

Nutrient Mass Balance for Ohio Watersheds

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Division of Surface Water
Modeling, Assessment and TMDL Section

Presentation to:
OWEA/OSWA Watershed Workshop



Objectives of Nutrient Mass Balance Project

- Guide policy & management

Objectives of Nutrient Mass Balance Project

- Support national programs – Annex 4 and Gulf Hypoxia Task Force

Objectives of Nutrient Mass Balance Project

- From HB 64, statutory obligation 6111.03 (U) requires Agency...
 - Total load, load sources
 - Report every 2 years

Nutrient Mass Balance Study for Ohio's Major Rivers



Report available at:

[http://epa.ohio.gov/Portals/35/documents/Nutrient Mass Balance Study 2018_Final.pdf](http://epa.ohio.gov/Portals/35/documents/Nutrient%20Mass%20Balance%20Study%202018_Final.pdf)

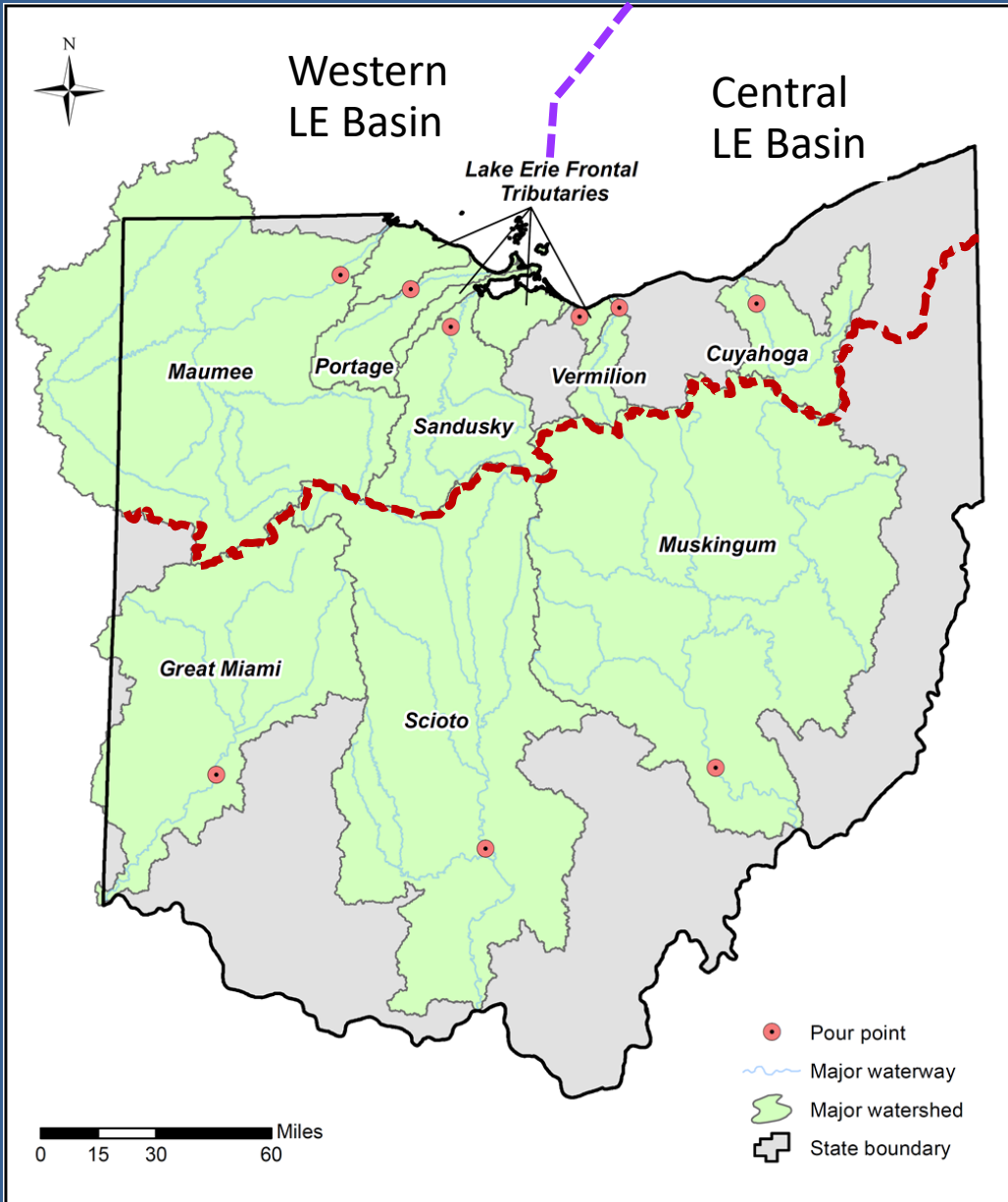
Division of Surface Water
Modeling, Assessment and
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April 16, 2018

