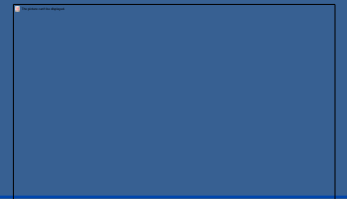


Ohio Statewide Nutrient Balance

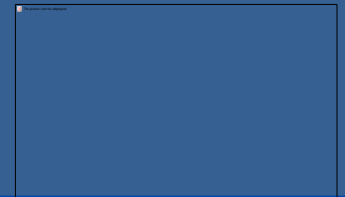
Division of Surface Water

Modeling, Assessment and TMDL Section



Objectives

- Guide Ohio EPA policy & management
 - Relative loads (by watershed)
 - Load sources (CSO vs. NPS vs. wastewater)
- Support national programs – Annex 4 and Gulf Hypoxia Task Force
- From HB 64, statutory obligation 6111.03 (U) requires Agency...
 - total load, load sources
 - report every 2 years



Report available at:

<http://www.epa.state.oh.us/dsw/wqs/NutrientReduction.aspx#146065085-nutrient-mass-balance>

Division of Surface Water
Modeling, Assessment and
TMDL Section

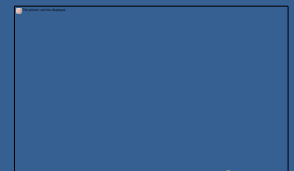
December 30, 2016

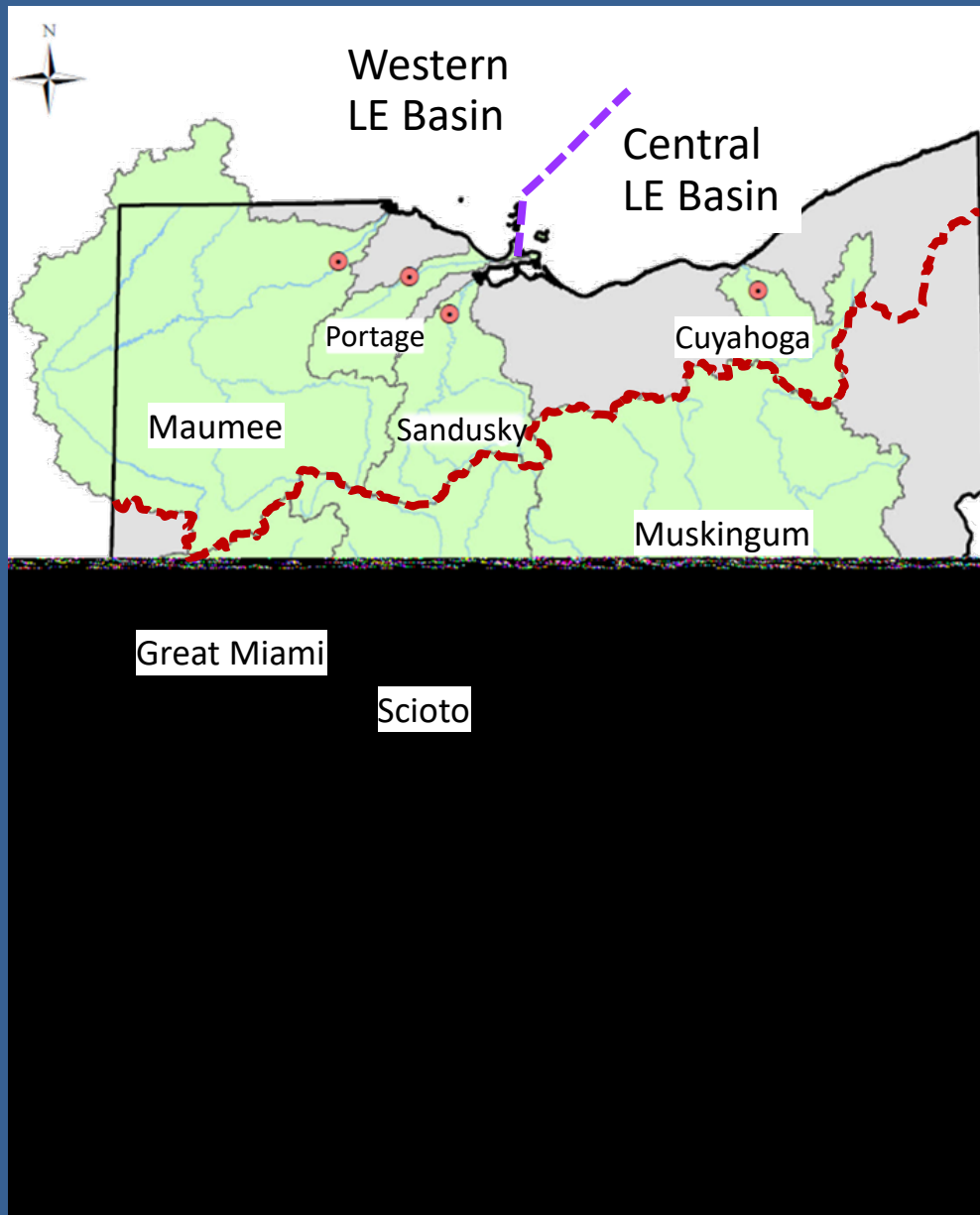


Statewide Nutrient Reduction Efforts

Strategies, Funding, and Legislation

- Nutrient Reduction Strategy (2013): 3 agencies
- GLRI Projects:
 - 9 grants, \$12 million
- Legislation
 - SB 1 (2015): POTW 1 mg/L, fertilizer/manure application
 - SB 150 (2014): certified fertilizer application
- WLEB Collaborative Plan:
 - 40% reduction tot P & DRP “Western Basin”





