Dunnville Drinking Water System
2021 Annual Water Quality Report

January 1, 2021 – December 31, 2021

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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

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, 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 and updated in 2021, with focus on Document and Records Control (Element 5) and Continual Improvement (Element 21) all while incorporating organizational changes within the County.

Internal audits were completed with support from Water and Wastewater Operations staff and Aclaims Environmental. No non-conformities were identified as a result of the internal audit. The audit report did note four areas for opportunities for improvement.

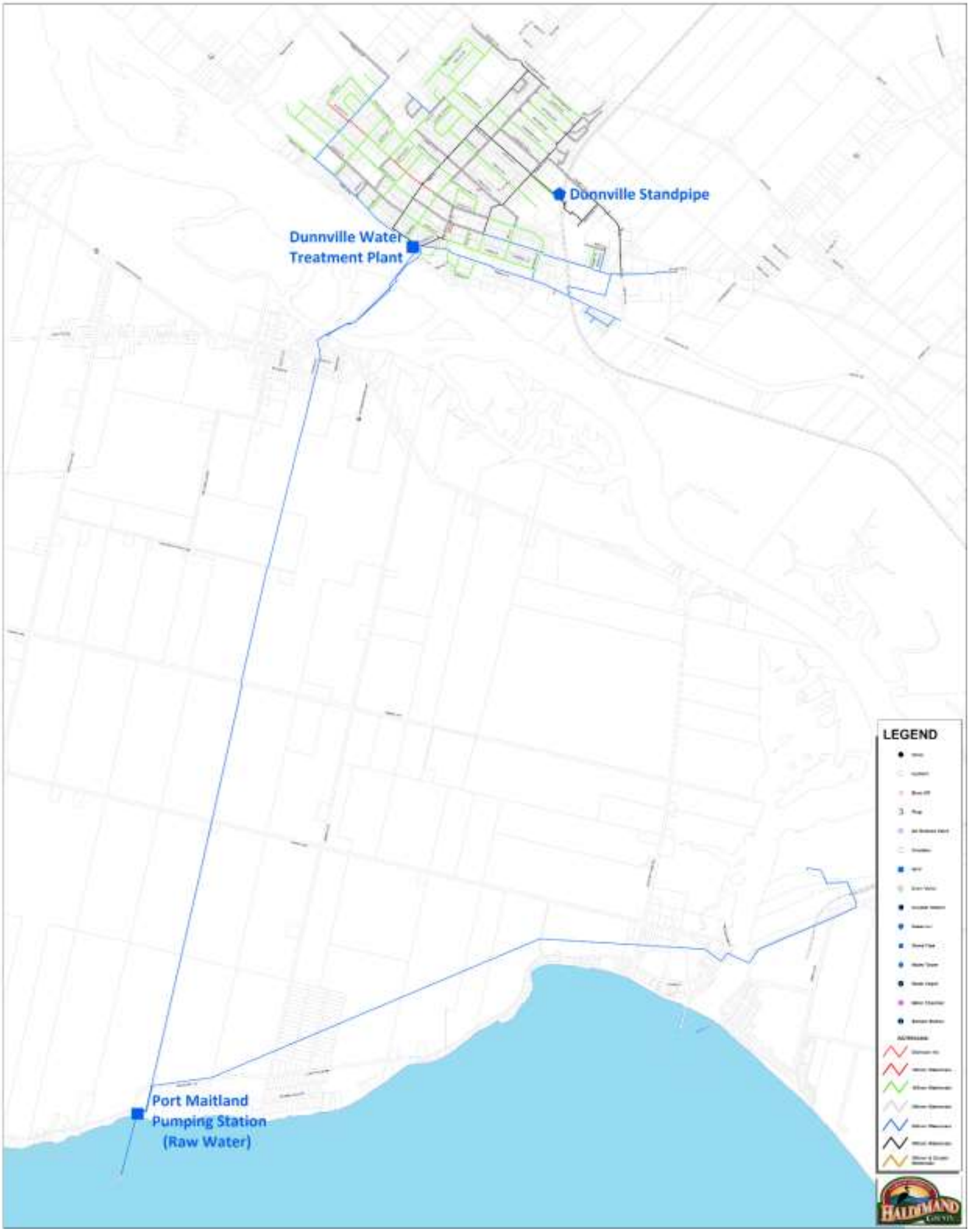
Haldimand County must receive accreditation annually to operate the water distribution systems. Through a qualified third party auditor, the County must demonstrate that its QMS (Quality Management System) meets the requirements of the DWQMS (Drinking Water Quality Management Standard). SAI Global conducted an external audit on November 9th, 2021. The County received one minor non-conformance. This was a result of an administrative issue and corrective action was implemented immediately to resolve the issue.

