Caledonia and Cayuga Distribution System 2024 Annual Water Quality Report

January 1, 2024 to December 31, 2024

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Quality Management System Policy

The Corporation of Haldimand County owns, maintains and operates various drinking water systems. Haldimand County is committed to:

- Ensuring our drinking water systems comply with all current legislation and regulatory requirements for the safe supply of drinking water;
- Ensuring financial support is provided to maintain infrastructure integrity to allow safe and consistent delivery of drinking water to our water customers;
- Reviewing, maintaining and continually improving our Quality Management System and to communicate the Plan 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, 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 conducted 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 2024, with focus on Document and Records Control (Element 5), conforming to the DWQMS standards and Continual Improvement (Element 21) while incorporating organizational changes within the County.

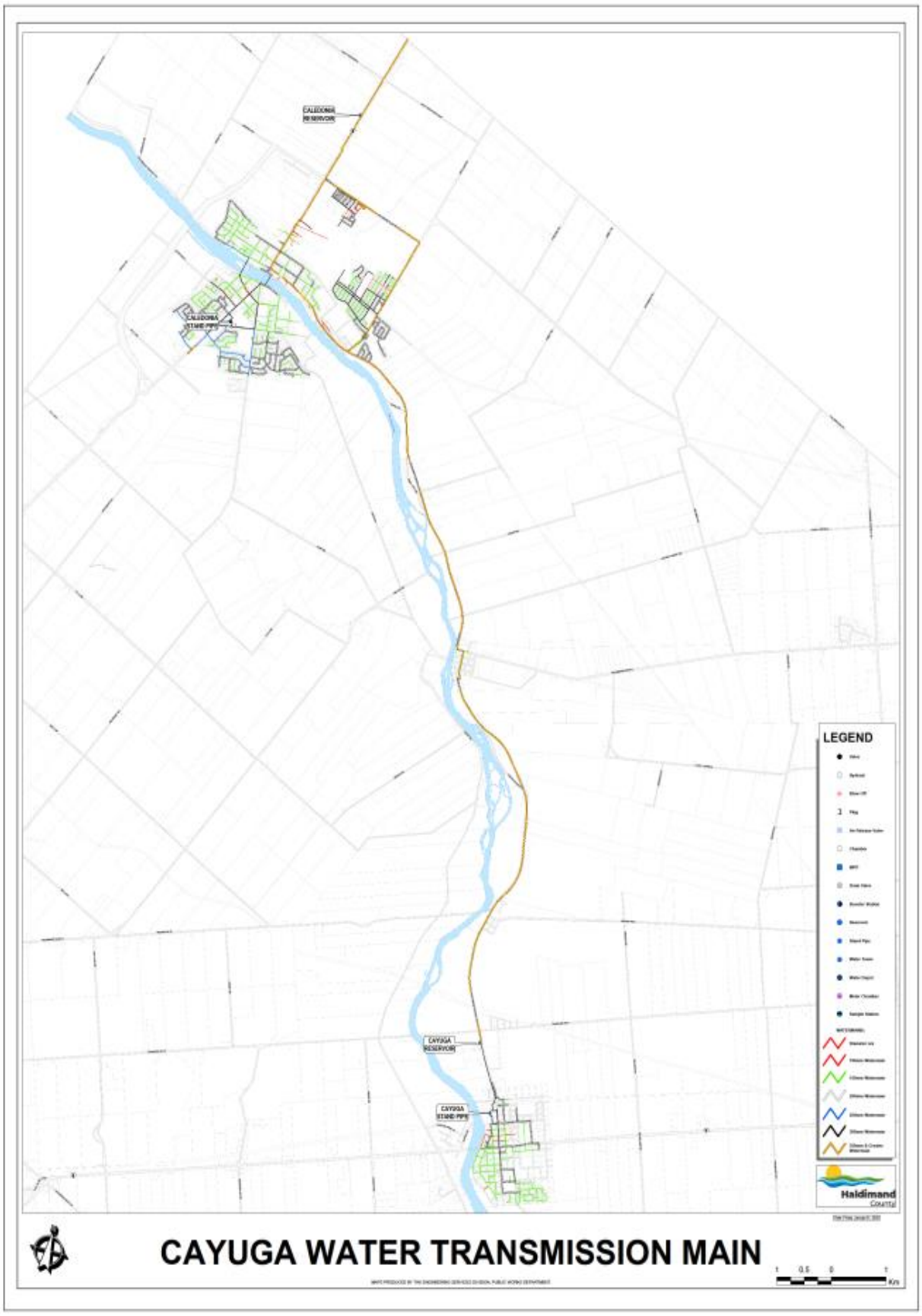
Internal audits were completed with support from Environmental Operations staff. Extra support from other County staff during internal audits would increase the coverage to ensure the system is conforming and efficient. No non-conformities were identified as a result of the internal audit. The audit report did note two 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). Intertek conducted a re accreditation audit on February 28 and 29, 2024. The County received three minor non-conformances. These were deemed to be minor and administrative in nature with no immediate risk to the drinking water system. Root cause analysis was conducted and preventative actions were developed to ensure the non-conformances will not occur in the future. Haldimand County received re-accreditation May 31, 2024.

