MID-OHIO REGIONAL
MORPC
PLANNING COMMISSION

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NOTICE OF A MEETING
SUSTAINING SCIOTO BOARD
MID-OHIO REGIONAL PLANNING COMMISSION

REMOTE MEETING

October 28, 2020, 2:30 pm – 4:00 pm

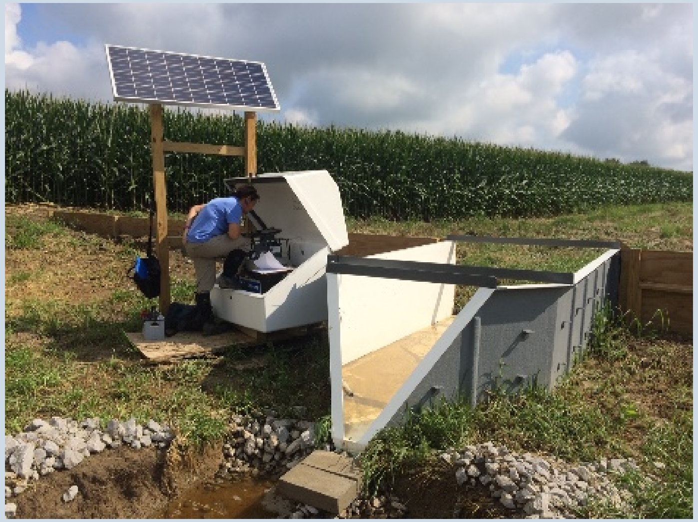
AGENDA

2:30 – 2:35 pm	**Welcome & Introductions** *Kristen Atha, Chair*
2:35 – 3:05 pm	**East Fork Watershed Research and Cooperative** – *Christopher Nietch, U.S. EPA*
3:05 – 3:15 pm	**Agricultural and Rural Communities Outreach Team –** *Jessica d'Ambrosio, Ag&Rural Working Team Chair*
3:15 – 3:35 pm	**Board Updates** *Vice Chair* *December and future meetings* *Water quality monitoring funding update* *MORPC programming update – 208 and Regional Sustainability Agenda*
3:35 – 3:55 pm	**Board member updates**
3:55 – 4:00 pm	**Next Steps** – *Kristen Atha , Chair*
4:00 pm	**Adjourn**

Please notify Lynn Kaufman at 614-233-4189 or LKaufman@morpc.org to confirm your attendance for this meeting or if you require special assistance.

The next Sustaining Scioto Board Meeting
will be on February 24, 2020, 2:30 pm – Remote

Critical Water Quantity and Quality (WQ2) Sensing, Monitoring and Modeling for Watershed Nutrient Pollution Management



Chris Nietch, USEPA/ORD, Cincinnati, OH

Disclaimer: The views expressed in this presentation are those of the author and do not necessarily represent the views or policies of the U.S. EPA. The mention of specific manufacturers does not constitute Agency endorsement.

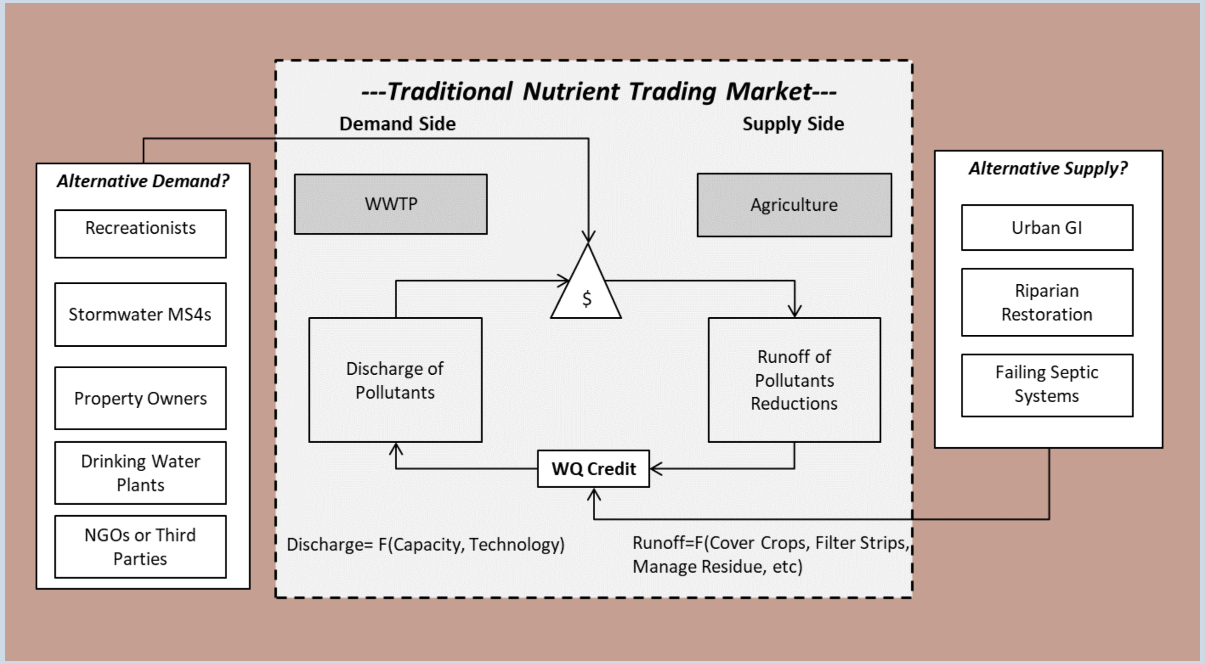
Background- Watershed-scale Nutrient Management

- Reducing nutrient pollution is arguably one of the greatest challenges facing water quality protection
- Changing climate is exacerbating the impacts of excess nutrients (e.g., Harmful Algae Blooms)
- Existing assessment and management approaches are failing to address the problem
  - Silo-ed and piece-meal
  - Underfunded
  - Assessment and management measures are out of sync
- New directions call for more comprehensive and integrative approach

Towards a Better Watershed Management

- We approach the goal of obtaining a better watershed nutrient management with an objective to provide tools and procedures for gaining a better understanding of the feasibility of adopting a market-based approach to nutrient reduction
- To understand the feasibility of a market-based approach we must understand the costs associated with management alternatives used for reducing nutrients
- Consider potential participants in addition to the traditional WWTP and agricultural producers
- Reduce uncertainties associated with modeling the watershed system
- Meet critical WQ2 sensing and monitoring

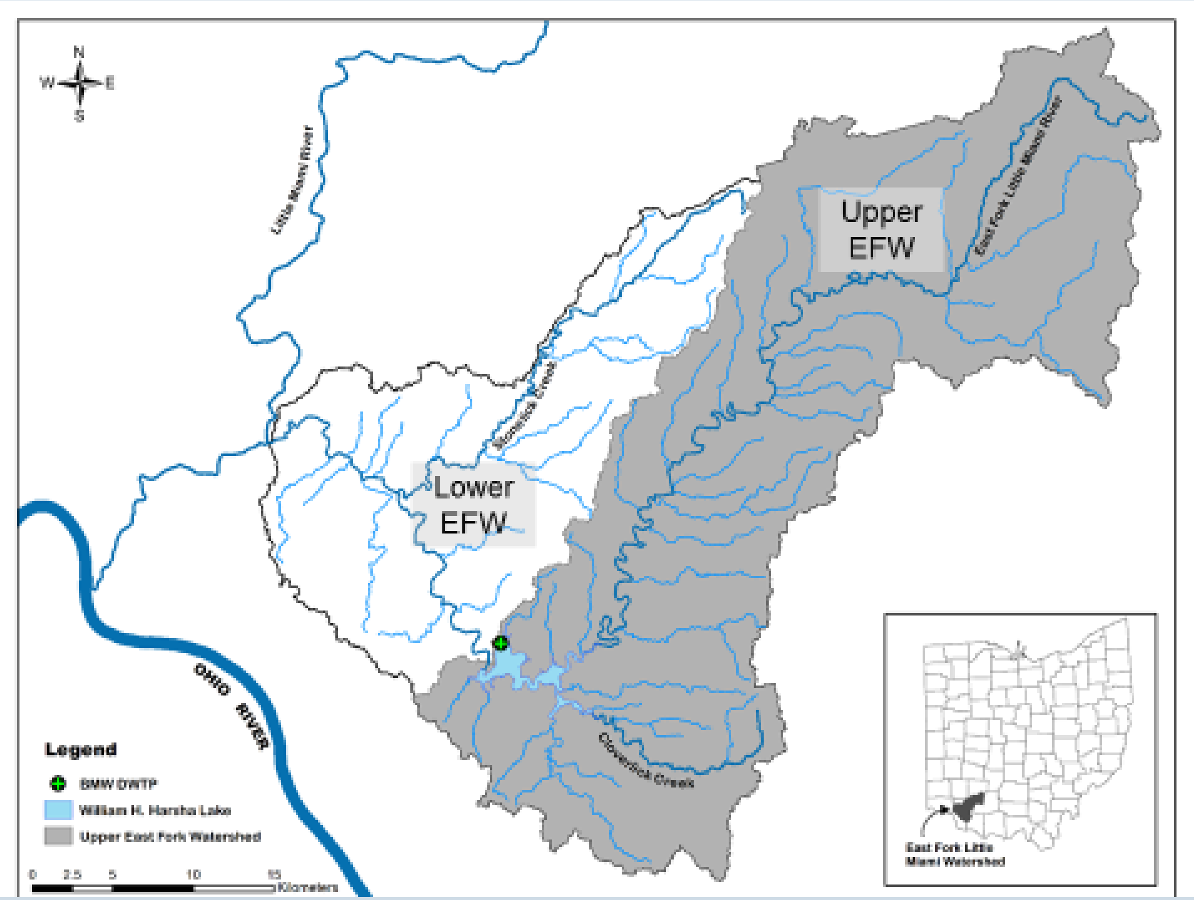
Exploring nontraditional participants in water quality trading



- *Heberling et al., 2015. Framework for linking drinking water treatment costs to nutrient management/source watershed protection costs*
- *Heberling et al. 2018. Exploring nontraditional participation as an approach to make water quality trading markets more effective*
- *Nietch et al. Informing market-based policy decision making: Developing a trading feasibility work-flow for watershed nutrient management. In Revision.*

Watershed Case-Study System

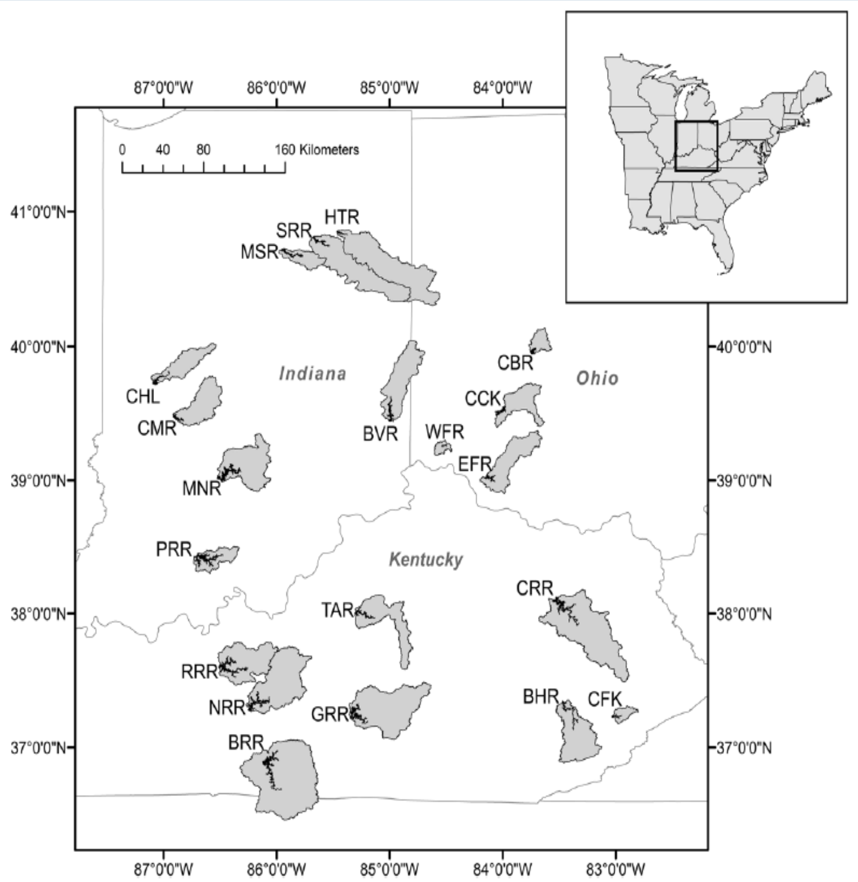
- We use a case study approach to conduct the R&D associated with the WQT feasibility research
- WQ2 Sensing/Monitoring categories were established after “living through” the assessment, monitoring, and modeling phases of understanding the sources and impacts of nutrient pollution
- Now moving into an implementation phase

