Nanticoke Drinking Water System
2018 Annual Water Quality Report

January 1, 2018 – December 31, 2018

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Quality Management System Policy

The purpose of The Corporation of Haldimand County's Quality Management System policies are to:

- Ensure our drinking water systems comply with all current legislation and regulatory requirements for the safe supply of drinking water;
- Ensure financial support is provided to maintain infrastructure integrity to allow safe and consistent delivery of drinking water to our water customers;
- Commit to review and update our Operational Plans as regulated by the Drinking Water Quality Management Standard in order to continually improve our Quality Management System and to communicate the results with our water customers.

Haldimand County Quality Management System Summary

Haldimand County's Quality Management System (QMS) is legislated under the Drinking Water Quality Management Standard (DWQMS) through the Safe Drinking Water Act. To maintain operating authority accreditation, Drinking Water Works Permits and Municipal Drinking Water Licenses for the County's waterworks systems, the Ministry of the Environment, Conservation and Parks (MECP) mandate tasks that must be completed annually. These activities include:

- Conducting an internal audit of the Quality Management System.
- Conducting a Management Review meeting.
- Participating in an external audit conducting by a third party Accreditation Body
- Updating the Quality Management System Operational Plan.
- Updating Council of the status of the County's Quality Management System.

The QMS Operational Plan was reviewed in 2018 including an update to the drinking water system's risk assessment. A review will be completed in 2019, with a focus on continual improvement and an update to staff roles and responsibilities directly impacting the drinking water system.

Haldimand County conducted internal audits with staff from Operations, Compliance and Management. An audit report was generated that identified minor non-conformances and opportunities for improvement. Staff have corrected the non-conformances and have been diligent in implementing all opportunities for improvement.

Haldimand County must receive accreditation annually to operate the water distribution systems. Through a qualified third party auditor, the County must demonstrate that its QMS meets the requirements of the DWQMS. SAI Global conducted an external audit on December 19 and 20, 2018. The County has reviewed the audit report, addressed the non-conformances and will be implementing the opportunities for improvement.

Staff are required to conduct an annual Management Review meeting to evaluate the effectiveness of the QMS. Deficiencies and opportunities for improvement are identified and action items are developed to ensure follow-up. The County held their management review meeting on November 1, 2018.

All requirements were achieved in 2018 and SAI Global have recommended that Haldimand County is issued continued accreditation to operate the drinking water systems in 2019.

As part of the Operating Agreement with the County and regulated requirement, the contracted Operator of the County Water Treatment Plants (WTPs) must receive Drinking Water Quality Management Standard (DWQMS) accreditation as an operating authority. On June 27, 2018, Veolia Water provided a manager review of the external audit and follow-up activities. No non-conformances were identified and three opportunities for improvement. The presentation identified activities to address the opportunities for improvement. All requirements were achieved in 2018 and SAI Global have recommended that Veolia Water is issued continued accreditation to operate the drinking water systems in 2019.

NANTICOKE DRINKING WATER SYSTEM

Nanticoke Drinking Water System Overview

Lake Erie raw water flows from the Ontario Power Generation forebay into the Nanticoke Industrial Pumping Station forebay. Raw water can be pre-chlorinated for zebra mussel control and then drawn into two raw water wet wells. Seven vertical turbine pumps are capable of supplying Imperial Oil and US Steel plants with raw water. Two submersible pumps supply the municipal treatment works with raw water.

A coagulant (poly-aluminum chloride was used in 2018) is injected into the raw water supply. Powdered activated carbon can be injected into the raw water if there are taste and odour issues, however it was not added in 2018. Water flows into a high-rate clarification process (Actiflo), which uses microsand and polymer to improve floc formation and significantly reduce settling times. Settled water then flows to three filter units containing sand and anthracite. Filtered water is chlorinated with sodium hypochlorite for primary disinfection prior to flowing to two reservoirs. These reservoirs feed into a high lift pumping station, where chlorine is injected for secondary disinfection, before being pumped into the distribution system.

A settling lagoon collects waste water from various water treatment plant processes and continuously discharges to Lake Erie.

Figure 1 is a simplified schematic of the Nanticoke Water Treatment Plant. A larger version of the diagram is included in the appendices.

The distribution system is comprised of three residential communities (Townsend, Jarvis and Hagersville) and the Lake Erie Industrial Park. Townsend utilizes a water tower for storage and to maintain pressure in the distribution system. A booster station is utilized to maintain pressure and flow to Hagersville. As required, this facility has the capability to add sodium hypochlorite to the potable water to boost chlorine residuals. Hagersville utilizes a standpipe for storage and to maintain pressure in the distribution system. Bulk water stations are located in Hagersville and Jarvis. In addition, the Nanticoke Drinking Water System provides potable water to the Mississaugas of the New Credit First Nation.