Intertek performed the annual systems audit September 12, 2024 which resulted in four opportunities for improvement. Any non-conformance or opportunity for improvement is added to the corrective action process.

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 31, 2024 with a second meeting on December 20, 2024.

Caledonia and Cayuga Distribution System



Caledonia and Cayuga Distribution System Overview

Chloraminated water is received from the City of Hamilton's Woodward Water Treatment Plant at the Caledonia Reservoir. Sodium hypochlorite is added to the water to achieve breakpoint chlorination and create a free chlorine residual that meets regulatory requirements. The chlorinated water is sent through the transmission mains to the Caledonia Distribution System. A standpipe provides secondary water storage and maintains water pressure within the distribution system.

Potable water is also sent via transmission mains to Cayuga. At the Cayuga Reservoir, sodium hypochlorite can be added to increase the disinfectant residual. The chlorinated water is then pumped to the Cayuga distribution system. A standpipe provides secondary storage and maintains water pressure within the distribution system.

The distribution system infrastructure services approximately 12,179 people in Caledonia and 1,720 people in Cayuga for a total of 13,899 (2021 Census). This number is suspected to increase steadily with the on-going development in the Caledonia distribution system.

Haldimand County operates and maintains all aspects of the drinking water system, including reservoirs, hydrants, valves, sample stations and watermains.

Expenditure Information

Haldimand County 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, key expenditures occurring in the Caledonia and Cayuga Distribution System are identified in Table 1. All drinking water expenditure information is not included in this report.

Table 1: Caledonia and Cayuga Distribution System 2024 Expenditures

Caledonia Standpipe Interior Re-lining	$ 621,734
Distribution Flow/ Pressure Control Improvements	$ 4,000
Cast Iron Watermain Replacements	$23,503
Total Cost	**$649,237**

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 1 shows how administration, design, maintenance, and operation work together to establish and maintain multi-barrier protection (US EPA, 1998).

