

Western Lake Erie Tributary Water Monitoring Summary

March 1, 2021 - July 31, 2021

lakeerie.ohio.gov

Why is water monitoring done, and by whom?

Federal, state, and educational institutions conduct water monitoring for a variety of reasons.

The U. S. Geological Survey (USGS), along with its federal, state, and local partners, investigates the occurrence, quantity, quality, distribution, and movement of surface and ground waters and shares data with the public and other agencies involved with managing our water resources.

Ohio EPA conducts water monitoring to assess stream condition and to develop Total Maximum

Daily Loads for impaired waters.

ODNR is interested in protecting recreation, fish, and wildlife water uses.

Educational institutions such as Heidelberg University's National Center for Water Quality Research do water testing to answer research questions.

What do we measure?

Many components are measured. This summary focuses on total phosphorus, dissolved reactive phosphorus, & nitrogen as nitrite (NO₂)+nitrate (NO₃).

USGS measures the amount of water that flows in rivers at their streamflow gaging stations.

Why this summary?

This summary provides a simplified overview of nutrient loads and concentrations that have been shown to be highly correlated with harmful algal blooms in Lake Erie.

Summarizing the results of these water monitoring efforts provides critical information to agencies and the public. This summary is a tool for tracking annual changes and comparisons to water quality goals established by Annex 4 of the Great Lakes Water Quality Agreement and the Western Basin of Lake Erie Collaborative Agreement.

Where is the water monitored?

Ohio EPA, ODNR, USGS, and Heidelberg University have established many sampling stations in the Lake Erie watershed. Some of these stations are in the same locations to take advantage of USGS streamflow gage locations.

The stations in Figure 1 were chosen from a larger set to indicate the nutrient contributions upstream of the lake influenced sections of the rivers. Due to its large size, several tributaries to the Maumee River were also included.