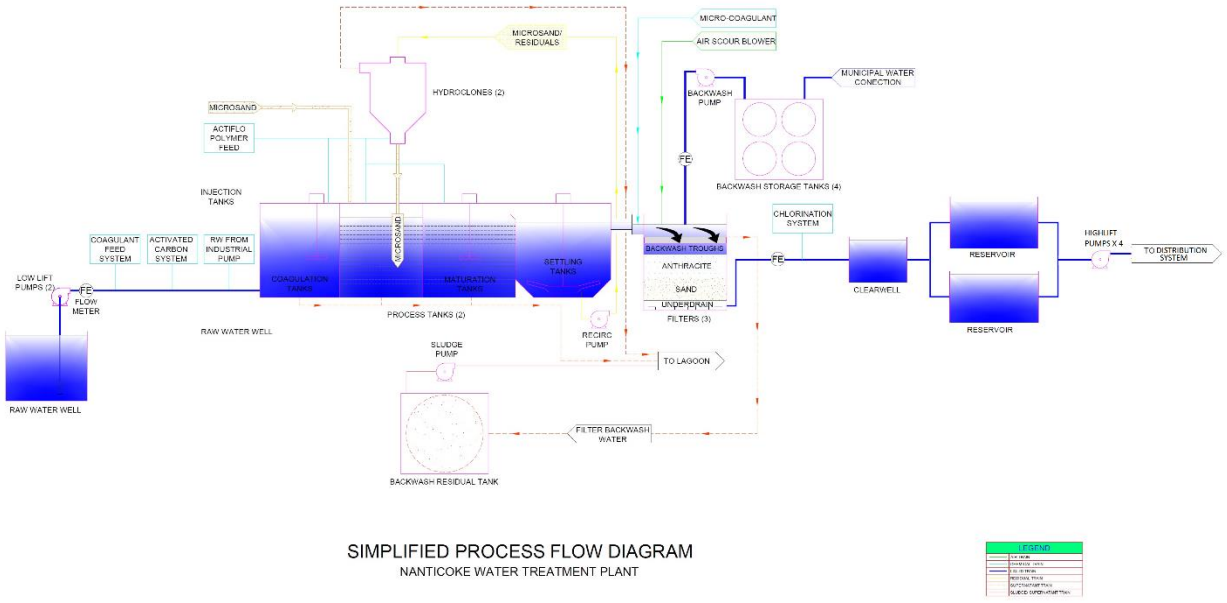

***Figure 1*: Nanticoke Water Treatment Plant Schematic**

The distribution system infrastructure services approximately 4,900 people (2016 Census).

Veolia Water Canada is contracted to operate and maintain the Nanticoke Water Treatment Plant, Townsend Re-chlorination Building, Townsend Elevated Tank, Hagersville Booster Station, Hagersville Standpipe and the transmission watermains. Haldimand County operates and maintains the distribution system, including the bulk water depots.

Expenditure Information

Haldimand County and Veolia staff are diligent in prioritizing projects on an annual basis to eliminate unnecessary expenditure. Using the best available information at the time of this report, expenses incurred in the Nanticoke Drinking Water System for 2018 are identified in Table 1. Not all drinking water expenditure information is included in this report.

Table 1: Nanticoke Drinking Water System 2018 Expenditures

Nanticoke Drinking Water System:	
Nanticoke Water Treatment Plant (WTP) Hydro-Cyclone Modifications	
Leak Detection	
Low Lift Online Analyzer Replacements	
Safety Rail Replacements	
Nanticoke Lagoon Clean Out	
Transmission Main Valve Chamber Repair Program	
Raw Water Quality Study & Pretreatment Options	
Nanticoke Filter Replacements	
High Rate Sedimentation Capacity Expansion	
Filter Building Expansion	
Total Cost:	**$3,362,652**

Multi-Barrier Approach

Through the Walkerton Inquiry, Justice O'Connor recommended that drinking water is best protected by taking an approach that uses multiple barriers to prevent contamination from affecting our drinking water. The multi-barrier approach addresses potential threats by ensuring barriers are in place to either eliminate or minimize their impact. This holistic approach recognizes that each barrier may not be able to completely remove a contaminant, but by working together the barriers provide a high-level of protection. Typical barriers include:

- **Source Protection**
  - ***Source Protection Plans***
- **Treatment**
  - ***Treatment and Disinfection Goals***
- **Distribution System**
  - ***Residual Maintenance***
- **Monitoring**
  - ***Sampling Programs***
- **Emergency Preparedness**
  - ***Emergency Plans***

Haldimand County has adopted the multi-barrier approach in ensuring safe, reliable drinking water. Figure 2 shows how administration, design, maintenance, and operations work together to establish and maintain multi-barrier protection (US EPA, 1998).

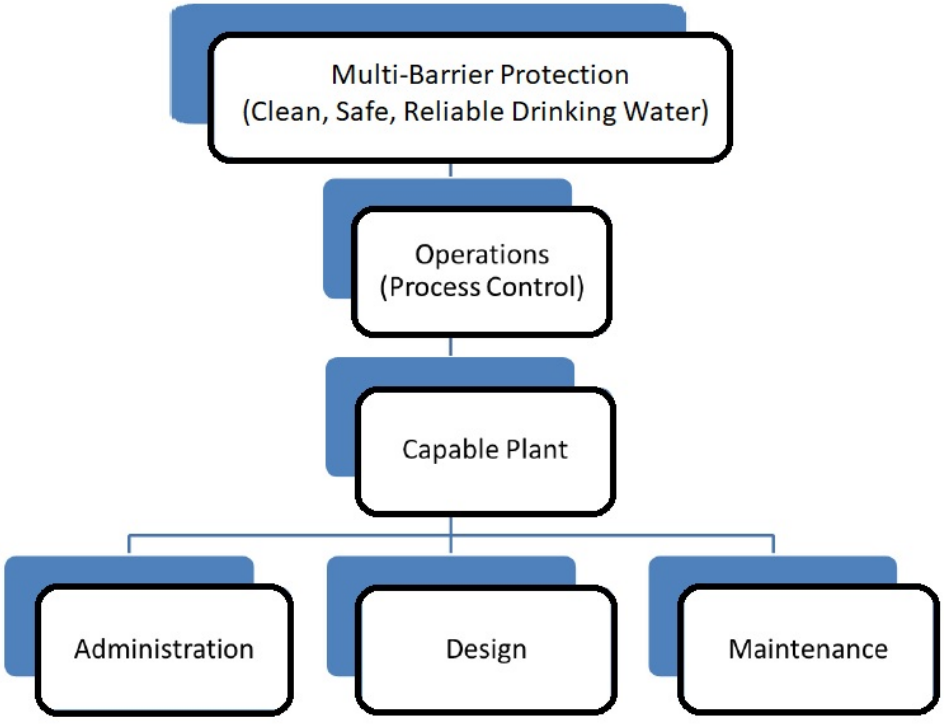

***Figure 2*: Responsibilities for Clean, Safe and Reliable Drinking Water**

A description of the responsibilities in each area is summarized as follows:

- **Administration**: The administrators or managers of a water treatment system are responsible for providing the resources (budget and staff) and policies (hours of staffing, reporting requirements, training and certification requirements, etc.). Funding may also need to be justified and obtained if the design of a system is inadequate or major upgrades are required. Managers establish and maintain emergency response plans and communication procedures to ensure prompt response to unsafe drinking water.

- **Design**: The designer's responsibility is to provide the physical infrastructure (pipes, valves, tanks, meters, etc.) capable of reliably producing and distributing the quality and quantity of water required. The design must provide adequate flexibility and controllability to enable the operator to make appropriate adjustments.

- **Maintenance**: The system must be maintained in good working order with the key equipment functional at all times. Should a key piece of equipment break down then it should be repaired in a timely manner.

- **Operations**: Once a capable system is in place, then it is the operator's responsibility to deliver safe drinking water through monitoring, testing and process control (for example by changing the setting on the dosing pumps). Operators are also responsible for maintaining records (log books, data forms, etc.), which aid in troubleshooting and design of upgrades. A further, and commonly unrecognized responsibility of the operator is to communicate the needs of the facility to administrators for possible action.

WATER SAMPLING

To comply with drinking water legislation, drinking water systems are required to monitor their water quality. Haldimand County has committed to providing safe, reliable drinking water and is diligent in ensuring that sampling and monitoring programs effectively characterize water quality. All samples are taken by certified operators and tests performed by accredited, licensed laboratories.

Microbiological Sampling

Microbial quality is one of the primary indicators for the safety of a drinking water supply. Of all contaminants in drinking water, human and/or animal feces present the greatest danger to public health. Pathogenic or disease causing microorganisms (including certain protozoa, bacteria or viruses) may be found in untreated water supplies. Bacteriological monitoring and testing is a way to detect and control pathogenic bacteria in treated drinking water supplies. Heterotrophic Plate Count (HPC) and background bacteria samples are monitored to identify potential changes in water quality and are not used as an indicator of adverse human health effects. Table 2 provides a summary of microbiological sampling completed in the Nanticoke Drinking Water System during 2018.

Table 2: 2018 Nanticoke Drinking Water System Microbiological Sampling

	Number of Samples	Range of E.coli Results (cfu/100ml)	Range of Total Coliform Results (cfu/100ml)	Number of HPC Samples	Range of HPC Results (cfu/ml)	Number of Background Samples	Range of Background Results (cfu/ml)
Raw	156	0 – 100	6– 42,000	N/A	N/A	N/A	N/A
Treated	156	0	0 - 2	156	0 – 103	N/A	N/A
Industrial Park Distribution System	52	0	0	52	0 - 1	52	0
Townsend Distribution System	104	0	0	104	0 - 2	52	0 - 73
Jarvis Distribution System	52	0	0	52	0 – 4	52	0
Hagersville Booster Station	104	0	0	102	0 - 10	N/A	N/A
Hagersville Distribution System	104	0	0	104	0 – 7	52	0

*****Note: At a minimum, 25% of all drinking water samples must be analyzed for HPC.

Operational Sampling

Operational sampling and monitoring is important in maintaining the integrity of each barrier in the multi-barrier approach. Schedules 7 and 8 of Ontario Regulation 170/03, specify requirements for operational checks that municipalities must follow. Table 3 provides a summary of operational samples taken for the drinking water system. Regulatory requirements were achieved for filtered water turbidity and efforts continue to consistently achieve settled and filter targets. Disinfection regulatory requirements and operational targets were consistently achieved in 2018.

Table 3: 2018 Nanticoke Drinking Water System Operational Sampling

	Number of Grab Samples	Range of Results	Regulatory Requirement	Recommended Target
Raw Turbidity	8760	0.2 5- 68.0	N/A	N/A
Settled Turbidity	8760	0.04 - 5.0	N/A	1.00 NTU
Filtered Turbidity	8760	0.02 - 0.40	≤ 0.30 in 95% of all monthly readings	0.10 NTU
Treated Turbidity	8760	0.01 - 10.0	N/A	≤ 5.00
Free Chlorine High Lift	8760	0.35-4.69	≥ 0.05 mg/L	≥ 0.20 mg/L
Free Chlorine Industrial Park	104	0.79 – 1.49 mg/L	≥ 0.05 mg/L	≥ 0.20 mg/L
Free Chlorine Townsend	156	0.70 - 1.38 mg/L	≥ 0.05 mg/L	≥ 0.20 mg/L
Free Chlorine Jarvis	104	0.40 – 1.38 mg/L	≥ 0.05 mg/L	≥ 0.20 mg/L
Free Chlorine Hagersville Booster Station	102	0.77 – 1.42 mg/L	≥ 0.05 mg/L	≥ 0.20 mg/L
Free Chlorine Hagersville	156	0.35 – 1.48 mg/L	≥ 0.05 mg/L	≥ 0.20 mg/L

*****Note: 8760 is used for continuous monitoring.

Water treatment plant filters are backwashed to maintain or improve performance of the filters. The backwash water is discharged to a lagoon, which continuously discharges to Lake Erie. Municipal Drinking Water License number 066-102 specifies sampling requirements, summarized in Table 4, to monitor the discharge and ensure minimal impact to the natural environment.