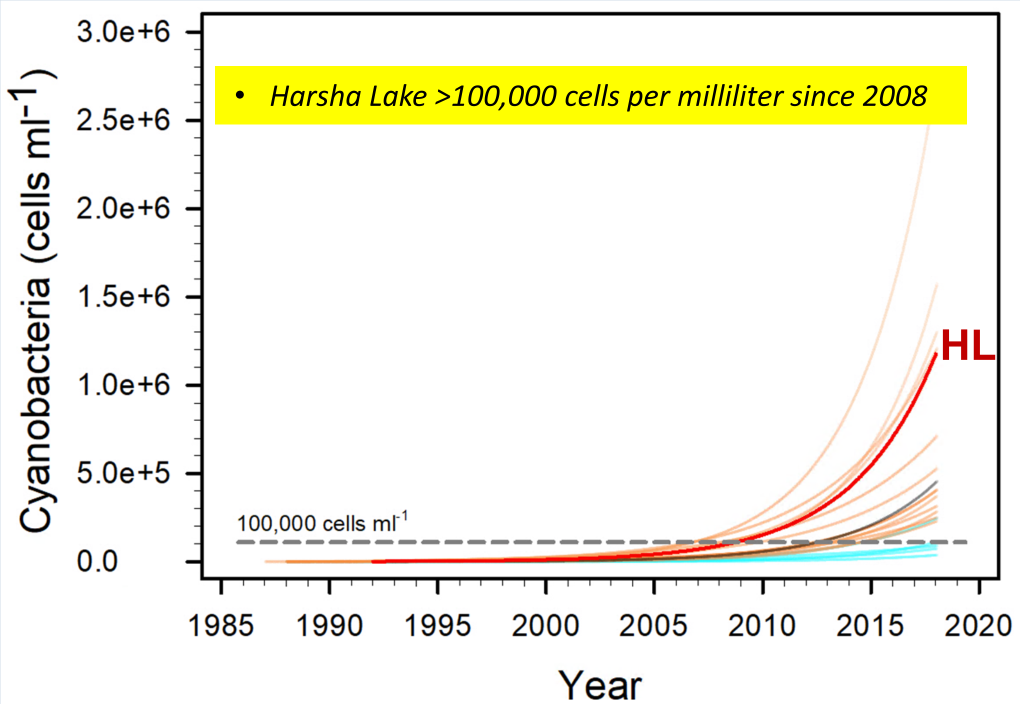


The East Fork of The Little Miami River Watershed: Mixed-Use system dominated by agriculture in Southwestern Ohio.

Maximum densities of cyanobacteria have been increasing in USACE reservoirs

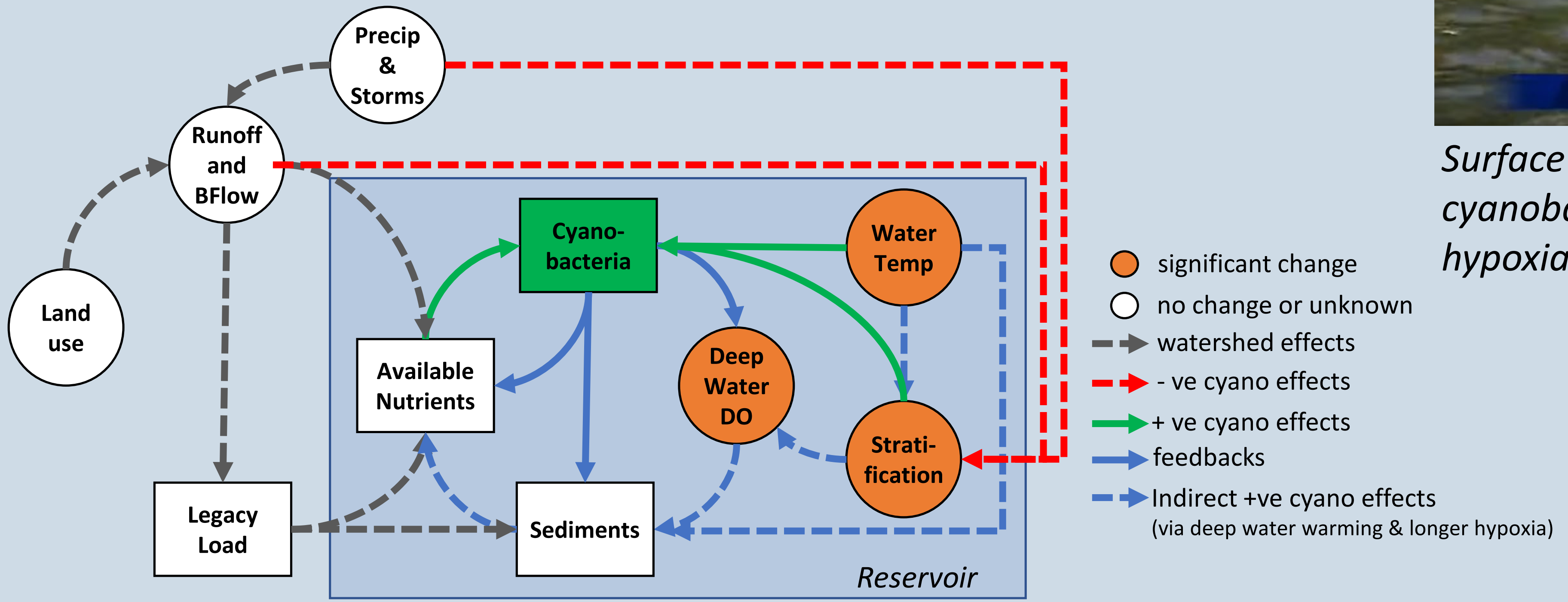
More reservoirs experiencing conditions with moderate to high risk to human health





- Greater cyanobacteria cell densities when watersheds have less forest cover. *Forested systems in blue*

Conceptual model developed from 20 reservoir and Harsha Data Analysis



Surface and deep waters are warming; cyanobacteria like it hot; duration of hypoxia is increasing

Adapted from Figure 4. (Smucker et al., resubmitted)

Set Strategic Monitoring Sites

Critical Components

1. At least one large scale WQ2 'comprehensive' gage
2. Multiple, small-scale sites strategically located to characterize unique land use/soil type combinations
3. Point Sources and Critical Areas (e.g. beaches and DWTP intakes)
4. HUC12-scale sites used to determine nutrient reduction requirements and track progress at intermediate spatial scales

https://www.exowater.com/blog/2015/03/unsw-uses-on-line-monitoring-of-cyanobacteria-in-source-water-treatment/

Secondary Considerations

1. *BMP effectiveness measurement sites*
2. *Edge-of-field evaluation site*
3. *In-stream attenuation sites*

Partnerships developed through the East Fork Watershed Cooperative have made meeting these needs possible

The East Fork Watershed (EFW) Cooperative

- **Federal Partners**

USDA
US Army Corps of Engineers®
USGS science for a changing world

- **State Partners**

OhioEPA
The Ohio State University
Ohio Department of Natural Resources
Ohio Department of Agriculture

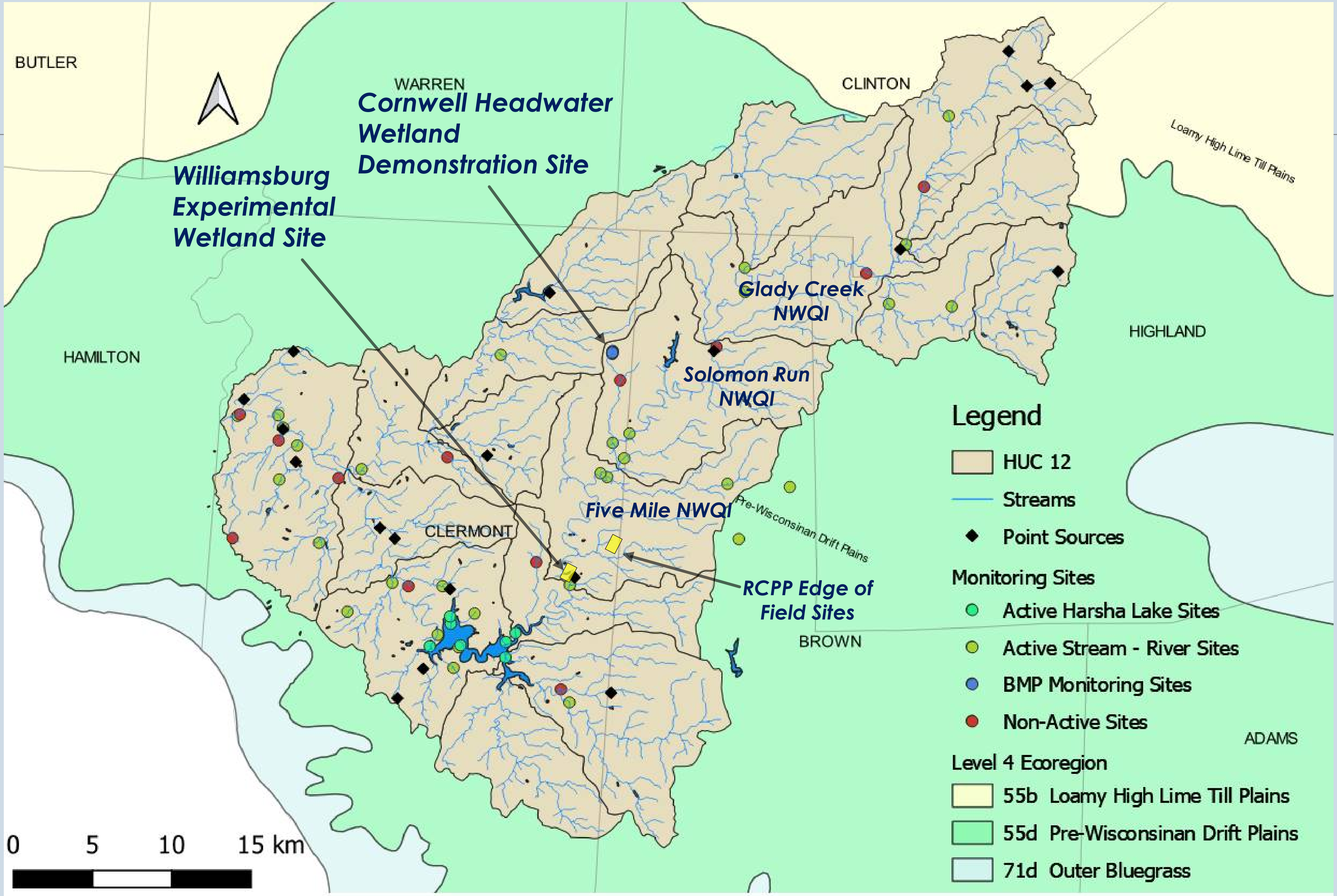
- **Local Partners**

Clermont S.W.C.D. Soil & Water Conservation District
Brown County, Ohio. SWCD
Clermont County Ohio

