

Western Lake Erie Tributary Water Monitoring Summary

March 1, 2019 - July 31, 2019

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 Load limits for some im-

paired 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?

A large number of components are measured. This summary focuses on total phosphorus, dissolved reactive phosphorus, and nitrogen in the form of nitrate (NO_2) + nitrite (NO_3).

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.

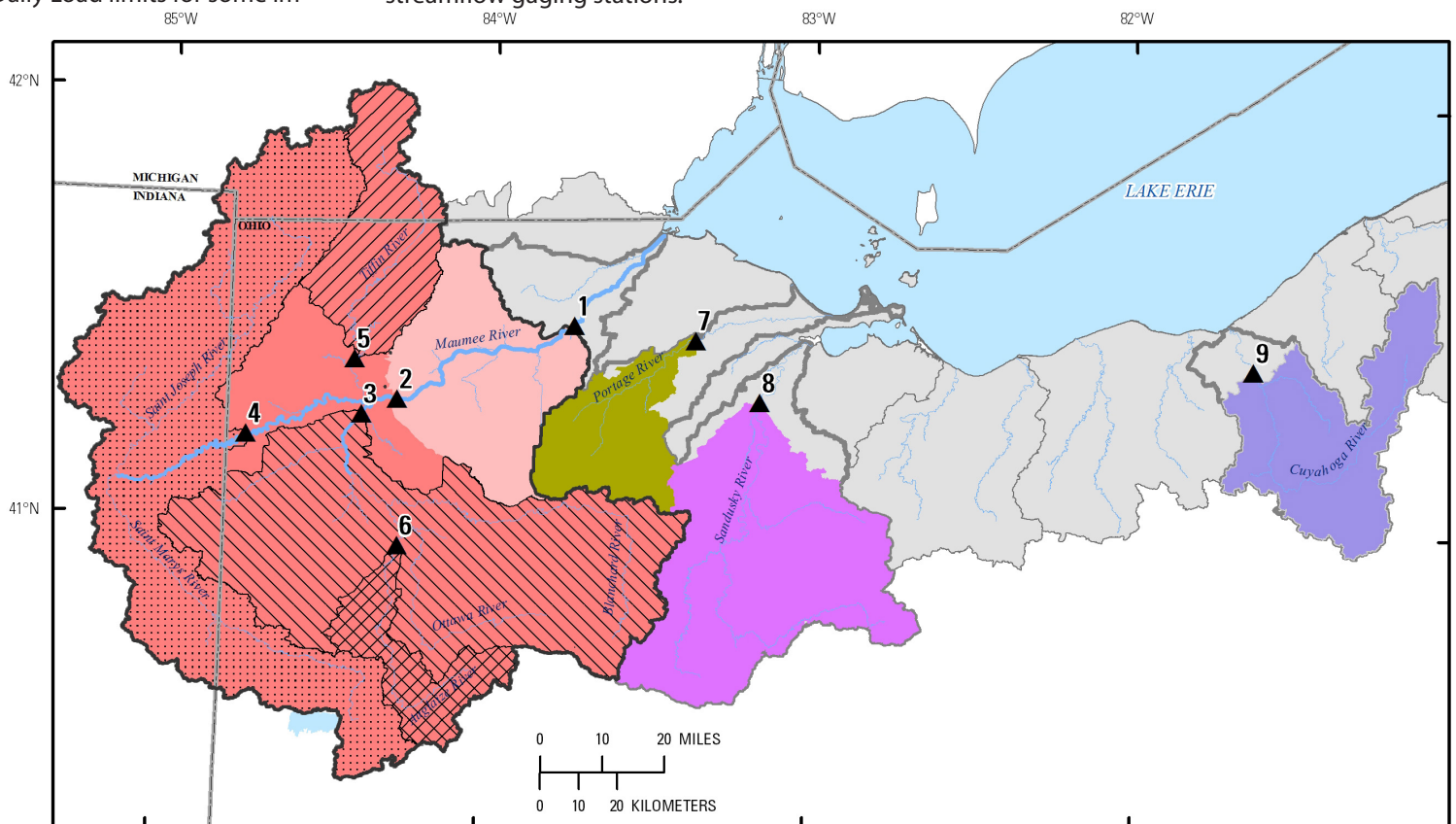


Figure 1: Sampling stations discussed in this report.