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 October 29th, 2021.

All requirements were achieved in 2021 and SAI Global have issued an accreditation certificate to Haldimand County, which allows us to continue to operate the water distribution systems.

As part of the agreement with the County and through the regulations, Ontario Clean Water Agency (OCWA) must obtain accreditation to operate the water treatment facilities on behalf of the County. November 11, 2021 OCWA obtained full scope accreditation under the requirements of DWQMS.

DUNNVILLE DRINKING WATER SYSTEM



Dunnville Drinking Water System Overview

The Dunnville Drinking Water System's primary raw water source is Lake Erie. Raw water is drawn into the Port Maitland Low Lift Pumping Station where it can be pre-chlorinated with sodium hypochlorite for zebra mussel control. Raw water is then pumped through approximately ten kilometres of raw water transmission watermain to the Dunnville Water Treatment Plant. Raw water is also supplied to industrial users in Port Maitland.

There is also a raw water intake located in the Grand River. This raw water source has not been used to supply the treatment plant since the early 2000's, however it is available for use in an emergency situation.

The Dunnville Water Treatment Plant is a conventional water treatment plant with a rated capacity of 14,500 m^3/day. A coagulant (Aluminum Sulphate was used in 2021) is injected into raw water and undergoes flash mixing. Water then flows through a series of flocculation and sedimentation tanks to five dual media filters containing sand and granular activated carbon. Following filtration, the water is disinfected with sodium hypochlorite and stored in two reservoirs. High lift pumps deliver potable water to the Dunnville Water Distribution System.