Table 4: 2018 Nanticoke Water Treatment Plant Lagoon Sampling

Date of Legal Instrument Issued	Parameter	# of Samples	Annual Average (mg/L)	Regulatory Requirement
License 066-102 July 15, 2016	Backwash Lagoon Total Suspended Solids	51	2.5	Annual Average Concentration 25 mg/L

As result of public inquiries, a quarterly treated water hardness sampling program was initiated in 2018.

The term hardness was originally applied to waters that were hard to wash in, referring to the soap wasting properties of hard water. Hardness prevents soap from lathering by causing the development of an insoluble curdy precipitate in the water; hardness typically causes the buildup of hardness scale (such as seen in cooking pans). Dissolved calcium and magnesium salts are primarily responsible for most scaling in pipes and water heaters and can cause numerous problems in laundry, kitchen, and bath. Hardness is usually expressed in grains per gallon (or ppm) as calcium carbonate equivalent.

The degree of hardness standard as established by the American Society of Agricultural Engineers (S-339) and the Water Quality Association (WQA) is shown in the following table:

Table 5: Standard Degree of Hardness

Degree of Hardness	Grains per Gallon (gpg)	Ppm (mg/L)
Soft	< 1.0	< 17.0
Slightly Hard	1.0 – 3.5	17 - 60
Moderately Hard	3.5 – 7.0	60 - 120
Hard	7.0 – 10.5	120 - 180
Very Hard	> 10.5	> 180

The sample results in Table 6 indicate that the average values for the Nanticoke system ranges from 107-151 mg/L. This is a moderately hard to hard water as taken from the Degree of Hardness Table above.

Table 6: 2018 Nanticoke Drinking Water System Hardness Sampling

Parameter	Sample Date	Industrial Park	Townsend	Jarvis	Hagersville
Total Hardness (mg/L as $CaCO_3$)	March 1, 2018	118	116	132	134
	June 19, 2018	112	118	120	118
	September 18, 2018	116	76	144	236
	November 6, 2018	112	116	120	116
	2018 Average ------>	**115**	**107**	**129**	**151**

Lead Sampling

The community lead testing program is a requirement of O. Reg. 170/03 under the Safe Drinking Water Act, 2002. Haldimand County is exempt from sampling private residences due to having less than 10% of plumbing sample locations exceed the standard for two consecutive periods of reduced sampling. Annual pH and alkalinity samples are taken, as well as distribution system lead samples every three years. There are no regulatory limits for alkalinity and pH, however Haldimand County sample results are within the operational guidelines provided by the MECP. A summary of 2018 sampling has been provided in Table 7.

Table 7: 2018 Nanticoke Drinking Water System Lead Sampling

	Sample Type	Number of Samples	Range of Results	Number of Exceedances
Industrial Park	Plumbing - Lead	N/A	N/A	N/A
	Distribution - Lead	2	.02 - .10 ug/L	0
	Distribution - Alkalinity	2	95 - 96 mg/L	N/A
	Distribution - pH	2	7.85 – 8.02	N/A
Townsend	Plumbing - Lead	N/A	N/A	N/A
	Distribution - Lead	2	.01 - .08 ug/L	0
	Distribution - Alkalinity	2	96 mg/L	N/A
	Distribution - pH	2	7.72 – 8.09	N/A
Jarvis	Plumbing - Lead	N/A	N/A	N/A
	Distribution - Lead	2	.01 - .07 ug/L	0
	Distribution - Alkalinity	2	94 - 99 mg/L	N/A
	Distribution - pH	2	7.90 – 7.92	N/A
Hagersville	Plumbing - Lead	N/A	N/A	N/A
	Distribution - Lead	2	.01 - .14 ug/L	0
	Distribution - Alkalinity	2	95 – 97 mg/L	N/A
	Distribution - pH	2	7.92 - 7.99	N/A

Organic Sampling

To protect drinking water from pathogens, a disinfectant (usually chlorine) is added to the drinking water. Disinfectants can react with naturally-occurring materials in the water to form disinfection byproducts (DBP), which may pose health risks.

A challenge for water systems is balancing pathogen control and disinfection byproduct formation. It is important to provide protection from pathogens while minimizing health risks from disinfection byproducts. More information on each byproduct is summarized in Table 6.

Haldimand County sample for haloacetic acids (HAA) and trihalomethanes (THM) at the water treatment plant and in the distribution system where there is an elevated potential for the formation of these byproducts. Although a treatment sample and individual distribution system samples are not required by regulation, these samples are used to monitor byproduct formation within the drinking water system.

Table 8: Disinfection Byproduct Information

Disinfection Byproduct	How it is formed?	Health Effects
Trihalomethanes	Trihalomethanes occur when naturally-occurring organic and inorganic materials in the water react with the disinfectants, chlorine and chloramine.	Some people who drink water containing total trihalomethanes in excess of the MCL over many years could experience liver, kidney, or central nervous system problems and an increased risk of cancer.
Haloacetic Acids	Haloacetic acids occur when naturally-occurring organic and inorganic materials in the water react with the disinfectants, chlorine and chloramine.	Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.

Regulatory reporting is based on a running annual average of quarterly sample results using the worst case scenario. The calculated THM and HAA averages were below the maximum allowable concentrations (MAC) permitted by the MECP. Table 9 provides a summary of 2018 disinfection byproduct sampling.