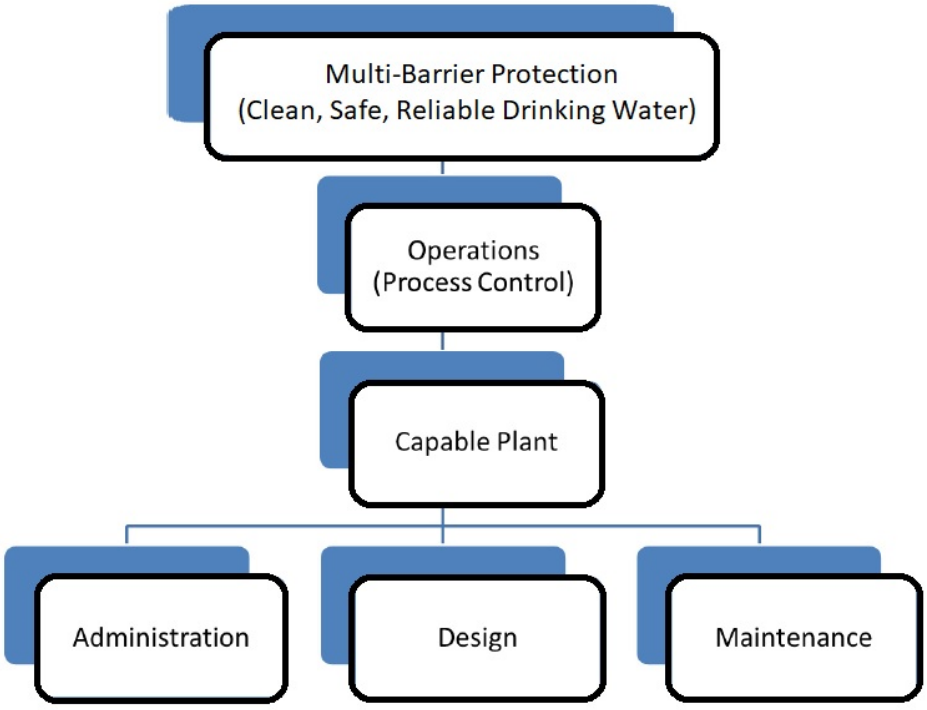


Figure 1: Responsibilities for Clean, Safe and Reliable Drinking Water

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

The Caledonia and Cayuga drinking water system receive their water from the Hamilton drinking water system. Hamilton provides Haldimand County with regular bacteriological samples and there is a strong relationship between the two municipalities to ensure clean, safe drinking water is supplied to all users.

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 or 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 Caledonia and Cayuga Distribution System during 2024.

Table 2: 2024 Caledonia and Cayuga Distribution System Microbiological Sampling

System	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)
Caledonia Distribution	208	0	0	52	0 – 190	208	0 – 200
Cayuga Distribution	157	0	0	52	0 - 10	157	0 – 10

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

Operational Sampling

Operational sampling and monitoring are 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 achieved for all samples taken. Although not included in this report, Caledonia and Cayuga Reservoirs have continuous monitoring chlorine residual analyzers, which monitor all water pumped to the distribution systems.

Table 3: 2024 Caledonia and Cayuga Distribution System Operational Sampling

System	Number of Grab Samples	Range of Results	Regulatory Requirement	Minimum Recommended Target
Free Chlorine Caledonia	368	0.56 – 1.57 mg/L	≥ 0.05 mg/L	≥ 0.20 mg/L
Free Chlorine Cayuga	316	0.22 – 1.26 mg/L	≥ 0.05 mg/L	≥ 0.20 mg/L

Hardness

As result of public inquiries, a sampling program for treated water 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 Caledonia and Cayuga can be considered on the high end of moderately hard water readings and the low end of hard water readings as taken from the Degree of Hardness Table above.

Table 5: 2024 Caledonia and Cayuga Distribution System Hardness Sampling

Parameter Total Hardness (mg/L as $CaCO_3$)

Sample Date	Caledonia	Cayuga
Feb 20, 2024	127	128
May 7, 2024	122	118
July 16, 2024	120	124
Nov 5, 2024	136	134
2024 Average >	**126**	**126**

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 2024 sampling has been provided in Table 6.

Table 6: 2024 Caledonia and Cayuga Distribution System Lead Sampling

Caledonia System Sample Type	Number of Samples	Range of Results	Number of Exceedances
Distribution - Lead	4	0.02-0.07(µg/L)	0
Distribution - Alkalinity	4	88 – 90 mg/L	0
Distribution - pH	4	7.02 – 7.30	N/A

Cayuga System Sample Type	Number of Samples	Range of Results	Number of Exceedances
Distribution - Lead	4	0.04-0.09 (µg/L)	0
Distribution - Alkalinity	4	86 – 91 mg/L	0
Distribution - pH	4	7.21 – 7.49	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, 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) in the distribution system where there is an elevated potential for the formation of these byproducts.

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 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 2024 organic sample results.

