21-22

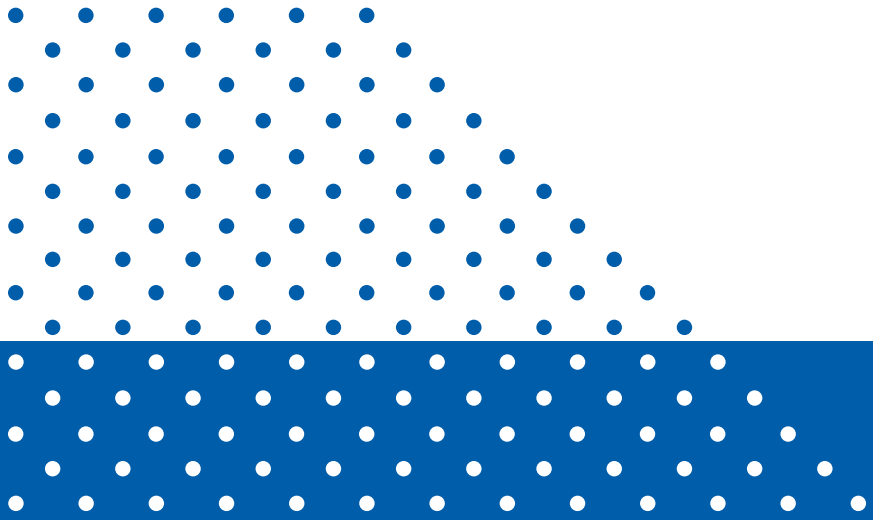
Twenty Sixth

Annual Report

March 31, 2022

STRAIGHT from the SOURCE

Halifax Water



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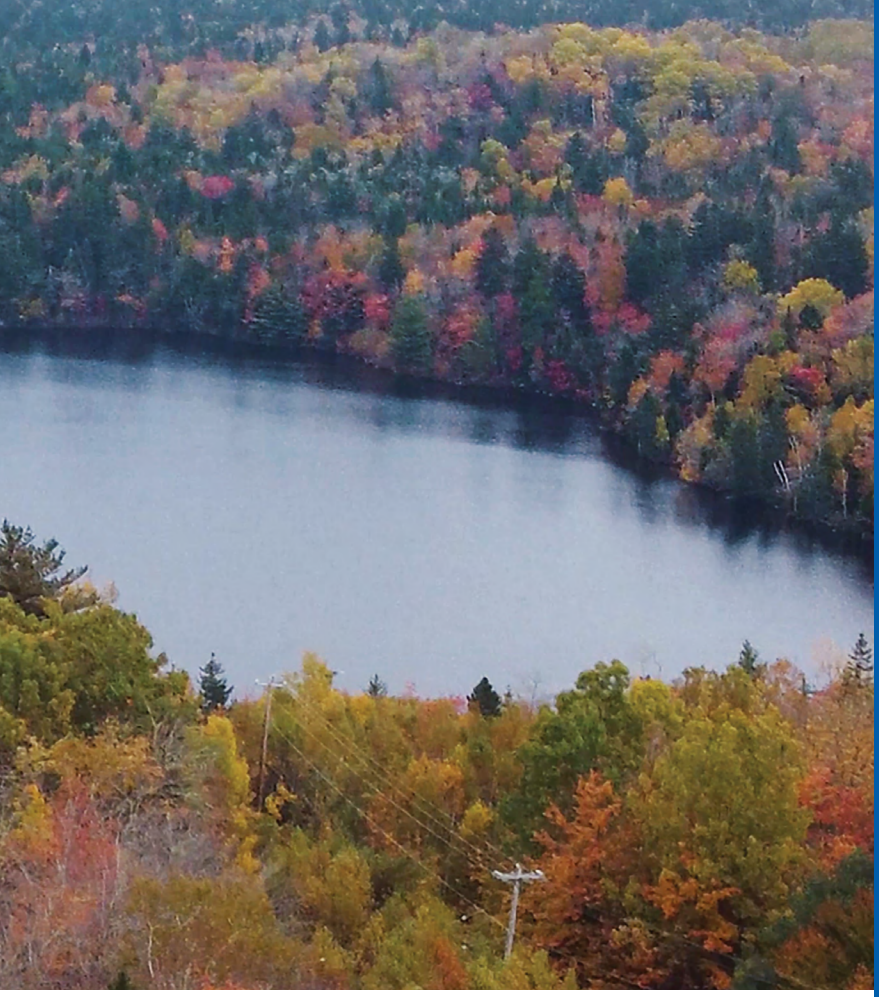

Halifax Water

Get in touch!

24-Hour Emergency Line:

902-420-9287

Customer Care Centre:

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Office Hours:

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HalifaxWater

Our Mission, Vision & Values

Our Mission

To provide world-class services for our customers and our environment.

Our Vision

We will provide our customers with high quality water, wastewater, and stormwater services.

Through adoption of best practices, we will place the highest value on public health, customer service, fiscal responsibility, workplace safety and security, asset management, regulatory compliance, and stewardship of the environment.

We will fully engage employees through teamwork, innovation, and professional development.

Our Values

Relationships

We nurture relationships with our customers, our team members and the environment. We are engaged in the neighbourhoods we serve and we support continual learning across our team.

Innovation

We are among the top utilities across the continent and we are known on the global stage. We always ask, "how can we improve efficiency, sustainability, creativity and the customer experience?"

Accountability

We refuse to cut corners. We check in with our excellence standards regularly and look to one another for support. Safety steers our decision-making. We are driven to make our policies, decisions and projects as clear as our drinking water.

Protection

Halifax Water protects the health and well-being of our population. We exist to guard natural resources, finding ways to sustain our communities and environment.

Our Leaders

Board of Commissioners March 31, 2022

Councillor Becky Kent
Chair

Colleen Rollings
P.Eng., PMP
Vice Chair

Brad Anguish
MBA, P.Eng.
Commissioner

Councillor Cathy Deagle Gammon
Commissioner

Councillor Pam Lovelace
Commissioner

Councillor Patty Cuttell
Commissioner

Mimi Kolomyytsev
Commissioner

Kostia Zaharov
P.Eng., PMP, MBA
Commissioner

Executive Staff March 31, 2022

Cathie O'Toole
MBA, FCPA, FCGA, ICD.D
General Manager

Louis de Montbrun
CPA, CA
Director, Corporate Services/CFO

Kenda MacKenzie
P.Eng.
Director, Regulatory Services

Reid Campbell
M.Eng., P.Eng.
Director, Engineering & Technology Services

Susheel Arora
M.A.Sc., P.Eng.
Director, Operations

Heidi Schedler
General Counsel & Corporate Secretary

Message from the Chair

As Board Chair during 2021/22, I want to recognize the continuing importance of Halifax Water's mission of providing world-class services for our customers and our environment and the progress made during the year.

This year saw some changes at the Halifax Water Board, including adding two new members of the public due to the term expirations for some existing Board members. The Halifax Water Board and Executive Team demonstrate gender balance and diversity, and Halifax Water is committed to building an increasingly diverse organization that is representative of the customers we serve.

This year also saw changes within the utility as some organizational changes were made to support the vision of "One Team, One Water." On April 1, 2021, Halifax Water implemented a new organizational structure that merged our operations groups into one department and aligned all information services and technology groups into one department. The intent was to increase focus on integrated planning and implementation to manage the full water cycle on behalf of our customers and the environment.

As an essential service provider, last year, Halifax Water focused on safely maintaining services, employment, and capital work.

Halifax Water employs approximately 550 employees, and the $126.2 million capital budget and $162.8 million operating budget in 2021/22 provided a significant local economic benefit that, in turn, benefits Halifax Water customers.

Halifax Water works hard to balance competing interests, such as the need to maintain and upgrade critical infrastructure, meet environmental requirements, and prudently plan for capacity to support further growth while maintaining high-quality services that are affordable for customers.

Water, wastewater, and stormwater services are vital to the residents and businesses of our region. With investments now and into the future, we will all benefit from the infrastructure that helps provide the economic and environmental backbone for current and future generations.

On behalf of the Halifax Water Board, I wish to convey to customers our continued commitment to providing responsible governance and oversight in the provision of water, wastewater and stormwater service by Halifax Water. I want to extend my sincere appreciation to the employees of Halifax Water, particularly the front-line workers, for your ongoing commitment and service to the community.

Becky Kent
Chair of the Board

Message from the General Manager

The challenges of managing, operating, and maintaining water and wastewater systems require continued dedication and perseverance at Halifax Water. Through a shared resolve, our employees continue to focus on providing high-quality services to our customers as we meet the challenges of aging infrastructure, increasingly stringent environmental compliance regulations and a growing population.

Through our collective efforts, Halifax Water meets all of its obligations under the Halifax Regional Water Commission Act (HRWC Act) and the Public Utilities Act. In addition to legislation obligations, the utility is also in compliance with all of its operating permits for its water and wastewater systems for the fiscal year ending March 31, 2022.

In fiscal 2021/22, our team continued to address the increasing challenges of managing source water quality. Halifax Water initiated a Water Supply Enhancement Program (WSEP) to see the utility spend $250 million over ten years to enhance and upgrade aging assets and dated treatment processes at the Lake Major Water Supply Plant in Dartmouth and the J.D. Kline Water Supply Plant on Pockwock Lake. In 2021/22, as part of the WSEP program, Halifax Water replaced one of two clarifiers at the Lake Major Water Supply Plant. This very significant undertaking was successfully carried out with minimal impact on customers.

For our wastewater systems, achieving compliance is an ongoing challenge balancing weather influences, equipment efficiency, and customer compliance with Halifax Water Rules and Regulations. We achieved 96% sample compliance with Nova Scotia Environment and Climate Change (NSECC) requirements at our wastewater treatment facilities, an improvement compared to 93% the prior year.

In February 2022, Halifax Water filed a two-year general rate application with the Nova Scotia Utility and Review Board (NSUARB) for increases in water, wastewater, and stormwater rates, because Halifax Water's current rates are not sufficient to cover the annual cost of providing the service or fund continuing investment in infrastructure. This rate application was filed to help prevent further deterioration of the utility's financial health and to protect our ongoing ability to serve customers.

Pending approval, this will be the first increase in water rates since 2016 and the first increase in stormwater rates since 2017. Wastewater rates were adjusted as part of the rate application filed in 2020. Halifax Water is a municipal utility that operates on a break-even basis, and no profit component is built into the rates.

We recognize that any rate increase is unwelcome at any time, particularly now when customers are experiencing more inflationary pressures. Halifax Water actively works to contain costs, which is one of the reasons we have been able to defer rate increases for several years. We will continue to deliver cost-effective service.

Thank you to all Halifax Water employees for their ongoing commitment to serving customers and protecting the environment!

Cathie O'Toole
General Manager

High Quality Water

Lead Service Line Replacement Program

Removing legacy lead service lines is a top priority for Halifax Water. Halifax Water has had an evolving lead service line replacement program in place since the 1970s, and lead service lines exist in both central Halifax and Dartmouth.

Our current "Get the Lead Out" lead service line replacement program was approved in October 2020 by the NSUARB. This program allows Halifax Water to cover the cost (up to $10,000) of replacing private lead service lines.

2020/21 was the first year of the Get the Lead Out program. As part of this, Halifax Water launched a new website (halifaxwater.ca/get-the-lead-out) to help simplify the process. This site allows property owners to apply for the program online.

The first year was successful, with a total of 185 private lead service lines and 105 public lead service lines being replaced, which exceeded our first-year goal of 150 private and 100 public replacements, respectively. Most of these replacements were coordinated with HRM's street paving and renewal schedule to minimize disruption to communities and be cost-efficient for our ratepayers. However, a limited number were completed based on customers most at-risk from lead exposure.

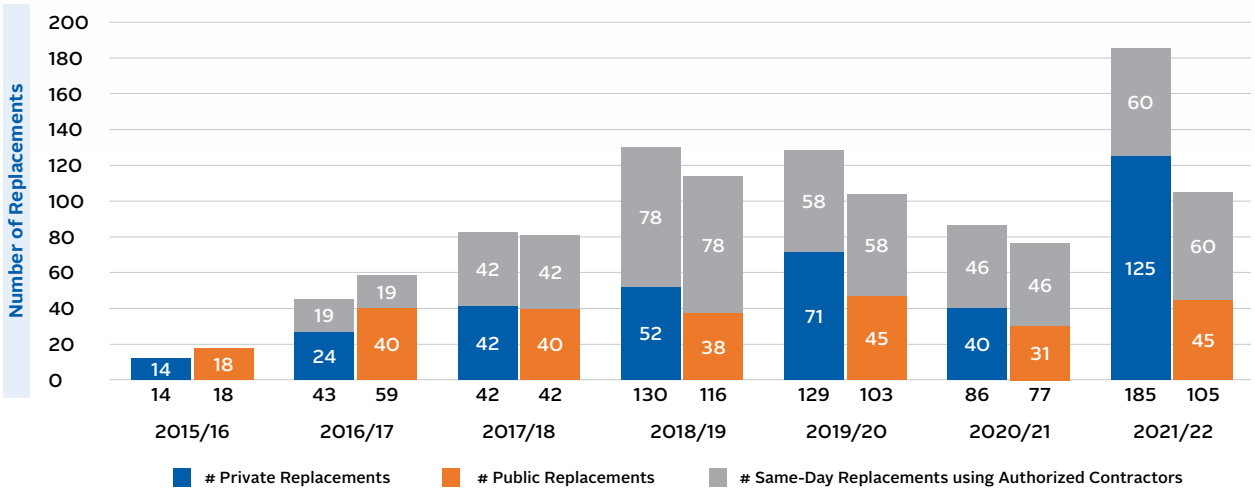
The Get the Lead Out program aims to replace all lead service lines by 2038 or earlier. This timeline is achievable as Halifax Water no longer needs to wait for the property owner to replace their portion before replacing the public portion. Work can be planned rather than reactive.

We continue to fine-tune the program. For example, identifying where lead service lines exist is a challenge because they are underground. Currently, Halifax Water relies on historical records and excavating a small hole around the service box to verify that the water service line is lead before planning a replacement. However, records are not always accurate, and excavation is time-consuming and costly.

To make this process more efficient, in 2021, Halifax Water engaged a third-party vendor to develop a predictive modelling method that uses historical records, property records, past construction practices, and other available information. The first model output was received this year and will be tested in planning for the 2023/24 construction season.

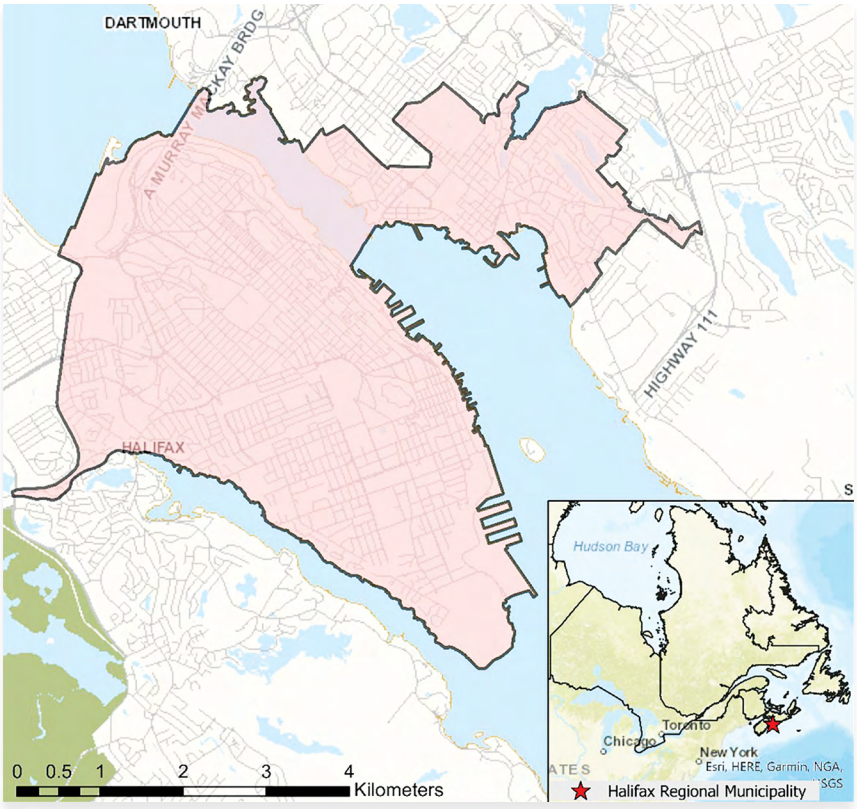
In recognition of our Get the Lead Out Program, Halifax Water was the recipient of the 2022 Water's Next Award in the Drinking Water Category. This recognition is a testament to the program's value and its importance to us and the industry. With the first year behind us and some lessons learned, combined with improving our inventory through innovative programs, we are well on our way toward eliminating lead service lines by 2038!

Public and Private Lead Service Line Replacements



Number of public (orange) and private (blue) service lines replaced by fiscal 2021-2022. Grey bars indicate residents who used the same-day authorized contractor program to renew both public and private service lines on the same day.

Halifax Water's Lead Service Line Boundary



Halifax Water's lead service line boundary contains areas of the distribution system that would have been served by a centralized water system before 1960.

Source Water Quality Monitoring

Halifax Water is committed to providing high-quality drinking water to our customers every day. Meeting that commitment requires a lot of work behind the scenes to ensure that the water sources remain healthy and safe.

We have industry-leading seasonal and long-term source water monitoring approaches to monitor pH, taste and odour (geosmin), colour, and algal activity. This includes testing for harmful algal blooms caused by cyanobacteria (blue-green algae).

Long-term monitoring has been in place for many years and enables us to plan appropriately to ensure that we have the robust treatment processes needed to manage future water quality.

The seasonal algal monitoring program has been developing over the past five years based on industry best practices. It allows us to respond quickly to changing water quality to ensure the delivery of high-quality, safe drinking water.

Understanding the dynamics of source water quality and monitoring for harmful algal blooms is an evolving field. It requires a multi-prong approach to provide tools and knowledge for risk-based decision-making. Halifax Water reviews its approach annually and participates in industry-leading research projects to ensure our approach aligns with best practices. Each source of water is unique in its water quality and biology. Thus long-term and seasonal source water monitoring programs are in place in Halifax Water's surface water sources.

In 2021/22, Halifax Water participated in three Water Research Foundation projects focused on source water monitoring. These three projects focused on developing tools to predict harmful algal blooms, utility responses to cyanobacterial/cyanotoxin events,

Our Lakes Are Changing

Many lakes in Nova Scotia are changing due to lake recovery and climate change.

Lake recovery is the process by which improved air emissions standards have reduced acid rain, and as a result, lakes in Nova Scotia and Atlantic Canada are recovering from historical acidification.

As a result, there is an increase in the potential for hydrogen (pH level) and greater natural organic matter. Other changes can be biological and may include changes to the types of plants and animals that lakes can support.

In addition, changing temperature and precipitation patterns, including timing and frequency, can also play a role in changing source water quality.

and a tailored collaboration project on developing a decision support framework for water utilities experiencing lake recovery. Through these projects, Halifax Water has developed tools to better use and understand source water data. The seasonal algal monitoring program has been adapted to reflect emerging industry best practices.

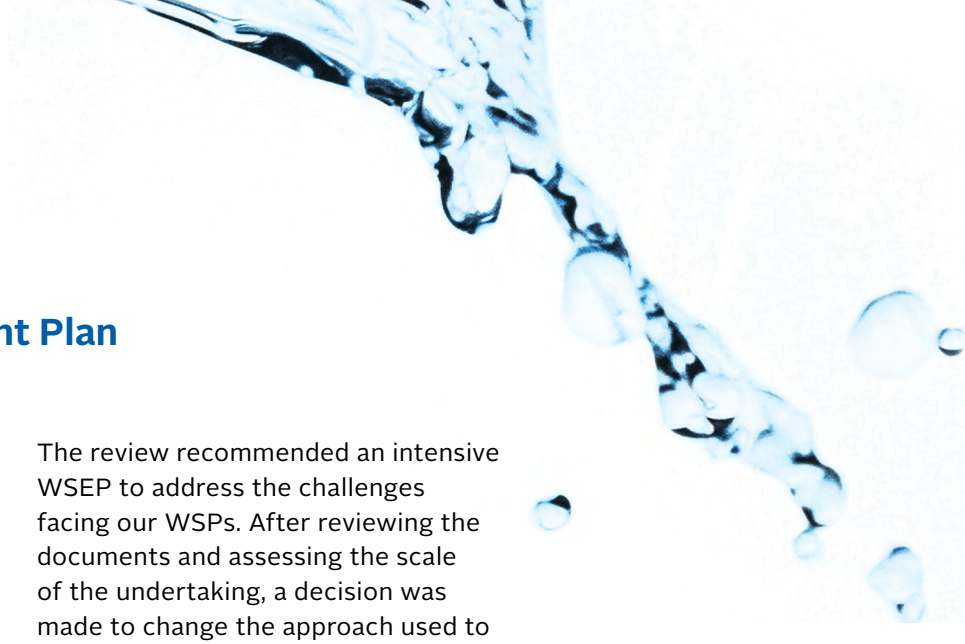
Lake recovery research through the Dalhousie/Halifax Water NSERC Industrial Research Chair in 2021/22 focused on the development of cyanotoxin analytical quantification tools. This was combined with the development of new and innovative passive sampling approaches that will enable us to gather more chemical and biological water quality data in our lakes and watersheds, feeding into Halifax Water's source water dataset to allow for both short-term and long-term decision making.

Halifax water has used a modelling tool to evaluate the ability of each surface water treatment facility to remove cyanobacteria cells and cyanotoxins. We have conducted exercises on various bloom scenarios and evaluated how treatment adjustments influence the degradation of cyanotoxins. This modelling tool provides an assessment of current and future treatment options.

In 2021/22, Halifax Water incorporated a genetic tool for assessing the presence of cyanobacteria and the likelihood that a population can produce cyanotoxins. This tool enables us to develop trigger points for further sampling and investigation and provides us with baseline data on algae in our lakes. This is one of several tools that can be deployed quickly if there are shifts in water quality. This tool, combined with visual inspections of our source water; routine monitoring at intakes for chemical and biological parameters; continuous monitoring for algal populations; and continuous monitoring of the treatment process, enable us to identify changes quickly and adjust treatment processes proactively.

The evolution of Halifax Water's source water protection and seasonal algal monitoring programs ensures Halifax Water has industry-leading tools in place to assess risk and respond quickly to water quality changes and ensure continued delivery of high-quality drinking water.

Example of a blue-green algae bloom.



Water Supply Enhancement Plan

The J.D. Kline and Lake Major Water Supply Plants (WSPs) have provided high-quality water to Halifax Water customers for many years. However, a combination of aging infrastructure, changes in source water conditions, and climate impacts have made the treatment processes at both WSPs more challenging.

This is especially pronounced at the J.D. Kline (JDK) WSP, where there is no clarification step in the treatment process. In addition to the adverse impacts on JDK's performance, geosmin has been detected in Pockwock Lake over the past few years. Although geosmin has no health impact, it can cause an earthy or musky taste/odour, which can impact consumer confidence in the quality of the water.

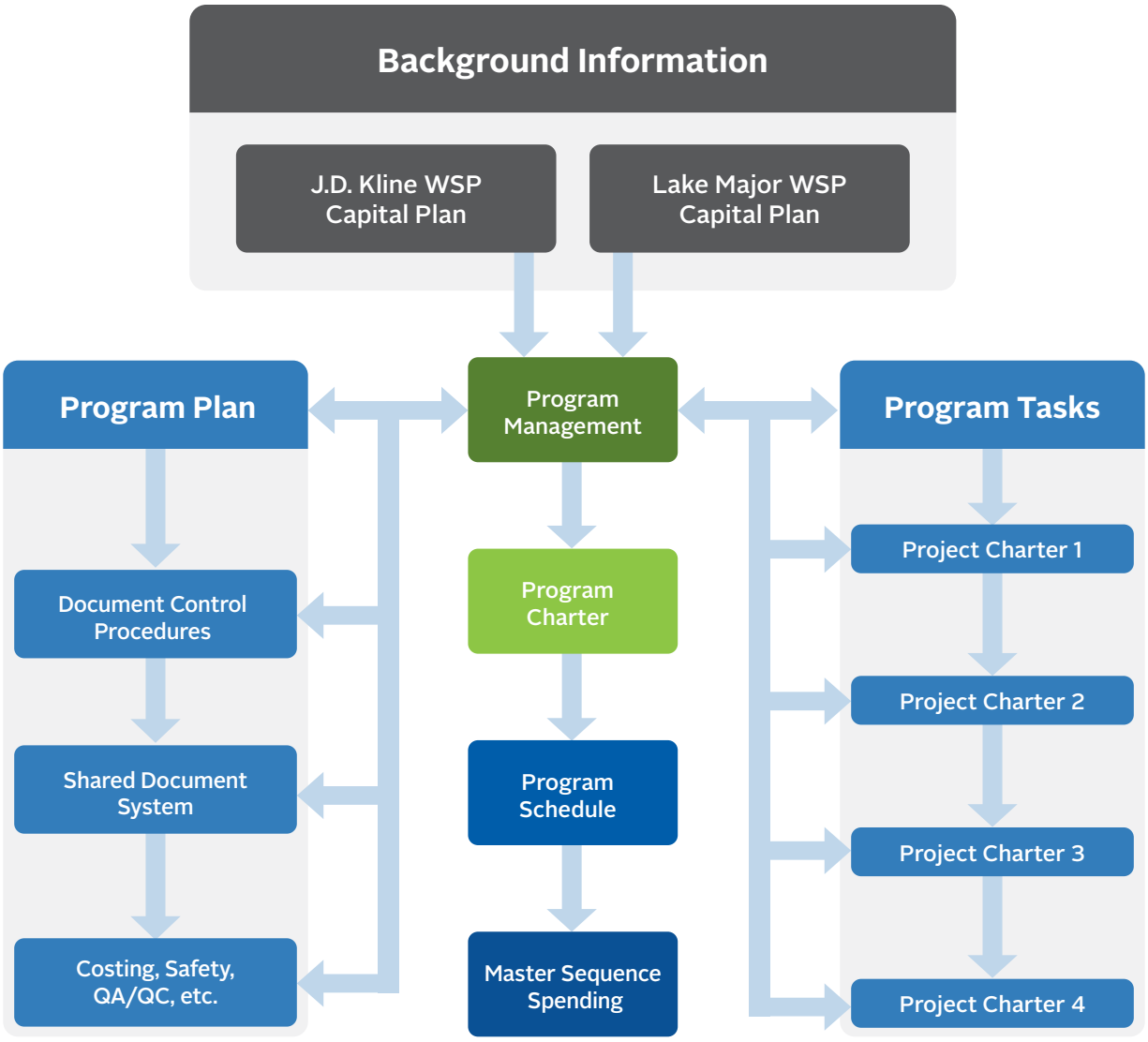
These dynamic source water changes leave both WSPs operating outside what they were designed for. This presents an elevated risk for maintaining high-quality water, increasing operational costs and inefficiencies, and negatively impacting customer service.

To ensure the continued reliable supply of safe, high-quality drinking water and to remain compliant with current and future regulatory requirements, Halifax Water began looking at capital upgrade strategies for J.D. Kline and Lake Major Water Supply Plants in 2019. Working with a third-party consultant, several workshops were held with different internal stakeholders to develop a complete list of risks and opportunities added to the Water Supply Enhancement Program (WSEP).

The review recommended an intensive WSEP to address the challenges facing our WSPs. After reviewing the documents and assessing the scale of the undertaking, a decision was made to change the approach used to complete the recommended upgrades. This change in direction will integrate capital investment and construction decisions in line with the Integrated Master Plan, the Asset Management Program, and the Water Engineering Capital Plan.

This integrated approach is intended to ensure that capital projects are executed in phases considering the WSEP-specific projects and others related to water treatment and distribution systems. This will help minimize any potential impacts on our services and our customers. This approach has also enabled the utility to adapt projects, such as advanced oxidation, to address emerging source water quality issues, including algal blooms, potential algal toxins, and other biological changes.

Initial design work has been completed. The team is now working on the design concept for new clarification technology, which will immediately improve the resilience of both WSPs. The WSEP will not only see more resilience built into the WSPs but the distribution system as well. These are the first steps into the estimated (2018) $250 million, 10-year WSEP, allowing the utility to construct infrastructure to address the challenges of an unpredictable world.



AI Intelligent Water

To better serve our customers, Halifax Water is exploring opportunities to take advantage of emerging digital technology. This could allow the utility to automate various functions and apply artificial intelligence and machine learning to the data we currently possess and generate. Our goal would be to automate certain activities, improve operations, and provide a higher level of service to customers.

As part of this, Halifax Water completed an intelligent water opportunities assessment. This assessment looked at all areas of Halifax Water operations and identified areas where there is room for improvement. It then paired those opportunities with intelligent water products and services currently in the marketplace to identify the most cost-effective options to improve service or to reduce costs through automation. This assessment will guide our next five-year IT plan.