Table 9: 2018 Nanticoke Drinking Water System DBP Sampling

Parameter	Sample Location	Sample Date	Sample Results (ug/L)	Annual Average (ug/L)	Regulatory MAC (ug/L)	Exceedance
Haloacetic Acids	Nanticoke WTP	February 5, 2018 April 30, 2018 August 7, 2018 November 5, 2018	11.5 15.5 13.9 17.9	14.7	80	**No**
	Industrial Park Distribution	February 13, 2018 May 7, 2018 August 7, 2018 November 5, 2018	17.4 9.7 25.3 7.9	15.1	80	**No**
	Townsend Distribution	February 13, 2018 May 7, 2018 August 7, 2018 November 5, 2018	17.5 10.4 21.7 18.9	17.1	80	**No**
	Jarvis Distribution	February 13, 2018 May 7, 2018 August 7, 2018 November 5, 2018	21.9 18.8 19.9 20.3	20.2	80	**No**
	Hagersville Distribution	February 13, 2018 May 7, 2018 August 7, 2018 November 5, 2018	22.2 25.7 18.4 22.5	22.2	80	**No**

Table 9: 2018 Nanticoke Drinking Water System DBP Sampling

Table 9: 2018 Nanticoke Drinking Water System DBP Sampling (continued)

Parameter	Sample Location	Sample Date	Sample Results (ug/L)	Annual Average (ug/L)	Regulatory MAC (ug/L)	Exceedance
Trihalomethanes	Nanticoke WTP	February 5, 2018 April 30, 2018 August 7, 2018 November 5, 2018	20.1 32.3 32.2 27.6	28.1	100	**No**
	Industrial Park Distribution	February 13, 2018 May 7, 2018 August 7, 2018 November 5, 2018	21 32 54 30	34.3	100	**No**
	Townsend Distribution	February 13, 2018 May 7, 2018 August 7, 2018 November 5, 2018	25 33 56 40	38.5	100	**No**
	Jarvis Distribution	February 13, 2018 May 7, 2018 August 7, 2018 November 5, 2018	29 37 57 46	42.3	100	**No**
	Hagersville Distribution	February 13, 2018 May 7, 2018 August 7, 2018 November 5, 2018	32 46 76 53	**51.8[1]**	100	**No**

[1] Result exceeded half the standard prescribed in Schedule 2 on the Ontario Drinking Water Quality Standards.

Additional sample results for organic and inorganic parameters are located in the appendices.

WATER USE

Raw Water

The Nanticoke Drinking Water System's raw water source is Lake Erie. A Permit to Take Water (PTTW) specifies the maximum volume of raw water that can be taken from the water source and conveys MECP site-specific regulatory requirements. Haldimand County has a large volume of available raw water capacity, however an interim limit of 437 MLD is in place until a number of conditions have been satisfied. When comparing the 2018 maximum raw water flow and the interim permit limits (Figure 2), 79.7% of Haldimand County's raw water allotment was available for use.

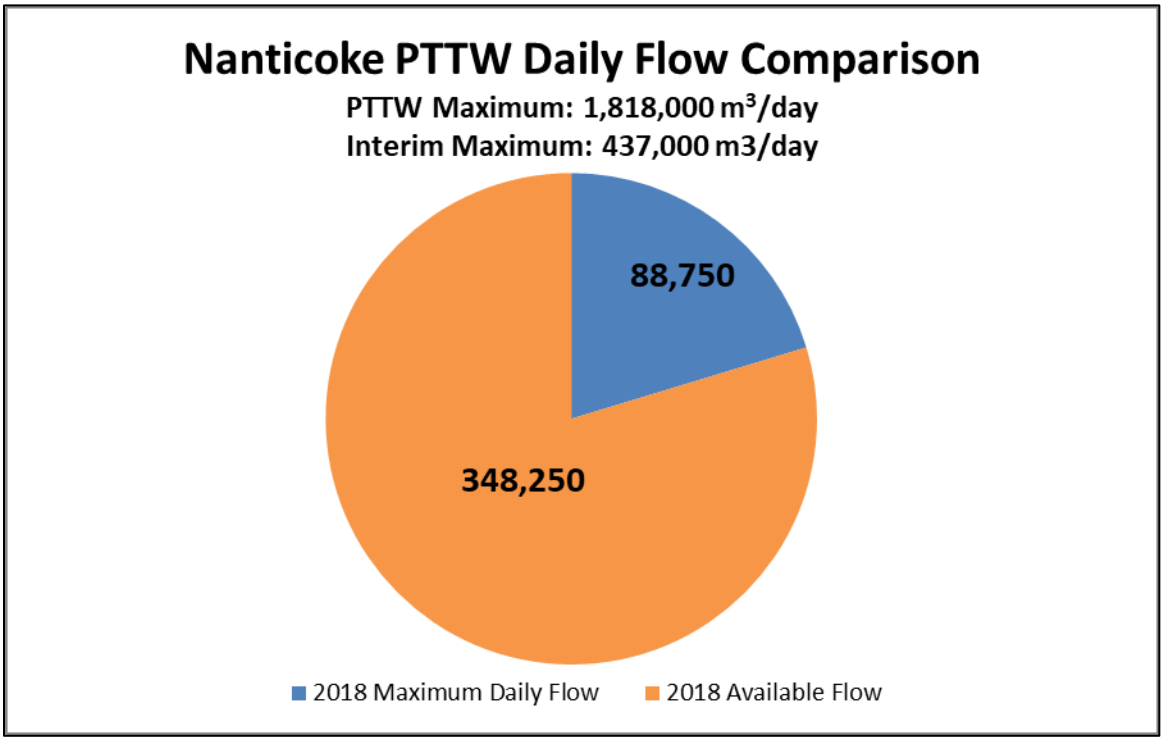

***Figure 2*: Nanticoke Permit To Take Water Flow Comparison**

Potable Water

As required by Schedule 22 of Ontario Regulation 170/03, Table 10, Table 11 and Figure 3 are intended to provide a summary of potable water supplied by the Nanticoke Drinking Water System in 2018.