Far-field vs. Near-field Impacts

- **Far-field: i.e. Lake Erie or Gulf of Mexico**
 - Annual NMB most informative
 - Most load delivered in high flows
 - Increasing importance of NPS
- **Near-field: i.e. Streams**
 - Annual NMB less informative
 - Lower Flow Index Period (May-Oct)
 - Shifting responsibility...PS

Study Area



↑ Lake Erie Basin

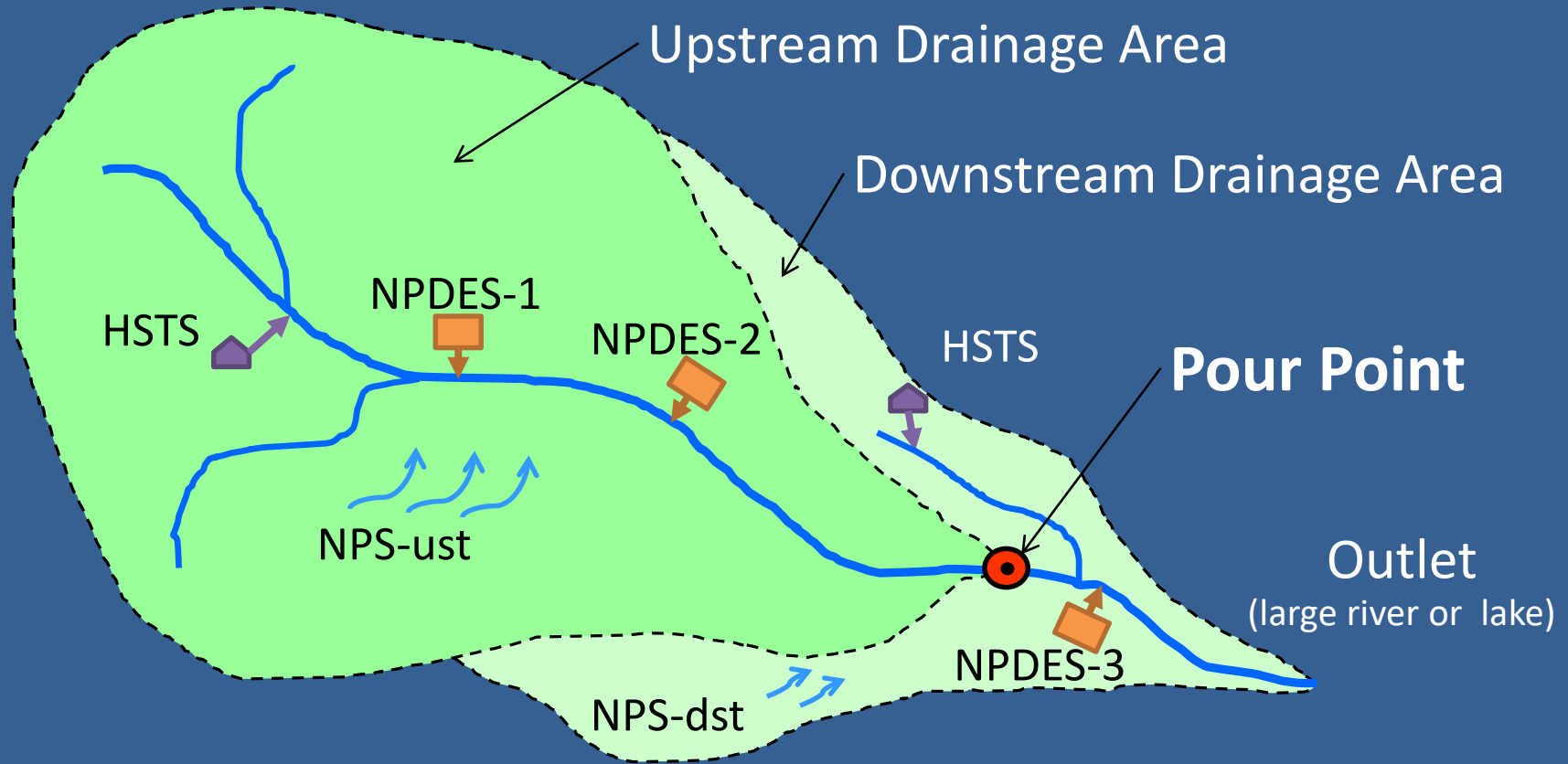
↓ Ohio River Basin

- 8 watersheds
+ frontal L Erie drainages
- 29,600 mi² (in Ohio)
- 66% Ohio's land area

Data Analysis Period

- Loads calculated for ‘water years’
(Oct 1 to Sept 30 basis)
 - Most recent complete data available was water year 2017
 - Designated “wy13” - “wy17”
 - 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: Point Sources