Halifax Water is now taking advantage of these opportunities by establishing several pilot projects:

Transmission Main Monitoring Pilot

By installing listening sensors on a length of Halifax Water transmission main, it provides the ability to listen for sounds in the water column that could indicate a small leak occurring in a large transmission main. The system identifies the type and location of the potential leak. It transmits an alert to operators who may be able to repair a small leak before interrupting service to our customers.

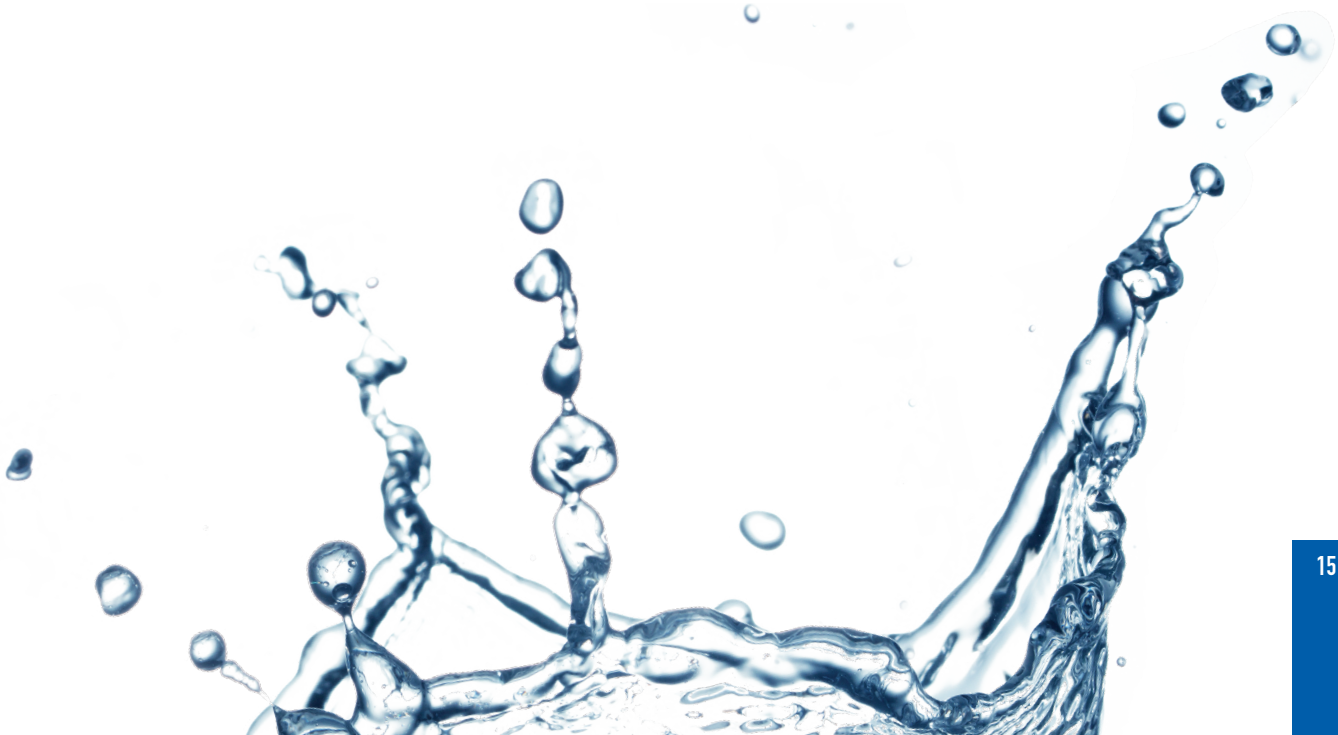
Central Event Management

By monitoring real-time operational data in the water distribution system and applying artificial intelligence, it can identify flow and pressure anomalies that may indicate a problem in the water distribution system. Similarly, alerts are then transmitted to operators to address the anomaly before it leads to a service interruption.

Lead Inventory Analysis

One of the issues in replacing lead service lines is the lack of data on where lead services are located. Without records, it takes costly excavation to verify that a lead service line exists. Halifax Water is working with a third-party vendor called Blue Conduit, which applies artificial intelligence to Halifax Water records and other publicly available data sets to predict where lead service lines are likely to exist. Improving our awareness of where lead service lines are will enable us to better protect public health with our Get the Lead Out program.

Upon completion, each pilot will be evaluated to determine if broader use across Halifax Water's systems is appropriate.



Responsible Financial Management

Annual Financial Results

Halifax Water received a clean audit opinion on the financial statements for the fiscal year ended March 31, 2022. The financial statements are presented in accordance with International Financial Reporting Standards (IFRS). Halifax Water also produces financial information in the format required by the Nova Scotia Utility and Review Board (NSUARB) in accordance with the NSUARB Water Utility Accounting and Reporting Handbook (Handbook).

The financial statements prepared under IFRS are used primarily for consolidation with the Halifax Regional Municipality's financial statements. In contrast, the financial information prepared under the Handbook is used for setting water, wastewater and stormwater rates.

Summary financial information is presented on page 32 under IFRS and under the Handbook on page 33.

The financial statements contain the independent auditor's report issued by Grant Thornton, IFRS statements and schedules containing financial information prepared in accordance with the Handbook. The financial statements can be located at halifaxwater.ca/publications-reports.

Statement of Earnings

Table 1 - Summarized Statement of Earnings Comparison to Budget

	Budget 2021/22 '000	Actual 2021/22 '000	Actual 2020/21 '000	2021/22 Budget/ Actual $ Variance	2021/22 Budget/ Actual % Variance
Operating revenues	**$ 150,467**	**$ 150,502**	$ 136,569	$ 35	0.0%
Operating expenditures	**125,379**	**122,521**	114,376	(2,858)	(2.3%)
Earnings from operations	**25,088**	**27,981**	22,193	2,893	11.5%
Financial and other revenues	**722**	**796**	963	74	10.2%
Financial and other expenditures	**37,460**	**35,159**	33,727	(2,301)	(6.1%)
Loss for the year	**$ (11,650)**	**$ (6,382)**	$ (10,571)	$ 5,268	(45.2%)

The key differences between the IFRS and Handbook financial statements are related to reporting requirements for the recognition of various expenditures as follows:

- The full actuarial liability of employee future benefits is not considered an expense for the Handbook and could result in either positive or negative impacts on earnings.
- Principal payments on long-term debt are an expense for the Handbook but not under IFRS.
- Depreciation expense on contributed assets is not an expense for the Handbook, and amortization of contributed capital is not considered revenue under the Handbook.
- Various depreciation adjustments, including the add-back of losses on the disposal of utility plant in service, componentization of assets and shorter useful lives, result in higher depreciation under IFRS than under the Handbook.

Table 2 - Reconciliation IFRS to Handbook Results

	2021/22 '000	2020/21 '000
IFRS comprehensive earnings (loss)	**$ 45,594**	$ (919)
Add non-cash pension expense	9,229	7,086
Subtract debt principal payments	(21,477)	(20,379)
Add depreciation expense on contributed assets	18,592	18,810
Subtract amortization of contributed capital	(18,592)	(18,810)
Add various depreciation adjustments	1,179	412
Add (subtract) OCI loss (gain)	(40,907)	3,229
NSUARB Loss	$ (6,382)	$ (10,571)

Under IFRS, the comprehensive earnings are $45.6M. After the adjustments described above, the loss for the year under the Handbook is $6.4M. From a budget perspective, the loss was less than the budget due to operating expenses and debt servicing being less than expected.

The water services loss of $3.4M as compared to earnings of $0.5M in the prior year and $1.8M less than budget. The primary difference from the budget was lower debt service costs.

The wastewater services' earnings of $0.4M increased over the prior year's loss by $7.5M and was $1.9M more than budget. The primary difference from the budget relates to lower depreciation and debt services costs.

The stormwater services loss of $3.3M decreased from the prior year's loss by $0.6M and was $1.6M less than budget. The difference from the budget relates to reduced costs being experienced in expenditure categories such as contract services and traffic control and associated reduction in wages and overtime.

Table 3 - Operating Results by Service

	Budget 2021/22 '000	Actual 2021/22 '000	Actual 2020/21 '000	2021/22 Budget/ Actual $ Variance	2021/22 Budget/ Actual % Variance	Actual/ Actual $ Change	Actual/ Actual % Change
Water	**$ (5,221)**	**$ (3,428)**	$ 493	$ 1,793	(34.3%)	$ (3,921)	(795.3%)
Wastewater	**(1,517)**	**389**	(7,110)	1,906	(125.6%)	7,499	(105.5%)
Stormwater	**(4,912)**	**(3,343)**	(3,954)	1,569	(31.9%)	611	(15.5%)
Loss	**$ (11,650)**	**$ (6,382)**	$ (10,571)	$ 5,268	(45.2%)	$ 4,189	(39.6%)

Revenue

Operating revenues increased from last year by $13.9M. Consumption increased by 1.2% on a volumetric basis resulting in an increase in consumption revenue. Base charge revenue remained consistent with the prior year. Overall, the main contributing factor to the increase in operating revenues was the wastewater discharge rate increase effective April 1, 2021, from $1.753 per cubic meter to $2.073.

The wastewater rebate, which is available to certain large customers whose wastewater is a lower proportion of their consumed water, increased $0.5M from the prior year due to new customers in the current year and existing customers increasing their discharge into our system due to operational requirements post COVID-19.

Stormwater site generated charge revenue is $1.2M more than the prior year. The increase relates to the impervious area satellite imagery update.

Fire protection revenues are $0.6M higher than the prior year due to an approved rate increase effective October 1, 2020.

Table 4 - Operating Revenues

	2021/22 '000	2020/21 '000	$ Change	% Change
Consumption revenue	**$ 96,497**	$ 84,538	$ 11,959	14.1%
Base charge revenue	**33,635**	33,544	91	0.3%
Wastewater rebate	**(1,297)**	(846)	(451)	53.3%
Metered sales total	**128,835**	117,236	11,599	9.9%
Stormwater site generated charge	**6,294**	5,127	1,167	22.8%
Stormwater right of way	**3,835**	3,835	0	0.0%
Public fire protection	**7,628**	7,336	292	4.0%
Private fire protection	**1,270**	1,001	269	26.9%
Other operating revenue	**2,640**	2,034	606	29.8%
Operating revenue total	**$ 150,502**	$ 136,569	$ $13,933	10.2%

Expenditures

Operating Expenditures

Operating expenditures for 2021/22 are $122.5M, an increase of $8.1M or 7.1% compared to the prior year. The drivers of the increase include depreciation and amortization expense, salaries and benefits, higher prices for chemicals, and increases related to software licenses and network costs.

Table 5 - Operating Expenditures

	2021/22 '000	2020/21 '000	$ Change	% Change
Water supply and treatment	**$ 10,760**	$ 9,987	$ 773	7.7%
Water transmission and distribution	**11,316**	10,960	356	3.2%
Wastewater collection	**12,988**	12,710	278	2.2%
Stormwater collection	**4,566**	4,700	(134)	(2.9%)
Wastewater treatment	**21,774**	20,623	1,151	5.6%
Engineering and technology services	**13,719**	11,171	2,548	22.8%
Regulatory services	**4,392**	3,981	411	10.3%
Customer services	**4,811**	5,081	(270)	(5.3%)
Corporate services	**3,062**	0	3,062	0.0%
Administration services	**5,359**	7,067	(1,708)	(24.2%)
Depreciation and amortization	**29,774**	28,096	1,678	6.0%
Operating expenditures total	**$ 122,521**	$ 114,376	$ 8,145	7.1%

Financial & Other Expenditures

Reported financial and other expenditures totalled $35.2M in 2021/22, an increase of $1.4M or 4.2% compared to the prior year. The increase was attributed to debt servicing costs, mainly long-term debt repayments, and the dividend/grant in lieu of taxes which increased due to the proration of the expense in the prior year as the three-year agreement with HRM to pay a dividend of 0.25% on wastewater and stormwater rate-based assets came into effect October 1, 2020.

Table 6 - Financial & Other Expenditures

	Budget 2021/22 '000	Actual 2021/22 '000	Actual 2020/21 '000	2021/22 Budget/Actual $ Variance	2021/22 Budget/Actual % Variance	Actual/Actual $ Change	Actual/Actual % Change
Interest on long-term debt	**$ 7,603**	**$ 6,859**	$ 7,118	$ (744)	(9.8%)	$ (259)	(3.6%)
Repayment on long-term debt	**22,716**	**21,477**	20,379	(1,239)	(5.5%)	1,098	5.4%
Amortization of debt discount	**258**	**228**	209	(30)	(11.6%)	19	9.1%
Dividend/grant in lieu of taxes	**6,837**	**6,466**	5,951	(371)	(5.4%)	515	8.7%
Other	**46**	**129**	70	83	180.4%	59	84.3%
Financial and other expenditures total	**$ 37,460**	**$ 35,159**	$ 33,727	$ (2,301)	(6.1%)	$ 1,432	4.2%

Regulated & Unregulated Activities

Regulated Activities

Activities regulated by the NSUARB show a loss of $6.9M, representing a decrease of $4.5M compared to the prior year.

Unregulated Activities

Earnings from unregulated activities decreased by $0.3M from the prior year due to an increase in operating costs for wastewater treatment and allocation of administrative costs.

Table 7 - Results by Activity

	Budget 2021/22 '000	Actual 2021/22 '000	Actual 2020/21 '000	2021/22 Budget/ Actual $ Variance	2021/22 Budget/ Actual % Variance	Actual/ Actual $ Change	Actual/ Actual % Change
Regulated activities	**$ (12,175)**	**$ (6,889)**	$ (11,397)	$ 5,286	(43.4%)	$ 4,508	(39.6%)
Unregulated activities	**525**	**507**	826	(18)	(3.4%)	(319)	(38.6%)
Loss	**$ (11,650)**	**$ (6,382)**	$ (10,571)	$ 5,268	(38.05%)	$ 4,189	(39.6%)

Statement of Financial Position

Cash and cash equivalents

Cash and cash equivalents balance of $65.6M is higher than the prior year by $17.4M due to new debt and net receipts of Regional Development Charges (RDC), reduced by debt repayments and spend on capital.

The liquidity on the balance sheet (ratio of current assets divided by current liabilities) is 1.33 (per NSUARB Handbook reporting).

Assets

Utility plant in services assets, net of accumulated depreciation, are $1,277.4M and is $2.9M or 0.2% lower than last year. The total of new assets capitalized in the fiscal year was $48.9M. At the end of the fiscal year, there was $51.0M in capital work in progress, compared to $30.9M last year.

Table 8 - Additions to Utility Plant in Service and Intangibles

	Cumulative '000
Wastewater System Trenchless Rehabilitation	$ 4,870
Romans and Federal Avenues Sewer Separation	2,862
Ellenvale Run Retaining Wall Phase 4	2,123
Ellenvale Run Retaining Wall Phase 5	2,236
Pump Station Control Panel/Electrical Replacement	1,745
	13,836
All other projects:	
Water	16,560
Wastewater	13,026
Stormwater	5,485
	35,071
Total additions	$ 48,907

Table 9 - Capital Work in Progress

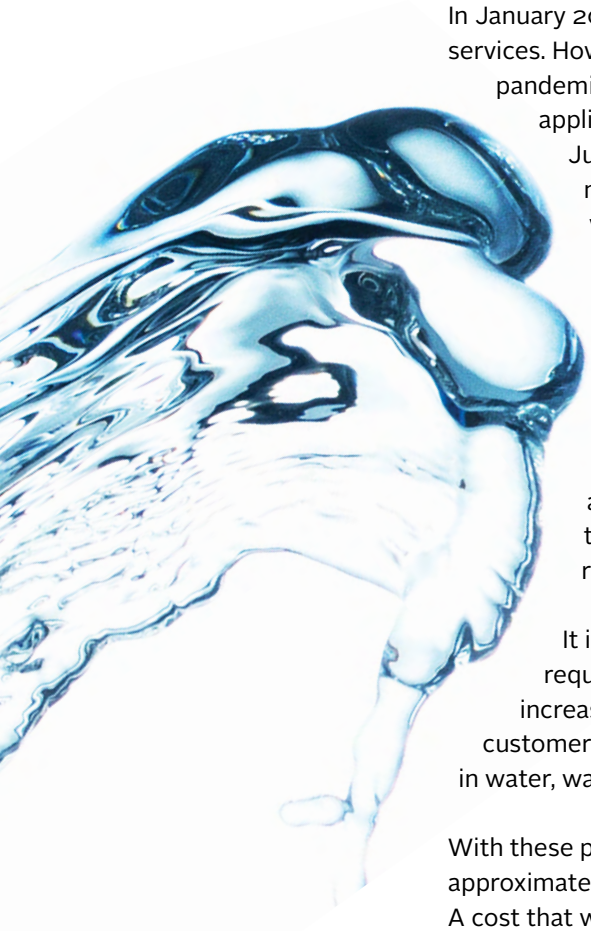
	Cumulative '000
Bedford South Reservoir	$ 5,865
ERP Replacement Project	5,600
Russell Lake Pumping Station	1,560
Morris Lake Pumping Station	1,533
Bedford to Halifax Trunk Sewer Upgrade	1,422
	15,980
All other projects:	
Water	16,394
Wastewater	16,184
Stormwater	2,455
	35,033
Capital work in progress	$ 51,013

Debt

Debt continues to be an important funding source for Halifax Water's capital program. Total long-term debt is $224.2M. New debt of $20.0M was received in May 2021, and repayments during the year were $20.6M.

The debt service ratio of 18.98% is well below the maximum 35.00% ratio allowed under the blanket guarantee agreement with HRM.

2022 General Rate Application



In January 2020, Halifax Water proposed rate increases in water and wastewater services. However, given the sensitivities and uncertainties created by the COVID-19 pandemic for our customers, the utility changed its approach and revised its application. The NSUARB approved Halifax Water's revised rate application in June 2020, with no increase in water and wastewater rates for 2019/20, no increase in rates for water services for 2020/21 and an increase in the volumetric rate for wastewater effective April 1, 2021.

As a result of this change in approach, Halifax Water has incurred a deficit of $9.9M in 2020/21 and a further deficit of $6.4M in 2021/22. Halifax Water has utilized accumulated surpluses and special reserves to make up the shortfall. However, this approach is not sustainable in the long term.

To help address this, in February 2022, Halifax Water filed a general rate application to adjust the water, wastewater and stormwater rates. If approved, the proposed rates would see the average water, wastewater and stormwater residential bill increase by 3.6% in 2022/23 and a further 3.6% in 2023/24.

It is important to recognize that Halifax Water's budgets and revenue requirements are developed on a break-even basis. These proposed rate increases will allow Halifax Water to maintain the current level of service to customers, recognize additions to utility plants in service, and continue investment in water, wastewater and stormwater infrastructure.

With these proposed increases, the median residential customer in Halifax would pay approximately 1.2% of their income for water, wastewater and stormwater services. A cost that would continue to be below the average benchmark for comparable communities across Canada.

Cost Comparison

Providing our customers with good value for our services is vital. We compare our rates to a number of comparable utilities across Canada to ensure that we continue to provide water, wastewater and stormwater services at a reasonable price.

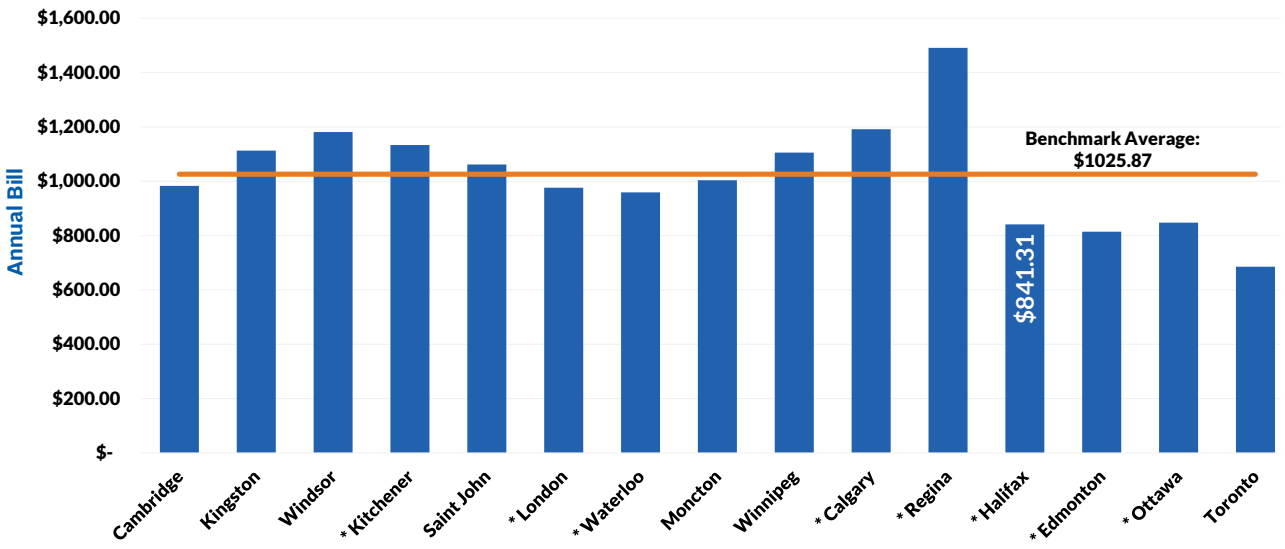
The median household income in the Halifax Census Metropolitan Area is $73,400 based on Statistics Canada, Canadian Income Survey 2012-2019. The median household income, if increased by CPI, would be expected to be $74,564 in 2021. The average family currently pays $841.31 for water, wastewater and stormwater services. The average bill equates to 1.2% of median household income, indicating that Halifax Water's rates benchmark favourably with the rate affordability threshold. Halifax Water rates also benchmark favourably with other comparable Canadian utilities.

As of the most recent benchmarking in 2020/21, the average residential bill for combined water, wastewater and stormwater service for the 14 benchmark cities was $1,025.87. With the proposed rate increases in 2022/23 and 2023/24, Halifax Water's total residential bills will remain below the 2020/21 average.

Halifax Water's rates for other meter sizes also benchmark well with other cities. The comparison based on current rates shows Halifax Water for all meter sizes, other than 10", was less than the average of the benchmark cities.

Benchmarking of Estimated Annual Residential Cost

(5/8" - 15mm Meter)



* Includes Water, Wastewater and Stormwater; all others are Water and Wastewater only

Cost Containment

Cost containment continues to be a focus for Halifax Water and contributes to our ability to maintain affordable rates. A formal cost containment program has been in place since 2013. Cost containment initiatives have had the most significant impact in the areas of Human Resources and Facilities/Process Strategies. The pension plan re-design initiated in 2015/16 is one of the main contributors to cost containment savings for the current year. Annual savings related to pension plan re-design are approximately $1.7M.

Facilities/Process Strategies initiatives vary; however, Halifax Water's Energy Efficiency Program is a significant contributor. Projects under this program represent approximately $1.4 million for 2021/22 and include energy savings programs such as:

- The renewable natural gas (RNG) utilized at the Mill Cove and Timberlea Wastewater Treatment Facilities (WWTFs) ($0.3M).
- The annual shutdown of the ultraviolet disinfection systems at the Harbour Solutions and Eastern Passage WWFTs ($0.2M).
- Heat recovery processes at the Harbour Solutions WWTFs ($0.1M).
- Lighting upgrades at various other facilities.

New cost containment initiatives implemented during 2021/22 resulted in one-time and ongoing cost savings amounting to $0.6 million. Significant initiatives during 2021/22 were:

Procurement Strategies

Procurement strategies from a capital perspective have led to much of the cost savings realized in the current year. For example, the 2019 Municipal Auditor General (MAG) Fleet Use Audit led to a reduction in the Fleet Upgrade Capital Program in 2021/22 of $1.1M, resulting in cost savings associated with depreciation expenses of approximately $0.2M annually. Adjustments were also made in the Sewer Jet Replacement Program, where $0.3M was trimmed from the capital budget by choosing to replace the chassis and perform modifications on an existing vehicle rather than purchase a new unit again, resulting in depreciation savings of an estimated $0.1M annually.

Facilities/Process Strategies

Cost savings are being experienced at the Mill Cove and Timberlea WWTFs, where anaerobic digesters are being used to produce biogas or RNG, which is then used to heat the digesters and all facility buildings. Cost savings are an estimated $0.3M annually.

Pension Plan

All Halifax Water employees are members of one of two defined benefit pension plans.

Employees that transferred from HRM, of which 49 remain, are members of the HRM Pension Plan. Halifax Water is obligated to make contributions for these employees' service to the HRM Pension Plan.

Halifax Water maintains the Halifax Regional Water Commission Employees' Pension Plan (the Plan) for all other employees. An actuarial valuation of the Plan is required every three (3) years to determine its financial health and future contribution rate and to meet statutory filing requirements. This valuation was conducted as of January 1, 2022, and abbreviated results are shown below:

Table 10 - Going Concern Financial Position

	January 1, 2022 '000's	January 1, 2019 '000's
Value of assets	$ 172,968	$ 126,429
Liabilities	(135,207)	(124,371)
Provision for Adverse Deviation (PFAD)	(9,405)	N/A
Going Concern Excess	$ 28,356	$ 2,058
Funded Ratio	**119.6%**	**101.7%**

The Plan's funded ratio has increased from 101.7% to 119.6% since the last valuation on January 1, 2019. The increase is primarily related to higher-than-expected revenues and a change in the discount rate. Effective January 1, 2022, employee and employer contribution rates will reduce from 10.34% to 9.6% as a result. The next valuation is due no later than January 1, 2025.

Table 11 - HRWC Employees' Pension Plan

Abbreviated Financial Position at December 31

	2021 '000	2020 '000
Net assets available for benefits	$ 174,636	$ 154,956
Pension obligation	144,612	141,763
Surplus	**$ 30,024**	**$ 13,193**

In 2021, the net assets available for benefits increased to $174.6M from $155.0M. The increase was primarily due to an increase in the fair value of investment assets of $15.4M. Over the same period, the pension obligation increased to $144.6M from $141.8M.

The financial statements for the Plan are audited by Grant Thornton LLP and can be located at halifaxwater.ca/publications-reports. The financial statements contain the independent auditor's report issued by Grant Thornton.

Table 12 - HRWC Employees' Pension Plan

Abbreviated change in net assets available for benefits at the Year Ended December 31

	2021 '000	2020 '000
Revenue	$ 18,771	$ 12,199
Contributions	6,693	6,540
Expenses	5,784	5,363
Increase in net assets available for benefits	**$ 19,680**	**$ 13,376**

Enterprise Resource Planning (ERP) Solution Project

Improving operational efficiencies helps Halifax Water lower operating costs and provide better customer service. The Enterprise Resource Planning (ERP) platform holds Halifax Water's key financial, customer and business records in one system and supports numerous business activities.

Currently, Halifax Water is in the process of replacing our ERP software platform through the ERP Solution Project.

The new platform, called Cayenta, is an integrated system that will provide real-time access to customer and financial information and enhanced tools to support decision-making and better manage infrastructure, services, programs, and capital delivery; as well as help improve our ability to meet the growing expectations of our customers.

Cayenta will provide dashboards and enhanced reporting tools for greater insight into daily activities. The modern design and workflows will automate many

manual processes and reduce the reliance on spreadsheets for analysis. With accessibility from any work device, Halifax Water staff will find a variety of business functions consolidated in one place.

The Cayenta Customer Information System module will enhance the business processes used by the Customer Care Centre, Billing and Metering departments. It will ensure Halifax Water stays connected with customers and integrate customer billing and metering information. New dashboards and reports will provide insight to see trends in real-time.

The Financial Management System module will power Halifax Water's insight into operations and financial resources. This includes managing budgets, funding, inventory, procurement and vendor management. Halifax Water will be able to improve spending decisions, optimize budgets, better forecast our cash, debt requirements and surpluses, track and manage operational and capital project expenses, process payments to suppliers efficiently, and align resources where they are needed at the right time.

