

## SUMMARY REPORT

# Archived Graphs of the COVID-19 Wastewater Surveillance in Ontario

Published: April 2023

## Introduction

The [COVID-19 Wastewater Surveillance in Ontario](#) report presents COVID-19 wastewater signals in Ontario and sub-regions. Analyses are conducted by Public Health Ontario (PHO) based on the original work of the Ontario COVID-19 Science Advisory Table entitled, *Wastewater Signals in Ontario*<sup>1</sup>, using data collected as part of the Ministry of Environment, Conservation, and Parks (MECP) [Wastewater Surveillance Initiative](#) (WSI).

As of April 13, 2023, PHO updated its [COVID-19 Wastewater Surveillance in Ontario report to align with changes to MECP's Wastewater Surveillance Initiative](#) (WSI) as well as changes to PHO's analytical approach. The purpose of this document is to provide a snapshot of the final COVID-19 Wastewater Surveillance in Ontario (as of March 31, 2023) report before the changes were implemented.

## Summary of Changes

On April 1, 2023, MECP's WSI transitioned to a targeted sentinel site approach that reduced the number of routinely participating sites from 108 to 59. At the same time, PHO also updated the statistical software (from STATA to R) used to run the analysis to a more flexible and sustainable system as well as changing the population source used to weight the signals from the entire public health unit population to sewershed populations.

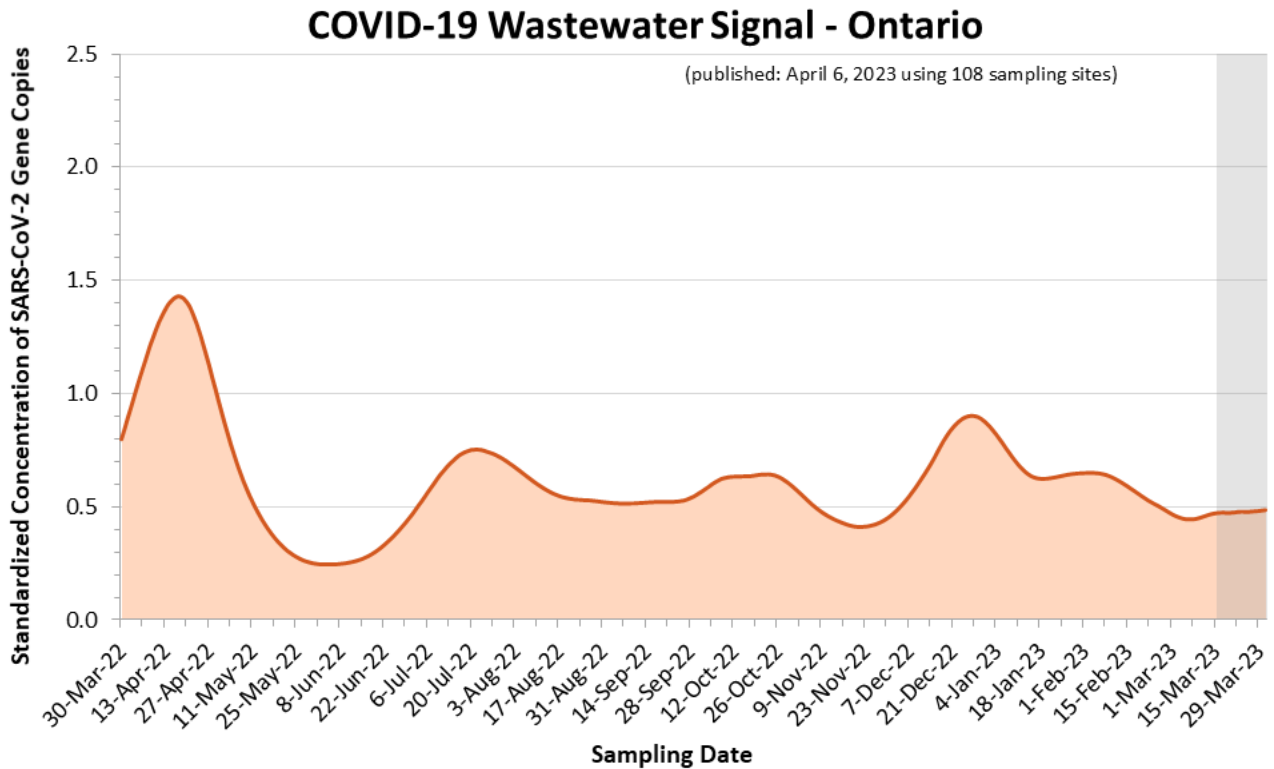
As a result of these changes, the COVID-19 Wastewater Surveillance in Ontario report may notice that the graphs in this document look different from the current reports. The graphs may look less smooth or the curves may be aligned differently due to:

