Stewardship Report 2017/18

STRAIGHT from the SOURCE

Our Mission

To provide world-class service 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.

Front Cover:
Halifax Water continues to be one of North America's first One Water Utilities, managing water, wastewater, and stormwater services for Halifax Regional Municipality. With an unbreakable focus on world-class service to our customers and environment displayed by the unbroken circle of water surrounding the Halifax Water logo.

A message from the General Manager

If you thought that there was a lot of construction activity in the metro area last year, you would be right. Last year saw an increased focus on the renewal of aging infrastructure to ensure that future generations are well served. Many of these projects are highlighted in this report including the replacement of 1856 and 1862 vintage cast iron water mains from Chain Lake to Quinpool Road, the renewal of a 1908 trunk sewer along the Northwest Arm of Halifax Harbour and the upgrade of the stormwater system downstream of Sullivan's Pond in Dartmouth. This latter project was particularly rewarding in that a segment of the works included daylighting of the former Sawmill River to facilitate fish passage. After all, that is what stewardship is all about! Speaking of stewardship, Halifax Water continued to pursue delivery of the highest quality water in the land and to discharge wastewater effluent to the receiving waters in full compliance of operating permits. With the completion of the Aerotech Wastewater Treatment Facility (WWTF) upgrade and expansion with the latest membrane technology, we will be closing in on full compliance with federal wastewater system effluent regulations. Also last year, we obtained ISO 14001 certification for the Herring Cove WWTF and after updating our documents and business processes to the latest standard, will seek the revised certification for our environmental management system this summer.

Looking ahead to this year, we will be spending significant funds on the upgrading of water supply plants including the replacement of filter underdrains at the J.D. Kline facility at Pockwock Lake. This facility was commissioned in 1977, and we have definitely got our monies worth out of this critical part of the treatment process. Over the next five years, we will continue with upgrades with many guided by research conducted by Dalhousie University through the Natural Science and Engineering Research Council (NSERC) Industrial Chair Program. The next focus for the Research Chair will be to gain understanding on the phenomena known as lake recovery. With the improvement of air emission standards in the United States over the last 20 years, there has been a marked decrease in acid rain falling over Nova Scotia. This is good news from an environmental perspective as the pH of lakes is increasing and generating more biological activity including better habitat for many fish species. The downside is the filtration plant at Pockwock was not designed for this higher pH and upgrades will be necessary to ensure we continue to meet the *Guidelines for Canadian Drinking Water Quality*.

In relation to water quality, Halifax Water continues to be internationally recognized as a leader in its approach to remove lead from the entire distribution system and facilitate solutions for residents and businesses to remove lead service lines on private property. This leadership was recently recognized by the Water Research Foundation who awarded Halifax Water the Outstanding Subscriber Award for Applied Research. Even with this track record, Halifax Water will not sit on its laurels and intends to pursue further research in wastewater to live up to its calling as a "One Water" utility. This is particularly important in recognition that all wastewater systems must meet regulations equivalent to secondary treatment by 2040 which will require upgrades to the Halifax, Dartmouth and Herring Cove WWTFs. To minimize the financial impact in relation to future capacity upgrades, Halifax Water intends to mature its wet weather management program to reduce inflow and infiltration into the sanitary sewer system. Over time, it is our vision to be as well known for this program as we are for our water loss control program. World class is what world class does!

Halifax Water has been privileged to serve the residents of the greater Halifax area since 1945, and with the confidence of its staff and customers will continue to pursue its mission of excellence for years to come.

Yours in service,

Carl Yates

Carl D. Yates, M.A.Sc., P.Eng.
General Manager

Drinking Water Quality

Providing our customers with 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 as the J. Douglas Kline (Halifax), Lake Major (Dartmouth), and Bennery Lake (Halifax Airport) Water Supply Plants.

Halifax Water undertakes a comprehensive water testing program. Bacteriological testing is done weekly at 51 locations within the urban core, and at each of the small systems that are managed by Halifax Water.

In the past year, 3,331 tests for total coliform bacteria were conducted. In 99.97% (3,330) of those tests, bacteria was absent from the water.

Additional testing 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.
- Sampling twice per year for compliance with the Guidelines for Canadian Drinking Water Quality which includes approximately 90 parameters.
- Quarterly sampling of Lake Major and Pockwock Lake raw lake water and water from contributing streams for approximately 40 chemical parameters.
- A bi-annual sampling of Lake Major and Pockwock Lake raw and treated water for all parameters in the Guidelines for Canadian Drinking Water Quality.
- Bi-annual testing and sampling for giardia and cryptosporidium for treated and raw water for all surface water systems.

Drinking Water Compliance Summary: Total Coliform Results

April 2017 - March 2018

System	No. of Samples	No. of Exceedances	% Absent
Pockwock	833	0	100%
Pockwock Central	521	1	99.81%
Lake Major	1195	0	100%
Bennery	156	0	100%
Five Islands	104	0	100%
Silver Sands	106	0	100%
Middle Musquodoboit	104	0	100%
Collins Park	103	0	100%
Miller Lake	103	0	100%
Bomont	106	0	100%
Total	**3331**	**1**	
Absent (A)	3330		99.97%
Present (P)		1	0.03%

Water test results are reported to Nova Scotia Environment and the Nova Scotia Medical Officer of Health 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 the unlikely event of a disruption in water quality.

Show me the Money

Financial Incentives Help Customers Get the Lead Out

Left: Lead Service Line, Right: Copper Service Line.

Prolonged exposure to lead can lead to adverse health effects. Lead exposure is particularly harmful to infants, young children, pregnant women and breastfeeding children. Getting lead service laterals out of the water system is a top priority for Halifax Water.

For most property owners removing lead service lines (LSLs) is a low priority. One of the most common barriers to replacement is the cost. Digging up your property to remove an issue that is out of sight is a hard sell, especially compared with the many others expenses associated with owning a property.

So how could Halifax Water helps its customers remove their lead service lateral? Working with their regulator, the Nova Scotia Utility and Review Board (NSUARB), Halifax Water proposed a program that would allow the utility to provide a financial incentive to property owners.

On August 22, 2017 Halifax Water received approval from the NSUARB to provide a financial incentive to customers who replace their private LSL. The program provides a 25% rebate, up to a maximum of $2,500. The utility will only replace the public side if the customer replaces their side. The program also helps customers navigate the headaches that can be encountered by property owners when dealing with contractors, permits etc.... Halifax Water is one of only a few utilities in North America to offer such a program.

Backhoe removing a lead service line.

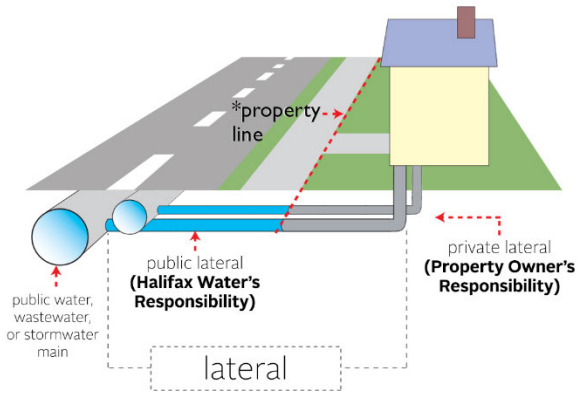


Diagram showing the division of responsibility for a LSL Replacement.

LeadLine Program Logo.

Details of the Lead Line program can be found at https://www.halifax.ca/home-property/halifax-water/water-services/lead-line. Three videos were also created to assist customers with the process. These can be found on Halifax Water's YouTube channel at https://www.youtube.com/channel/UC4SuO2XqgECbp2qNFK7f7kQ.

Removing public and private lead laterals from Halifax Water's system will take years, but by providing programs that help customers reduce one of the biggest barriers, the job is now within the financial reach of many more customers.

Energy Efficiency

Energy use in urban water and wastewater/stormwater treatment facilities and their respective distribution and collection systems remains among the highest in North America, typically consuming over 30% of municipal energy usage, and over 4% of the total national energy usage (US Data). With this in mind, Halifax Water has continued its efforts to improve its energy footprint.