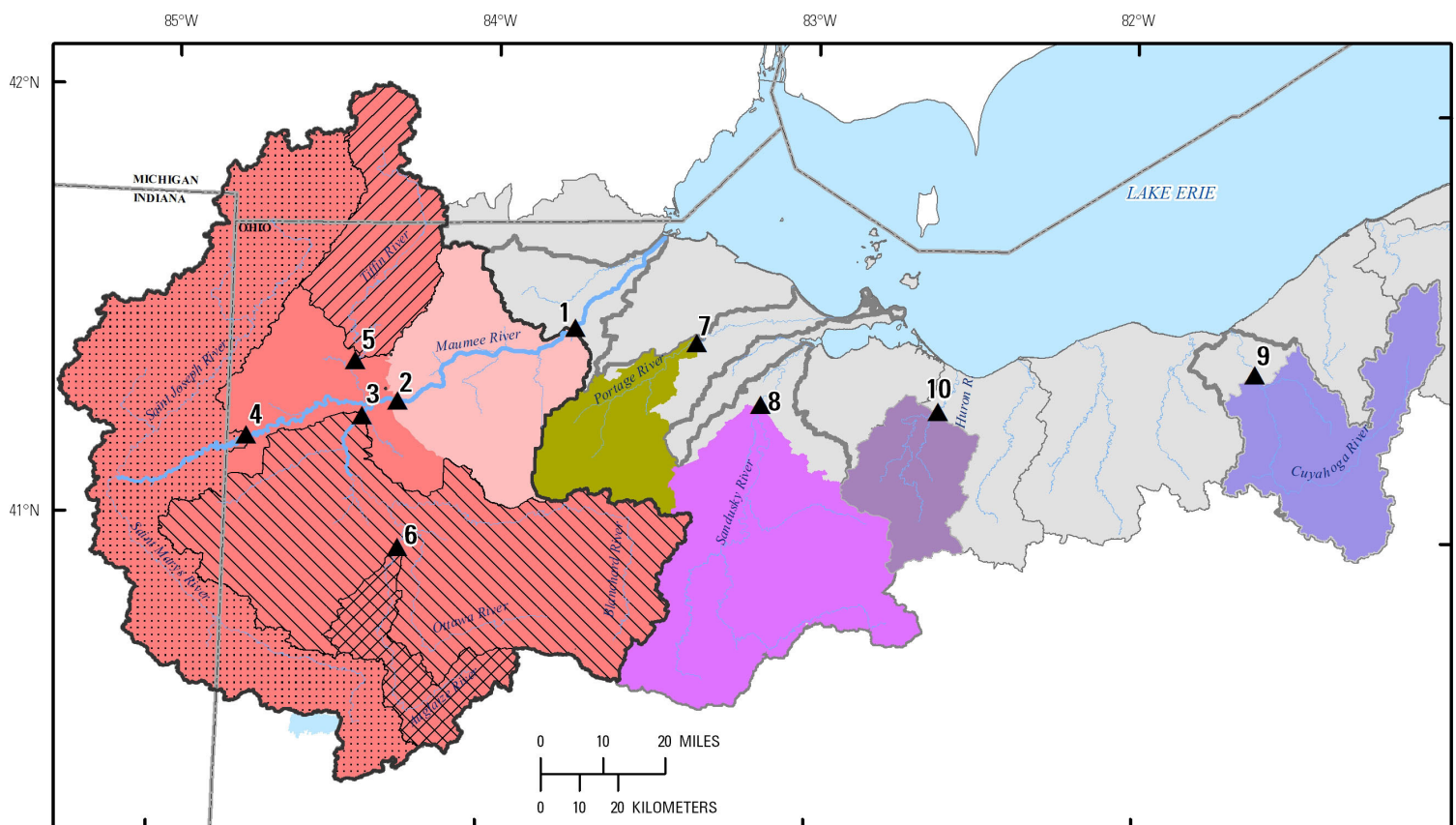


Figure 1: Sampling stations discussed in this report.

Station 1: Gage 04193500 - Maumee River at Waterville

Station 2: Gage 04192500 - Maumee River near Defiance

Station 3: Gage 04191500 - Auglaize River near Defiance d/s Dam

Station 4: Gage 04183500 - Maumee River at Antwerp

Station 5: Gage 04185318 - Tiffin River near Evansport

Station 6: Gage 04186500 - Auglaize River near Fort Jennings

Station 7: Gage 04195500 - Portage River at Woodville

Station 8: Gage 04198000 - Sandusky River near Fremont

Station 9: Gage 04208000 - Cuyahoga River at Independence

Station 10: Gage 04199000 - Huron River at Milan

What were the nutrient loads and concentrations for the loading season in 2021?

This set of charts compares nutrient levels at these stations for the months of March through July. This period is used because the Annex 4 subcommittee determined that phosphorus contributions in this period correlate well with the occurrence of harmful algae blooms. Nitrogen is included because of its role in augmenting the blooms and/or their toxicity. The six Maumee River basin stations are grouped together to the left of the vertical line for ease of comparison, going upstream to downstream from the left to right. Red lines indicate the targets where they apply. Note that reports are now available for the Huron River.