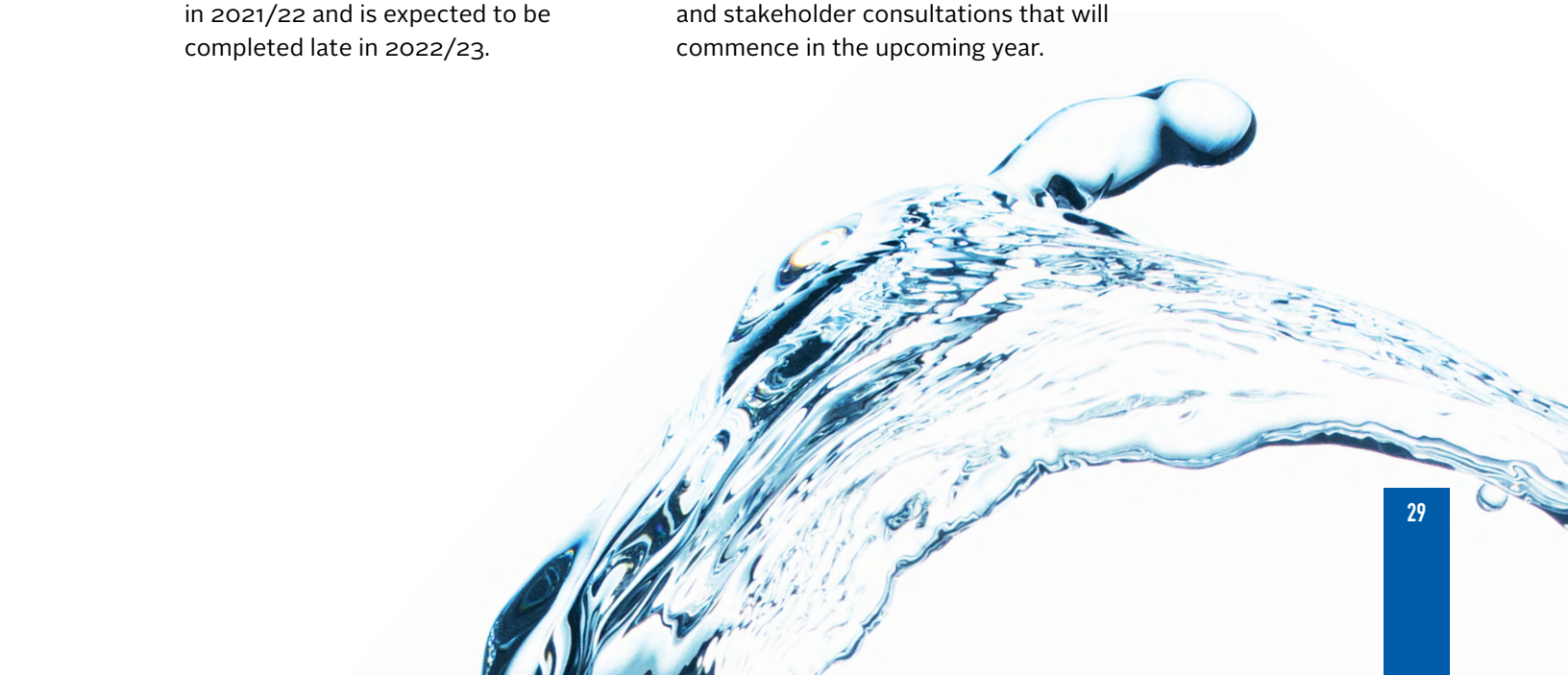
The ERP Solution Project began early in 2021/22 and is expected to be completed late in 2022/23.

Regional Development Charge

The application to update the Regional Development Charge (RDC) was submitted to the Nova Scotia Utility and Review Board (NSUARB) in November 2019, with the associated hearing occurring in June 2020. The proposed RDC was based on the 2019 Infrastructure Master Plan, which determined the water and wastewater infrastructure required to support the projected growth within HALIFAX in the next 20 years.

Using this information, a charge per new residential dwelling unit or non-residential floor area was created. Halifax Water is committed to regular reviews of the RDC and to identify interim changes and impacts based on the new and best information that may result in a 15% +/- change to the RDC. In consultation with HALIFAX staff, a proposed deferral of the RDC charges to assist Affordable Housing initiatives with their financing was introduced and subsequently approved by the NSUARB.

The NSUARB issued a decision in October 2020 with an ultimate final order in April 2021. The decision outlined a number of annual reports and stakeholder consultations that will commence in the upcoming year.



Financial Overview

Abbreviated Financial Overview (IFRS)

	March 31, 2022 '000	March 31, 2021 '000	$ Change	% Change
ASSETS				
Current				
Cash and cash equivalents	$ 65,586	$ 48,228	$ 17,358	36.0%
Receivables	35,589	38,112	(2,523)	(6.6%)
Inventory and prepaids	4,450	3,573	877	24.5%
Total current assets	$ 105,625	$ 89,913	$ 15,712	17.5%
Utility plant in services				
Cost	1,607,243	1,562,720	44,523	2.8%
Accumulated depreciation	(329,883)	(282,437)	(47,446)	16.8%
Net utility plant in service	1,277,360	1,280,283	(2,923)	(0.2%)
Intangible assets	20,805	20,588	217	1.1%
Capital work in progress	51,013	30,908	20,105	65.0%
Total non-current assets	1,349,178	1,331,779	17,399	1.3%
Regulatory deferral account	2,428	2,620	(192)	(7.3%)
Total assets and regulatory deferral account	**$ 1,457,231**	**$ 1,424,312**	**$ 32,919**	**2.3%**
LIABILITIES AND EQUITY				
Payables, deposits and unearned revenue	$ 33,138	$ 23,121	$ 10,017	43.3%
Long term debt	224,182	224,665	(483)	(0.2%)
Deferred contributed capital	908,589	898,952	9,637	1.1%
Employee benefit obligations	41,950	73,796	(31,846)	(43.2%)
Total liabilities	1,207,859	1,220,534	(12,675)	(1.0%)
Total equity	249,372	203,778	45,594	22.4%
Total liabilities and equity	**$ 1,457,231**	**$ 1,424,312**	**$ 32,919**	**2.3%**

	2022 '000	2021 '000	$ Change	% Change
EARNINGS AND COMPREHENSIVE EARNINGS				
Operating revenues	$ 150,502	$ 136,569	$ 13,933	10.2%
Operating expenditures (excluding depreciation and amortization)	(101,976)	(93,366)	(8,610)	9.2%
Depreciation and amortization	(49,572)	(48,607)	(965)	2.0%
Loss from operations	(1,046)	(5,404)	4,358	(80.6%)
Financial and other revenues	19,607	19,773	(166)	(0.8%)
Financial and other expenditures	(13,682)	(11,867)	(1,815)	15.3%
Earnings for the year	4,879	2,502	2,377	95.0%
Regulatory deferral account depreciation	(192)	(192)	0	0.0%
Re-measurement on defined benefits plans	40,907	(3,229)	44,136	(1366.9%)
Total comprehensive earnings (loss) for the year	**$ 45,594**	**$ (919)**	**$ 46,513**	**(5061.3%)**

Abbreviated Financial Overview (NSUARB Handbook)

	March 31, 2022 '000	March 31, 2021 '000	$ Change	% Change
ASSETS				
Current				
Cash and cash equivalents	$ 65,586	$ 48,228	$ 17,358	36.0%
Receivables	35,589	38,112	(2,523)	(6.6%)
Inventory and prepaids	4,450	3,573	877	24.5%
Total current assets	$ 105,625	$ 89,913	$ 15,712	17.5%
Utility plant in services				
Cost	1,924,866	1,877,874	46,992	2.5%
Accumulated depreciation	(590,704)	(543,355)	(47,349)	8.7%
Net utility plant in service	1,334,162	1,334,519	(357)	(0.0%)
Capital work in progress	51,013	30,908	20,105	65.0%
Total non-current assets	1,385,175	1,365,427	19,748	1.4%
Regulatory deferral account	2,428	2,620	(192)	(7.3%)
Total assets and regulatory deferral account	**$ 1,493,228**	**$ 1,457,960**	**$ 35,268**	**2.4%**
LIABILITIES AND EQUITY				
Payables, deposits and unearned revenue	$ 33,138	$ 23,121	$ 10,017	43.3%
Long term debt	224,182	224,665	(483)	(0.2%)
Deferred contributed capital	69,140	56,155	12,985	23.1%
Total liabilities	326,460	303,941	22,519	7.4%
Total equity	1,166,768	1,154,019	12,749	1.1%
Total liabilities and equity	**$ 1,493,228**	**$ 1,457,960**	**$ 35,268**	**2.4%**

	2022 '000	2021 '000	$ Change	% Change
EARNINGS AND COMPREHENSIVE EARNINGS				
Operating revenues	$ 150,502	$ 136,569	$ 13,933	10.2%
Operating expenditures (excluding depreciation and amortization)	(92,747)	(86,281)	(6,466)	7.5%
Dividend/grant in lieu of taxes	(6,466)	(5,951)	(515)	8.7%
Depreciation and amortization	(29,774)	(28,095)	(1,679)	6.0%
Earnings from operations	21,515	16,242	5,273	32.5%
Financial and other revenues	796	963	(167)	(17.3%)
Financial and other expenditures	(28,693)	(27,776)	(917)	3.3%
Loss for the year	**$ (6,382)**	**$ (10,571)**	**$ 4,189**	**(39.6%)**

Service Excellence

Customer Care Centre

Performance was down this year due to staffing shortages and an increase in call volume of 16%. The volume increase was related to the high uptake on Customer Connect, our online customer portal with customers requiring assistance with registrations and the result of a more proactive approach to collecting overdue customer accounts.

Improvement in Customer Care Centre performance continues by utilizing the insights from our state-of-the-art telephony system. Customer Care is enhancing the resource plan to ensure staff are available as required to ensure all service levels are achieved in the coming year. Customer Care is also planning to introduce the ability to web chat with customers in the coming year as another communication option for our customers.

	Calls Offered	Calls Answered	Calls Abandoned	Abandon Rate	Calls Answered Within 20 Seconds	The Average Speed Of Answer
2021/2022	73,336	67,871	5,465	7%	60%	106 seconds
2020/2021	63,336	60,880	2,446	4%	71%	56 seconds
2019/2020	86,871	67,360	19,494	22%	32%	260 seconds

Enhancing our online Customer Experience Through Customer Connect

As part of our ongoing commitment to meet the needs of our customers, Halifax Water continues to develop and improve Customer Connect, our online customer portal. At the end of fiscal 2021/22:

- 29% of our total customer base had registered for Customer Connect.
- Approximately 62% of those registered opted for paperless billing, with an estimated savings of approximately $88,000 a year.
- A leak and high consumption alert system was introduced in December 2021 and was welcomed by customers.
- 960 leak alerts and 1,132 high consumption alerts have been sent to customers.
- 20,000 customer logins per month.

Effective Asset Management

Contractors nearing the completion of the Cobequid Road Water Main Replacement.

Providing high-quality water, wastewater and stormwater services to a region of our size relies on infrastructure (assets) that is well maintained and performing as intended.

Similar to our vehicles or homes, these assets require regular maintenance but will deteriorate over their expected life span. Some maintenance activities are based on a schedule; others may be completed on an as-needed basis to extend that asset's life cost-effectively. However, eventually, it must be replaced.

Depending on the potential impact on our ability to provide services to our customers, different types of assets have different priorities regarding maintenance. For example, Halifax Water has a lower tolerance for service disruptions associated with water transmission mains due to the magnitude of the impact on our customers.

In our most recent Integrated Resource Plan (IRP), Halifax Water requires a $4,054M program over 30 years of investment in its infrastructure. Approximately 68% or $2,748M of this total amount has been identified for asset renewal (refer to Figure 1 – 2019 IRP Costs by Driver).

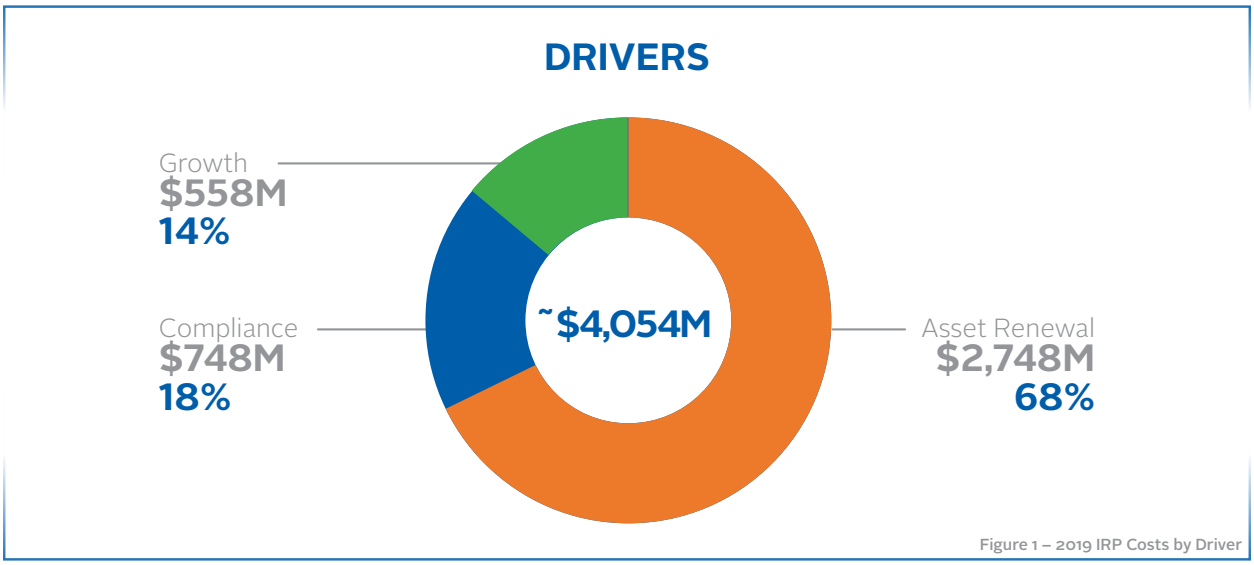


Figure 1 – 2019 IRP Costs by Driver

To ensure effective asset management, Halifax Water has an ongoing program to gather accurate information about its infrastructure's condition, how it performs, and whether it is fit for the purpose. This data helps inform Halifax Water as it decides what work is needed, when, and how much.

Information collected about the assets, institutional knowledge about these assets and service levels, and integration considerations (e.g., different assets in the same corridor, integration with HRM, coordination with projects driven by growth or compliance) are reviewed as capital budgets are prepared.

Asset management is a dynamic system that adapts to allow a continuous improvement cycle. Each iteration of data collection improves Halifax Water's collective understanding of the assets and their impact on service delivery. It enhances the accuracy of the information and enables collaboration amongst the various departments through internal knowledge sharing of reliable data and information that creates a foundation for decision making.

The success of this process is further enhanced by layering in risk, climate change, and operability factors when selecting what assets need reinvestment. All aimed at continuously improving service delivery for our customers.

Capital Infrastructure Projects

Water Capital Infrastructure

2021/22 was another challenging year due to the impacts of the pandemic and supply chain disruptions.

The Water Capital Group continued to develop and implement the recommendations of Halifax Water's Integrated Resource Plan, which identifies key capital upgrades required to accommodate the anticipated short-term and long-term growth in HRM.

Some milestones for 2021/22 included the tender and award of contracts for the construction of transmission main segments, including St Michaels Avenue, Windgate Drive, Cork Street, and Phase 1 of the Burnside-Bedford Connector.

Water Supply Enhancement Program (WSEP)

Halifax Water continues to refine project charters, concept plans and program details for the Water Supply Enhancement Program (WSEP). This is a multi-year capital upgrade and process improvement program for our two largest water supply plants, J.D. Kline (West/Central Regions) and Lake Major (East Region).

In addition to the long-term WSEP work, Halifax Water carried out a number of discrete capital projects within its water supply plants, including the Carbon Dioxide Supply System Replacement and the Low Lift Pump Replacement at the J.D. Kline WSP, the Alum Tank replacement at the Lake Major WSP, and control valve replacements at the Bennery Lake WSP.

Integrated Capital Work with HRM

Wherever practical, Halifax Water integrates the renewal of its water, wastewater, and stormwater assets with HRM's planned capital work. This HRM/Halifax Water integration provides coordinated, cost-effective project delivery for both partners and helps to reduce traffic and community disruptions.

Halifax Water continued its water main renewal program in cooperation with HRM's Streets Capital Upgrade Program. A number of the integrated water main renewal projects were located within the Lead Service Line (LSL) boundary, and Halifax Water was able to make very good progress in getting the lead out of our system through the HRM/Halifax Water Integrated Program.

One of these integrated projects involved HRM's Spring Garden Road Redevelopment project. In partnership with HRM, Halifax Water completed

capital upgrades to our utility infrastructure as part of this project. Work included key water system valve and service replacements and structurally lining the existing wastewater main.

In partnership with HRM and CN Rail, Halifax Water installed a new water main and wastewater mains across the South Street CN Rail Bridge. This represents the fourth project where water and wastewater assets have been renewed as part of the CN Rail Bridge Rehabilitation Program along the rail-cut on peninsular Halifax.

Water Storage Reservoirs

The construction of the new Hemlock Reservoir continued through 2021. The reservoir has become a landmark along the Bicentennial Highway and a symbol of Halifax's exciting growth. Completion is scheduled for the summer of 2022.

The contract to replace the old Cowie Hill Reservoir at 450 Cowie Hill Road was tendered and awarded in 2021. Demolition of the old Cowie reservoir was carried out in early 2022. Project completion is expected later in 2022.

The demolition of the old Cowie Reservoir in preparation for the construction of a new reservoir in its place.

Water Storage Reservoir Inspections

Halifax Water continues to work on the inspection and reinvestment planning for all of its water storage reservoirs as part of a utility-wide asset management approach. In 2021/22, a comprehensive assessment of all seven water supply-related dams owned and maintained by Halifax Water was completed. This assessment, carried out in accordance with the Canadian Dam Association guidelines, is also part of Halifax Water's ongoing asset management program.

Improving Worker Safety

As part of its commitment to improving worker safety, Halifax Water carried out capital upgrades to the Zinck Avenue Pressure Reducing Valve (PRV) Chamber and the Farnham Gate PRV Chamber. This work is part of a long-term program to eliminate the confined space entry risks at key underground control chambers. This will enable staff to quickly and safely enter these chambers to serve our customers better.

Lake Major Clarifier Project – Phase 1

Halifax Water has two primary water supply plants (WSPs) that must operate efficiently and effectively to ensure our customers with a high level of service. J.D. Kline WSP and the Lake Major WSP have provided high-quality water to our customers for many years.

Commissioned in 1999, the Lake Major WSP is equipped with dual train Degremont Ultrapulsators clarifiers. These clarifiers help remove solids after chemical mixing and before the water flows through filters.

However, changing source water conditions and the need for higher chemical doses to maintain high-quality water have put excess demands on the clarifiers. Ultimately, more solids are being processed, which adds additional strain on the clarifiers. Given the age and high strain on these units, Halifax Water began to have concerns about the structures that posed an unacceptable risk to the water supply.

Based on the development of the 2019 capital upgrade strategy, it was determined that this clarification technology was no longer suitable for ensuring current and future compliance with regulatory standards and customer expectations. As a result, it was determined that this clarification technology should be replaced with a new clarification process as part of the ongoing Water Supply Enhancement Program (WSEP). To facilitate the $250M WSEP capital upgrades at J.D. Kline and Lake Major WSPs, the consultants, engineering, and operations groups decided that the clarifier hardware at Lake Major should be replaced.

The replacement of clarifier #1 at Lake Major WSP began in October 2021. There were no interruptions to the water supply in terms of quality or quantity throughout the project, and it was completed within the planned time period.

The challenges encountered for this project can be broadly classified into three themes, as shown below, along with the mitigation efforts to lower the impact or concern posed by that challenge:

Theme	Challenge	Corrective Action Plan
Water Quantity	◤ During the replacement, capacity constraints meant that only 70% of average daily demand could be supplied by the Lake Major Plant. ◤ Lyle Street Booster Station posed a single point of failure as there was no redundant pump to deliver the remaining 30% of the water from Halifax to Dartmouth.	◤ Supplement the remaining 30% capacity from the Halifax system via the MacDonald Bridge line through Lyle Street Booster Station. Additionally, the project was executed in November when the water demand from customers was historically at its lowest. ◤ Engage the Distribution Operations and Technical Services departments to overhaul the pump, install a new VFD and test it in almost a full-scale setup to optimize operations prior to project start-up.
Water Quality	◤ Bringing water from Halifax into Dartmouth meant that there were areas in Dartmouth where the normal direction of flow would have to be reversed, risking discoloured water. ◤ Bringing a new water source into an existing system provides a different taste profile which customers are not used to.	◤ An aggressive flushing program (customer calls #s) was executed in the Dartmouth water system prior to the commencement of this project to lower the risk of discoloured water complaints. ◤ The finished water quality between the two plants was optimized and matched up as close as possible prior to the project commencement.
Constructability	◤ As we could not guarantee the structural integrity of the clarifiers once the water was drained from them, it was deemed that from an occupational health and safety perspective, contractors could not enter from the bottom of the tank to clean or demolish the clarifiers. Hence, all work had to be performed top-down.	◤ A strict scope of work with defined timelines was tendered. The successful proponent was selected based on their capabilities to do the work using ropes. This was a specialized team of 14 experienced rope technicians working around the clock at the start of the project until all demolition was complete. After that, they were split into individual day shifts.
General Reputational Risk to Halifax Water	◤ This was a high-risk project for Halifax Water, given that water quality and quantity could have been seriously disrupted. If either item suffered, Halifax Water ran the risk of losing customer confidence, regulatory censure, and negative media coverage. There were few contingency options.	◤ The project was managed through the Incident Command System and was given priority from all levels of the organization.. Dedicated resources from water treatment, distribution operations, water quality, regulatory services, communications, corporate services, and technical services were allocated to the project to ensure a greater level of emphasis and availability for its execution.

The comprehensive planning and the ICS structure allowed the team to adapt and remain effective until the project was completed. The project was also a success from an inter-departmental collaboration as it involved large parts of the organization.

Wastewater Capital Infrastructure

Trenchless Wastewater Main Lining Program

Over the past eight years, Halifax Water has successfully conducted an annual mainline sewer rehabilitation program using trenchless cure-in-place pipe (CIPP) lining methods. This proven rehabilitation method does not require excavation and causes much less disruption to customers and their neighbourhood streets. In addition, CIPP lining results in a long-term complete structural rehabilitation of the sewer that has also been instrumental in controlling pipe infiltration and ex-filtration.

The primary goals of CIPP are:

- To restore the structural integrity of ageing and compromised sewer mains prone to disruptions.
- To provide and restore flow capacity.

The 2021-22 program included two groups of wastewater mains to be rehabilitated to address:

- Wet weather impacts on the wastewater system.
- Asset renewal pipe rehabilitation.

Contractor installing CIPP liner in a wastewater main.

In addition, residual linings from the previous year's program were also completed in 2021-22. The sewer lengths lined and investments in this infrastructure from 2021-22 are listed in the table below.

The 2021-22 program took place in streets throughout areas of Halifax, Dartmouth and Bedford. The sewers ranged from 200 mm to 900 mm in diameter and included both circular and non-circular pipes. The average cost of lining completed in 2021-22 was approximately $530.00/m.

2021-22 CIPP Wastewater Main Lining

Lining Programs	Length of Sewers Lined (m)	Cost
2020-21 - Structural (residual)	2,230	$1,712,376.12
2021-22 - Infiltration Reduction	1,383	$553,237.23
2021-22 - Structural	3,415	$1,471,110.46
Total	**7,028**	**$3,736,723.81**
Average cost/m	**$530.00**	

Russell Lake Pumping Station Upgrades

The Russell Lake Wastewater Pumping Station is in Dartmouth and was constructed in the mid-1980s as a duplex submersible station. The station did not have backup power and required operational intervention to prevent overflows to Russell Lake during power outages. The existing cinderblock building housed electrical and control systems that were in poor condition and did not meet current electrical codes. The existing valve chamber was challenging to enter during maintenance activities and there was no forcemain redundancy.

This pumping station upgrade project included the installation of a backup power source, constructing a small building to house new electrical, instrumentation and control systems, a new valve chamber and an interconnection of the Russell Lake PS to the Morris Lake PS forcemain to provide redundancy.

Construction of this project is mostly complete, with final commissioning expected in mid-2022.

Morris Lake wastewater forcemain prepared for the installation of a replacement elbow.

Morris Lake wastewater forcemain replacement elbow being installed.

Integrated Capital Projects

To provide our customers with high levels of service for good value, Halifax Water proactively replaces and rehabilitates wastewater, water and stormwater infrastructure in conjunction with municipal street reconstruction projects. Working with the HRM to complete this work together reduces project costs and disruptions to the public. Significant integrated projects completed in 2021/2022 include the following:

Coles Road, SACKVILLE

Wastewater System Replacement
(230 m of main & 2 manholes)

Water System Replacement
(300 m of main)

Stormwater System Replacement
(10 m of main & catchbasin leads)

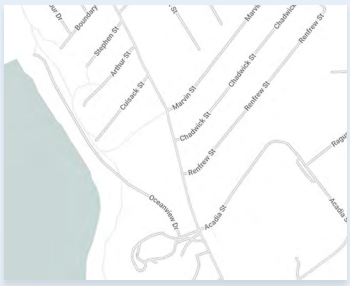
Howland Drive & Howland Court, SACKVILLE

Wastewater System Replacement
(300 m of main, six manholes & 1 lateral)

Water System Replacement
(470 m of main & 3 hydrants)

Stormwater System Replacement
(70 m of main, three manholes, two catchbasins & 30 m of catchbasin leads)

Renfrew Street, DARTMOUTH



Wastewater System Replacement
(430 m of main, 14 manholes & 29 laterals)

Water System Replacement
(230 m of main)

Stormwater System Replacement
(10 m of catchbasin leads)

Morris Lake Pumping Station & Russell Lake Pumping Station - Forcemain Repairs

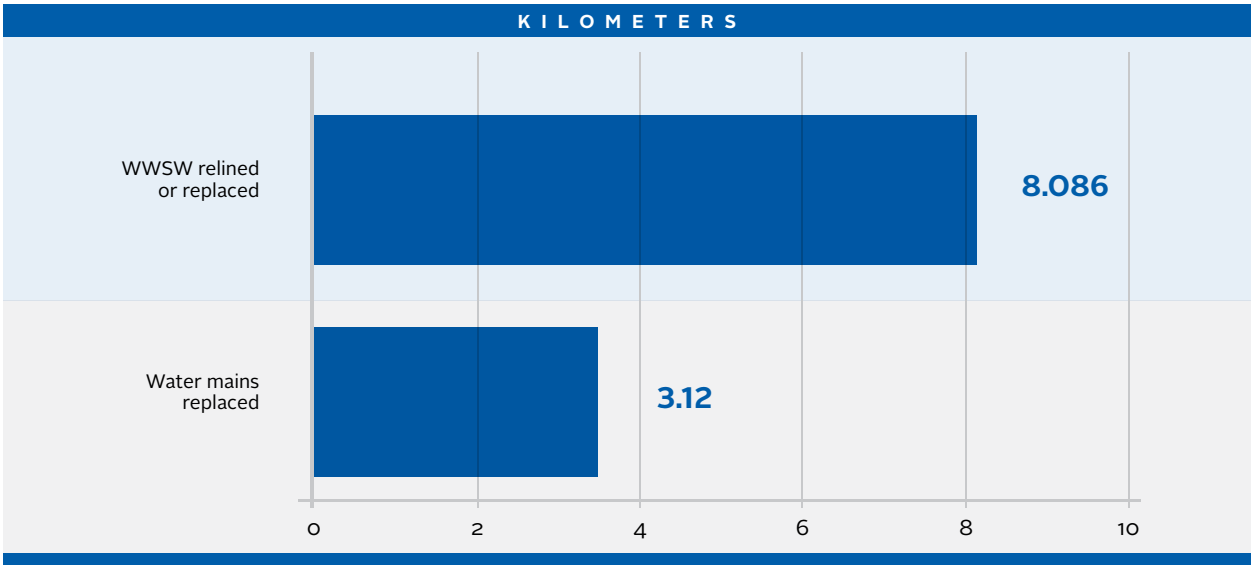
The Morris Lake and Russell Lake pumping stations and forcemains are a critical part of the wastewater collection system in this community. They collect wastewater from thousands of customers in the surrounding area and pump it to the nearby Dartmouth Wastewater Treatment Facility.

Halifax Water staff completed a number of repairs on the Morris Lake Pumping Station (PS) forcemain (circa 1986-87) over the past several years. It appeared that the issues being experienced were primarily a result of deficiencies in the material thickness of the pipe bends, poor pipeline fusing practices or the corrosion and metal loss at pipe flange locations.

The Morris Lake PS forcemain is a 600 mm polyethylene pipe approximately 2.5 km long. Since the Russell Lake PS forcemain was of the same vintage and travelled parallel to the Morris Lake PS forcemain, Halifax Water considered repairs to the joints and bends on this forcemain.

The Russell Lake PS forcemain is a 350 mm diameter polyethylene pipe approximately 1.2 km long. The project included the replacement of bends and flanged joint connections at 13 locations along the length of both forcemains. It also had a complex bypass arrangement to keep the system operational during construction.

Water & Wastewater Main Renewals & Linings in 2020/2021



Stormwater Capital Infrastructure

Halifax Water has an inventory of more than 900 km of stormwater gravity sewers. Through our Asset Management Plan and in collaboration with our Stormwater Collection Operations groups, storm sewers are prioritized for capital renewal annually to ensure the proper ongoing operation of the stormwater system.

For 2021/22, there were two significant infrastructure projects as part of that planning:

Ellenvale Run Project

As a stormwater channel that allows stormwater to flow from Lemont Lake to Morris Lake, Ellanvale Run is a watercourse that has been significantly urbanized over the years. It was a constructed channel in many places instead of a natural stream, with formed retaining walls in varying need of repair or replacement.

This project involves the replacement of these assets. It includes features that make the channel more similar to a natural stream, including natural stone on the bottom of the channel liner to stabilize the channel walls, ‘naturalize’ the channel, and reestablish or improve the natural habitat. These improvements reduce water flow speed, create pools, and meanders, and help improve fish passage.