- The Energy Management Plan was updated to identify specific annual energy reduction targets and activities to be completed in 2017/18.
- Various equipment and infrastructure upgrades were completed in 2017/18, as well as a number of ongoing annual operating initiatives. A number of other projects are being considered for future implementation. The technical and financial feasibility of each opportunity will determine which projects are taken on. Projects and initiatives completed in 2017/18 resulted in over 4,495,000 kWh_e in annual energy savings, over $458,000 in cost savings, and over 2,400 Tonnes CO_{2e} in GHG (greenhouse gas) reductions. Completed projects and annual initiatives include:

Service Area	Facility	Project/Initiative	Annual Savings ($)	Energy Reductions (kWhe)	CO2 Reduction (tonnes/yr)	Energy Source
Capital Project Completions						
Water	JD Kline	Boiler Replacement	$ 3,800.00	47,448	12	Heating Fuel Oil (HFO)
Water	JD Kline	Admin HVAC Upgrades	$ 83,350.00	482,023	71	HFO/Electricity
Wastewater	Mill Cove WWTF	PS Upgrade	$ 26,041.00	241,300	202	Electricity
Wastewater	Mill Cove WWTF	UV Upgrade	$ 139,698.00	1,253,293	880	Electricity
Wastewater	Dartmouth WWTF	Ventilation Air Heat Recovery	$ 45,133.00	801,078	130	Natural Gas
Annual Initiatives						
Wastewater	HHSPs + EPWWTF	UV Shutdown	$ 160,632.00	1,669,913	1,169	Electricity
			$ 458,654.00	4,495,055	2,464	

- Use of the Energy Management Information System continued in 2017/18, with the addition of potable water consumption data monitoring for all of Halifax Water's facilities, and water and wastewater treatment flow data for the larger facilities. These efforts improve the accuracy of data for each facility.
- Early stage development of the Cogswell District Energy System (DES) has also continued. The preliminary design of the underground linear infrastructure (i.e., DES distribution piping systems) was started in 2017/18, along with a by-law review of similar Canadian systems, stakeholder information package to facilitate the promotion of the project to the local community and stakeholders, and updating of the business case to reflect any changes coming from the 60% design exercise. Halifax Regional Municipality has also completed amendments to their City Charter, adding language that will allow district energy systems to be implemented within the city's boundaries, and designating the Cogswell Redevelopment Area a mandatory connection zone for the DES. Next steps include the completion of the detailed designs for the linear infrastructure, energy centre, energy transfer stations, and the development of the required building specifications.
- A continued focus on early stage involvement in infrastructure projects has also brought a focus on energy efficiency and sustainability at the design stage, resulting in efficiency improvements implemented during construction of these projects. Current projects include the Aerotech WWTF Upgrade, Kearney Lake Trunk Sewer Pump Station upgrades, and the Mill Cove Pump Station upgrade project.
- When appropriate, Halifax Water has also taken advantage of provincial energy efficiency rebate programs offered by Efficiency Nova Scotia, which help to reduce capital costs and improve project payback.

Overall results for 2017/18 were excellent, with an overall annual energy reduction of -7.2%, an aggregate reduction in water and wastewater flows of -0.9%, and an overall reduction in GHG emissions of -5.9%. A focus on further energy efficiency and operational improvements to existing infrastructure and on completing energy audits in the rest of our facilities in the coming years will allow Halifax Water to continue to build on these results.

Wastewater Treatment Facility Compliance

Wastewater Treatment Facilities (WWTFs) in Nova Scotia are regulated by Nova Scotia Environment. They set effluent discharge limits for all wastewater facilities; those limits define maximum concentrations of parameters. Those parameters include Carbonaceous Biochemical Oxygen Demand (CBOD), a measure of the amount of material in water that will consume oxygen as it decomposes, Total Suspended Solids (TSS), a measure of the amount of particulate matter in the water, and Fecal Coliform, bacteria associated with human waste. For some facilities, parameters such as nutrients (nitrogen and phosphorus that 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.

Since becoming responsible for these facilities, Halifax Water continues to optimize and upgrade treatment processes. A major upgrade to the Aerotech WWTF is nearing completion, to improve capacity and performance.

Halifax Water has undertaken a number of optimization projects that involve reduction of wet weather influences, equipment upgrades and process enhancements, which have resulted in improved compliance results. This past year Halifax Water successfully had permits re-issued to allow for Seasonal Disinfection at the Halifax, Dartmouth, Eastern Passage, and Herring Cove WWTFs. These permit changes allow for the ultraviolet (UV) lamps that disinfect the treated wastewater to be turned off in the winter months, when recreational activities are reduced, to save on energy costs and optimize the ability to clean the lamps.

Compliance for the harbour facilities are measured on monthly averages. There has been a significant improvement in the compliance at the five harbour facilities with nine months where all five of these facilities were fully compliant. Two of these facilities, Herring Cove and Eastern Passage, were fully compliant for the entire year. Halifax and Dartmouth WWTFs both had only one occurrence of non-compliance, and Mill Cove had two throughout the entire year.

Wastewater Treatment Facility Compliance Summary

April 2017 to March 2018

WWTF	Apr-17					May-17					Jun-17				
	$CBOD_5$	TSS	E.Coli	pH	Toxicity Pass	$CBOD_5$	TSS	E.Coli	pH	Toxicity Pass	$CBOD_5$	TSS	E.Coli	pH	Toxicity Pass
Halifax	43	39	N/A	7	YES	23	22	2,268	7	YES	26	15	1,870	7	YES
Herring Cove	23	20	N/A	7	N/A	20	19	376	7	YES	20	24	863	7	N/A
Dartmouth	39	25	N/A	7	YES	23	24	1,031	7	YES	32	15	142	7	YES
Eastern Passage	6	7	N/A	7	N/A	8	7	50	7	YES	6	7	79	7	N/A
Mill Cove	14	16	100	7	N/A	7	14	49	7	YES	10	18	100	7	N/A
	Jul-17					Aug-17					Sep-17				
Halifax	26	37	3,966	7	YES	30	37	1,548	7	NO	35	20	2,069	7	YES
Herring Cove	32	26	776	7	N/A	41	40	763	7	YES	28	22	197	7	N/A
Dartmouth	27	15	520	7	YES	45	23	5,374	7	YES	42	20	3,081	7	YES
Eastern Passage	5	6	29	7	N/A	8	7	73	7	YES	6	4	23	7	N/A
Mill Cove	9	12	21	7	N/A	15	19	35	7	YES	11	10	32	7	N/A
	Oct-17					Nov-17					Dec-17				
Halifax	29	17	1,369	7	YES	37	26	1,641	7	YES	23	31	931	7	YES
Herring Cove	16	10	151	7	N/A	13	8	37	7	YES	17	13	73	7	N/A
Dartmouth	34	20	1,642	7	YES	28	19	601	7	YES	25	38	100	7	YES
Eastern Passage	5	4	40	7	N/A	4	6	N/A	7	YES	6	5	90	7	N/A
Mill Cove	24	22	56	6	N/A	16	23	18	7	YES	11	17	31	7	N/A
	Jan-18					Feb-18					Mar-18				
Halifax	29	22	N/A	7	YES	27	22	N/A	7	YES	30	17	N/A	7	YES
Herring Cove	24	20	N/A	7	N/A	17	22	N/A	7	YES	22	25	N/A	7	N/A
Dartmouth	34	25	N/A	7	YES	25	40	N/A	7	YES	35	33	N/A	7	YES
Eastern Passage	6	8	N/A	7	N/A	6	13	N/A	7	YES	5	8	N/A	7	N/A
Mill Cove	17	27	24	7	N/A	17	30	12	7	YES	10	18	YES	7	N/A

N/A due to seasonal disinfection and toxicity requirements

Performance assessments for the ten smaller Wastewater Treatment Facilities are based upon quarterly averages. Results for April 2017 to March 2018 are presented on the next page.

Wastewater Treatment Facility Compliance Continued...