- Updates to the WSI: The initiative now uses a strategic sampling network for collecting wastewater samples across each public health unit region, resulting in a change in number of sample collection sites used in the analysis from 108 down to 59 as of April 1, 2023.
- Change to the statistical software PHO uses to run the analysis: The analysis is run in R now with 14-day knots compared to the previous 10-day knots used in STATA. A knot is a point where two different segments of a curve are connected, and the curve changes direction or slope at that point. Knots are used to fit a more flexible curve that can better capture nonlinear relationships in the data.
- Changes to population source used to weight the signals. In the analysis, weighing the wastewater signal refers to giving a value to each individual site or sewersheds so that it accurately reflects its relative contribution to the overall amount of wastewater in the region.

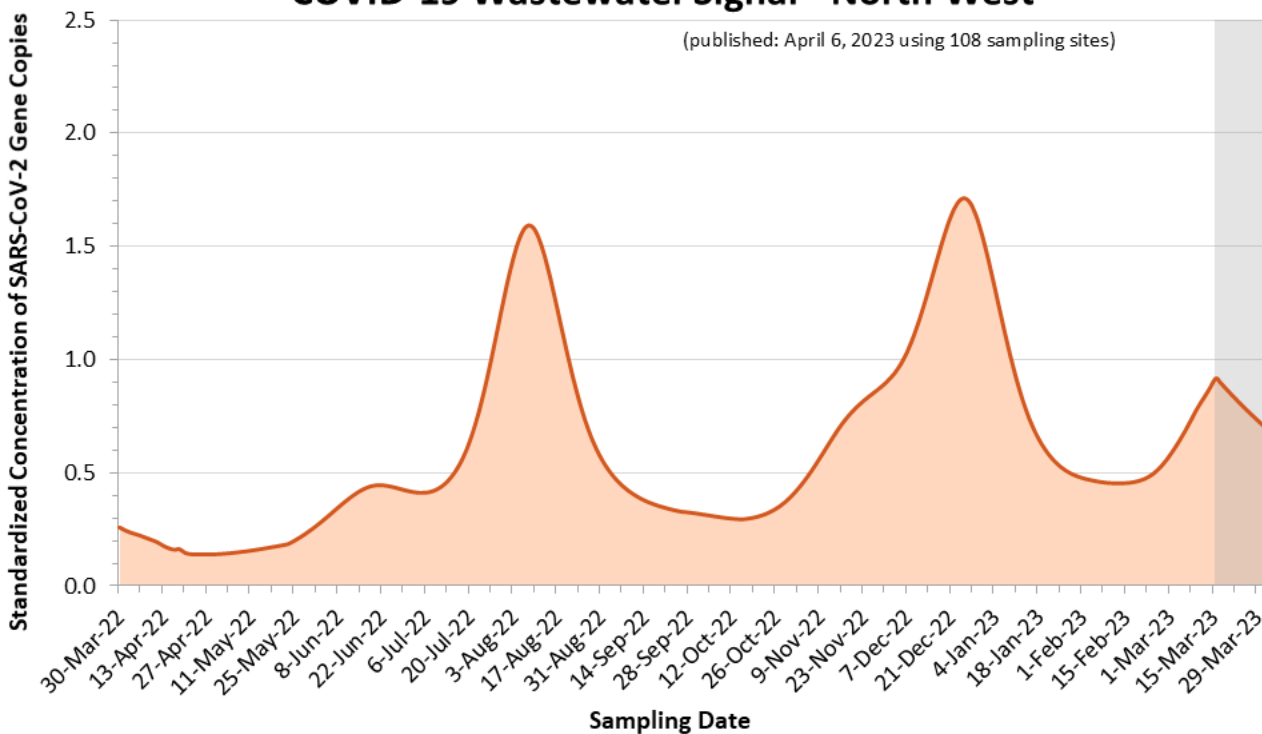
- There are also a number of reasons that the curves in the wastewater graphs could change from week to week. These reasons include, but are not limited to the analytical approach used, new data submissions for recent days or updates to previously reported data. The curves in the graphs therefore represent the best estimates for the wastewater signal when they were run. Past estimates may be under- or over-estimated.