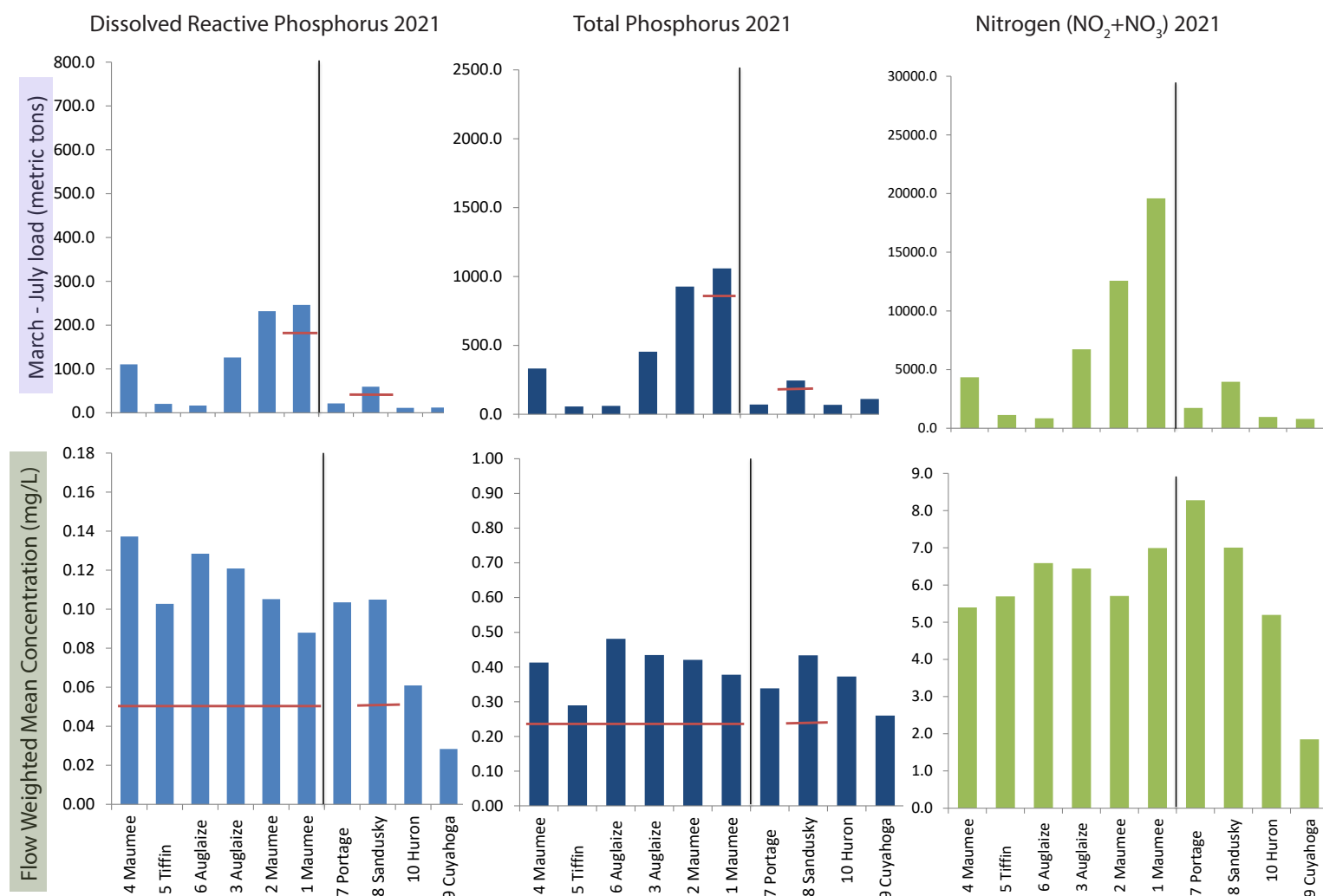


Figure 2: Side by side comparison of loads and flow-weighted mean concentrations. Axis titles at bottom and left. Red lines indicate target levels at the points where they apply (targets may vary by location). Station numbers as in Figure 1.

March-July Load (MT)

The loading graphs across the top show that the two most downstream sites on the main stem of the Maumee River have the largest nutrient loads. The Portage, Sandusky, Huron, and Cuyahoga Rivers have a much lower contribution to the overall nutrient loading; however they also drain smaller areas.

In 2021, the Annex 4 target loads

were exceeded for both dissolved reactive phosphorus and total phosphorus as indicated by the red lines at the Maumee River near Waterville station where the target is applied. The Sandusky River load targets were also exceeded.

There are no targets for nitrogen, but the pattern of loading is similar because it is also influenced by the amount of flow.

