect potential water quality issues. Monitoring to confirm all samples were completed helps ensure compliance with regulations and helps to detect water quality issues in a timely manner so that corrective actions can be taken.

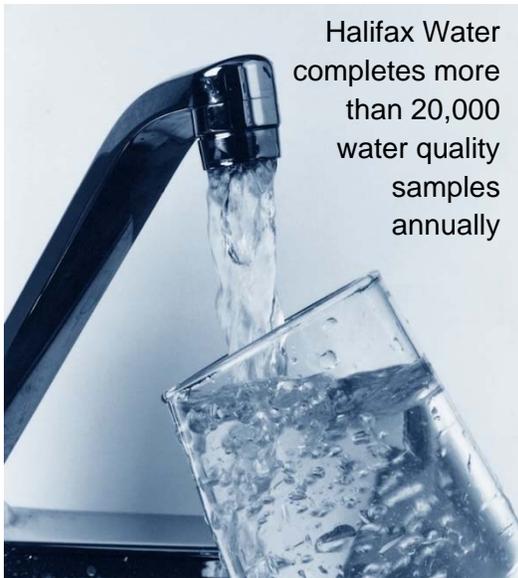


Recommendation 4

Halifax Water should compare all scheduled samples to recorded sample results in its system to identify missed samples on a timely basis.

Management Response

Halifax Water agrees with the recommendation. In January 2017, with the discovery samples were missed, the tracking system was modified and the Compliance Inspectors are required to advise the Data Analysts if a sample was missed and the rationale. Staff are currently documenting this tracking system and developing a Standard Operating Procedure to ensure samples will not be missed in the future. The Manager is reviewing the possibility of setting an alert in WaterTrax to advise of a missed sample during the sampling period.



Halifax Water completes more than 20,000 water quality samples annually

Halifax Water is required to submit annual compliance reports to Nova Scotia Environment for each of its water systems. These reports are prepared manually and contain large amounts of water quality data. We sampled eight compliance reports submitted and compared the information in the reports to the source data. We found the reports were largely accurate; however, there were three instances of missing information in compliance reports. Management told us there is no quality check by a second staff member to confirm the report includes all original data and does not have errors. Manual processes are subject to human

error and need a quality check by an independent staff member. Otherwise, errors may not be identified and incomplete information could be provided to Nova Scotia Environment.

Recommendation 5

Halifax Water should have an independent staff person review annual compliance reports to Nova Scotia Environment to confirm the reports were prepared accurately.

Management Response

Halifax Water agrees with the recommendation. Halifax Water will establish a process whereby the Data Analysts will review each other's reports for their respective regions and the Manager and Director will review all of the reports for consistency.

Automated settings to report possible water quality issues not effectively managed

We found errors in the computer-generated alert settings Halifax Water uses to identify water sample results entered in its system which fall outside acceptable ranges. These alerts are automatically sent to Halifax Water employees and, in some cases, Nova Scotia Environment. Several staff members can change these alert settings.

Regulations require Halifax Water report potential water quality issues to Nova Scotia Environment immediately. The errors we identified did not affect alerts which are automatically forwarded to Nova Scotia Environment; however, the opportunity for errors exists. If alert settings are incorrect, issues may not be identified, and Halifax Water risks not complying with regulations.

We also identified three individuals who are no longer employed at Halifax Water who had access to the system and four current employees whose access level may not be required for their job duties. As the system is a web-based application, former employees who still had access could make changes. This situation was corrected after we brought it to management's attention during the audit.

Recommendation 6

Halifax Water should establish a process to ensure access to edit alert settings is limited to only those staff who require it. It should also review all those who currently have access to confirm if access is needed for current job requirements.

Management Response

Halifax Water agrees with the recommendation. Halifax Water's Information Technology (IT) group currently utilizes Active Directory, based on organizational based reporting structures, in establishing reporting and approval rights for access to software and system directories. Regulatory Services and Water Services will adopt the Active Directory framework in establishing levels for access to edit alert settings and overall access for inputting data based on position titles and roles within the respective groups.

Recommendation 7

Halifax Water should establish a process to ensure access to the system is updated as employees move within the organization and removed on termination of employment.

Management Response

Halifax Water agrees with the recommendation. Further to the response to recommendation 6, Human Resources currently notifies IT when an employee leaves the organization or moves within the organization. IT currently disables or modifies access rights to corporate software based on this notification. A standard operating procedure will be developed to expand this process whereby IT will identify a responsible person, based on position title, for other software. With respect to WaterTrax, the responsible person will be the Manager of Regulatory Compliance. IT will notify the Manager of Regulatory Compliance, who will then adjust the WaterTrax access rights based on position title.

Recommendation 8

Halifax Water should periodically review settings for all automated alerts (those internal to Halifax Water and those sent to Nova Scotia Environment) to confirm the settings are accurate.