- **NPDES (National Pollution Discharge Elimination System)**
 - Municipal NPDES
 - Use reported data from DMR (discharge monitoring reports)
 - CSOs (all wet weather) includes bypass flows
 - Actual reporting data or LTCP if under-represented
 - CSO concentration fixed (0.73 mg/L for TP and 20 mg/L for TN)
 - SSOs not report flow (only occurrence) – not considered (small)
 - Industrial facilities
 - Use reported data (DMR)
 - If no nutrient monitoring, assume *de minimis* contribution

Calculation: HSTS

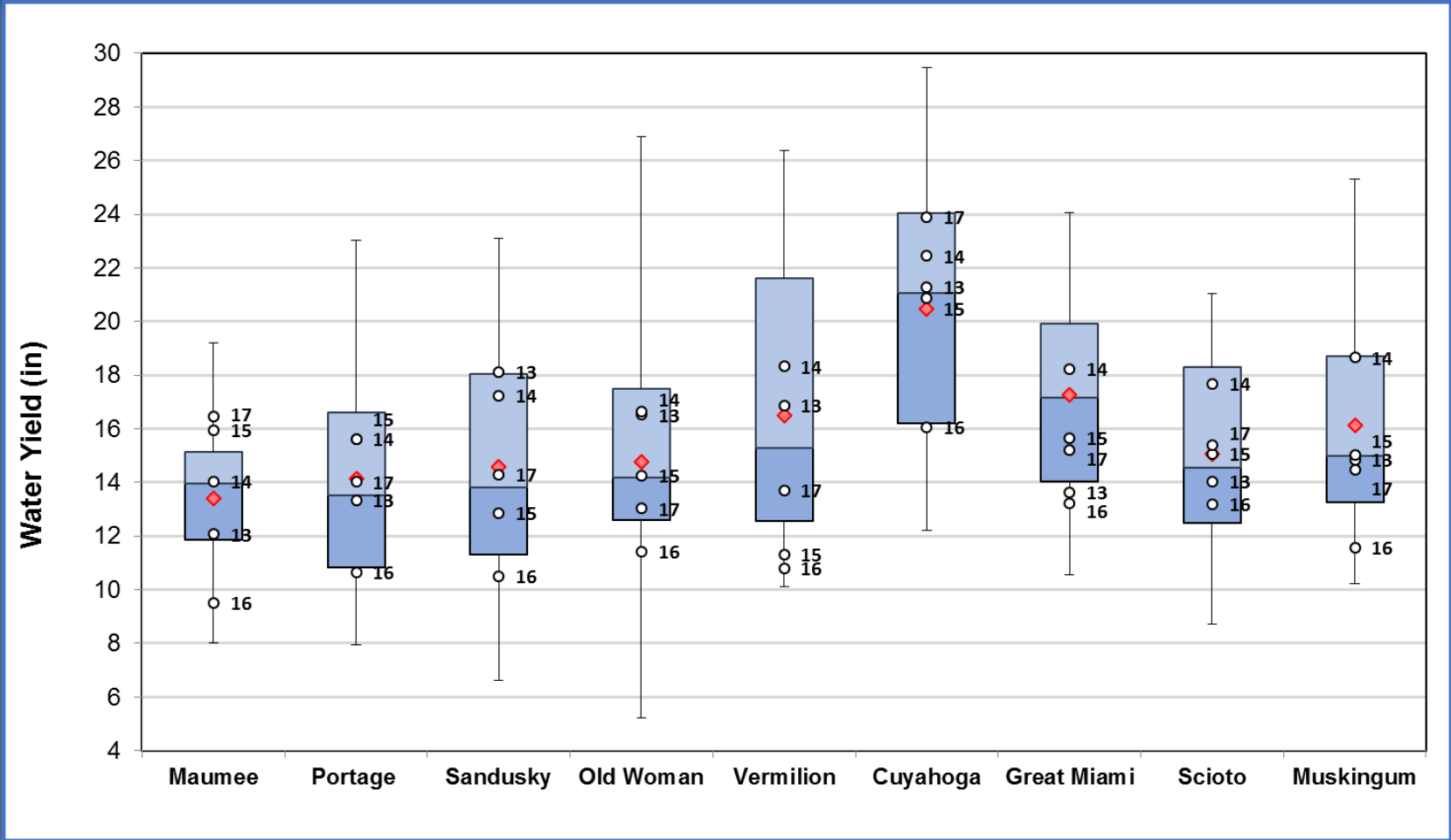
- **Household sewage treatment systems (HSTS)**
 - Population using HSTS (2010 US Census)
 - Nutrient yield (lb/person/year): from literature
 - Differentiated by regional 2012 survey (ODH, 2013)
 - direct discharge vs. onsite