Flow-Weighted Mean Concentration (mg/L)

The corresponding concentration graphs are shown across the bottom. Dissolved reactive phosphorus concentrations ranged from 0.088 to 0.137 milligrams/liter (mg/L) in the Maumee, Portage, and Sandusky Rivers. The Huron River had a dissolved reactive phosphorus concentration of 0.061 mg/L.

Flow-weighted mean concen-

trations of total phosphorus ranged from 0.29 mg/L in the Tiffin River to 0.481 mg/L in the Auglaize River at Ft. Jennings.

In 2021, the Annex 4 target flow weighted mean concentrations were exceeded at all stations for both total phosphorus and dissolved reactive phosphorus.

What is Flow-Weighted Mean Concentration (FWMC)?

The FWMC is the total load for the time period divided by the total discharge volume for the time period. FWMC standardizes the measure of phosphorus delivery from a tributary so that year-to-year and trib-to-trib performance can be compared despite different flows.

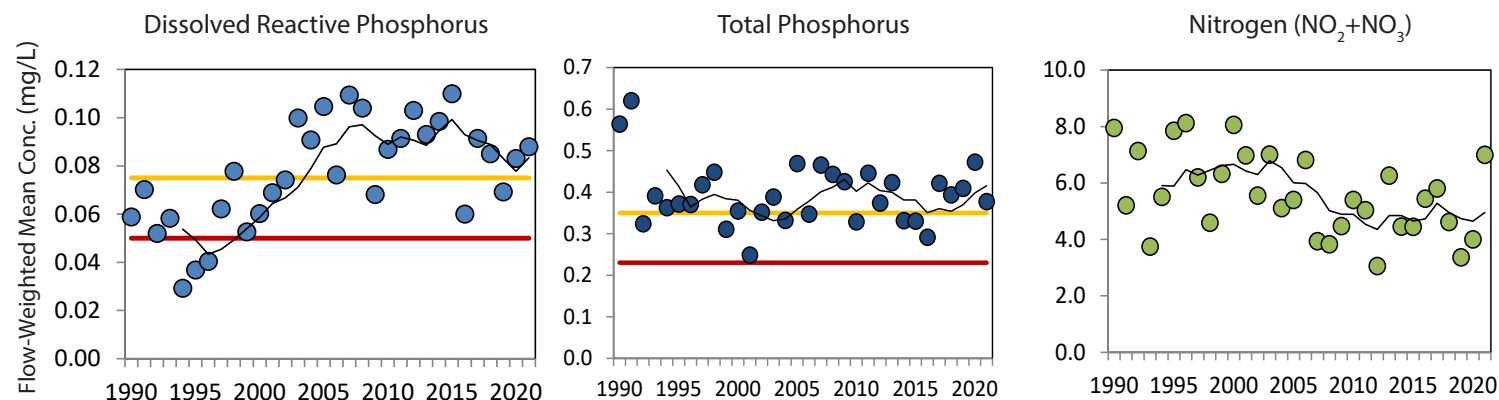


Figure 3: Loading season nutrient flow-weighted mean concentrations for the Maumee River at Waterville by water year. The five-year running average (black line) smooths out annual variation and shows trends. The red line is the Annex 4 target flow-weighted mean concentrations. The yellow line is halfway between the 2008 baseline and the 40% reduction target.

How does 2021 compare to previous years?

The top left chart shows dissolved reactive phosphorus at about 0.088 mg/L in 2021. This was about the same as expected given the streamflow in 2021. Note that in the mid-1990s, the dissolved reactive phosphorus flow-weighted mean concentrations were below the 0.05 mg/L Annex 4 target level. Total phosphorus decreased from high levels in the early 1990s, but have been around 0.4 mg/L since 1995. In 2021, total phosphorus was 0.38 mg/L, slightly lower than recent averages. Nitrogen levels are consistently lower than the averages in the 1990s.

Where are the nutrients coming from?

