Sub-Indicator: Treated Drinking Water

Overall Assessment

Status: Good

10-Year Trend (2014 - 2023): Unchanging

Long-term Trend:

U.S.: Undetermined

Ontario (2005 - 2023): Unchanging

Rationale:

U.S.: During the 2023 calendar year, 19.8 million U.S. residents received drinking water from the 810 community water systems (CWSs) that source from the surface waters of the Great Lakes and its connecting river systems (including the international section of the St. Lawrence River). Overall, 99.1% of the 810 CWSs met all health-based standards, and 96.9% of this population was served by CWSs that met all health-based standards, achieving an assessment of Good for drinking water quality for the U.S. side of the Great Lakes Basin. From 2014 – 2023, the percentage of CWSs meeting all health-based standards did not display any statistically significant trends, therefore the 10-year trend was assessed as Unchanging.

Ontario: Approximately 65% of Ontario residents (roughly 10.3 million as of 2023) receive treated drinking water sourced from the surface waters of the Great Lakes. Every year from 2005-2023, 99.88%-99.94% of treated drinking water test results from drinking water systems using Great Lakes source water met the Ontario drinking water quality standards for microbes, chemicals and radionuclides. From 2014 – 2023 and from 2005 – 2023, the percentage of test results meeting standards did not change. Therefore, treated drinking water quality on the Canadian side of the Great Lakes is assessed as Good, and the trends are Unchanging.

Lake-by-Lake Assessment

Note: The U.S. Lake-by-lake status assessments are primarily based on 2023 data, and the U.S. 10-year trends are based on data from 2014-2023. There is insufficient data to produce a U.S. long-term trend assessment; thus, those assessments are Undetermined. The Ontario status assessments are based on data from 2021-2023. The Ontario 10-year trends are based on data from fiscal year 2013/2014-2022/2023 (simplified to “2014-2023” in this report), and the long-term trends are based on data from fiscal year 2005/2006-2022/2023 (simplified to “2005-2023” in this report).

Lake Superior

Status: Good (U.S.: Good; Ontario: Good)

10-Year Trend (2014 - 2023): (US.: Deteriorating; Ontario: Unchanging)

Long-term Trend:

U.S.: Undetermined

Ontario (2005 - 2023): Unchanging

Rationale:

U.S.: There are 17 CWSs that source from the surface waters of Lake Superior, which serve a population of 169,622 people. 98.6% of this population was served by CWSs that met all health-based standards, and 16 of the 17 CWSs (94.1%) met all health-based standards. Due to the small number of CWSs, the aggregated annual percentage of drinking water systems meeting all health-based requirements is highly sensitive to discrete violations. In recent years, 1-2 systems have had health-based violations, causing a statistically decreasing trend in the reported percentages; the resulting 10-year trend is **Deteriorating**. The downward trend stems from the small number of systems rather than a widespread decline in water quality.

Ontario: Every year from 2005 – 2023, 99.53% – 99.94% of treated drinking water test results from drinking water systems using Lake Superior source water met the Ontario drinking water quality standards for microbes, chemicals and radionuclides. From 2014 – 2023 and from 2005 – 2023, the percentage of test results meeting standards did not change. Therefore, treated drinking water quality on the Canadian side of Lake Superior is assessed as Good, and the trends are Unchanging.

Lake Michigan

Status: Good

10-Year Trend (2014 - 2023): U.S.: Unchanging

Long-term Trend:

U.S.: Undetermined

Rationale: Lake Michigan is wholly within the United States. There are 356 CWSs that source from the surface waters of Lake Michigan, which serve a population of 9,677,989 people. 98.9% of these CWSs met all health-based standards, and 99.5% of this population was served by CWSs that met all health-based standards, resulting in an assessment of Good for the whole lake. From 2014 – 2023, the percentage of CWSs meeting all health-based standards did not significantly change.

Lake Huron (including St. Marys River)

Status: Good (U.S.: Good; Ontario: Good)

10-Year Trend (2014 - 2023): (U.S.: Unchanging; Ontario: Unchanging)

Long-term Trend:

U.S.: Undetermined

Ontario (2005 – 2023): Improving

Rationale:

U.S.: There are 133 CWSs that source from the surface waters of Lake Huron (n=132) and the St. Marys River (n=1), which serve a population of 1,671,038 people. The status is assessed as Good because 97.7% of these 133 CWSs met all health-based standards, and because 97.6% of this population was served by CWSs that met all health-based standards. Specifically for Lake Huron, of the 132 CWSs that source from the lake, 96.9% met all health-based standards, and 97.6% of the population was served by CWSs that met all health-based standards. From 2014 – 2023, the percentage of CWSs meeting all health-based standards did not significantly change.

Ontario: Every year from 2005 – 2023, 99.76% – 99.96% of treated drinking water test results from drinking water systems using Lake Huron source water met the Ontario drinking water quality standards for microbes, chemicals and radionuclides. From 2014 – 2023, the percentage of test results meeting standards did not change. From 2005

– 2023, the percentage of test results meeting standards increased. Therefore, treated drinking water quality on the Canadian side of Lake Huron is assessed as Good, the 10-year trend is Unchanging, and the long-term trend is Improving.

Lake Erie (including St. Clair-Detroit River Ecosystem)

Status: Good (U.S.: Good; Ontario: Good)

10-Year Trend (2014 - 2023): (U.S.: Unchanging; Ontario: Unchanging)

Long-term Trend:

U.S.: Undetermined

Ontario (2005 – 2023): Unchanging

Rationale:

U.S.: There are 205 CWSs that source from the surface waters of Lake Erie (n=117) and the St. Clair- Detroit River (n=88), which serve a population of 6,801,126 people. The status is assessed as Good because 95.6% of these 205 CWSs met all health-based standards, and because 92.6% of this population was served by CWSs that met all health-based standards. From 2014 – 2023, the percentage of CWSs meeting all health-based standards did not significantly change.

Specifically for Lake Erie, 98.3% of the 117 CWSs that source from the lake met all health-based standards, and 88.2% of the population was served by CWSs that met all health-based standards.

Specifically for the St. Clair-Detroit River, 96.6% of the 88 CWSs that source from the St. Clair-Detroit River met all health-based standards, and 99.1% of the population was served by CWSs that met all health-based standards.

Ontario: Every year from 2005 – 2023, 99.82% – 99.98% of treated drinking water test results from drinking water systems using Lake Erie source water met the Ontario drinking water quality standards for microbes, chemicals and radionuclides. From 2014 – 2023 and from 2005 – 2023, the percentage of test results meeting standards did not change. Therefore, treated drinking water quality on the Canadian side of Lake Erie is assessed as Good, and the trends are Unchanging.

Lake Ontario (including Niagara River, and the international section of the St. Lawrence River)

Status: Good (U.S.: Good; Ontario: Good)

10-Year Trend (2014 - 2023): (U.S.: Improving; Ontario: Unchanging)

Long-term Trend:

U.S.: Undetermined

Ontario (2005 – 2023): Unchanging

Rationale:

U.S.: There are 99 CWSs that source from the surface waters of the Niagara River (n=30)*, Lake Ontario (n=51) and the international section of the St. Lawrence River (n=18), which serve a population of 1,502,290 people. The status is assessed as Good because 99.0% of the 99 CWSs met all health-based standards, and 99.9% of the

population was served by CWSs that met all health-based standards. From 2014 – 2023, the percentage of CWSs meeting all health-based standards significantly increased, resulting in an **Improving** trend.

Ontario: Every year from 2005 – 2023, 99.87% – 99.94% of treated drinking water test results from drinking water systems using Lake Ontario source water met the Ontario drinking water quality standards for microbes, chemicals and radionuclides. From 2014 – 2023 and from 2005 – 2023, the percentage of test results meeting standards did not change. Therefore, treated drinking water quality on the Canadian side of Lake Ontario is assessed as Good, and the trends are Unchanging.

*****Note: The CWSs in the U.S. that rely on the Niagara River for source water all obtain water from the Upper Niagara River (i.e., upstream of Niagara Falls). No CWSs in the U.S. draw water from the Lower Niagara River (i.e., downstream of Niagara Falls).

Status Assessment Definitions

United States

Good: At least 90% of CWSs met all health-based standards and at least 90% the population was served by CWSs that met all health-based standards.

Fair: 80% to 90% of CWSs met all health-based standards and 80 to 90% of the population was served by CWSs that met all health-based standards.

Poor: Less than 80% of CWSs met all health-based standards and less than 80% of the population was served by CWSs that met all health-based standards.

Undetermined: Data were not available or were insufficient to assess condition of the ecosystem components.

Ontario

Based on the percentage of treated drinking water tests meeting the Ontario drinking water quality standards as follows:

Good: At least 99%

Fair: Between 97-98.9%

Poor: Less than 97%

Undetermined: Data are not available or are insufficient to determine the percentage of treated drinking water tests meeting standards

Trend Assessment Definitions

United States

Improving: Increase in the percentage of CWSs that met all health-based standards.

Unchanging: No change in the percentage of CWSs that met all health-based standards.

No Trend: Data are available for a 10-year or longer period but the data are reflecting conflicting trends, or the trend is not statistically Improving or Deteriorating due to high variability in the data.

Deteriorating: Decrease in the percentage of CWSs that met all health-based standards.