↑ Lake Erie Basin
 ↓ Ohio River Basin

Study Area Covered

- 7 major watersheds
- 26,000 sq. mi. (in Ohio)
- 63% of Ohio's land area

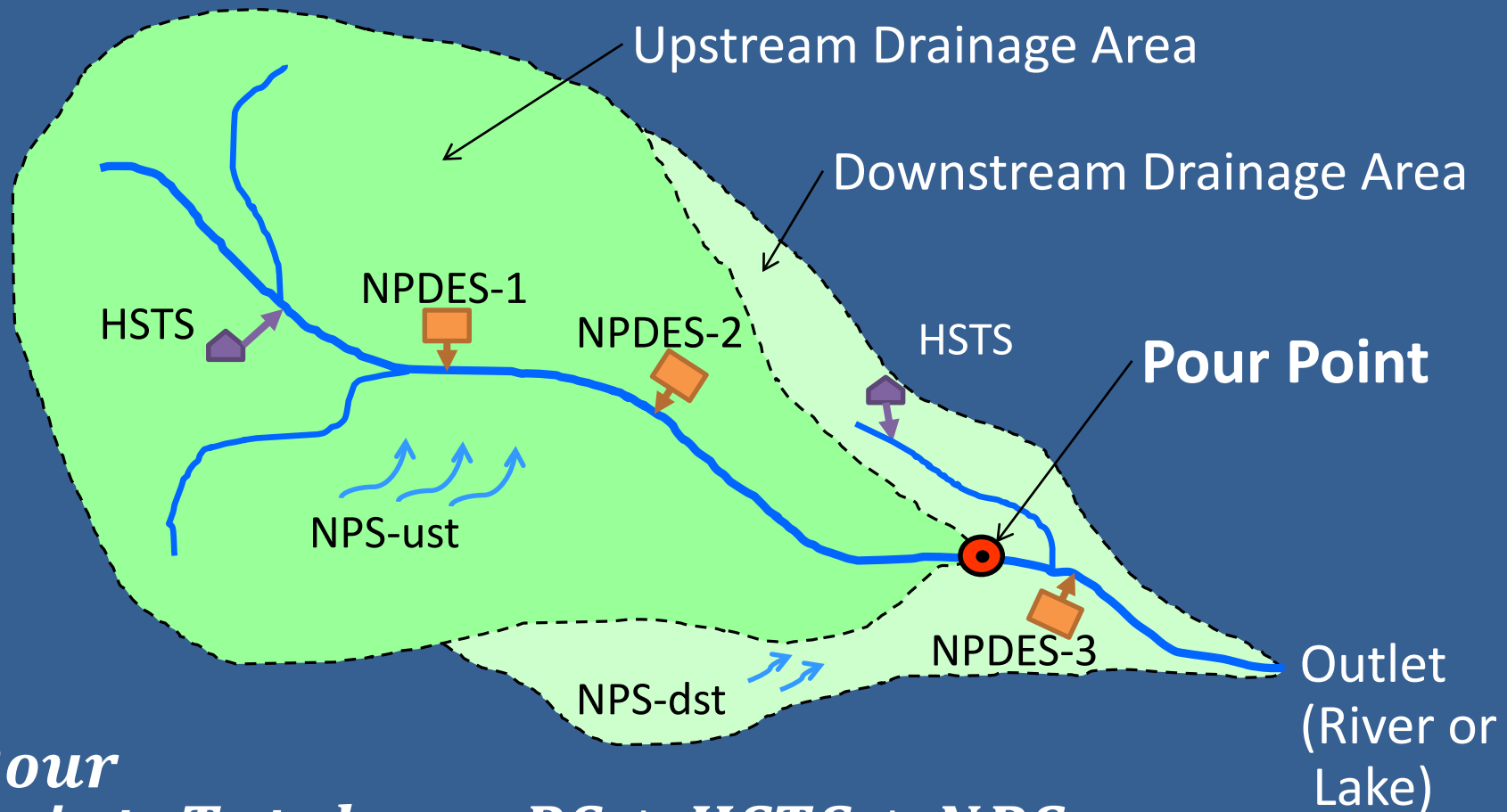


Data Time Period

- Loads calculated for ‘**water years**’ (Oct 1 to Sept 30 basis)
 - Most recent complete data available for 2013 and 2014 (when study started)
 - Designated “wy13” and “wy14”
 - Matches related efforts in reporting e.g., GLWQA-Annex 4, NCWQR, USGS



Watershed Schematic for Calculation



Pour

- *Point: Total_{ust} = PS + HSTS + NPS_{ust}*

Total

- *Load = Pour Point + PS_{dst} + HSTS_{dst} + NPS_{dst}*

Calculation: NPDES

- **NPDES sources**

- Municipal NPDES

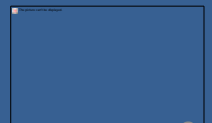
- Total annual discharge (reported data)
- Median of nutrient concentration, if reported
- Nutrient concentration estimates from similar facilities, if not reported

- CSOs (all wet weather) includes bypass flows

- Actual reporting data or system characterization flows (LTCP) if under-represented
- Most SSOs do not report volume (only occurrence)
- CSO nutrient concentrations fixed (based on literature values)

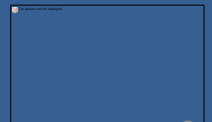
- Industrial facilities

- Total annual discharge (reported data)
- Nutrient concentration only if there was reported data
- If no nutrient monitoring, assume *de minimis* contribution



