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# smart water

## VIRTUAL WORKSHOP

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**April 20, 2022**

**9:00 am - Noon**

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- 9:00**      **Welcome/Introductions by Mayor McCann**
- 9:10**      **Overview of Defiance Smart Water Phase I** Jen English, City of Defiance
- 9:15**      **Overview of Seagull Platform & Mini-Grant** Shelby Brunner, Great Lakes Observing System
- 9:30**      **Overview of Data Collection and Dashboard** Ed Verhamme, LimnoTech
- 9:45**      **Panel Discussion on Nutrients/Source Water:** MODERATOR: Joe Ewers, City of Defiance WTP  
Adam McDowell, City of Defiance WTP  
Bruce Cleland, Tetra Tech  
Brigitte Moneymaker, OSU Extension
- 10:25**      **BREAK**
- 10:35**      **Panel Discussion on Research/Monitoring:** MODERATOR: Kevin Connor, City of Defiance WWTP  
Kimberly Shaffer, USGS  
Laura Johnson, Heidelberg  
Ed Verhamme, LimnoTech
- 11:15**      **Developing A Shared Vision For Phase II** Jen English, City of Defiance
- Wrap-Up/Summary/Next Steps:** Jeff Leonard, City of Defiance Administrator



# Upper Maumee Smart Watershed Pilot

- GLOS Mini-Grant ~ \$90K
- Real-Time Data Collection
- Main Focus: Ammonia
- Source Water Protection



# MAUMEE RIVER BASIN

Sub-Watersheds:

-  St Joseph
-  Tiffin
-  Lower Maumee
-  Upper Maumee
-  Auglaize
-  Blanchard
-  St Marys



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great lakes  
observing system



*Shelby Brunner joined the Great Lakes Observing System as their first Observing Technology Manager almost 2 years ago. Previously, Shelby served as a project manager for large-scale oceanographic projects at NOAA's Global Ocean Monitoring and Observing Office. She has research experience in Great Lakes hypoxia and biogeochemistry, sediment dynamics, and water quality evaluation.*



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*Ed is a Principal and Senior Engineer with LimnoTech and has been involved in dozens of Great Lakes and other large lake projects that push the limits of technology and innovative research and development. He oversees a network of buoys and sensors that support boaters, water treatment plant personnel, and many other operational users of large lake and river systems. He has been involved with hydrodynamic modeling and the application of water quality and nutrient models across the country since joining the firm in June 2005. Ed has also recently served as the president of the International Association for Great Lakes Research.*



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**Nitrate (mg/L)**  
**2.58**

**Phosphate (mg/L)**  
**0.01**

**Defiance Water Treatment Plant**

Sonde Data Last Updated: 4:00 PM EDT Tue, Apr 19  
Nutrient Data Last Updated: 3:18 PM EDT Tue, Apr 19

**Water Temp (°C)**  
**10.48**

**Specific Cond. (uS/cm)**  
**585.0**

**Ammonia (mg/L)**  
**0.01**

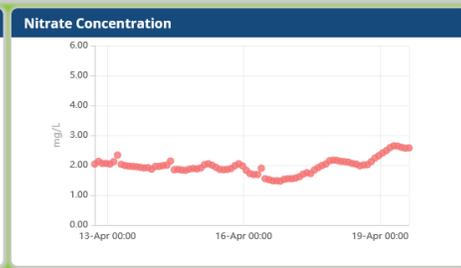
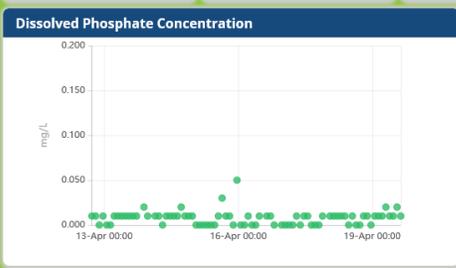
**Flow Rate (GPM)**  
**22.2**

**Monitoring Instrumentation**

Water Quality - [YSI EXO3 Sonde](#)  
Nutrients - [Green Eyes Science Autonomous Nutrient Analyzer](#)

**Chlorophyll (RFU)**  
**8.26**

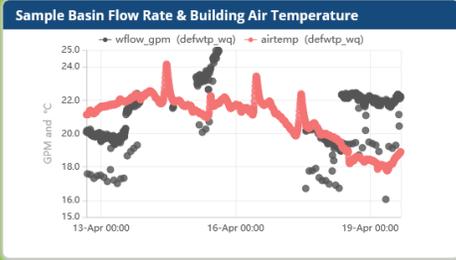
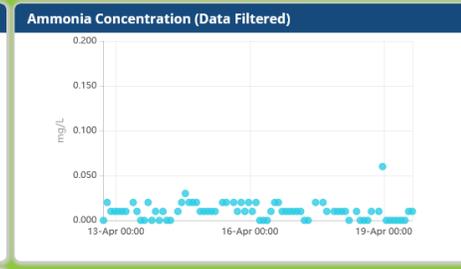
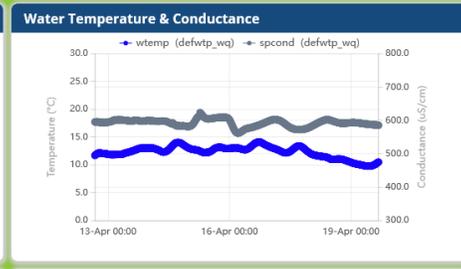
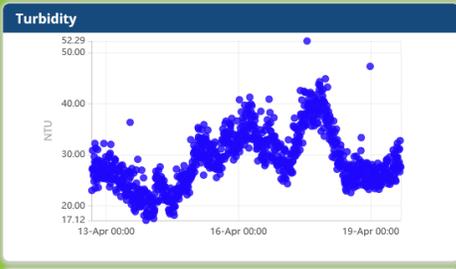
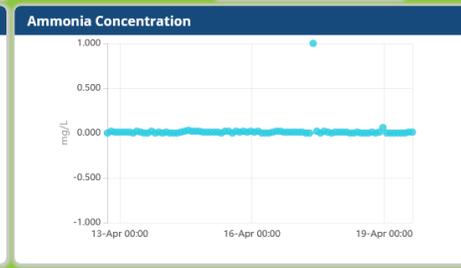
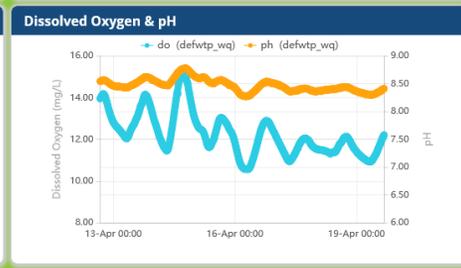
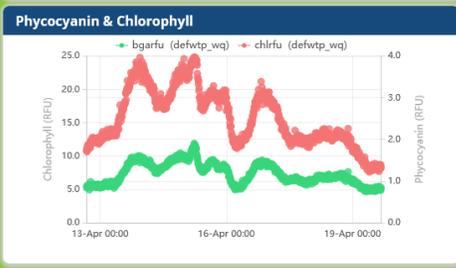
**Turbidity (NTU)**  
**27.6**



**DO (mg/L)**  
**12.21**

**pH**  
**8.41**

**Phycocyanin (RFU)**  
**0.84**



**Data Disclaimer**

The information is provided by The City of Defiance Water Treatment Plant's Green Eye nutrient analyzer and YSI EXO water quality sonde. The material on this website is provided for informational purposes only. Real time monitoring data has not been extensively validated and is therefore subject to change. All information on the monitoring site is subject to verification by other means. Use of The City of Defiance water quality real time monitoring data is at the user's discretion and should be done with caution. If you have questions concerning this data, please contact 419-782-1886 or by email at [amcdowell@cityofdefiance.com](mailto:amcdowell@cityofdefiance.com).