Undetermined: Data on CWSs that met all health-based standards were insufficient to generate a 10 year or longer trend.

Ontario

Improving: Increase in percentage of treated drinking water test results meeting standards.

Unchanging: No change in percentage of treated drinking water tests meeting standards.

No Trend: Data are available for a 10-year or longer period but the trend is not statistically Improving or Deteriorating due to high variability in the data.

Deteriorating: Decrease in percentage of treated drinking water tests meeting standards.

Undetermined: Data are not available or are insufficient to determine the trend in percentage of treated drinking water test results meeting standards.

Endpoints and/or Targets

Levels of disease-causing organisms, concentrations of hazardous or toxic chemicals, and radioactive substances should not exceed established U.S. federal, state and provincial human health objectives, drinking water standards or guidelines.

Sub-Indicator Purpose

The purposes of this sub-indicator are to:

- Assess chemical, microbial and radiological contaminant levels in drinking water;
- Evaluate the potential for human exposure to drinking water contaminants; and,
- Evaluate the efficacy of policies and technologies to ensure safe drinking water.

Ecosystem Objective

As vital sources of drinking water, the objective is for the Great Lakes ecosystem to be protected from harmful microbial, chemical, and radiological contaminants that require advanced treatments to meet all drinking water standards. This sub-indicator best supports work towards General Objective #1 of the 2012 Great Lakes Water Quality Agreement, which states that the Waters of the Great Lakes should “be a source of safe, high-quality drinking water.”

Methods

United States

For the U.S.-portion of the assessment, drinking water quality was assessed by calculating the proportion of the population served by community water systems (CWSs) that provide drinking water sourced from the surface waters of the Great Lakes that meets all applicable health-based water standards, as reported in the Safe Drinking

Water Information System (SDWIS). Health-based violations (HBVs) may occur in the finished (i.e., treated) drinking water of a public water system (includes drinking water treatment plants and their distribution systems). States are required to issue HBVs when a public water system fails to comply with requirements for a treatment technique and when compliance monitoring results exceed maximum levels for regulated contaminants. HBVs for treated drinking water fall into three categories: 1) exceedances of the maximum contaminant levels (MCLs) for regulated contaminants, such as disinfectants (e.g., chlorine), disinfection byproducts (e.g., chlorite), inorganic chemicals (e.g., arsenic, chromium, fluoride), organic chemicals (e.g., atrazine, benzene), microorganisms (e.g., *E. coli*), and radionuclides (e.g., radium, uranium),[1] 2) exceedances of the maximum residual disinfectant levels (MRDLs), which specify the highest concentrations of disinfectants allowed in drinking water, and 3) treatment technique requirements, which specify certain processes intended to reduce the level of a contaminant. When treated drinking water consistently meets health-based standards, it indicates that the treatment processes are effectively removing contaminants present in the source water to protect public health. Other types of violations include monitoring and reporting of water quality required by SDWA and notice of violations and public health protection guidance to drinking water consumers. These violations can be representative of the source water treated at the drinking water utility, the water circulated to consumers through the distribution system, or both. Health based violations at CWS presented in this sub-indicator were limited to treatment processes at the utility. The following violation codes – 1A, 64, 65, Stage 2 DBP – were excluded from the status and trend analyses, as they often reflect issues that are more pertinent to the distribution system rather than the source water quality:

- 1A: Failure to meet Revised Total Coliform Rule requirements, such as conducting required assessments, corrective actions, or not submitting a report
- 64: Failure to meet lead service line replacement
- 65: Failure to provide required public education about reducing lead intake from drinking water
- Stage 2 Disinfectants and Byproducts: Failure to monitor and comply with maximum contaminant levels for disinfection byproducts

To assess U.S. drinking water quality, the following indicators were used:

- Proportion of CWSs that met all health-based standards
- Proportion of population served by CWSs that met all health-based standards[2]

To assess the 10-year trend, the percentages of CWSs that met all health-based standards (e.g., zero health-based violations in a calendar year) from 2014 – 2023 were analyzed for each lake and for the entire Great Lakes basin. The non-parametric Mann-Kendall test was used to identify significant trends for each time series. 10-year trends with p values of less than 0.05 were deemed statistically significant for this report.

Ontario

The treated drinking water assessment criterion is the percentage of tests meeting Ontario drinking water quality standards for microbes, chemicals and radionuclides.

[1] See *Drinking Water Regulations* for more information about U.S. EPA's health-based standards.

[2] Because the drinking water sub-indicator is part of the human health assessment, the proportion of population served by CWSs that met all health-based standards was the measure that determined the overall and the lake-by-lake statuses.

The Ontario Ministry of the Environment, Conservation and Parks provided the data for the Ontario component of this report. The data is from the Ministry's regulatory drinking water information system (DWIS). DWIS is administered by the Drinking Water and Environmental Compliance Division.

Data is for the period 2005 – 2023 and is from all large and small municipal residential drinking water systems using Great Lakes source water. Source waters include Lakes Superior, Huron, Erie and Ontario and connecting channels. Data includes all results in this period from regulatory testing requirements for microbes, chemicals and radionuclides.

The number of drinking water systems on each lake contributing data to this report is as follows (Figure 1):

- Lake Superior – 2
- Lake Huron – 34
- Lake Erie – 21
- Lake Ontario – 45

Discussion

United States

In the United States, the principal law governing pollution of the nation's surface waters is the Federal Water Pollution Control Act, better known as the Clean Water Act. Originally enacted in 1948, it was totally revised by amendments in 1972 that gave the act its current dimensions. The 1972 legislation spelled out ambitious programs for water quality improvement that have since been expanded and are still being implemented by industries and municipalities (CRS, 2016).

The Safe Drinking Water Act (SDWA), Title XIV of the Public Health Service Act, is the key federal law for protecting public drinking water supplies from harmful contaminants. First enacted in 1974 and substantially amended in 1986, 1996, and 2018, the act is administered through programs that establish standards and treatment requirements for public drinking water supplies, finance drinking water infrastructure projects, promote water system compliance, and control the underground injection of fluids to protect underground sources of drinking water. The 1974 law established the current federal-state arrangement in which states may be delegated primary implementation and enforcement authority (i.e., primacy) for the drinking water program. The state-administered Public Water Supply Supervision Program remains the basic program for regulating the nation's public water systems (PWSs), and 49 states and the Navajo Nation have assumed this primacy authority (CRS, 2017). As of December 2020, the U.S. Environmental Protection Agency has set legally enforceable standards for 94 contaminants per the National Primary Drinking Water Regulations (NPDWRs) (CRS, 2021).

The SDWA Amendments of 1996 (P.L. 104-182) require all community water systems (CWSs) to provide drinking water quality information annually to their consumers. To satisfy this obligation, CWSs produce an annual Consumer Confidence Report (CCR).[3] These CCRs provide information including the specific drinking water sources, the availability of source water assessments, and a summary of:

- Potential sources of contamination

[3] For more information and to find your local CCR, visit https://www.epa.gov/ccr/ccr-information-consumers.

- Water treatment processes
- Contaminants detected in finished drinking water
- Violations that occurred
- Other relevant information

Depending on the applicable rules, monitoring for contaminants may be required in the source water (prior to treatment), in the drinking water treatment plant at the point-of-entry to the distribution system (after treatment), and/or in the distribution system. For microbial contaminants, while *Legionella*, *Giardia*, and viruses are regulated under the surface water treatment rules (SWTR), no monitoring is required (treatment technique requirements). *Cryptosporidium* monitoring is required for 24 months for new PWSs under the LT2 rule.[4] Notably, required sampling results are not reported directly to the U.S. EPA except in limited situations, such as direct implementation, rule violations, SDWA six-year review cycles,[5] and unregulated contaminant monitoring rule compliance.[6] Sampling results are recorded in databases maintained by the primacy agencies (e.g., states' departments of environmental protection), and violations of the rules are issued by the primacy agencies to the PWSs and are reported to the U.S. EPA. For the purposes of this sub-indicator report, the available information assessed by the U.S. EPA focused on finished (i.e., treated) drinking water quality as indicated by health-based violations of CWSs with the primary source of surface water from the Great Lakes or its connecting rivers. Thus, only a small subset of all PWSs was included in our analyses.[7] Excluded were CWSs with the primary source of surface water from inland waterbodies or groundwater, non-community water systems, and systems that serve less than 25 people. This sub-indicator utilizes violations associated with source water that is processed and treated at the plant, such as violations associated with filtration, corrosion control, and/or maximum contaminant levels, because they are indicative of source water quality. Violations associated with the distribution system, such as high levels of disinfection byproducts, lead service line replacement and public education were excluded.

Reducing the number of health-based violations (HBVs) supports Pillar 1 of the U.S. EPA's "Powering the Great American Comeback" initiative, which calls for "clean air, land, and water for every American" and Pillar 3, which calls for cooperative federalism, as States are the primary regulator of drinking water. HBVs are expected to return

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[4] The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) went into effect in January 2006 and required surface water systems to conduct 24 months of source water monitoring, calculate an average *Cryptosporidium* concentration, and use those results to determine if their source was vulnerable to contamination, which may have required further treatment. Most PWSs have already fulfilled the monitoring requirements of this rule and are no longer required to report surface water monitoring results to their primacy agency or the U.S. EPA. New surface water systems are subject to this rule. See *Surface Water Treatment Rules* for more information.