Wastewater Treatment Facility Compliance Summary									
Q1 - April to June 2017									
WWTF	$CBOD_5$	TSS	E. coli	Phosphorus	Ammonia	pH	Dissolved Oxygen	Chlorine	Toxicity Pass
AeroTech	4	4	13	0.4	3.0	7.0	7.4	N/A	YES
Frame	4	1	10	N/A	N/A	6.7	N/A	N/A	N/A
Lakeside-Timberlea	5	21	18	1	4	7.0	7.2	0.10	YES
Lockview-MacPherson	4	5	13	0.3	7	7.0	N/A	N/A	N/A
Middle Musquodoboit	12	21	1704	N/A	N/A	7.2	N/A	N/A	N/A
North Preston	4	5	13	0.9	7	7.5	N/A	N/A	N/A
Springfield	6	11	22	N/A	N/A	6.9	N/A	N/A	N/A
Steeves (Wellington)	5	8	100	0.2	0.05	6.8	N/A	N/A	N/A
Uplands Park	24	19	2,021	N/A	N/A	7.0	N/A	N/A	N/A
Q2 - July to September 2017									
	$CBOD_5$	TSS	E. coli	Phosphorus	Ammonia	pH	Dissolved Oxygen	Chlorine	Toxicity Pass
AeroTech	5	6	17	1.2	1.4	7.0	6.1	N/A	YES
Frame	4	1	10	N/A	N/A	7.3	N/A	N/A	N/A
Lakeside-Timberlea	5	21	12	1	1	7.0	6.8	0.10	YES
Lockview-MacPherson	4	3	16	0.4	1	7.3	N/A	N/A	N/A
Middle Musquodoboit	4	14	27	N/A	N/A	7.6	N/A	N/A	N/A
North Preston	5	2	10	0.2	0.1	6.8	N/A	N/A	N/A
Springfield	4	9	12	N/A	N/A	7.0	N/A	N/A	N/A
Steeves (Wellington)	5	1	10	0.1	0.05	7.2	N/A	N/A	N/A
Uplands Park	4	9	22	N/A	N/A	7.0	N/A	N/A	N/A
Q3 - October to December 2017									
	$CBOD_5$	TSS	E. coli	Phosphorus	Ammonia	pH	Dissolved Oxygen	Chlorine	Toxicity Pass
AeroTech	5	6	18	0.5	0.10	7.0	8.3	N/A	YES
Frame	4	1	10	N/A	N/A	6.8	N/A	N/A	N/A
Lakeside-Timberlea	5	20	11	3	3	7.0	8.0	0.08	YES
Lockview-MacPherson	5	7	19	0.4	2	6.8	N/A	N/A	N/A
Middle Musquodoboit	5	20	126	N/A	N/A	8.0	N/A	N/A	N/A
North Preston	4	5	10	0.3	0.2	6.7	N/A	N/A	N/A
Springfield	5	5	21	N/A	N/A	7.0	N/A	N/A	N/A
Steeves (Wellington)	5	2	10	0.1	0.1	7.2	N/A	N/A	N/A
Uplands Park	5	5	10	N/A	N/A	7.0	N/A	N/A	N/A

There was a noticeable improvement in the smaller facilities in 2017/18. In the third quarter, all facilities were compliant except for one parameter at Aerotech WWTF. Of the nine facilities, three, Springfield, Steeves, and Frame, were fully compliant for the entire year.

Wastewater Treatment Facility Compliance Continued...

Q4 - January to March 2018									
	$CBOD_5$	TSS	E. coli	Phosphorus	Ammonia	pH	Dissolved Oxygen	Chlorine	Toxicity Pass
AeroTech	6	16	200	0.5	18.5	7.4	8.6	N/A	YES
Frame	5	1	10	N/A	N/A	6.8	N/A	N/A	N/A
Lakeside-Timberlea	6	21	13	2	7	7.2	7.9	0.10	YES
Lockview-MacPherson	5	9	35	0.3	15	7.1	N/A	N/A	N/A
Middle Musquodoboit	7	9	66	N/A	N/A	8.0	N/A	N/A	N/A
North Preston	8	28	10	0.7	1.1	7.1	N/A	N/A	N/A
Springfield	5	4	10	N/A	N/A	6.7	N/A	N/A	N/A
Steeves (Wellington)	6	10	10	0.1	0.1	6.7	N/A	N/A	N/A
Uplands Park	5	4	10	N/A	N/A	6.4	N/A	N/A	N/A

Definitions:

CBOD5: Carbonaceous Biochemical Oxygen Demand – a measure of the amount of organic material.
TSS: Total Suspended Solids – a measure of the number of particles in the wastewater.
Fecal Coliform / E. coli: Bacteria which are present in the treated sewage.
Phosphorus (phosphate): A plant nutrient which can impact water bodies.
Ammonia: A chemical compound containing nitrogen, another plant nutrient.
pH: A measure of the acidity of water.
Dissolved Oxygen: The amount of oxygen in the water, essential for fish and other aquatic organisms.
Aluminum: A metal dissolved in water
N/A: Not Applicable

Environmental Management Systems (EMS)

An Environmental Management System (EMS) is a 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 can be audited against ISO 14001 standards, and if found to comply, receives a certification through ISO. The ISO standard has recently changed from 2004 version to a 2015 version with a greater focus placed on organizational leadership and identification of risks and the associated influences, both internal and external to an organization.

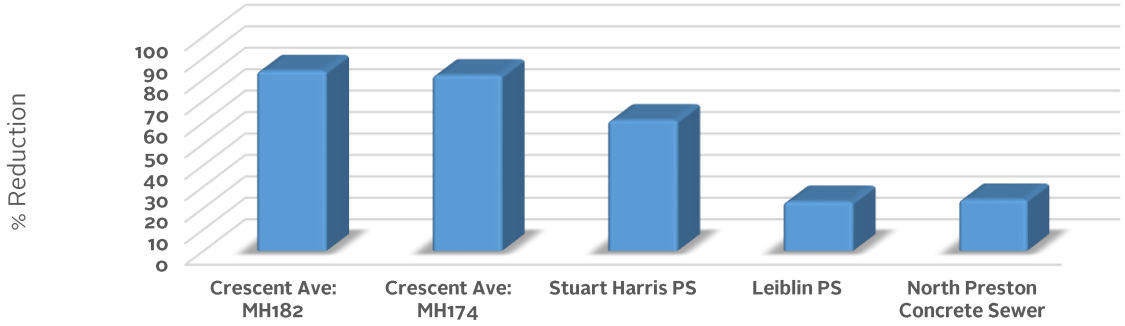
Staff have commenced the process to adjust the existing documents for the Pockwock, Lake Major and Bennery Water Treatment Facilities and the Herring Cove Wastewater Treatment Facility for an internal audit in April 2018 and an external audit in June 2018.

Herring Cove WWTF – ISO 14001 Certified

Wet Weather Management

Recognizing the impacts of wet weather generated flows on the sanitary sewer system, Halifax Water developed a proactive program to systematically address the negative impacts of wet weather on the collection system, wastewater treatment processes, and ultimately the environment. The Halifax Water Wet Weather Management Program (WWMP) was developed to effectively manage these impacts.

Figure 1: Peak Rainfall Derived Flow Reduction

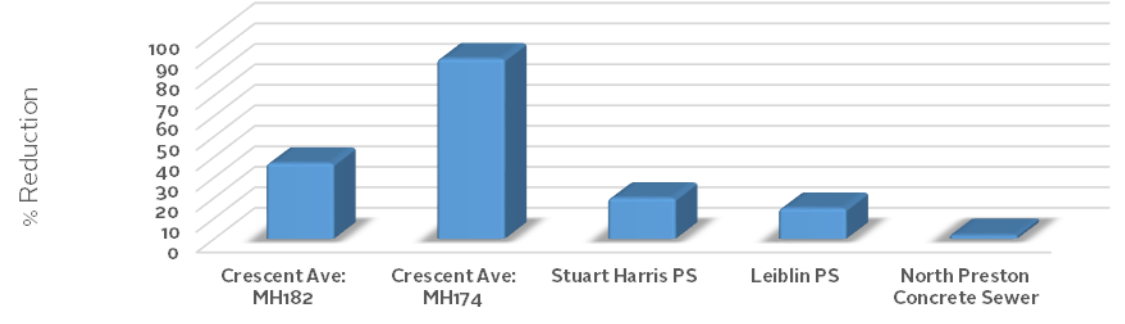


Peak flows resulting from wet weather influences are the single biggest operational challenge facing Halifax Waters Department of Wastewater and Stormwater Services. These wet weather flows consume valuable system capacity and place unnecessary hydraulic demand on collection systems and Wastewater Treatment Facilities (WWTFs). The burden of that excess flow can lead to process upsets within WWTFs and ultimately make it more costly and difficult to maintain environmental compliance with operating permits.

The WWMP has activated five pilot projects to gather specific information on the effectiveness of various rehabilitation techniques that can be employed to reduce system inflow and infiltration. To date, the pilots have reduced peak wet weather flows in the sewersheds by as much as 86% **(see Figure 1)**, and minimized sanitary sewer overflows without requiring capacity increases in treatment or pumping facilities.