# Defiance WTP Monitoring Station Dashboard

<https://limnotech.iot.ubidots.com/app/dashboards/public/dashboard/L79uculbjuuUcLkT3jL66Hz20dfkkkvPODpzvHAokAQ?datePicker=true&displayTitle=true>









Adam is the Superintendent at the Defiance City Water Treatment Plant. This Class 4 surface water plant is located at the very end of the Upper Maumee Watershed. He has been employed with the City for 31 years and has worked and is licensed in both water and wastewater. He is also currently working on obtaining a degree in Project Management from Northwest State College. After the City of Defiance installed its 74 acre reservoir in 2008 Defiance was thrust into river water quality issues more than ever. The effects of excessive nutrients are compounded in the clearer, warmer conditions the reservoir creates. This leads to aggressive blooms that occur quickly and affect water quality significantly. Adam's involvement in this project has been primarily driven by the need to protect the reservoir quality.

Bruce is a senior project manager with over 40 years experience in water quality monitoring, modeling, and watershed planning. He graduated from Michigan State University with a B.S. in Engineering Sciences and from the University of Washington with an M.S.E. in Water Resources Engineering. Prior to joining Tetra Tech, he worked for USEPA where, among other things, he provided capacity building assistance to states, local communities, and EPA Regions across the country with a focus on connecting TMDLs to implementation. His recent efforts include work with Defiance to examine data in the Maumee and explore solutions related to the City's water supply concerns. He has also assisted communities in Ohio, Indiana, and Michigan in their efforts to develop meaningful watershed implementation plans. An outgrowth of this work, is viewing solutions to water resource concerns from an agricultural perspective. He is particularly interested in turning the wide range of water resource data into meaningful information for producers through an integrated approach that considers the relationship between farm economics and stewardship. Though residing in Washington State, Bruce grew up in southwest Michigan and remains deeply interested in work to address the array of water quality concerns in the Great Lakes Region.

Brigitte Moneymaker covers Auglaize, Mercer and Allen Counties engaging farmers in new production strategies, technologies, and best management practices to improve fertilizer use efficiency and farm profitability while promoting soil health and reducing nutrient and sediment losses within the western Lake Erie basin. she holds a BS in Environmental Science from The State University of New York College of Environmental Science and Forestry, and a Master's in Climate and Society from Columbia University. Brigitte previously worked with invasive species as a National Park Ranger with the Great Lakes Restoration Initiative and a project lead for NASA DEVELOP, a division of NASA's Applied Sciences Program that addresses environmental and public policy issues through NASA Earth observations.



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# Nutrient Problems Experienced by Defiance Water Treatment Plant



May 31, 2016 River Algal Counts  
Total 1,965,976/ml;  
Planktothrix agardhii 84.9%(1,669,437/ml),  
Planktolyngbya limnetica 6.2%(122400/ml),  
Harmful cyano 85.5%(1,682,397/ml)

Algal Toxins over 19 ppb in Maumee River!

Blooms very common these are just 2 examples!



October 2017

Euglena                      Anabaena

Planktolyngbya limnetica

Aphanocapsa

Planktothrix agardhii

And several others!



# So what? The river has always been like that!



2008 Defiance was required to build our reservoir due to frequent nitrate violations

River water quality dictates pumping frequency, and we are only able to average about 160 days a year

The effects of this algal activity is measured in real dollars

## Reservoir Algaecide cost

2018- \$10,500

2019- \$17,425

2020- \$28,905

2021- \$48,205

See a trend?

Or how about \$10,000,000 for Granular Activated Carbon?



# Turning Data into Information



## Connecting the Pieces



### Ammonia

- Exceedances unpredictable (any month)
- Recent trend in wrong direction

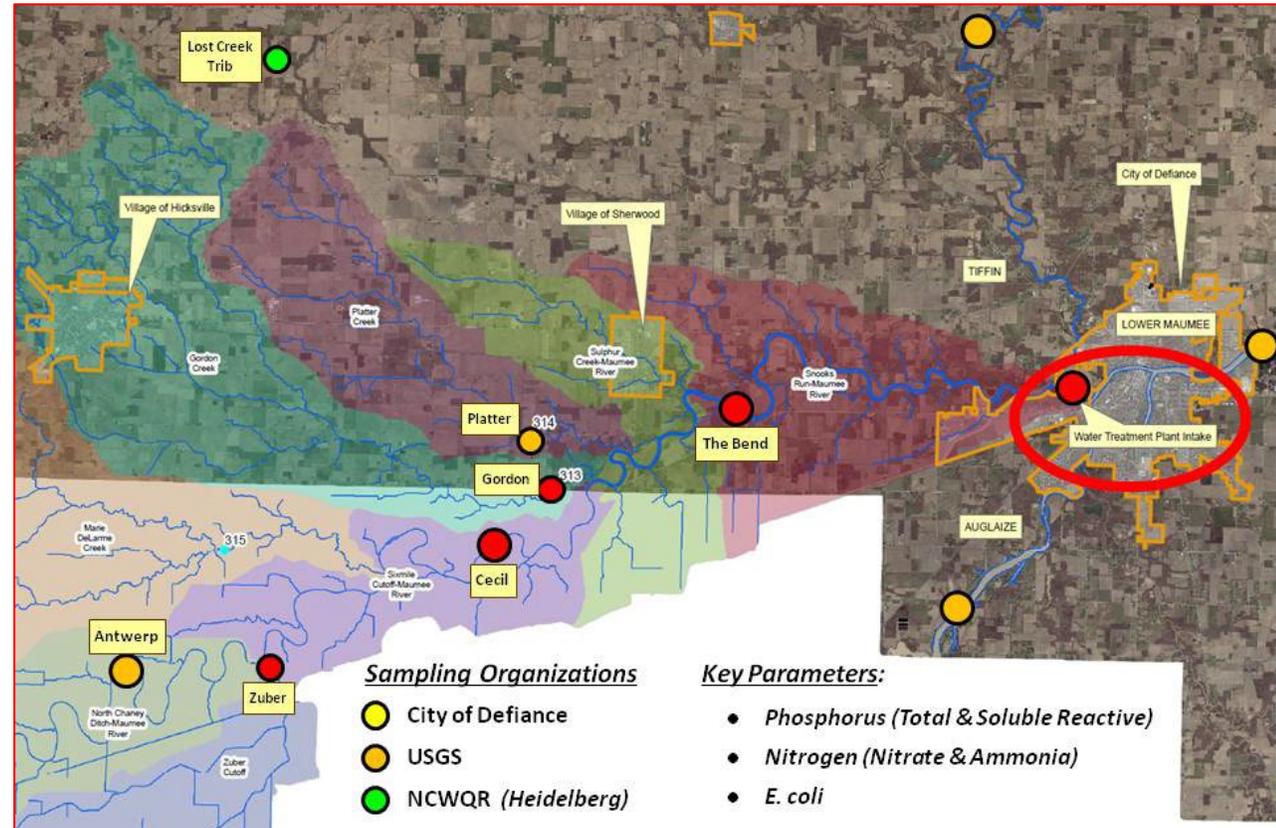


### Insights from Other Data

- City of Defiance sampling
- USGS -- WLEB network & edge-of-field
- NCWQR (Heidelberg)
- OSU Extension, Ft. Wayne area, +++