Management Response

Halifax Water agrees with the recommendation. Further to the proposed standard operating procedures noted in recommendations 6 and 7, Regulatory Services and Water Services will establish levels for the automated alerts within the two groups and liaise with NSE to establish the appropriate personnel for notification. When the quarterly reports are submitted, the automated alerts will be reviewed to ensure the identified NSE personnel are still responsible for the respective Approvals.

No central tracking of action items required by Nova Scotia Environment

Halifax Water does not track all corrective action required by its regulator, Nova Scotia Environment. The regulator conducts inspections of Halifax Water's operations. Inspection reports include corrective actions the utility needs to take. Environment also includes corrective actions with implementation deadlines as part of the operating permits it issues to Halifax Water. The Regulatory Services division tracks most action items; however, they do not track all corrective actions. Management told us there are some exceptions which are tracked by other divisions of Halifax Water, depending on when and how the corrective action items were issued. This means Regulatory Services does not know the status of all outstanding action items which increases the risk they are not completed in a timely manner. While management has told us the corrective action items which are not tracked by Regulatory Services have been completed or partially completed, the lack of tracking is still a concern. It is important that the Regulatory Services division knows the status of all corrective actions required by Nova Scotia Environment.

Recommendation 9

Halifax Water should centrally track the status of action items required by Nova Scotia Environment for regulatory compliance.

Management Response

Halifax Water agrees with the recommendation. Halifax Water will request that the outcomes of all NSE audits and correspondence pertaining to Approvals be directed to the Manager of Regulatory Compliance and copied to the Director of Regulatory Services. The Manager of Regulatory Compliance will be responsible for tracking the corrective actions or outcomes from the Audits and communicating with the appropriate facility Superintendent and/or Director. The Manager of Regulatory Compliance will be responsible for submitting the requested documentation to NSE.

Background

Halifax Water is responsible for providing safe drinking water to more than 365,000 residents in Halifax Regional Municipality. Halifax Water’s key infrastructure includes: two large water treatment plants, one medium plant, six community plants and 1,500 km of transmission and distribution mains.

Large Water Treatment Plants		
<p>J.D. Kline (Pockwock) Serves population of 235,000</p> <ul style="list-style-type: none"> - Halifax - Bedford - Sackville - Fall River - Waverley - Timberlea 	<p>Lake Major Serves population of 120,000</p> <ul style="list-style-type: none"> - Dartmouth - Eastern Passage - Cole Harbour - Westphal - Cherry Brook - North Preston 	
Medium Supply Plant		Six Community Plants
<p>Bennery Lake</p> <ul style="list-style-type: none"> - Stanfield International Airport - Aerotech Park 	<p>Collins Park Middle Musquodoboit Bomont Subdivision</p>	<p>Silver Sands Five Island Lake Miller Lake</p>

To provide safe drinking water, water is sent from a designated supply to a water treatment plant where it undergoes treatment processes. Treated water is sent through the distribution system to customer’s homes. Halifax Water is responsible for the infrastructure up to a home’s property line.

Nova Scotia Environment is the regulator responsible for enforcing applicable drinking water legislation and regulations within the Province. Halifax Water must comply with the regulations set out by Nova Scotia Environment. To comply with regulatory requirements, Halifax Water must collect a minimum number of water samples to test certain water quality parameters and immediately report noncompliant results to the regulator. Halifax Water must also submit annual compliance reports to the regulator, which include all sampling results for the year.

Nova Scotia Environment issues operator certifications. There are four classes of operator certifications. Regulations require staff to have a minimum level depending on their job duties and require water utilities to ensure operations staff have the appropriate operator certification.