The pilot program has seen the installation of 1,000 metres of deep storm as well as the renewal of 4,400 metres of mainline, 41 laterals, and 25 manholes. Collectively, the five pilots have reduced the burden on the system by almost 1 million litres per day **(see Figure 2)**, representing approximately 350 million litres per year. **Figure 3** shows the response of the Crescent Avenue sewershed to a dramatic precipitation event before rehabilitation and after rehabilitation. Note the reduced peak response as well as the reduced average flow before and after the rainfall event.

Figure 2: Average Daily Flow Reduction

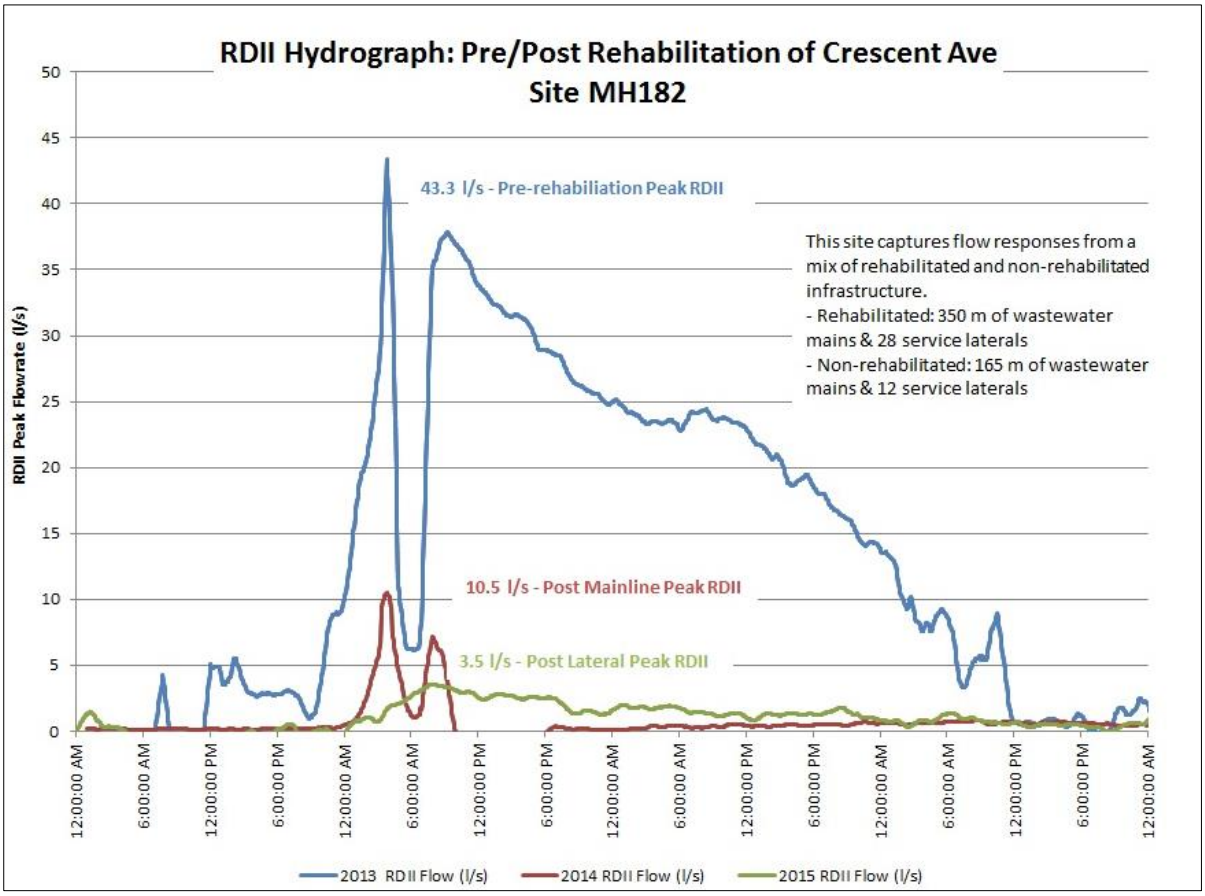


Wet Weather Management Continued...

In 2018, the WWMP initiated a rehabilitation project in Fairview. This project directly supports the long-term planning vision of the West Region Wastewater Infrastructure Plan with a targeted reduction of 200 litres per second. This is a milestone project for the WWMP, as it is the first project with a defined reduction target and was directed largely on information gathered from the pilot program. While the Halifax Water WWMP has matured substantially over the first four years, it is recognized that wet weather management is long-term in nature and will be a critical component in assisting operations and planning within Halifax Water to meet our environmental responsibilities.

The programs focus is to gather relevant practical data that can be used to make strategic decisions around wet weather flow management. The dataset will be used to aid designers in making reasonable assumptions regarding wet weather flow reductions within Halifax Water infrastructure. The dataset also informs Halifax Water of the cost of wet weather flow reduction based on local projects that are substantiated by local tender prices. Given these two pieces of information, Halifax Water can make decisions based on relevant local information that implements the most cost-effective way to ensure environmental compliance of the sanitary system for generations to come.

Figure 3: Comparison of Pre- and Post-Rehabilitation Flows



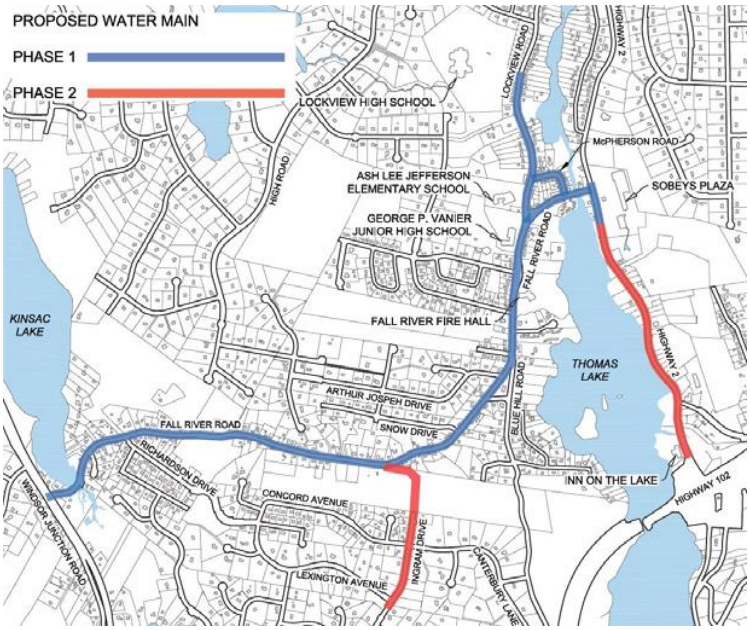
Water Service Extends to the Community of Fall River

Access to safe, clean, reliable and affordable water service is essential to the health and well-being of a community and its residents. For many residents and businesses in the Fall River area, this is an issue.

In order to bring municipal water service to the community, Halifax Regional Council approved the extension of the water service boundary. With this designation in place, the project was designed and tendered by Halifax Water.

In fall 2017, Halifax Water, through its contractor, began work to install 4.6 KM of new water main, fire hydrants, valves and laterals to each property line. Work on Phase 1 is scheduled to wrap up in summer 2018. Phase 1 is budgeted at $7.2 million.

To further enhance water service to the Fall River area, Phase 2 is scheduled to get underway in the summer of 2018 and continue into fall 2018. Phase 2 will see Halifax Water, through its contractor, install 2.0 KM of new water main, fire hydrants, valves and laterals to each property line. Construction will take place on Highway#2 from Fall River Road to Inn on the Lake and a portion of Ingram Drive from Lexington Avenue to the end. Phase 2 is budgeted at $2.8 million.



Map showing the areas affected by Phase 1 & 2 of the Fall River Water Main Extension Project.

A section of water main being installed on Fall River Road.

Phases 1 and 2 are being funded, (approximately 75%) through $8.3million from the federal/provincial Clean Water and Wastewater Fund (CWWF) program. The remaining portion of the project is funded through a Local Improvement Charge (LIC) administered by the Municipality.

A Pressure Reducing Valve Chamber being installed on Fall River Road.