Calculation: HSTS, NPS

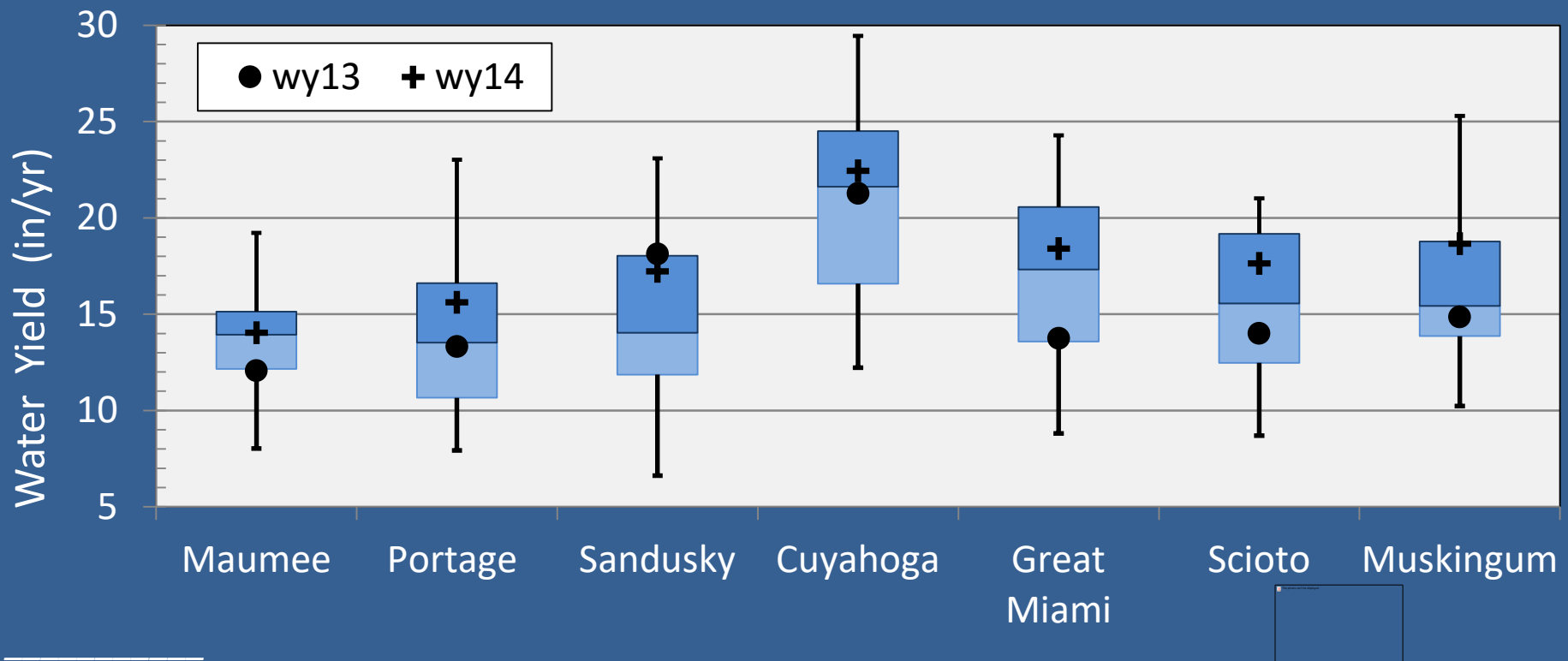
- **Household sewage treatment systems (HSTS)**
 - Population using HSTS (2010 US Census)
 - Estimated using GIS analysis of census information
 - Nutrient yield (lb/person/year): from literature (Lowe, 2009)
 - Differentiated by regional 2012 survey (ODH, 2013)
 - direct discharge vs. onsite
 - onsite: working vs. failed
- **Nonpoint source**
 - NPS upstream of pour point
 - Does not differentiate between types of NPS (e.g., agriculture vs. urban stormwater)
 - NPS downstream = Upstream NPS Yield x Downstream Area
 - NPS Yield = NPS Load *divided by* Watershed Area



Water Yield: Study vs. 20-year History

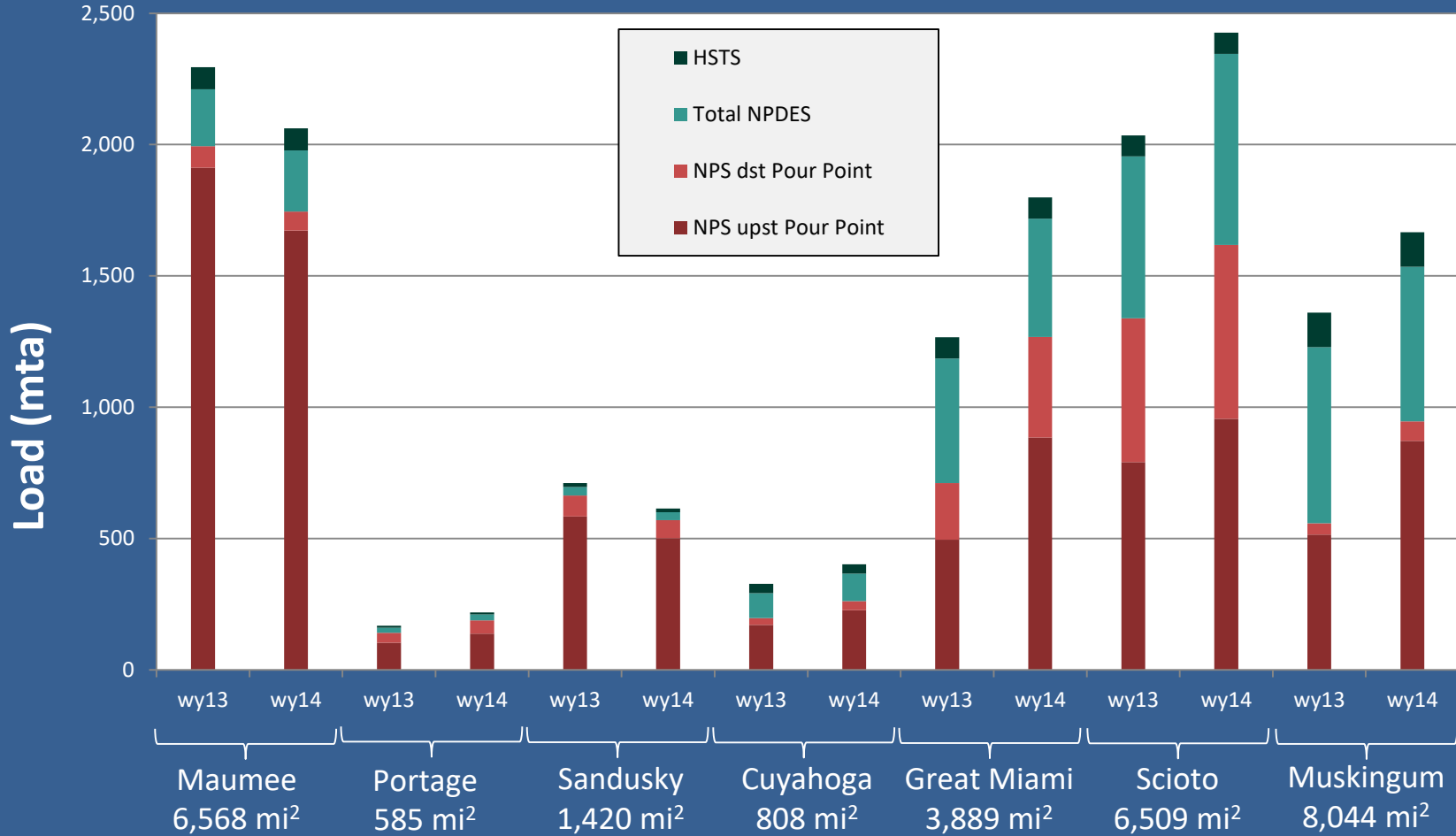
Water Yield = total discharge divided by watershed area