## Final Graphs Produced Using STATA and Data from 108 Sites

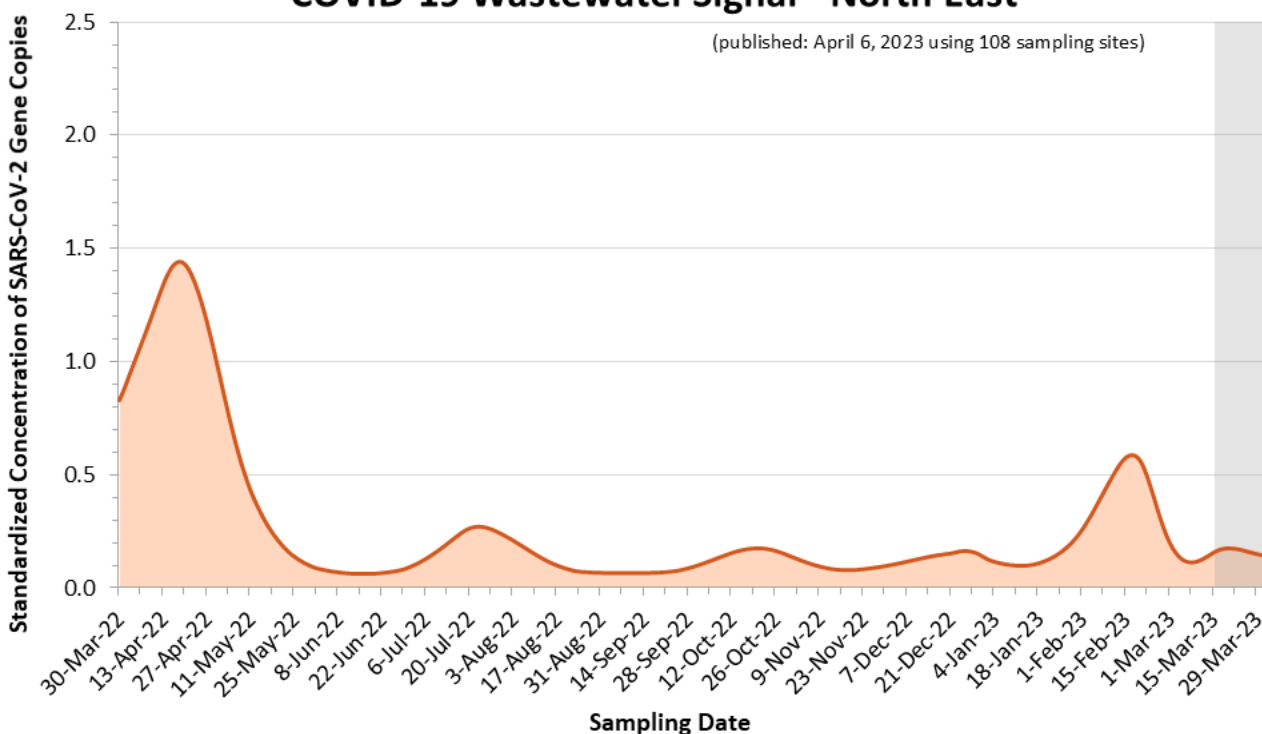
**Grey Background:** The portion of the curves highlighted with a grey background should be interpreted with caution because these estimates have a higher likelihood of changing due to a combination of reasons, including but not limited to the analytical approach used, new data submissions, or updates to previously reported data.