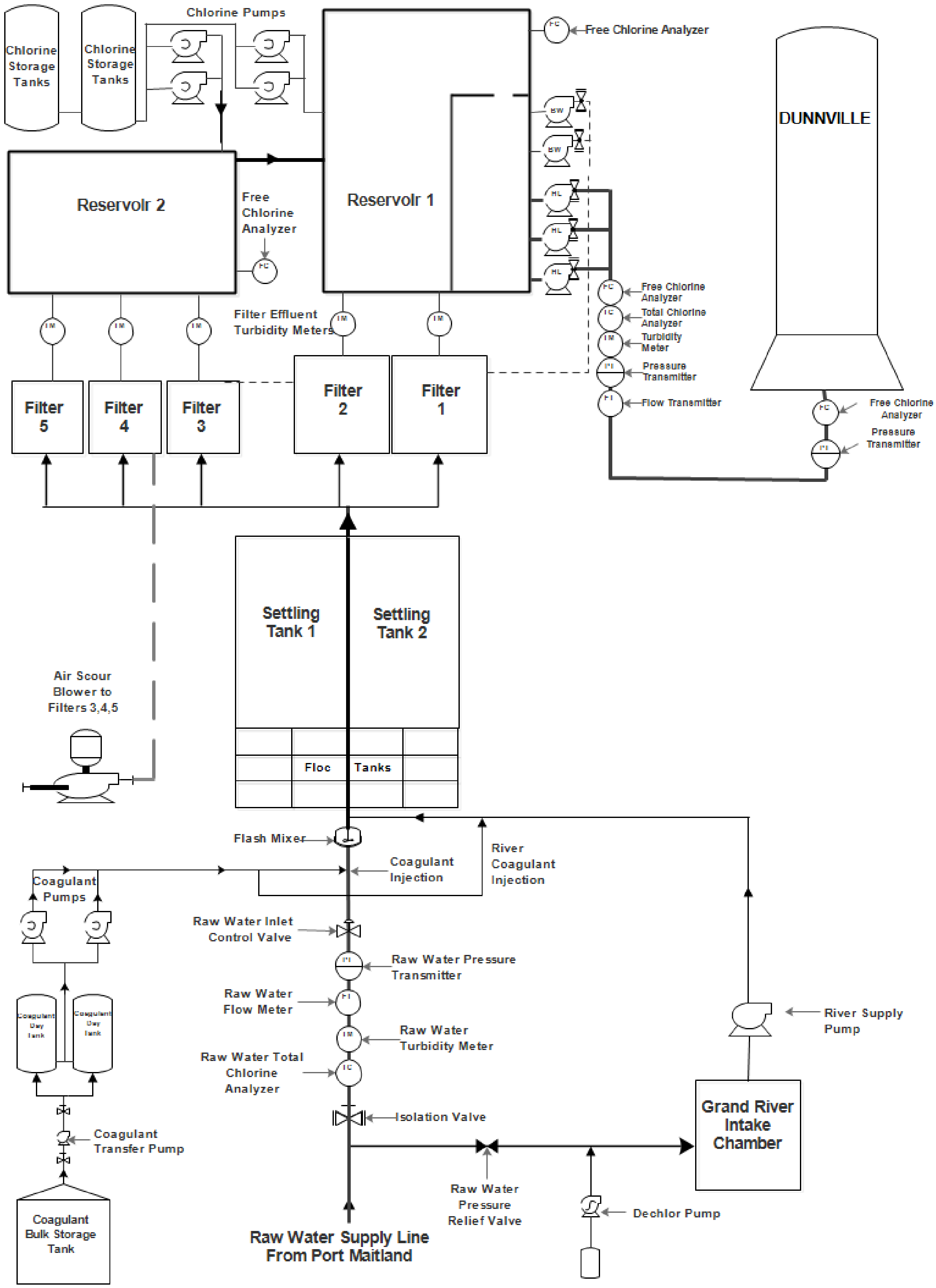


***Figure 1*: Dunnville Water Treatment Plant Schematic**

The water distribution system utilizes a standpipe for storage and to maintain water pressure. A bulk water depot provides potable water to rural residents and bulk water haulers.

The distribution system infrastructure services approximately 5,759 people (2016 Census).

Ontario Clean Water Agency operates and maintains the raw water transmission mains, low lift pumping station, water treatment plant, and the standpipe. Haldimand County operates and maintains the distribution system, including the bulk water depots.

Expenditure Information

Haldimand County and its contract operators are diligent in prioritizing projects on an annual basis to eliminate unnecessary expenditures. Using the best available information at the time of this report, expenses incurred in the Dunnville Drinking Water System for 2021 are identified in Table 1. All drinking water expenditure information is not included in this report.

Table 1: Dunnville Drinking Water System 2021 Expenditures

Dunnville Drinking Water System:		
Dunnville WTP Coagulant Static Mixer Replacement		
Port Maitland Raw Water Pump Facility Installation of New Bar Screens		
Port Maitland Wet Wells Sluice Gates Repair		
Port Maitland Intake Housing Reset		
	Total Cost:	$212,000

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**
    - ***Chlorine 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 operation work together to establish and maintain multi-barrier protection (US EPA, 1998).