Local Farmers

University of Cincinnati

- **Leverages monitoring and management effort**
- **Since 2009 the EFWCoop has used its partnerships to help:**
  - Document historical changes in river water quality and coincident shifts in algal communities in Harsha Lake
  - Facilitate focused research studies
  - Support the development, testing and validation of watershed modeling tools
  - Engage a broader stakeholder community to promote watershed protection with best management practices (BMPs)
  - Provide the State TMDL development support
  - Serve as demonstration watershed for BMP effects



BUTLER
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Loamy High Lime Till Plains
Pre-Wisconsinan Drift Plains
Cornwell Headwater Wetland Demonstration Site
Williamsburg Experimental Wetland Site
Glady Creek NWQI
Solomon Run NWQI
Five Mile NWQI
RCPP Edge of Field Sites
0 5 10 15 km
Legend
HUC 12
Streams
Point Sources
Monitoring Sites
Active Harsha Lake Sites
Active Stream - River Sites
BMP Monitoring Sites
Non-Active Sites
Level 4 Ecoregion
55b Loamy High Lime Till Plains
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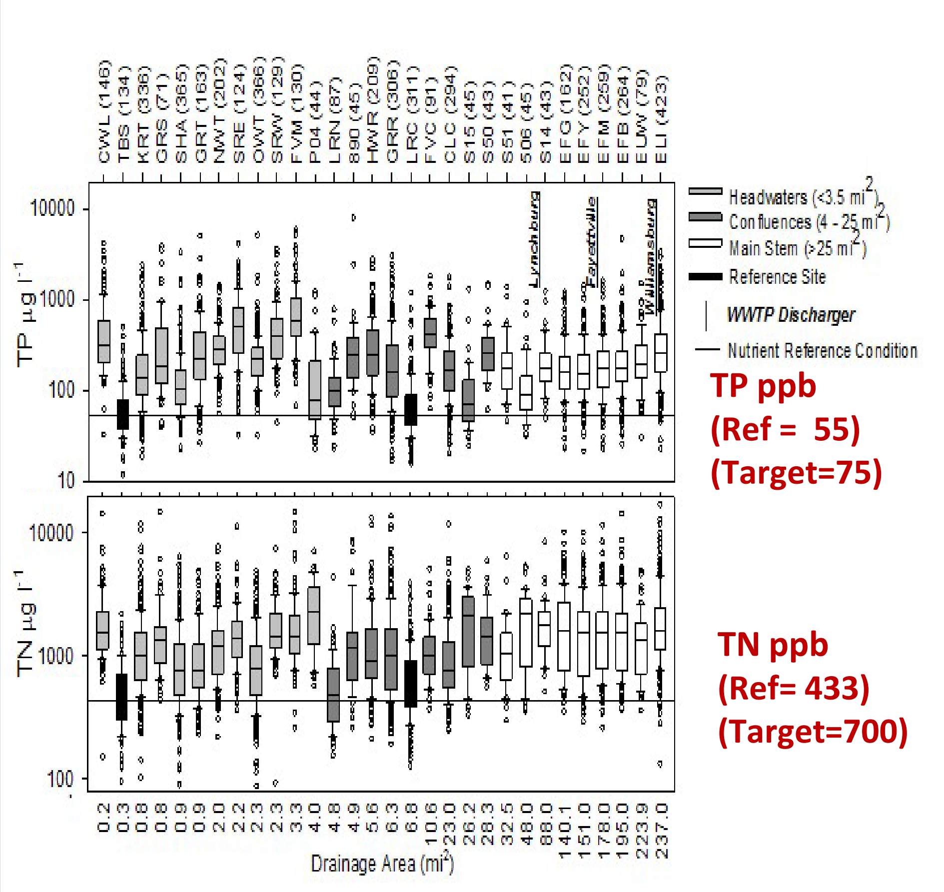
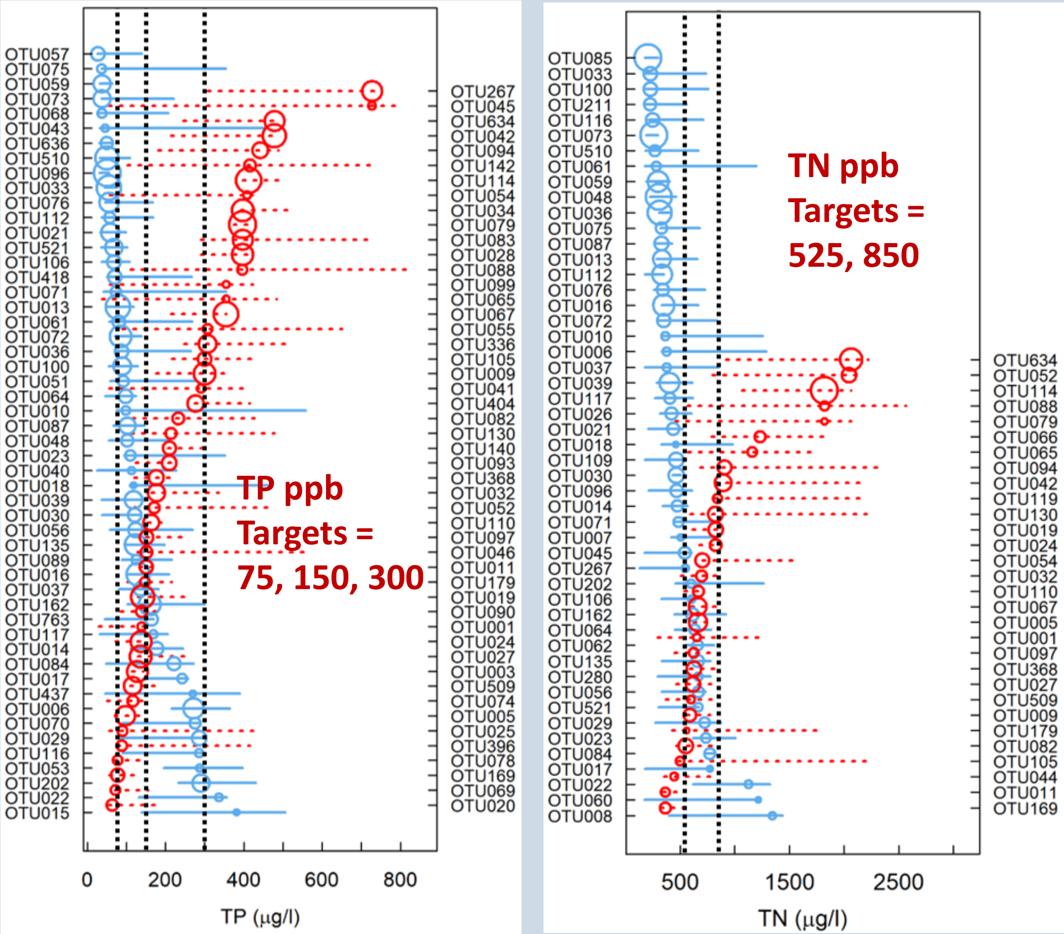
71d Outer Bluegrass

Setting Defensible Targets

Nutrient Targets set for the Water Quality Trading Research – obtained from weekly monitoring

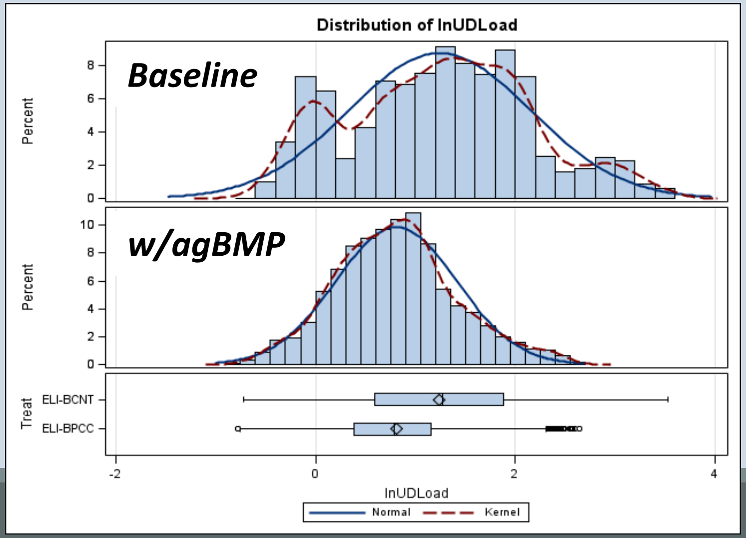


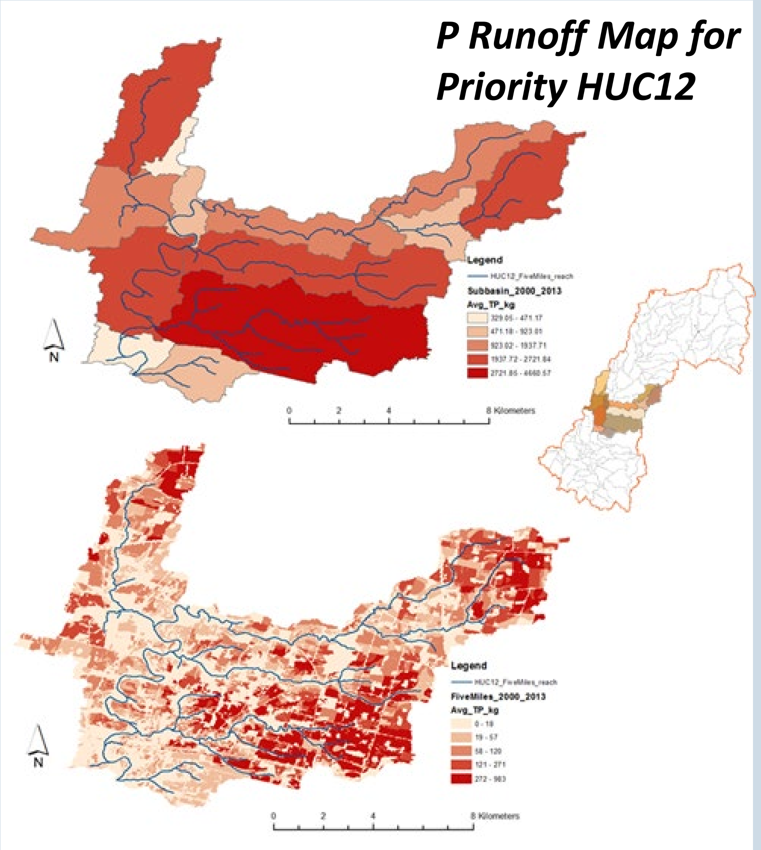
Results from diatom metabarcoding. Possible targets based on all responses from TITAN, Boosted Regression, and Gradient Forest statistical methods



Watershed Modeling – One model approach – calibrated and evaluated at multiple spatial scales

- **Soil and Water Assessment Tool (SWAT)** – Semi-distributed, physically based, capable of simulating a diversity of crop types and management options and operations
- **SWAT- Calibration and Uncertainty Program (CUP)** for uncertainty analysis
- Use model parametric uncertainty to obtain distributions for agBMP reduction efficiencies



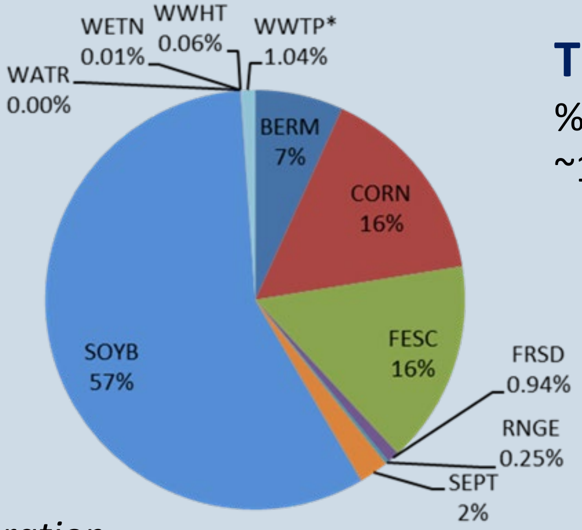


- Simulates watershed-scale BMP effectiveness scenarios for cost comparisons and progress tracking