Customer Connect Project Update

Upgraded Meter Face

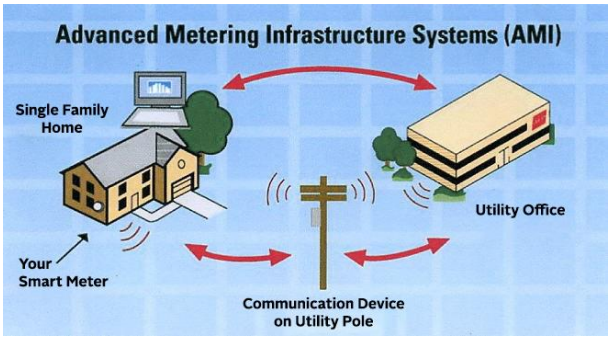
Customer Connect is a Halifax Water initiative to upgrade our metering technology throughout Halifax Regional Municipality. Currently, Halifax Water provides water services to roughly 84,000 customers that are within the scope of the Customer Connect project to be upgraded with AMI (Advanced Metering Infrastructure) Technology. Neptune Technology Group has been contracted by Halifax Water to install the majority of these new water meters. In Nova Scotia, water meters tend to be located in basements, or crawlspaces, as such, the installation of these new meters requires that Neptune Technicians enter business and residence premises to complete these upgrades.

How does the new technology work?

The upgraded water meters will measure water consumption, which is then relayed to Halifax Water through a small battery-powered transmitter that will be installed on the outside of our customers' premises.

AMI Transmitter Box

The transmitter reads the meter at regular intervals and sends a brief, low-powered radio signal to a nearby data collector, which then transmits the reading to a data server at Halifax Water. With the introduction of the AMI system, Halifax Water expects to receive 24 reads a day, one per hour.



How water usage data is transmitted to Halifax Water.

The Benefits

There are a number of benefits to both Halifax Water and its customers from the day of installation, onward, Halifax Water receives all water usage data for its customers securely and wirelessly, so customers will have fewer visits from Halifax Water Meter Reading staff for meter readings. High Consumption Alerts are another immediate benefit to Halifax Water customers, alerting them when water is being used at a high rate. This alert can save customers hundreds of dollars by making them aware that they may have a leak somewhere on their property. With better, more detailed water usage data, Halifax Water can be more responsive and give more detail to customer inquiries regarding water use. Of course, with every meter that is installed, we reduce our vehicle travel requirements for manual meter reading. This change is perhaps the most environmentally significant, enabling Halifax Water to take a number of vehicles off the road, reducing our carbon footprint.

In late 2019, as this and other projects come to completion, customers will be able to log onto www.halifaxwater.ca and view their water usage data, and past bills. Making this detailed information available directly to Halifax Water customers will enable them to more closely monitor their water usage and, hopefully, prevent unexpectedly high water bills caused by leaks or overuse.

Project Milestones So Far

March 20, 2018 – 10,000 meters installed.

June 22, 2018 – 20,000 meters installed.

Aerotech WWTF Upgrades

After investing over $20 million in capital upgrades to the Aerotech Wastewater Treatment Facility (WWTF), we are pleased to announce that as of April 16th, 2018 the process of upgrading the existing treatment facility into an Enhanced Nutrient Removal treatment facility utilizing Membrane bioreactors (MBRs) technology was completed.

MBRs are known for producing high-quality effluent from wastewater treatment facilities in order to meet stringent regulatory requirements. The most significant advantage of MBR technology is its ability to consistently produce high-quality effluent, including effluent total nitrogen (TN) concentrations of <3.0 mg/L and total phosphorus (TP) concentrations of < 0.30 mg/L with the possibility of even lower concentrations following process optimization.

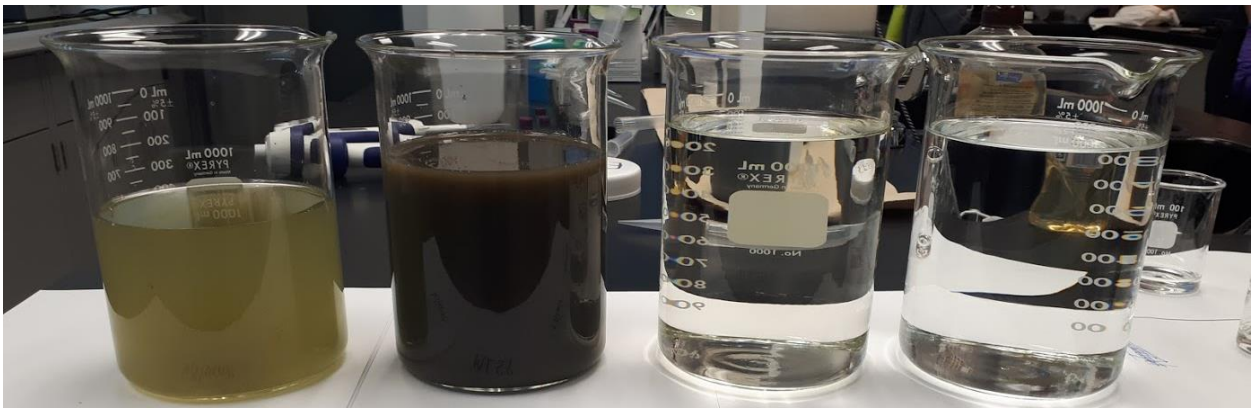
Installation of the membrane modules.

The successful start-up and optimization of any new biological treatment process can be jeopardized by a wide range of potential setbacks, including schedule delays, equipment deficiencies, inadequate feedback or data collection, and lack of coordination between the parties involved. We were able to overcome these unique challenges as well as those associated with implementing MBR technology, including:

- A large number of interconnected components operating as a single system;
- Reliance on complex automatic controls and interlocks with the risk of costly failures;
- Use of proprietary terminology, configurations, operational schemes, testing protocols, etc., by different system suppliers; and
- A relatively wide range of potential operating conditions, control strategies, and performance targets.

Considering the above challenges, we were able to achieve plant optimization for all regulatory parameters by implementing a specific testing sequence for successful MBR system start-up that included initial planning and coordination (comprehensive commissioning plan), preliminary equipment checks, clean water testing, MBR seeding and introduction of wastewater, and final performance testing and optimization. From the initial start date with extensive laboratory testing as well as data collection, plant staff, and commissioning agents, we were able to achieve plant optimization within two months of start-up.

The facility will be substantially complete in the summer of 2018 when final landscaping and deficiencies are completed.



WWTF Samples (from left to right): Facility Influent, Bioreactor (8,000 mg/L MLSS), Treated Effluent, Potable Water.

Water Research Programs

Industrial Research Chair

Since 2007, Halifax Water has sponsored an Industrial Research Chair in Water Quality and Treatment held by Dr. Graham Gagnon of Dalhousie University. The Natural Sciences and Engineering Research Council of Canada as well as six industrial partners, including Halifax Water fund the Chair.

Under the Chair, Dr. Gagnon and his team of researchers focus their efforts on improving water treatment processes and drinking water quality for Halifax Water customers. Research findings by Dr. Gagnon and his team have been used to develop water treatment plant process improvements. These improvements have reduced operating costs by optimizing treatment processes, chemical use, and have allowed Halifax Water to reduce the levels of disinfection by-products in the water.

Perhaps most significantly, research by Dr. Gagnon has shaped Halifax Waters approach to lead service line replacement. Halifax Water has now developed an approach to lead service line replacement that is among the most advanced in North America. The policy has been shaped incrementally by research findings related to lead since 2012.

Dr. Gagnon and his team have also been instrumental in discovering the phenomenon of lake recovery in Halifax Water water sources. Lake recovery is the process whereby the reduction of acid rainfall in Nova Scotia has allowed the pH levels in local water sources to rise. This new pH level is much more accommodating to biological activity. This increased level of organic life in Pockwock Lake and Lake Major was not present or planned for during the design of their respective Water Supply Plants in the previous century. While the reduction of acid rain and the improved pH are both very positive from an environmental standpoint, those changes bring with them a host of challenges in the treatment of these water sources. Dr. Gagnon's team is leading efforts to characterize lake recovery and identify process improvements for the water supply plants affected by this environmental change.

Dr. Gagnon, Dalhousie University

Water Research Foundation

Halifax Water has been a subscriber to the Water Research Foundation since 1989. The foundation directs research in the water industry across North America for the benefit of water utilities. Further, by being a Water Research Foundation Subscriber, Halifax Water staff have the opportunity to participate directly in relevant projects. This provides Halifax Water staff an opportunity to learn from the leading experts from across North America.

In 2018, the Water Research Foundation awarded the Outstanding Subscriber Award for Applied Research to Halifax Water, recognizing our efforts to utilize research to improve performance and benefit Halifax Water customers.

The Water Research Foundation has contributed $100,000 USD under their Tailored Collaboration Program to fund the development of a tool for selecting treatment technology and monitoring plans when source water is rapidly changing, as we are seeing now with lake recovery in Nova Scotia.