### Real-time data helps fill gaps



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# Turning Data into Information



## Connecting the Pieces



### Real-time data helps fill gaps

- Better understanding of timing & frequency of source water concerns



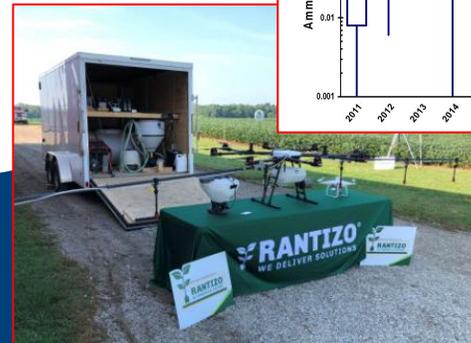
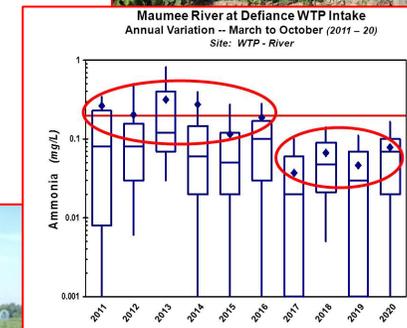
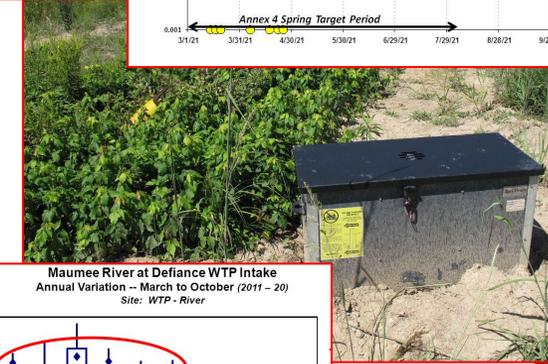
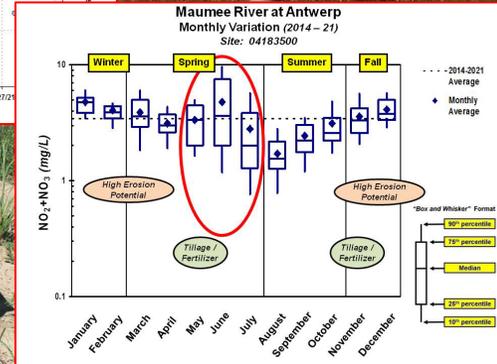
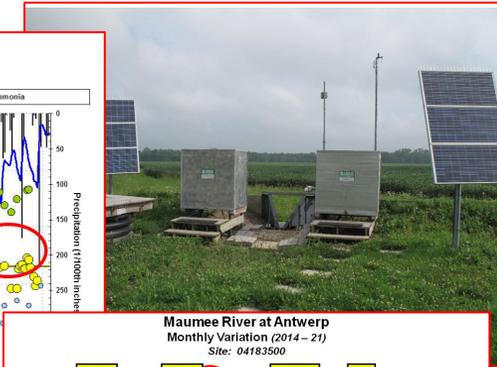
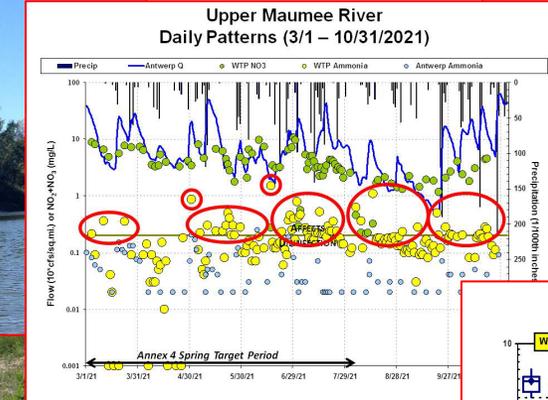
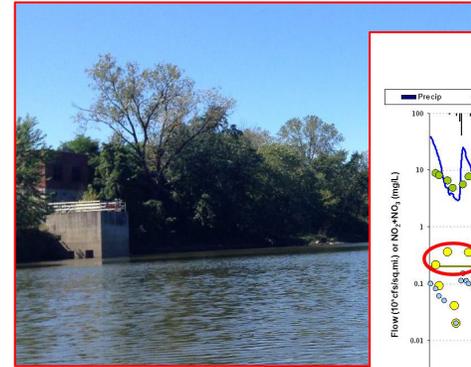
### Proactively Work to Explore Solutions

- Nitrogen issues offer unique opportunities
- Elevated river nutrients => Resource loss from fields

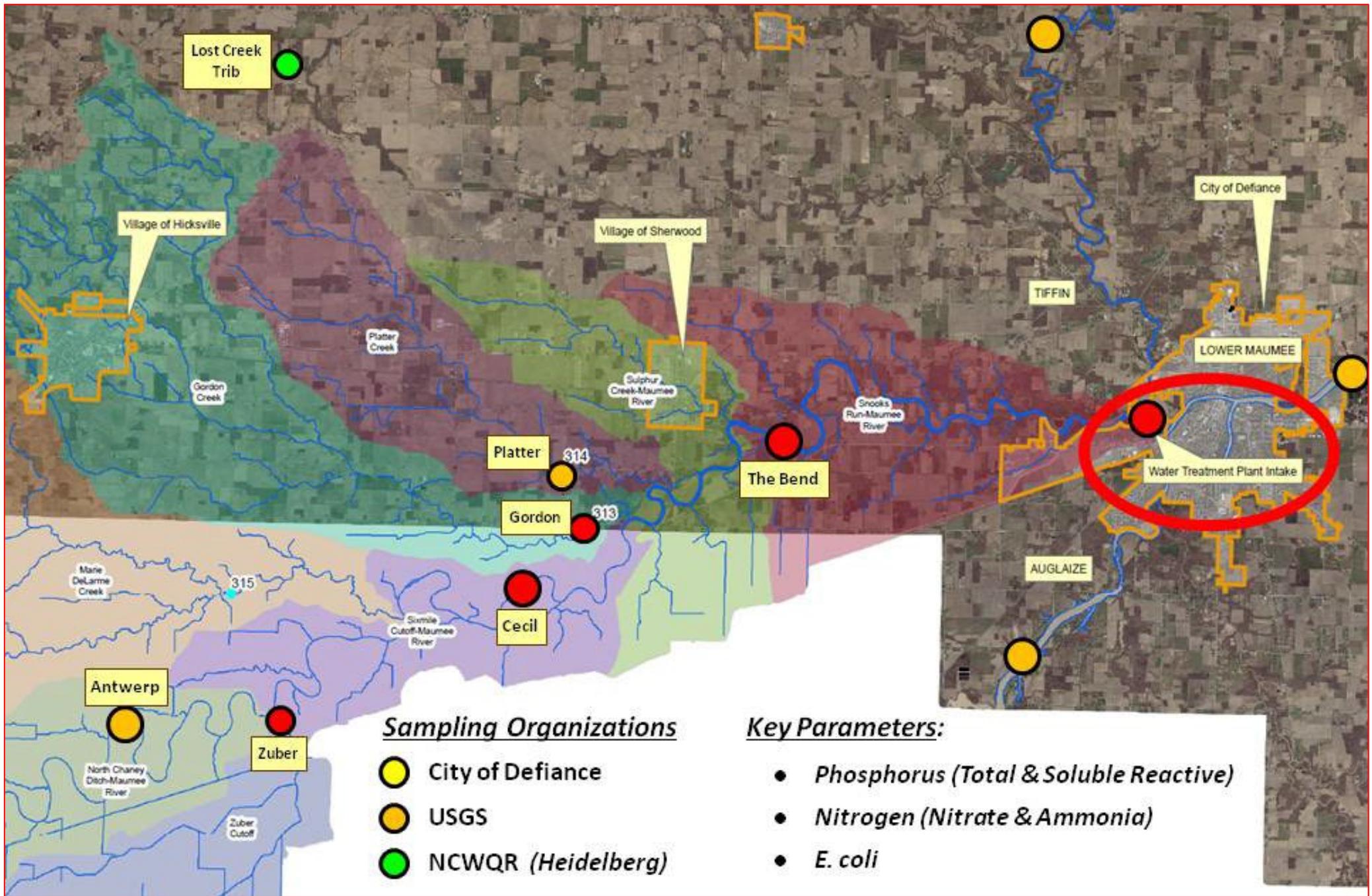


### WQ Patterns & Management Practices

- Consider variability (daily, seasonal, year-to-year)
- Recognize & incorporate innovations