Neitsch et al., 2011, http://swat.tamu.edu/media/99192/swat2009-theory.pdf

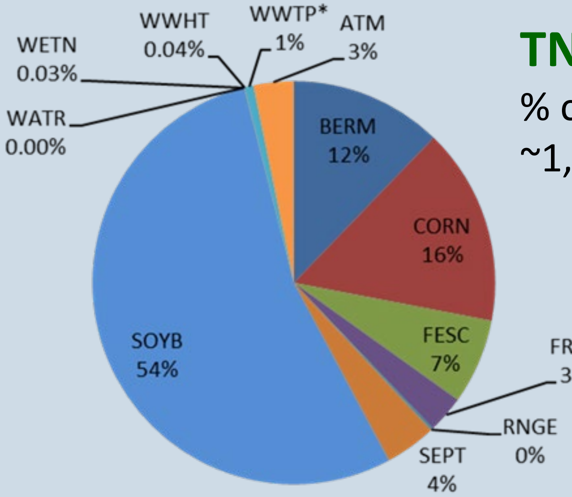
- Used to set nutrient reduction requirements
- Must have high spatial resolution for agBMP placement and to study trading scenarios

Model Output - Nutrient Source Distribution and Reduction Requirements



TP

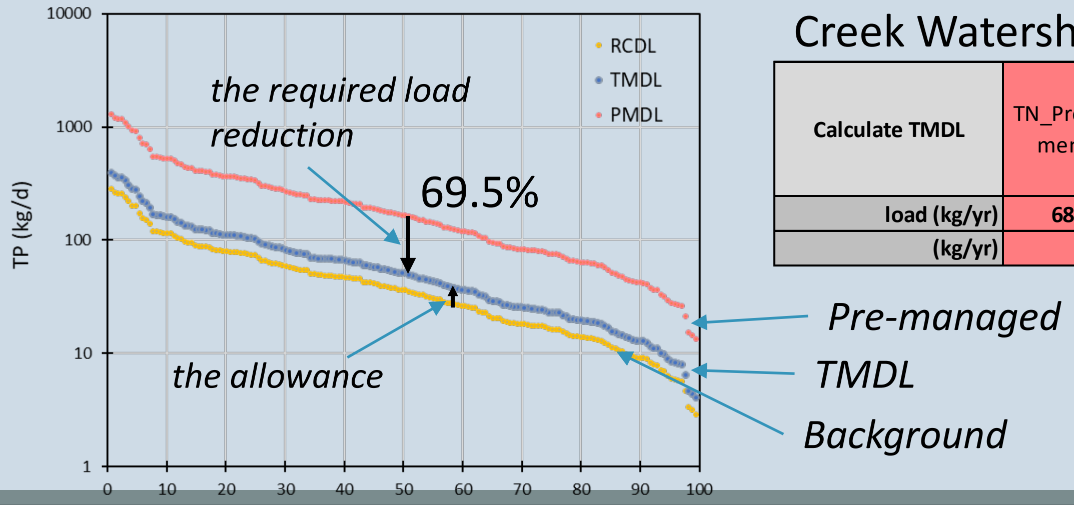
% contribution of ~100,000 kg·yr^{-1}



TN

% contribution of ~1,000,000 kg·yr^{-1}

Daily Load duration curves



Compute Background and TMDL Loads– HUC 050902021102 (outlet of Five Mile Creek Watershed); site ELI – Main outlet of UEFW

Calculate TMDL	TN_PreManagement Load	TNBackground (baseload)	TNAllowed Load	TP_PreManagement Load	TPBackground (baseload)	TPAllowed Load	Excess TN|TP (kg/yr)	TN|TP_MOS (10%)	TN|TP_AFG (2%)	TN|TP TMAL
load (kg/yr)	689,626	187,923	306,883	88,466	19,286	26,982	382,742	11,896	2,379	104,685
(kg/yr)			118,960			7,697	61,484	770	154	6,773

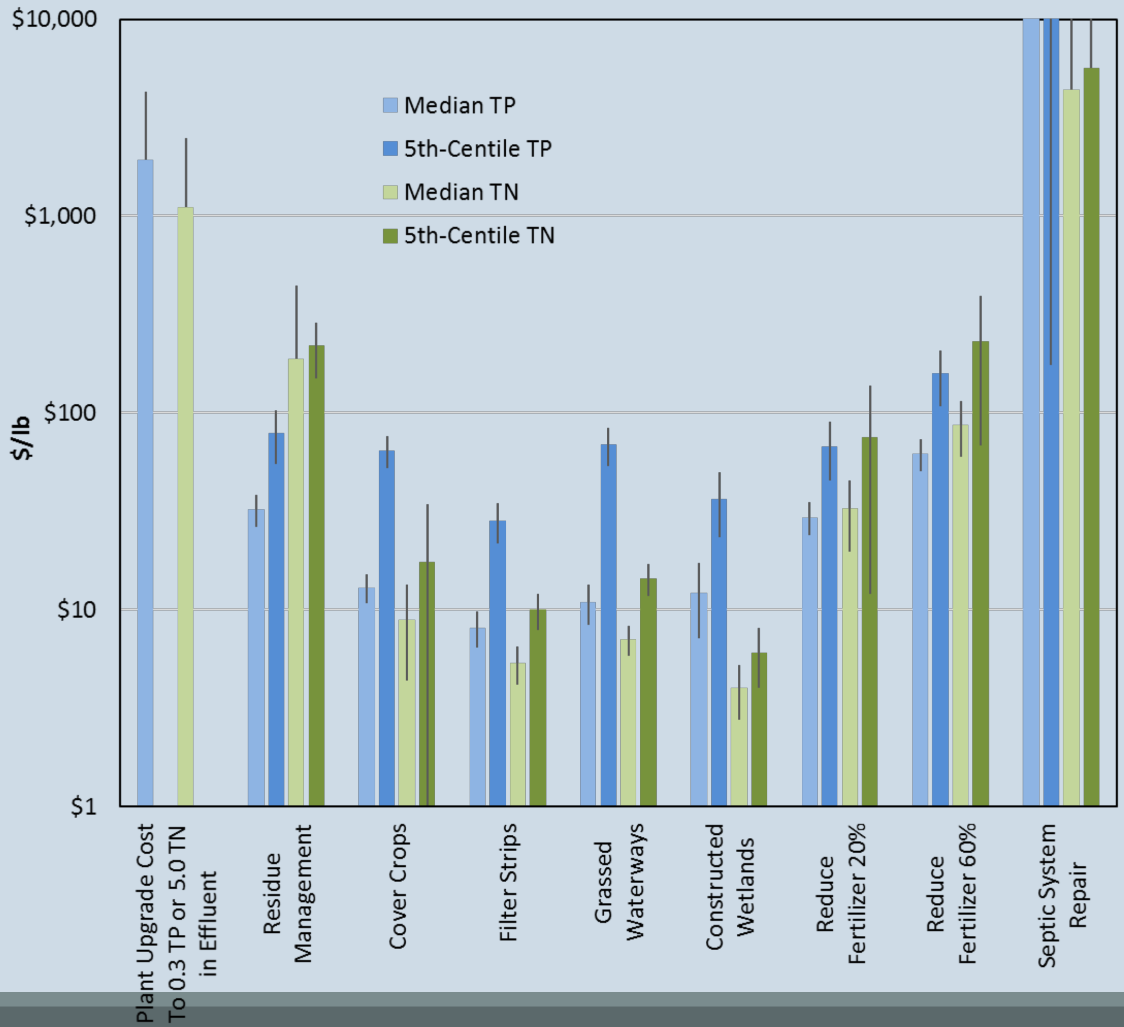
For TP expressed as Annual Loads (kg/yr)

- ***TMDL = BL+(WLA + LA) + MOS + AFG***
- **26,982 = 19,286 + (6,773) + 770 + 154**

Model Output - Wastewater Plant Upgrades vs. agBMPs

- **agBMPs scenarios modeled:**
  - Residue Management, Cover Crops, Filter Strips, Wetlands, Grassed Waterways, Reduced Fertilizer Application and Septic Repair
  - Septic Repair >> WWTP upgrade >> agBMPs

Unit Cost of Nutrient Removal

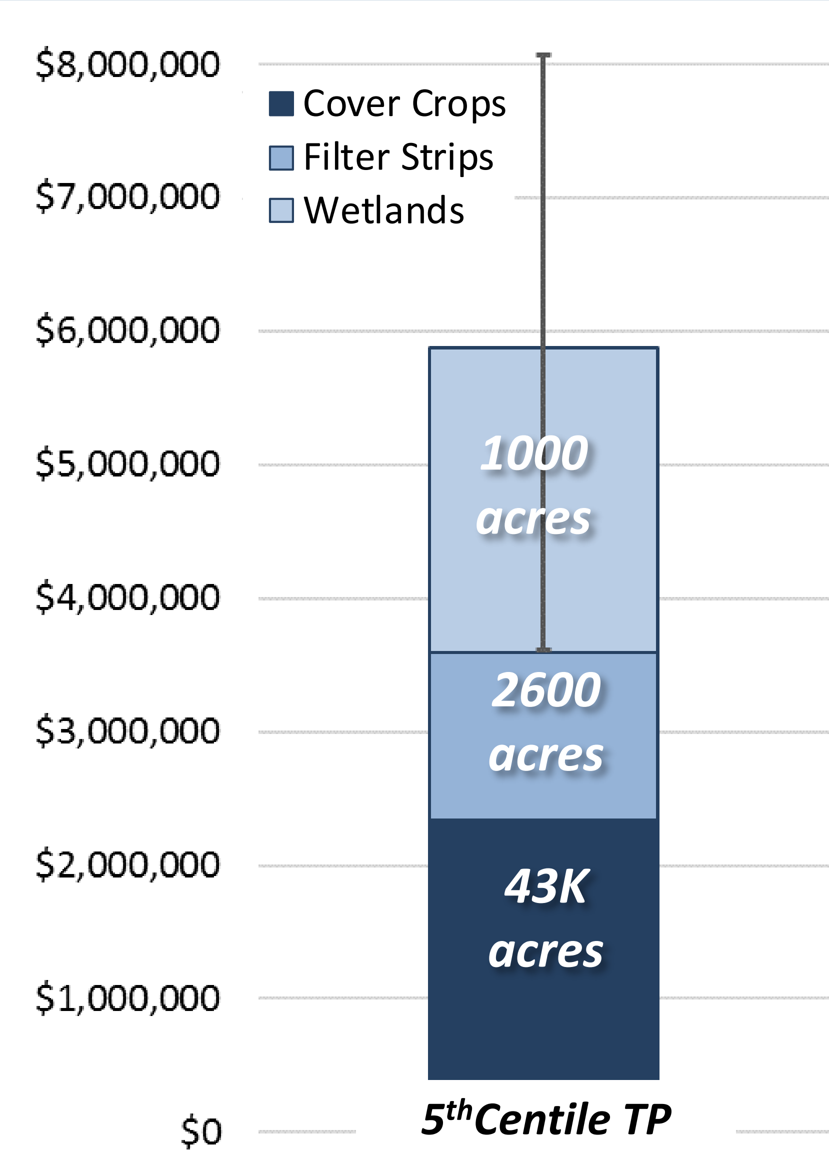


Example Watershed-scale Cost Differences

https://www.no-tillfarmer.com/

- To reduce 1% of phosphorus source from WWTPs:
  - **$5.4 million** to upgrade plants or **$425K** for cover crops over only **7900 acres**
- Or, for the same cost to upgrade WWTPs, cover crops could be used on all of the row crop fields (**104,000 acres**) if median removal efficiency is realized
- However, if we account for uncertainty in cover crop effectiveness, then the TP problem cannot be fixed with cover crops alone