- Water yields for study years (wy13 & wy14) were within typical ranges during past 20 years for all watersheds

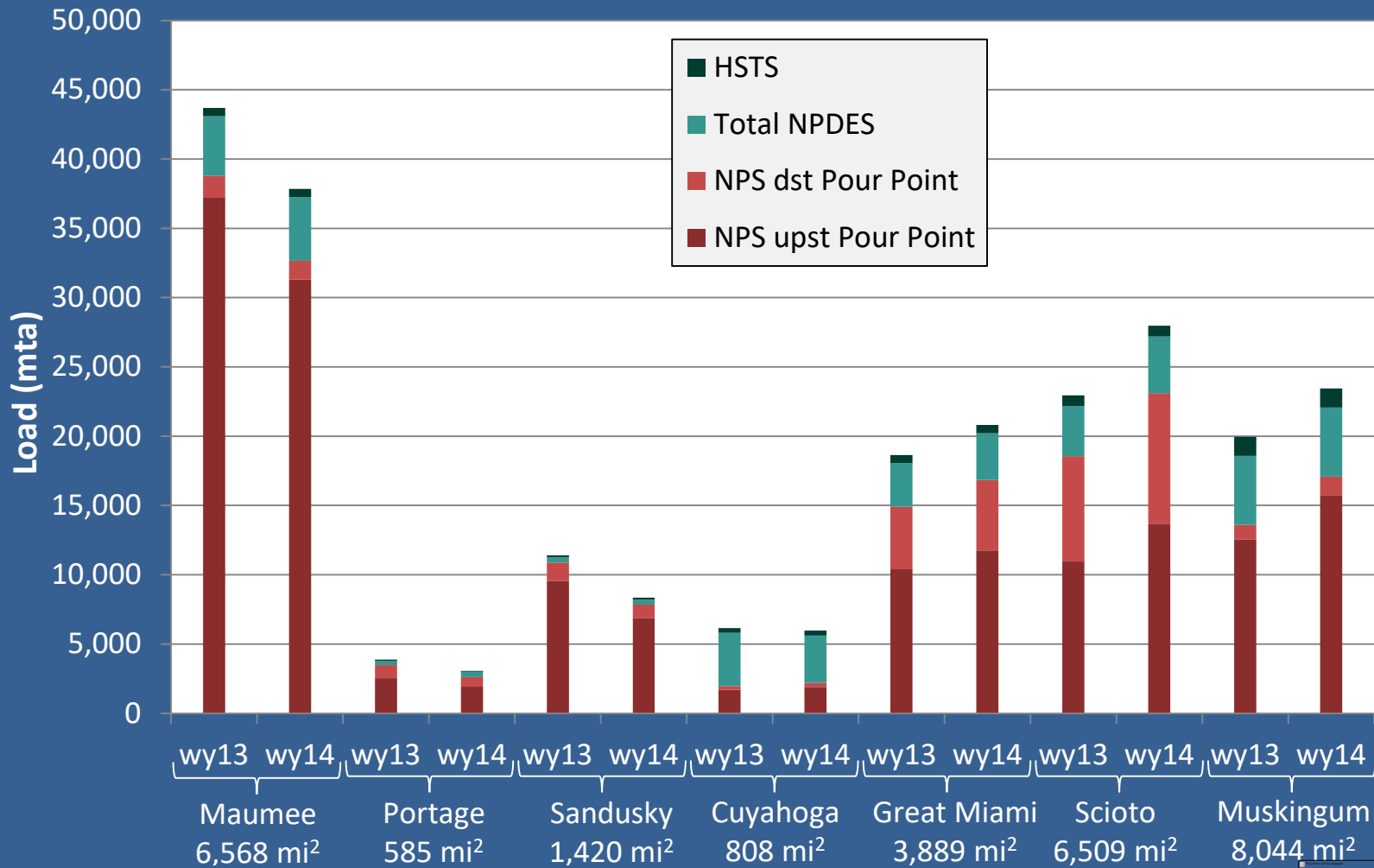


* Water Years 1996-2015; (2002-2015 for Muskingum)