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Lost Creek Trib

Village of Hicksville

Village of Sherwood

Platter Creek

Gordon Creek

Sulphur Creek-Maumee River

Snooks Run-Maumee River

Platter 314

The Bend

Gordon 313

Cecil

Antwerp

Zuber

Marie DeLarme Creek

315

Sixmile Cutoff-Maumee River

North Chaney Ditch-Maumee River

Zuber Cutoff

City of Defiance

TIFFIN

LOWER MAUMEE

Water Treatment Plant Intake

AUGLAIZE

**Sampling Organizations**

- City of Defiance
- USGS
- NCWQR (Heidelberg)

**Key Parameters:**

- Phosphorus (Total & Soluble Reactive)
- Nitrogen (Nitrate & Ammonia)
- E. coli

Kimberly Shaffer has a degree in Civil Engineering from The Ohio State University and has worked for the U.S. Geological Survey for the past 25 years. As a hydrologist, she has collected and published streamflow, water-quality, and water-use data. In 2021, Kim became the Continuous Water-Quality Technical Lead in the USGS Water Mission Area Observing Systems Division, Hydrologic Networks Branch.

Laura Johnson is director of the National Center for Water Quality Research at Heidelberg University where long-term monitoring of streams and rivers is used to examine the influence of human activities on water quality to help decide actions that lead to healthier ecosystems. Laura is best known for research examining the linkages between agricultural runoff and harmful algal blooms in Lake Erie.

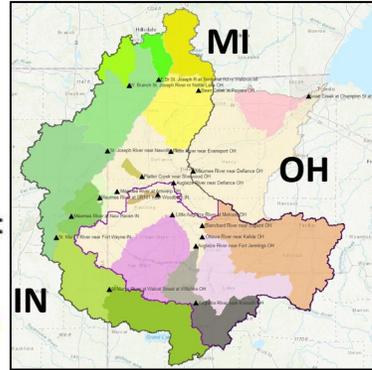


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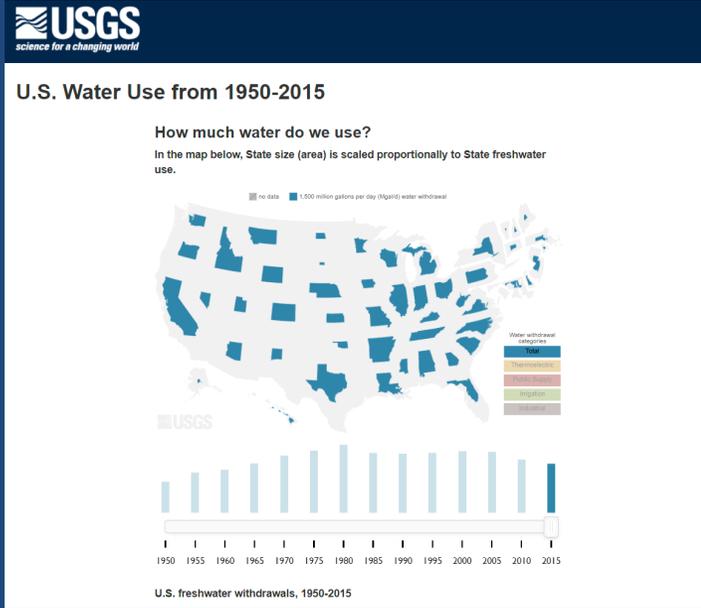
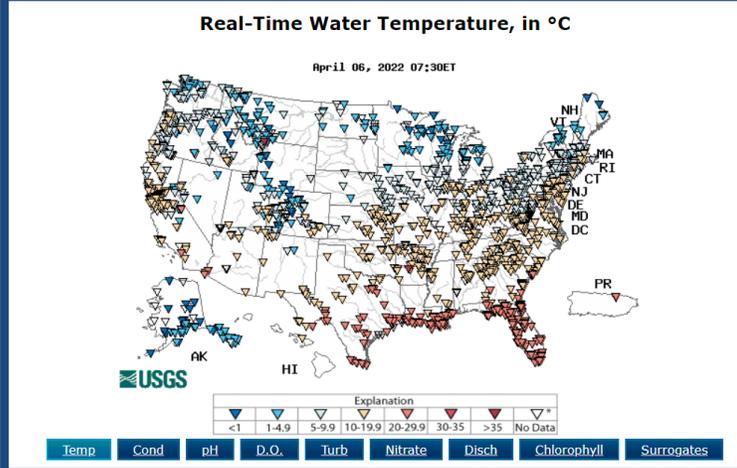
Western Lake Erie Basin

Nutrient and Sediment Concentration and Loading Data  
<http://arcg.is/21i9CUF>



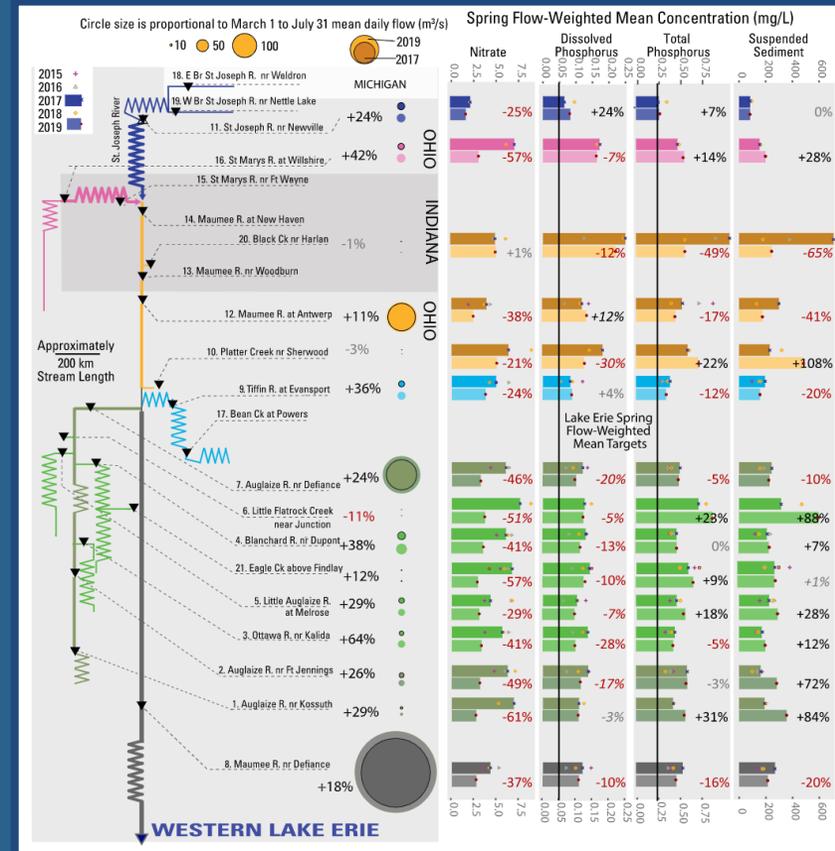
Kimberly Shaffer  
[kshaffer@usgs.gov](mailto:kshaffer@usgs.gov)