Watershed Action Planning



- **\$3.5 – \$8.0Mil annually** to fix **TP** assuming 5th centile removal efficiency, or \$250K – \$600K per HUC12
- Would account for 46% to 100% of the **TN** problem pending efficiency

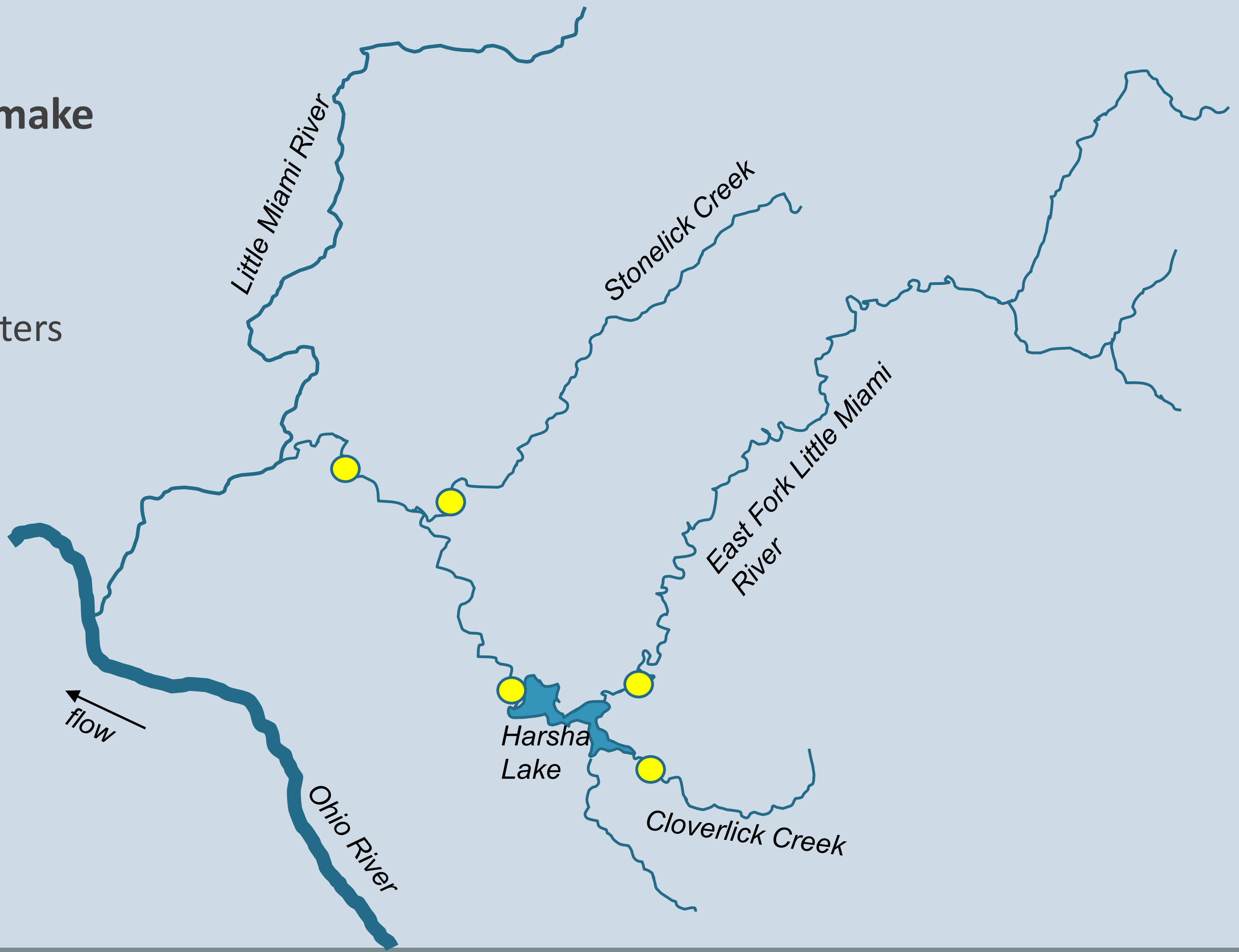
For context

- The DWTP spends ca. **\$650K yr^{-1}** for GAC to keep drinking water safe
- agBMP cost would be **20%** of annual row crop revenue, which is **\$30 million**
- Outdoor recreation adds **\$2 million** to local economy
- Soil and Water Conservation Districts (SWCDs) have obligated **\$2.75 million** in EQIP funds for nutrient reduction projects
    - Including 17,000 acres in cover crops – growing from ~ 100 acres over the last 10 yrs
- State is spending ca. **\$80 million** on the Maumee River Watershed, or ~ \$250K per HUC12

“Comprehensive” Gages at Critical Mains and Confluences

Similar to USGS’s Super Gages – To make it “Super” must have:

- Discharge
- 5 standard water-quality field parameters
  - Specific Conductance
  - pH
  - Dissolved Oxygen
  - Temperature
  - Turbidity
- One other parameter
  - Sediment
  - Nutrients
  - etc..



Newer nutrient sensing technologies

- Need, at minimum, Total Nitrogen (TN) and Total Phosphorus (TP) to meet watershed management objectives
  - Nitrate sensors
  - Phosphate High Frequency Sampling
  - Turbidity Sensors

Sea-Bird Scientific's – SUNA V2 Nitrate Sensor (http://www.seabird.com/suna

Sea-Bird Scientific Hydro-Cycle-PO4 Phosphate Sensor

https://www.ott.com/products/water-quality-128/

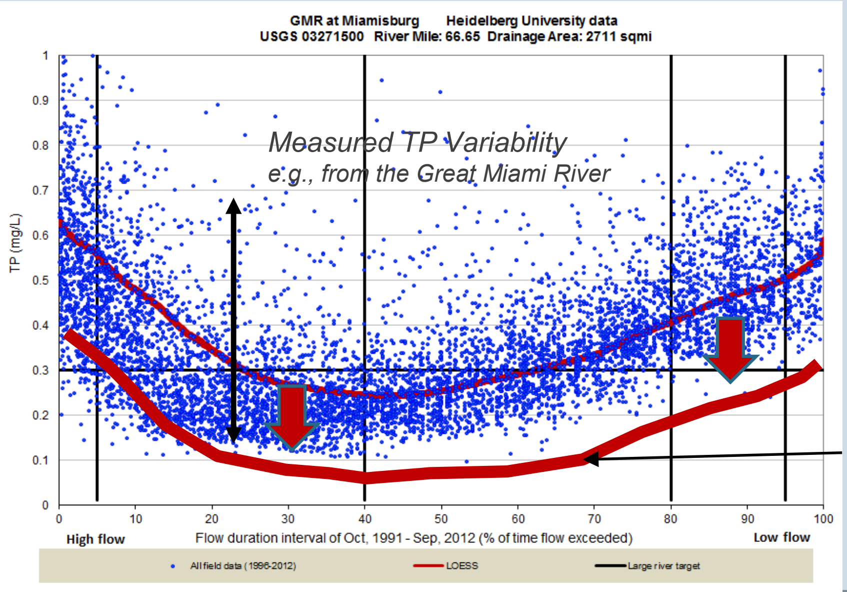
TN and TP "Sensing"

Sampling equipment and/or scheduling for collecting TN and TP samples remains the best way to characterize these constituents at high temporal frequency