Halifax Water representatives receiving the Outstanding Subscriber Award for Applied Research, from left to right: Wendy Krkosek, Sanjeev Tagra, Barry McMullin, Andrew Houlihan, Carl Yates, Reid Campbell, and Jamie Hannam.

Water Research Programs Continued...

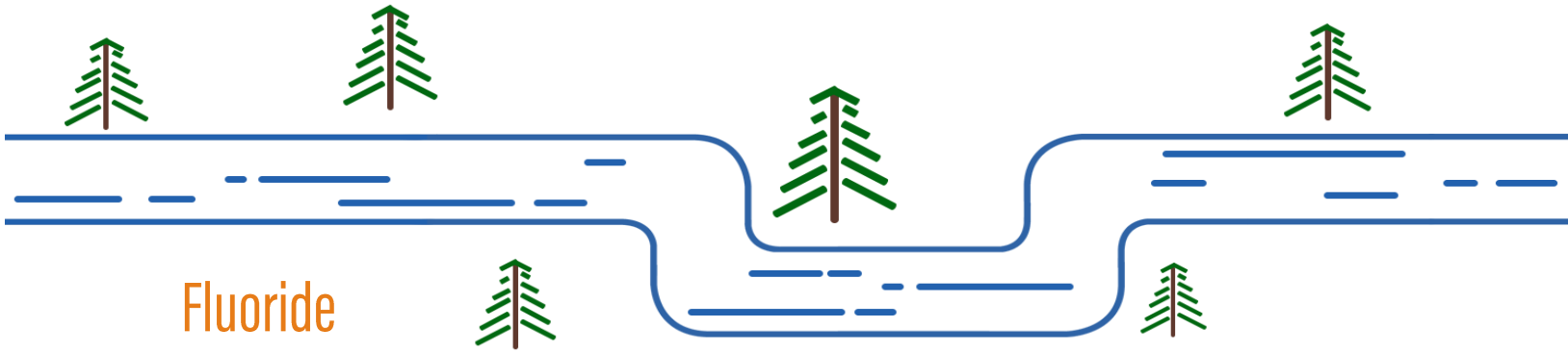
*for*Water Network

In addition to research work with Dalhousie, which focuses on treatment and water quality, Halifax Water has recently helped to establish a national network, the *for*Water Network, designed to coordinate research to protect forested water sources.

Forested water supplies, as we have in the Halifax area, are known to be some of the best sources, due to the mitigative effects of the forest on land disturbance and their comparatively low level of development impacts. Unfortunately, this inaccessibility has resulted in little research having been conducted historically in forest management for water supply purposes.

In 2017, professors Monica Emelko of the University of Waterloo and Uldis Silins of the University of Alberta received a five year, $5 million network grant from the Natural Sciences and Engineering Research Council of Canada to coordinate and promote research into forested water sources across Canada. Local research will be conducted by professors Rob Jamieson and Peter Duinker, of Dalhousie University. Halifax Water supports the network application and is a research partner along with several other Canadian Water utilities.

Through the *for*Water network, Halifax Water will have the opportunity to understand forest management techniques in other, similar, watersheds across Canada, as well as host other utilities and researchers in the Pockwock and Lake Major Watersheds. This will position Halifax Water to utilize the latest scientific research in the protection of our water sources.



Fluoride

Fluoride in drinking water is an issue that engenders strong opinions on all sides of the argument. Fluoride is added to drinking water in the Pockwock and Lake Major systems, at the encouragement of public health officials, to reduce the incidence of dental cavities, especially in children. Halifax Water has been fluoridating the water supply since the 1950's.

While there are many people with strong objections to water fluoridation, the fact remains that most major public health organizations in the world, take the position that fluoridation of drinking water has a positive public health impact while exhibiting insignificant risk to public health. This includes Health Canada, the US Environmental Protection Agency, the Centers for Disease Control and the World Health Organization. Locally, the Nova Scotia Dental Association, the IWK Children's Hospital, Dalhousie School of Dentistry and the Medical Officers of Health have all supported continued fluoridation of drinking water.

Fluoridation practice at Halifax Water is governed by the Guidelines for Canadian Drinking Water, published by Health Canada which specifies an optimal level of 0.7 mg/L

Based on objective scientific evidence, and the recommendations of leading public health agencies, Halifax Water is proud to support the dental health of our customers and their children through drinking water fluoridation.

Water Loss Control

Non-revenue water is defined as water that is produced but does not find its way to customers. Water loss in a distribution system can be from "real losses" or "apparent losses." A real water loss occurs when there is a physical loss of water. This would include water lost during water main breaks. An apparent water loss can be the result of inaccurate customer metering, water theft, and billing errors.

In 1999, Halifax Water became the first utility in North America to adopt a new methodology for reducing non-revenue water that has allowed Halifax Water to reduce the volume of water lost significantly.

The key to reducing real losses is to decrease leak run times. Contrary to popular belief, most water lost to leakage is not lost in the large water main breaks that make the nightly news. This is because these leaks are stopped quickly once they occur. Most leaks start out as very small flows that can run for days, weeks and even years if no one is actively looking for them. By locating and repairing these smaller leaks in a timely manner, water loss is kept to a minimum.

With over 1,500 km of water mains, finding leaks is an ongoing challenge. To combat this issue, Halifax Water has divided its system into 75 District Metered Areas (DMA's). Halifax Water is one of only two utilities in North America who have 100% of its system separated into DMA's. By analyzing the flow of water into a DMA between 3:00 AM and 4:00 AM in the morning, when customer water demand is at its lowest, Halifax Water can quickly determine if there may be active leakage. Once a potential leak is identified, crews are dispatched to the DMA and using sophisticated acoustic leak detection equipment will pinpoint the leak. By using DMA's, Halifax Water can repair most of its leaks when they are small before they grow into larger leaks that can cause disruption of service and property damage.

Acoustic Leak Detection Equipment being used to pinpoint a leak between hydrants.

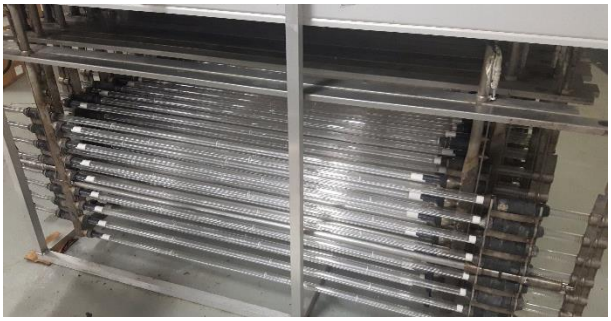
Halifax Water is also working to prevent water main breaks by managing pressure in the water distribution system. Reducing pressure has been shown to reduce the amount of background leakage and the number of water main breaks. As well, trying to eliminate sudden pressure changes in the system can help reduce the number of water main breaks.

Water main leak detected and uncovered for a repair.

Seasonal Disinfection Program

Halifax Water's Operating Permits for Halifax, Dartmouth, Eastern Passage and Herring Cove Wastewater Treatment Facilities have been amended successfully to allow for a permanent Seasonal Disinfection program to run between November and April (except for two weeks before the Polar Bear Swim on January 1).

Seasonal Disinfection involves the Ultraviolet (UV) lights at the end of the wastewater treatment process being turned off in the winter months when recreational activities and human contact are reduced.



UV Light Bank removed from tanks for cleaning.

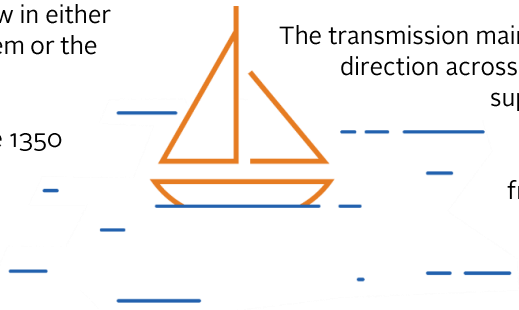
UV Light Bank actively disinfecting treated wastewater.

When on, these UV lights disinfect the treated wastewater.

During this past year, staff were able to more safely and efficiently clean and replace the UV lamps within the wastewater facilities. In addition, there were significant cost savings and reductions in greenhouse gases and there was no noticeable impact in the harbour quality as a result of the UV lamps being turned off. As well, a savings of $ 166,000, 1,739,000 kWh and 1,218 tonnes of Green House Gases, equivalent to getting 265 vehicles off the road, were realized.