U.S. Department of the Interior  
 U.S. Geological Survey



Nutrient and suspended-sediment concentrations in the Maumee River and tributaries during 2019 rain-induced fallow conditions

Tanja N. Williamson<sup>a</sup>, Kimberly H. Shaffer<sup>b</sup>, Donna L. Runkle<sup>b</sup>, Matthew J. Hardebeck<sup>c</sup>, Edward G. Dobrowolski<sup>c</sup>, Jeffrey W. Frey<sup>c</sup>, Nancy T. Baker<sup>c</sup>, Katie M. Collier<sup>c</sup>, Carrie A. Huitger<sup>b</sup>, Stephanie P. Kula<sup>b</sup>, Ralph J. Haefner<sup>d</sup>, Lisa M. Hartley<sup>b</sup>, Hunter F. Crates<sup>b</sup>, Dennis P. Finnegan<sup>b</sup>, Nicholas J. Reithel<sup>d</sup>, Chad A. Toussant<sup>b</sup>, Thomas L. Weaver<sup>d</sup>



Comparison between 2017 and 2019 are in percent difference.



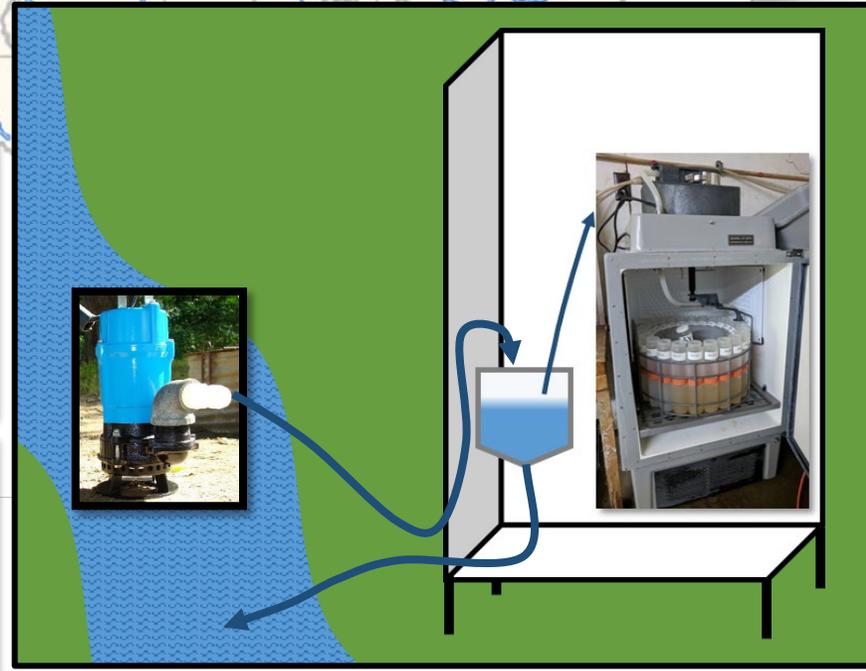
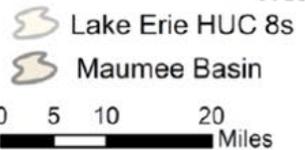
Laura Johnson

Director

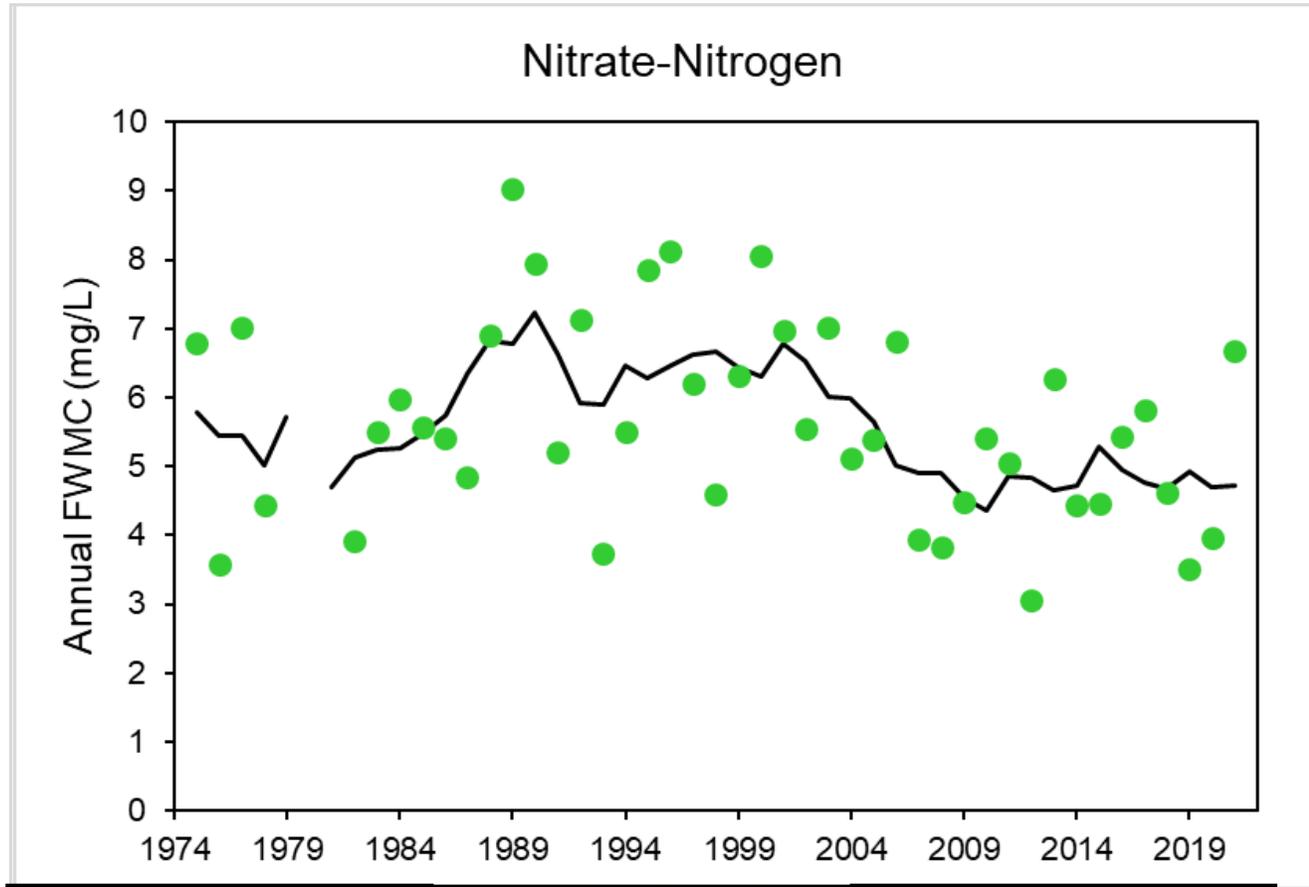
National Center for Water Quality Research  
Heidelberg University