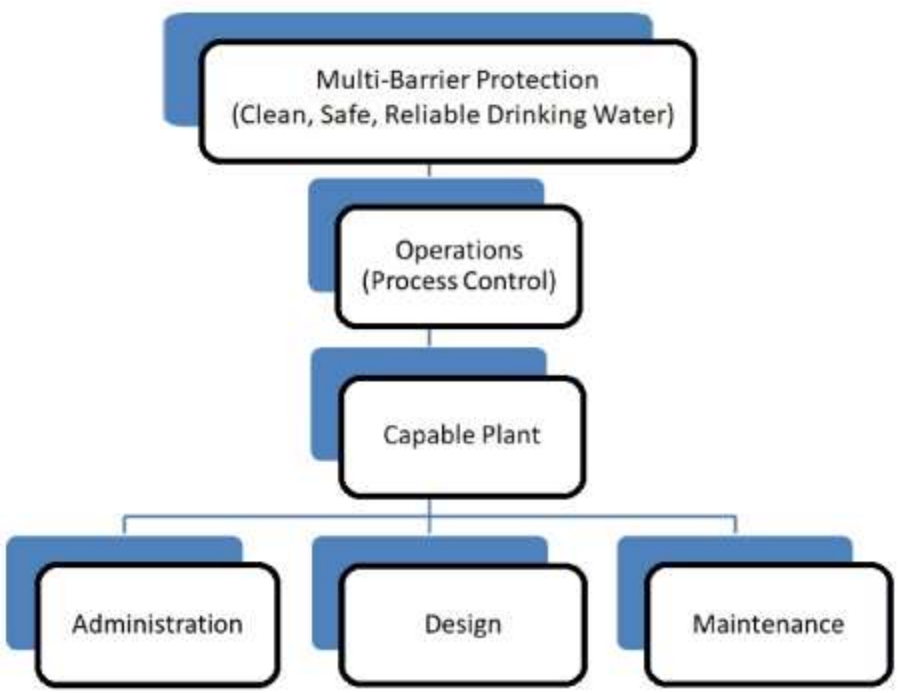


Figure 2: **Responsibilities for Clean, Safe and Reliable Drinking Water**

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 micro-organisms (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) 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 Dunnville Drinking Water System during 2021.

Table 2: 2021 Dunnville 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 – Lake Erie	52	1– 120	1– 5200	N/A	N/A	N/A	N/A
Raw at WTP	52	1- 90	1 – 5300	N/A	N/A	N/A	N/A
Raw – Grand River	52	1 – 2300	1 – 54000	N/A	N/A	N/A	N/A
Treated	156	0	0	156	0 - 10	123	0
Distribution System	260	0	0	104	0 - <10	249	0 - 48

*****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. Schedule 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 consistently achieved for filtered water turbidity and efforts continue to consistently achieve recommended settled and filter targets. Disinfection regulatory requirements and operational targets were consistently achieved in 2021.

Table 3: 2021 Dunnville Drinking Water System Operational Sampling

	Number of Grab Samples	Range of Results	Regulatory Requirement	Recommended Target
Raw Turbidity	8760	5.27-199.94	N/A	N/A
Settled Turbidity	8760	0.13-2.61	N/A	2.00 NTU
Filter Turbidity	8760	0.044-0.518	≤ 0.30 in 95% of all monthly readings	0.10 NTU
Treated Turbidity	8760	0.043- 5	N/A	≤ 5.00 NTU
Free Chlorine High Lift	8760	0.82 – 1.49	≥ 0.05 mg/L	≥ 0.20 mg/L
Free Chlorine Distribution System	416	0.37 - 1.31	≥ 0.05 mg/L	≥ 0.20 mg/L

*****Note: 8760 is used for continuous monitoring (24 samples per day * 365 days/year)

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

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 4: 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 5 indicate that the average value for Dunnville is considered to have hard water as taken from the Degree of Hardness Table above.

Table 5: 2021 Dunnville Drinking Water System Hardness Sampling

Parameter	Sample Date	Dunnville
Total Hardness (mg/L as $CaCO_3$)	February 25, 2021	144
	May 12, 2021	116
	August 25, 2021	144
	November 16, 2021	126
	2021 Average ----->	**133**

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 2021 sampling has been provided in Table 6.

Table 6: 2021 Dunnville Drinking Water System Lead Sampling

Location Type	Number of Samples	Range of Results (min) – (max)	Number of Exceedances
Plumbing - Lead	N/A	N/A	N/A
Distribution - Lead	3	0.10 – 0.19 µg/L	0
Distribution - pH	6	7.01 - 7.45	N/A
Distribution - Alkalinity	6	71 – 83 mg/L	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 7.

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 is not required by regulation, the sample is used to monitor byproduct formation within the drinking water system.

Table 7: 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. The calculated THM and HAA averages were below the maximum allowable concentrations (MAC) permitted by the MECP. Table 8 provides a summary of 2021 disinfection byproduct sampling.

Table 8: 2021 Dunnville Drinking Water System DBP Sampling

Parameter	Sample Date	Sample Results (ug/L)	Annual Average (ug/L)	Regulatory MAC (ug/L)	Exceedance
Haloacetic Acids Dunnville WTP	February 25, 2021 May 12, 2021 August 25, 2021 November 16, 2021	5.3 5.3 5.3 5.5	5.35	80	No
Haloacetic Acids Dunnville Distribution	February 25, 2021 May 12, 2021 August 19, 2021 November 16, 2021	5.3 5.9 18.4 12.2	10.45	80	No
Trihalomethanes Dunnville WTP	February 16, 2021 May 17, 2021 August 16, 2021 November 16, 2021	8.1 9.9 20 21	14.75	100	No
Trihalomethanes Dunnville Distribution	February 25, 2021 May 12, 2021 August 25, 2021 November 16, 2021	15 22 35 40	28	100	No

Additional sample results for organic and inorganic parameters can be found in the appendices.