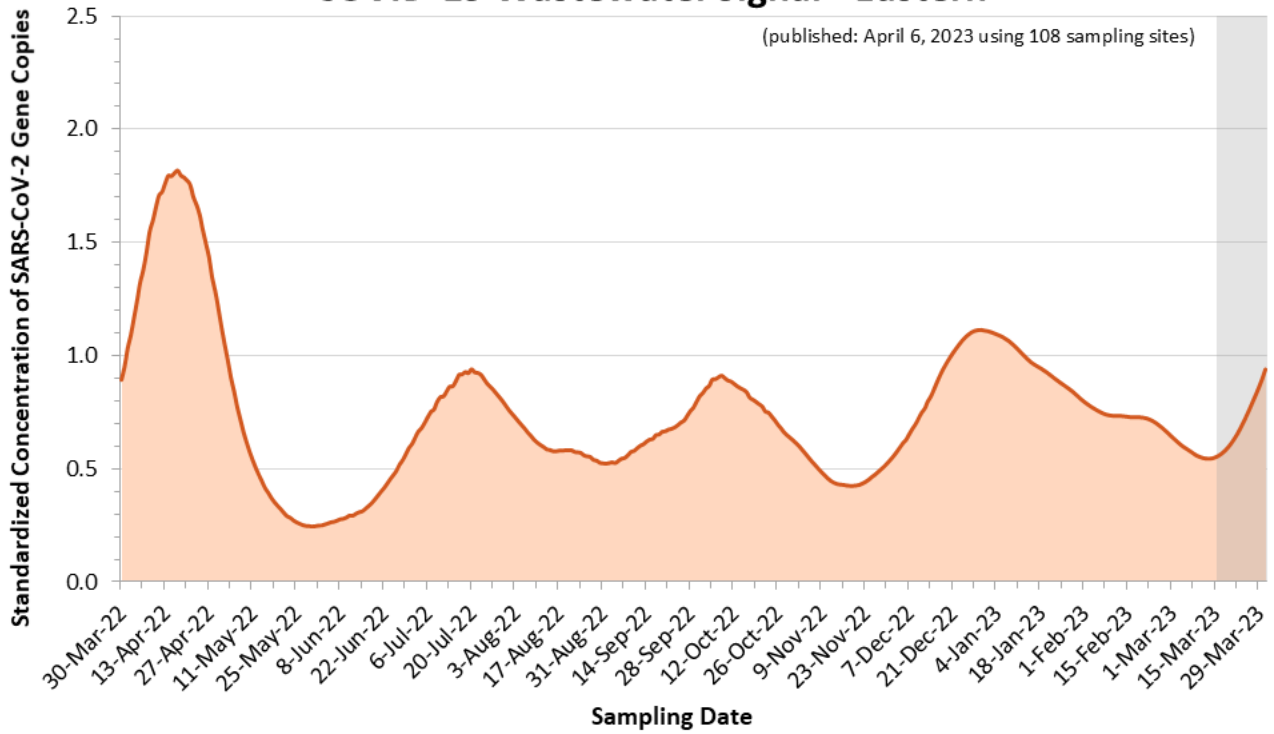
### COVID-19 Wastewater Signal - North West



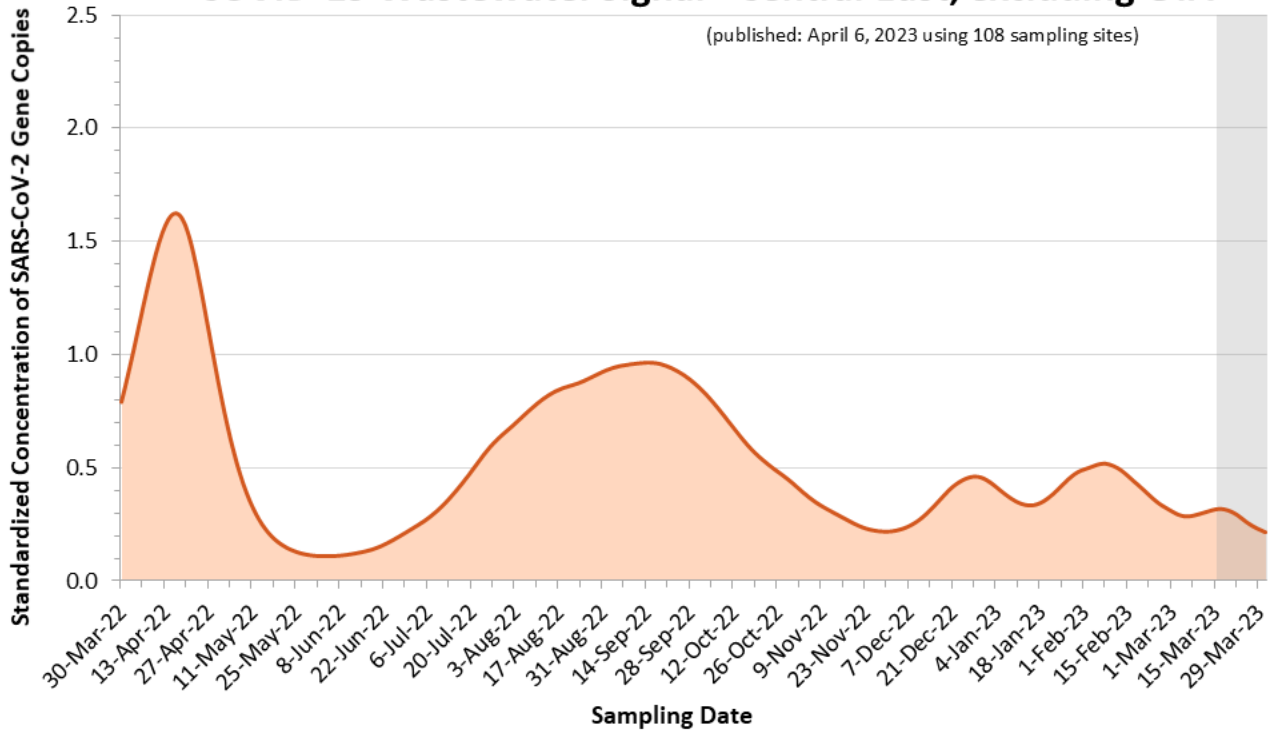
### COVID-19 Wastewater Signal - North East