This map shows the spatial distribution of dissolved reactive phosphorus flow-weighted mean concentrations (triangles) superimposed on total phosphorus load (circles) across nine stations. Dissolved reactive phosphorus concentration was highest in the Maumee River at Antwerp (4) and the Auglaize at Ft. Jennings (6): 0.137 mg/L and 0.128 mg/L, respectively. Total phosphorus load was highest on the Maumee River at Waterville (1): 1049 MT. Within the Maumee River watershed, the Maumee at Waterville (1) had the lowest dissolved reactive phosphorus levels at 0.088 mg/L while the Auglaize River at Ft. Jennings (2) and the Tiffin River near Evansport (5) had the lowest total phosphorus loads at 57 MT and 61 MT respectively. The Cuyahoga River (9) had the lowest dissolved reactive phosphorus concentrations (0.028 mg/L) and a low total phosphorus load (110 MT). The Huron River also had a low dissolved reactive phosphorus concentration (0.061 mg/L) and a low total phosphorus load (69 MT).

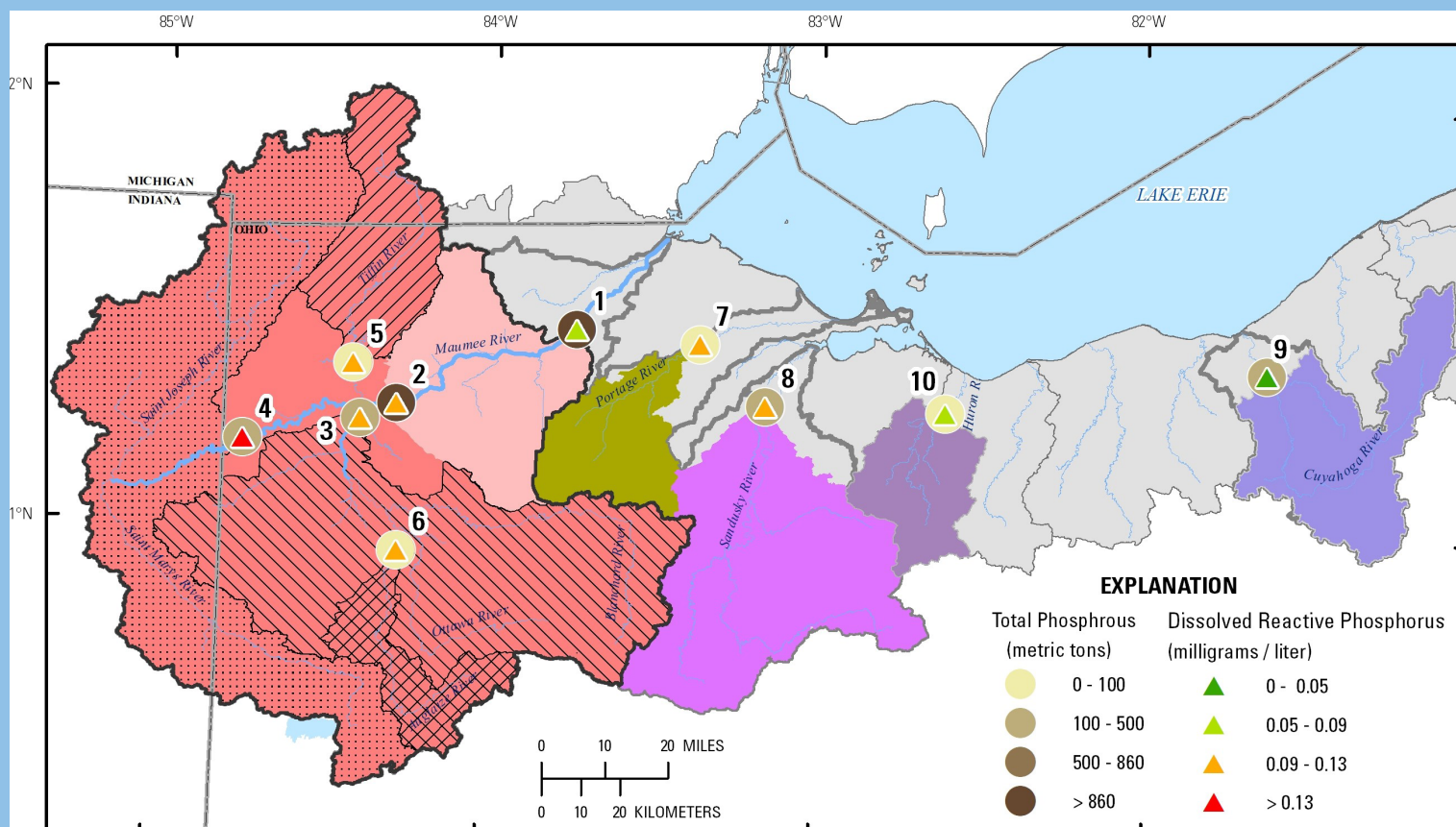


Figure 4: Phosphorus monitoring in the Lake Erie watershed. Data from March 1, 2021 - July 31, 2021.