Table 10: 2018 Nanticoke Monthly Potable Water Flow Data

System	Month	Monthly Total m^3	Daily Average m^3/d	Maximum Daily Flow m^3/d	Maximum Daily Peak Flow L/s
Nanticoke Drinking Water System	January	180,986	5,838	7,685	277.9
	February	163,352	5,834	8,518	251.2
	March	178,284	5,751	6,722	273.4
	April	181,574	6,053	8,218	265.0
	May	213,267	6,891	8,450	252.1
	June	207,322	6,911	7,902	250.5
	July	216,135	6,972	8,282	278.6
	August	209,885	6,770	8,220	262.5
	September	176,828	5,894	6,938	253.6
	October	198,120	6,391	7,321	274.7
	November	188,223	6,274	7,684	265.4
	December	195,727	6,314	7,530	249.2

Figure 3 compares the monthly flows over the last five years at the Nanticoke Water Treatment Plant. When comparing the average monthly flows for 2017 and 2018, there was a 9.71% increase in potable water supplied to the distribution system.

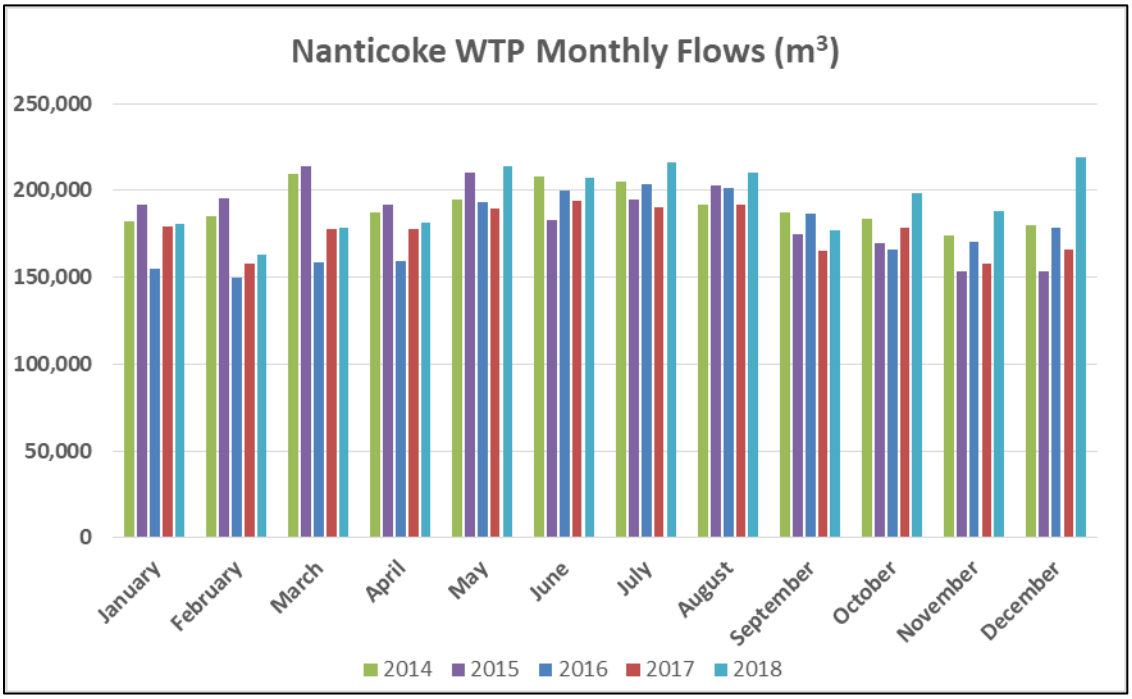

***Figure 3*: Nanticoke WTP Five Year Monthly Potable Flow Comparison**

Based on the most recent plant upgrade, the facility has a rated capacity of 13,636 cubic metres per day. When compared against the maximum daily flow for 2018, the Nanticoke Water Treatment Plant is operating at approximately 63% of design capacity, however this calculation does not take into account any operational and infrastructure limitations.

Table 11: Comparison of Rated Capacity and 2017 Maximum Flow Rate

System and Municipal Drinking Water Licence	Rated Capacity (m^3/day)	Maximum Daily Flow (m^3)	Percentage of Capacity
Nanticoke 066-102	13,636	8,518	62.5 %

To ensure the water treatment facility is capable of meeting current and projected demands, Haldimand County staff annually review plant capability and performance and update development allocation accordingly.

REGULATORY COMPLIANCE

Adverse Water Quality Incidents

Regulatory compliance requires reporting adverse water quality incidents to the Ministry of Health (MOH) and the MECP. In all instances, corrective action is initiated to resolve the issue. A summary of the incidents and corrective actions is provided in Table 12.

Table 12: 2018 Nanticoke Drinking Water System Reported Adverse Events

Incident Date	Parameter	Result	Corrective Action	Date Resolved
July 17, 2018	Total Coliforms	Nanticoke WTP East Reservoir 2 cfu/100 mL	Isolated the location. Resampled – upstream, downstream and at the original adverse location.	July 19, 2018

Corrective actions are based on each incident and is determined through discussion with the MOH. For each adverse identified in Table 10, resamples were taken at the source of the adverse and upstream and downstream locations. All samples were negative for the presence of total coliform bacteria.