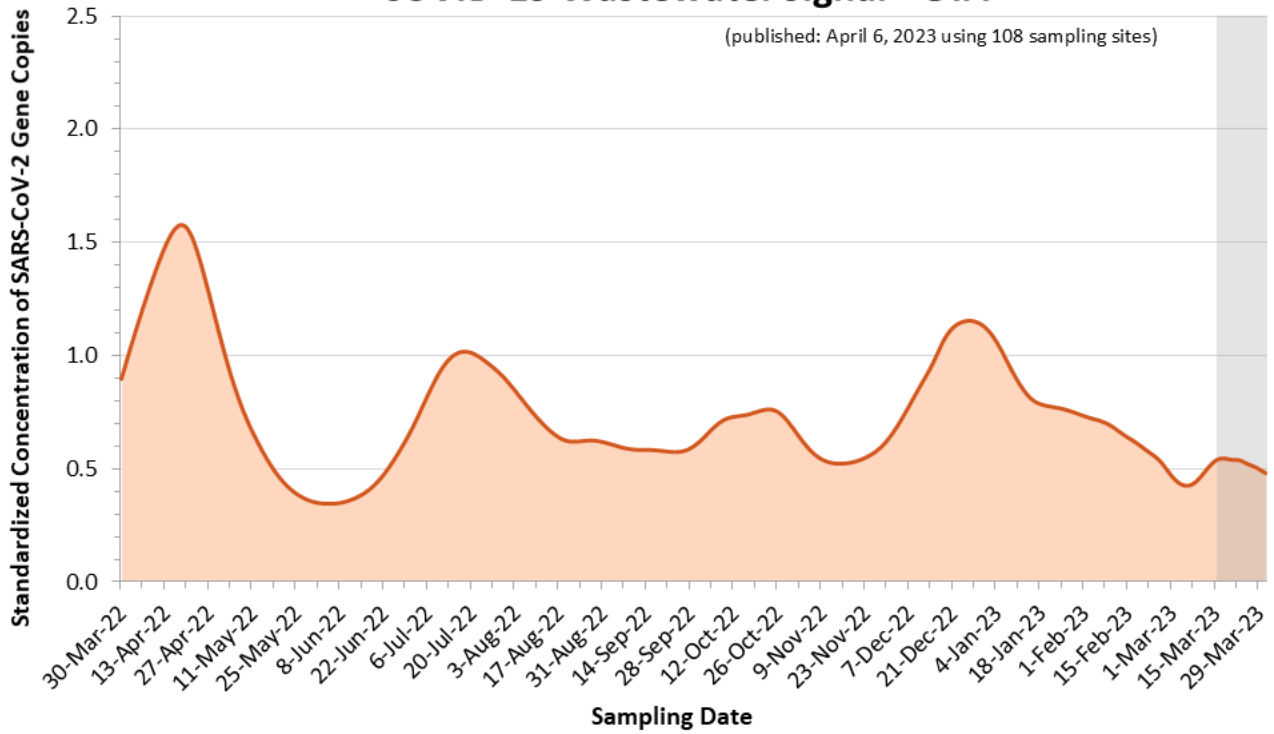
## COVID-19 Wastewater Signal - Eastern