Calculation: NPS

- **Nonpoint source**
 - NPS upstream of pour point
 - NPS downstream of pour point
- Not differentiated between sources

Water Yield: Study vs. 20-year* History

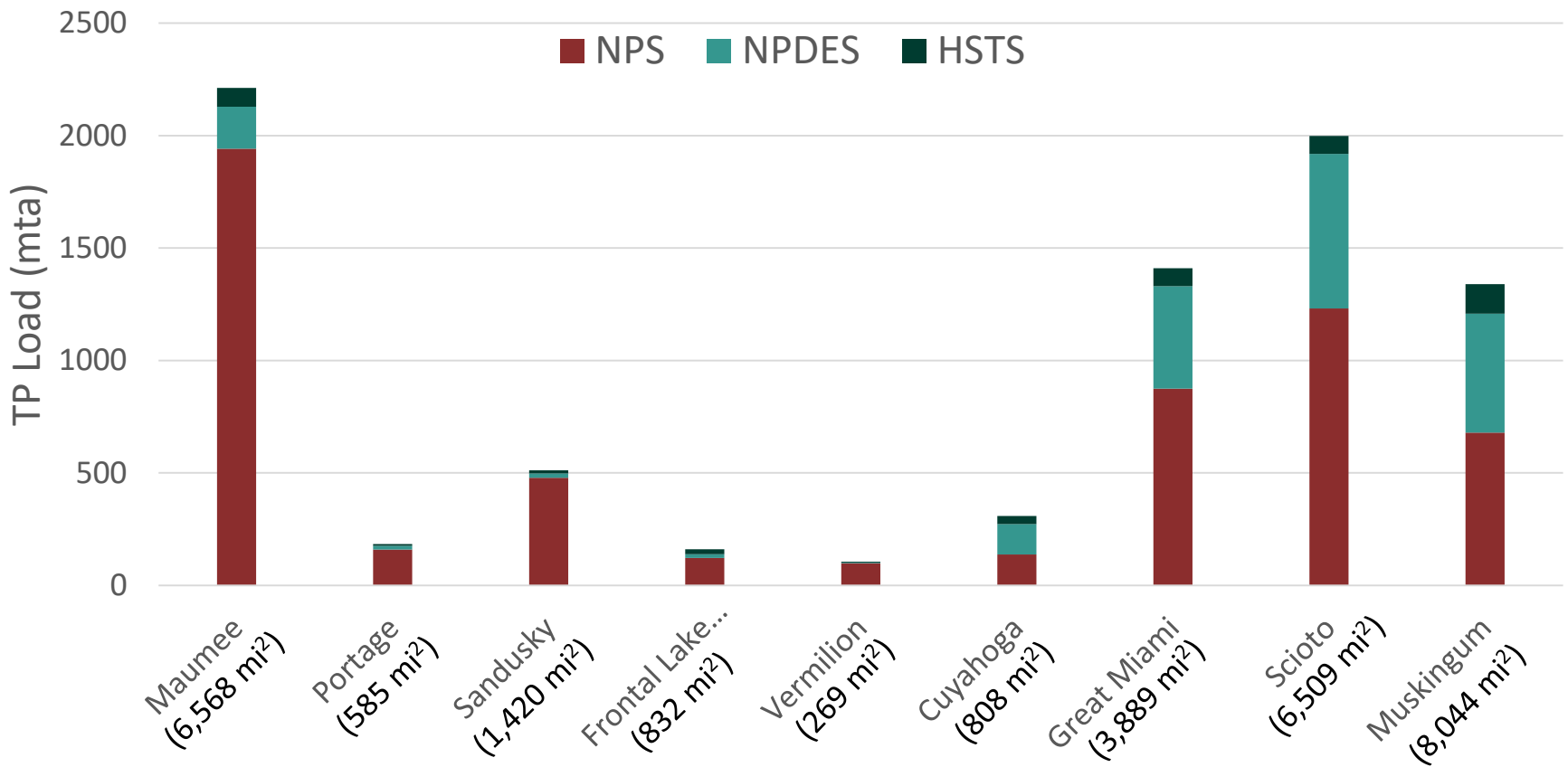
water yield = total discharge / watershed area