Station 1: Gage 04193500 - Maumee River at Waterville

Station 2: Gage 04192500 - Maumee River near Defiance

Station 3: Gage 04191500a - 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

What were the nutrient levels for the loading season in 2019?

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 potential role in augmenting the blooms or their toxicity. The six Maumee River stations are grouped together to the left of the vertical line for ease of comparison, going roughly upstream to downstream from the left to right.

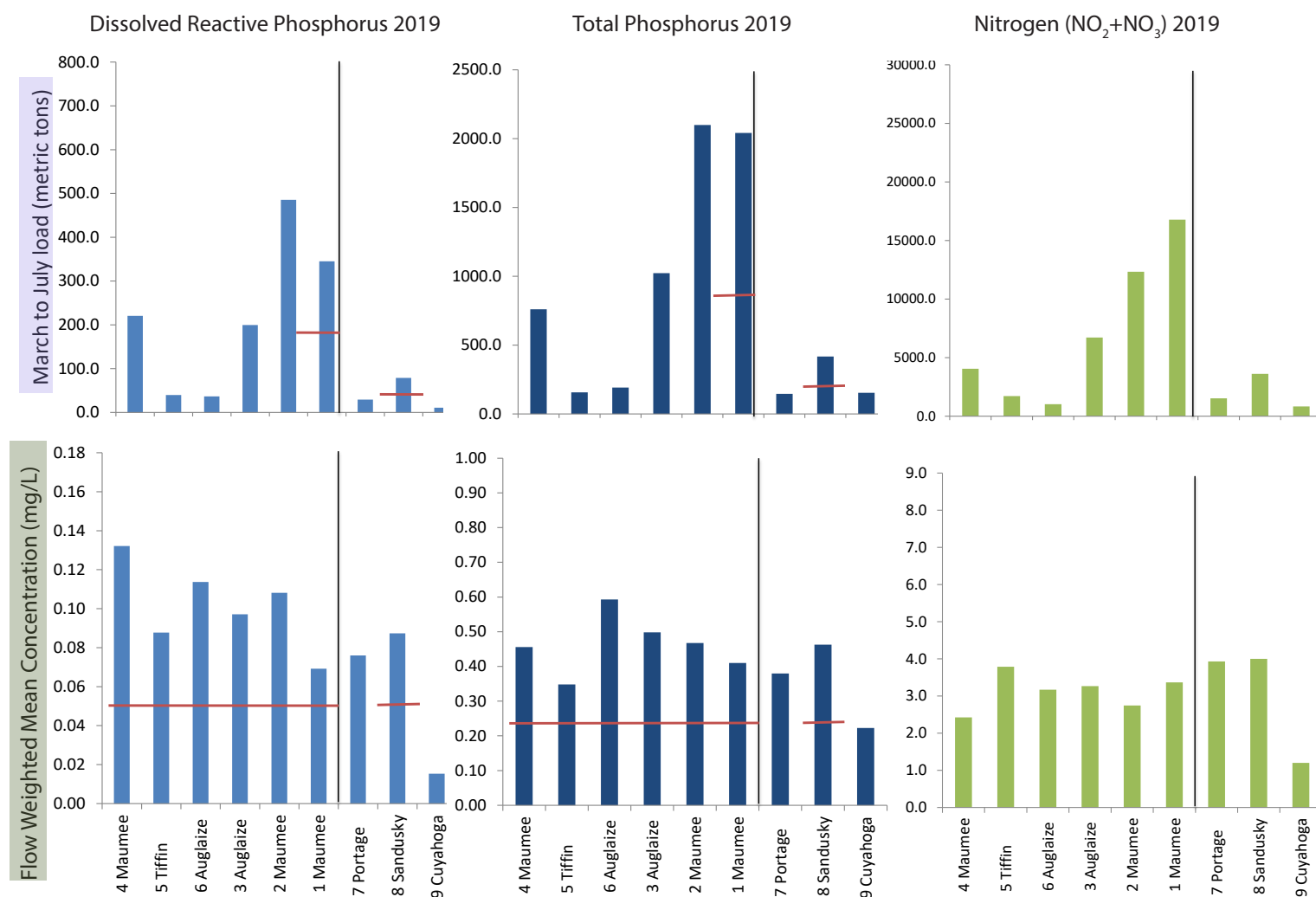


Figure 2: Side by side comparison of loads and flow weighted mean concentrations. Axis titles at bottom and left. Red lines indicate target levels at the points where they apply (not all targets are the same at all locations). Station numbers as in Figure 1.

March-July Load (MT)

The loading graphs across the top show that the two farthest downstream sites on the main stem of the Maumee River have the largest nutrient loads. The Portage, Sandusky, and Cuyahoga Rivers have a much lower contribution to the overall nutrient loading.

In 2019, 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 bot-

tom. Dissolved reactive phosphorus concentrations ranged from 0.069 to 0.13 milligrams/liter (mg/L) in the Maumee, Portage, and Sandusky Rivers.

Total phosphorus flow weighted mean concentrations ranged from 0.22 mg/L in the Cuyahoga River to 0.59 mg/L in the Auglaize River at Ft. Jennings.

In 2019, the Annex 4 target flow weighted mean concentrations were exceeded at all stations

for both total phosphorus and dissolved reactive phosphorus. This target applies throughout the Maumee River watershed and for the Sandusky River.

Dissolved reactive phosphorus and nitrogen were lower than expected at this rate of flow. Scientists think that this is due to high rains during the 2019 loading season that reduced the amount of agricultural fields in production, reducing the amount of fertilizer applied.

What is Flow Weighted Mean Concentration (FWMC)?

The FWMC represents the total load for the time period divided by the total discharge 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.