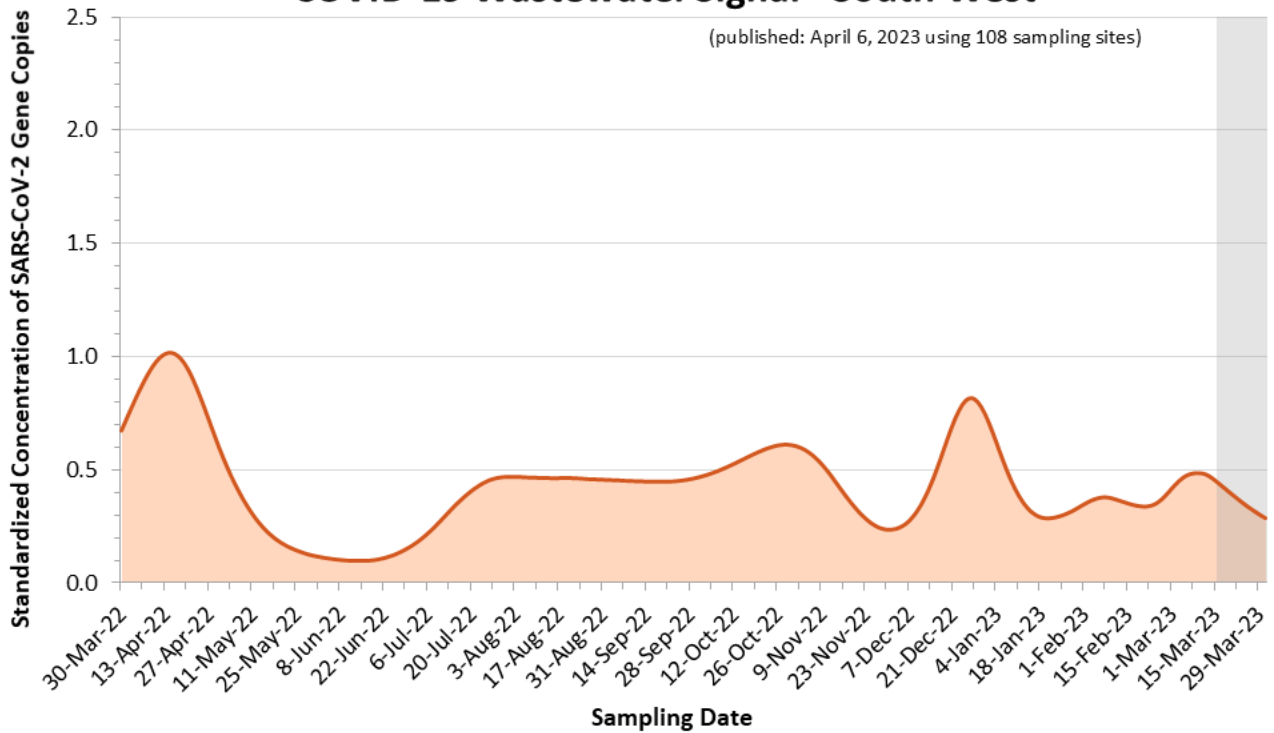
## COVID-19 Wastewater Signal - Central East, excluding GTA