[5] For six-year review contaminant occurrence data, visit https://www.epa.gov/dwsixyearreview/contaminant-occurrence-and-related-data-six-year-review-drinking-water-standards.

[6] For unregulated contaminant monitoring rule data, visit https://www.epa.gov/monitoring-unregulated-drinking-water-contaminants/occurrence-data-unregulated-contaminant.

[7] U.S. EPA has established three broad categories of public water systems (PWSs). A community water system (CWS) serves the same population year-round. A non-transient non-community water system (NTNCWS) regularly supplies water to at least 25 of the same people at least six months per year but not year-round (e.g., schools, factories, office buildings, and hospitals that have their own wells). Transient non-community water systems (TNCWS) provide water in places where people do not remain for long periods of time (e.g., gas stations, restaurants, and campgrounds). Because individuals typically obtain drinking water from multiple PWSs (e.g., home, work, school, community building, restaurant) throughout the day, there may be double counting of population served across the three categories. See EPA draft guidance manual for clarification of definitions and methods (WSG 61A).

to compliance as soon as possible but long-term changes may be needed to do so, such as securing additional technical, managerial, and financial support or infrastructure upgrades (e.g., additional advanced treatment processes, changing source water with a new well or intake or a purchase agreement).

Health-Based Violations Assessment

For context, during the 2023 calendar year there were about 143,500 active PWSs across the country that served over 330 million people. Across the eight Great Lakes States, there were nearly 58,000 active PWSs that served nearly 81 million people, of which 11,283 were CWSs that served roughly 74 million people (Table 1).[8]

Categorizing by primary water source, of the 11,283 CWSs across the eight Great Lakes States, only 2,555 (22.7%) were CWSs with the primary source of surface water, which served nearly 53 million people (71.4%) (Table 2). Additionally, there were 8,728 (77.3%) CWSs with the primary source of groundwater, which served about 21 million people (28.6%). Due to this report's focus on assessing drinking water quality sourced from the Great Lakes, the CWSs with the primary source of groundwater were excluded from our analyses.

As shown in Table 3, of the 2,555 CWSs across the eight Great Lakes States with the primary source of surface water, only 810 were CWSs with the primary source of surface water from the Great Lakes or its connecting rivers (Superior-to-Huron ecosystem: St. Marys River; Huron-to-Erie ecosystem: St. Clair River, Lake St. Clair and Detroit River; Erie-to-Ontario ecosystem: Niagara River; and the international section of the St. Lawrence River),[9] which were only 7.0% of all active CWSs across the eight Great Lakes States. Those 810 CWSs served a population of 19,822,065, which was 37.5% of the population served by all active CWSs across the Great Lakes States.

To assess Great Lakes drinking water quality, the 810 CWSs with the primary source of surface water from the Great Lakes and its connecting rivers were included in our analyses for this sub-indicator report. These CWSs were identified in response to a request to the primacy agencies and aided using the Drinking Water Mapping Application to Protect Source Waters (DWMAPS) application.[10]

The 10-year (2014-2023) trend assessment for all lakes except two were Unchanging, with respect to percentage of CWSs that met all health-based standards (Figure 2). Lake Ontario's 10-year trend was assessed as Improving due to a statistically significant increase in percentage of CWSs that met all health-based standards. Lake Superior's 10-year trend was assessed as Deteriorating because in recent years, more than one CWS had HBVs. There are only 17 US drinking water systems that draw from Lake Superior's surface water. Due to this small number, the annual percentage of CWSs meeting all health-based standards is highly sensitive to discrete violations. In recent years, 1-2 systems have had HBVs, causing a statistically decreasing trend in the reported percentages.

In examining the 10-year trend of percentage of CWSs meeting all health-based standards, it is important to consider the influence of the number of drinking water systems for each lake. The aggregated percentage-based assessment results uses a single data point per year. Therefore, single violations in lakes with few CWSs can

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[8] The number of water systems and population served includes Tribal water systems. EPA Region 2 and EPA Region 5 conduct direct implementation of NPDWRs for the Tribal systems in the Great Lakes region. See Tables 2, 3 and 4 for a breakdown of water systems by primacy agency.

[9] The international section of the St. Lawrence River is the section of the river approximately between Cape Vincent, New York and St. Regis, New York. See the Great Lakes Water Quality Agreement Article 1 for the formal definition.

[10] To request the list of water systems assessed for this report, please contact the authors. See Acknowledgements section for the list of authors and contact information.

disproportionately affect percentage calculations. The observed downward trend in Lake Superior is not necessarily indicative of a widespread decline in water quality; rather, it highlights the statistical sensitivity that is inherent in analyses involving small sample sizes. This sub-indicator would benefit from methodological refinements, including the exploration of alternative trend analysis approaches that offer greater statistical power and that are better suited to small sample sizes.

During the 2023 calendar year there were 810 CWSs that sourced surface water from the Great Lakes or its connecting rivers, which served a population of 19,822,065 (Table 3). Lake Michigan was the top surface water source by both the number of systems with 356 (44.0%) CWSs and by population served with 9,677,989 (48.9%) people served. Figure 3 is a map of the population served by the CWSs that source surface waters from the Great Lakes by county.

Table 4 shows the number of HBVs by surface water source. During the 2023 calendar year, there were 15 HBVs at 14 of the 810 CWSs. Therefore, 796 (98.2%) of the CWSs met all health-based standards, achieving an assessment of Good (>90%) overall. By population served, there were 601,980 (3.0%) served by a CWS with one or more HBVs. Therefore, 97.0% of the population was served by CWSs that met all health-based standards, achieving an assessment of Good overall.

All but one of the surface water sources were assessed as Good for both measures: by proportion of the CWSs that met all health-based standards, and by proportion of population served by a CWS that met all health-based standards.[11] The sole exception was Lake Erie, where 98.3% of CWSs met all health-based standards but 88.2% of the population was served by CWSs that met all health-based standards. Because the drinking water sub-indicator is part of the human health assessment, the proportion of population served by CWSs that met all health-based standards is the measure that determines the overall status.

Figure 4 shows the total population served compared to population served by CWSs with HBVs by surface water source.

Figure 5 shows the type of HBVs by rule and surface water source. There were nine Lead and Copper Rule treatment technique violations (failure to submit an optimal corrosion control study, failure to maintain optimal water quality parameters, , and lead action level exceedance), three Interim Enhanced Surface Water Treatment Rule violations (failure to enhance the control of microbial pathogens), two surface water treatment rule treatment technique violations (a system that did not meet the minimum residual disinfectant concentration and one post-filtration turbidity sample that exceeded 1 NTU), and one Groundwater Rule violation (failure to identify and/or address potential sources of contamination).

Canada

From 2005 – 2023, 99.88% – 99.94% of treated drinking water test results from Canadian drinking water systems using Great Lakes source water met Ontario drinking water quality standards for microbes, chemicals and radionuclides (Figure 6). There was no change in the percentage of test results meeting standards. Ontario's treated drinking water quality was assessed as Good and Unchanging during this time. A small percentage of test results did not meet standards. When a test result does not meet a standard, it does not necessarily mean that the drinking water is unsafe but does mean that the drinking water system owner and operator need to investigate what may have caused the adverse test result and take all steps necessary to resolve it.

[11] The St. Marys River was not rated due to an insufficient CWS sample size (n=1).

From 2005 – 2023, 99.53% – 99.94% of treated drinking water test results from Canadian drinking water systems using Lake Superior source water met Ontario drinking water quality standards (Figure 7). There was no change in the percentage of test meeting standards except for an outlier low value in 2013-14. The trend from Lake Superior drinking water systems is more prone to outliers than trends from other Great Lakes because the Lake Superior data comes from only two drinking water systems. Overall, treated drinking water quality from Lake Superior drinking water systems was Good and Unchanging from 2005 – 2023.

From 2005 – 2023, 99.76% – 99.96% of treated drinking water test results from Canadian drinking water systems using Lake Huron source water met Ontario drinking water quality standards (Figure 7). The percentage of test results meeting standards did not change from 2014 – 2023 but increased over the longer term from 2005 – 2023. From 2005 – 2023, treated drinking water quality from Lake Huron drinking water systems was assessed as Good. It was assessed as Unchanging from 2014 – 2023 and Improving over the longer term from 2005 – 2023.

From 2005 – 2023, 99.82% – 99.98% of treated drinking water test results from Canadian drinking water systems using Lake Erie source water met Ontario drinking water quality standards (Figure 7). There was no change in the percentage of test results meeting standards. Treated drinking water quality from Lake Erie drinking water systems was assessed as Good and Unchanging during this time.

From 2005 – 2023, 99.87% – 99.94% of treated drinking water test results from Canadian drinking water systems using Lake Ontario source water met Ontario drinking water quality standards (Figure 7). There was no change in the percentage of test results meeting standards. Treated drinking water quality from Lake Ontario drinking water systems was assessed as Good and Unchanging during this time.

Linkages

Following is a brief discussion of other Great Lakes sub-indicators that can influence drinking water quality. In general, the quality of treated drinking water can be linked with other sub-indicators and may be negatively impacted by the demands of an increasing Great Lakes human population.