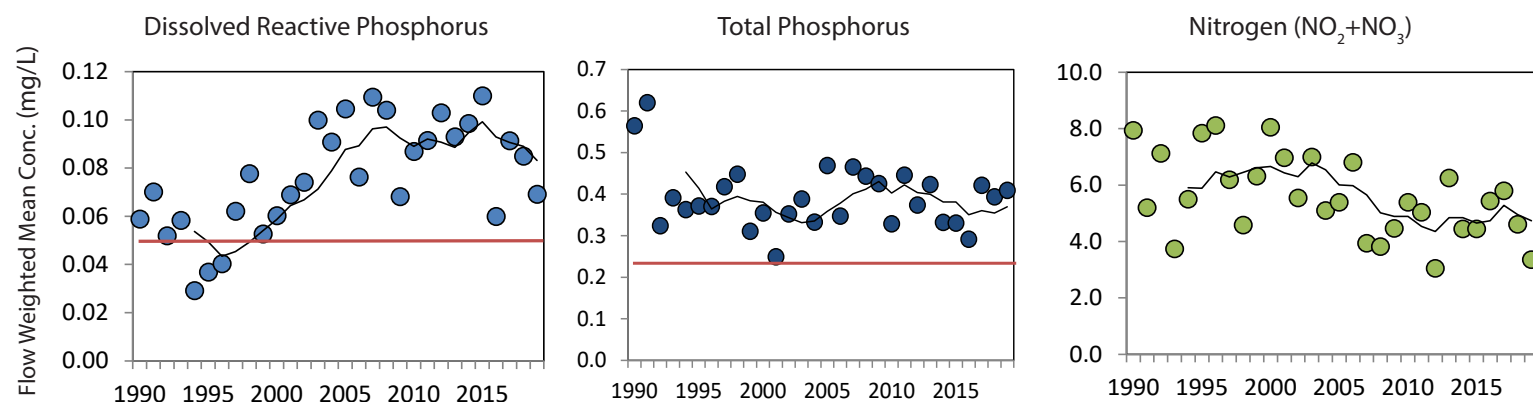


Figure 3: Annual nutrient flow weighted mean concentrations for the Maumee River at Waterville by water year. The five-year running average (black line) smooths out annual variation and shows trends. The red line is the Annex 4 target flow weighted mean concentrations.

How does 2019 compare to previous years?

Figure 3 shows that dissolved reactive phosphorus dropped to about 0.07 mg/L in 2019. 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, but more recently are nearly twice as high. Total phosphorus decreased from its high levels in the early 1990s, but have been about the same at around 0.4 mg/L since. Nitrogen levels are variable but consistently lower than the averages in the 1990s. Although total phosphorus was about the same as expected at the stream flow in 2019, dissolved reactive phosphorus and nitrogen were both lower than expected at the rate of flow that occurred.

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: 0.13 mg/L (6), and total phosphorus load was highest on the Maumee River at Defiance (2): 2100 MT and at Waterville (1): 2042 MT. Sandusky River at Fremont (8) and the Portage River at Woodville (7) had slightly higher dissolved reactive phosphorus concentrations: 0.087 mg/L and 0.08 mg/L, respectively, than the Maumee at Waterville (1): 0.07 mg/L, but much lower total phosphorus loads at 418 MT and 147 MT, respectively. Within the Maumee River watershed, the Tiffin River near Evansport (5) had the lowest dissolved reactive phosphorus levels at 0.09 mg/L and the Auglaize River at Ft. Jennings (2) had the lowest total phosphorus load at 192 MT. The Cuyahoga River (9) had the lowest dissolved reactive phosphorus concentrations (0.015 mg/L) and a low total phosphorus load (154 MT).