Table 8: 2024 Caledonia and Cayuga Distribution System DBP Sampling

Parameter	Sample Date	Sample Results (ug/L)	Annual Average (ug/L)	Regulatory MAC (ug/L)	Exceedance
Haloacetic Acids Caledonia Distribution	May 16, 2024 July 30, 2024 October 30, 2024	15.8 16.3 18.0	16.2	80	No
Haloacetic Acids Cayuga Distribution	May 16, 2024 July 30, 2024 October 30, 2024	18.1 19.0 29.7	16.7	80	No
Trihalomethanes Caledonia Distribution	May 13, 2024 July 30, 2024 October 30, 2024	34 42 54	43.6	100	No
Trihalomethanes Cayuga Distribution	May 13, 2024 July 30, 2024 October 30, 2024	49 59 51	62.6	100	No

Note: Missed sample in Feb 2024. This incident was reported to the MECP. Corrective/preventative actions were developed and accepted by the MECP.

Water Use

Raw Water

Haldimand County does not have a Permit to Take Water for the Caledonia and Cayuga Distribution System. All water supplied to the Caledonia and Cayuga Distribution System originates from Lake Ontario and is treated by the City of Hamilton at their Woodward Water Treatment Plant.

Potable Water

As required by Schedule 22 of Ontario Regulation 170/03, Table 9, Table 10, *Figure* 2 and *Figure* 3 are intended to provide a summary of potable water supplied to the Caledonia and Cayuga Distribution System in 2024.

Table 9: 2024 Caledonia Reservoir Monthly Potable Water Flow Data

Month	Monthly Total m^3	Daily Average m^3	Maximum Daily m^3
January	116,186	3,748	4,289
February	107,450	3,705	4,167
March	113,316	3,655	4,160
April	114,405	3,817	4,280
May	135,731	4,378	5,397
June	129,304	4,310	4.971
July	133,301	4,300	5,041
August	136,510	4,404	4,194
September	141,183	3,999	5,281
October	131,388	4,706	5,304
November	125,185	4,238	4,613
December	125,805	4,058	4,866

The Caledonia Reservoir flows include all water pumped to York and Cayuga. *Figure* 2 compares the monthly flows over the last five years at the Caledonia Reservoir. When comparing the average monthly flows for 2023 and 2024, there was a **3.68% increase** in potable water distributed from the Caledonia Reservoir.