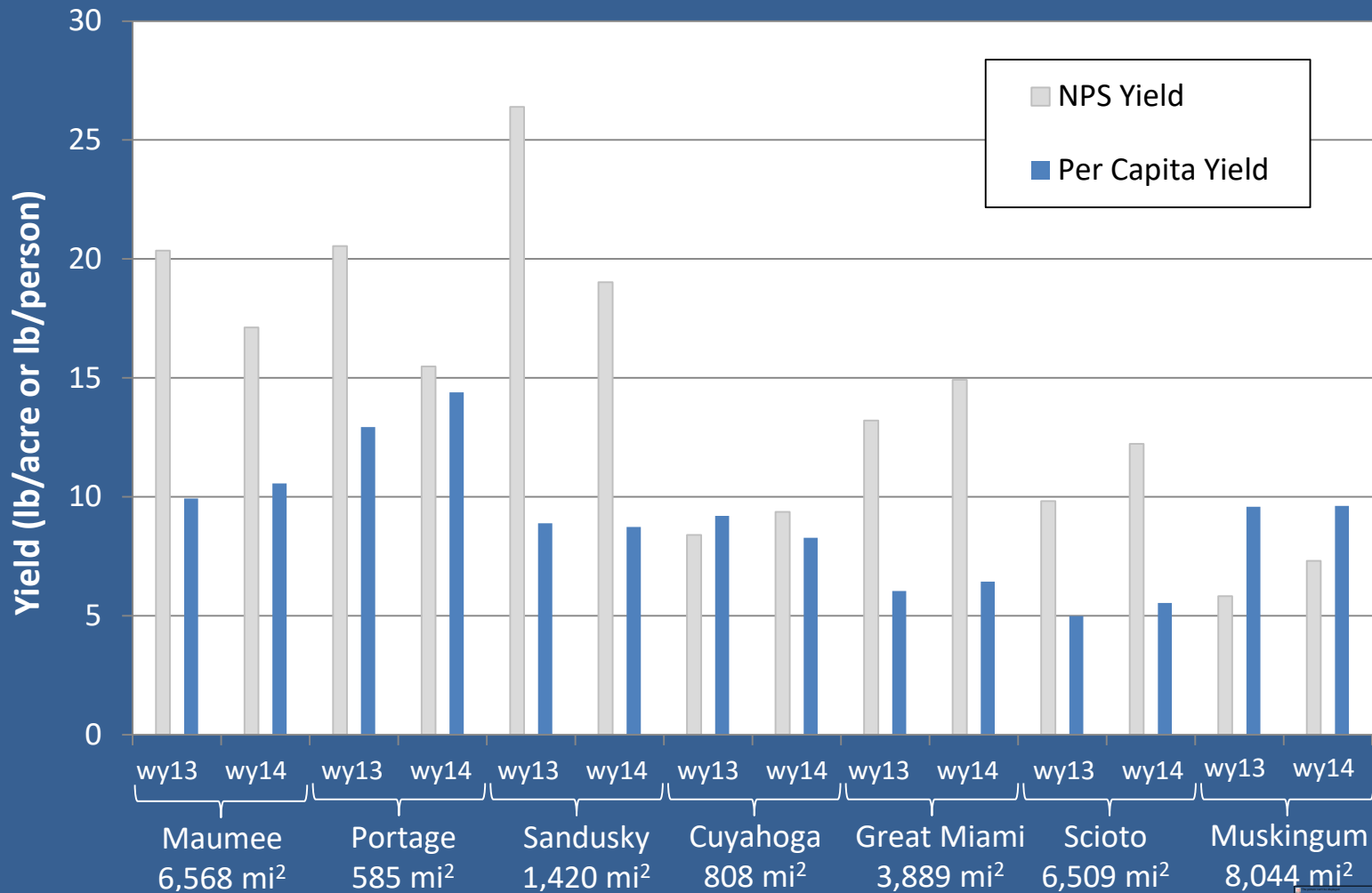
Total P Load



Total N Load



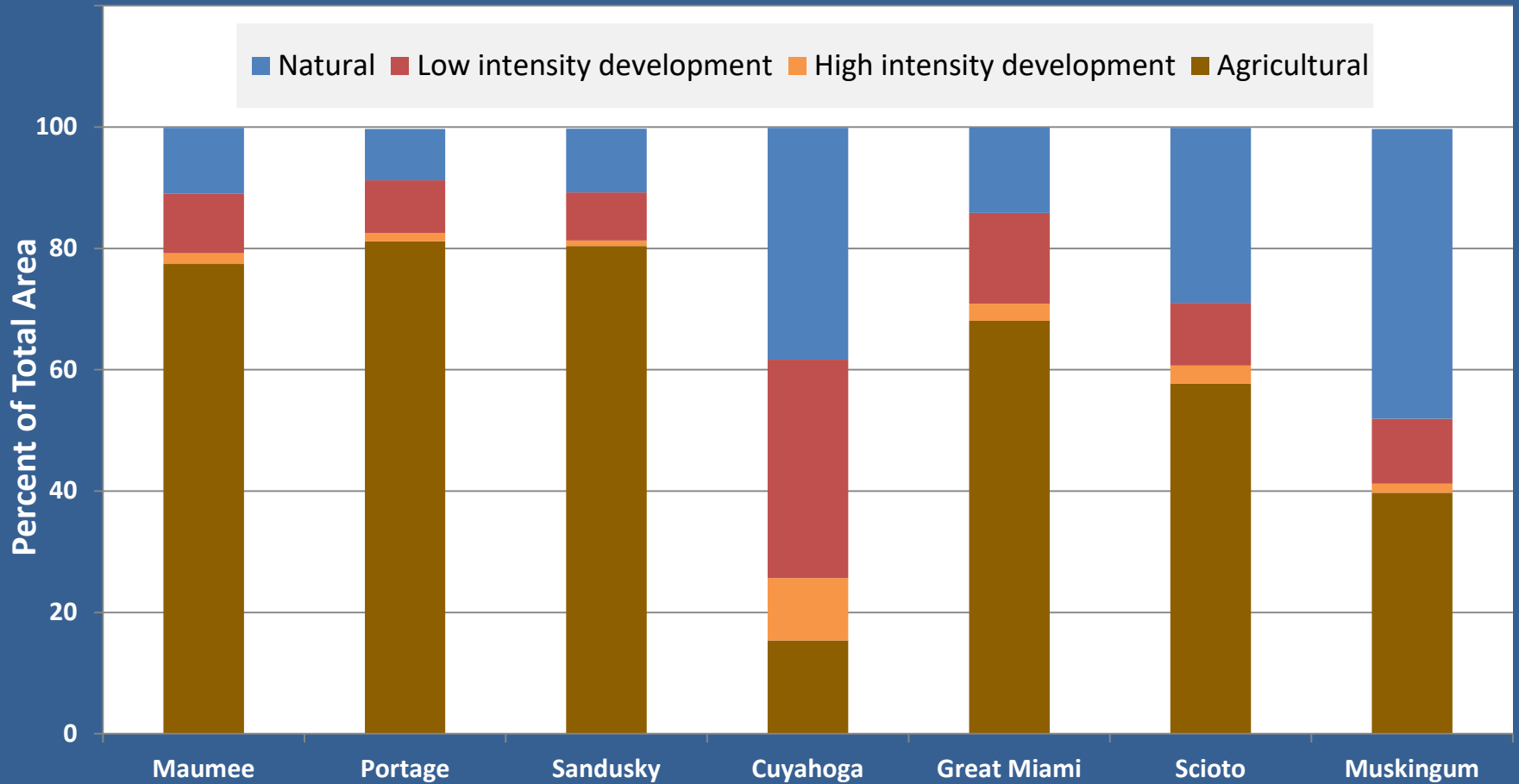
Total N Yield



Population Density

Watershed	Total Population (# persons)	Population Density (persons/sq. mi.)
Maumee	1,086,242	165
Portage	67,181	115
Sandusky	130,088	92
Cuyahoga	1,005,298	1,244
Great Miami	1,359,723	350