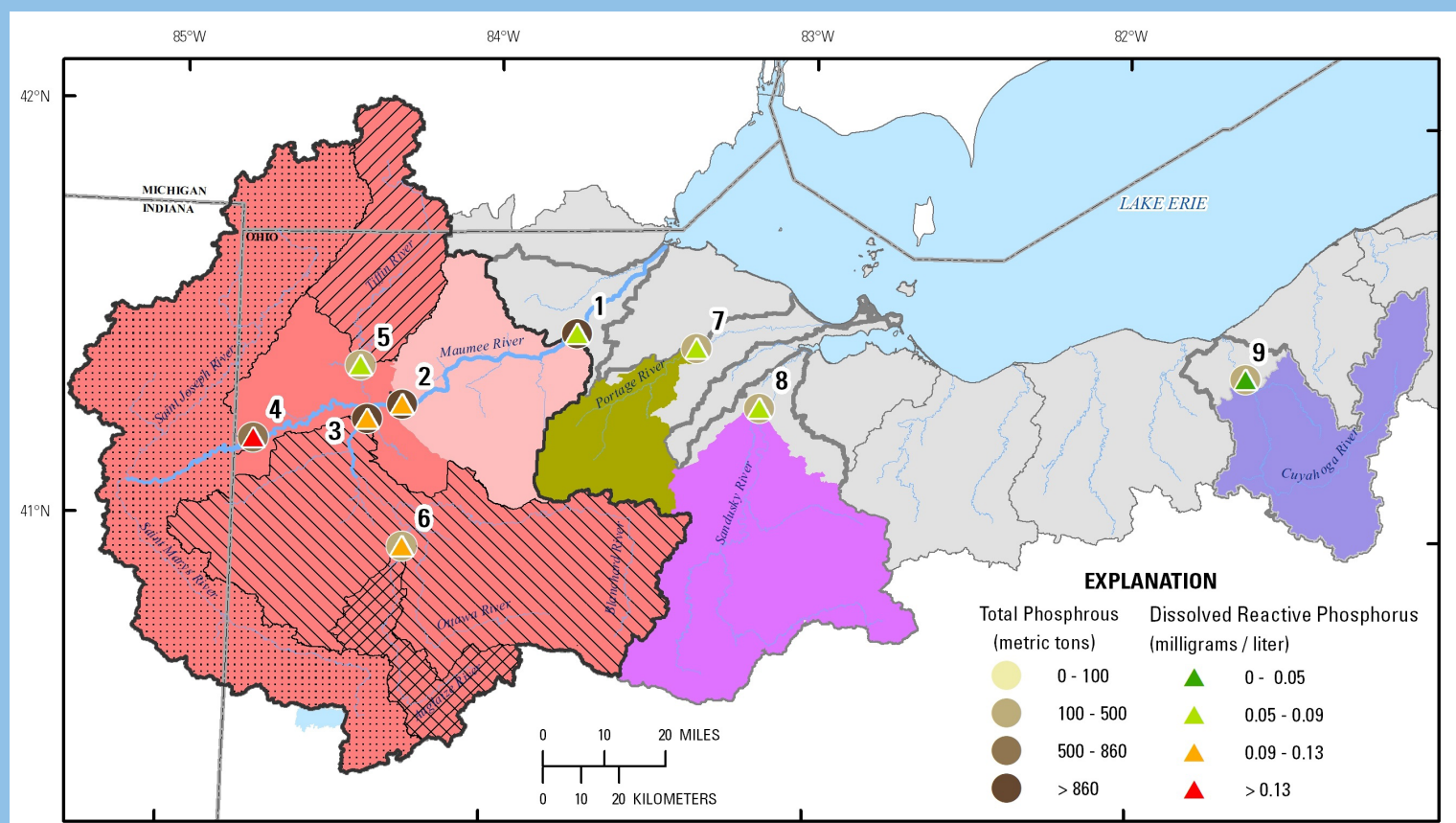


Figure 4: Phosphorus monitoring in the Lake Erie watershed. Data from March 1, 2019 - July 31, 2019.