The past year saw two additional sections of Ellenvale Run completed near Waltdale Drive and Wanda Lane. Each section was replaced with concrete channel liners with textured faces and naturalized bottoms. Construction was challenging due to the proximity of the adjacent private properties. Our contractor, consultant, and staff had to work collaboratively with the property owners to complete the project and ensure that reinstatement was satisfactory.

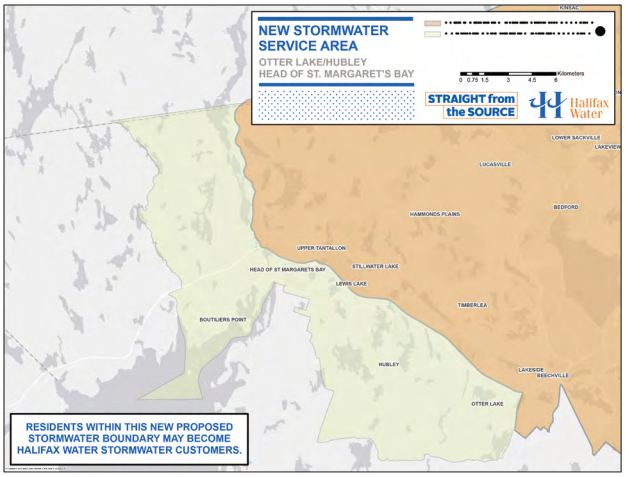
Rehabilitated section of Ellenvale Run.

Thistle Street Project

Located in central Dartmouth, the Thistle Street stormwater sewer was at the end of its service life and was prioritized for replacement in 2021. The project involved the replacement of approximately 200 metres of 450 mm diameter pipe, including associated catchbasins and maintenance holes.

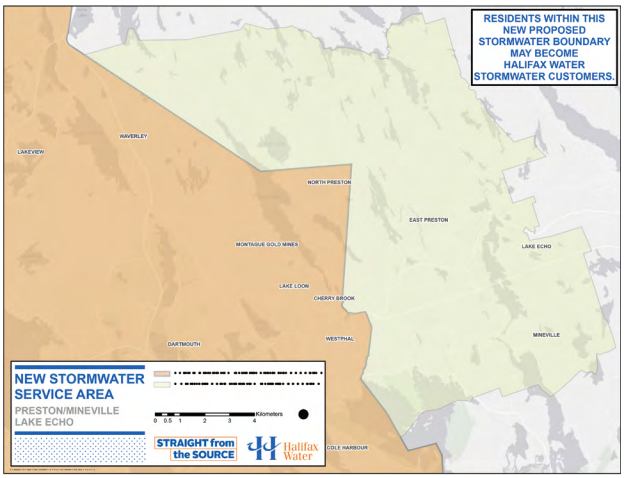
Stormwater Service Expansion

In July 2021, HALIFAX Council agreed to enter into a transfer of road assets from the Province. This transfer was set to take place in June 2022. In keeping with the 2007 agreement between the Municipality and Halifax Water, the responsibility for providing stormwater service for the two expansion areas was transferred to the utility, pending Nova Scotia Utility and Review Board (NSUARB) approval.



Area 1

Included the communities of Boutiliers Point, Ingramport, Head of St Margarets Bay, Lewis Lake, Hubley and Upper Tantallon.



Area 4

Included the communities of East Preston, Lake Echo, Mineville, and parts of Lawrencetown.

In October 2021, Halifax Water formally applied to the NSUARB to approve this expansion of its stormwater services in these two areas.

In addition, Halifax Water began a comprehensive community engagement and communications process with property owners and residents in these two areas. The goal was to inform and engage residents in an open and transparent process that allowed us to gather input for the future delivery of stormwater services. Topics covered included information about the regulatory process, the level of service that Halifax Water would provide if approved, and also offer property owners that could be potentially impacted an opportunity to ask any questions and to provide Halifax Water will feedback.

Information was made publicly available on our website, and Halifax Water hosted several public information sessions (in person and virtual) between November 2021 and January 2022. During this time, staff were collecting data to confirm details on the assets that would be transferred and which properties would be serviced should the NSUARB approve the expansion.

The NSUARB held a paper hearing regarding the stormwater service expansion in February 2022. Pending approval, Halifax Water will commence providing service to the expansion areas on June 1 and provide further communications to the residents as to whether they will become customers of Halifax Water and when they could anticipate receiving their first stormwater bill.

Temporary road installed for emergency traffic and school buses.

The new culvert installed beneath Cole Harbour Road.

Cole Harbour Road Culvert Replacement Project

The stormwater system protects public and private property from issues caused by uncontrolled stormwater flows. As part of this system, cross culverts enable stormwater to flow beneath a street without washing it out. The locations can vary from minor to significant stormwater systems within watercourses and fish habitats, which require coordination and approval with regulatory authorities. As a result, the regulations of Nova Scotia Environment & Climate Change (NSECC) and Fisheries and Oceans Canada (DFO) must be met.

Halifax Water has an inventory of more than 2,500 crossroad culverts and manages an annual crossroad culvert renewal program as part of its overall asset management plan. As a result, crossroad culverts are prioritized for capital renewal annually.

In the 2021/22 fiscal year, one of the more challenging replacement projects was on Cole Harbour Road near Glazerbrook Lane. This culvert had reached the end of its service life and was prioritized for capital renewal in 2021. During preliminary design, it was determined that this culvert is within a provincial watercourse which included a fish habitat and discharged directly into Cole Harbour. In accordance with NSECC and DFO rules and regulations, the replacement culvert accommodates the 1-in-100-year storm event capacity and re-establishes fish passage. All design elements were completed by Halifax Water staff.

Following a competitive procurement process, the contract was awarded to Cumberland Paving and Contracting Ltd., and construction began in August 2021. Given the heavy traffic flow, the Cole Harbour Road culvert replacement presented particular challenges concerning traffic control. As a result, a temporary traffic diversion lane was constructed adjacent to the project site per HRM requirements to ensure local residents had continued access to emergency and school bus services.

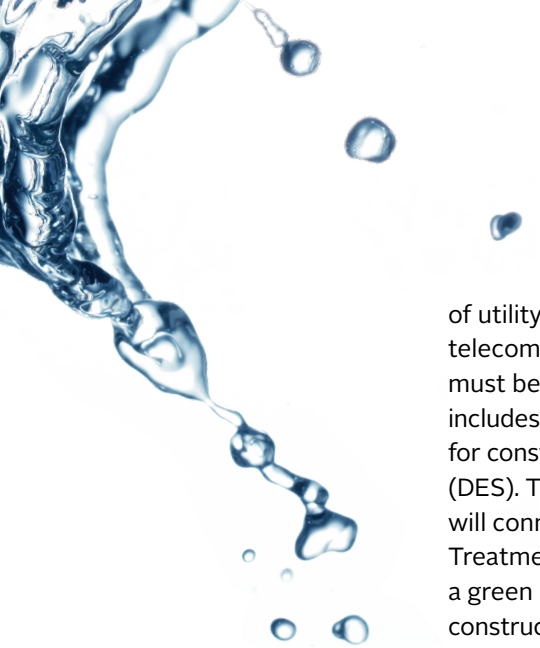
Based on the impact this work would have on traffic and residents, this project required increased public awareness and communication. It also provided excellent learning opportunities, including discovering a relatively large volume of contaminated soils. This resulted from creosote timbers from the previous culvert leaching into the surrounding soils. This required the safe removal of soil from the site so it could be sent to a specialized facility that accepts and remediates contaminated material.

Throughout the project, Halifax Water staff carried out full-time inspection services. The culvert was successfully replaced by collaborating with the contractor, achieving environmental permit requirements in October 2021.

Cogswell Redevelopment Project

The Cogswell District Redevelopment Project (CDRP) is a municipal-led initiative that will transform the Cogswell interchange into a more vibrant urban neighbourhood in the heart of downtown Halifax.

The project will convert 16 acres of road infrastructure into a mixed-use neighbourhood, extending the downtown entrance northwards and reuniting communities separated by the interchange lands. The urban street grid will be reinstated as part of the plan to create development blocks capable of supporting new residential and commercial environments for 2,500 people. As a result, a significant amount



of utility infrastructure (i.e. power, gas, telecommunications, water, sewer, storm) must be removed and relocated. This includes the necessary infrastructure work for constructing a District Energy System (DES). This ambient heat recovery system will connect to the Halifax Wastewater Treatment Facility (WWTF) and provide a green energy source for buildings constructed within the Cogswell District.

Following a competitive procurement process, the tender for the CDRP was awarded to Dexter Construction on September 14, 2021, and construction is now underway. With an estimated cost of approximately $122.6M, the CDRP is expected to span fiscal years 2021-22 to 2024-25.

Cost sharing from Bell Aliant, Halifax Water, Heritage Gas and Nova Scotia Power is expected to offset the project construction cost. However, the amounts of those contributions are not yet finalized. Contributions from Halifax Water and Nova Scotia Power will require the approval of the Nova Scotia Utility and Review Board.

Halifax Water is currently working with the Municipality to develop a prudent cost-sharing arrangement for our customers.

Operational Highlights

One Team, One Water – Fostering more collaboration between Water and Wastewater/ Stormwater Operation

Over many years, through multiple municipal amalgamations and the resulting integration of services, Halifax Water has acquired and developed a broad range of unique abilities. As a result, the utility has experience in a wide range of operational and construction activities that allow us to provide a high-level service to our customers.

For many years, the water and wastewater/stormwater departments had operated in separate groups and used different processes. This created inconsistent policies and procedures that could lead to staff morale and labour management issues. It also meant that some equipment and fleet vehicles were underutilized, creating opportunities for standardized work procedures and improved operational efficiency.

As Halifax Water continues to mature and grow, there was an opportunity to address these issues, gain operational efficiency, and improve customer service. This represents a significant cultural change for Halifax Water. Still, it is also an opportunity to engage staff, supervisors, and managers and develop a more collaborative approach to problem-solving our historically segmented approach to service delivery.

The One Water operation approach was introduced in 2021 and represented the best practice for effective utility management. It is designed to create efficiencies in service delivery across the previously siloed department and business units. Focusing on resilience and reliability through an integrative decision-making approach, it considers the entire water cycle and larger infrastructure systems.

Through this approach, Halifax Water is now using a more integrated approach to delivering operational services, using ALL of our highly skilled workforces. This

approach is critical as we move towards the creation of a new integrated operations depot in Dartmouth, which will combine four different collections and distribution teams into one centralized operational facility.

Through the managers' collaboration, several operational initiatives were delivered in 2021/22 that were fostered from our 'One Team, One Water' approach and enabled us to serve our customers better. They represent a broad range of assignments; some were planned events, and others were emergency response support.

These include:

Cobequid Road Water Main Repairs

A section of the 600 mm diameter water main failed in the summer of 2021, impacting water service for customers in parts of nearby communities and disrupting an essential roadway in the Lower Sackville community. The water distribution staff took the lead on the repair to stabilize the situation and reinstate service. They quickly realized that additional resources were required to address the problem and subsequently engaged wastewater/stormwater collection services staff to assist at the repair site. This integrated delivery allowed the response team to direct our own resources as required in the response.

Water and Wastewater/Stormwater Operations groups working together to serve our customers.

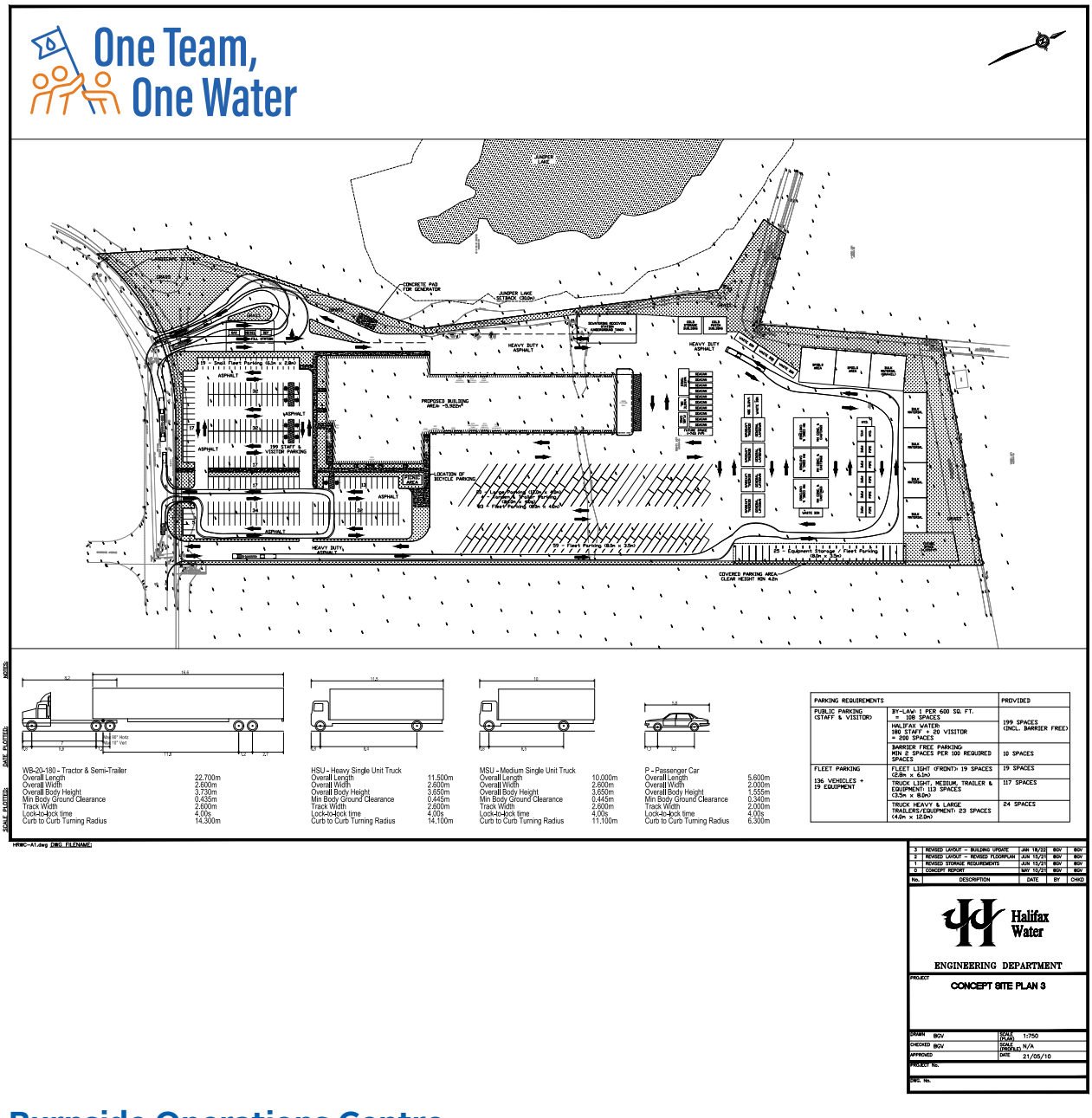
Temporary Housing Servicing

In response to the housing crisis within our municipality, HALIFAX constructed a new temporary housing development in Dartmouth. The project required water and wastewater services for the multi-unit facility. The city engaged Halifax Water to install these service connections. Halifax Water operations took the lead on the project with a joint delivery between East Region water distribution and wastewater/stormwater collections services. The servicing was completed on schedule in preparation for delivery of the housing units.

Barrington Street/Inglis Street Sewer Separation

This project involved the sewer separation of a section of Barrington Street that will result in an estimated flow reduction of 18 million litres per year from the Pier A sewer shed. The project was multi-disciplined with the challenge of aligning three separate mains (water, wastewater, and stormwater) in a section of the street that is already densely packed with buried infrastructure. Construction sequencing was critical to maintaining wastewater, stormwater and water services for the project's duration. A joint operations team from West Region water distribution and wastewater/stormwater collection services successfully completed this complex project and minimized service disruptions to our customers.

The One Water approach involved the coordination of efforts of senior managers. Still, it was primarily driven by the water distribution and wastewater/stormwater collection managers, their respective supervisors, frontline staff, support clerks and administrative staff.



Burnside Operations Centre

Throughout 2021/22, extensive internal stakeholder engagement was completed to develop and further refine the concept design for the new Burnside Operations Centre. The project team recognized the importance of listening and taking deliberate actions to involve all user groups in the future depot design. As part of the engagement process, the goal was to understand the needs, workflows, and operational challenges of consolidating the four depots - East and Central Region Water, Wastewater & Stormwater Operations.

The project team, in collaboration with EastPoint Engineering's consulting team, met with Halifax Water staff to gather input for the facility design; to identify and understand the type of spaces needed; functional requirements of yard design and alignment between inside and outside. This also considered the flow of people and work, especially at the beginning and end of the day; important amenities to better serve employee needs; positive environmental impact/stewardship desired; and application of lessons learned from other buildings and projects (i.e. 455 Cowie Hill Road Depot).

Input was facilitated through the development of three concept design options for the building and lot layout, three energy and building performance options, and cost estimates for each. The feedback provided enabled the selection and progression of one of the concepts, Concept #3. This concept was then further refined and rolled out for added engagement and additional feedback to all affected groups that would be moving into the new facility.

At the end of the fiscal year, we had a well-defined concept building floor plan and lot layout. This is the result of a strong engagement plan and is very close to achieving the desired functionality required for our operational teams. Through the consultation process, we've also generated and sustained interest in the building and the potential for future improvements to business processes from the staff. There is excitement in the air for the move into this new consolidated depot anchored on a One Team, One Water culture.

Construction costs and schedule estimation have been challenging throughout the pandemic, creating increased risk and uncertainty with forecasting. As a result, the project team is moving forward with an Integrated Project Delivery methodology to achieve the best possible value in this volatile marketplace. The procurement for an IPD team will be executed in 2022/23, with the design and construction of the new facility anticipated for completion in 2025. Ongoing engagement and feedback will continue throughout this time as well.

IT Strategic Plan Process

In 2018, Halifax Water adopted a 5-year IT strategic plan to address critical gaps in the utility's IT capabilities related to its service provision to customers. Since then, the team has been advancing the plan as scheduled. In 2021, some key accomplishments included:

- Completion of the deployment of Customer Connect,the advanced metering infrastructure program.
- The use of advanced metering data to support the launch of Customer Connect, a customer portal to allow customers to receive bills electronically, get information on their hourly water consumption and receive alerts to high consumption and suspected leaks.
- Adoption of software platforms that improve customer service by automating processes such as water quality monitoring, environmental permit compliance, asset management and work order processing.

The IT Strategic Plan is now in its fifth and final year, with two significant initiatives remaining. This includes a multi-phase program to modernize and upgrade Halifax Water's cybersecurity capabilities, with the goal of protecting customer data and maintaining our ability to deliver service. The second is the adoption of a new modern Enterprise Resource Planning system and customer relationship system.

Regulatory Compliance

Engineering Approvals

The Engineering Approvals group is focused on adherence to the Halifax Water Design Specifications, the Supplementary Standard Specification and the Schedule of Rates, Rules and Regulations with respect to connections to and expansions of the Halifax Water systems. The administration of the new service connections includes the administration of the Regional Development Charge.

In 2021/22, the Engineering Approvals group processed:

Application Type	2021/2022	2020/2021	2019/2020
Water Permit Reviews	3,538		
Water Permit Approvals	1,223	1,226	1,338
Subdivision Approvals	166	199	273
Metres of New Water Main	3,185	2,175	2,205
Metres of New Wastewater Main	4,037	1,861	2,191
Metres of New Stormwater Main	3,247	1,582	2,509
Demolition Permits	154	167	118
Clearance Letters	30	18	40
Tender Reviews	85	80	83
New Backflow Prevention Applications	115	122	112
Backflow Prevention Devices Active	5,812	7,204	7,182

Regional Development Charge

Halifax Water oversees the development and collection of water and wastewater Regional Development Charges (RDCs). These funds are used to upgrade regional water and wastewater systems to facilitate projected population growth. The 2019 application to update the RDC was approved in April 2021. The new approval allows annual adjustments for the Consumer Price Index (CPI), with five-year updates submitted to the NSUARB.

The table below shows the cumulative accounting of all Regional Development Charges received and invested in infrastructure at the end of the fiscal year on March 31, 2022. The Regional Development Charge program is cost-neutral, fulfilling the desired need to provide central services for the projected growth of the Halifax Regional Municipality (HRM). Halifax Water is coordinating with HRM on updating the infrastructure requirements to support projected growth as they update the Regional Plan.

Collections and Expenditures

Regional Development Charge	Regional Development Charges Collected	Interest	RDC Funds Invested in Infrastructure	Remaining RDC Funds available for Future Investment in Infrastructure
Water	$6,899,082	$94,250	$3,729,740	$3,263,592
Wastewater	$85,803,897	$1,080,107	$23,031,126	$63,852,878
Grand Total	**$92,702,978**	**$1,174,357**	**$26,760,866**	**$67,116,469**

Environmental Engineering

During the year, Environmental Engineering continued to use Cityworks, Halifax Water's computerized maintenance monitoring system (CMMS), in new and innovative ways to track and manage Pollution Prevention (P2) and Inflow and Infiltration (I&I) Program cases. This year, parts of the field programs were impacted by COVID-19 when restrictions were placed on customer interactions.

The P2 and I&I Program staff are responsible for regulating the quantity and quality of discharge from customer connections to the wastewater and stormwater systems.

P2 is responsible for managing situations where a private wastewater system is inadvertently cross-connected to a stormwater system. P2 successfully resolved seven wastewater to stormwater cross-connections and completed 235 audit inspections of industrial/commercial/institutional customers over the past year. Staff also responded to a number of spills and non-compliant discharges, including silt discharge into wastewater and stormwater systems. P2 is also working with HRM on two lake quality studies

– Lake MicMac/Lake Banook and First Lake – and helping to identify possible sources of water quality impairment.

The I&I Reduction Program identifies and resolves private property connections where stormwater enters the wastewater system. Staff completed over 2,300 private property assessments on a priority basis across the municipality and worked closely with the Wet Weather Management Program team to reduce I&I in target areas from public and private properties. These assessments included 15.6 km of smoke testing involving non-harmful smoke being blown into wastewater systems to look for leaks or illegal cross-connections.

The I&I group also works on other I&I initiatives, such as a Downspout Disconnection Program, with the aim of redirecting stormwater flows from downspouts away from the wastewater system. The I&I group also advanced work on a Campus Customer Pilot Program which involves the compliance of larger private properties, identifying thirteen properties for the pilot. The collected data will be used to develop a program manual and guidelines. Work continued with the New Service Account Compliance Program (NSAC), which will link private property I&I compliance with the creation of a new service account with Halifax Water.

Water Quality

Providing our customers with safe, reliable, affordable, high-quality drinking water requires investment in infrastructure, research, and robust quality assurance/ quality control programs. Halifax Water has made considerable investments in all of these areas.

In order to ensure quality control is optimized, we maintain ISO 14001 Environmental Management System Registration at the J. D. Kline (Halifax), Lake Major (Dartmouth), and Bennery Lake (Halifax Airport) and smaller community water supply plants.

Halifax Water undertakes a comprehensive water testing program with bacteriological testing done weekly at 63 locations within the urban core and at each of the small systems.

Approximately 3,250 tests are conducted each year for Total Coliform bacteria and E.coli. Halifax Water consistently achieves results where 99.9% of samples are absent of bacteria, as shown below:

Drinking Water Compliance Summary
Total Coliform Sample Results
April 2021 - March 2022

Systems	% Absent	# of Samples
Pockwock	99.9%	884
Pockwock Central	100.0%	520
Lake Major	99.9%	1206
Bennery	100.0%	156
Five Islands	100.0%	121
Silver Sands	100.0%	104
Middle Musquodoboit	100.0%	104
Collins Park	100.0%	104
Bomont	100.0%	104
TOTAL	**99.9%**	**3303**
Absent (A)	99.9%	3301
Present (P)	0.1%	2

Additional testing of drinking water includes:

- Chlorine residual, pH, and turbidity of treated water leaving each plant as well as multiple locations within the plant to monitor and optimize the treatment process.
- Quarterly sampling of treated water at 2-3 locations within the distribution system for approximately 40 chemical parameters.
- Quarterly sampling of raw lake water and water from contributing streams for approximately 40 chemical parameters.
- Bi-annual sampling of all raw and treated water for all parameters in the Guidelines for Canadian Drinking Water Quality (Health Canada).
- Bi-annual testing and sampling for giardia and cryptosporidium for treated and raw water for all surface water systems.

Water test results are reported to Nova Scotia Environment & Climate Change (NSECC) and the Nova Scotia Medical Officer of Health (NSMOH) on a regular basis. Protocols have been established between Halifax Water and the provincial Health and Environment departments to clearly delineate roles and responsibilities in advance of the unlikely event of a disruption in water quality. During the COVID-19 pandemic, some of the dedicated sampling locations were not accessible, and the group had to locate other suitable sites that could be safely accessed and provide a representative sample within the system. These adjustments were reported weekly to NSECC.

Wastewater Treatment Facility Compliance

As a provider of wastewater services, part of Halifax Water's role is protecting the environment. This includes ensuring that the treated effluent released into the environment meets the regulatory requirements outlined in our operating permits.

Wastewater treatment facilities (WWTFs) in Nova Scotia are regulated by Nova Scotia Environment and Climate Change (NSECC). They set effluent discharge limits for all wastewater facilities. The limits define maximum concentrations of parameters such as Carbonaceous Biochemical Oxygen Demand (CBOD – a measure of the amount of material in water which will consume oxygen as it decomposes), Total Suspended Solids (TSS – a measure of the amount of particulate matter in the water), and E.Coli (bacteria associated with wastewater). For some facilities, parameters such as nutrients (nitrogen and phosphorus, which cause excess growth of algae and plants) or pH (a measure of acidity) are also regulated.

Halifax Water oversees five large Harbour WWTFs and nine smaller, community-based WWTFs.

Compliance for the Harbour WWTFs is measured on monthly averages. There has been a significant improvement in the compliance at the five Harbour WWTFs, with Herring Cove, Eastern Passage and Mill Cove being fully compliant for the year. Operational improvements have been underway at Halifax and Dartmouth and have been the reason for some of the non-compliance results throughout the year.

Wastewater Treatment Facility Compliance Summary

Monthly Performance - April 2019 to March 2020

Wastewater Treatment Facility	April 21					May 21					June 21				
	CBOD5	TSS	E.coli	pH	Toxicity Pass	CBOD5	TSS	E.coli	pH	Toxicity Pass	CBOD5	TSS	E.coli	pH	Toxicity Pass
Halifax	33	23	N/A	7	YES	36	21	996	7	YES	36	20	4,421	7	YES
Herring Cove	23	20	N/A	7	N/A	38	24	20	7	YES	31	23	14	7	N/A
Dartmouth	40	40	N/A	7	YES	45	21	55	7	YES	44	18	89	7	YES
Eastern Passage	8	6	N/A	7	N/A	7	8	24	7	YES	7	8	10	7	N/A
Mill Cove	16	18	22	7	N/A	17	18	17	7	YES	11	15	10	7	N/A
	July 21					August 21					September 21				
	CBOD5	TSS	E.coli	pH	Toxicity Pass	CBOD5	TSS	E.coli	pH	Toxicity Pass	CBOD5	TSS	E.coli	pH	Toxicity Pass
Halifax	47	16	2,496	7	YES	54	27	18,230	7	YES	56	44	131,628	7	NO
Herring Cove	35	20	10	7	N/A	21	15	13	7	YES	25	13	16	7	N/A
Dartmouth	55	13	135	7	YES	26	8	23	7	YES	56	14	26	7	YES
Eastern Passage	6	7	19	7	N/A	7	6	29	7	YES	9	17	115	7	N/A
Mill Cove	11	16	10	7	N/A	11	14	17	7	YES	10	10	12	7	N/A
	October 21					November 21					December 21				
	CBOD5	TSS	E.coli	pH	Toxicity Pass	CBOD5	TSS	E.coli	pH	Toxicity Pass	CBOD5	TSS	E.coli	pH	Toxicity Pass
Halifax	58	45	62,492	7	YES	41	41	N/A	7	YES	24	21	N/A	7	YES
Herring Cove	40	18	12	7	N/A	18	14	N/A	7	YES	24	22	N/A	7	N/A
Dartmouth	68	17	114	7	YES	45	35	N/A	7	YES	44	42	N/A	7	YES
Eastern Passage	7	9	34	7	N/A	8	7	N/A	7	YES	9	16	N/A	7	N/A
Mill Cove	11	14	22	7	N/A	10	15	23	7	YES	11	17	33	7	N/A
	January 22					February 22					March 22				
	CBOD5	TSS	E.coli	pH	Toxicity Pass	CBOD5	TSS	E.coli	pH	Toxicity Pass	CBOD5	TSS	E.coli	pH	Toxicity Pass
Halifax	33	21	N/A	7	YES	33	19	N/A	7	YES	32	29	N/A	7	YES
Herring Cove	19	12	N/A	7	N/A	30	15	N/A	7	YES	19	13	N/A	7	N/A
Dartmouth	37	39	N/A	7	YES	37	26	N/A	7	YES	38	25	N/A	7	N/A
Eastern Passage	17	12	N/A	7	N/A	8	8	N/A	7	YES	10	11	N/A	7	N/A
Mill Cove	11	14	12	7	N/A	19	19	12	7	YES	25	23	20	7	N/A

Performance assessments for the nine smaller WWTFs are based upon quarterly averages. Results for April 2021 to March 2022 are presented below:

Wastewater Treatment Facility Compliance Summary

Q1 – April to June 2021

Wastewater Treatment Facility	Averaging Period Compliance per Parameter								
	CBOD5	TSS	E.coli	Phosphorus	Ammonia	pH	Dissolved Oxygen	Chlorine	Toxicity Pass
Aerotech	2	1	10	0.1	0.1	7.4	8.2	N/A	YES
Frame	5	1	10	N/A	N/A	6.5	N/A	N/A	N/A
Lakeside-Timberlea	5	17	10	1	1	6.9	N/A	0.10	YES
Lockview-MacPherson	7	9	10	0.3	12	6.9	N/A	N/A	N/A
Middle Musquodoboit	5	17	46	N/A	N/A	7.2	N/A	N/A	N/A
North Preston	4	3	10	0.7	0.1	6.4	N/A	N/A	N/A
Springfield	5	7	63	N/A	N/A	7.4	N/A	N/A	N/A
Steeves (Wellington)	3	1	10	0.1	0.5	7.2	N/A	N/A	N/A
Uplands Park	4	12	10	N/A	N/A	6.6	N/A	N/A	N/A

Q2 – July to September 2021

Wastewater Treatment Facility	Averaging Period Compliance per Parameter								
	CBOD5	TSS	E.coli	Phosphorus	Ammonia	pH	Dissolved Oxygen	Chlorine	Toxicity Pass
Aerotech	2	1	10	0.05	0.1	7.7	7.1	N/A	YES
Frame	5	1	5	N/A	N/A	6.0	N/A	N/A	N/A
Lakeside-Timberlea	5	15	11	0	1	6.9	N/A	0.10	YES
Lockview-MacPherson	5	4	14	0.3	1	6.9	N/A	N/A	N/A
Middle Musquodoboit	7	7	10	N/A	N/A	7.4	N/A	N/A	N/A
North Preston	5	3	10	1.6	0.1	6.6	N/A	N/A	N/A
Springfield	8	32	22	N/A	N/A	6.6	N/A	N/A	N/A
Steeves (Wellington)	5	1	10	0.1	0.06	7.1	N/A	N/A	N/A
Uplands Park	7	10	23	N/A	N/A	6.5	N/A	N/A	N/A

Seven of the smaller community WWTFs, Aerotech, Frame, Lakeside-Timberlea, Middle Musquodoboit, North Preston, Steeves and Uplands Park, were fully compliant for the year.