Scioto	1,939,124	298
Muskingum	1,462,086	182

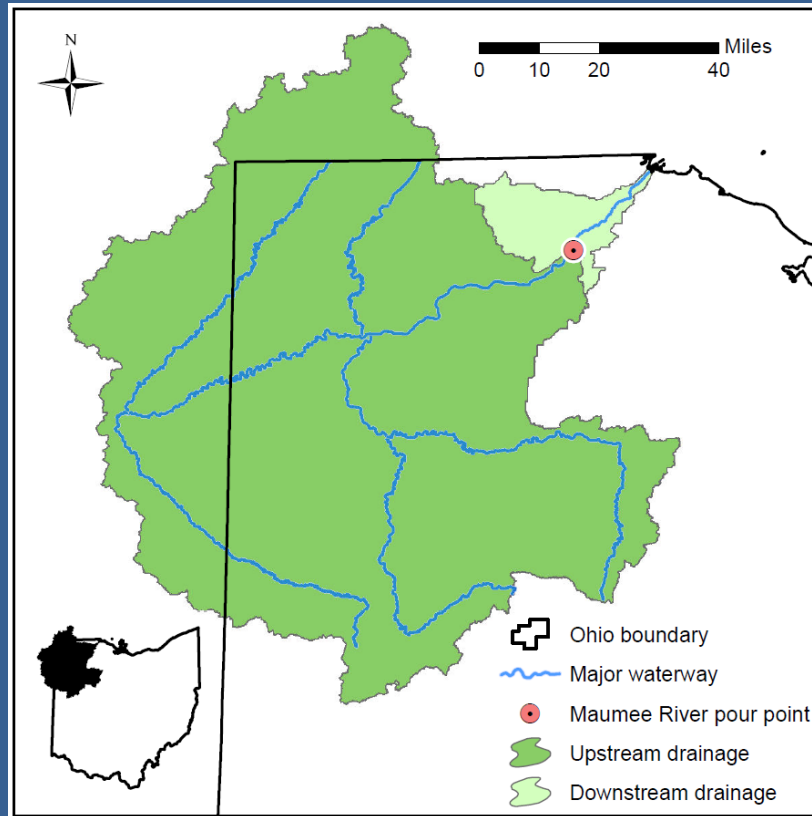
Land Use



Facility Size Classes

Group	Type	Design Flow (mgd)
Industrial	All industrial permits	--
Major	Sewage treatment	> 1.0
Class 2	Sewage treatment	0.5 to 1.0
Class 3	Sewage treatment	0.25 to 0.5
Class 4	Sewage treatment	0.1 to 0.25
Class 5	Sewage treatment	< 0.1