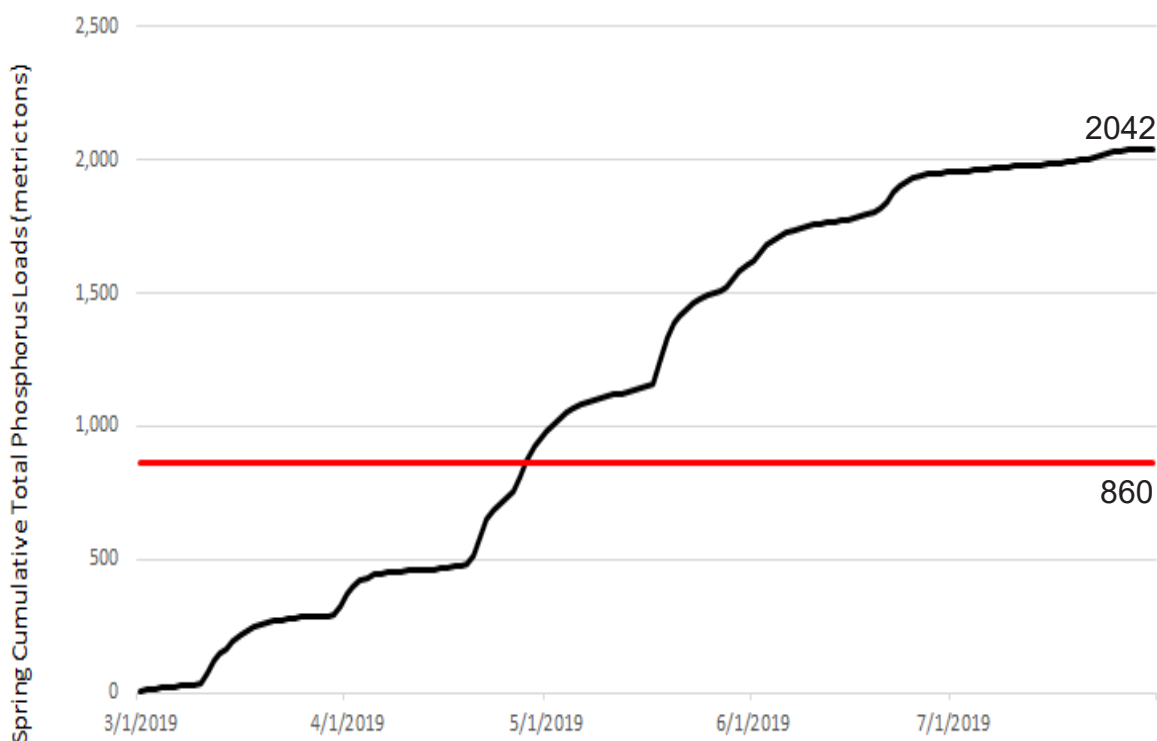


Figure 5: Cumulative total phosphorus loads at the Maumee River at Waterville station (1).

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, 2019. Each day, the water carries more load past the mon-

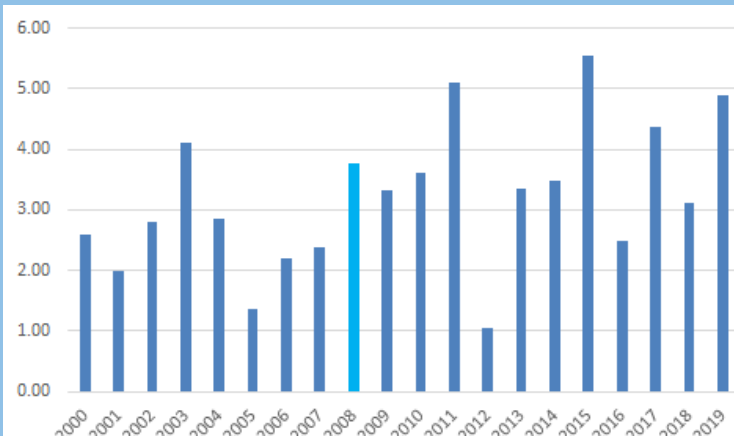
itoring station which is summed to create the running cumulative total. When the amount of water moving through the river increases due to rainfall, the load increases.

Total phosphorus movement through the system is closely coupled to the timing of rainfall, as shown by the jumps in loads. In 2019, rains in March and April increased the total phosphorus

load at this station above the 860 MT Annex 4 target load by the beginning of May. More rainfall in May and June led to a final total of 2042 MT, 137% higher than the target.

How wet was March-July 2019 in comparison to March-July in the target year of 2008?

The volume of flow for the period is a major factor influencing how much phosphorus and nitrogen moves down the river into the lake as runoff. For the period March 1-July 31, 2019, flow in the Maumee River at Waterville (1) was **4.9 km³**. By comparison, flow for March 1-July 31, 2008 (base year for the target loads and concentrations, and selected because it represented a wet year) was **3.76 km³**. Flows at this station for these months for the period 2000-2017 averaged 3.13 km³. Flow in 2019 was more than the target year - about 30% more than the amount of flow recorded in 2008 - and it was also much higher than the recent past average.



Concentration and Loading information can be accessed at <http://arcg.is/21i9CUF> (USGS) and <https://ncwqr.org/> (Heidelberg). Find the Expanded Monitoring Report with the complete data set at lakeerie.ohio.gov/LakeEriePlanning/OhioDomesticActionPlan2018.aspx

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