Wastewater Treatment Facility Compliance Summary

Q3 – October to December 2021

Wastewater Treatment Facility	Averaging Period Compliance per Parameter								
	CBOD5	TSS	E.coli	Phosphorus	Ammonia	pH	Dissolved Oxygen	Chlorine	Toxicity Pass
Aerotech	2	1	10	0.06	0.1	7.6	8.9	N/A	YES
Frame	8	1	10	N/A	N/A	6.7	N/A	N/A	N/A
Lakeside-Timberlea	5	16	10	1	1	6.9	N/A	0.10	YES
Lockview-MacPherson	6	13	10	0.5	1	6.9	N/A	N/A	N/A
Middle Musquodoboit	5	4	10	N/A	N/A	7.3	N/A	N/A	N/A
North Preston	4	5	10	0.6	0.5	6.5	N/A	N/A	N/A
Springfield	5	5	14	N/A	N/A	6.7	N/A	N/A	N/A
Steeves (Wellington)	5	1	10	0.1	01	7.2	N/A	N/A	N/A
Uplands Park	8	7	27	N/A	N/A	6.7	N/A	N/A	N/A

Q4 – January to March 2022

Wastewater Treatment Facility	Averaging Period Compliance per Parameter								
	CBOD5	TSS	E.coli	Phosphorus	Ammonia	pH	Dissolved Oxygen	Chlorine	Toxicity Pass
Aerotech	2	1	10	0.1	0.2	7.0	10.3	N/A	YES
Frame	7	1	10	N/A	N/A	6.9	N/A	N/A	N/A
Lakeside-Timberlea	9	19	23	1	2	6.8	N/A	0.10	YES
Lockview-MacPherson	8	15	30	0.4	13	6.4	N/A	N/A	N/A
Middle Musquodoboit	6	4	10	N/A	N/A	7.3	N/A	N/A	N/A
North Preston	7	9	10	0.7	0.9	6.5	N/A	N/A	N/A
Springfield	6	5	10	N/A	N/A	6.8	N/A	N/A	N/A
Steeves (Wellington)	10	1	10	0.1	0.1	7.1	N/A	N/A	N/A
Uplands Park	9	6	10	N/A	N/A	7.1	N/A	N/A	N/A

Environmental Sustainability

Two hundred twenty-six solar PV panels on the roof of the Halifax Wastewater Treatment Facility with a peak capacity of 75kW.

Staff holding the ISO 14001 certification in front of the Mill Cove Wastewater Treatment Facility.

Environmental Management System

An Environmental Management System (EMS) is an internationally accepted system of procedures, records and processes to manage environmental issues and assist with regulatory compliance. It also makes day to day operations more sustainable and engages employees in these operational activities. The EMS program is audited against ISO 14001 standards, and if found to comply, it receives certification through the International Organization for Standardization (ISO).

Staff have successfully obtained certification for the J. D. Kline, Lake Major, Bennery Lake and Small Systems Water Supply Plants (WSPs) and the Herring Cove, Dartmouth, Halifax, Eastern Passage, Mill Cove, Aerotech and Community Wastewater Treatment Facilities (WWTFs). An expansion of scope audit is scheduled for May 2022; at that time, Beechville-Lakeside-Timberlea WWTF and the facilities at 450 & 455 Cowie Hill Road and some shared services will be audited. Once the expansion of scope audit is completed, all water and wastewater facilities and supporting services at Halifax Water will be ISO 14001-2015 certified by SGS Canada.

With this expansion of scope audit at the facilities at 450 & 455 Cowie Hill Road, corporate expansion is underway. Shared resources such as Regulatory Compliance, Human Resources and Procurement are now working within the system. Looking ahead, operational teams, water distribution, and wastewater/stormwater collections will be included, and other shared resources such as Customer Care, Engineering, IT and Asset Management will be brought into the system.

The Regulatory Compliance group also completed implementing a new software system, KLIR, which will be used to store all Halifax Water quality data and regulatory compliance obligations in one system. KLIR will provide a central storage location for quality data previously stored in several locations and is sometimes challenging to access. KLIR will also track regulatory compliance documents and provide reminder alerts to staff before a task is due. The Regulatory compliance group also began to roll out a revised regulatory compliance system to facility and collections staff. This system aims to ensure consistent and reliable reporting of releases from Halifax Water infrastructure to our Regulators.

Wet Weather Management Program

In older sections of the municipality, HRM, stormwater and wastewater flow into a combined system and enter a wastewater treatment facility. As a result, the stormwater adds additional strain

to the wastewater system and unnecessarily takes up capacity, chemicals, and energy used in the treatment process. By reducing the amount of stormwater, we can regain lost capacity in the wastewater treatment system and delay unnecessary upgrades to treatment facilities, as well as the associated costs for our customers.

Through its Wet Weather Management Program (WWMP), Halifax Water continues to build on previous successes and learn from past experiences. In 2021/22, we formalized a reporting structure associated with Decision Matrix Reports (DMRs) that were prepared for six WWMP areas in the Fish Hatchery sewershed. And the benefits of the report were immediately apparent. These reports summarize all activity within a WWMP sewershed and will support decision making, capital project selection, private side investigations and preparation of the WWMP Annual Report.

Priority Sewersheds

The WWMP continues to follow the direction of the 2019 Infrastructure Master Plan (IMP) and is concentrating the majority of activity in the priority sewersheds of Fish Hatchery, Ellenvale, Loon Lake, and Eastern Passage are the focus of the program over the next several years.

Sanitary Sewer Evaluation Survey (SSES) activities identify system deficiencies and characterize sources of I/I within the collection system. They include but are not limited to flow monitoring, CCTV inspections of mainline and laterals, smoke testing and private side inspections. In 2021/22, 49 WWMP contract flow meters were in place, focusing on monitoring the IMP priority Sewersheds. This flow data prioritizes areas and supports future RDII reduction projects.

Approximately 23,000m of CCTV inspections were completed in 2021/22, focusing on several Priority Sewersheds, including Ellenvale, Fish Hatchery PS and Eastern Passage. In 2021/22, approximately 13,300 m of wastewater main smoke testing investigations were completed in the Fish Hatchery PS Sewershed. Smoke testing assists in identifying public and private defects and leads to repairs or further investigation.

Community Sewersheds

The WWMP monitors six of Halifax Water's small community wastewater treatment facilities (WWTF) systems: Wellington, Frame, Uplands, North Preston, Springfield Lake and Fall River sewersheds. These WWTF flows are monitored with the intent to identify trends of increasing flows within each system. When issues become apparent, the WWMP investigates the sewershed following the decision matrix to identify defects for repair or rehabilitation.

In 2020/21, continued high flows in the North Preston and Springfield Lake WWTF sewersheds prompted the WWMP to investigate further any defects that may be present in the system. Through an extensive review of SSES and coordination with Operations, several public side repairs were identified and repaired in Springfield Lake WWTF sewershed.

Eastern Passage Wastewater Treatment Facility

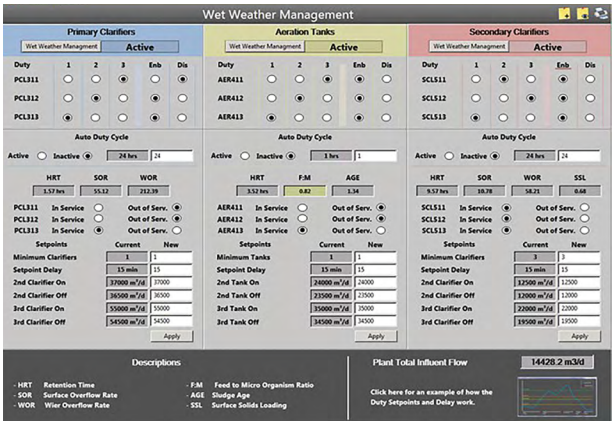
Wet weather presents challenges at wastewater treatment facilities (WWTFs) when precipitation rapidly increases incoming plant flow above the average treatment capacity of online vessels. Standby treatment trains are needed to come into immediate service to deal with a sudden change in flow. However, not all facilities are staffed 24/7, so an automated response is required. New automated tools often involve the integration of planning, design, and operation of the wastewater treatment system.

Staff at the Eastern Passage WWTF have improved the management of wet weather treatment issues in two ways. First, Process Technicians assessed and compared plant treatment train performance to engineered design guidelines across various flow conditions. Eastern Passage staff then worked alongside their colleagues in Technical Services to develop an automated Supervisory Control & Data Acquisition (SCADA) program to open and close actuated gates to bring additional tankage online and offline at the right time in response to changing flows.

A second problem would quickly manifest in a biological, secondary treatment plant such as EPWWTF's activated sludge process if it were not for the staff's diligence to proactively prepare our treatment organisms before a wet weather event. Unlike additional vessels that can be easily opened or closed or chemical feeds that can quickly be increased, activated sludge organisms take time to acclimatize and adjust to extreme variations. By closely monitoring the health of our offline biological organisms through evaluating various online sensors, water quality parameters and microscopy in our lab, Process Technicians will condition the aeration tanks by reintroducing healthy activated sludge with food (primary effluent), air and alkalinity adjustments to prepare and grow our microorganisms before a wet weather event. Once the microorganisms are conditioned, SCADA can readily bring tankage online or offline as flows dictate without detrimental impacts on our effluent quality. Lessons learned from the long, iterative process of tuning a plant to respond to significant variations in flow have been documented in our Wet Weather Manual for continual improvement and compliance optimization.

Three aeration tanks where microorganisms are conditioned to good health before fully coming online to treat high wet weather flows.

Secondary clarifiers automatically come online and offline according to defined flow ranges.



SCADA wet weather management Human-Machine Interface.

Wastewater Treatment Facility Enhancement & NSERC Wastewater Research

Harbour Solutions WWTF – Technology Upgrade – Fine Screen

Mechanical treatment is indispensable as the first step in preliminary wastewater treatment. The existing Halifax Harbour Treatment Plants (HHSPs) were initially equipped with unidirectional bar-type screening technology that frequently did not capture inert materials in the process chain, creating operational and maintenance issues downstream in the plants. The goal of this capital project was threefold: Improve the performance of downstream processes, sludge quality and the overall appearance of the final effluent; therefore, bidirectional screening technology use perforations were selected (Figure 1). Additionally, the upgrade would reduce expenditures related to poorly functioning treatment systems due to debris carryover, minimize maintenance and operational costs associated with damages to downstream processes and avoid non-compliance in permits to operate.

In January 2020, Halifax Water tendered requests for quotations to supply fine screen and compactor technology to replace all the existing screens in the HHSPs. Halifax Water received five submissions, and through an evaluation process, Veolia Water Technologies Canada was awarded the goods and services contract for $2.67M for all three treatment facilities to be implemented one at a time.

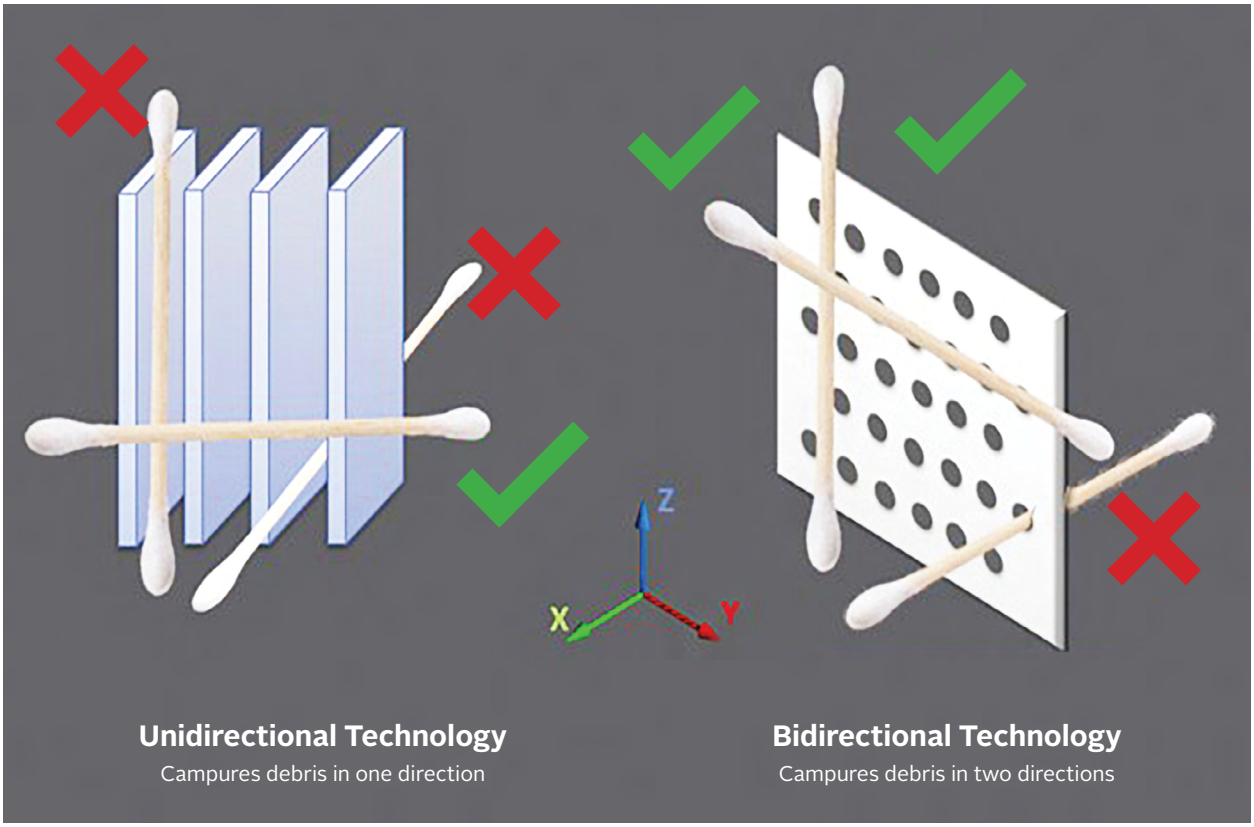


Figure 1: Screening types (IMAGE COURTESY OF VEOLIA WATER).

The selected fine screening technology will remove nearly all inorganic debris at the headworks and provide tremendous benefits for the facility. The first plant to receive the screening upgrade was the Dartmouth WWTF. The construction tender was awarded to Black & McDonald; work began in January 2021 and was completed in April 2021.

Using a fine screen with 6mm perforated plate technology allows the facility to run more efficiently — the savings aren't obvious, but over time they add up. One visible sign of the fine screen's success is the increased tonnage of screenings hauled to the landfill and minimal debris retained on the UV lamps compared to facilities yet to be upgraded (See figures 3-5).

Currently, work is underway at the Halifax WWTF to replace the screens at that facility, and engineering is underway for the Herring Cove Plant for implementation in the 2022/23 fiscal year.

Overall capital costs are approximately $4.65M and include equipment, construction, commissioning, and project overhead; and is broken down as follows:

- Halifax WWTF - $ 1.75M
- Dartmouth WWTF - $ 1.55M
- Herring Cove WWTF - $ 1.35M

Some construction photos of the project are shown in Figures 6-8.

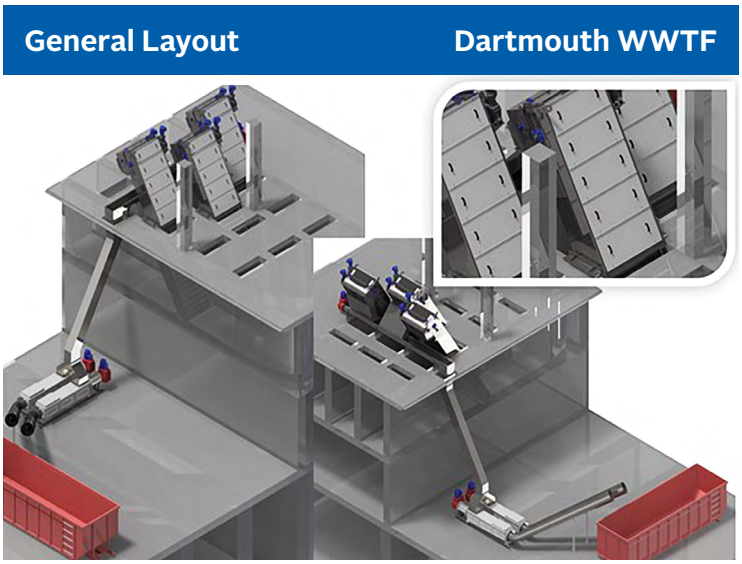


Figure 2: General layout arrangement of DWWTF (IMAGE COURTESY OF VEOLIA WATER).

Figure 3: UV lamps pre-screen upgrades covered in debris.

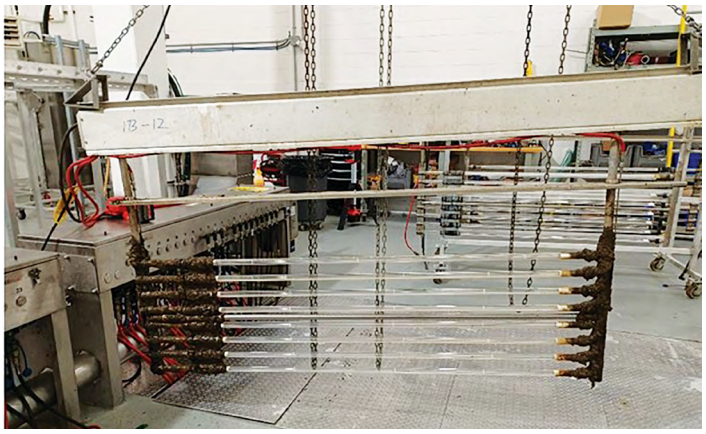


Figure 4: UV lamps post-screen upgrade showing significant improvements.

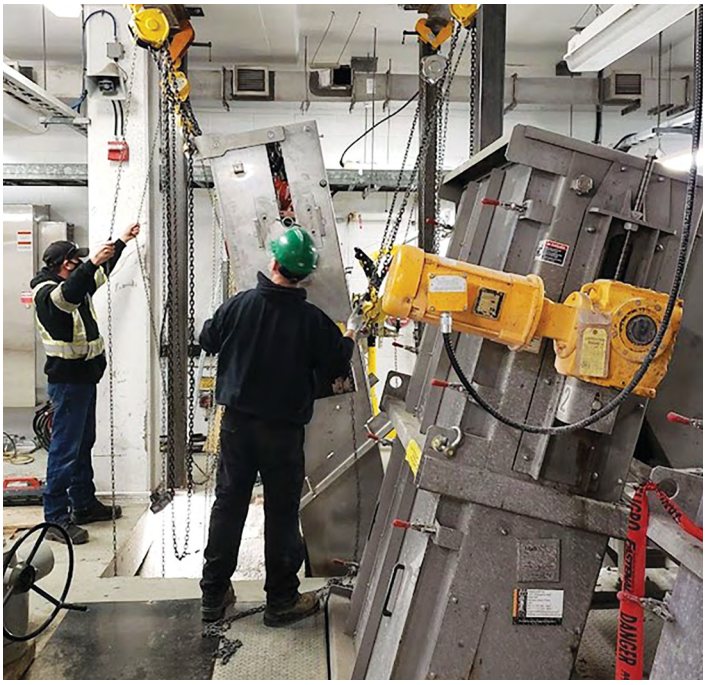


Figure 7: Installing Fine Screen No. 3 at DWWTF.

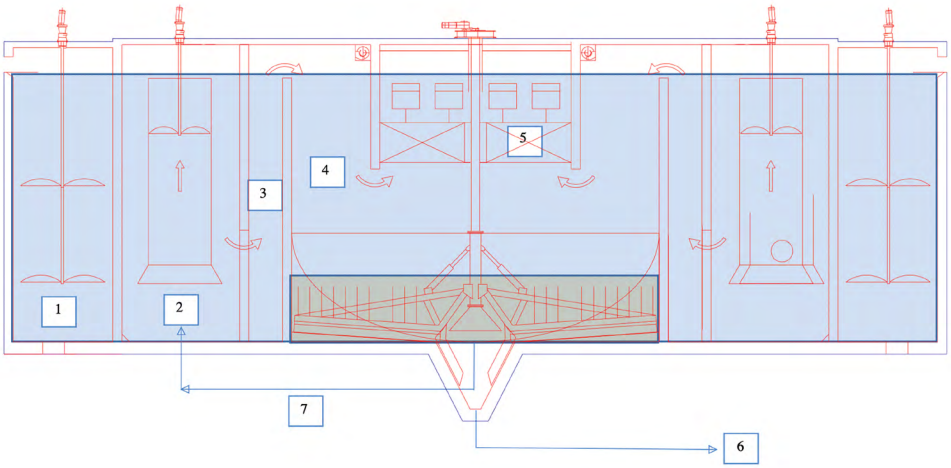
Figure 8: Completed screens installed at DWWTF.

Figure 5: Compacted and dewatered screenings from DWWTF.

Figure 6: Construction Phots at DWWTF.

Harbour Solutions WWTF - Densadeg Lamella Clarifier Inclined Tube Settler Replacement

The Harbour Solution Wastewater Treatment Facilities (WWTFs) located in Halifax, Dartmouth and Herring Cove were constructed to improve water quality in Halifax Harbour, as part of the Harbour Solutions Project. The facilities were commissioned between 2007-2009 and consist of chemically enhanced preliminary treatment designed by Suez utilizing their high rate physical/chemical solid contact primary clarification process known as Densadeg. The overall schematic of the treatment process is illustrated here:



1. Flash Mixing (Chemical Addition)
2. Mechanical Flocculation
3. Hindered Flocculator
4. Settling Tank
5. Lamella Inclined Tubes
6. Sludge Extraction
7. Sludge Recirculation

As part of the ongoing process optimization enhancement initiatives, some of the clarification equipment was underperforming due to the amount of manual labour required to clean the units to maintain optimal performance. It was decided that the best option was to replace the clarification modules referred to as inclined tubular hexagonal lamella modules.

The lamella modules are designed to increase the surface area within the clarifier to remove particulates from liquids. By placing the hexagonal modules within the clarifier, we can increase the equivalent settling area by over ten times, when compared to tanks without these installed. As a result, it reduces the clarifiers' footprint and significantly minimizes the danger of fouling while providing a large equivalent settling area. Enhanced cleaning capabilities were added to the treatment process by adding a lamella cleaning system that injects compressed air through the lamella pack via perforated PVC pipes affixed to supports beneath the lamella pack, known as air scour. The shock of the air bubbles on the lamella produces vibrations, releasing the accumulated sludge stuck to the sides of the hexagonal modules. Previously the only way to remove the accumulated sludge was to drain the tanks and hose them down with a fire hose from the top, which proved ineffective. Now process technicians can complete the cleaning tasks in 1 hour vs 4-6 per tank previously.

The overall capital costs associated with this project are $2.45M, broken down as follows:

- Halifax WWTF - $ 1.1M
- Dartmouth WWTF - $0.775M
- Herring Cove WWTF - $ 0.575M

The equipment was tendered in Q1 2020 and was awarded to Veolia Water Canada, whereas the construction tender for DWWTF was awarded to Black & McDonald Limited in Aug 2020, with work commencing September 2020 - December 2020. Material for HWWTF and HCWWTF arrived in July 2021, work at HWWTF started on the same date. The project ran into some complications with material quality, but one treatment train was completed, and HW continues to work on resolving the materials issues.

These projects also allowed additional work to be carried out while 50% of the plant underwent construction. Some of the other work included: Overhauling the sludge scraper system, install of additional blades to the coagulant mixer in each reactor, replacing reactor drain lines, replacing the automatic extraction pump inlet valve and the clean-out pipework, and concrete and hydraulic modifications.

Horizon 2040: Wastewater Treatment Innovation for Continuous Improvement of Effluent Quality

Halifax Water continues to build on the partnership with Dalhousie University through a Natural Science and Engineering Council of Canada (NSERC) Collaborative Research & Development (CRD) Grant to improve effluent quality from the three chemically enhanced primary treatment Wastewater Treatment Facilities in Halifax, Dartmouth and Herring Cove.

A summary of the work completed thus far is discussed below, including an overview of future activities.

Bench Scale and Pilot Scale Testing

Students from Dalhousie University and Halifax Water staff have conducted over 200 bench-scale jar tests since Fall 2020 to identify optimal conditions for improving effluent standards related to permit requirements (BOD and TSS) and determine what chemistry is required to achieve optimal removal efficiencies at the Dartmouth WWTF. Work also includes analyzing historical operational data and water quality data to identify patterns in operations such as sludge recirculation and impact on clarifier performance and mapping out ideal operating ranges for chemical dosing and sludge recirculation rates under variable influent conditions. Ongoing activities include purchasing a large-scale pilot to be built at the Dartmouth Wastewater Treatment Facility.