National Center for Water Quality Research

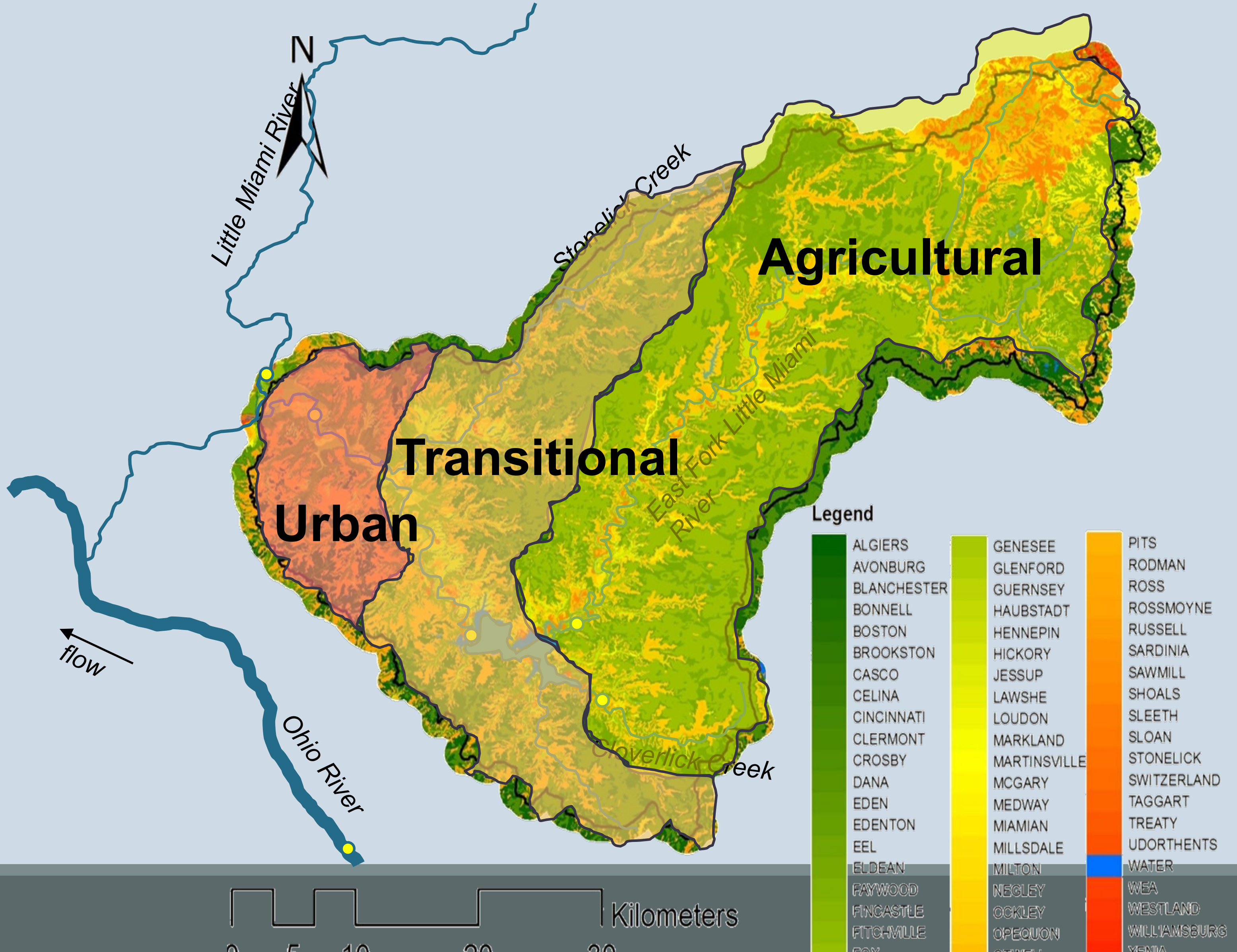
HEIDELBERG UNIVERSITY

https://ncwqr.org/



New TP Trend with flow post management

Small Scale sites – Soil/Land-use type flow and loading characterization



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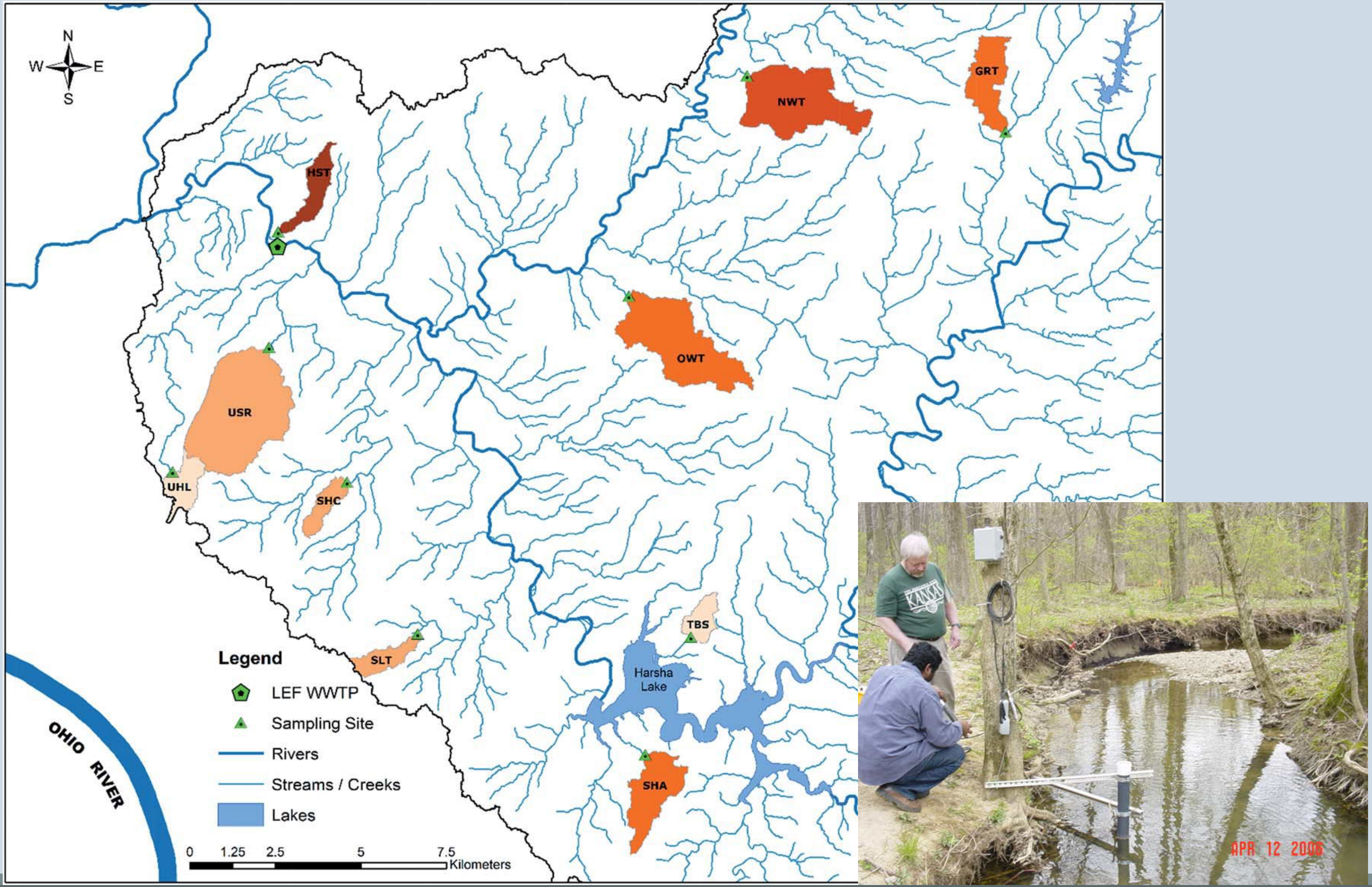
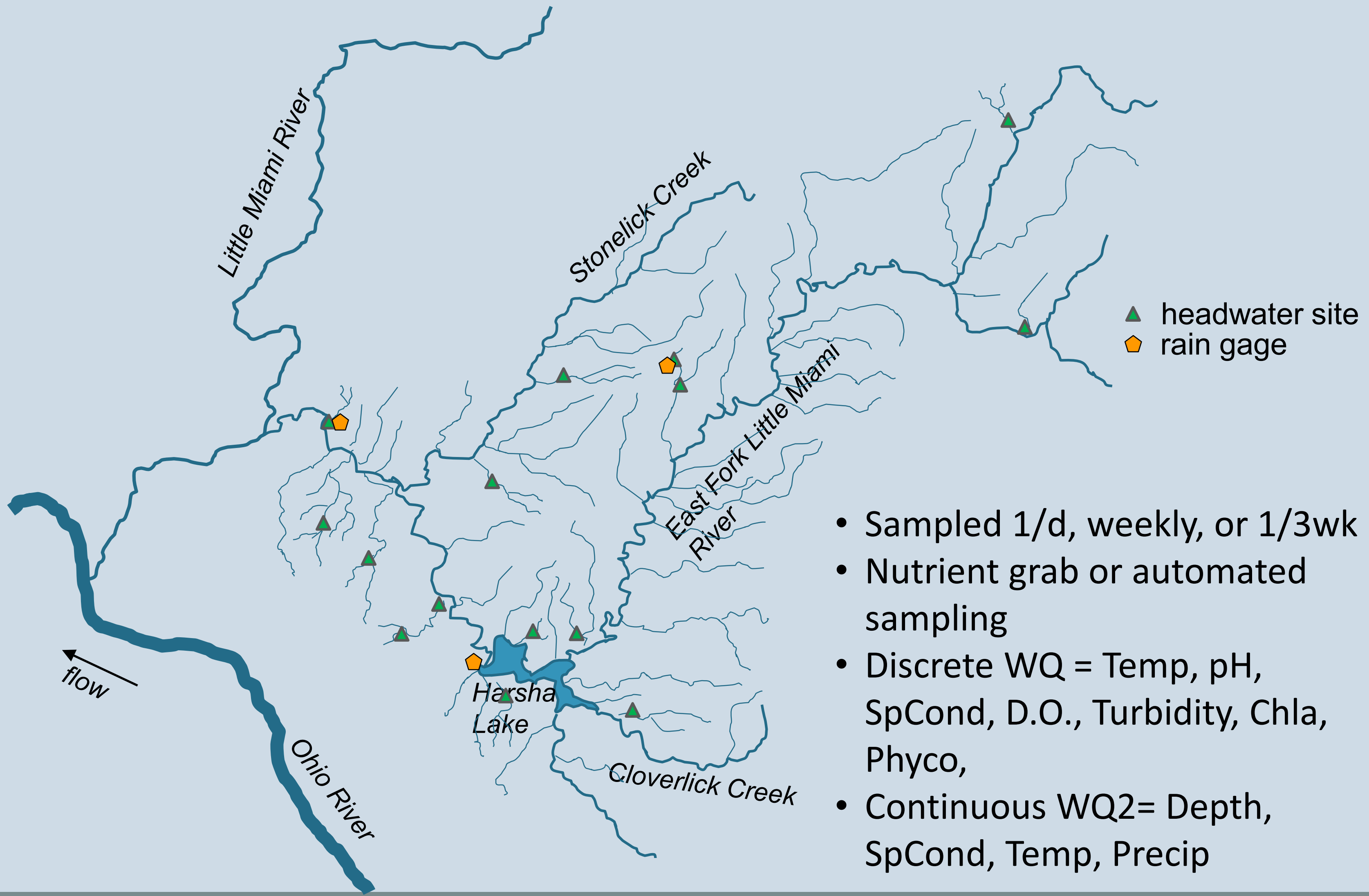


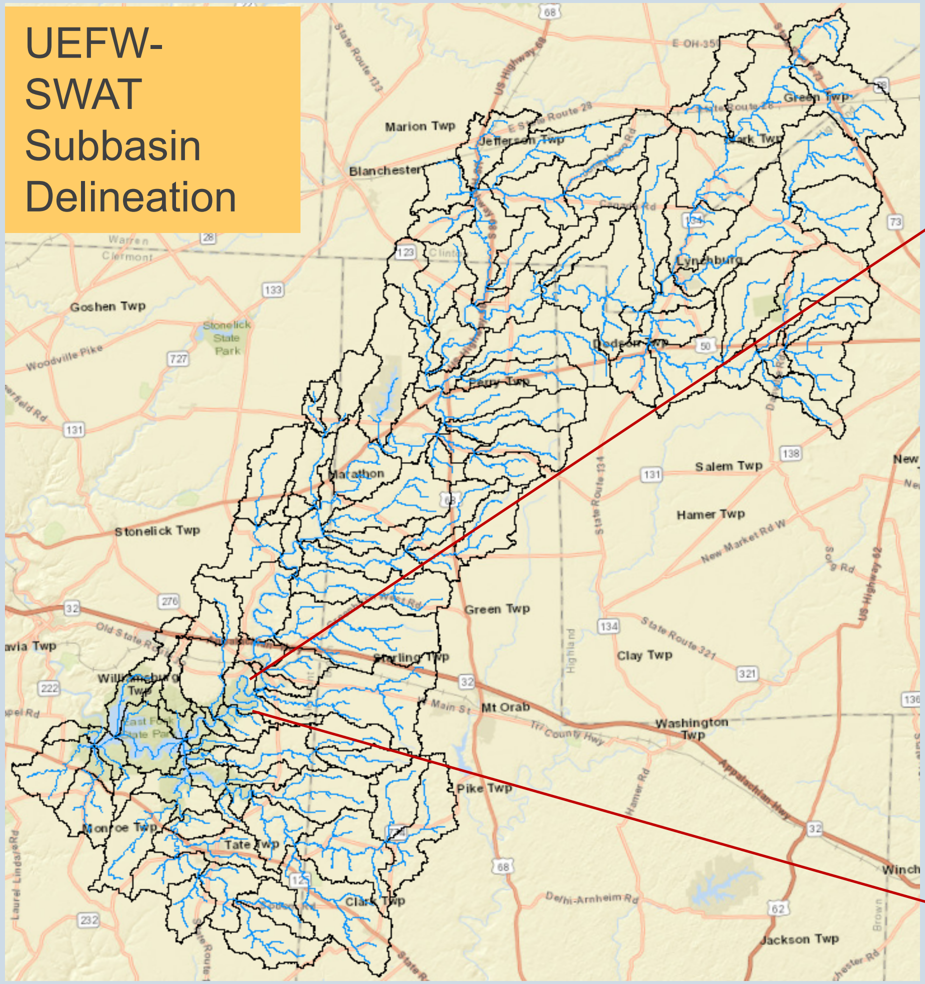
Small Scale Soil/Land-use type flow and loading characterization



- Sampled 1/d, weekly, or 1/3wk
- Nutrient grab or automated sampling
- Discrete WQ = Temp, pH, SpCond, D.O., Turbidity, Chla, Phyco,
- Continuous WQ2= Depth, SpCond, Temp, Precip

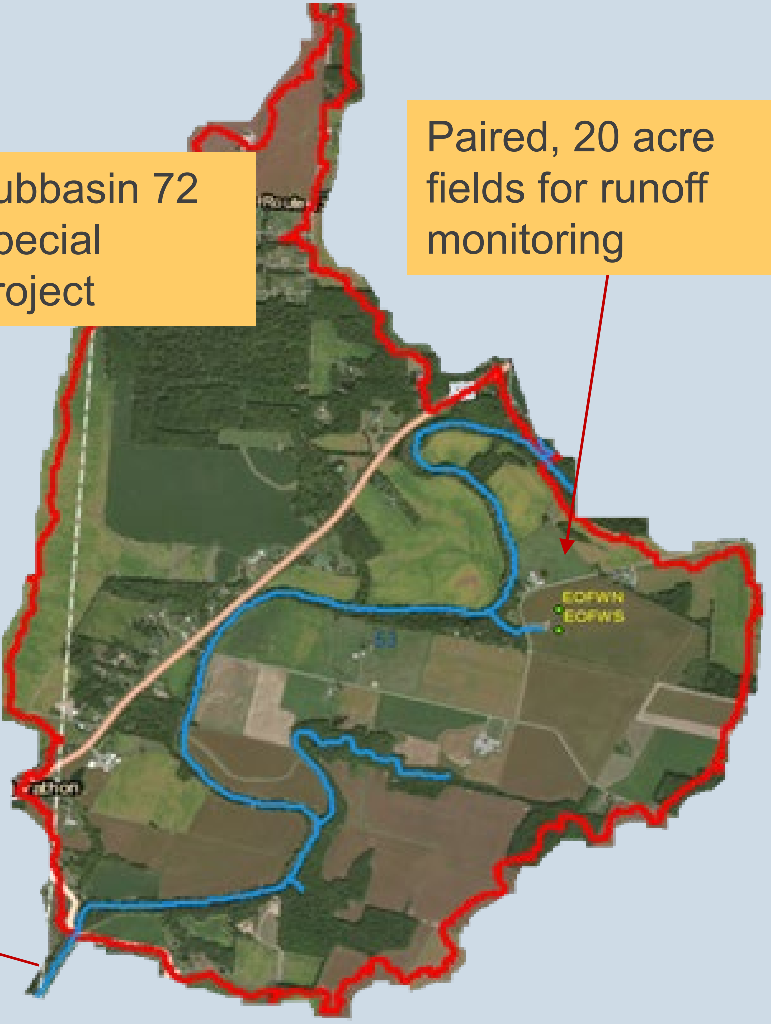
Edge-of-field Evaluation and Model Validation Sites