- Groundwater Quality – Many municipalities within the Great Lakes Basin obtain their drinking water from groundwater sources.
- Water Quality in Tributaries – Many municipalities use tributaries as their drinking water source, and tributaries are the main route by which contaminants reach the Great Lakes.
- Precipitation Amounts in the Great Lakes Basin and Land Cover are linked to the Treated Drinking Water sub-indicator as they can influence the potential for contaminants to wash into tributaries and reach Great Lakes drinking water intakes.
- Algal Bloom Extent – Algal blooms can cause algal toxin contamination of drinking water sources. By extension the related sub-indicators of Nutrients in Lakes and Surface Water Temperature are important because they have a direct impact on the formation of algal blooms.
- Toxic Chemicals in the Atmosphere and Toxic Chemicals in Water can influence toxics concentrations at drinking water intakes.

This sub-indicator also links directly to the other human health related sub-indicators including Beach Advisories and Contaminants in Fish Fillet.

Citizen Science, Traditional Ecological Knowledge (TEK), and other Bodies of Knowledge

The lifeways of the Tribes and First Nations of the Great Lakes Basin are inexorably linked to the Great Lakes water resources, who have retained their rights to hunt, fish and gather within the Great Lakes Basin in areas ceded to the United States or Canada in various treaties (GLRC, 2005; HETF, 2005). As an example of this commitment, in 2004 the Tribes and First Nations of the Great Lakes sent an accord to the federal, state and provincial governments of the Great Lakes Region to demand their rights to protect and preserve the Waters of the Great Lakes Basin, to secure a healthy future for the Great Lakes, and to be included to fully participate in the negotiations of the Great Lakes Compact.

In a recent poll of Great Lakes Basin residents, more respondents that identified as Indigenous or Métis felt it was important to protect the Great Lakes water quality than non-Indigenous respondents (GLWQB, 2018). In fact, Indigenous respondents were substantially more likely to contact public officials, attend public meetings, and engage online to protect the Great Lakes water quality than non-Indigenous respondents (Guo et al., 2020).

In a series of interviews of Anishinaabe and non-Indigenous residents across the Great Lakes Basin, both groups of interviewees expressed that water characterizes “the way of life” in the region as well as a greater concern about water quality than water quantity, but Anishinaabe respondents expressed greater water-related values than non-Indigenous residents (Kozich et al., 2018).

Assessing Data Quality

Data Characteristics	Agree	Neutral or Unknown	Disagree	Not Applicable
Data are documented, validated, or quality-assured by a recognized agency or organization	X			
Data are from a known, reliable and respected generator of data and are traceable to original sources	X			
Geographic coverage and scale of data are appropriate to the Great Lakes Basin	X			
Data obtained from sources within the U.S. are comparable to those from Canada			X	
Uncertainty and variability in the data are documented and within acceptable limits for this sub-indicator report	X			

Data used in assessment are openly available and accessible	U.S.: Yes Canada: Yes	U.S.: Sources are described and linked in the text. Canada: https://data.ontario.ca/dataset/drinking-water-quality-and-enforcement

Data Limitations

The purpose of this sub-indicator is to assess General Objective #1 of the 2012 Great Lakes Water Quality Agreement, which states that the Waters of the Great Lakes should "be a source of safe, high-quality drinking water." There are numerous data limitations that prevented a harmonized binational assessment of a consistent suite of indicators in source water and treated drinking water.

While treated drinking water provides valuable information about the overall safety and quality of the water supply, it is not a standalone indicator of source water quality. The quality of treated drinking water reflects both the condition of the source water and the effectiveness of the treatment processes used to make the water safe for consumption.. The method employed by EPA in this report is the percentage of CWSs that met all health-based standards for treated drinking water, which is more reflective of compliance with the existing SDWA regulations. At present, there is no comprehensive measure of source water quality. Because of the inherent differences in measures employed by the US and Canada, data comparability is not possible.

Additional Information

First incorporated in the 1987 amendments of the GLWQA was a procedure for data assessment and identification of Areas of Concern (AOC) and development of corresponding remedial action plans (RAPs) based on a suite of 14 beneficial use impairments (BUI).[12] Relevant to drinking water is BUI#9: "restrictions on drinking water consumption, or taste and odor problems." Of the 43 locations formally identified as AOCs by Canada and the United States, eight locations were deemed to have a BUI affecting drinking water (BUI#9). Since 1987, six of these eight locations have completed remedial actions to remove the drinking water BUI. The two locations with the drinking water BUI still assigned are Lower Green Bay/Fox River AOC in Wisconsin[13] and the U.S. portion of binational St. Clair River AOC.[14] There are no CWSs that use the Fox River or Lower Green Bay as its source water. In Michigan, there are 12 CWSs serving nearly 100,000 residents that rely on the St. Clair River as their source water. 7 of 12 CWSs received HBVs in 2023.

[12] For more information about the Areas of Concern program, see https://binational.net/annexes/a1/, https://www.ijc.org/en/what/glwq-aoc, https://www.epa.gov/great-lakes-aocs, and https://www.canada.ca/en/environment-climate-change/services/great-lakes-protection/areas-concern.html.

[13] For more information, see https://www.epa.gov/great-lakes-aocs/lower-green-bayfox-river-aoc.

[14] For more information, see https://www.epa.gov/great-lakes-aocs/st-clair-river-aoc and https://www.canada.ca/en/environment-climate-change/services/great-lakes-protection/areas-concern/st-clair-river.html.

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Table 1. U.S. Public Water Systems in the Great Lakes Region

Notes: Data are from CY2023 (2024Q1 SDWIS) and include all active PWSs (both surface water and groundwater sources). Rows display primacy agencies, which exercise primary enforcement responsibility of the National Primary Drinking Water Regulations (NPDWRs). The eight Great Lakes States each have primacy to implement the NPDWRs. EPA Region 2 conducts direct implementation for the NPDWRs for Tribal water systems in New York. EPA Region 5 conducts direct implementation of the NPDWRs for Tribal water systems in Indiana, Michigan, Minnesota, and Wisconsin. There are not any federally recognized Tribes in Illinois, Ohio or Pennsylvania (86 FR 7554). U.S. EPA has established three broad categories of public water systems (PWSs). A community water system (CWS) serves the same population year-round. A non-transient non-community water system (NTNCWS) regularly supplies water to at least 25 of the same people at least six months per year but not year-round (e.g., schools, factories, office buildings, and hospitals that have their own wells). Transient non-community water systems (TNCWS) provide water in places where people do not remain for long periods of time (e.g., gas stations, restaurants, and campgrounds). Because individuals typically obtain drinking water from multiple PWSs (e.g., home, work, school, community building, restaurant) throughout the day, there may be double counting of population served across the three categories. See the EPA draft guidance manual for clarification of definitions and methods (WSG 61A). Sources: Safe Drinking Water Information System (SDWIS) Federal Reports Advanced Search, Report Filters: Water System Summary by PWS Type, Submission Year is 2024 and Quarter is 1 and EPA Region in (05), EPA Region 2 and New York (within EPA Region 2) and Pennsylvania (within EPA Region 3), and Activity Status is Active.

	Community Water System		Non-Transient non-community system		Transient non-community system		Overall	
Primacy Agency	**# Systems**	**Population Served**	**# Systems**	**Population Served**	**# Systems**	**Population Served**	**# Systems**	**Population Served**
EPA Region 2	7	12,387	1	175	1	200	9	12,762
EPA Region 5	74	118,983	24	20,759	13	1,194	111	140,936
Illinois	1,773	12,141,330	417	162,107	2,957	287,099	5,147	12,590,536
Indiana	770	5,084,779	597	207,623	2,551	338,113	3,918	5,630,515
Michigan	1,383	7,456,861	1,376	324,978	8,096	1,238,419	10,855	9,020,258
Minnesota	965	4,602,633	460	61,723	5,145	504,791	6,750	5,169,147
New York	2,253	18,322,600	707	268,754	5,220	779,544	8,180	19,370,898
Ohio	1,145	10,578,931	587	259,587	2,496	363,980	4,228	11,202,498
Pennsylvania	1,884	11,463,045	1,101	503,545	4,845	693,830	7,830	12,660,420
Wisconsin	1,029	4,160,319	881	187,718	9,101	715,308	11,011	5,063,345
Column Total	11,283	73,941,868	6,151	1,996,969	40,425	4,922,478	57,859	80,861,315
% Overall Total	19.5%	91.4%	10.6%	2.5%	69.9%	6.1%	100%	100%

Table 2. U.S Great Lakes Region Community Water Systems by Primary Source.

Notes: Data are from CY2023 (2024Q1 SDWIS/Fed data freeze) and only include CWSs (non-community water systems were excluded).

'% CWSs' and '% Population Served' are proportions of their respective overall totals. Rows display primacy agencies, which exercise primary enforcement responsibility of the National Primary Drinking Water Regulations (NPDWRs). The eight Great Lakes States have primacy to implement the NPDWRs. EPA Region 2 conducts direct implementation for the NPDWRs for Tribal water systems in New York. EPA Region 5 conducts direct implementation of the NPDWRs for Tribal water systems in Indiana, Michigan, Minnesota, and Wisconsin. There are not any federally recognized Tribes in Illinois, Ohio or Pennsylvania (86 FR 7554).

Acronyms: Community Water Systems (CWSs); Calendar Year (CY)

Sources: Safe Drinking Water Information System (SDWIS) Federal Reports Advanced Search, Report Filters: Water System Summary by Primary Source,

Submission Year is 2024 and Quarter is 1 and EPA Region in (05), EPA Region 2 and New York (within EPA Region 2) and Pennsylvania (within EPA Region 3), and Activity Status is Active.