Turbidity Reduction

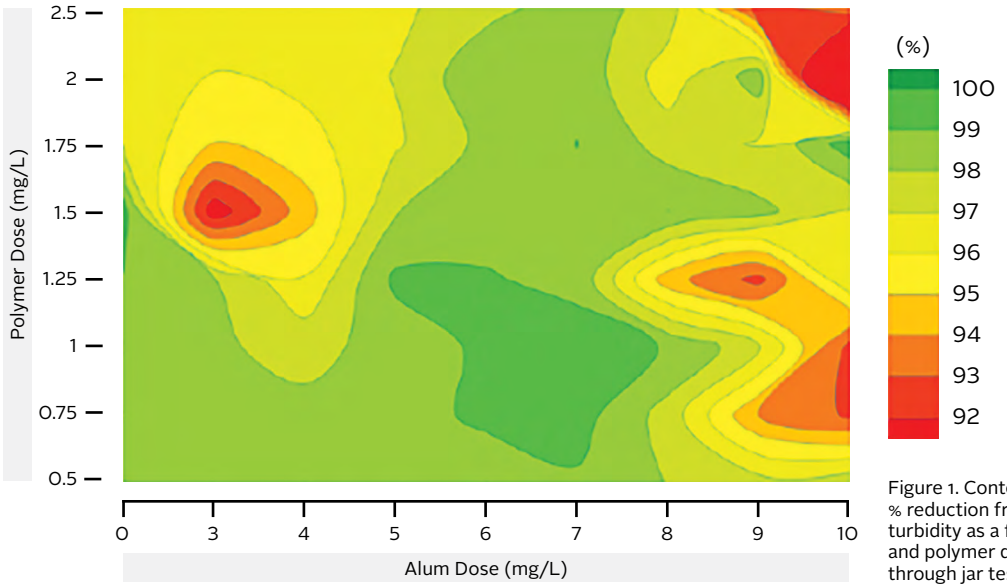
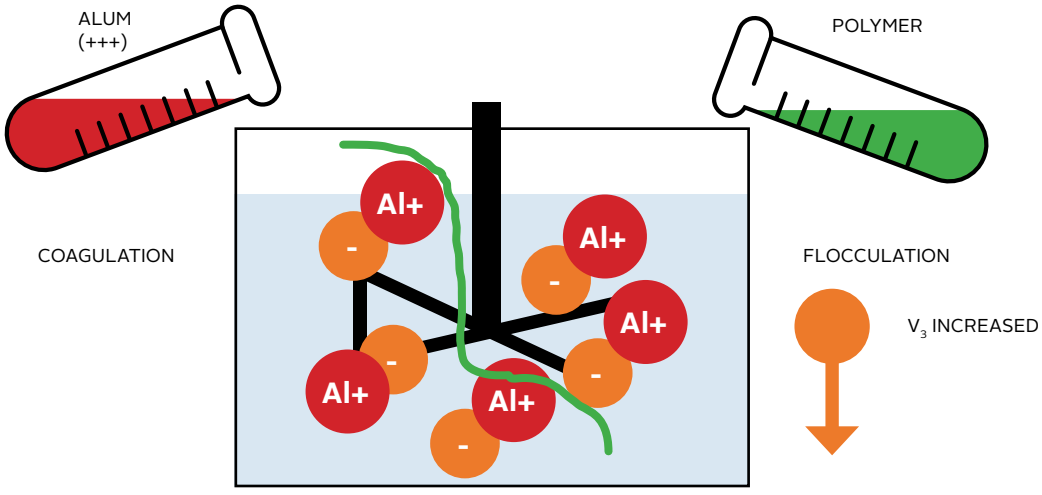
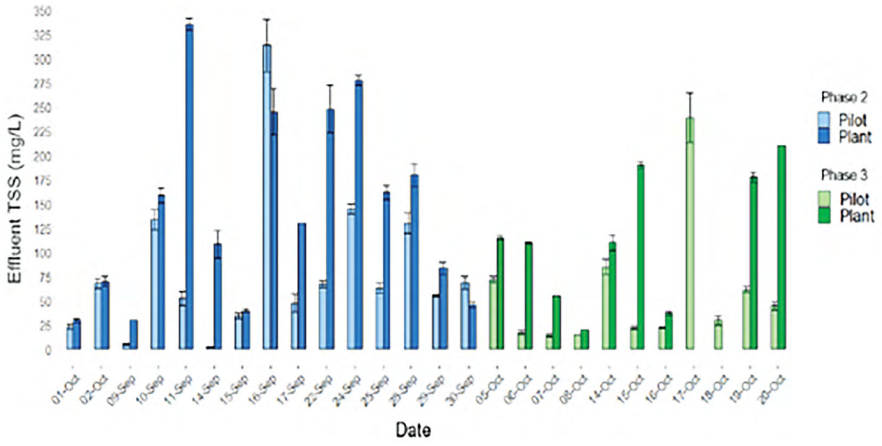


Figure 1. Contour plot showing % reduction from influent turbidity as a function of alum and polymer dose, determined through jar testing.



Pilot Scale - Optimization at the Dartmouth Wastewater Treatment Facility

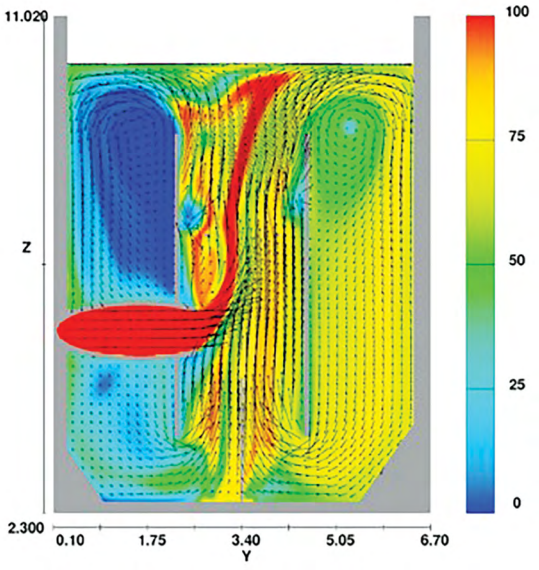
A pilot scale alternative ballasted media clarification system was tested at the Dartmouth WWTF in the Summer/Fall of 2020. Preliminary findings indicated that ballasted media clarification system outperformed existing technology and provided improved performance in wet weather events due to fast settling velocities of particles and may be helpful for future expansion to meet enhanced treatment requirements.



Average effluent TSS of pilot (light shade) and plant (dark shade) where blue bars represent Phase 2 and green bars represent Phase 3.

Computer Modeling

Polymer and Sludge Recirculation Modeling of Piston Reactors using Computational Fluid Dynamic Modeling revealed unfavourable hydraulic mixing in existing configuration and clarified existing operational challenges to remediate.



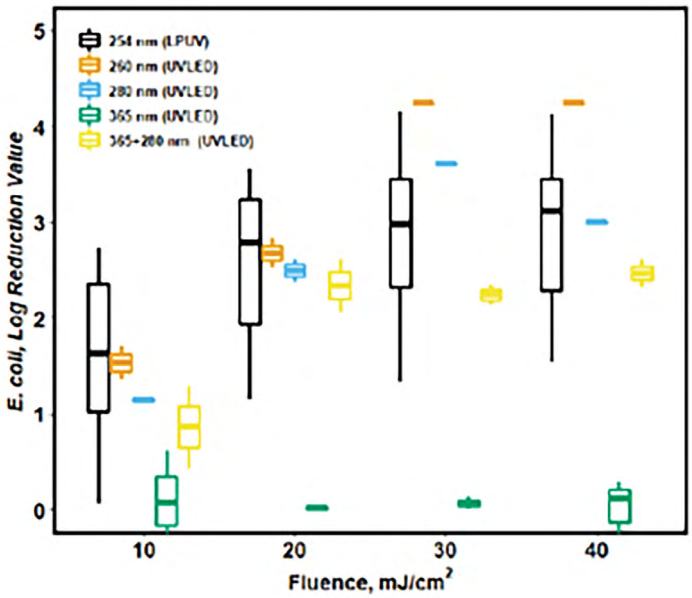
Online Computer Dashboard at the Dartmouth Wastewater Treatment Facility

Many of our wastewater projects generate very large and complex datasets that can often be difficult to manage and visualize. Dalhousie worked on amalgamating the vast data sets generated to date from bench, pilot, and full-scale optimization projects at the Dartmouth WWTF to an online database.

Desktop version of Dartmouth wastewater data dashboard showing bench-scales jar testing data.

UV Disinfection Optimization at Dartmouth WWTF

Utilized instrumentation to develop dose-response curves at a bench-scale to determine the inactivation rates for a given species (e.g., E. coli) in wastewater samples and examined the effectiveness of LED UV technology for disinfection compared to conventional low-pressure lamps. Results indicate that LED UV technology can achieve the same disinfection results as conventional technology in reducing power consumption.



Log Reduction Values for E. Coli in Dartmouth Wastewater Treatment Facility Effluent for Various UV Sources.

Contaminants of Emerging Concern

Developing methods to detect microplastics and nanoplastics in wastewater will be used to establish treatment approaches and remove these contaminants of emerging concern to our environment.

Additional Research – SARS-CoV2

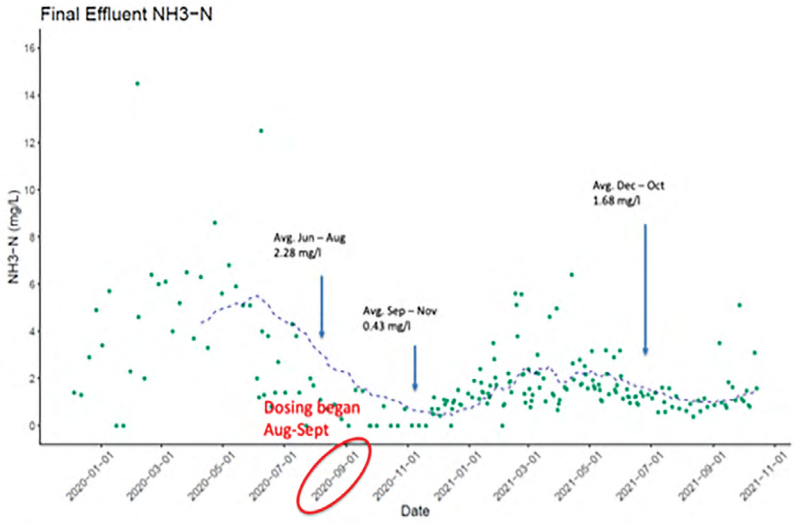
Environmental surveillance of SARS-CoV-2 in wastewater has the potential to support understanding of COVID-19 occurrence and transmission in communities. As such, wastewater may be monitored for SARS-CoV-2 to determine the prevalence of COVID-19 infections in a given population through wastewater-based epidemiology.

Over 200 samples (consisting of wastewater and biosolids from Halifax Water and other partners) have been received and analyzed by Dalhousie's staff.

Additional Research – Bioaugmentation

Dosing microorganisms in strategic locations in the Timberlea Sewershed causes the network to act as a bioreactor, and the wastewater is treated before entering the treatment facility itself.

This technology could help Halifax Water meet national effluent quality standards and potentially avoid the cost associated with extensive upgrades.



Decreases in effluent ammonia concentration since bioaugmentation dosing began in late Summer 2021.

Future Activities

The Dalhousie and Halifax Water collaboration continues with a 5-year Research Alliance grant that will focus on improving water and wastewater quality under climate change pressures through advancing science and technology.

Cogswell District Energy System

As the city of Halifax continues its redevelopment of the Cogswell district, Halifax Water will take the opportunity to design and install the distribution piping system required for the Cogswell District Energy System (DES).

Pending approval by the Nova Scotia Utility and Review Board (NSUARB), the Cogswell DES will enable the transfer of thermal energy from the Halifax WWTF effluent stream. This transfer will provide heating and cooling for six mixed-use high-rise commercial/residential developments proposed for the Cogswell redevelopment area.

This project aligns very well with Halifax Water's mission, vision, and strategic and environmental objectives. It will significantly contribute to the goals of HALIFAX's "HalifACT 2050" initiative, providing long-term energy and GHG emission reductions within the downtown core.

On June 30, 2021, the Federal and Provincial governments announced $10.1M of cost-shared funding for this project, citing it as one of the "first systems of its kind in eastern Canada." The funds will offset the capital costs of the DES for Halifax Water.

So far for the DES, Halifax Water has:

- Completed an initial feasibility study for the DES.
- Assisted HALIFAX city charter changes to allow district energy within HRM.
- Assisted HALIFAX with the enactment of By-Law D-500, Respecting District Energy.
- Completed the 100% detailed design of the linear infrastructure.
- Developed a draft financial model and business case analysis for the new utility.
- Evaluated the business case based on several operating and ownership scenarios.
- Completed a by-law review of other Canadian jurisdictions that have implemented similar district energy utilities.
- Completed a stakeholder/developer information document to better inform our stakeholders and potential developers on the DES.
- Submitted an application to the Nova Scotia Utility and Review Board (NSUARB) for approval of related capital expenditures and establishing a regulated district energy service within Halifax Water based on the established business case.
- Drafted a cost-sharing agreement for the DES distribution piping system with HALIFAX, pending NSUARB approval.

The key utility development activities yet to be undertaken include:

- Completion of a DES cost of service study and rate structure model.
- Development of operating procedures and business processes.
- Establishment of the DES utility regulations.
- Enhancement of the business case analysis to align with the cost-of-service model and rate structure.
- Complete detailed designs and construct the remaining DES infrastructure, including the DES Energy Center (located at the Halifax WWTF), and the Energy Transfer Stations (located in each new building).

Biosolids Processing Facility Expansion

The Aerotech Biosolids Processing Facility (BPF) is situated in the Aerotech Industrial Park in Goffs, NS. The facility receives and processes dewatered sludge, or biosolids, from all of Halifax Water's wastewater treatment facilities. Biosolids are currently processed using the N-Viro alkaline stabilization process to produce a Canadian Food Inspection Agency (CFIA) registered fertilizer that is subsequently used on non-food bearing crops.

The Infrastructure Master Plan (IMP) completed in 2019, along with subsequent analyses by Halifax Water staff, identified a 204% increase in biosolids production by 2046 due to population growth within the HRM, as well as the implementation of new secondary treatment processes at the Halifax, Dartmouth, and Herring Cove wastewater treatment facilities. This forecast exceeds the current production capacity of the BPF.

Work completed to date includes the completion of a third-party study to validate and confirm the earlier work conducted by Halifax Water and the start of the procurement process to execute a "Design, Build, Operate and Maintain" (DBOM) agreement for the design, construction and long-term operation of the new facility. A request for "Expressions of Interest" (EOI) was completed in June 2021. A "Request for Qualifications" (RFQ) was completed in April 2022 and resulted in three respondents being invited to submit proposals during the upcoming "Request for Proposal" (RFP) process.

The next steps include the development of the RFP documents, as well as the draft project agreement. The RFP process is expected to be completed early in 2023, and a new long-term DBOM contract will be in place by mid-2023.

The new facility is expected to include provisions for enhanced resource recovery. Biosolids will be used to produce fertilizer and recover renewable natural gas (RNG) via anaerobic digestion that will be exported and sold into the North American natural gas distribution system. The facility is anticipated to produce more than 35,000 tonnes/year of fertilizer and over 200,000 GJ/year of RNG at full capacity.

Water Loss Control

The American Water Works Association (AWWA) utilizes the water balance to account forall water in a piped water network.

Ultimately, water is categorized as revenue waterornon-revenue water. There are three main subsets of non-revenue water

1. Unbilled Authorized consumption
2. Apparent losses
3. Real Losses

Water Loss Control primarily focuses on managing the real losses through various strategies and tactics.

Halifax Water ratepayers bear the cost of the supply and treatment of water. As a result, it is imperative that any water utility work to aggressively reduce real water losses.

Beyond the immediate financial benefits, there are societal, environmental, and engineering advantages to water loss control.

Halifax is fortunate to have an abundant fresh water supply. However, many areas of the world either do not have the same access to fresh water or have seen their water source significantly depleted; therefore, we cannot take our resources for granted.

From an environmental perspective, leakage directly increases supply plant production, which places a higher demand on chemicals and energy consumption.

As a result, the industry, through the American Water Works Association (AWWA), has developed strategies in engineering and asset management to manage a water utility efficiently. Ignoring leakage would lead to an overall decay of the system, leaving a monumental burden for future generations.

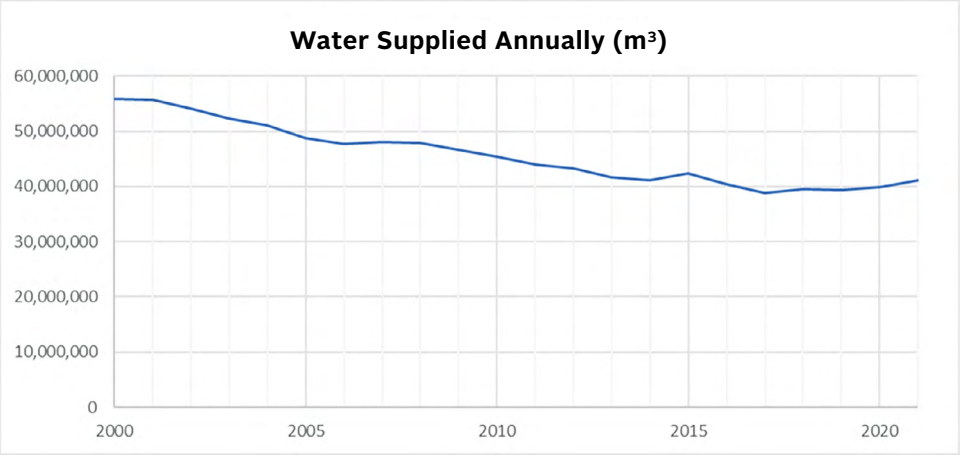
AWWA's Manual, M36, the industry standard in Water Loss Control, segments the challenge into four pillars. Halifax Water has active and planned initiatives in all of these categories.

- Speed and Quality of Repair
- Pressure Management
- Active Leakage Control
- Pipeline and Asset Management Selection, Installation, Renewal and Replacement

While the efficient operation of the water system and rapid and efficient response to leakage lies with Water Services, an effective water loss control program takes the collective effort of the entire Utility. Technical Services maintains the data historian backbone, Engineering designs and delivers the system upgrades; Corporate Services manages the metering inputs and customer education. Regulatory Services maintains policies and controls new connections to and expansion of the system.

The program's success can be measured in several ways. The combined treated water output is used as a metric to track the internal effectiveness of the program. It is estimated that the utility saves $600,000 a year due to the reduced production since the program began. The Infrastructure Leakage Index (ILI) and calculating the Real Loss/service connection/day are two AWWA metrics Halifax Water tracks which can also be used to benchmark against other utilities.

The graph below shows the water supplied from both water supply plants since 2000. The water supplied has plateaued in recent years; this may be a function of approaching the Economic Level of Leakage – the point where costs to reduce leakage exceed what is saved. A rising population will also begin to increase production.



Solar & Energy Efficiency Projects

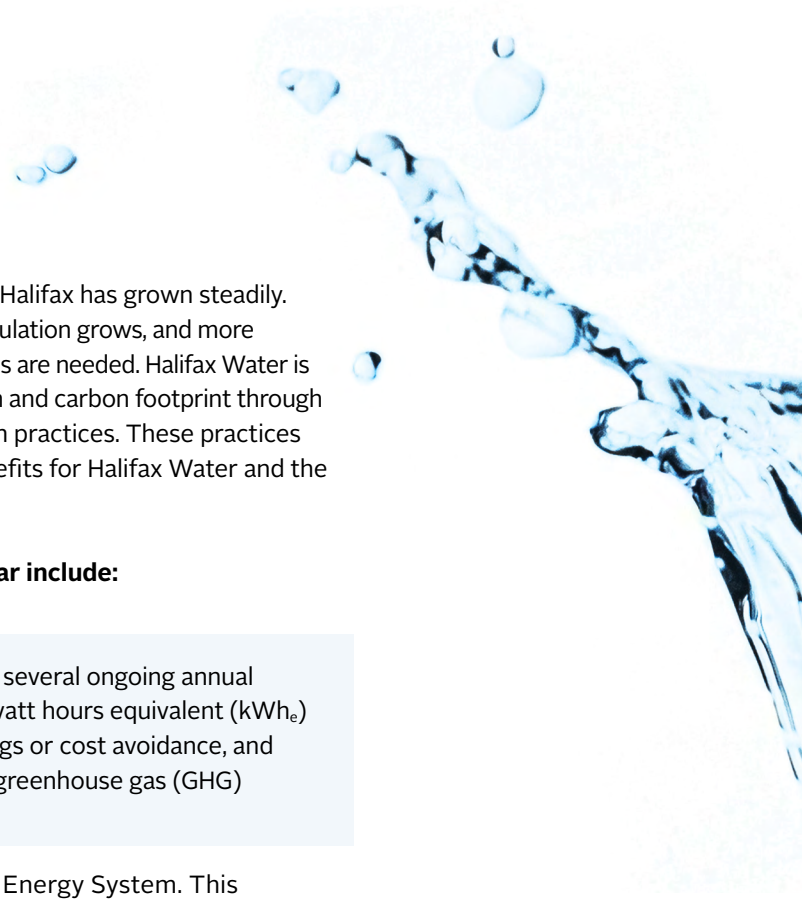
Solar Energy Projects

In July 2020, Halifax Water successfully applied for funding from the Investing in Canada Infrastructure Program (ICIP) under the climate change mitigation sub-stream for four multi-facility Community Solar PV projects, as follows:

PROJECT LOCATION	SIZE	TOTAL COST	FED/PROV PORTION (73.33%)	HALIFAX WATER PORTION (26.67%)	YEAR 1 ESTIMATED REVENUES	SIMPLE PAYBACK
Aerotech Wastewater Treatment Facility	125 KW_{AC}	$526,384	$385,997	$140,387	$23,214	6.3 years
450 Cowie Hill Road Administration Building	100 KW_{AC}	$382,990	$280,847	$102,143	$13,870	7.7 years
455 Cowie Hill Road West Operations Facility	100 KW_{AC}	$382,990	$280,847	$102,143	$13,870	7.7 years
New East Operations Facility	100 KW_{AC}	$382,990	$280,847	$102,143	$15,105	7.1 years
Totals	**425 KW_{AC}**	**$1,675,355**	**$1,228,537**	**$446,817**	**$66,059**	**7.1 years**

The first project, located at the Aerotech WWTF, was awarded in May 2022 and will be constructed and operational in the Fall of 2022. The two Cowie Hill Road projects are anticipated to be awarded early in 2023, for construction by the Fall of 2023. The new East Operations Building solar project will be included in the scope of work for the design, construction and commissioning of this new facility, with an anticipated completion sometime in 2025.

The Halifax Water Community Solar PV projects will see the installation of approx. 425 kW_{AC} of solar capacity, will offset Halifax Water's current electrical use with a renewable energy source, will reduce GHG emissions by over 6,975 tonnes of CO_{2e}, and will reduce the Utility's operating costs by over $1.6 million over the expected life of the project, directly benefiting all of Halifax Water's rate base.



Energy Efficiency

Energy use in delivering water and wastewater services in Halifax has grown steadily. It will continue to increase over the coming years as our population grows, and more stringent water quality and wastewater treatment regulations are needed. Halifax Water is continually trying to control and reduce energy consumption and carbon footprint through more efficient energy management and emission reduction practices. These practices help achieve operational, financial and environmental benefits for Halifax Water and the communities we serve.

Some of these improvements in the 2021/22 fiscal year include:

- Upgrades to equipment and infrastructure, as well as several ongoing annual operating initiatives resulting in over 8,670,000 kilowatt hours equivalent (kWh_e) in annual energy savings, over $720,000 in cost savings or cost avoidance, and over 3,000 tonnes carbon dioxide equivalent (CO_{2e}) greenhouse gas (GHG) reductions.
- Development of an Ambient Temperature District Energy System. This system will be part of the Cogswell interchange development. It will extract heat from the wastewater travelling through the plant and use the energy to heat buildings contained within the new development. The system will also provide cooling in summer.
- Working with building designers to achieve LEED silver certification for the new Burnside Operations Centre. This will help ensure that the building's carbon and energy footprints are consistent with current best practices.
- A submission of an expression of interest in the anticipated provincial Green Choice Program was completed in 2021/22. It is anticipated that full enrollment in this program will be approved in 2022/23, leading to the eventual supply of almost 100% of our annual electrical energy use from renewable resources, eliminating nearly all indirect GHG emissions from utility operations.
- Continuously pursuing funding opportunities for alternate energy projects and greenhouse gas reduction efforts.

For 2021/22, the utility saw an overall decrease of 1.6% in energy use, a 10.0% reduction in energy intensity, an increase of 9.23% in water and wastewater flows, and a decrease of 5.1% in GHG emissions, compared to 2020/21. During 2021/22, direct GHG emissions were 2,194 tonnes CO_{2e}, while indirect emissions were 32,604 tonnes CO_{2e}.

Focusing on further energy efficiency, operational improvements within our existing infrastructure, and completing energy use inventories in all our facilities in the coming years will allow Halifax Water to continue optimizing energy use and build upon these results.

Safety & Security

Halifax Water and its Employees remain committed to providing a healthy and safe work environment. One that works to prevent occupational illness and injury and promotes mental wellness. This commitment is based upon our understanding that health and safety is a core business function for our organization and is treated as a priority in our work. Halifax Water continues to evaluate, develop and improve safety and security initiatives across the organization to ensure this commitment.

Halifax Water tracks key lead-and-lag indicators to benchmark the safety program's success. Safety audits are conducted in the field to ensure employees are delivering our services safely. This past year the average score on internal safety audits was up from the previous year to 96.7%, along with a reduction in motor vehicle accidents from 5.5 to 3.4/1,000,000 km driven. Also, this past year, lost time incidents increased slightly at 2.0 per 100 employees.

With COVID-19 still present within our community and the requirement to provide essential services to our customers, we continued to adapt how services were provided, guidance on PPE and distancing requirements, gathering limits, and overall awareness of safety recommendations from Nova Scotia Public Health were provided to employees.

This past year, Halifax Water reviewed the overall safety program and identified a three-to-five-year plan to enhance the program and improve the safety culture. As a result, three additional resources were required. In the last quarter, the process commenced to hire a Safety and Training Specialist, and a Fire and Security Advisor working within the Regulatory Services department, and an Occupational Health and Hygienist, working within the Human Resources department.

Some near-term highlights of the safety program for implementation this coming year include:

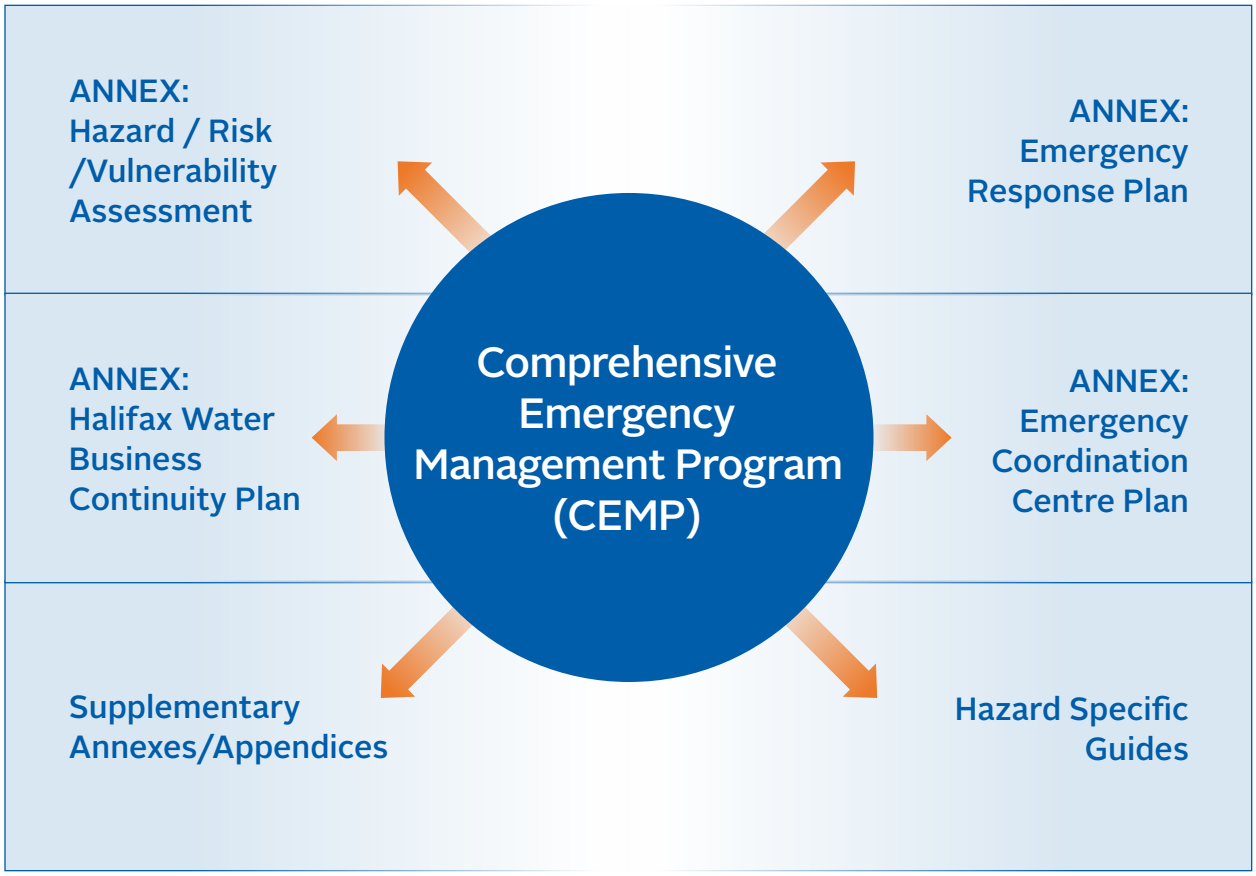
- Safety 101 Leadership Training for Supervisors/Managers/Directors and Safety Representatives
- Commence the transition of the current Occupational Health Safety Manual to a Safety Management System
- Transitioning the external safety worksite inspection/audits process to build on internal resources capabilities
- Review and update fire safety plans for all facilities

Incident Command System

The Incident Command System (ICS) is a standardized approach to the command, control, and coordination of emergency response. ICS provides a common hierarchy within which responders from multiple agencies can be effective. Halifax Water continues to utilize the ICS when managing water main and forcemain breaks and as a planning tool for larger multi-faceted projects. Halifax Water enacted ICS with the Lake Major Clarifier replacement project.