WATER USE

Raw Water

The Dunnville 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. When comparing the 2021 maximum raw water flow and the permit limits (*Figure* 3), 77.2% of Haldimand County's raw water allotment was available for use.

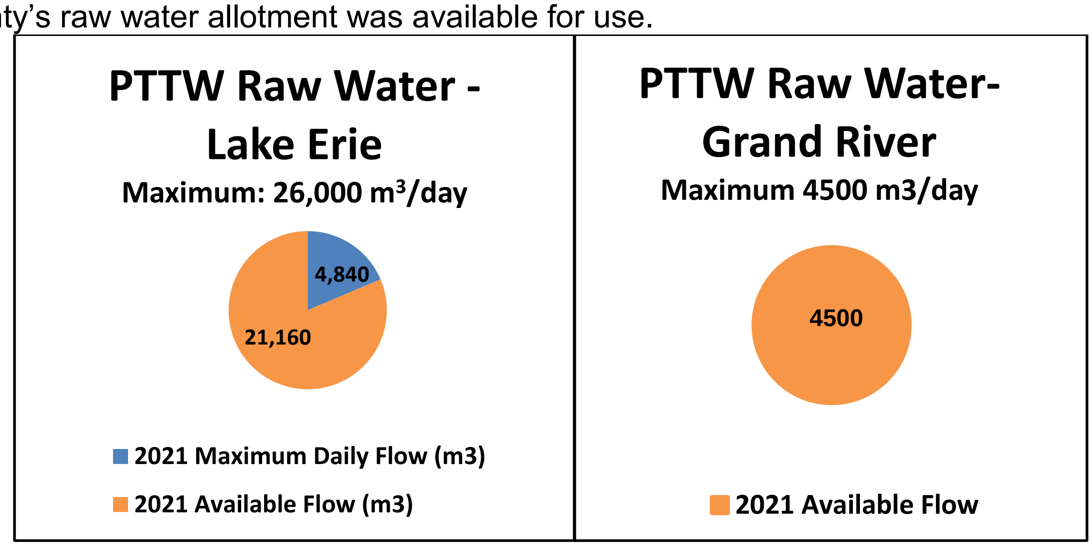


***Figure 3*: Dunnville Permit to Take Water (PTTW) Flow Comparisons**

Potable Water

As required by Schedule 22 of Ontario Regulation 170/03, Table 9, Table 10 and *Figure* 3 are intended to provide a summary of potable water supplied by the Dunnville Drinking Water System in 2021.

Table 9: 2021 Dunnville Monthly Potable Water Flow Data

System	Month	Monthly Total m^3	Daily Average m^3	Maximum Day m^3	Maximum Daily Flow Rate L/s
Dunnville Drinking Water System	**January**	84,772	2734	3613	96
	February	84956	3034	3808	174
	March	94783	3057	4017	107
	April	86678	2889	3862	105
	May	108130	3488	4990	104
	June	110406	3680	5053	113
	July	92432	2981	4367	111
	August	104777	3379	4793	104
	September	89906	2996	4063	128
	October	80785	2605	3241	103
	November	77238	2574	3542	113
	December	82824	2671	3556	108

Figure 4 compares the monthly flows over the last five years at the Dunnville Water Treatment Plant. When comparing the average monthly flows for 2020 and 2021, there was a 1.7% increase in potable water supplied to the distribution system.