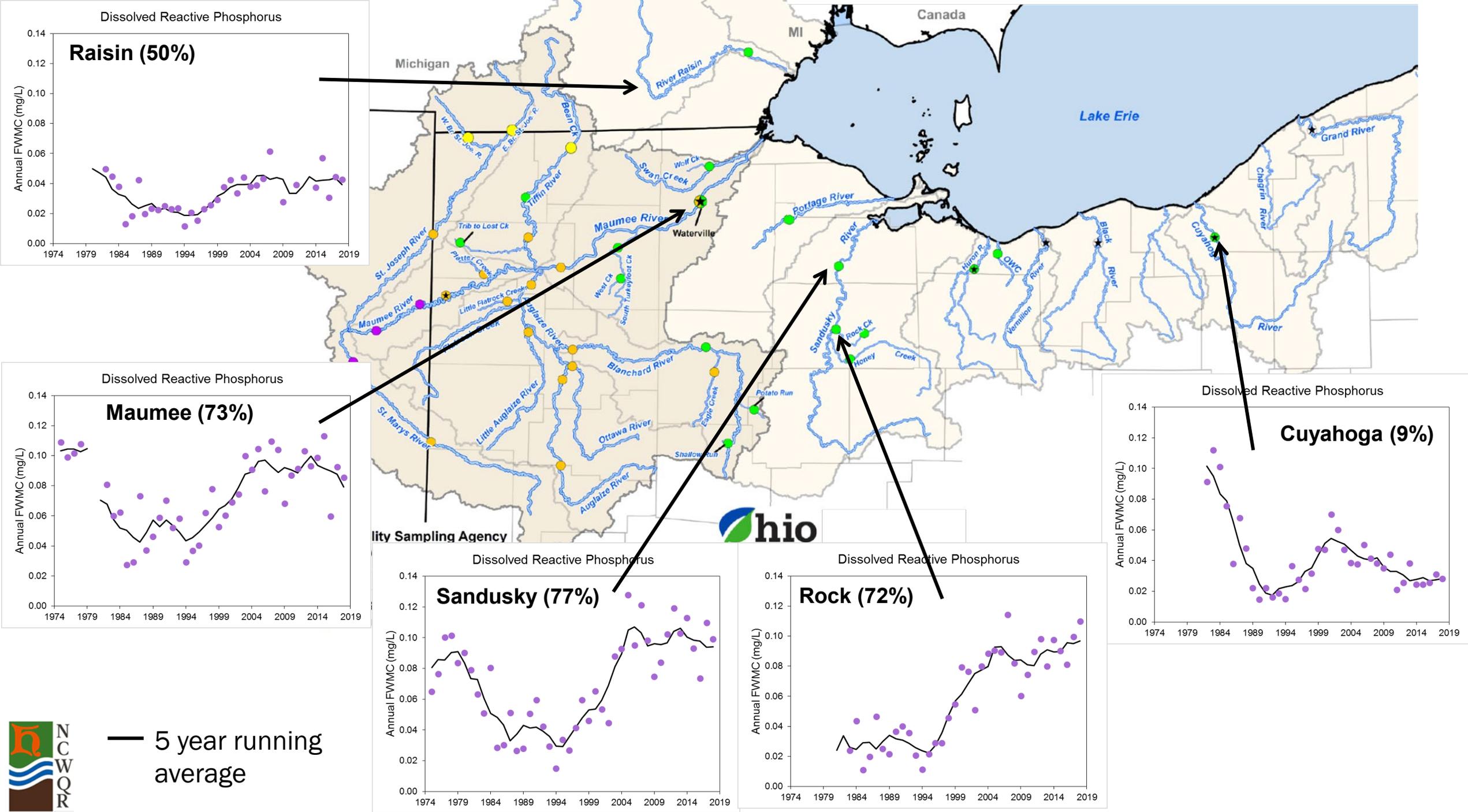


- Water Quality Sampling Agency**
- NCWQR (Heidelberg)
  - USGS - Ohio
  - USGS Surrogate (Super) Gage
- Non-Ohio Sampling Agencies**
- Indiana - USGS
  - Michigan - USGS