Annual Drinking Water Inspection

The MECP annually confirms compliance with drinking water legislation by conducting inspections on drinking water systems. All aspects of the drinking water system are reviewed, including treatment equipment, disinfection, training records, and operational data required under the Safe Drinking Water Act, Ontario Regulations 170/03, 169/03 and 128/04. These inspections provide Haldimand County and Veolia Water an opportunity to review best management practices and work towards continually improving the operation and management of the drinking water systems. Any issues of regulatory non-compliance are identified and corrective actions issued.

The findings for the 2018 annual drinking water system inspections is included in this report. Below is a summary of the key findings for the inspection:

Nanticoke Drinking Water System – Waterworks # 210001558

There was one non-compliance identified during the 2018 inspection period. As a result of the non-compliances, the County received a **96.9%** inspection rating from the MECP.

The following issues were identified during the drinking water inspection:

1. The owner had not ensured that all equipment was installed in accordance with Schedule A and Schedule C of the drinking Water Works Permit.

   Follow-Up: At the time of the physical inspection, only one sodium hypochlorite chemical feed pump was installed at the Hagersville Booster Pumping Station. The booster pump was re-installed prior to the final inspection report being issued and the MECP required no additional actions.

During each inspection, the Ministry may provide recommendations and best practices specific to each drinking water system. No recommendations were identified during the 2018 drinking water inspection.

Haldimand County continues to work closely with regulatory bodies to ensure a continued supply of safe, reliable drinking water to its users. All recommendations have been addressed and communicated to the MECP.

REPORT AVAILABILITY

This report can be viewed online at:

https://www.haldimandcounty.ca/drinking-water/

Reports can also be obtained upon request at any Haldimand County Satellite Office:

Cayuga Administration Building
45 Munsee Street North
PO Box 400
Cayuga, ON N0A 1E0

Phone: 905-318-5932
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Appendix A

Inorganic and Organic Sample Results

Inorganic Parameters:

Parameter	Sample Date	Result Value	Unit of Measure	Exceedance
Antimony	February 26, 2018	**ND**	ug/L	No
Arsenic	February 26, 2018	**ND**	ug/L	No
Barium	February 26, 2018	22	ug/L	No
Boron	February 26, 2018	**ND**	ug/L	No
Cadmium	February 26, 2018	**ND**	ug/L	No
Chromium	February 26, 2018	**ND**	ug/L	No
Fluoride	February 26, 2018	**ND**	mg/L	No
Mercury	February 26, 2018	**ND**	mg/L	No
Nitrite	February 5 2018 April 30, 2018 August 7, 2018 November 5, 2018	**ND**	mg/L	No
Nitrate	February 5 2018 April 30, 2018 August 7, 2018 November 5, 2018	0.291 0.331 0.099 0.314	mg/L	No
Selenium	February 26, 2018	**ND**	ug/L	No
Sodium	February 26, 2018	14.5	mg/L	No
Uranium	February 26, 2018	**ND**	ug/L	No

ND = Not Detectable

Organic Parameters:

Parameter	Sample Date	Result Value	Unit of Measure	Exceedance
Alachlor	February 26, 2018	**ND**	ug/L	No
Atrazine + Metabolites	February 26, 2018	**ND**	ug/L	No
Azinphos-methyl	February 26, 2018	**ND**	ug/L	No
Benzene	February 26, 2018	**ND**	ug/L	No
Benzo(a)pyrene	February 26, 2018	**ND**	ug/L	No
Bromoxynil	February 26, 2018	**ND**	ug/L	No
Carbaryl	February 26, 2018	**ND**	ug/L	No
Carbofuran	February 26, 2018	**ND**	ug/L	No
Carbon Tetrachloride	February 26, 2018	**ND**	ug/L	No
Chlorpyrifos	February 26, 2018	**ND**	ug/L	No
Diazinon	February 26, 2018	**ND**	ug/L	No
Dicamba	February 26, 2018	**ND**	ug/L	No
1,2-Dichlorobenzene	February 26, 2018	**ND**	ug/L	No
1,4- Dichlorobenzene	February 26, 2018	**ND**	ug/L	No
1,2- Dichloroethane	February 26, 2018	**ND**	ug/L	No
1,1- Dichloroethylene	February 26, 2018	**ND**	ug/L	No
Dichloromethane (Methylene Chloride)	February 26, 2018	**ND**	ug/L	No
2,4- Dichlorophenol	February 26, 2018	**ND**	ug/L	No
2,4- Dichlorophenoxy acetic acid (2,4-D)	February 26, 2018	**ND**	ug/L	No
Diclofop-methyl	February 26, 2018	**ND**	ug/L	No
Dimethoate	February 26, 2018	**ND**	ug/L	No
Diquat	February 26, 2018	**ND**	ug/L	No
Diuron	February 26, 2018	ND	ug/L	No
Glyphosate	February 26, 2018	ND	ug/L	No
Malathion	February 26, 2018	**ND**	ug/L	No
MCPA	February 26, 2018	**ND**	ug/L	No
Metolachlor	February 26, 2018	**ND**	ug/L	No
Metribuzin	February 26, 2018	**ND**	ug/L	No
Monochlorobenzene (Chlorobenzene)	February 26, 2018	**ND**	ug/L	No
Paraquat	February 26, 2018	**ND**	ug/L	No
Pentachlorophenol	February 26, 2018	**ND**	ug/L	No
Phorate	February 26, 2018	**ND**	ug/L	No
Picloram	February 26, 2018	**ND**	ug/L	No
Prometryne	February 26, 2018	**ND**	ug/L	No
Simazine	February 26, 2018	**ND**	ug/L	No
Terbufos	February 26, 2018	**ND**	ug/L	No
Tetrachloroethylene	February 26, 2018	**ND**	ug/L	No
2,3,4,6- Tetrachlorophenol	February 26, 2018	**ND**	ug/L	No
Total PCBs	February 26, 2018	**ND**	ug/L	No
Triallate	February 26, 2018	**ND**	ug/L	No
Trichloroethylene	February 26, 2018	**ND**	ug/L	No
2,4,6- Trichlorophenol	February 26, 2018	**ND**	ug/L	No
Trifluralin	February 26, 2018	**ND**	ug/L	No
Vinyl Chloride	February 26, 2018	**ND**	Ug/L	No