Maumee Watershed

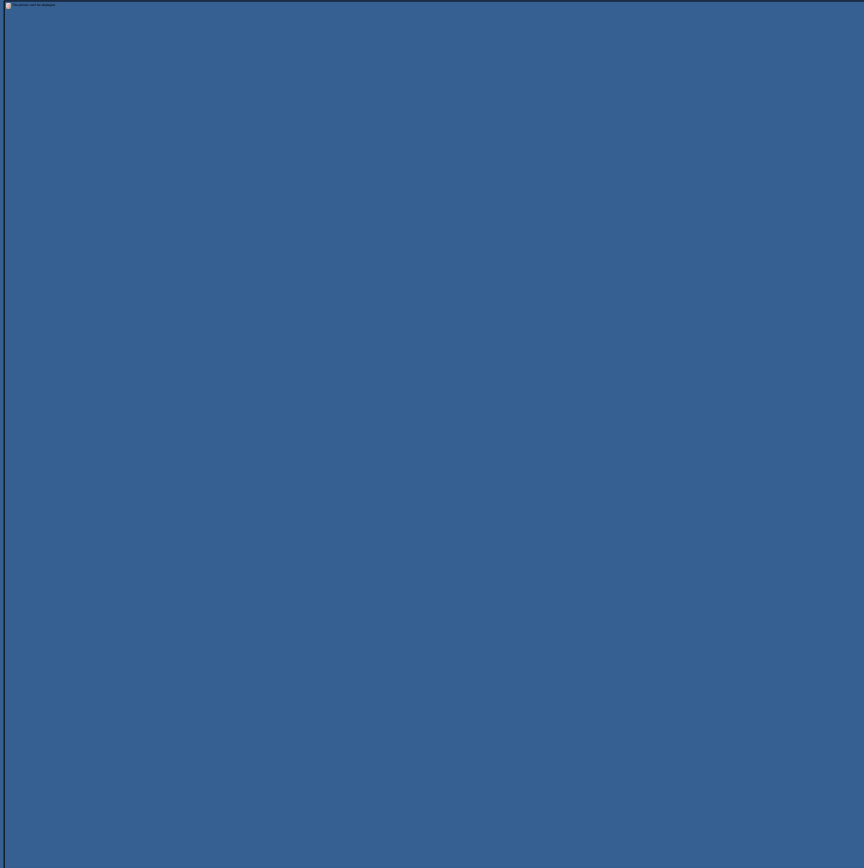


Located in NW Ohio draining to the Western Lake Erie Basin

77% Agricultural Lands

Major cities include Toledo and Lima, Ohio and Fort Wayne, Indiana

Portage Watershed



Located in NW Ohio draining to the Western Lake Erie Basin

81% Agricultural Lands

Largest cities are Fostoria and Bowling Green – skewed per capita yields because large portion of these two cities are outside of the watershed

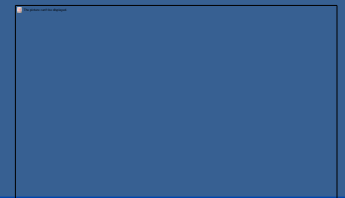


Sandusky Watershed

Located in NW Ohio draining to Sandusky Bay and the Central Lake Erie Basin – sometimes considered a Western Lake Erie Basin Tributary

80% Agricultural Lands

Largest cities are Tiffin and Fremont



Cuyahoga Watershed

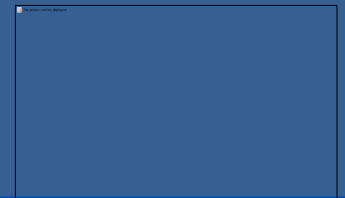
Located in NE Ohio draining to the Central Lake Erie Basin

15% Agricultural Lands

Most developed watershed in the study

Includes the Cuyahoga Valley National Park and other extensive park systems resulting in 38% natural areas

Largest cities are Cleveland and Akron

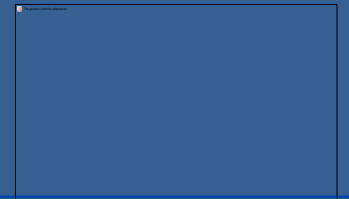


Great Miami Watershed

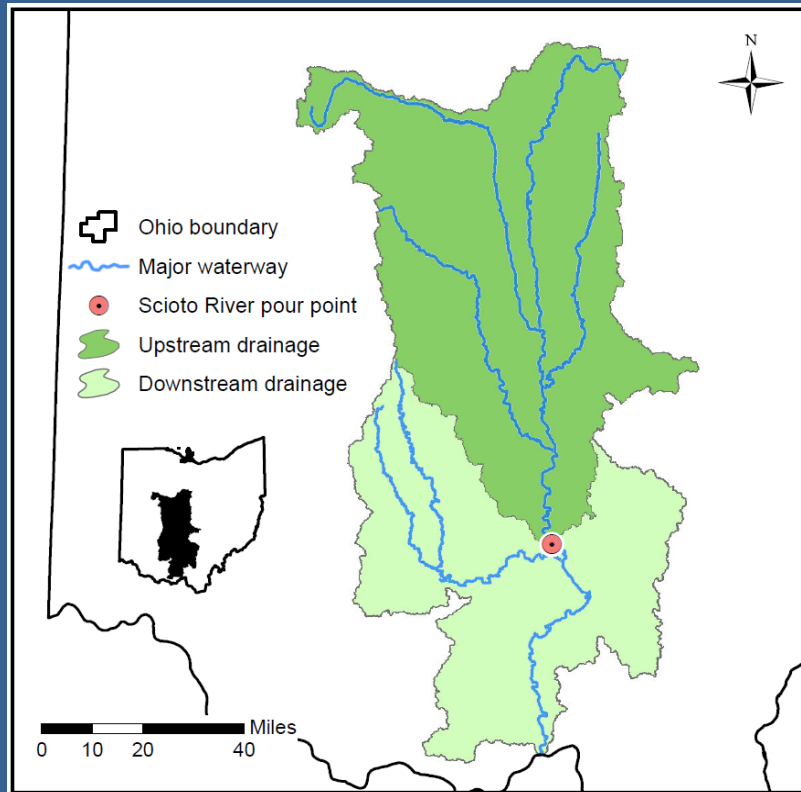
Located in SW Ohio draining to
the Ohio River