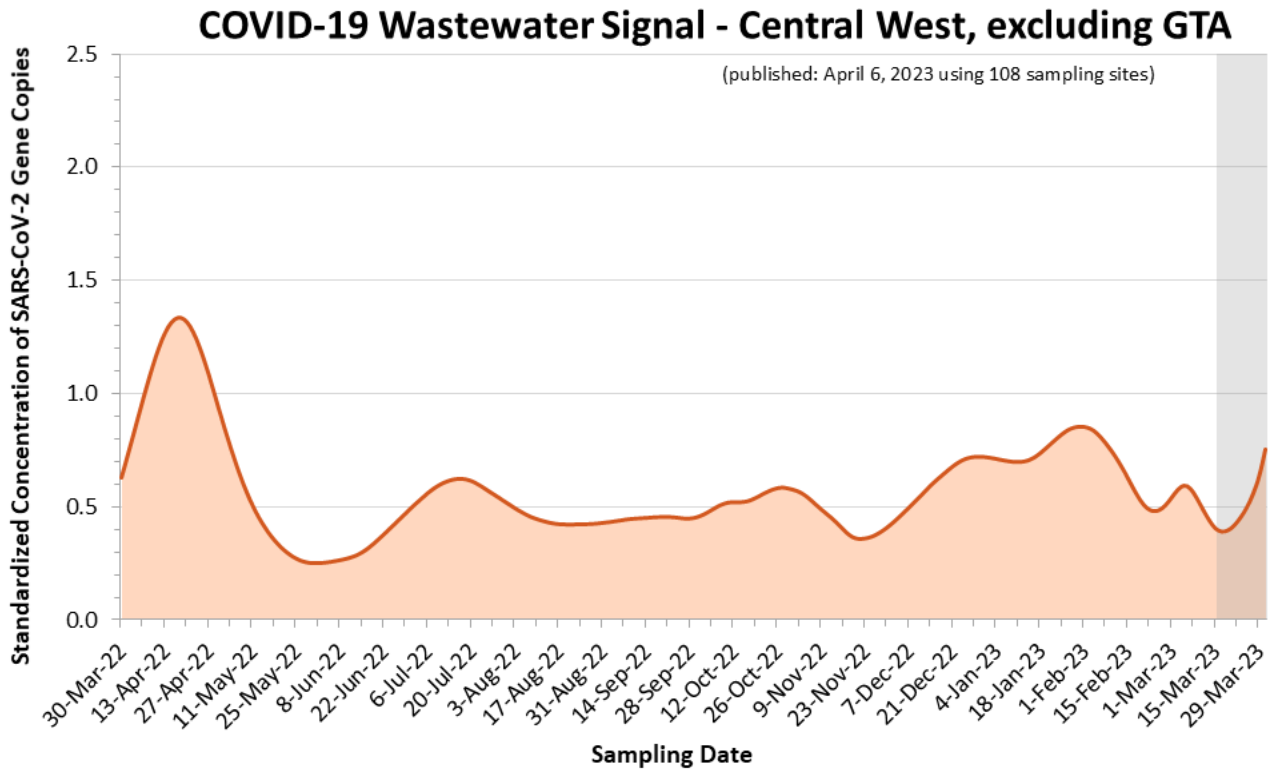


## COVID-19 Wastewater Signal - GTA



## COVID-19 Wastewater Signal - South West





**Grey Background:** The portion of the curves highlighted with a grey background should be interpreted with caution because these estimates have a higher likelihood of changing due to a combination of reasons, including but not limited to the analytical approach used, new data submissions, or updates to previously reported data.

# Glossary

## Ontario Sub-regions

These refer to the following geographical groupings of public health units:

- North West: Northwestern Health Unit and Thunder Bay District Health Unit.
- North East: Algoma Public Health; North Bay Parry Sound District Health Unit; Porcupine Health Unit; Public Health Sudbury & Districts; and Timiskaming Health Unit.
- Eastern: Eastern Ontario Health Unit; Hastings Prince Edward Public Health; Kingston, Frontenac and Lennox & Addington Public Health; Leeds, Grenville & Lanark District Public Health; Ottawa Public Health; and Renfrew County and District Health Unit.
- Central East, excluding GTA: Haliburton Kawartha and Pine Ridge District Health Unit; Peterborough Public Health; and Simcoe Muskoka District Health Unit.
- Greater Toronto Area (GTA): Durham Region Health Department; Halton Region Public Health; Peel Public Health; Toronto Public Health; and York Region Public Health
- South West: Chatham-Kent Public Health; Grey Bruce Health Unit; Huron Perth Public Health; Lambton Public Health; Middlesex-London Health Unit; Southwestern Public Health; and Windsor-Essex County Health Unit.
- Central West, excluding GTA: Brant County Health Unit; Haldimand-Norfolk Health Unit; City of Hamilton Public Health Services; Niagara Region Public Health, Region of Waterloo Public Health and Emergency Services; and Wellington-Dufferin-Guelph Public Health.

## Sampling Date

This refers to the date that the wastewater sample was collected.

## Standardized Concentration of SARS-CoV-2 Gene Copies

This calculated measure refers to the estimated wastewater signal for SARS-CoV-2 using analytic methods developed by the former Ontario COVID-19 Science Advisory Table (described below).<sup>1</sup>

## Data Source

Wastewater gene concentration data were extracted from the MECP WSI data hub's *Ontario – Extended Aggregated WSI Dataset* [unpublished data table] on Wednesday, April 5, 2023 at 1:00pm by Public Health Ontario.