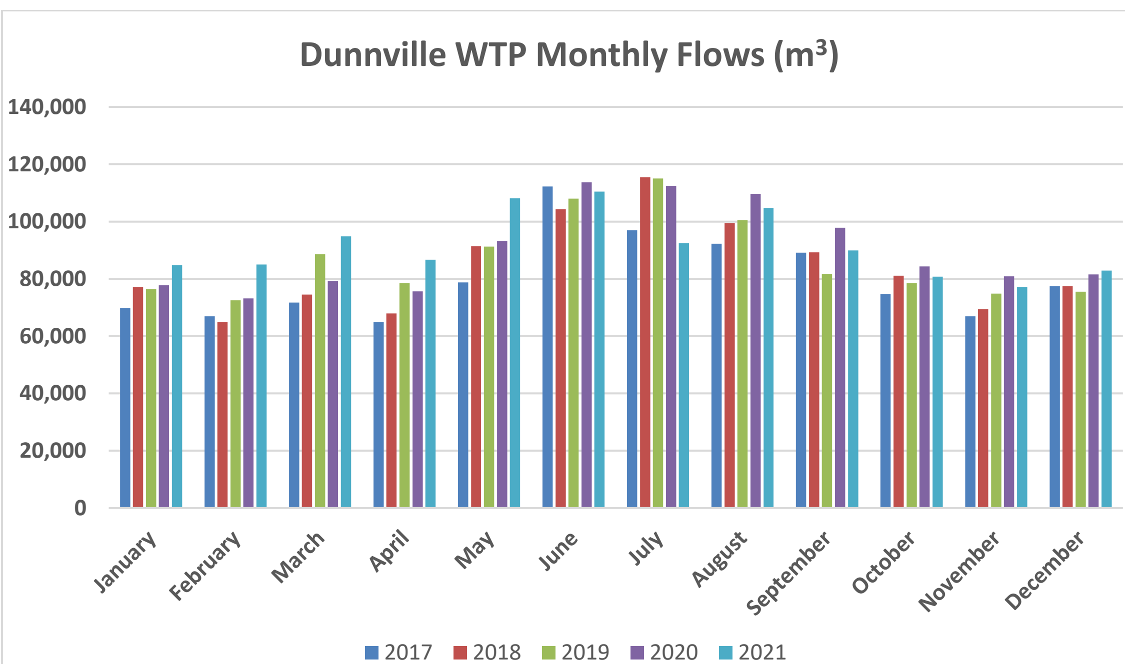


***Figure 4*: Dunnville Water Treatment Plant Five Year Monthly Potable Flow Comparison**

According to the Dunnville Water Treatment Plant's Engineer's Report, the facility has a rated capacity of 14,500 cubic metres per day. When compared against the maximum daily flow for 2021, the Dunnville Water Treatment Plant is operating at approximately 34.8% of design capacity, however this calculation does not take into account any operational and infrastructure limitations.

Table 10: Comparison of Rated Capacity and 2021 Maximum Flow Rate

System and Municipal Drinking Water License	Rated Capacity	Maximum Daily Flow (m^3 / day)	Percentage of Capacity
Dunnville 066-101	14,500 m^3/day	5,053 m^3/day	34.8 %

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 Ministry of the Environment, Conservation and Parks (MECP). In all instances, corrective action is initiated to resolve the issue. Over the 2021 period there were no adverse water quality incidents to report.

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 OCWA 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 2021 annual drinking water system inspection is included in this report. Below is a summary of the key findings for the inspection:

Dunnville Drinking Water System – DWS# 220003555

There were no non-compliance items identified during the 2021 inspection period. The County received a 100% inspection rating from the MECP.

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 the Haldimand County Administration Building:

Cayuga Administration Building
53 Thorburn St.
Cayuga, ON
N0A 1E0

For more information on report content, please contact the Haldimand County Environmental Operations Division at:

Email: wwwops@haldimandcounty.on.ca

Telephone: 905-318-5932

Appendix A

Inorganic and Organic Sample Results

Inorganic Parameters:

Parameter	Sample Date	Result Value	Unit of Measure	Exceedance
Antimony	March 1, 2021	ND	ug/L	No
Arsenic	March 1, 2021	0.3	ug/L	No
Barium	March 1, 2021	19.3	ug/L	No
Boron	March 1, 2021	17	ug/L	No
Cadmium	March 1, 2021	0.008	ug/L	No
Chromium	March 1, 2021	0.27	ug/L	No
Mercury	March 1, 2021	ND	mg/L	No
Nitrite	February 1,2021 May 3,2021 August 2,201 November 1,2021	ND	mg/L	No
Nitrate	February 1,2021 May 3,2021 August 2,201 November 1,2021	0.264 0.234 0.215 0.4	mg/L	No
Selenium	March 1, 2021	0.12	ug/L	No
Uranium	March 1, 2021	0.016	ug/L	No

ND = Not Detectable (below detection limit)

Organic Parameters:

Parameter	Sample Date	Result Value	Unit of Measure	Exceedance
Alachlor	March 1, 2021	ND	ug/L	No
Atrazine + Metabolites	March 1, 2021	ND	ug/L	No
Azinphos-methyl	March 1, 2021	ND	ug/L	No
Benzene	March 1, 2021	ND	ug/L	No
Benzo(a)pyrene	March 1, 2021	ND	ug/L	No
Bromoxynil	March 1, 2021	ND	ug/L	No
Carbaryl	March 1, 2021	ND	ug/L	No
Carbofuran	March 1, 2021	ND	ug/L	No
Carbon Tetrachloride	March 1, 2021	ND	ug/L	No
Chlorpyrifos	March 1, 2021	ND	ug/L	No
Diazinon	March 1, 2021	ND	ug/L	No
Dicamba	March 1, 2021	ND	ug/L	No
1,2-Dichlorobenzene	March 1, 2021	ND	ug/L	No
1,4- Dichlorobenzene	March 1, 2021	ND	ug/L	No
1,2- Dichloroethane	March 1, 2021	ND	ug/L	No
1,1- Dichloroethylene	March 1, 2021	ND	ug/L	No
Dichloromethane (Methylene Chloride)	March 1, 2021	ND	ug/L	No
2,4- Dichlorophenol	March 1, 2021	ND	ug/L	No
2,4- Dichlorophenoxy acetic acid (2,4-D)	March 1, 2021	ND	ug/L	No
Diclofop-methyl	March 1, 2021	ND	ug/L	No
Dimethoate	March 1, 2021	ND	ug/L	No
Diquat	March 1, 2021	ND	ug/L	No
Diuron	March 1, 2021	ND	ug/L	No
Glyphosate	March 1, 2021	ND	ug/L	No
Malathion	March 1, 2021	ND	ug/L	No
MCPA	March 1, 2021	ND	ug/L	No
Metolachlor	March 1, 2021	ND	ug/L	No
Metribuzin	March 1, 2021	ND	ug/L	No
Monochlorobenzene (Chlorobenzene)	March 1, 2021	ND	ug/L	No
Paraquat	March 1, 2021	ND	ug/L	No
Pentachlorophenol	March 1, 2021	ND	ug/L	No
Phorate	March 1, 2021	ND	ug/L	No
Picloram	March 1, 2021	ND	ug/L	No
Prometryne	March 1, 2021	ND	ug/L	No
Simazine	March 1, 2021	ND	ug/L	No
Terbufos	March 1, 2021	ND	ug/L	No
Tetrachloroethylene	March 1, 2021	ND	ug/L	No
2,3,4,6- Tetrachlorophenol	March 1, 2021	ND	ug/L	No
Total PCBs	March 1, 2021	ND	ug/L	No
Triallate	March 1, 2021	ND	ug/L	No
Trichloroethylene	March 1, 2021	ND	ug/L	No
2,4,6- Trichlorophenol	March 1, 2021	ND	ug/L	No
Trifluralin	March 1, 2021	ND	ug/L	No
Vinyl Chloride	March 1, 2021	ND	Ug/L	No

ND = Not Detectable

[1] Final quarterly Benzo(a)pyrene adverse resample required through Regulation 170 Schedule 24.

Microcystin Sample Results

Parameter	Sample Date	Raw Water Results		Treated Water Results	Unit of Measure	Exceedance
		Lake Erie	Grand River			
Microcystin	June 7, 2021	ND	ND	ND	ug/L	No
	June 17, 2021	ND	ND	ND		
	June 21, 2021	ND	ND	ND		
	June 28, 2021	ND	ND	ND		
	July 5, 2021	ND	ND	ND		
	July 12, 2021	ND	ND	ND		
	July 19, 2021	ND	ND	ND		
	July 26, 2021	ND	ND	ND		
	August 2, 2021	ND	ND	ND		
	August 9, 2021	ND	ND	ND		
	August 16, 2021	ND	ND	ND		
	August 23, 2021	ND	ND	ND		
	September 1, 2021	ND	ND	ND		
	September 9, 2021	ND	ND	ND		
	September 13,2021	ND	ND	ND		
	September 22,2021	ND	ND	ND		
	September 27,2021	ND	ND	ND		
	October 6,2021	ND	ND	ND		
	October 11, 2021	ND	ND	ND		
	October 18, 2021	ND	ND	ND		
	October 25, 2021	ND	ND	ND		

ND = Not Detectable