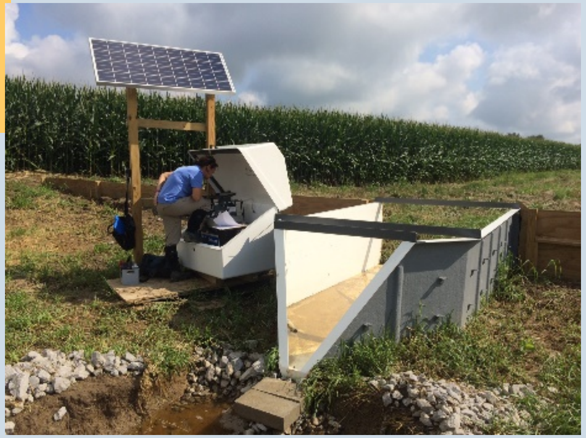
UEFW-SWAT Subbasin Delineation



Subbasin 72 Special Project

Paired, 20 acre fields for runoff monitoring





- *Flume/Bubbler-Flowmeter*
- *Autosampler*
- *Rain gauge*

Regional Conservation Partnership Program (RCPP) - Edge of Field Monitoring Study

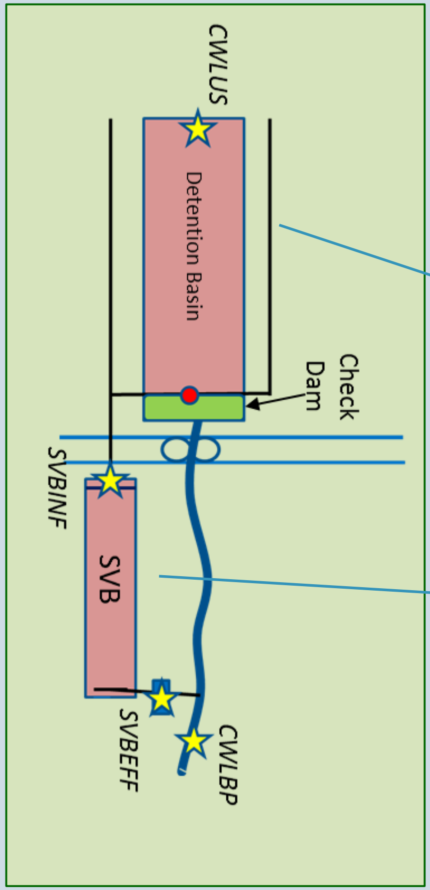
Will also test cover crop effectiveness

Urban Edge-of-field Site- Flow and Nutrient monitoring

- 9.4 acre - Mostly multi-family residential site in suburban subwatershed
  - *AD-bubbler flow meter*
  - *SpCond, Water Temperature*
  - *Autosampler*
  - *Rain gage*

Innovative BMP Demonstration and Model Validation – Headwatershed Constructed Wetland Site

Design layout



Aerial View

Performance/Effectiveness Monitoring

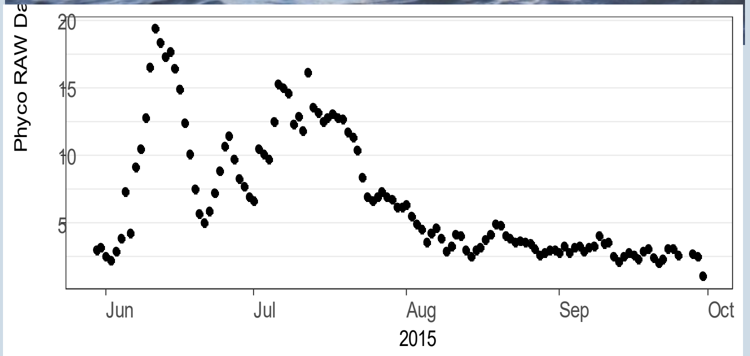
- *In-stream and in-pipe flow meters*
- *Piezometers – level gages*
- *Autosamplers*
- *Continuous Temp, SpCond*
- *Rain gage*

Natural Headwater Stream Channel and Wetland *(looking downstream)*

- *Is the system a cost effective BMP for nitrogen and phosphorus removal?*
- *Does it validate model predictions?*

Point Sources, Critical Intakes/Areas and HUC12 Outlets

0.1 mgd WWTP, Williamsburg, OH



Monitoring at Critical Intakes/Areas

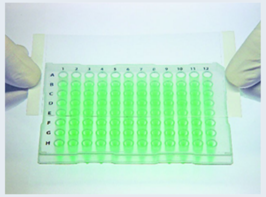
Two Buoy Sites; Sampling 1x/3wks year-round, weekly during bloom season

HF Physico-chemical
- Water Quality
  - Temp
  - pH
  - ORP
  - Sp Cond
  - Turbidity
  - Dis Oxygen
  - TOC
  - DOC
  - NO_3-N
  - UV-Vis spectra
- PAR
- Weather

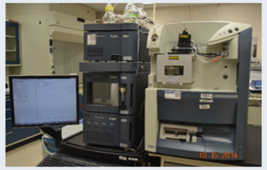
Wet Chemistry
- Total Nitrogen
- NO_2-NO_3
- NO_2
- Total NH_4
- Total Phosphorous
- Total Reactive Phosphorous

Phototroph Dynamics
- *In-vivo* Fluorescence
  - Phycocyanin
  - Chlorophyll
  - Other pigments
    - Diatoms
    - Cryptophyta
- Microscopic enumeration

Molecular Markers
- Next Gen Sequencing
  - 16S rRNA gene
  - 18S rRNA gene
  - Cytochrome oxidase
  - Metagenome
  - Metatranscriptome
- qPCR/RT-qPCR assays
  - Toxin specific gene assays

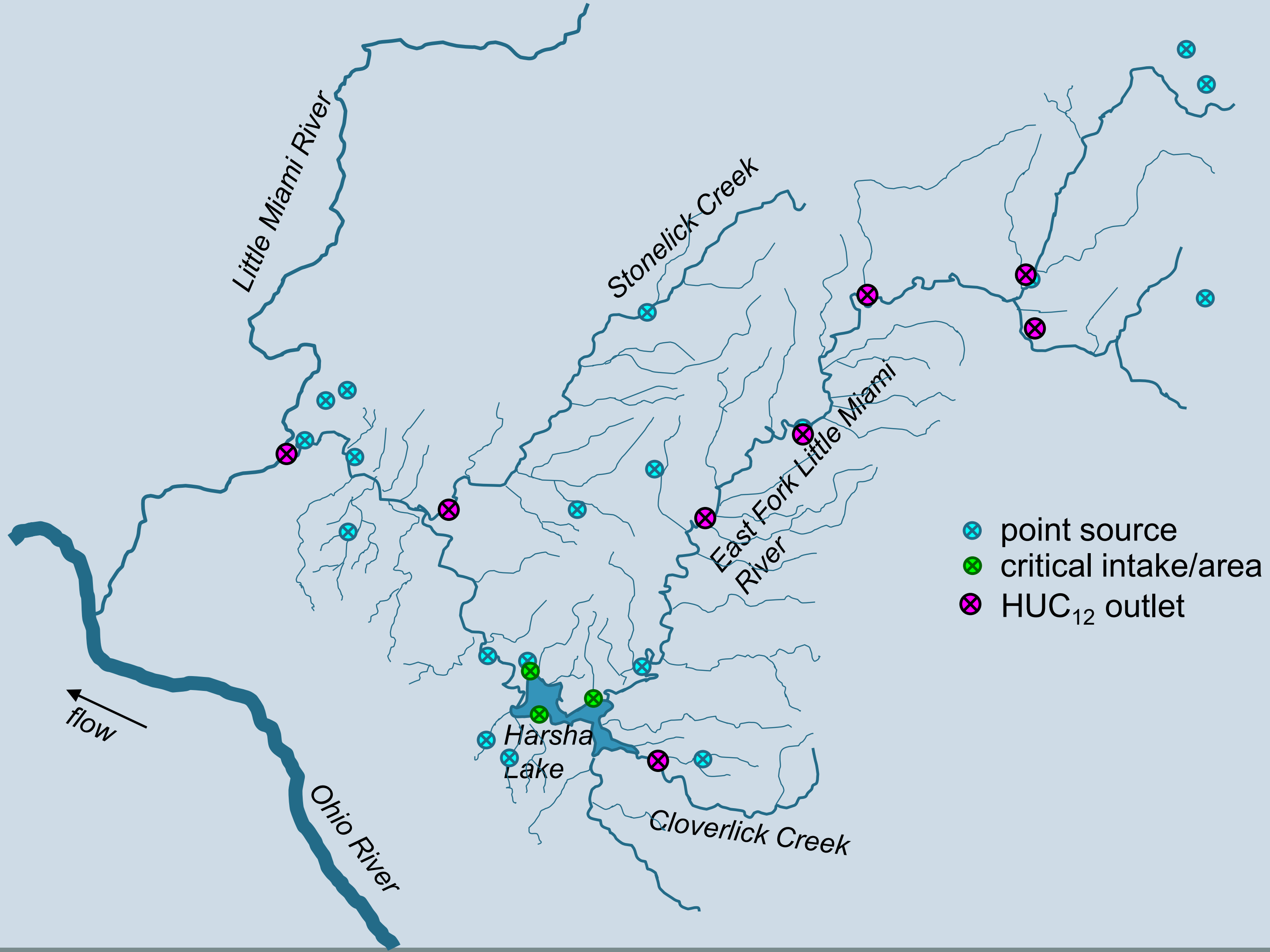


Cyanotoxin Analysis
- ELISA
  - MC-ADDA
- LC-MSMS
  - MC congeners
  - Cylindrospermopsin
  - Anatoxin-a
  - MMPB