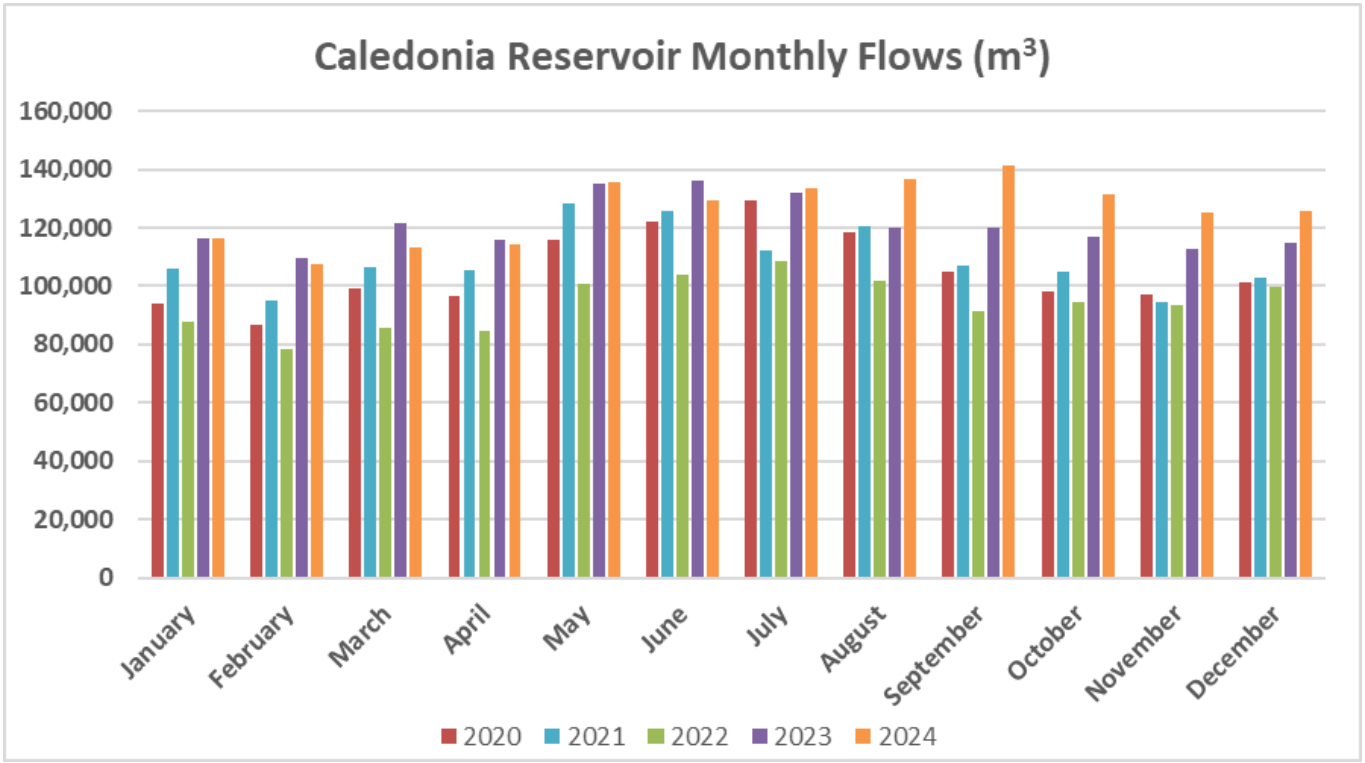


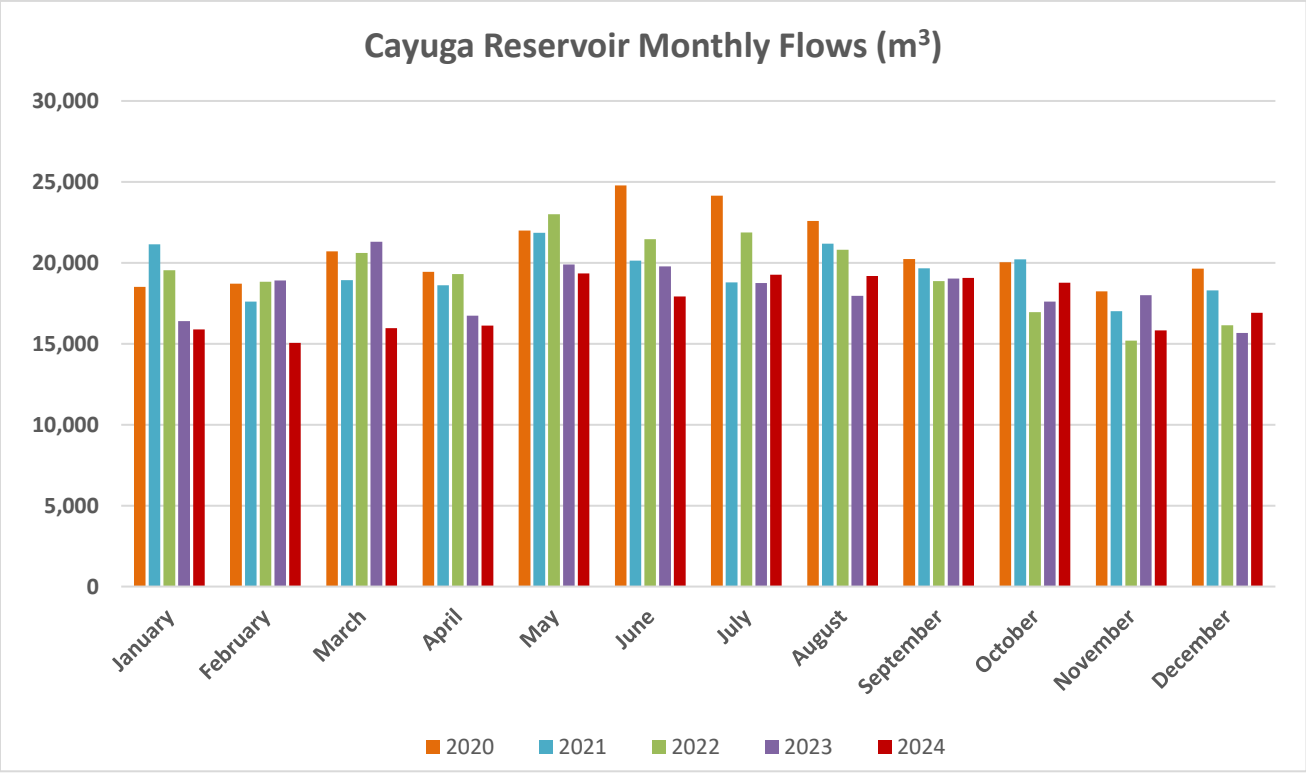
Figure 2: Caledonia Reservoir Five Year Monthly Flow Comparison