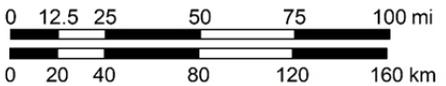
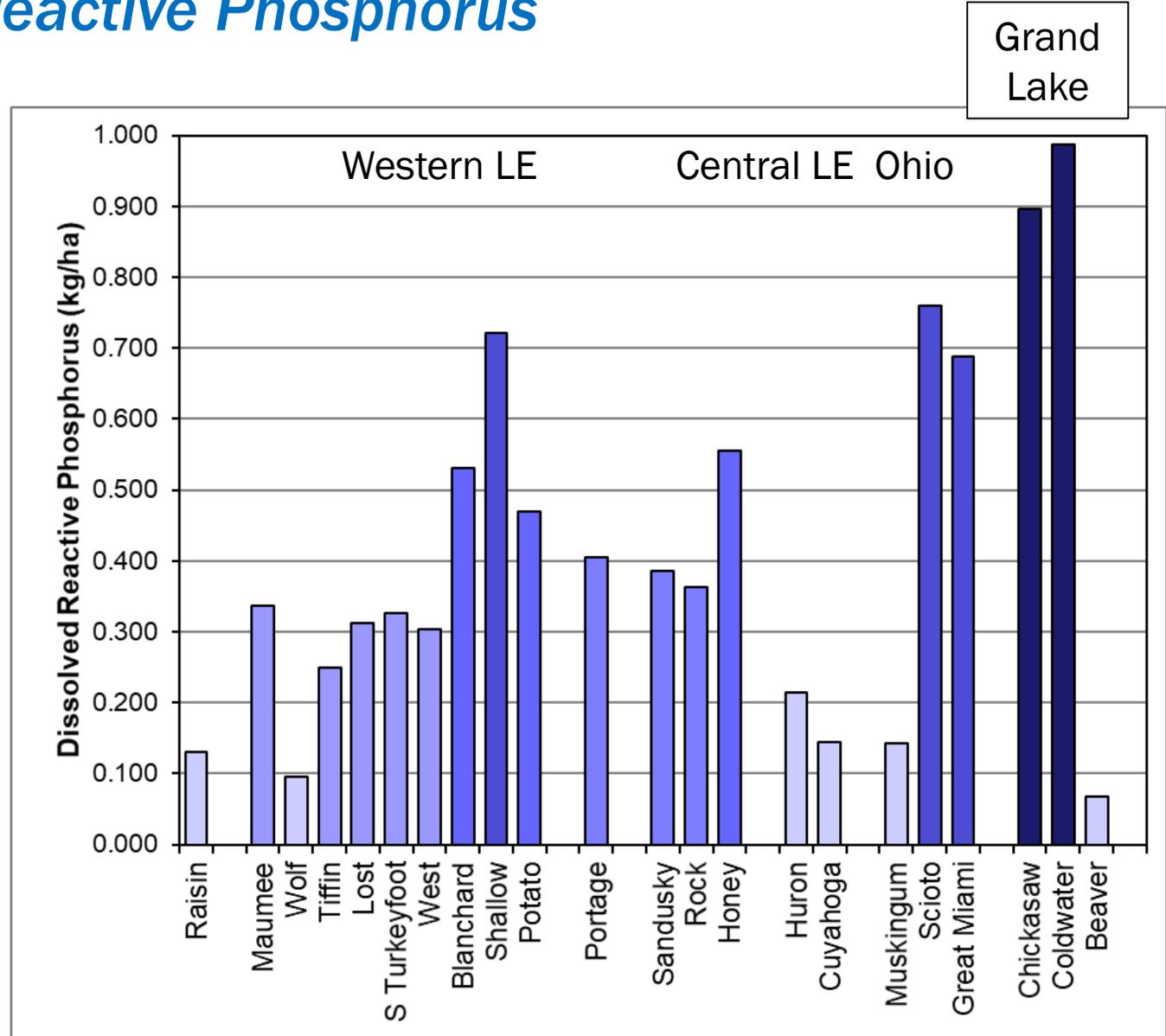
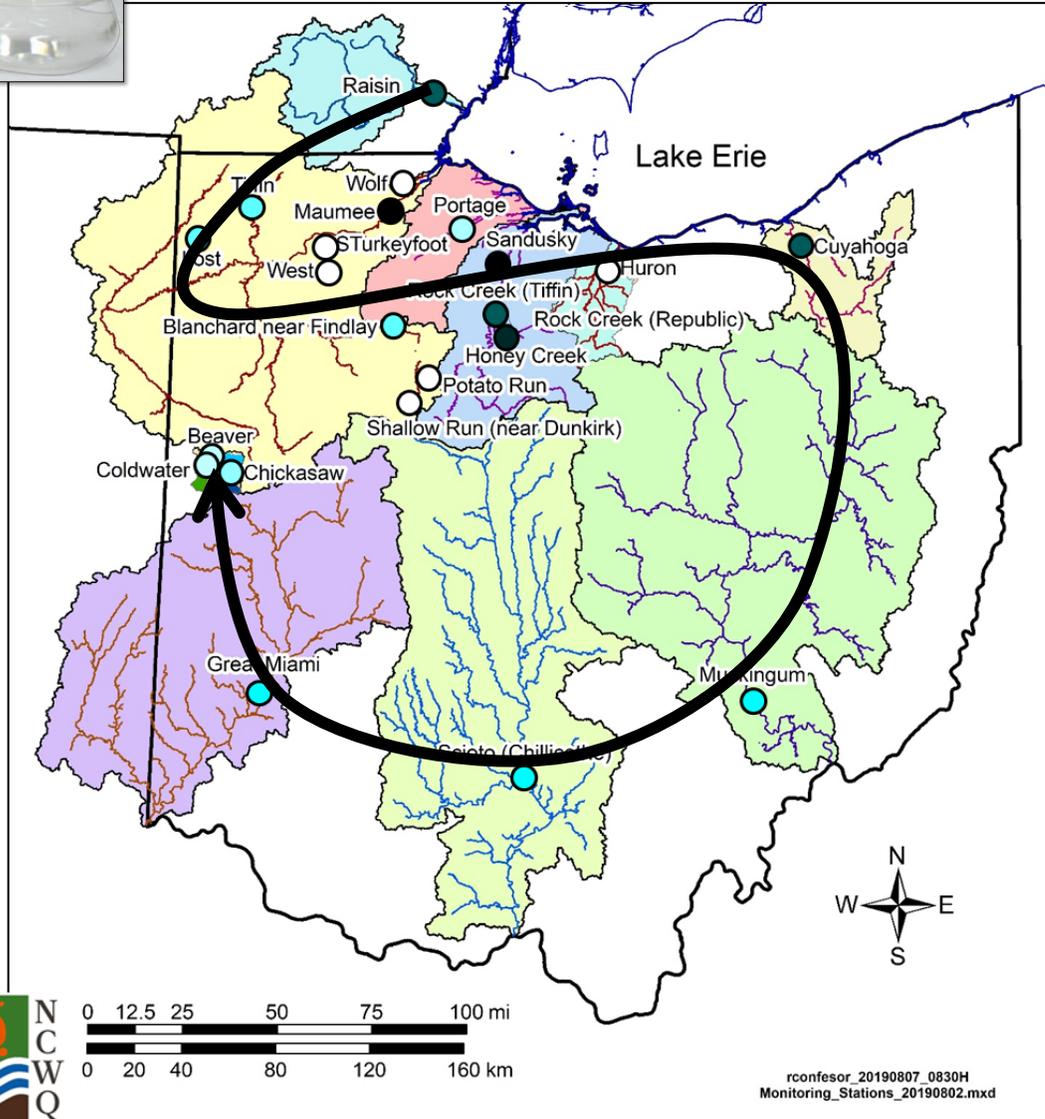
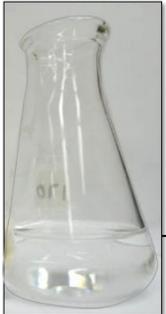
# Long-term trends in annual nutrient concentrations from the Maumee River





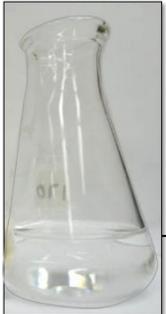
# Comparing watersheds: Unit Area Loads \*similar to lbs/acre