Emergency Management Program

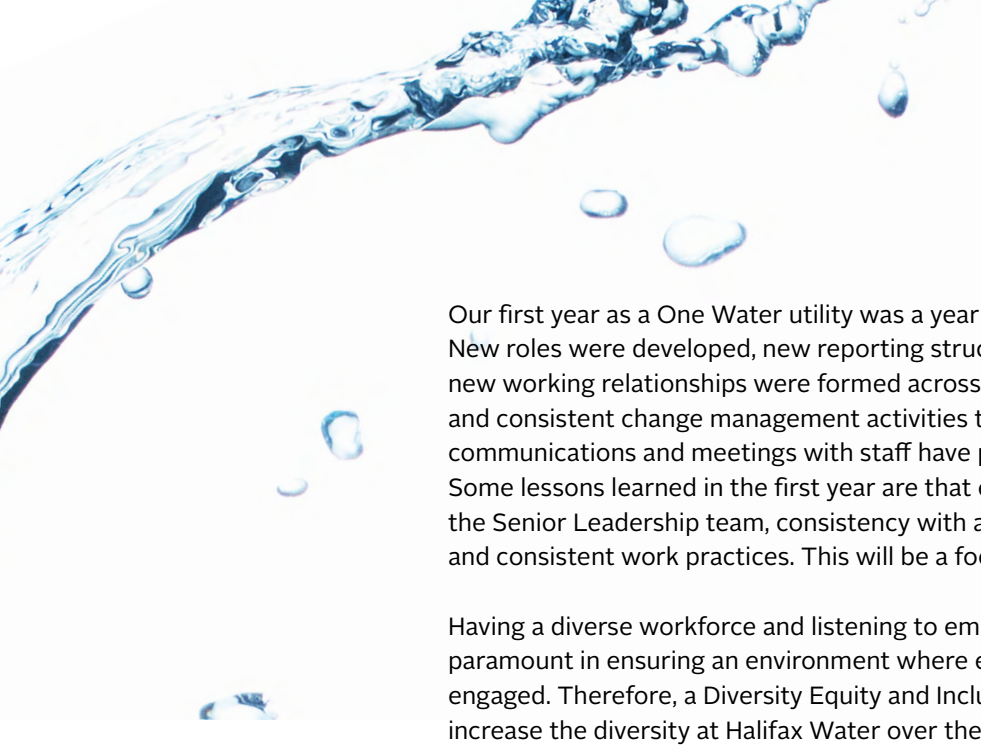
The review of the Emergency Response Plan (EMP) and Business Continuity Plan, a collaboration with the Enterprise Risk Manager, commenced resulting in the development of the framework for a Comprehensive Emergency Management Plan (CEMP), comprised of:



In the coming year, the focus will be on updating the EMP to enhance the strategies for appropriate responses within the first 24 to 48 hours of an event and build upon those to strengthen our Business Continuity Plans.

Motivated & Satisfied Employees

Crews testing a water valve on Windmill Road, Dartmouth.



Our first year as a One Water utility was a year of many changes for employees. New roles were developed, new reporting structures were embraced, and many new working relationships were formed across all departments. The preparation and consistent change management activities that involved many forms of communications and meetings with staff have proven to make this change successful. Some lessons learned in the first year are that employees want more interaction from the Senior Leadership team, consistency with accountability across all departments, and consistent work practices. This will be a focus in the coming years.

Having a diverse workforce and listening to employees' different perspectives is paramount in ensuring an environment where employees feel safe, valued and engaged. Therefore, a Diversity Equity and Inclusion framework was developed to increase the diversity at Halifax Water over the next three years.

The proposed objectives are:

- Increase the percentage of employees who agree that the workplace reflects a diverse cultural background to 75% by the end of the three-year period.
- Increase customers' recognition of Halifax Water's Corporate Social Responsibility by 10% by the end of the three-year period.
- Work towards gender equality and increase employee perception that the workplace reflects gender equality as measured by the employee survey.
- Increase accessibility at primary Halifax Water work locations compared to the status quo.
- Expand employee knowledge and inclusion of the LBGTQ2S+ community and measure awareness via the employee survey.

In 2021-22 we successfully trained all employees on Unconscious Bias, which laid the foundation for successfully implementing this robust Diversity plan.

Talent Management is another pillar in employee satisfaction and ensuring that Halifax Water has continued successors to fill key roles. Last year the framework to train employees who aspire to be in a leadership role was implemented, and the first year of this training will start in 2022-23. Halifax Water also implemented the new Learning Management Module in the Human Resource Information System, ViP. This new module will ensure that all employees have all required training before expiration and track CEUs required to maintain certification.

Ensuring that policies are up to date and in line with legislation and current market trends is important as these provide the guidelines for day-to-day operations while ensuring compliance with laws and regulations. A new policy framework was implemented to ensure that all policies are reviewed and updated promptly. This will assist all employees with better decision-making and streamline internal processes.

Halifax Water staff at the Bruce Street Pump Station Replacement project. Left to right: Sanjoli Tagra, Stormwater Engineer; Cathie O'Toole, General Manager; and Renée Roberge, Wastewater Infrastructure Engineer.

2021 Service Awards List

35 Years of Service	
Sandra Hood	Administration
Brian Gazeley	Operations
Rick Reid	Operations

30 Years of Service	
Dave Dort	Operations
Laurie Sperry	Operations
Tim Dewolfe	Operations

25 Years of Service	
Dawn Slaunwhite	Administration
Karen Kearney	Administration
Tanya Shatford	Administration
Michael Campbell	Engineering & Technology Services
Rudy Thomas	Engineering & Technology Services
Andrea LeGassie	Operations
Chris Weeks	Operations
Evan Beaton	Operations
Gary McPherson	Operations
Heather Shea	Operations
Mark Stevens	Operations
Richard Masters	Operations
Robert Cohoon	Operations
Robert Wyman	Operations
Charlie Lloyd	Regulatory Services
Ian Guppy	Regulatory Services

20 Years of Service	
Bernardino Amaral	Engineering & Technology Services
Melissa O'Grady	Engineering & Technology Services
Tom Gorman	Engineering & Technology Services
Karen Amaral	Operations
Mike Clements	Operations
Craig Campbell	Regulatory Services

15 Years of Service	
Amanda Richards	Engineering & Technology Services
Paul Taylor	Engineering & Technology Services
Valerie Williams	Engineering & Technology Services
Barry Geddes	Operations
Daniel Englehutt	Operations
Hannah MacKay	Operations
James Bruce	Operations
Jerry MacDonald	Operations
Tracy Hatch	Operations
Andrew Driscoll	Regulatory Services

10 Years of Service (Continued)	
Cathie O'Toole	Administration
Jessica Haley	Corporate Services
Tracy Philpott	Corporate Services
Ashley Ward	Engineering & Technology Services
Christopher Solomon	Engineering & Technology Services
Jeffrey Knapp	Engineering & Technology Services
John White	Engineering & Technology Services
Robert Gillis	Engineering & Technology Services
Andrew Crowe	Operations
Anna McCarron	Operations
Brian Chinn	Operations
Jason Fraughton	Operations
Jeffrey Englehutt	Operations
Kara Baisley	Operations
Lyle Morash	Operations
Mark Payzant	Operations
Mark Sellon	Operations
Matthew Tufts	Operations
Michael Englehutt	Operations
Patrick Miller	Operations
Robert Oakley	Operations
Todd Cameron	Operations
Amanda O'Brien	Regulatory Services
Andrew Livingston	Regulatory Services
Joel Haley	Regulatory Services
Kimberly Murphy	Regulatory Services
Patricia Isnor	Regulatory Services
Patricia Jodrey	Regulatory Services

5 Years of Service (Continued)	
Jeffery McAulay	Administration
Anna Thibault	Corporate Services
Christopher McNeil	Corporate Services
Jennifer Wilson	Corporate Services
Melissa Levangie	Corporate Services
Merissa Campbell	Corporate Services
Shannon Cowan	Corporate Services
Alexander McLeod	Engineering & Technology Services
Daniel Levesque	Engineering & Technology Services
Jayesh Patel	Engineering & Technology Services
Mark Kennedy	Engineering & Technology Services
Myra Davis	Engineering & Technology Services
Stewart Green	Engineering & Technology Services
Zachary Galbraith	Engineering & Technology Services
Aaron Chisholm	Operations
Adam Foy	Operations
Cameron Wadden	Operations
Cameron Corey	Operations
Corey Sullivan	Operations
James Mosher	Operations
Jason Lillington	Operations
Jordan Stark	Operations
Lisa Misener	Operations
Matthew Vautour	Operations
Shayne Speight	Operations
Timothy MacEachern	Operations
Leah Pottie	Operations

In the Community

Supporting Diversity, Equity & Inclusion (DE&I) at Halifax Water

Halifax Water is committed to having a more diverse workplace founded on ensuring we are equitable and inclusive to everyone currently on our team and new employees.

aIn 2021/22, we established a Diversity, Equity & Inclusion (DE&I) Framework, which set goals along with a 3-year roadmap. To support this framework, we launched the following initiatives over the fiscal year:

- DE&I questions were added to our annual employee satisfaction survey so we can gather feedback.
- All Halifax Water employees completed Unconscious Bias Training.
- A self-identification option was added to our job applications, and we now encourage new employees to self-identify on either their form or in their cover letters.
- Reviewed and expanded our contact lists for career opportunities to ensure we have captured as many relevant organizations as possible and associations that share our DE&I goals.
- A specific DE&I subcommittee on supporting and attracting more Women in Non-Traditional Trades was formed.
- Corporate Social Responsibility Committee continued, with participation from Union Presidents.
- Recognized and encouraged our employees to reflect on the meaning of National Truth and Reconciliation Day.
- Incorporated the use of the "Diversity Moment" topic in our monthly employee newsletters.

With his permission, we were proud to share the talent of Anthony Riley, Water Utility Maintenance, with all Halifax Water employees, as he sang the Black National Anthem, Lift Every Voice, during the opening ceremonies of the African Heritage Month Opening Night - hosted by the Black Cultural Centre for Nova Scotia and Halifax Public Libraries.

- Worked with NSCC to optimize the Scholarship and Bursary Program for African Nova Scotians.
- Provided Indigenous Cultural Training.
- Senior women leaders hosted coffee breaks to recognize International Women's Day.
- Shared examples, with their permission, of our employees celebrating their history and culture with the entire organization.

As an organization, Halifax Water recognizes that we are on a journey to ensure we have a workforce that better reflects the diverse communities we serve. We believe that our 3-year framework will continue to help us advance our goals.

Employee Donations

H_2O Fund

$5,755.00

(Employee payroll deductions only)

Water for People

$10,402.00

Amount for United Way

$4,428.00

Angel Tree

For 102 children

All received a special toy, and a hat, mitts and/or scarf. Children were from newborn to 11 years old.

Fundraising & Volunteering

Halifax Water employees take great pride in the communities we live and serve. Employees can get involved in several different fundraising events, volunteer groups and community causes throughout the year.

United Way Halifax

Halifax Water employees have been helping support United Way Halifax for over 23 years. This year's campaign was 100% virtual, and employees could donate through a payroll deduction plan. Halifax Water employees proudly pitched in and raised a total of $4,218.00!

Water for People

Halifax Water employees donated $10,402 to Water for People. These funds support the digging of wells to provide clean drinking water for approximately 4 million people in nine different countries.

Festival of Trees in support of the Mental Health Foundation

The utility provided a corporate donation of $1,500 to the Festival of Trees in support of the Mental Health Foundation of NS. The Mental Health Foundation of NS is a charity, not a mental health provider. Through the help of their generous donors, Nova Scotians living with mental disorders have access to support where they need it when they need it.

Angel Tree Toy Drive

For more than ten years, it has been a tradition for Halifax Water employees to continue the Angel Tree Program to provide gifts for children in need in our community.

We had a total of 102 children, from newborns to 11 years old, and thanks to the giving spirit of Halifax Water employees, they will get something special on Christmas Morning!

Special Olympics

Halifax Water fleet operators showed pride in their trucks as they volunteered to participate in the Special Olympics Nova Scotia Truck Convoy.

The Truck Convoy is a way to raise money for the Special Olympics NS; this year, a record amount was increased. Halifax water was a Silver Level Sponsor of the event and was proud to have seven of its fleet involved again this year.

Purple Ribbon Campaign

In recognition and support of The Purple Ribbon Campaign, a movement to raise awareness of violence against women, Halifax Water employees came together and donated a total of $750 worth of gift cards. These gift cards were given to the women at the Transition House Association of Nova Scotia, transitional homes empowering women to get the things they need to move forward.

Christmas Families Fundraising

The generosity of Halifax Water employees is beyond compare. Giving back to the communities we serve gives Halifax Water employees a sense of belonging. The holiday season can be challenging for some to get through, but our employees rallied and were able to raise the following

Final totals for the cash portion of this year's fundraising:

Feed NS (Metro Food Bank)-$1000
Halifax Transition House (Bryony House)-$100
Hope Cottage-$100
Souls Harbour Rescue Mission-$100
Salvation Army-$480

H2O Fund

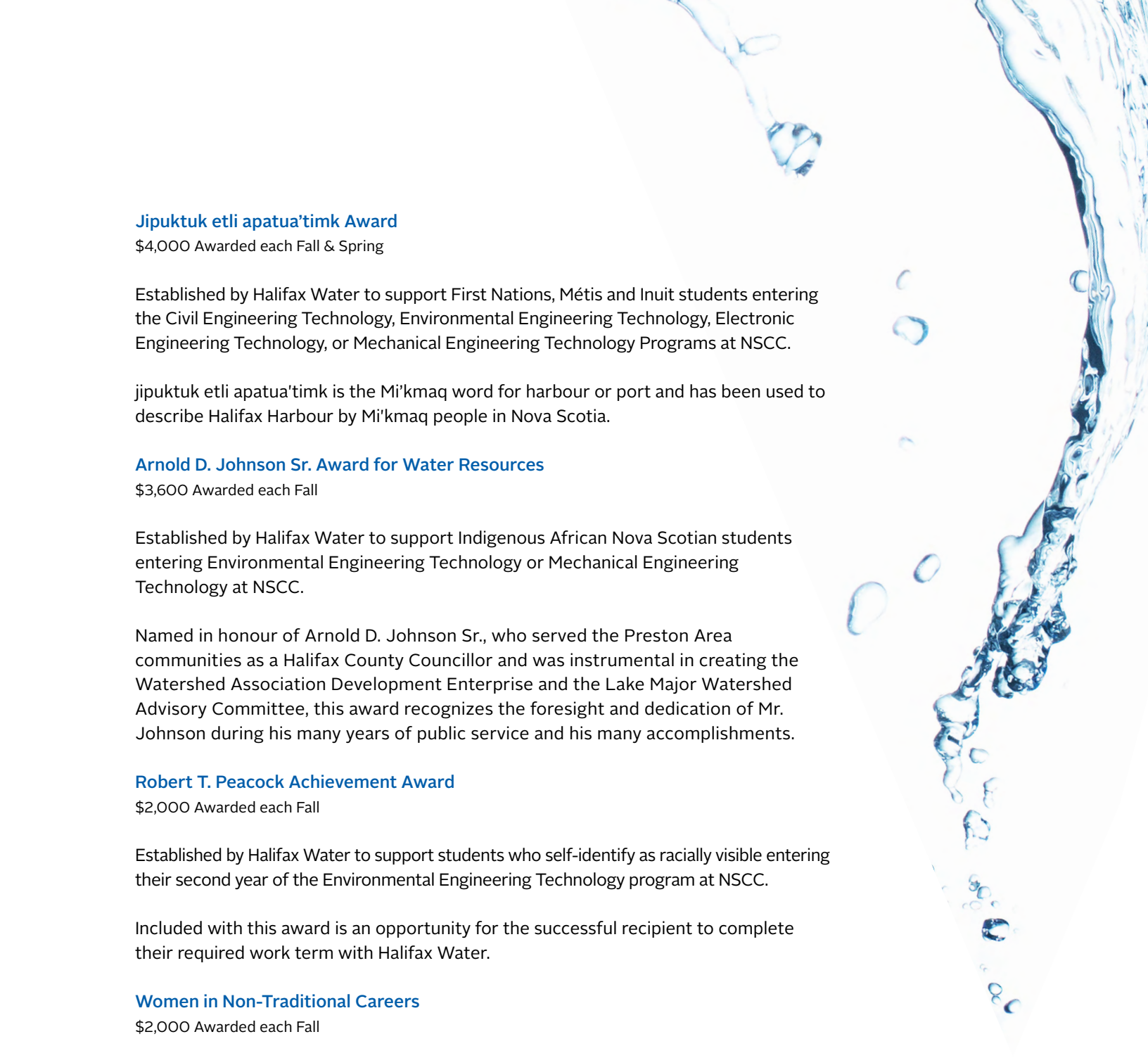
The H2O (Help to Others) Fund is a water, wastewater, and stormwater assistance fund that can be used by Halifax Water residential customers who are having difficulty making their bill payments.

Approved applicants will receive assistance once in a 24-month period to a maximum of $275.00. This program is administered by the Salvation Army on behalf of Halifax Water.

Halifax Water's H2O Fund is funded by donations from Halifax Water employees throughout the year. Halifax Water matches these donations to a maximum of $25,000 annually. These funds are used to help Halifax Water customers who are having a hard time paying their bill. This year, Halifax Water employees donated $5,755.00 through payroll deductions.

Scholarships

Halifax Water is an active supporter of the educational growth of our community through scholarships provided to the Nova Scotia Community College. Since 2008 Halifax Water has offered over $111,000 in scholarships for NSCC students, with accompanying work-terms. The scholarships not only benefit the community and recipients, they have provided Halifax Water with many highly skilled and motivated employees over the years:



Jipuktuk etli apatua'timk Award

$4,000 Awarded each Fall & Spring

Established by Halifax Water to support First Nations, Métis and Inuit students entering the Civil Engineering Technology, Environmental Engineering Technology, Electronic Engineering Technology, or Mechanical Engineering Technology Programs at NSCC.

jipuktuk etli apatua'timk is the Mi'kmaq word for harbour or port and has been used to describe Halifax Harbour by Mi'kmaq people in Nova Scotia.

Arnold D. Johnson Sr. Award for Water Resources

$3,600 Awarded each Fall

Established by Halifax Water to support Indigenous African Nova Scotian students entering Environmental Engineering Technology or Mechanical Engineering Technology at NSCC.

Named in honour of Arnold D. Johnson Sr., who served the Preston Area communities as a Halifax County Councillor and was instrumental in creating the Watershed Association Development Enterprise and the Lake Major Watershed Advisory Committee, this award recognizes the foresight and dedication of Mr. Johnson during his many years of public service and his many accomplishments.

Robert T. Peacock Achievement Award

$2,000 Awarded each Fall

Established by Halifax Water to support students who self-identify as racially visible entering their second year of the Environmental Engineering Technology program at NSCC.

Included with this award is an opportunity for the successful recipient to complete their required work term with Halifax Water.

Women in Non-Traditional Careers

$2,000 Awarded each Fall

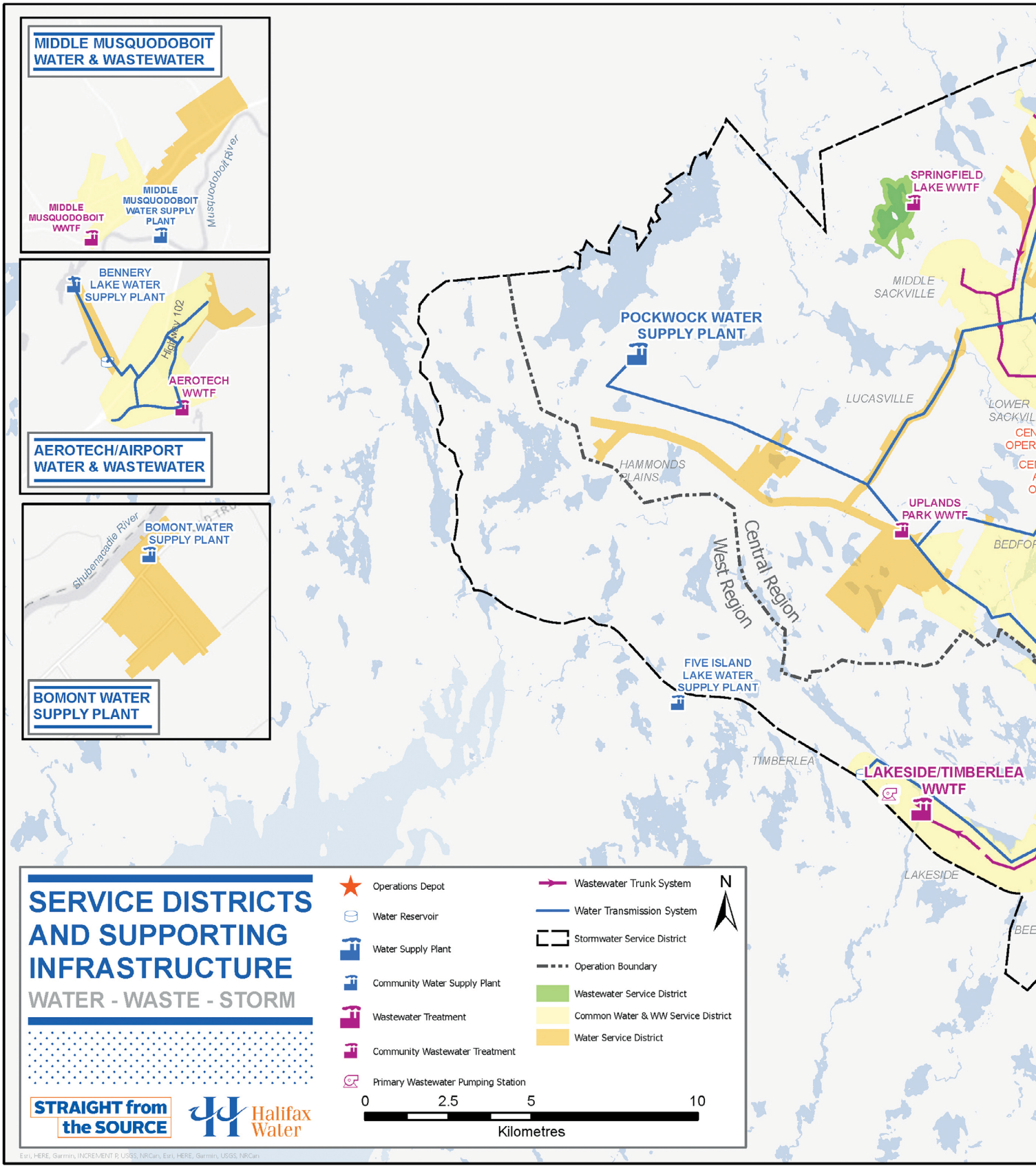
This award is open to women in non-traditional careers that are entering one of the eligible NSCC programs listed. Included with this award is an opportunity for the successful recipient to complete their required work placement with Halifax Water as well as an opportunity for summer employment with Halifax Water.

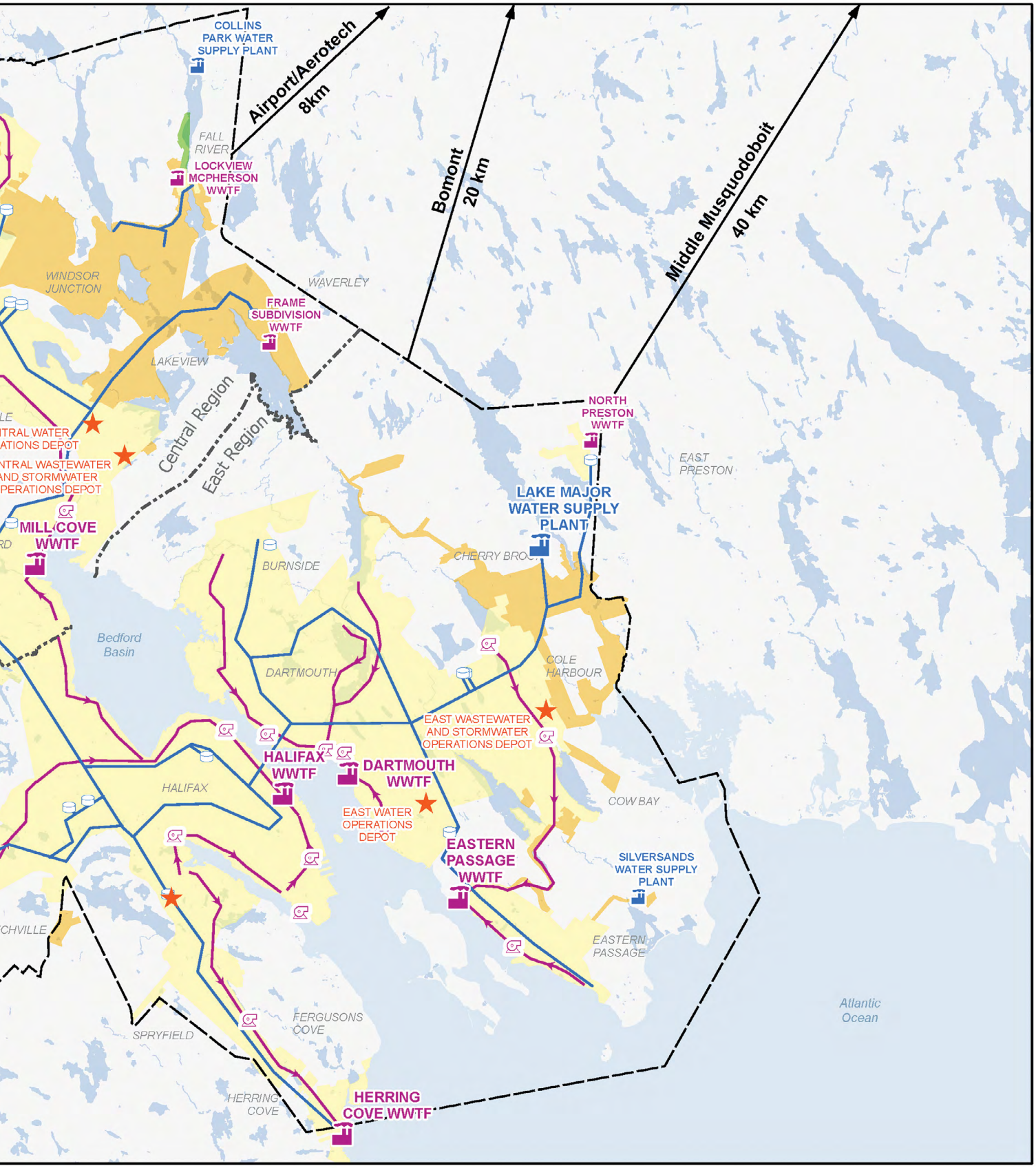
Halifax Water Achievement Award

$2,000 Awarded each Fall

This award is open to any student enrolled full-time in the Civil Engineering Technology program at NSCC. Included with this award is an opportunity for the successful recipient to complete their required work term with Halifax Water.