* Water year's 1998-2017 (2002-2017 for Vermilion & Muskingum)

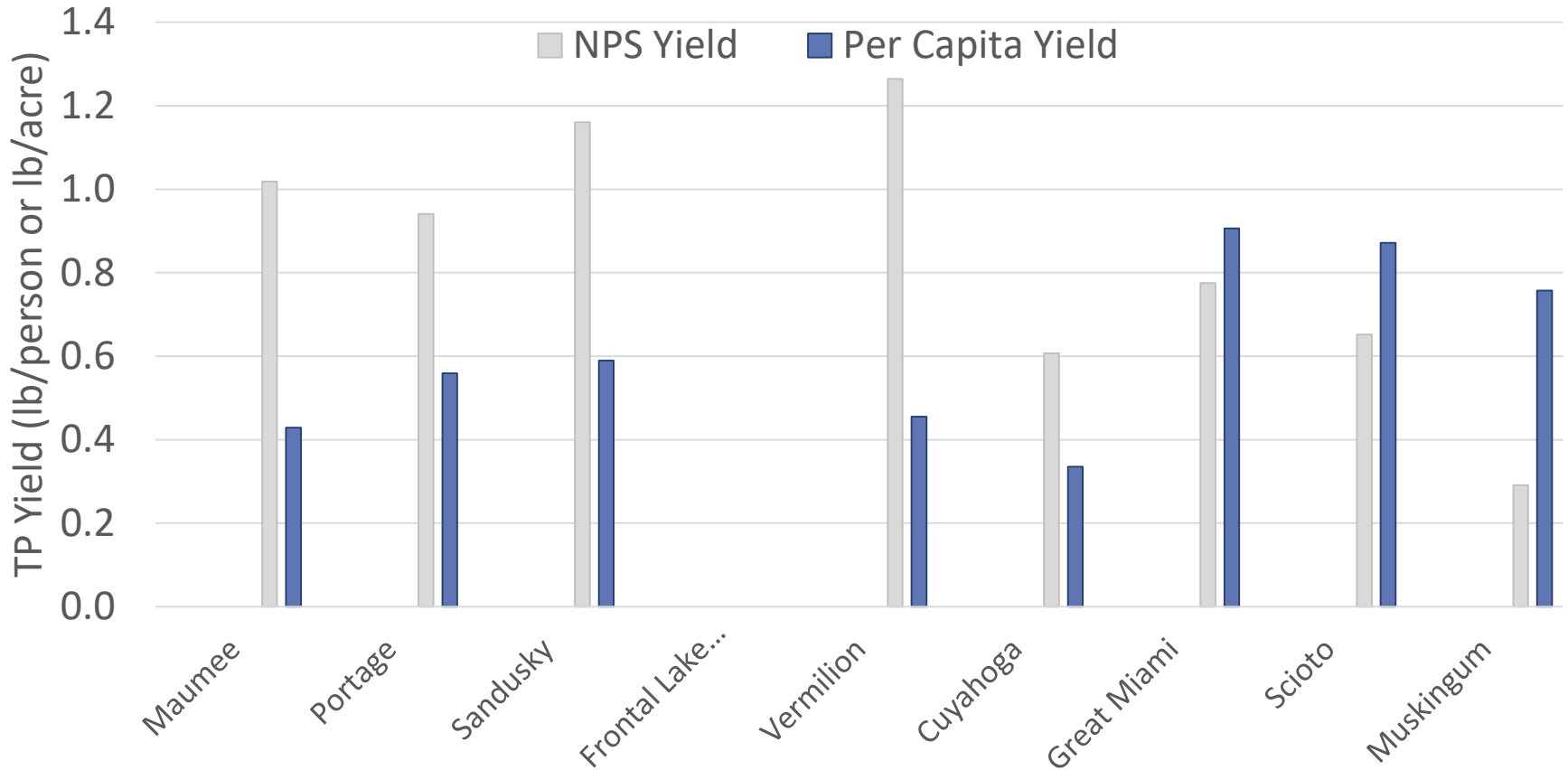