Contact: Joel Allen, allen.joel@epa.gov

Point Sources, Critical Areas and HUC12 Outlets



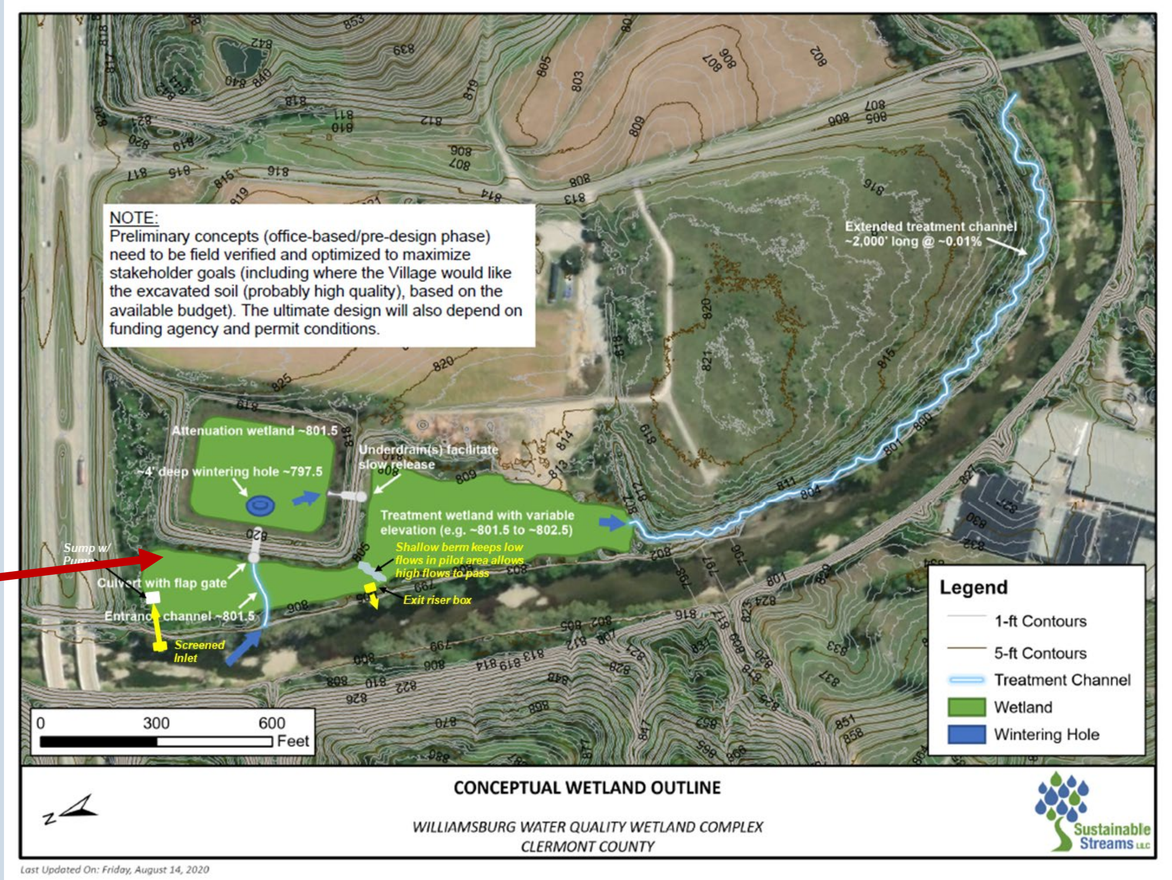
Constructed Wetlands to Mitigate Excess Nutrients in the Upper East Fork/Harsha Lake Watershed

An EFWCoop supported proposal from Clermont Soil and Water Conservation District to OhioDNR

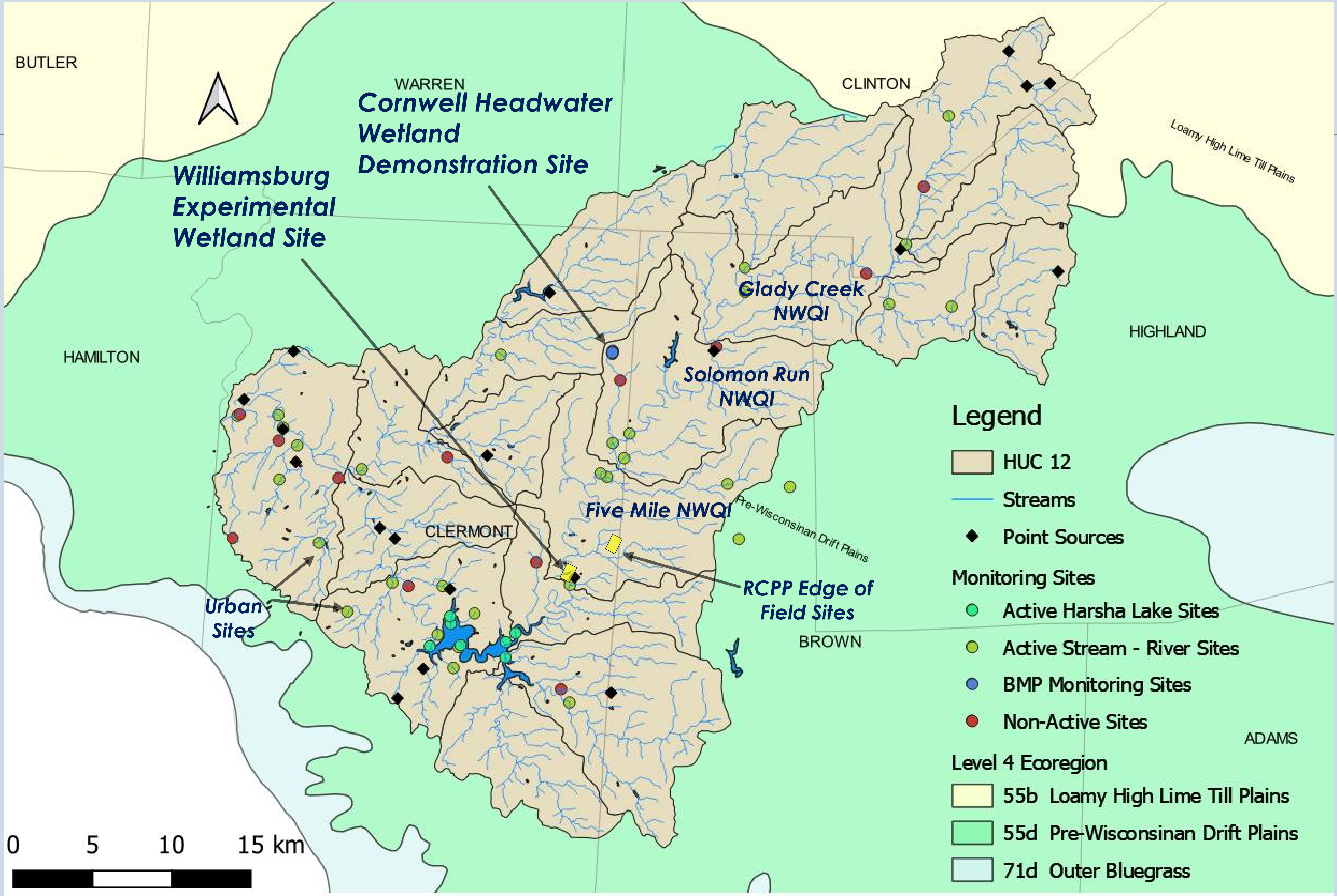
Project Partners: Clermont SWCD, Clermont Office of Environmental Quality (OEQ), Clermont County Park District, U.S. Environmental Protection Agency (EPA) Office of Research and Development (ORD), U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service (USFWS).

3 components

1. *Williamsburg Wetland Treatment Experimental System*
2. *Identification of Priority Wetland Areas in the Harsha Lake Watershed*
3. *Acquisition and Construction of a Second Wetland Treatment System for Nutrient Removal*



Design Idea – Preliminary



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SUSTAINING SCIOTO BOARD MEETING

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East Fork Watershed Research and Cooperative

Christopher Nietch, Ph.D.

US EPA

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Agricultural and Rural Outreach Working Team

Jessica D’Ambrosio, Chair

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3:05 – 3:15 pm	**Agricultural and Rural Communities Outreach Team –** *Jessica d'Ambrosio, Ag&Rural Working Team Chair*
3:15 – 3:35 pm	**Board Updates** *Vice Chair* *December and future meetings* *Water quality monitoring funding update* *MORPC programming update – 208 and Regional Sustainability Agenda*
3:35 – 3:55 pm	**Board member updates**

Sustaining Scioto Board Vice Chair

Glenn Marzluf
CEO
Del-Co Water Co.

Sustaining Scioto Board Meetings

MORPC

Final 2020 Meeting:
Wednesday
December 9th 2-3:30pm

Meeting format moving forward:
30 minutes presentation
30 minutes Board Business
30 minutes member updates

OWDA Grant Application Update

July 31: Successful Submission

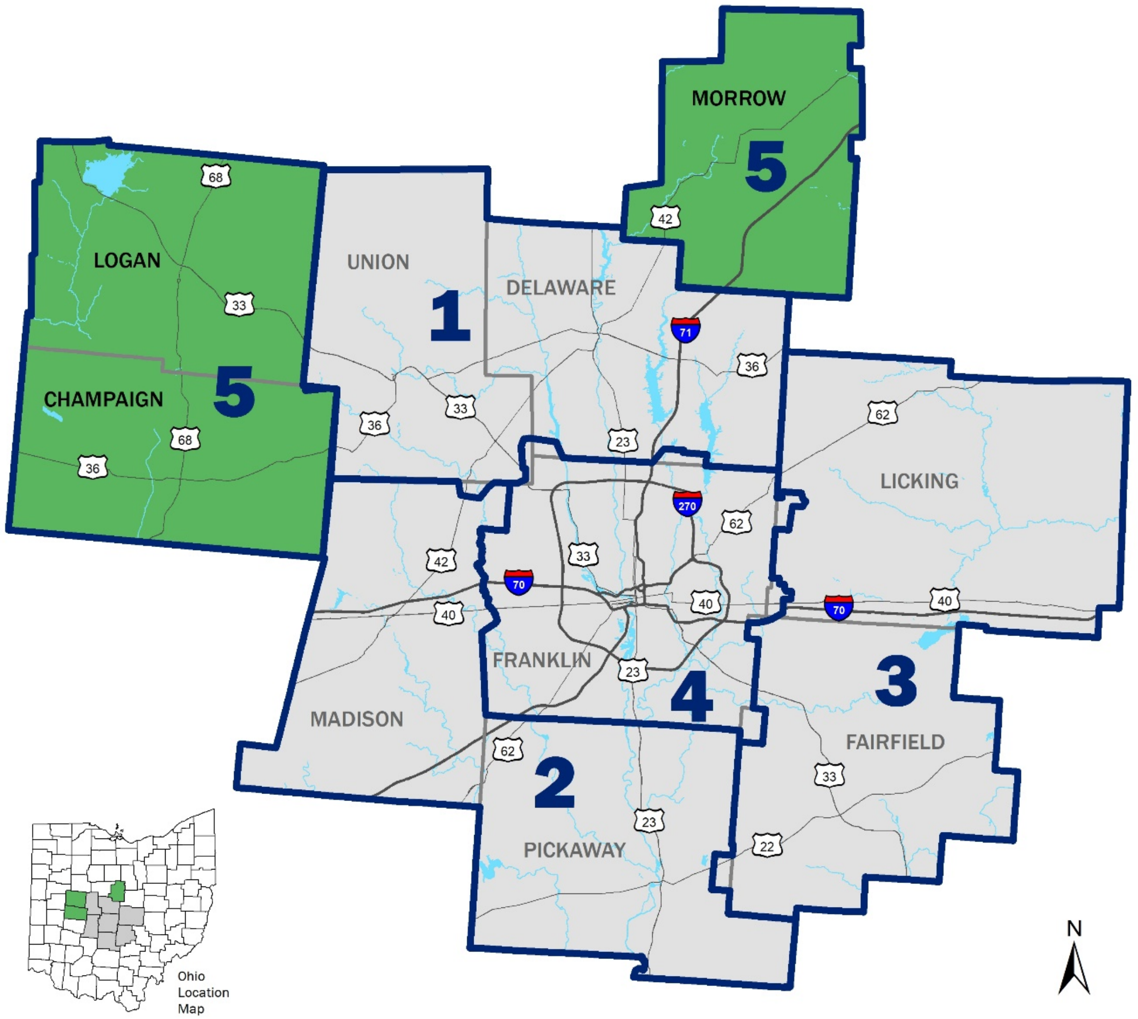
October 8: Applicant Presentations

October 29: Recommendations to OWDA Board

December 10: Board approval of grants

NEW PHASE WATER RESOURCES PLANNING

MORPC



Brandi Whetstone
Sustainability Officer
MORPC

AGENDA

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MID-OHIO REGIONAL MORPC PLANNING COMMISSION