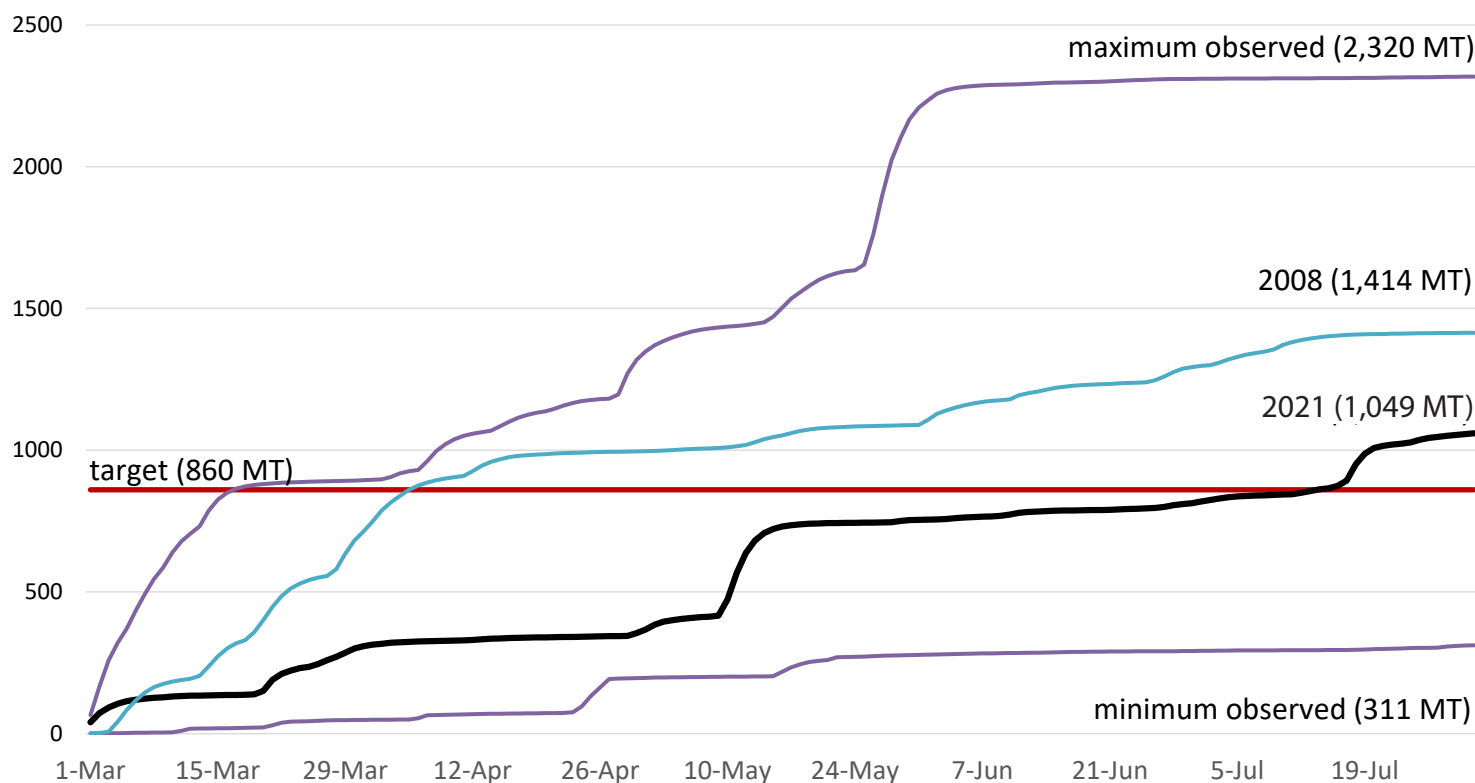


Figure 5: Cumulative total phosphorus loads in metric tons at the Maumee River at Waterville station (1) in March-July 2021 compared to maximum and minimum cumulative values for each day for the period 2002-2020 and the cumulative chart for the target year of 2008.

When does total phosphorus enter the rivers?

This graph shows the cumulative load of total phosphorus at the Maumee River at Waterville (1) station for March 1 to July 31, 2021. Each day, the water in the river carries more load past the monitoring station which is

summed with the running total to create the cumulative total for that day.

Total phosphorus movement through the system is closely coupled to the timing of rain-fall, as shown by the steeper

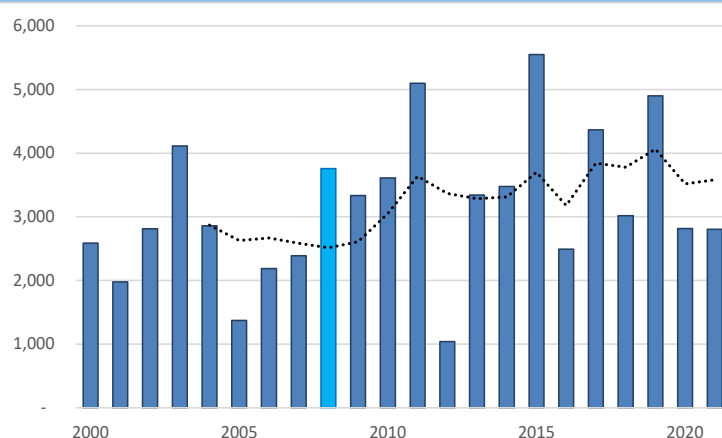
increases in loads. In 2021, loads remained below the target for most of the season. Rain in mid-July increased the cumulative total phosphorus load at this station above the 860 MT Annex 4 target load. The final total of 1,059 MT was only 23% higher

than the target.

Minimum and maximum lines are provided for comparison. These are the lowest or highest cumulative load values for each day, selected from 2002-2020, summed for the season.

How wet was March-July 2021 in comparison to March-July in the target year of 2008?

The total volume of water for the period is a major factor influencing how much phosphorus and nitrogen is carried to the lake. For the period March 1-July 31, 2021, total volume for the Maumee River at Waterville (1) was **2.8 km³**. By comparison, volume for March 1-July 31, 2008 (base year for the target loads and concentrations, and selected because it represented a wet year) was **3.8 km³**. Volumes at this station for these months for the period 2000-2021 averaged 3.2 km³. Volume in 2021 was less than the target year - about 25% less than the amount recorded in 2008 - and it was also lower than the five year running average.



Concentration and Loading information can be accessed at <http://arcg.is/21i9CUF> (USGS) and <https://ncwqr.org/> (Heidelberg). Expanded Monitoring Report with complete data set: <https://lakeerie.ohio.gov/wps/portal/gov/lec/planning-and-priorities/03-wms/wms>

A publication of the Ohio Lake Erie Commission with the assistance of the following partners:



Lake Erie Commission
Environmental Protection
Agency