	Surface Water				Ground Water				Overall			
Primary Agency	**# CWSs**	**% CWSs**	**Population Served**	**% Population Served**	**# CWSs**	**% CWSs**	**Population Served**	**% Population Served**	**# CWSs**	**% CWSs**	**Population Served**	**% Population Served**
EPA Region 2	2	0.02%	10,499	0.01%	5	0.04%	1,888	0.01%	7	0.06%	12,387	0.02%
EPA Region 5	2	0.02%	1,170	0.01%	72	0.6%	117,813	0.1%	74	0.7%	118,983	0.2%
Illinois	630	5.6%	8,936,795	12.1%	1,143	10.1%	3,204,535	4.3%	1,773	15.7%	12,141,330	16.4%
Indiana	110	1.0%	2,605,380	3.5%	660	5.9%	2,479,399	3.4%	770	6.8%	5,084,779	6.9%
Michigan	314	2.8%	5,735,294	7.8%	1,069	9.5%	1,721,567	2.3%	1,383	12.3%	7,456,861	10.1%
Minnesota	44	0.4%	1,485,409	2.0%	921	8.2%	3,117,224	4.2%	965	8.6%	4,602,633	6.2%
New York	668	5.9%	14,355,026	19.4%	1,585	14.0%	3,967,574	5.4%	2,253	19.9%	18,322,600	24.8%
Ohio	264	2.4%	7,724,657	10.4%	881	7.8%	2,854,274	3.9%	1,145	10.1%	10,578,931	14.3%
Pennsylvania	463	4.1%	10,083,157	13.6%	1,421	12.6%	1,379,888	1.9%	1,884	16.9%	11,463,045	15.5%
Wisconsin	58	0.5%	1,885,813	2.6%	971	8.6%	2,274,506	3.1%	1,029	9.1%	4,160,319	5.6%
Column Total	**2,555**	**22.7%**	**52,823,200**	**71.4%**	**8,728**	**77.3%**	**21,118,668**	**28.6%**	**11,283**	**100%**	**73,941,868**	**100%**

Table 3. U.S. Population Served by CWSs that source Surface Water from the Great Lakes and Connecting Rivers

Notes: Data are from CY2023 (2024Q1 SDWIS/Fed data freeze) and only include CWSs with the primary source of surface water from the Great Lakes or its connecting rivers. Primacy agencies exercise primary enforcement responsibility of the National Primary Drinking Water Regulations (NPDWRs). The eight Great Lakes States have primacy to implement the NPDWRs. EPA Region 2 conducts direct implementation for the NPDWRs for Tribal water systems in New York. EPA Region 5 conducts direct implementation of the NPDWRs for Tribal water systems in Indiana, Michigan, Minnesota, and Wisconsin. There are not any federally recognized Tribes in Illinois, Ohio or Pennsylvania (86 FR 7554).

See Figure 3 for maps of the CWSs by county and population served by county.

Acronyms: Community Water Systems (CWSs); Calendar Year (CY)

Sources: Safe Drinking Water Information System (SDWIS) Federal Reports Advanced Search for selected systems. Report Filters: Health Based is Yes.

		Surface Water Source									
Primacy Agency	**Statistic**	**Lake Superior**	**Lake Michigan**	**St. Marys River**	**Lake Huron**	**St. Clair-Detroit River**	**Lake Erie**	**Niagara River**	**Lake Ontario**	**St. Lawrence River**	**Row Total**
EPA Region 2	#CWSs	-	-	-	-	-	1	-	-	1	2
	Population Served	-	-	-	-	-	4,999	-	-	5,500	10,499
EPA Region 5	#CWSs	2	-	-	1	-	-	-	-	-	3
	Population Served	1,170	-	-	4,653	-	-	-	-	-	5,823
Illinois	#CWSs	-	231	-	-	-	-	-	-	-	231
	Population Served	-	6,698,037	-	-	-	-	-	-	-	6,698,037
Indiana	#CWSs	-	16	-	-	-	-	-	-	-	16
	Population Served	-	489,453	-	-	-	-	-	-	-	489,453
Michigan	#CWSs	5	62	1	131	88	5	-	-	-	292
	Population Served	30,962	916,413	14,689	1,651,696	2,708,679	104,326	-	-	-	5,426,765
Minnesota	#CWSs	8	-	-	-	-	-	-	-	-	8
	Population Served	103,406	-	-	-	-	-	-	-	-	103,406
New York	#CWSs	-	-	-	-	-	30	30	51	17	128
	Population Served	-	-	-	-	-	902,199	348,006	1,101,115	47,669	2,398,989
Ohio	#CWSs	-	-	-	-	-	73	-	-	-	73
	Population Served	-	-	-	-	-	2,835,074	-	-	-	2,835,074
Pennsylvania	#CWSs	-	-	-	-	-	8	-	-	-	8
	Population Served	-	-	-	-	-	245,849	-	-	-	245,849
Wisconsin	#CWSs	2	47	-	-	-	-	-	-	-	49
	Population Served	34,084	1,574,086	-	-	-	-	-	-	-	1,608,170
Column Total	#CWSs	17	356	1	132	88	117	30	51	18	810
	Population Served	169,622	9,677,989	14,689	1,656,349	2,708,679	4,092,447	348,006	1,101,115	53,169	19,822,065

Table 4. U.S. Great Lakes Community Water Systems: Health-Based Violations and Population Served

Notes: Data are from CY2023 (2024Q1 SDWIS/Fed data freeze) and only include CWSs with the primary source of surface water from the Great Lakes or its connecting river ecosystems. "St. Lawrence River" includes only the CWSs that source from the international section of the river (between Cape Vincent, NY and St. Regis, NY). Violation codes 1A, 64, 65, and Stage 2 DBP were omitted from this analysis.

Rating key: Good is >90% met all health-based standards; Fair is 80-90% met all health-based standards; Poor is <80% met all health-based standards. The St. Marys River was not rated due to an insufficient CWS sample size (n=1).

See Figure 4 U.S. Great Lakes Community Water Systems: Total Population Served vs. Population Served by CWSs with Health-Based Violations

See Figure 5. U.S. Great Lakes Community Water Systems: Health-Based Violations by Rule and Surface Water Source

Acronyms: Community Water Systems (CWSs); Health-Based Violation (HBV); Calendar Year (CY)

Sources: Safe Drinking Water Information System (SDWIS) Federal Reports Advanced Search for selected systems. Report Filters: Health Based is Yes.

Great Lake (including connecting river)	Surface water source	HBVs	CWSs with HBV	Total CWSs	% of CWSs that met all Health-Based Standards	Rating	Population served by CWSs with HBV	Total population served	% of population served by CWSs that met all Health-Based Standards	Rating
Lake Superior	Lake Superior	1	1	17	94.1%	Good	2,355	169,622	98.6%	Good
Lake Michigan	Lake Michigan	4	4	356	98.9	Good	52,355	9,677,989	99.5%	Good
Lake Huron	St. Marys River	0	0	1	100%	Good	0	14,689	100%	Good
	Lake Huron	4	3	132	96.9%	Good	40,313	1,656,349	97.6%	Good
	River & Lake combined	4	3	133	97.7%	Good	40,313	1,671,038	97.6%	Good
Lake Erie	St. Clair – Detroit River	3	3	88	96.6%	Good	25,544	2,708,679	99.1%	Good
	Lake Erie	2	2	117	98.3%	Good	480,865	4,092,447	88.2%	Fair
	River & Lake combined	5	5	205	95.6%	Good	506,409	6,801,126	92.6%	Good
Lake Ontario	Niagara River	0	0	30	100%	Good	0	348,006	100%	Good
	Lake Ontario	0	0	51	100%	Good	0	1,101,115	100%	Good
	St. Lawrence River	1	1	18	94.4%	Good	548	53,169	98.8%	Good
	Rivers & Lake combined	1	1	99	99.0%	Good	548	1,502,290	99.9%	Good
Overall		**15**	**14**	**810**	**98.2%**	**Good**	**601,980**	**19,822,065**	**97.0%**	**Good**