Total P: Load

Average 2013-2017



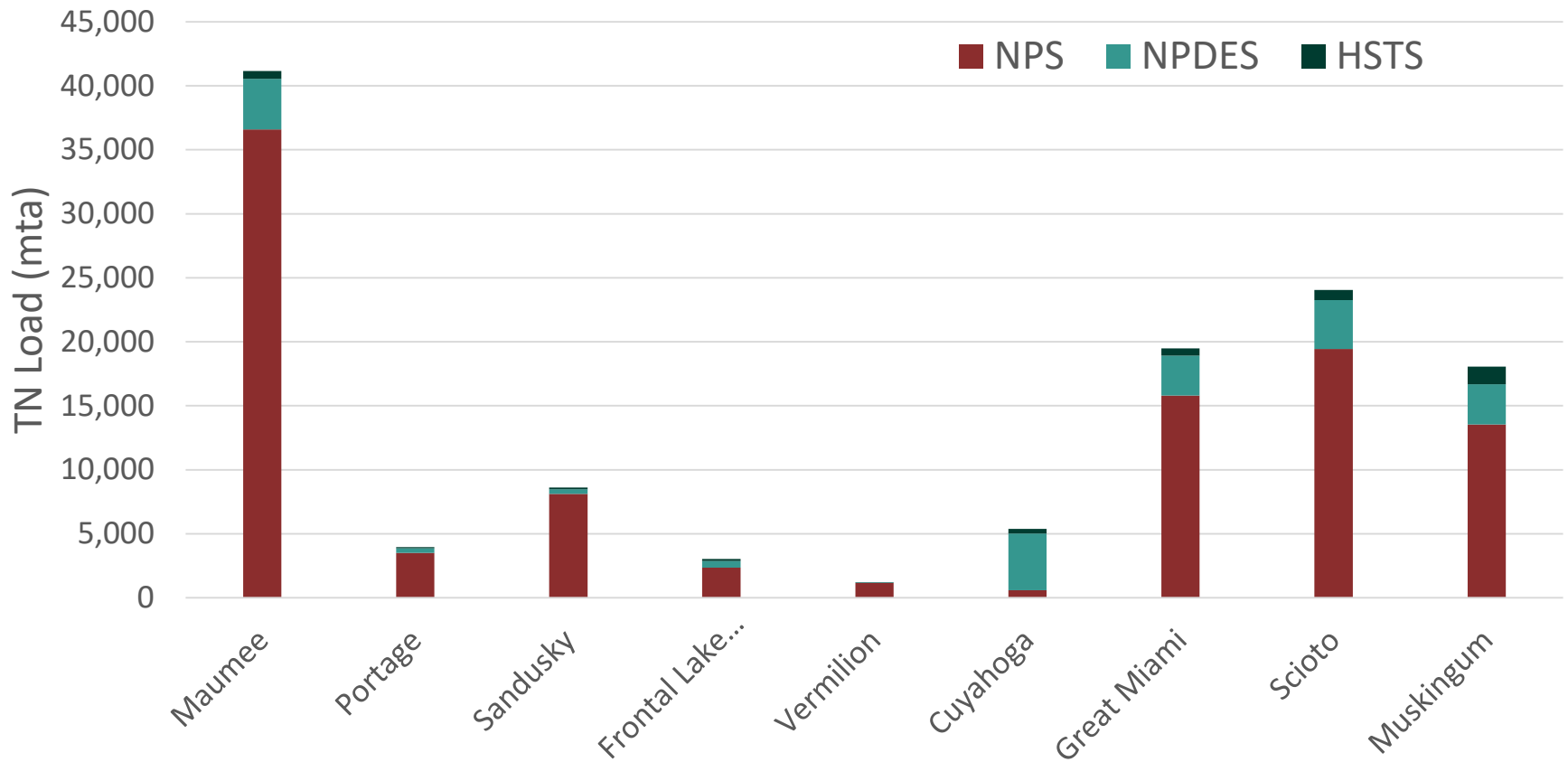