MacDonald Bridge Water Line

As part of the Harbour Bridge's "Big Lift" re-decking project, Halifax Water's existing water main under the suspended span of the MacDonald Bridge had to be replaced. This 600mm (24") water main was originally installed in 1972 and served as a backup connection allowing water to flow in either direction should the Halifax system or the Dartmouth water system need additional supply. Overall, approximately 850 metres of the 1350 metres of the existing main was replaced as part of the project. The main was deactivated and drained in March of 2015 and placed back in service in January of 2018.



The final cost of the Transmission Main Replacement portion of the project was just under $7.0M. American Bridge Company were the General Contractor with Cahill Group as the subcontractor responsible for the water main installation. Buckland & Taylor, a part of COWI were the principal design engineers and CBCL were sub-consultants for the water main design.

The transmission main provides flow in either direction across the bridge. Depending on the supply requirements, the line can supply approximately 2 MIGPD (million imperial gallons per day) from Halifax to Dartmouth and approximately 4 MIGPD from Dartmouth to Halifax. The line is kept in active service with approximately 100 IGPM (imperial gallons per minute) flowing all the time. This line forms a critical part of Halifax Water's water system resiliency and redundancy approach to supply and emergency management.

Northwest Arm Trunk Sewer Project

The Northwest Arm is a valuable recreational, economic and quality of life asset to our community. The area is enjoyed by boaters and swimmers, is home to two yacht clubs, rowing and social clubs, a beach, and numerous oceanfront properties. To help protect this important community asset, Halifax Water undertook an ambitious and complex $23 million project to rehabilitate 4.1 KM of 100+ year-old sewer. The project received funding through the Clean Water and Wastewater Fund (CWWF) with $8,171,854 in funding from the federal government and $4,085,927 from the province.

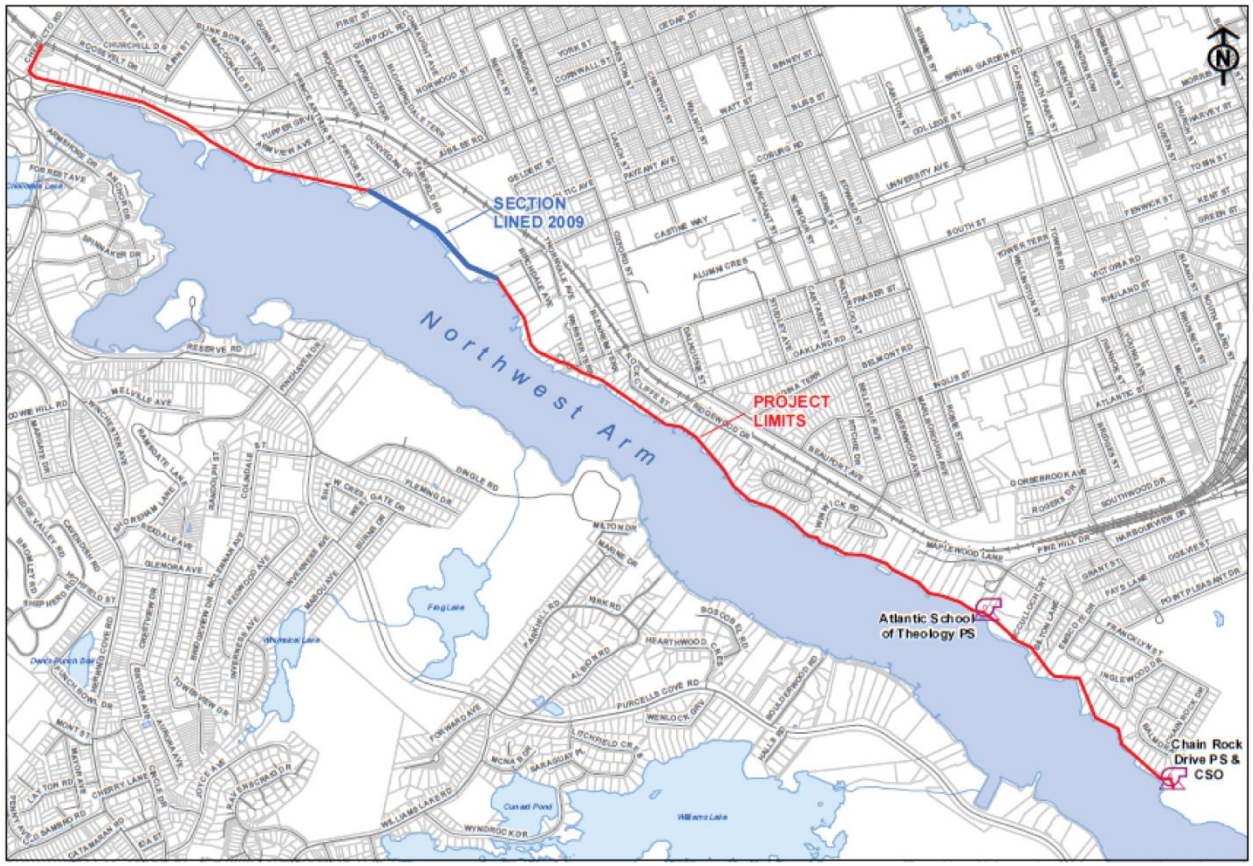
The Northwest Arm sewer runs from the Armdale Roundabout to Point Pleasant Park, via a Halifax Water easement, through the backyards of numerous homes along the Arm. Repairing this 4.1 KM section of sewer posed a number of challenges. The homes along the route would need to have use of their sewer while the project was underway; the timeline for completion was very tight (complete by March 2018) in order to qualify for Clean Water and Wastewater Funds; weight restrictions on some area bridges created additional logistical/supply hurdles; tight working spaces within Halifax Water's easement; and keeping residents informed throughout the project.

In order to complete the work under these tight restrictions, innovative trenchless/Cure in Place Pipe (CIPP) technology was used. CIPP technology eliminates the need for traditional open-cut excavation and means the majority of the surrounding landscape remains undisturbed. The CIPP process involves inserting a resin liner inside the existing pipe via manhole access points. Once the resin liner is in the pipe, it is cured using steam or hot water. Holes are cut in the newly lined pipe at each property's sewer connection pipe (lateral), and a fully functioning sewer system is restored with a new lifespan of 75 years.

Work began in the spring of 2017 with crews moving full speed ahead at multiple locations along the pipe route with cleaning of the sewer line, video inspection, setting up bypass sewer pipes and pumps to ensure residents had use of their sewer throughout the work, and finally lining the sewer. The last section of liner was installed December 4th with the system fully operational December 5th, 2017, well ahead of schedule.

Aerial photo of the main point of access to the Northwest Arm Sewer Line.

Northwest Arm Trunk Sewer Project Continued...



Map of Northwest Arm Trunk Sewer Project Area.

A few project stats and unique challenges:

- Approximately 1,000,000 lbs. of resin was used;
- One lining section was 680 meters, the longest large diameter liner to be placed in Canada. This pushed the boundaries of CIPP technology as it is well beyond the typical CIPP installation lengths of 100m to 200m. This section was further complicated by the 25+ laterals and interconnections over its 680-meter length, and it transitioned from a 4ft round diameter to 4x5ft arch shape;
- A 240-meter liner section had to be transported in two pieces and stitched together on site in order to accommodate weight restrictions on CN's Belmont on the Arm bridge. A specialized crew was flown in from out of the country to complete this section as this type of stitch work is very rare, reportedly only completed once a year globally.

Pipe lining laid out in preparation for insertion in existing sewer pipe.

Sullivan's Pond Project

Sawmill River Sees the Light

The Sullivan's Pond stormwater system conveys stormwater from Lake Banook/Sullivan's Pond and the upstream watershed to Halifax Harbour. In 1971 Hurricane Beth flooded most of downtown Dartmouth. In 1972, in order to help reduce future flooding events and protect public and private property, a piped stormwater system was constructed from Sullivan's Pond to the Harbour. The piped stormwater system has reached the end of its service life.

Sullivan's Pond – Pre-construction.

Sullivan's Pond – Construction of new open-channel.

Sullivan's Pond – Construction of new open-channel.

Following extensive consultation with the Department of Fisheries and Oceans, as well as feedback from the community, a stormwater system was designed that included a series of engineered open channels to provide for fish passage. The new system was designed to handle stormwater flows associated with a 1 in 100-year storm event which has been adjusted to account for climate change.

Phase 1 involved the replacement of 290 metres of deteriorated storm sewer from Sullivan's Pond to approximately Irish Town Rd. Two permanent sections of engineered open channel were included in this Phase.