68% Agricultural Lands

Largest cities are Dayton,
Middletown and Hamilton



Scioto Watershed

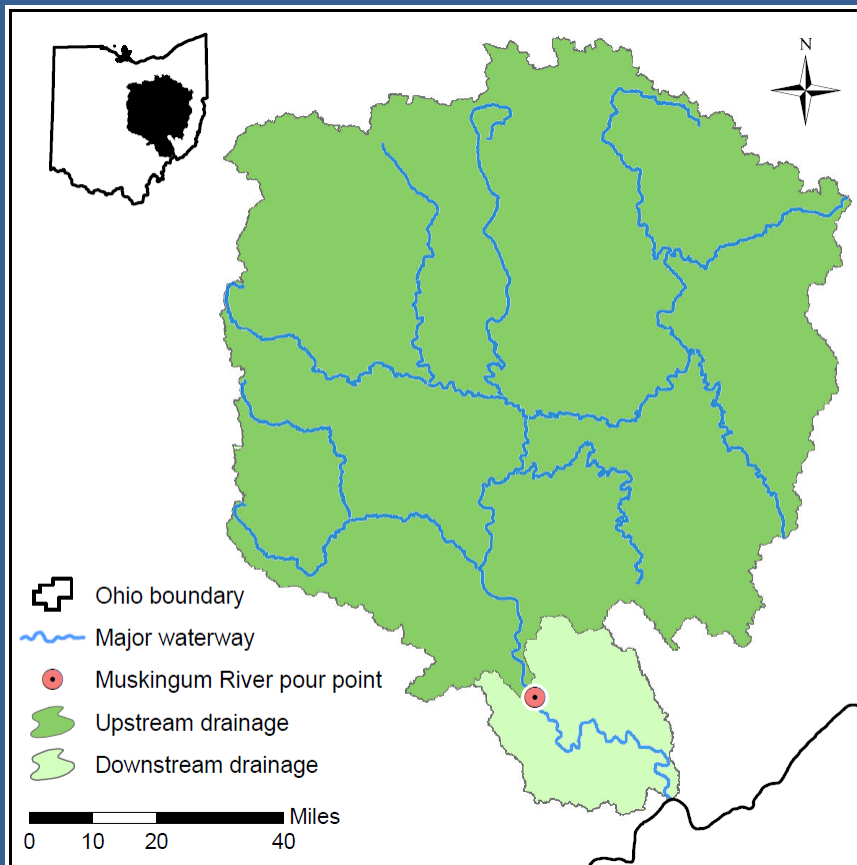


Located in Central and Southern Ohio draining to the Ohio River

58% Agricultural Lands

Large cities include Columbus, Delaware, Marion and Chillicothe

Muskingum Watershed



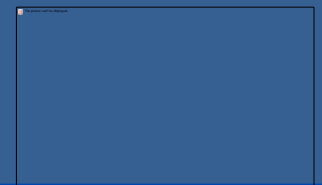
Located in SE Ohio draining to the Ohio River

40% Agricultural Lands

Large cities include Canton, Massillon, Dover/New Philadelphia and Zanesville

What's Next

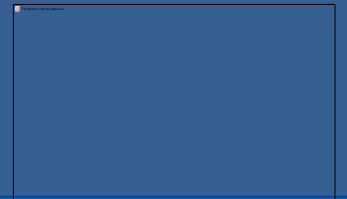
- Increase the portion of the state covered by mass balance calculations
- Start to establish trends with 5-years of data
- Refine HSTS estimates
 - Use county level statistics where needed
 - Improve population estimates by refining sewerage areas
- Improve nutrient concentration estimates for CSO discharges
- Refine NPS load estimates
 - Separate urban storm water component
 - Differentiate agricultural loads by nutrient source



Closing Note

While the report was not intended to make recommendations about how to achieve nutrient reductions, the information within could and should inform the Agency and others about the most effective ways of achieving reductions.

Questions



Discussion Slides

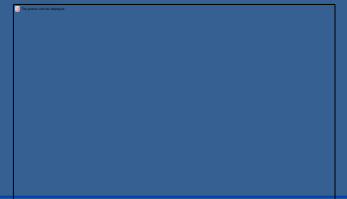


Methods (1 of 4)

- Early (technical) stakeholder outreach resulted in feedback from AOMWA (Guy Jamesson), Ohio Farm Bureau (Larry Antosch), TNC (Anthony Sasson), USGS (Dan Button), NCWQR (Rem Confessor), and City of Akron (Kathy Richards).
- Loads calculated for ‘water years’ (Oct to Sept basis)
 - Named wy13 and wy14
 - Matches related efforts in reporting (Annex 4, NCWQR, USGS)
 - “Spring” loads compiled for Maumee, Portage and Sandusky
- Overall loading equation...for both total P and total N...
 - $Total\ Load = PS + HSTS + NPS_{upst} + NPS_{dst}$

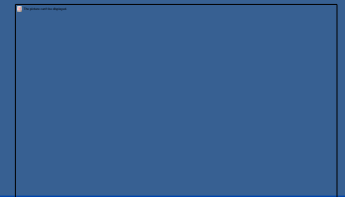
Methods (2 of 4)

- Source loads determined from:
 - NPDES sources – includes CSOs
 - Household sewage treatment systems (HSTS)
 - Nonpoint source (total)



Methods (3 of 4)

- NPDES sources
 - Municipal NPDES
 - Total annual discharge (reported data)
 - Median of nutrient concentration, if reported
 - Nutrient concentration estimates from similar facilities, if no reporting
 - CSOs (all wet weather) includes bypass flows
 - Actual reporting data or system characterization Q (LTCP) if under-represented
 - Most SSOs do not report volume (only occurrence)
 - CSO nutrient concentrations fixed
 - Industrial facilities
 - Total annual discharge (reported data)
 - Nutrient concentration only if there was reported data
 - If no nutrient monitoring, assume de minimis contribution



Methods (4 of 4)

- Household sewage treatment systems (HSTS)
 - Population using HSTS (2010 US Census)
 - Estimated using GIS analysis of census information
 - Nutrient yield (lb/person/year): from literature (Lowe 2009)
 - Differentiated by regional 2012 survey (ODH 2013)...
 - direct discharge vs. onsite
 - onsite: working vs. failed
- Nonpoint source (total)
 - Determined as the total load minus the point source load
 - Does not discriminate between types of NPS (e.g., agriculture vs. urban stormwater)
 - Land use/cover characterized upstream/downstream of pour-point
 - Unit area loads applied downstream of pour-point



20-year Seasonal (Mar-Jul) Discharge

1996-2015 (2002-2015 for Muskingum)