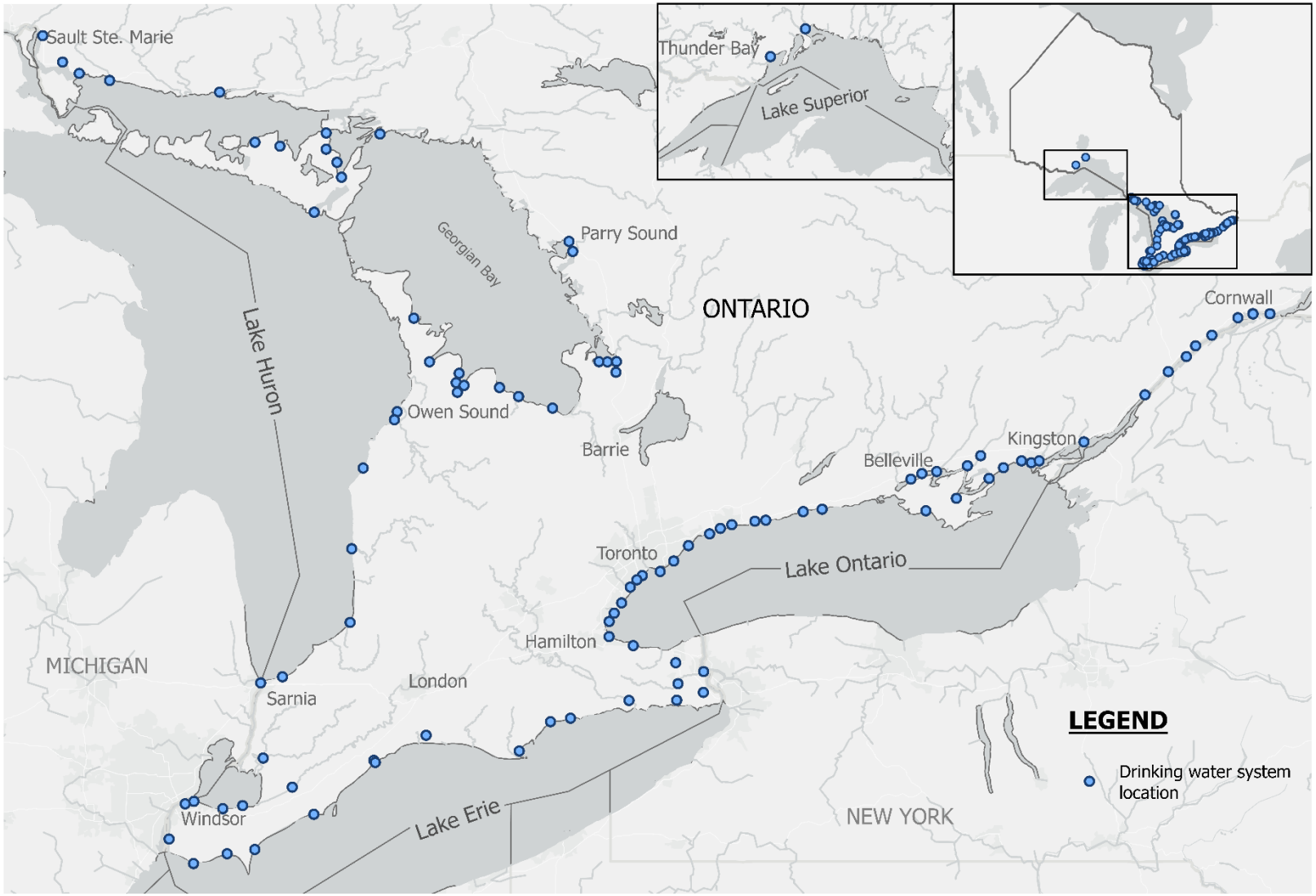


Figure 1. Locations of Ontario drinking water systems included in this report. Source: Ontario Ministry of the Environment, Conservation and Parks, Adaptation and Resilience Branch, Geomatics and Analytics Section, 2024. Contact: Pat McInnis, 416-235-6204, patrick.mcinnis@ontario.ca

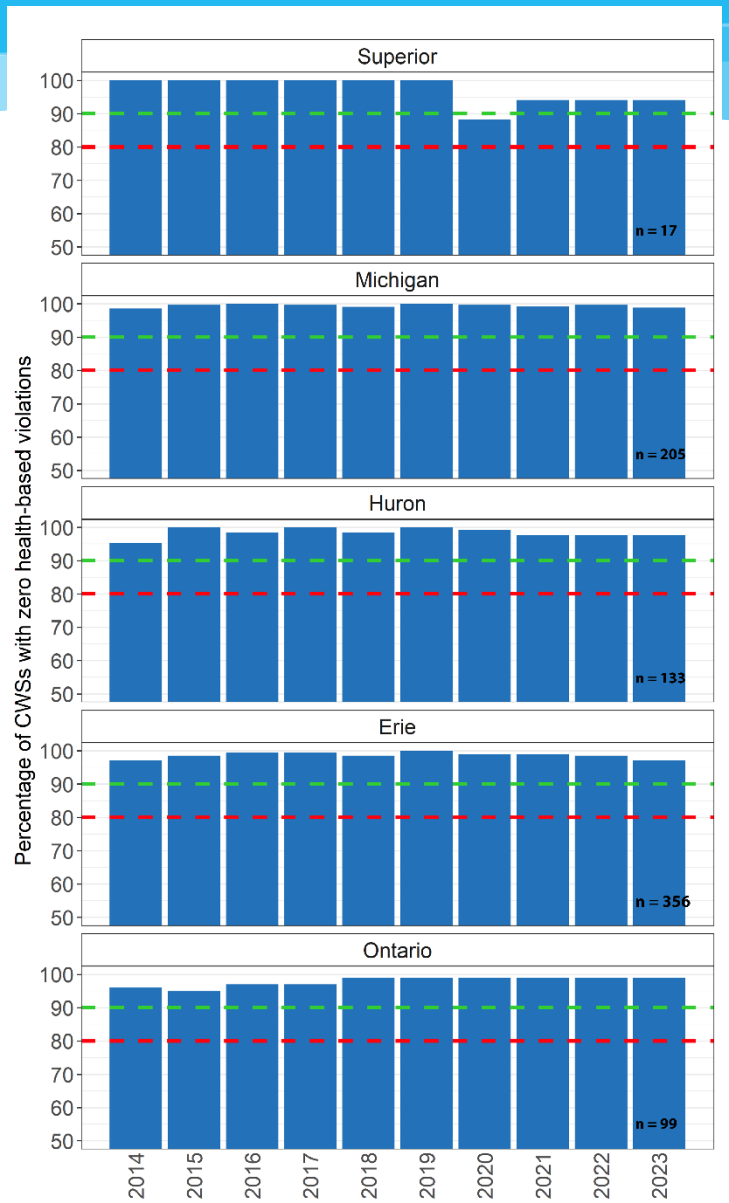
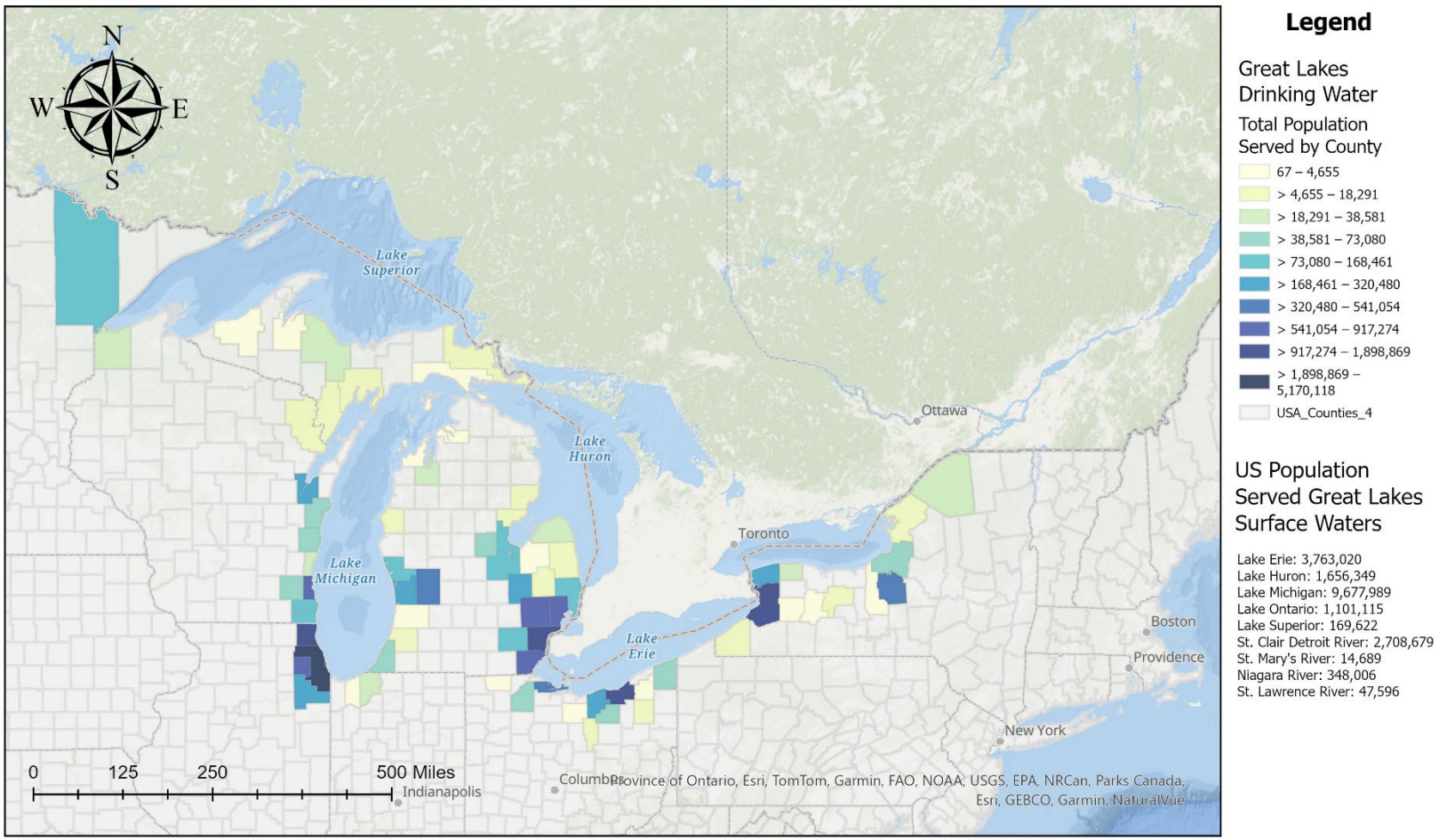


Figure 2. 10-year trend in proportion of CWSs that met all health-based standards. Green and red dashed lines indicate Good and Poor thresholds. Violation codes 1A, 64, 65, and Stage 2 DBP were omitted from this analysis. Sources: Safe Drinking Water Information System (SDWIS) Federal Reports Advanced Search for selected systems.