Total P: Yield

Average 2013-2017



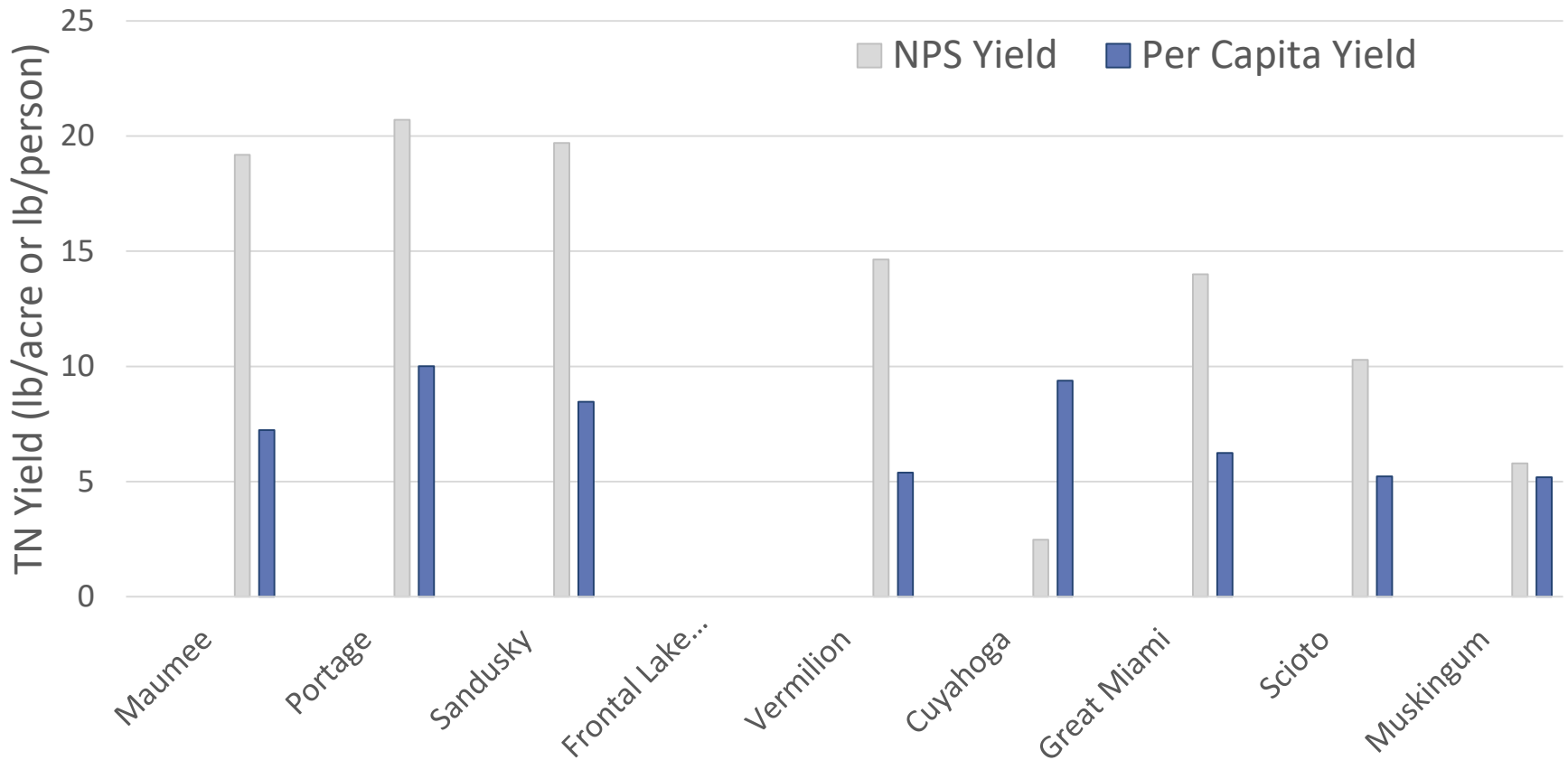
Total N: Load