Table 10: 2024 Cayuga Reservoir Monthly Water Quantities and Flow Rates

Month	Monthly Total m^3	Daily Average m^3/d	Maximum Daily Flow m^3/d
January	15,878	512	631
February	15,061	519	609
March	15,955	515	675
April	16,125	538	694
May	19,340	624	808
June	17,927	598	686
July	19,262	621	757
August	19,191	619	703
September	19,072	636	703
October	18,776	606	708
November	15,827	528	606
December	16,912	546	604

Figure 3 compares the monthly flows over the last five years at the Cayuga Reservoir. When comparing the average monthly flows for 2023 and 2024, there was a **4.87% decrease** in potable water serviced by the Cayuga Reservoir.

Figure 3: Cayuga Reservoir Five Year Monthly Flow Comparison



Each facility is assigned a rated capacity in their Engineer's Report. When the maximum daily flow for 2024 and the rated capacity are compared, the Caledonia and Cayuga are operating at approximately 41.5% for Caledonia and 34.6% for Cayuga, however this calculation does not take into account any operational and infrastructure limitations.

Table 11: Summary Comparison of Rated Capacities and 2024 Maximum Flows

System and Municipal Drinking Water License	Rated Capacity	Maximum Daily Flow (m^3 / day)	Percentage of Capacity
Caledonia 066-103	13,000 m^3/day	6,414	41.5%
Cayuga 066-103	2,333 m^3/day	808	34.6%

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 includes reporting any adverse water quality incidents to the Ministry of Health (MOH) and the MECP. In all instances, corrective action is initiated to resolve the issue. There were three non-confirmed adverse water quality reports in 2024.

#	Adverse Type	Corrective Action	Status
1	June 12, 2024 Lab report of 6 cfu/100mL of Total Coliforms at a sampling station.	Flushing of stations and chlorine residual testing was completed.	Resolved
2	June 26, 2024 Lab report of 80 cfu/100mL of Total Coliforms and 1 E.coli at a sampling station.	Flushing of stations and chlorine residual testing was completed.	Resolved
3	September 25, 2024 Lab report of 7 cfu/100mL of Total Coliforms at a sampling station.	Flushing of stations and chlorine residual testing was completed.	Resolved

Annual Drinking Water Inspection

The MECP annually confirms compliance with drinking water legislation by conducting inspections on municipal 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 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.

An inspection of the Caledonia and Cayuga Distribution System for the 2023/2024 reporting period was completed on January 31, 2024. At the time of the 2024 report Haldimand County has not received the Inspection Report or the rating from the MECP.

The findings for the 2023/2024 annual drinking water system inspections are included in this report. Below is a summary of the key findings for the inspection:

There was one non-compliances identified during the 2023 inspection period. The inspection rating for 2023/2024 in section was 97.35%.

	Finding Type	Finding	Status
# 1	Non-compliance	One of the four sets of pH and alkalinity samples were missed in the spring of 2023.	Corrective Actions Complete

Report Availability

This report can be viewed online at:

haldimandcounty.ca/drinking-water/

Reports can also be obtained upon request at the Haldimand County Administration Building:

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

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