## *Dissolved Reactive Phosphorus*



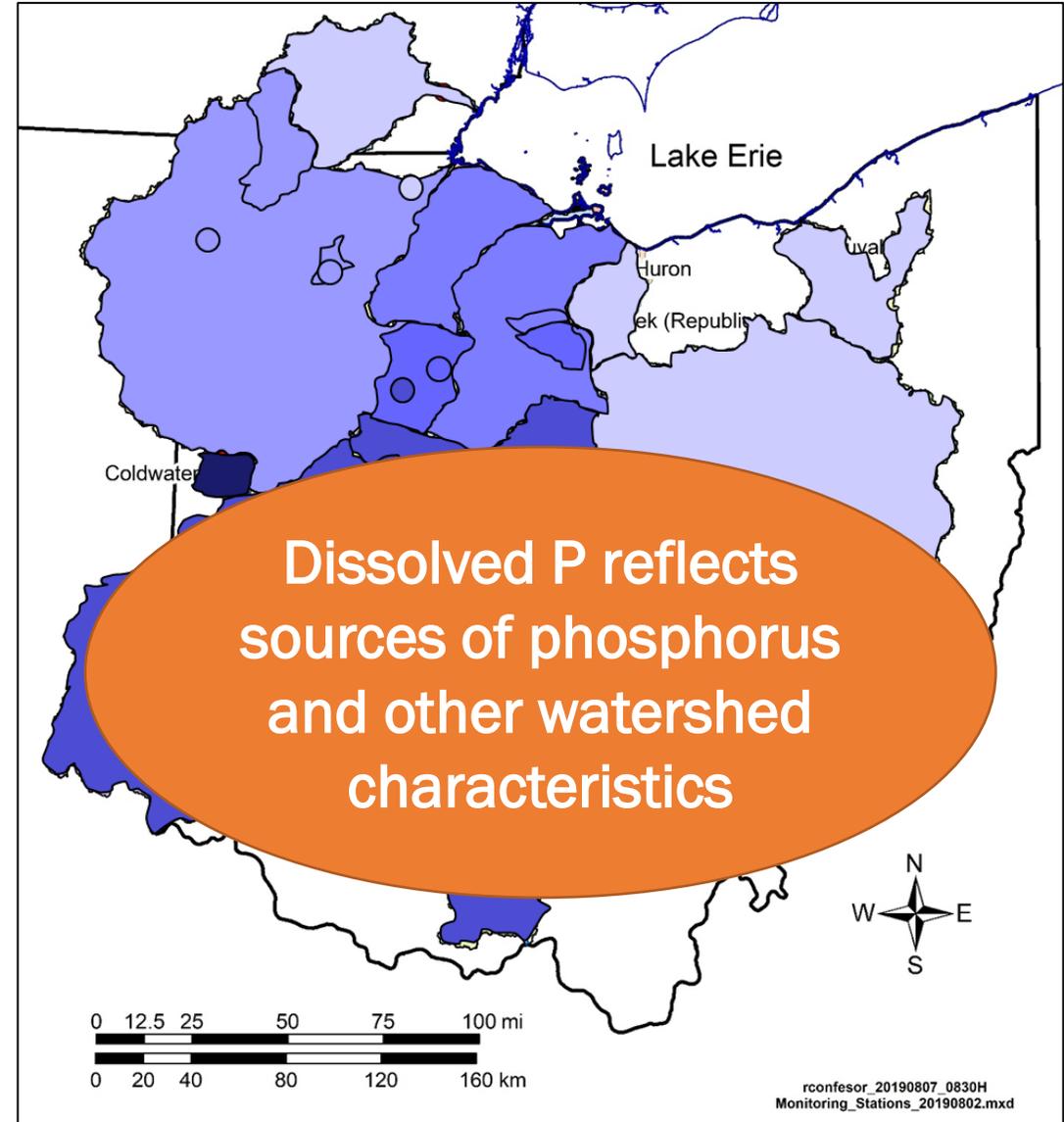
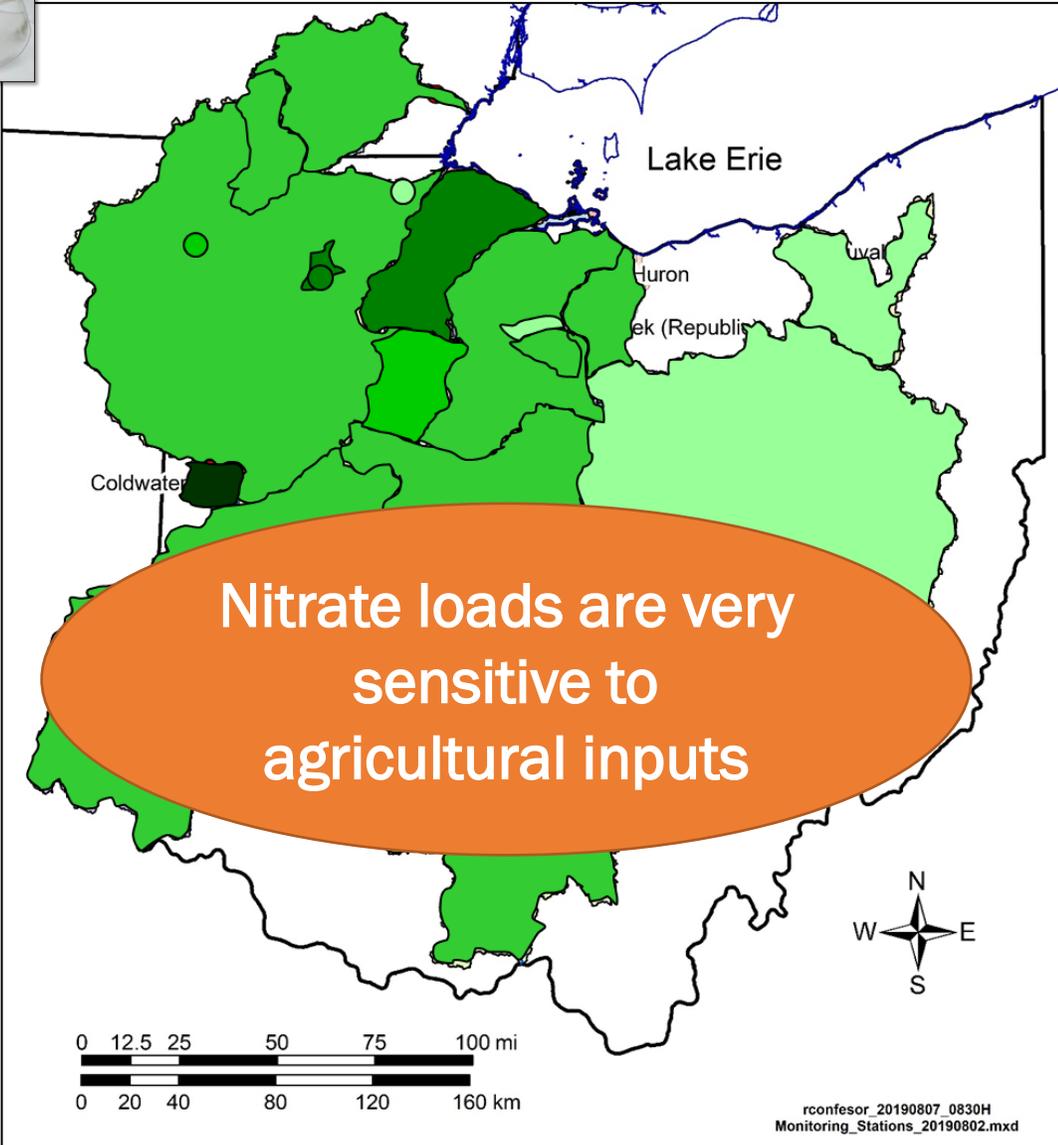
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# Comparing watersheds: Unit Area Loads (kg/ha)



*Nitrate-Nitrogen*

*Dissolved Reactive Phosphorus*



# Thanks!

Laura T. Johnson

Director

National Center for Water Quality Research

Heidelberg University

310 E. Market Street

Tiffin, OH 44883

[ljohnson@heidelberg.edu](mailto:ljohnson@heidelberg.edu)

419.448.2056

<http://www.ncwqr.org>

<https://ncwqr-data.org/>



- **Defiance Alliance**

- *Partnership with Defiance College, Ohio Tri-River Research Alliance*
- *Congressionally Directed Spending from Senator Brown's Office*

- **Conservation Kick**

- *Great Lakes Commission – GLRI Funding*
- *Defiance SWCD – Design Denitrifying Bioreactor*
- *Mike Zeedyk – Landowner to Install*

- **H2Ohio Wetland Project**

- *Biohabitats – Selected as Design/Build Firm*
- *City Land Acquisition of 40 Acre Parcel*
- *Support from The Nature Conservancy*

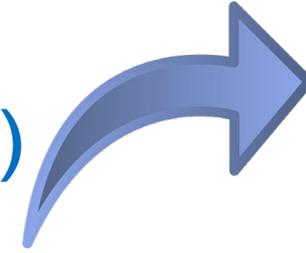
- **P-Optimal Wetland Research Project**

- *US Army Corps of Engineers Project with LimnoTech, USGS*
- *City-Owned Parcel*



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# Ohio Tri-River Alliance (OTRA)



Press Release

- \$500,000 government funding for water quality research in the Upper Maumee River Watershed
- Goals:
  - Establish the Maumee River Data Research Center at Defiance College
  - Establish collaboration with management, research, and education





- **Science and Research**

- *Understanding Water Quality*
- *Data-Driven Decision Making*

- **Enterprise and Community Development**

- *Precision Agriculture*
- *Precision Conservation*

- **Technology and Rural Innovation**

- *Innovate Ohio*
- *Intelligent Community Forum*
- *Smart and Sustainable Great Lakes Cluster*

- **Strategic Doing – Collaboration – Alignment – Partnerships**

- *ASPIRATIONAL – Must Forge Working Relationships!!*
- *Triple Helix*