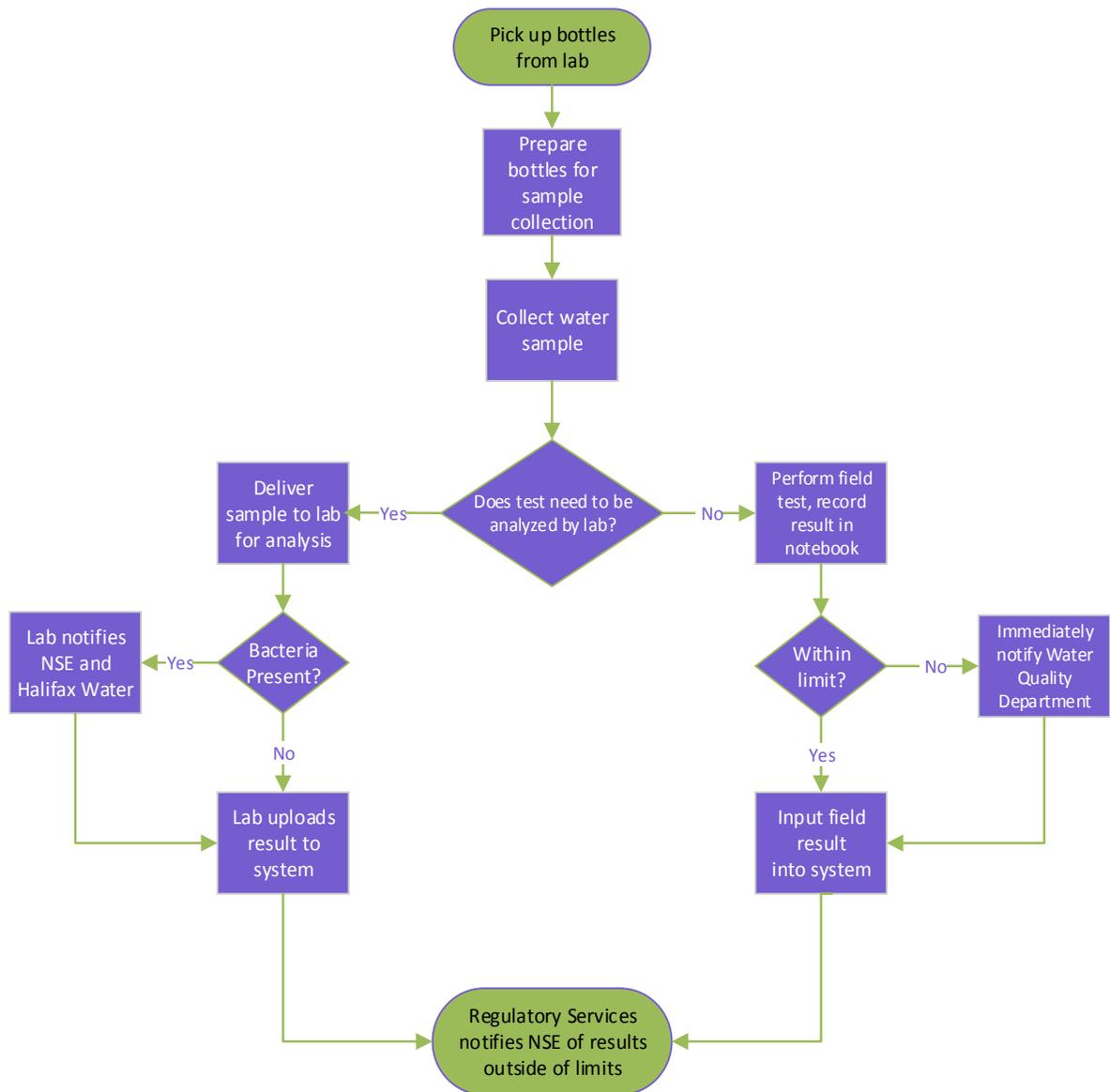
Halifax Water’s Regulatory Services Department is responsible for scheduling and carrying out the water sampling program developed to meet compliance sampling requirements. Compliance inspectors take water samples from the water supply, treated

water at the treatment plants, and throughout the distribution system and submit to a qualified lab for analysis or, for some parameters, test in the field using a hand-held device. Sampling results are communicated to Nova Scotia Environment through annual compliance reports. Noncompliant sample results that could have an adverse health effect must be reported to Nova Scotia Environment immediately.

Halifax Water's Water Services Department performs additional water sampling to meet quality assurance goals and objectives. Water Services is also responsible for tracking and renewing operator certifications as required by legislation.

The following chart summarizes the process followed by compliance inspectors to collect water quality samples. Samples are collected at predetermined sample sites and certain water quality parameters are tested to meet regulatory requirements. Some tests are performed using hand-held devices and some must be performed by a qualified lab. In either case, the sample results are entered in the same web-based application where they can be reviewed by Halifax Water staff. The system generates automated e-mail alerts for sample results that are outside of a specified range.

Compliance Inspector – Drinking Water Sample Collection Process



NSE = Nova Scotia Environment

Audit Objectives and Scope

This audit examined Halifax Water's management of drinking water infrastructure and safety risks, and compliance with drinking water safety regulations. Wastewater services and stormwater services were not included in the scope of this audit.

The purpose of the audit was to determine whether Halifax Water effectively manages risks to provide HRM with safe drinking water.

The objectives of the audit were to determine whether Halifax Water effectively manages:

- its regulatory requirements to ensure compliance;
- its drinking water infrastructure risk; and
- risks associated with drinking water safety.

We developed criteria for this audit. These were discussed with, and accepted as appropriate by, Halifax Water senior management.

The audit period was April 1, 2015 to March 31, 2017. Information from outside the audit period was considered as necessary.

Our audit approach included: reviewing applicable Federal and Provincial legislation, guidelines, and standards; reviewing internal policies; interviews with management and staff; examining compliance; and other relevant documentation.

This audit was conducted in accordance with the Canadian Standard for Assurance Engagements (CSAE) 3001 – Direct Engagements published by Chartered Professional Accountants of Canada.

We apply the Canadian Standard on Quality Control 1, and our staff follow the Chartered Professional Accountants of Nova Scotia Code of Conduct.

Contact Information

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