## Methods

The COVID-19 Wastewater Surveillance in Ontario report is based on the original work of the Ontario COVID-19 Science Advisory Table entitled, *Wastewater Signals in Ontario*. This method provides a province-wide COVID-19 wastewater signal for Ontario by taking a weighted mean of the standardized, biomarker-normalized concentrations of SARS-CoV-2 gene copies sampled across 108 wastewater treatment plants, pumping stations and sewersheds located in all 34 public health units.

Given differences in testing, sampling, and watershed characteristics across the province, each time-series of biomarker-normalized gene concentrations (N1 and N2) is standardized at each sampling location, by dividing by the site- and gene-specific standard deviation, and then log transformed. Next, the average daily standardized gene concentration (i.e., the average of the standardized N1 and N2 signals) for each sampling location is smoothed using restricted cubic splines, with knots located every 10 days.

The above estimates are subsequently aggregated to provide regional and provincial trends. To create wastewater signals at the public health unit level, a fixed-effects meta-analysis approach is applied using an inverse-variance weighted mean of the log transformed estimates for each wastewater treatment plant, pumping station, and sewershed. To create an aggregated provincial signal, the daily inverse-variance weighted means at the public health unit level are further combined using a fixed-effects analysis weighted by the estimated 2021 public health unit population size.<sup>2</sup>

## Data Notes and Caveats

- Samples are typically taken 3 times per week at each location. There is an estimated lag of 5 to 7 days between the detection of SARS-CoV-2 gene copies in sampled wastewater and the diagnosis and reporting of COVID-19 cases. The wastewater signal on January 21, for example, is reflected in reported COVID-19 cases around January 26 to 28.
- Ontario's wastewater surveillance is coordinated and hosted by the MECP. Laboratory analyses are done by Carleton University, University of Guelph, Health Sciences North Research Institute, McMaster University, National Microbiology Laboratory, Ontario Tech University, University of Ottawa, Queen's University, Toronto Metropolitan University, University of Toronto, Trent University, University of Waterloo, University of Western Ontario and University of Windsor.
- Previously presented wastewater signals are subject to change for the following reasons:
  - Incorporation of newly received results that were not available in previous weeks due to occasional shipping and laboratory processing delays. This may result in signal changes compared to previous weeks.
  - Revisions to previously submitted data. Examples include updates to analytical methods made at testing laboratories and re-processing of previously tested samples.



- Standard deviations which are used to standardize the entire time series are updated as new data are added or updated. This would result in changes to the historical signal.
- The presented graphs display estimates of wastewater signals using the statistical approaches described above. As the graphs include recent periods of time for which complete data are not yet available, more recent estimates are subject to change with receipt of additional data. The grey background on the graphs represents days or weeks where the wastewater signals are most sensitive to changes such as, but not limited to, new or updated data submissions and/or the analytical weighting method that is used. For example, the standardized values are plotted when at least 50% of data are available for any of the genes for a given date. As such, the portion of the curve within the grey box is subject to change as more data become available.
- The number of wastewater treatment plants, pumping stations and sewersheds providing data from each of the seven regions prior to April 1, 2023 include:
  - North West: 3
  - North East: 8
  - Eastern: 18
  - Central East, excluding GTA: 14
  - Greater Toronto Area (GTA): 28
  - South West: 19
  - Central West, excluding GTA: 18

## References

1. Jüni P, da Costa BR, Maltsev A, Katz GM, Perkhun A, Yan S, et al. Briefs of the Ontario COVID-19 Science Advisory Table: Ontario dashboard: tracking Omicron [Internet]. Toronto, ON: Ontario COVID-19 Science Advisory Table; 2021 [cited 2022 Sep 4]. Available from: <https://doi.org/10.47326/ocsat.dashboard.2021.1.0>
2. Statistics Canada. Table 17-10-0134-01: estimates of population (2016 census and administrative data), by age group and sex for July 1st, Canada, provinces, territories, health regions (2018 boundaries) and peer groups [Internet]. Ottawa, ON: Government of Canada; 2022 Mar 22 [extracted 2022 Mar 25]. Available from: <https://doi.org/10.25318/1710013401-eng>

## Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Archived graphs of the COVID-19 wastewater surveillance in Ontario. Toronto, ON: King's Printer for Ontario; 2023.

## Disclaimer

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