Date: 10/01/2024
Author: Hira Ahmad
Layers: USA Counties; esri_dm
Data are from 2023 Community Water Systems Great Lakes

Figure 3. U.S. Population Served by Community Water Systems that Source from Great Lakes Surface Waters.

Note: The symbology displays the population served by CWSs that source from the surface waters of the Great Lakes and connecting rivers (surface water and surface water purchase systems) by county.

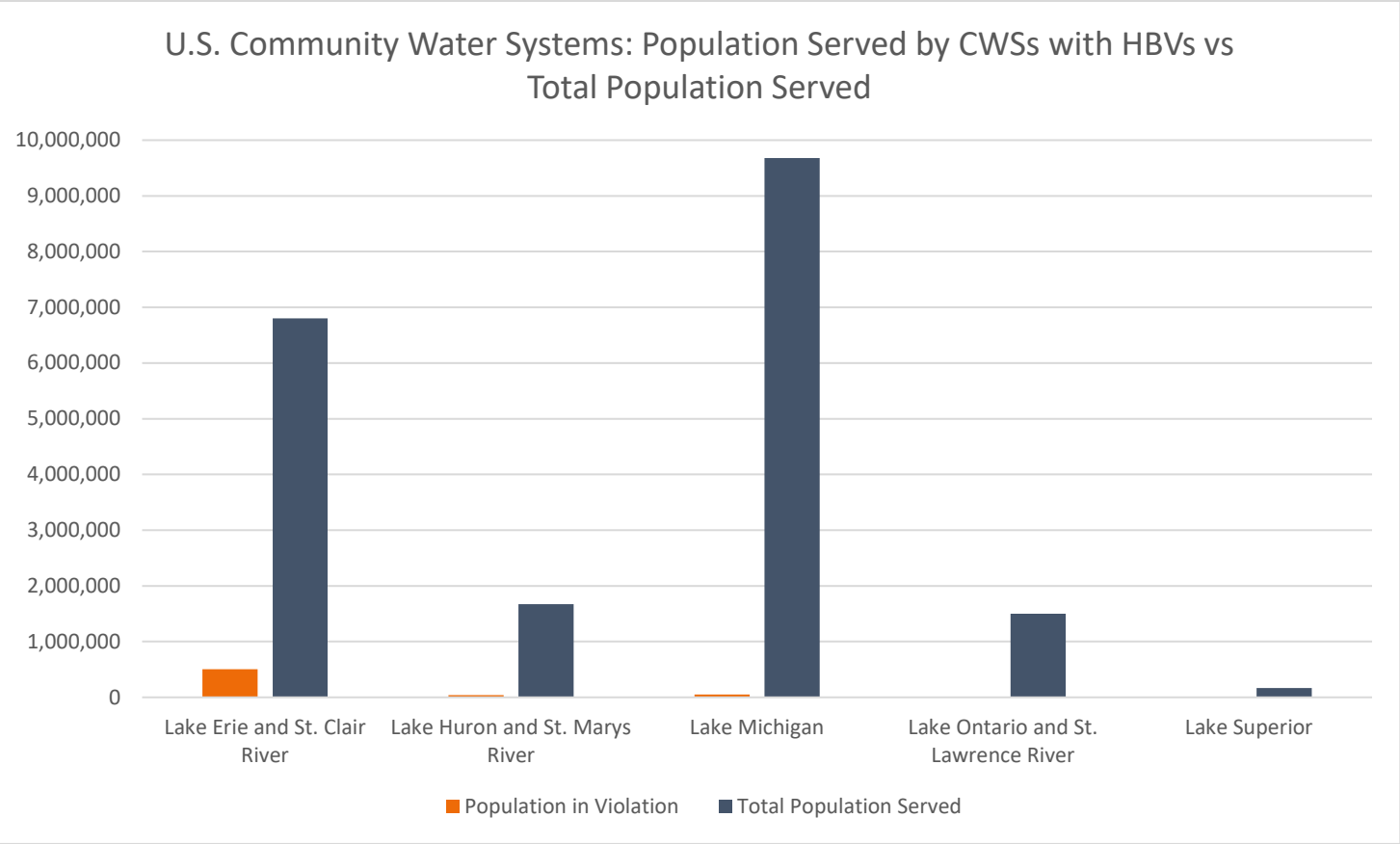


Figure 4. U.S. Great Lakes Community Water Systems: Total Population Served vs. Population Served by CWSs with Health-Based Violations

Note: Data are from CY2023 (2024Q1 SDWIS/Fed data freeze) and only include CWSs with the primary source of surface water from the Great Lakes or its connecting rivers. Violation codes 1A, 64, 65, and Stage 2 DBP were omitted from this analysis.

Acronyms: Community Water Systems (CWSs); Health-Based Violation (HBV)

Sources: Safe Drinking Water Information System (SDWIS) Federal Reports Advanced Search for selected systems. Report Filters: Health Based is Yes.

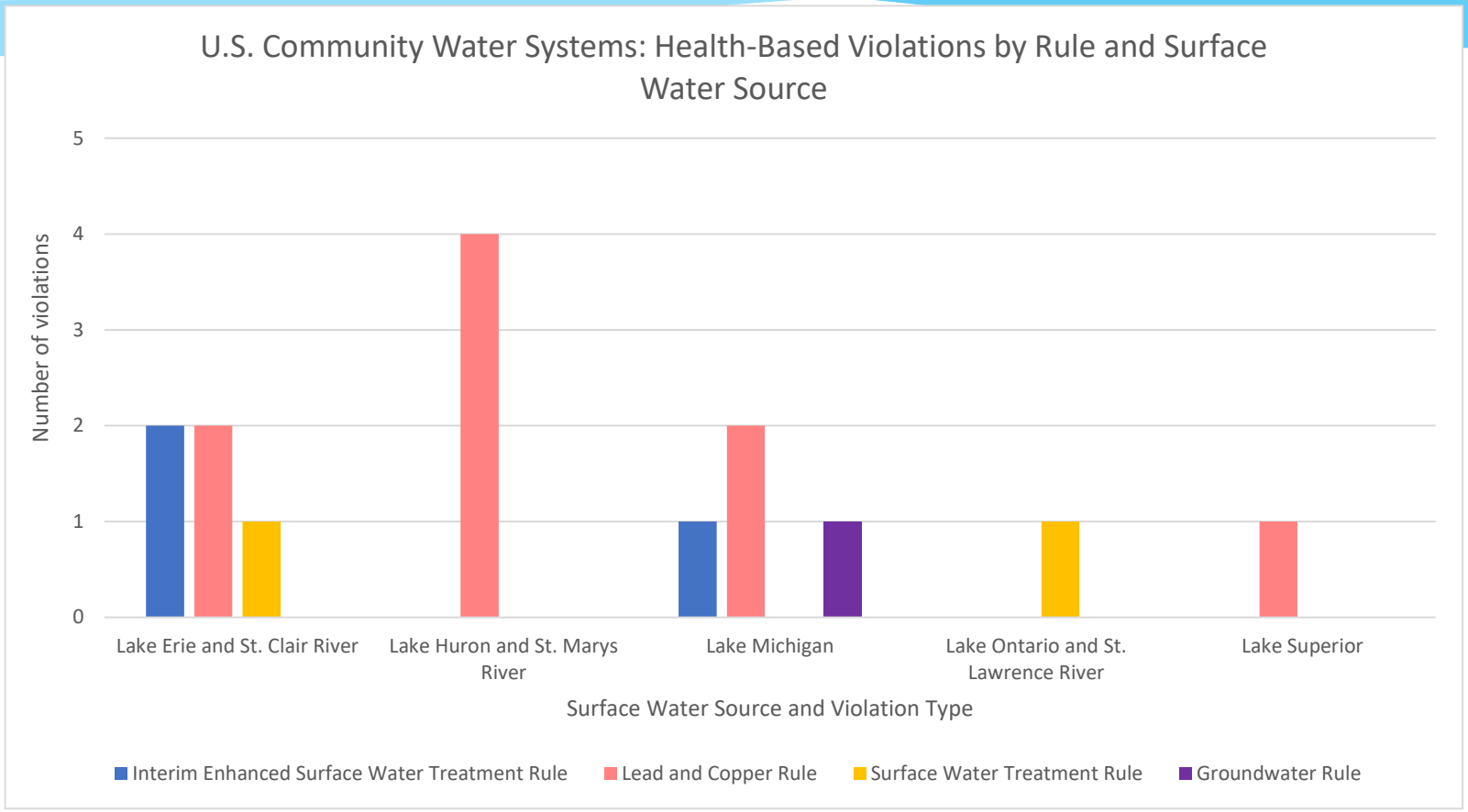


Figure 5. U.S. Great Lakes Community Water Systems: Health-Based Violations by Rule and Surface Water Source

Notes: Data are from CY2023 (2024Q1 SDWIS) and only include CWSs with the primary source of surface water from the Great Lakes or its connecting rivers. Violation codes 1A, 64, 65, and Stage 2 DBP were omitted from this analysis. DBPR violations included systems whose locational running annual average exceeded the MCL for TTHMs or HAA5s, and a system that was not operated by a state-approved operator (TT). LCR violations included failure to submit an optimal corrosion control study, failure to maintain optimal water quality parameters, failure to complete all public education requirements, and a lead action level exceedance. SWTRs violations included a system that did not meet the minimum residual disinfectant concentration and one post-filtration turbidity sample that exceeded 1 NTU. The RTCR violation was a positive *E. coli* sample result in the distribution system.