ND = Not Detectable

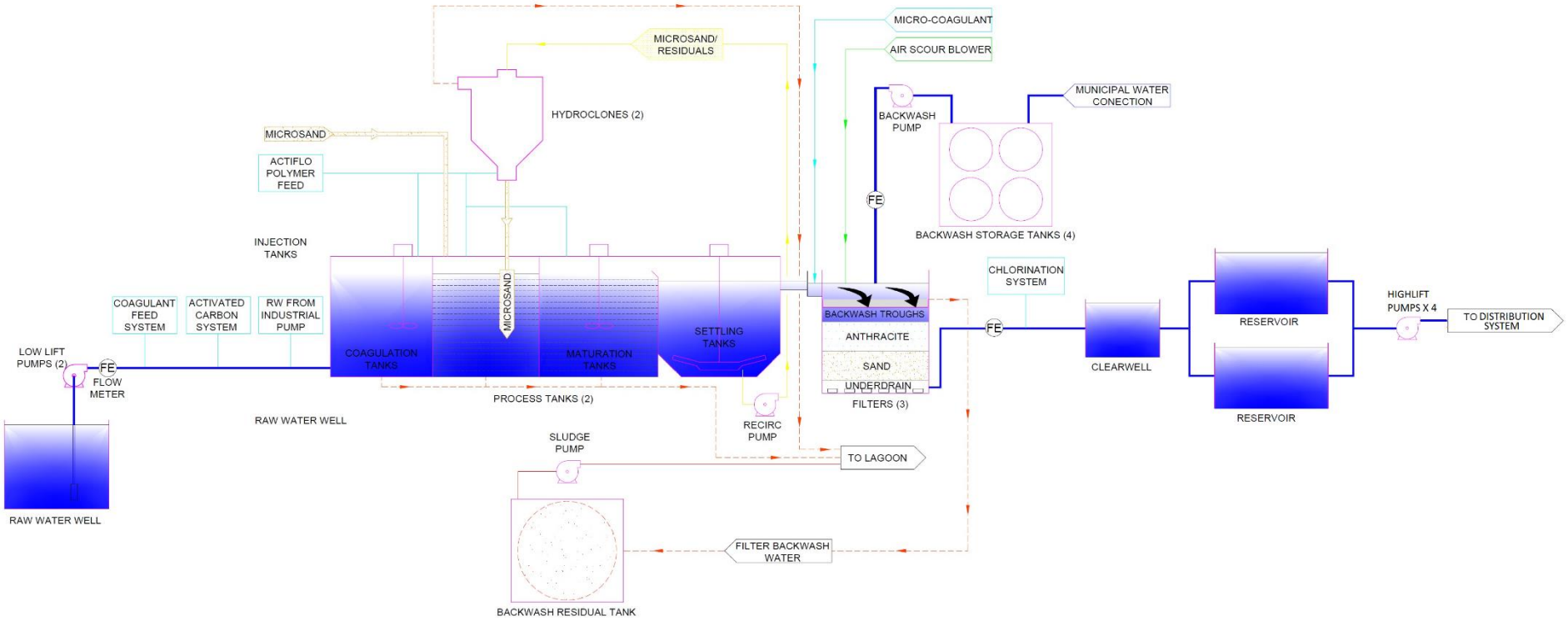
Microcystin Sample Results

Parameter	Sample Date	Raw Water Results	Treated Water Results	Unit of Measure	Exceedance
Microcystin	May 7, 2018	ND	ND	mg/L	No
	May 14, 2018	ND	ND		
	May 22, 2018	ND	ND		
	May 28, 2018	ND	ND		
	June 4, 2018	ND	ND		
	June 11, 2018	ND	ND		
	June 18, 2018	ND	ND		
	June 25, 2018	ND	ND		
	July 3, 2018	ND	ND		
	July 9, 2018	ND	ND		
	July 16, 2018	ND	ND		
	July 23, 2018	ND	ND		
	July 30, 2018	ND	ND		
	August 7, 2018	ND			
	August 13, 2018	ND	ND		
	August 20, 2018	ND	ND		
	August 27, 2018	ND	ND		
	Sept. 4, 2018	ND	ND		
	Sept. 10, 2018	ND	ND		
	Sept. 17, 2018	ND	ND		
	Sept. 24, 2018	ND	ND		
	October 1, 2018	ND	ND		
	October 9, 2018	0.12	ND		
	October 15, 2018	ND	ND		
	October 22, 2018	ND	ND		
	October 29, 2018	ND	ND		

ND = Not Detectable

Hardness Sample Results:

Parameter	**Sample Date**	Industrial Park	Townsend	Jarvis	Hagersville
Total Hardness (mg/L as $CaCO_3$)	March 1, 2018	118	116	132	134
	June 19, 2018	112	118	120	118
	September 18, 2018	116	76	144	236
	November 6, 2018	112	116	120	116
	2018 Average ----->	**115**	**107**	**129**	**151**



SIMPLIFIED PROCESS FLOW DIAGRAM

NANTICOKE WATER TREATMENT PLANT