In late July 2017, construction got underway on Phase 1 of this very complex project. The complexities

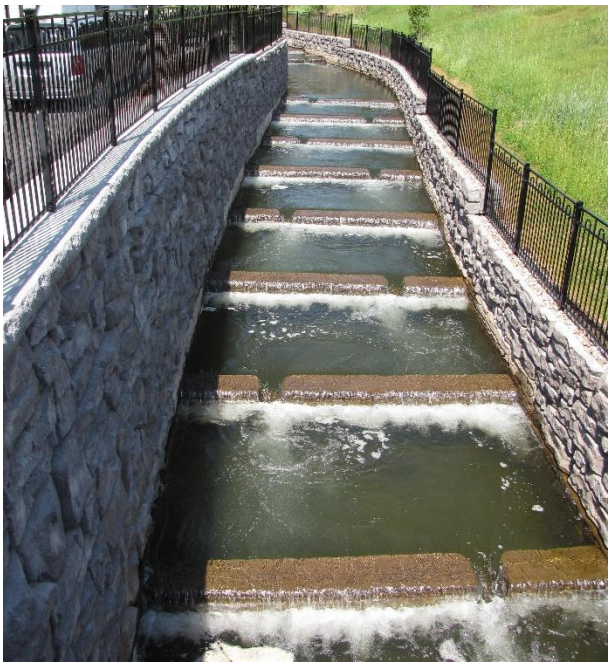
Sullivan's Pond Project Continued...

Sullivan's Pond – Completed section of open-channel. Final landscaping work underway.

included integration of the new stormwater system with ongoing construction of the Shubenacadie Canal Marine Railway; working within Halifax Water's easement on private property; managing lake levels and flows during construction including adjustment of water levels in Lake Banook (an active canoeing/kayaking lake); access to adjacent residential and commercial properties during construction; and pedestrian and vehicle detours

Along with the complexity of the project, came a tight timeline of completion by March 2018 in order to qualify for $6.3 million in federal/provincial funding through the Clean Water and Wastewater Fund.

A milestone for the project and the community occurred on February 3, 2018 with water flowing through the new stormwater system. The response from the community to the project has been overwhelmingly enthusiastic and will leave a legacy to the neighbourhood for generations to come.



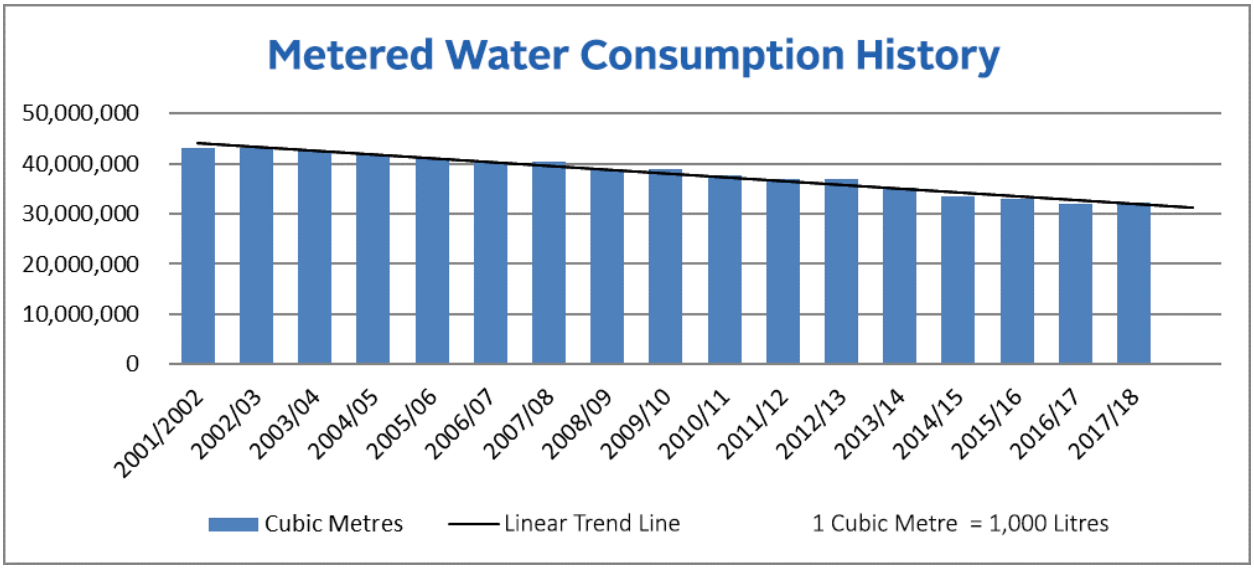
Sawmill River Sees the Light

Reduction in Customer Water Consumption

Water: A Resource Too Precious to Waste

Water is a precious resource, one we should all try to conserve to both help our environment and reduce your water bill. Halifax Water is doing its part through the adoption in 1999 of the International Water Association (IWA) methodology to minimize leakage in the water distribution system. Halifax Water was the first utility in North America to adopt the IWA standard. Since 1999, Halifax Water has reduced leakage in the water distribution system by 40,000,000 liters/day, valued at $600,000 in annual savings. Although we operate a system with some of the oldest pipes in Canada, our leakage rates are amongst the best in the world.

Water consumption has been declining over the years. Since 2001/2002 consumption has dropped 22%. This can be attributed to more efficient household appliances such as dishwashers, washing machines, etc., and customers using water more wisely.



Median:	-2.2%	Rolling Historic Four-Year Avg.	- 2.2%
Total Decrease since 2001/02:	-22%	Average	- 2.0%
2017/18 Change in Annual Consumption	0.02%	(First slight increase in 17 years.)	

Average Indoor Water Usage Chart

Water bills change according to water usage so each household or business will differ based on individual usage (or consumption) patterns. Conservation starts at home.

So what can you do to conserve?

Reduction in Customer Water Consumption Continued...

Conservation in the Bathroom

- Turn off the tap while brushing your teeth, and use short bursts of water for rinsing.
- Flush toilet only when necessary. Install low flush toilets.
- Toilets are the most common source of water leakage. See Leak Investigation for more information.
- Turn off the taps tightly but gently, so they do not drip.
- Stop using the toilet as an ashtray or wastebasket. Every time you flush a cigarette butt, facial tissue, or other small bit of trash, you waste water.
- Take shorter showers. Long, hot showers can waste over 26 liters every minute. Limit your showers to the time it takes to soap up, wash down, and rinse off.
- Install water-saving showerheads or flow restrictors.
- Check faucets and pipes for leaks. Even the smallest drip from a worn washer can waste 75 or more liters a day. Larger leaks can waste hundreds.

Conservation in the Kitchen

- Take foods out of the freezer early to allow plenty of time to thaw. Thawing frozen goods under a running tap wastes water.
- Keep water in the fridge, so you don't have to run the tap to get cold water.
- Install a water efficient dishwasher and fill the dishwasher before you turn it on.
- If you wash dishes by hand, don't leave the water running for rinsing. If you have two sinks, fill one with soapy water and one with rinse water. If you have only one sink, gather washed dishes in a dish rack and rinse them with a spray device or a pan full of water.
- Don't let the faucet run while you clean vegetables. Just rinse them in a stoppered sink or a pan of clean water.
- Check faucets and pipes for leaks. Leaks waste water 24 hours a day, seven days a week and often can be repaired with only an inexpensive washer.

Conservation in the Laundry Room

- Install a water efficient washing machine. Pay attention to the size of your load of laundry and adjust your washer's settings accordingly. Washing full loads is best.
- To cut down on energy costs use warm or cold water to wash clothing rather than hot water.

Conservation Outdoors

- Deep-soak your lawn, long enough for the moisture to soak down to the roots where it will do the most good. A light sprinkling can evaporate quickly and tends to encourage shallow root systems.
- Water during the cool parts of the day. Early morning generally is better than dusk. It helps prevent the growth of fungus.
- Don't water the sidewalk or driveway. Position your sprinklers, so water lands on the lawn or garden, not on paved areas. Avoid watering on windy days.
- Put a layer of mulch around trees and plants. Mulch will slow evaporation of moisture and discourage weed growth.
- Use a broom, not a hose, to clean driveways and sidewalks.
- When washing your car, rather than use a running hose use a bucket, a sponge, and a hose with a trigger nozzle.
- Leaks outside the house may not seem as bad since they are not as visible. But they can be just as wasteful as leaks inside. Check frequently and keep them drip-free.

Contact Us

If you have questions, comments, or suggestions for future editions of The Stewardship Report, please contact:

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