Service Area Map




COLLINS PARK WATER SUPPLY PLANT
Airport/Aerotech 8km
Bomont 20 km
Middle Musquodoboit 40 km
FALL RIVER
LOCKVIEW MCPHERSON WWTF
WINDSOR JUNCTION
WAVERLEY
FRAME SUBDIVISION WWTF
LAKEVIEW
Central Region
East Region
NORTH PRESTON WWTF
EAST PRESTON
LAKE MAJOR WATER SUPPLY PLANT
MILL COVE WWTF
BURNSIDE
CHERRY BROOK
Bedford Basin
DARTMOUTH
COLE HARBOUR
EAST WASTEWATER AND STORMWATER OPERATIONS DEPOT
HALIFAX WWTF
DARTMOUTH WWTF
HALIFAX
EAST WATER OPERATIONS DEPOT
COW BAY
EASTERN PASSAGE WWTF
SILVERSANDS WATER SUPPLY PLANT
EASTERN PASSAGE
Atlantic Ocean
FERGUSONS COVE
SPRYFIELD
HERRING COVE
HERRING COVE WWTF

Water Infrastructure as of March 31, 2022

WATER SUPPLY PLANT	WATER SOURCE	TREATMENT PROCESS	AVERAGE FLOWS/DAY	FILTER QUANTITY & CAPACITY/DAY	MAXIMUM FLOW RATE	DESIGN CAPACITY/DAY
J. D. Kline	Pockwock Lake	Dual Media Direct Filtration & Manganese Removal	84 039	8 Filters 143 m^2/filter	0.137 m^3/m^2 per minute	227 000 m^3
Lake Major	Lake Major	Upflow Clarification, Iron & Manganese Removal	31 756	4 Filters 85 m^2/filter	0.192 m^3/m^2 per minute	94 000 m^3
Bennery Lake	Bennery Lake	Sedimentation, Dual Media Filtration & Manganese Removal	705	2 Filters 26.65 m^2/filter	0.10 m^3/m^2 per minute	7 950 m^3
Middle Musquodoboit	Musquodoboit River	Raw Water Infiltration Gallery, Ultra/Nano Filtration	48	2 Ultra Filters 1 Nano Filter	0.139 m^3/min 0.264 m^3/min	260 m^3
Collins Park	Lake Fletcher	Ultra/Nano Filtration	68	2 Ultra Filters 1 Nano Filter	0.111 m^3/min 0.145 m^3/min	160 m^3
Bomont	Shubenacadie River	Nano Filtration/Ionic Exchange Resin	2	N/A	0.0132 m^3/min	38 m^3
Silver Sands	2 Wells	Green Sand Pressure Filters, Iron & Manganese Removal	18	2 Filters	0.378 m^3/min	30 m^3
Five Island Lake	1 Well	UV Disinfection	14	N/A	0.016 m^3/min	N/A

SOURCE WATER	WATERSHED AREA	SAFE YIELD/DAY
Pockwock Lake	5 661 ha	145 500 m^3
Chain Lake	206 ha	4 500 m^3
Lake Major	6 944 ha	65 900 m^3
Lake Lemont/Topsail	346 ha	4 500 m^3
Bennery Lake	644 ha	2 300 m^3

SOURCE WATER	RAINFALL IN 2021-22	SNOWFALL IN 2021-22
Pockwock Lake	1 521.8	219.7
Lake Major	1 606.9	120.2

Halifax Water by the Numbers

WATER SUPPLY	WATER PRODUCTION IN 2021-22 (M^3)
Pockwock Lake	30 674 399
Lake Major	11 590 820
Bennery Lake	257 233
Small Systems	55 272
Total	**42 577 724**

TRANSMISSION & DISTRIBUTION SYSTEM	
Size of Water Mains	19 mm - 1 500 mm
Total Water Mains	1 574 km
Main Valves	15 702
Fire Hydrants	8 496
Distribution Pumping (Booster) Stations	20
Pressure Control & Flow Meter Chambers	143

WATER SERVICES & METERS	
Water Sprinkler Systems (25 mm - 300 mm)	2 280
Supply Services (10 mm - 400 mm)	86 797
Water Meters (15 mm - 250 mm)	86 497

POPULATION SERVED	
Halifax Municipality Est. Population Served	381 000
Consumption per Capita	238.18 litres/day

RESERVOIR	ELEVATION ABOVE SEA LEVEL	CAPACITY
Lake Major	60 m	9 092 m^3
Pockwock	170 m	13 600 m^3
Geizer 158	158 m	36 400 m^3
Geizer 123	123 m	31 800 m^3
Cowie	113 m	11 400 m^3
Robie	82 m	15 900 m^3
Lakeside	119 m	5 455 m^3
Mount Edward 1	119 m	22 728 m^3
Mount Edward 2	119 m	22 728 m^3
Akerley Blvd.	119 m	37 727 m^3
North Preston	125 m	1 659 m^3
Meadowbrook	95 m	9 091 m^3
Sampson	123 m	12 273 m^3
Stokil	123 m	23 636 m^3
Waverley	86 m	1 364 m^3
Middle Musq.	81 m	275 m^3
Aerotech	174 m	4 085 m^3
Beaver Bank	156 m	6 937 m^3
Total	N/A	259 213 m^3

Wastewater & Stormwater Infrastructure as of March 31, 2022

WASTEWATER TREATMENT FACILITY	TREATMENT PROCESS	DESIGN AVERAGE FLOWS/DAY	AREA(S) SERVED	RECEIVING WATER	VOLUME TREATED IN 2021–22
Halifax	Enhanced Primary UV	139 900 m^3	Halifax	Halifax Harbour	34 239 295
Dartmouth	Enhanced Primary UV	83 800 m^3	Dartmouth	Halifax Harbour	18 973 938
Herring Cove	Enhanced Primary UV	28 500 m^3	Halifax & Herring Cove	Halifax Harbour	4 094 748
Mill Cove	Secondary UV/Pure Oxygen Activated Sludge	28 400 m^3	Bedford & Sackville	Bedford Basin	10 319 296
Eastern Passage	Secondary UV/Conventional Activated Sludge	25 000 m^3	Cole Harbour & Eastern Passage	Halifax Harbour	5 375 533
Timberlea	Secondary Sodium Hypochlorite/RBC	4 540 m^3	Lakeside & Timberlea	Nine Mile River	1 060 133
Aerotech	Tertiary UV/Membrane Bioreactors	3 000 m^3	Aerotech Park & Airport	Johnson River	293 162
Springfield Lake	Secondary UV/Activated Sludge	543 m^3	Springfield Lake	Lisle Lake	157 766
Fall River	Tertiary UV/Activated Sludge & Post Filtration	454.5 m^3	Lockview Road & McPherson Road	Lake Fletcher	58 520
North Preston	Tertiary UV/SBR & Engineered Wetland	680 m^3	North Preston	Winder Lake	234 153
Middle Musquodoboit	UV/RBC	114 m^3	Middle Musquodoboit	Musquodoboit River	53 948
Uplands Park	Secondary UV/Trickling Filter & Wetland	91 m^3	Uplands Park	Sandy Lake	45 392
Wellington	Tertiary UV/Activated Sludge/ Reed Bleed	68 m^3	Wellington	Grand Lake	6 083
Frame Subdivision	Tertiary UV/Membrane Reactor	80 m^3	Frame Subdivision	Lake William	9 095

Wastewater & Stormwater Collection System

Size of Pipes	50 mm - 3 000 mm	Total Ditch Length	Approx. 602 KM
Total Collection System Length	2 311 km	Holding Tanks & Retention Ponds	45
Wastewater Services	83 020	Cross Culverts	2 511
Total Manholes	39 104	Driveway Culverts	14 409
Total Pumping Stations	165	Catchbasins	25 029

Corporate Balanced Scorecard Results

Since 2001, Halifax Water has been measuring organizational performance using a Corporate Balanced Scorecard (CBS). The CBS ensures that all employees are focused on strategic outcomes. The Critical Success Factors shown below are developed in support of the Halifax Water mission: to provide world-class services to our customers and our environment. The CBS has a proven track record of driving performance within the organization.

Critical Success Factor	2020/21 RESULTS	2021/22 TARGET	2021/22 RESULTS	2022/23 TARGET
Adherence with 5 objectives of Water Quality Master Plan for all water systems: Percentage of sites achieving targets	76	80	70	80
Bacteriological tests: Percentage free from Total Coliform	100%	99.9%	99.94%	99.9%
Customer satisfaction about water quality: Percentage from customer survey	84%	85%	89%	85%
Customer satisfaction with service: Percentage from customer survey	96%	95%	96%	95%
Water service outages: Number of connection hours/1000 customers	3612.62	200	192.42	200
Wastewater service outages: Number of connection hours/1000 customers	0.92	4	0.93	4
Average speed of answer: Percentage of calls answered within 20 second	71%	70%	60.4%	70%
Operating expense/revenue ratio percentage	81.5%	82%	81.19%	83%
Annual cost per customer connection: Water	$498	$543	$540	%543
Annual cost per customer connection: Wastewater	$724	$758	$741	$782
Water leakage control: Target leakage allowance of 160 litres/service connection/ day *Note 1	193	160-170	220	160-170
I&I reduction: Number of inspections to identify private property discharge of stormwater into the wastewater system *Note 2	1316*	900	1502	1200
Peak flow reduction from wet weather management capital projects *Note 3	70 l/sec	5-10 l/sec	N/A	5-10 l/sec
Percentage of time GIS and Cityworks are available	100%	96-98%	99.99%	96-98%
Capital budget expenditures: Percentage of budget spend by end of fiscal year	30.78%	70-80%	28.62%	70-80%
Average score on internal safety audits	94.5%	85-95%	96.7%	85-95%

NS Labour and Advanced Education compliance: # of Incidents with written compliance orders	0	0-2	0	0-2
Lost time accidents: Number of accidents resulting in lost time per 100 employees *Note 4	0.59	1.5-2.0	2.0	3.5
Safe driving: Number of traffic Accidents per 1,000,000 km driven (maximum of 5)	5.5	4	3.36	4
Training: Number of employees trained or re-certified before due date	59%	80-90%	70%	80-90%
Percentage of completed safety talks	86%	80-90%	58%	80-90%
Percentage of public health and environmental regulatory infractions resulting in a summary offense	0	0-2	0	0-2
Percentage of WWTFs complying with NSE approval permits (Project for 20/21 at end of February)	93%	95-100%	96.2%	95-100%
Number of ICI properties inspected by Pollution Prevention each year	356	500	361	250
Energy management kwh/m3 reduction associated with capital projects	+8%	3%	7.76%	3%
Bio-solids residual handling: Percentage of sludge meeting bio-solids concentration targets	98.6%	92-97%	98.5%	92-97%
Number of arbitrations divided by total number of grievances	0	0	0	0
Percentage of jobs filled with internal candidates	75%	80%	68%	80%
Employee satisfaction survey result	B+	A	B+	A
Average number of days absenteeism	7.54	<7	7.16	<7

Corporate Balanced Scorecard Notes

01 Water leakage control - The final results are not available until year-end,but current data indicates this target will not be met for 2021/22.

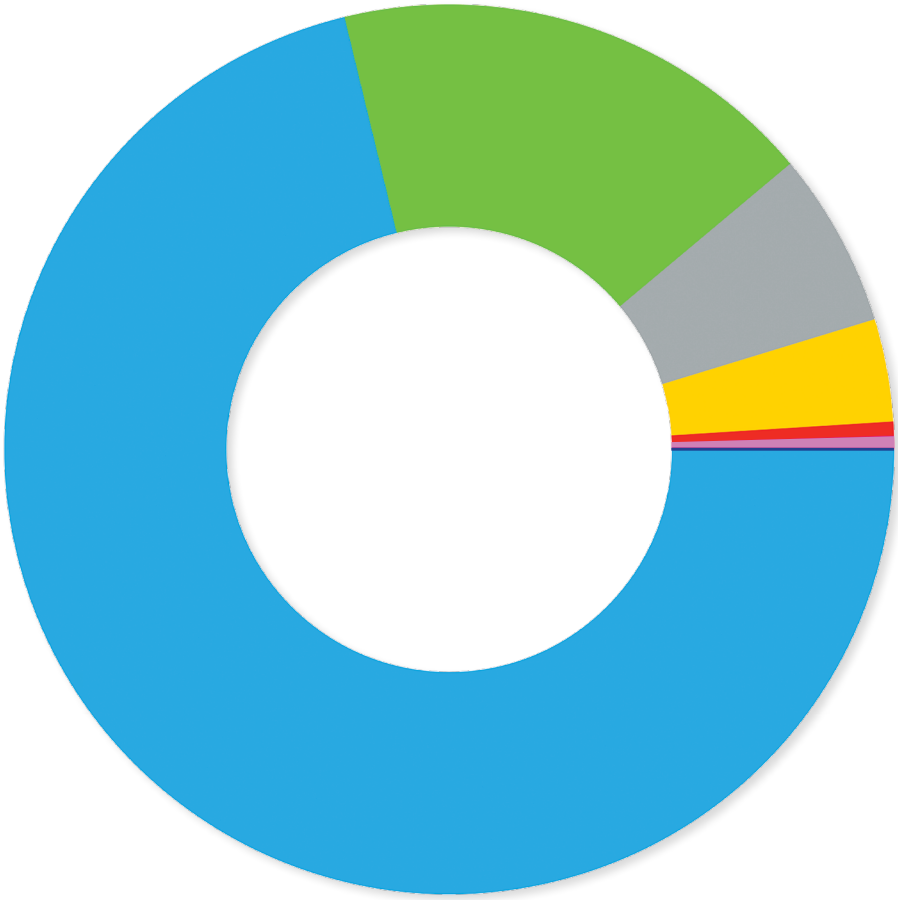
02 I&I inspections - The target is proposed to increase to 1200 next year, and the methodology is under review for additional change. Environmental Engineering will be tracking inspections and requests for inspections in greater detail this year to propose a new metric in 2023/24.

03 Peak flow reduction - The Crescent Avenue lining program start was delayed due to a longer than normal NSUARB approval process. As a result, the program was completed in October, 2021, after the start of the calendar year Q4 data collection through flow monitoring. As a result, it is recommended that this target carry forward to 2022/23 so that a complete Q4 data is available to measure the peak flow reduction.

04 Lost Time Incidents Rate (LTIR) - The measurement of Lost Time Incidents will change to align with industry standards. Lost time Cases x 200,000/Total Employee Hours Worked (The number 200,000 equates to approx. 100 employees, working 40 hours per week, and 50 weeks per year with two weeks leave average.) We are recommending targeting a 0.5 reduction each year for the next four years, and our ultimate goal is eventually have a target of 0.5 or less lost time incidents, consistent with world class companies.

Customers by Service Type

Halifax Water provides one or more of the following to our customers: water, wastewater and/or stormwater services. Those services support an estimated population of 381,000 people, and numerous visitors to the region.



Customer Numbers by Type		
	Number of Accounts	Percentage of Total
Water, Wastewater & Stormwater	75,559	71.11%
Stormwater Only	18,769	17.66%
Water & Wastewater	6,765	6.37%
Water & Stormwater	3,952	3.72%
Wastewater & Stormwater	540	0.51%
Water Only	520	0.49%
Wastewater Only	156	0.15%
Total of All Types	**106,261**	**100%**

Typical Water Analysis

TYPICAL ANALYSIS OF SMALL SYSTEMS 2021 - 2022
(in milligrams per litre unless shown otherwise)
Note: All Regulatory Compliance Analysis are Processed by Third Party Laboratories

PARAMETERS	BENNERY LAKE		BOMONT		GUIDELINES FOR CANADIAN DRINKING WATER QUALITY	
	Raw Water	Treated Water	[A]Raw Water	Treated Water	Maximum Acceptable Concentration	Aesthetic Objective Concentration
Alkalinity (as $CaCO_3$)	5.9	30.0	-	22.0	-	-
Aluminum	0.130	0.019	-	0.026	-	0.1
Ammonia (N)	< 0.05	< 0.05	-	< 0.05	-	-
Arsenic	< 0.001	< 0.001	-	< 0.001	0.010	-
Calcium	2.4	15.4	-	6.7	-	-
Chloride	6.4	9.5	-	10.0	-	≤250
Chlorate	0.5	0.2	-	0.1	1.0	-
Chlorite	0.5	< 0.1	-	< 0.1	1.0	-
Colour (True Colour Units)	42.0	< 5.0	-	< 5.0	-	≤15.0
Conductivity (µS/cm)	38	140	-	97	-	-
Copper (Total)	0.1550	0.0200	-	< 0.0005	2.0	≤1.0
Fluoride	< 0.1	< 0.1	-	< 0.1	1.5	-
Hardness (as $CaCO_3$)	8.0	42.0	-	18.0	-	-
HAA_5 (avg.)	-	0.029	-	0.041	0.080	-
Iron (Total)	0.72	< 0.05	-	< 0.05	-	≤0.3
Lead (Total) (µg/l)	< 0.5	< 0.5	-	< 0.5	5.0	-
Magnesium	0.5	0.6	-	0.4	-	-
Manganese (Total)	0.447	0.060	-	0.006	0.12	≤0.02
Mercury (µg/l)	< 0.013	< 0.013	-	< 0.013	1.0	-
Nitrate (as N)	< 0.05	< 0.05	-	< 0.05	10.0	-
Nitrite (as N)	< 0.01	< 0.01	-	< 0.01	1.0	-
pH (pH Units)	6.4	7.5	-	7.5	-	7.0 - 10.5
Potassium	0.2	0.3	-	0.3	-	-
Sodium	4.0	12.0	-	12.0	-	≤200
Solids (Total Dissolved)	30	93	-	50	-	≤500
Sulphate	2.8	30.0	-	11.0	-	≤500
Turbidity (NTU)	1.0	0.1	-	0.2	[B]0.2/1.0; C5.0	-
Total Organic Carbon (TOC)	5.5	1.9	-	2.0	-	-
THM's (avg.)	-	0.049	-	0.039	0.100	-
Uranium (µg/l)	< 0.1	< 0.1	-	< 0.1	20.0	-
Zinc (Total)	< 0.005	0.042	-	0.124	-	≤5.0
PCB (µg/l)	-	-	-	-	-	-
Gross Alpha / Gross Beta (Bq/L)	< 0.1 / <0.1	< 0.1 / <0.1	-	< 0.1 / <0.1	0.5 / 1.0	-

[A] Raw water samples were not collected from the Bomont raw water source this past year. Treated water was supplied from either the Lake Major or Pockwock water systems.
[B] The Bennery Lake plant analyzes turbidity immediately post-filtration and must produce water with a turbidity of <0.2 NTU 95% of the time and <1.0 NTU 100% of the time.
[C] Filtered turbidity values are not reported due to the fact that the Bomont Water Supply Plant was not treating raw water. Instead, treated water turbidity is reported and calculated from clearwell monitoring and must be less than 5.0 NTU as required by Provincial Permit.

TYPICAL ANALYSIS - SMALL SYSTEMS 2021 - 2022

(in milligrams per litre unless shown otherwise)

Note: All Regulatory Compliance Analysis are Processed by Third Party Laboratories

PARAMETERS	COLLINS PARK		MIDDLE MUSQUODOBOIT		GUIDELINES FOR CANADIAN DRINKING WATER QUALITY	
	Raw Water	Treated Water	Raw Water	Treated Water	Maximum Acceptable Concentration	Aesthetic Objective Concentration
Alkalinity (as $CaCO_3$)	15.0	15.0	40.0	107.0	-	-
Aluminum	0.064	< 0.005	0.036	0.004	-	0.1
Ammonia (N)	< 0.05	< 0.05	0.06	< 0.05	-	-
Arsenic	0.003	< 0.001	< 0.001	< 0.001	0.010	-
Calcium	6.9	0.2	13.3	3.4	-	-
Chloride	36.0	8.9	9.4	8.2	-	≤250
Chlorate	< 0.1	0.2	< 0.1	0.1	1.0	-
Chlorite	< 0.1	< 0.1	< 0.1	< 0.1	1.0	-
Colour (True Colour Units)	21.0	< 5.0	3.6	< 5.0	-	≤15.0
Conductivity (µS/cm)	160	37	130	200	-	-
Copper (Total)	0.0010	< 0.0005	0.0005	0.0006	2.0	≤1.0
Fluoride	< 0.1	< 0.1	< 0.1	< 0.1	1.5	-
Hardness (as $CaCO_3$)	22.0	< 1.0	50.0	13.6	-	-
HAA_5 (avg.)	-	< 0.005	-	< 0.005	0.080	-
Iron (Total)	0.12	< 0.05	< 0.05	< 0.05	-	≤0.3
Lead (Total) (µg/l)	< 0.5	< 0.5	< 0.5	< 0.5	5.0	-
Magnesium	1.0	< 0.1	4.8	1.2	-	-
Manganese (Total)	0.068	< 0.002	< 0.002	< 0.002	0.12	≤0.02
Mercury (µg/l)	< 0.013	< 0.013	< 0.013	< 0.013	1.0	-
Nitrate (as N)	0.07	< 0.05	0.57	0.48	10.0	-
Nitrite (as N)	< 0.01	< 0.01	< 0.01	< 0.01	1.0	-
pH (pH Units)	7.2	7.1	6.7	7.9	-	7.0 - 10.5
Potassium	0.9	0.2	0.9	0.5	-	-
Sodium	22.0	8.1	5.9	51.0	-	≤200
Solids (Total Dissolved)	92	25	78	170	-	≤500
Sulphate	7.1	< 2.0	10.2	< 2.0	-	≤500
Turbidity (NTU)	1.4	0.1	0.23	0.1	[B]0.2/1.0; C5.0	-
Total Organic Carbon (TOC)	4.8	< 0.5	0.78	< 0.5	-	-
THM's (avg.)	-	<0.001	-	0.001	0.100	-
Uranium (µg/l)	< 0.1	< 0.1	< 0.1	< 0.1	20.0	-
Zinc (Total)	< 0.005	0.069	< 0.005	0.049	-	≤5.0
PCB (µg/l)	-	-	-	-	-	-
Gross Alpha / Gross Beta (Bq/L)	< 0.1 / <0.1	< 0.1 / <0.1	< 0.1 / <0.1	< 0.1 / <0.1	0.5 / 1.0	-

[A] AUltra-filtration membrane plants must produce water with turbidity of <0.1 NTU 99% of the time and <0.3 NTU 100% of the time, as required by Provincial Permit. Treated water turbidity is calculated from clearwell monitoring.

TYPICAL ANALYSIS OF POCKWOCK LAKE & LAKE MAJOR WATER

(in milligrams per litre unless shown otherwise)

Note: All Regulatory Compliance Analysis are Processed by Third Party Laboratories

PARAMETERS	(Halifax) POCKWOCK		(Dartmouth) LAKE MAJOR		GUIDELINES FOR CANADIAN DRINKING WATER QUALITY	
	Raw Water	Treated Water	Raw Water	Treated Water	Maximum Acceptable Concentration	Aesthetic Objective Concentration
Alkalinity (as $CaCO_3$)	< 5.0	18.0	< 5.0	22.0	-	-
Aluminum	0.102	0.033	0.190	0.016	-	[A]0.20/0.10
Ammonia (N)	< 0.05	< 0.05	< 0.05	< 0.05	-	-
Arsenic	< 0.001	< 0.001	< 0.001	< 0.001	0.010	-
Calcium	0.9	5.8	1.0	16.5	-	-
Chloride	6.3	8.0	6.4	8.2	-	≤250
Chlorate	< 0.1	< 0.1	< 0.1	< 0.1	1.0	-
Chlorite	< 0.1	< 0.1	< 0.1	< 0.1	1.0	-
Colour (True Colour Units)	17.0	< 5.0	40.0	< 5.0	-	≤15.0
Conductivity (µS/cm)	31	83	34	140	-	-
Copper (Total)	0.0430	< 0.0005	0.0440	0.0008	2.0	≤1.0
Fluoride	< 0.1	[B]0.2	< 0.1	[B]< 0.1	1.5	-
Hardness (as $CaCO_3$)	4.1	16.0	4.3	42.0	-	-
HAA_5 (avg.)	-	0.016	-	0.027	0.080	-
Iron (Total)	0.06	< 0.05	0.10	< 0.05	-	≤0.3
Lead (Total) (µg/l)	< 0.5	< 0.5	< 0.5	< 0.5	5.0	-
Magnesium	0.4	0.6	0.4	0.4	-	-
Manganese (Total)	0.038	0.010	0.037	0.003	0.12	≤0.02
Mercury (µg/l)	< 0.013	< 0.013	< 0.013	< 0.013	1.0	-
Nitrate (as N)	< 0.05	< 0.05	< 0.05	< 0.05	10.0	-
Nitrite (as N)	< 0.01	< 0.01	< 0.01	< 0.01	1.0	-
pH (pH Units)	6.0	7.3	5.9	7.3	-	7.0 - 10.5
Potassium	0.2	0.3	0.2	0.2	-	-
Sodium	4.3	11.0	4.1	12.0	-	≤200
Solids (Total Dissolved)	24.5	54.0	27.5	91.0	-	≤500
Sulphate	3.3	11.0	2.6	34.0	-	≤500
Turbidity (NTU)	0.29	0.05	0.59	0.04	[C]0.15/0.2	-
Total Organic Carbon (TOC)	3.4	1.9	5.3	1.7	-	-
THM's (avg.)	-	0.028	-	0.041	0.100	-
Uranium (µg/l)	< 0.1	< 0.1	< 0.1	< 0.1	20.0	-
Zinc (Total)	< 0.005	0.168	0.011	0.190	-	≤5.0
PCB (µg/l)	-	-	-	-	-	-
Gross Alpha / Gross Beta (Bq/L)	< 0.1 / <0.1	< 0.1 / <0.1	< 0.1 / <0.1	< 0.1 / <0.1	0.5 / 1.0	-

[A]Aluminum objective is related to type of plant filtration; the aluminum objective for direct filtration (Pockwock) is <0.20 mg/l and conventional filtration (Lake Major) is <0.10 mg/l.
[B]Fluoride was not being added to the finished water at the Pockwock WSP and Lake Major WSP approximately 40% and 100% of the time respectively due to system maintenance.
[C]The Pockwock and Lake Major plants analyze turbidity immediately post-filtration. Each filter must produce water with a turbidity of <0.15 NTU 95% of the time at the Pockwock Water Supply Plant and <0.2 NTU 95% of the time at the Lake Major Water Supply Plant. Both Water Supply Plants must produce water with a turbidity <1.0 NTU 100% of the time, as required by Provincial Permit.

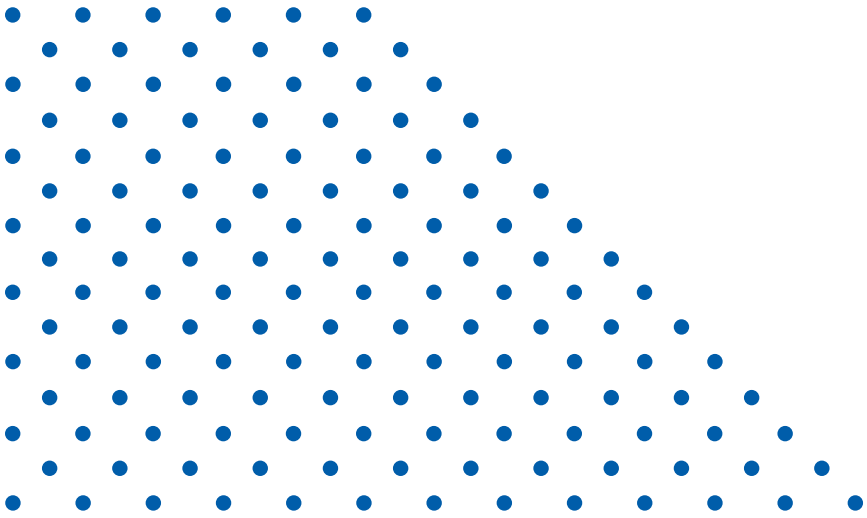
TYPICAL ANALYSIS OF SMALL SYSTEMS 2021 - 2022

(in milligrams per litre unless shown otherwise)

Note: All Regulatory Compliance Analysis are Processed by Third Party Laboratories

PARAMETERS	FIVE ISLAND LAKE		SILVER SANDS		GUIDELINES FOR CANADIAN DRINKING WATER QUALITY	
	Raw Water	Treated Water	Raw Water	Treated Water	Maximum Acceptable Concentration	Aesthetic Objective Concentration
Alkalinity (as $CaCO_3$)	30.0	36.0	66.0	67.0	-	-
Aluminum	0.007	< 0.005	< 0.005	< 0.005	-	0.2
Ammonia (N)	< 0.05	< 0.05	< 0.05	< 0.05	-	-
Arsenic	0.004	0.004	0.002	< 0.001	0.010	-
Calcium	9.0	8.7	37.0	37.0	-	-
Chloride	6.4	7.6	63.0	69.0	-	≤250
Chlorate	< 0.1	0.1	< 0.1	0.4	1.0	-
Chlorite	< 0.1	< 0.1	< 0.1	< 0.1	1.0	-
Colour (True Colour Units)	9.3	< 5.0	8.8	< 5.0	-	≤15.0
Conductivity (µS/cm)	79	82	350	380	-	-
Copper (Total)	0.0020	0.0094	< 0.0005	0.0670	2.0	≤1.0
Fluoride	0.4	0.4	0.2	0.2	1.5	-
Hardness (as $CaCO_3$)	27.0	26.0	110.0	110.0	-	-
HAA_5 (avg.)	-	< 0.005	-	< 0.005	0.080	-
Iron (Total)	< 0.05	< 0.05	0.95	< 0.05	-	≤0.3
Lead (Total) (µg/l)	< 0.5	< 0.5	< 0.5	< 0.5	5.0	-
Magnesium	1.1	1.1	5.1	5.1	-	-
Manganese (Total)	< 0.002	< 0.002	1.071	0.007	0.12	≤0.02
Mercury (µg/l)	< 0.013	< 0.013	< 0.013	< 0.013	1.0	-
Nitrate (as N)	0.065	0.060	< 0.05	< 0.05	10.0	-
Nitrite (as N)	< 0.01	< 0.01	< 0.01	< 0.01	1.0	-
pH (pH Units)	7.0	7.7	7.7	7.7	-	7.0 - 10.5
Potassium	0.5	0.5	1.0	0.9	-	-
Sodium	6.1	7.1	26.0	29.0	-	≤200
Solids (Total Dissolved)	56	50	200	210	-	≤500
Sulphate	2.1	3.0	18.0	18.0	-	≤500
Turbidity (NTU)	0.3	0.2	14.0	0.1	[A]1.0	-
Total Organic Carbon (TOC)	< 0.5	< 0.5	< 0.5	< 0.5	-	-
THM's (avg.)	-	0.001	-	< 0.001	0.100	-
Uranium (µg/l)	10.0	9.7	< 0.1	< 0.1	20.0	-
Zinc (Total)	< 0.005	0.006	< 0.005	< 0.006	-	≤5.0
PCB (µg/l)	< 0.05	< 0.05	-	-	-	-
Gross Alpha / Gross Beta (Bq/L)	0.3 / 0.5	0.4 / < 0.1	< 0.1 / < 0.1	< 0.1 / <0.1	0.5 / 1.0	-

[A] The Five Island Lake and Silver Sands Water Supply Plants must produce water with turbidity of <1.0 NTU 95% of the time, as required by Provincial Permit. Treated water turbidity is calculated from clearwell monitoring.




Halifax
Water

STRAIGHT from the SOURCE