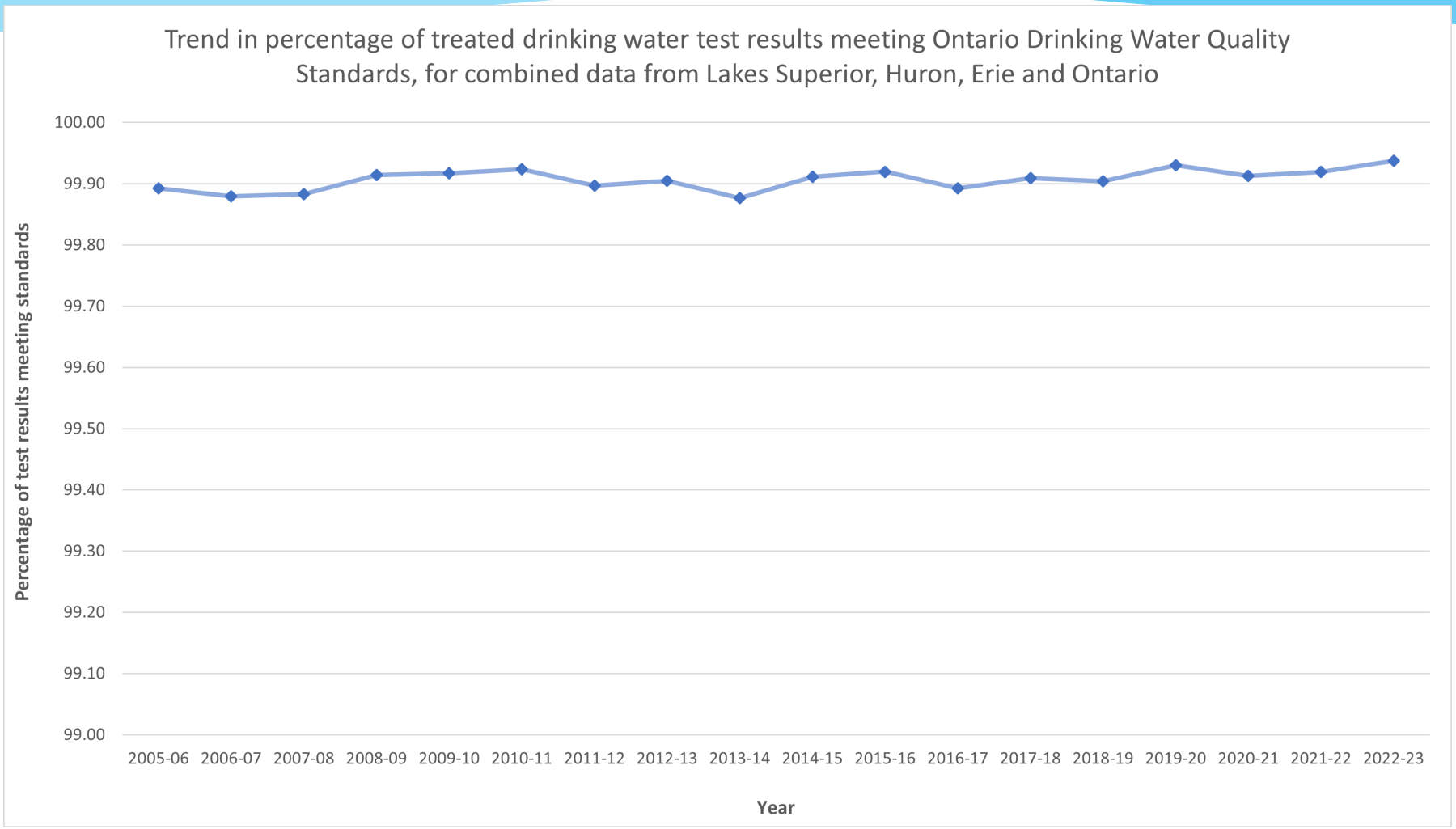


Figure 6. Trend in percentage of treated drinking water test results meeting Ontario Drinking Water Quality Standards, for combined data from Lakes Superior, Huron, Erie and Ontario. Source: Ontario Ministry of the Environment, Conservation and Parks, Drinking Water and Environmental Compliance Division, 2024. Contact: Pat McInnis, 416-235-6204, patrick.mcinnis@ontario.ca

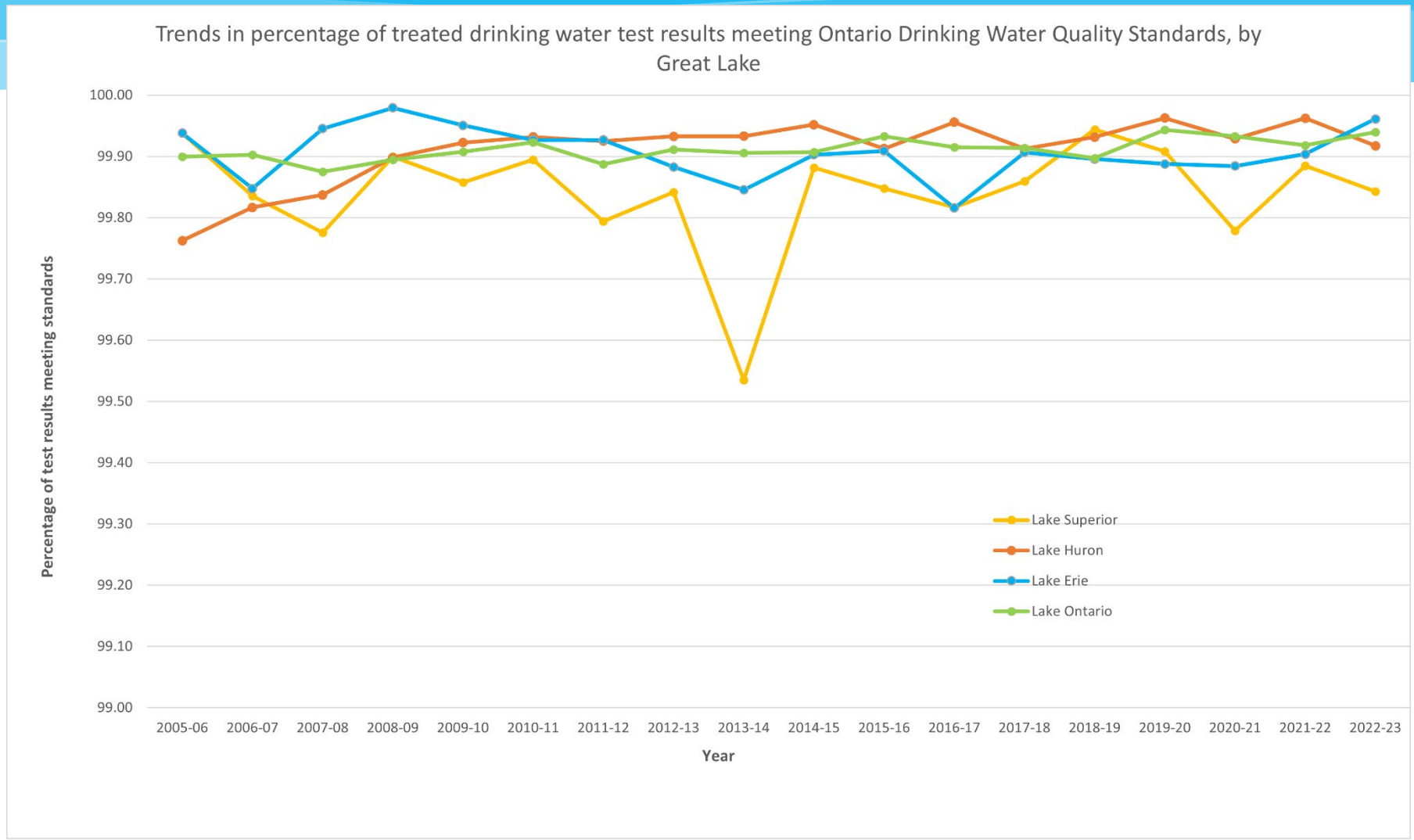


Figure 7. Trends in percentage of treated drinking water test results meeting Ontario Drinking Water Quality Standards, by Great Lake. Source: Ontario Ministry of the Environment, Conservation and Parks, Drinking Water and Environmental Compliance Division, 2024. Contact: Pat McInnis, 416-235-6204, patrick.mcinnis@ontario.ca

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State of the Great Lakes 2025 Report