Average 2013-2017

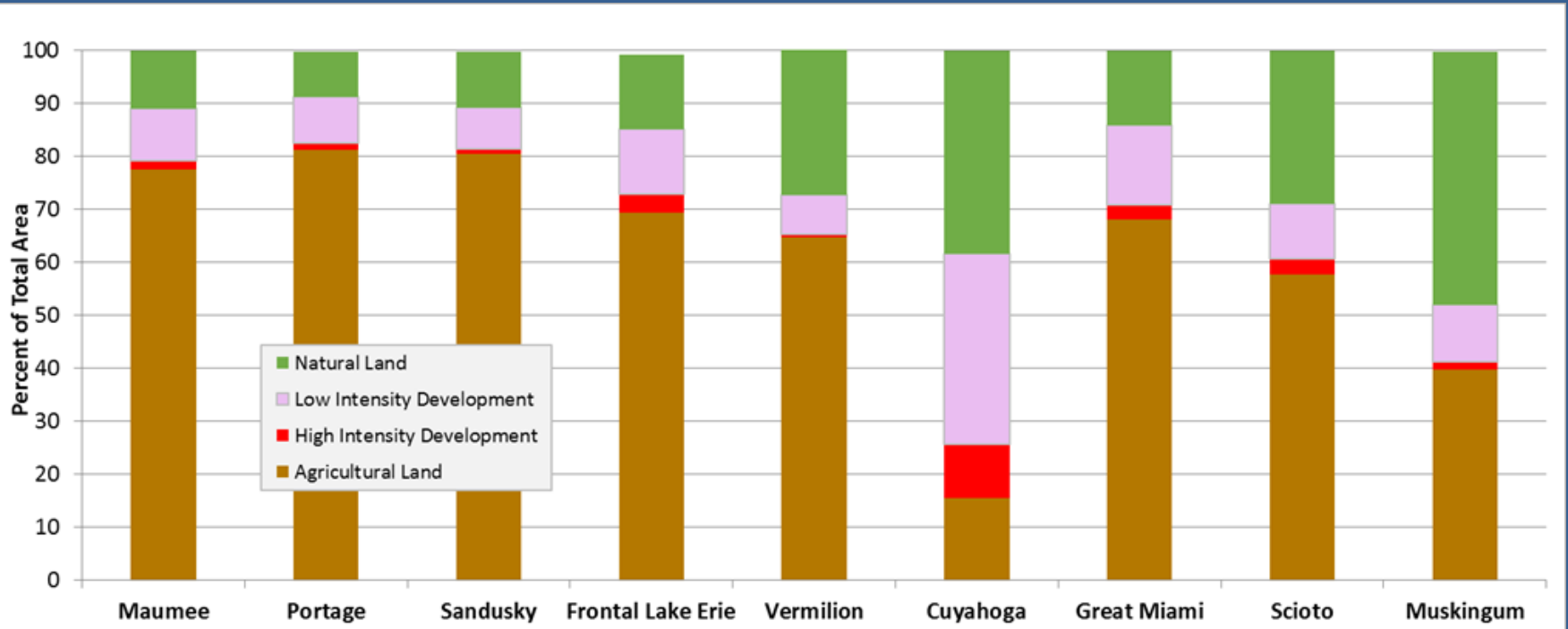


Total N: Yield

Average 2013-2017

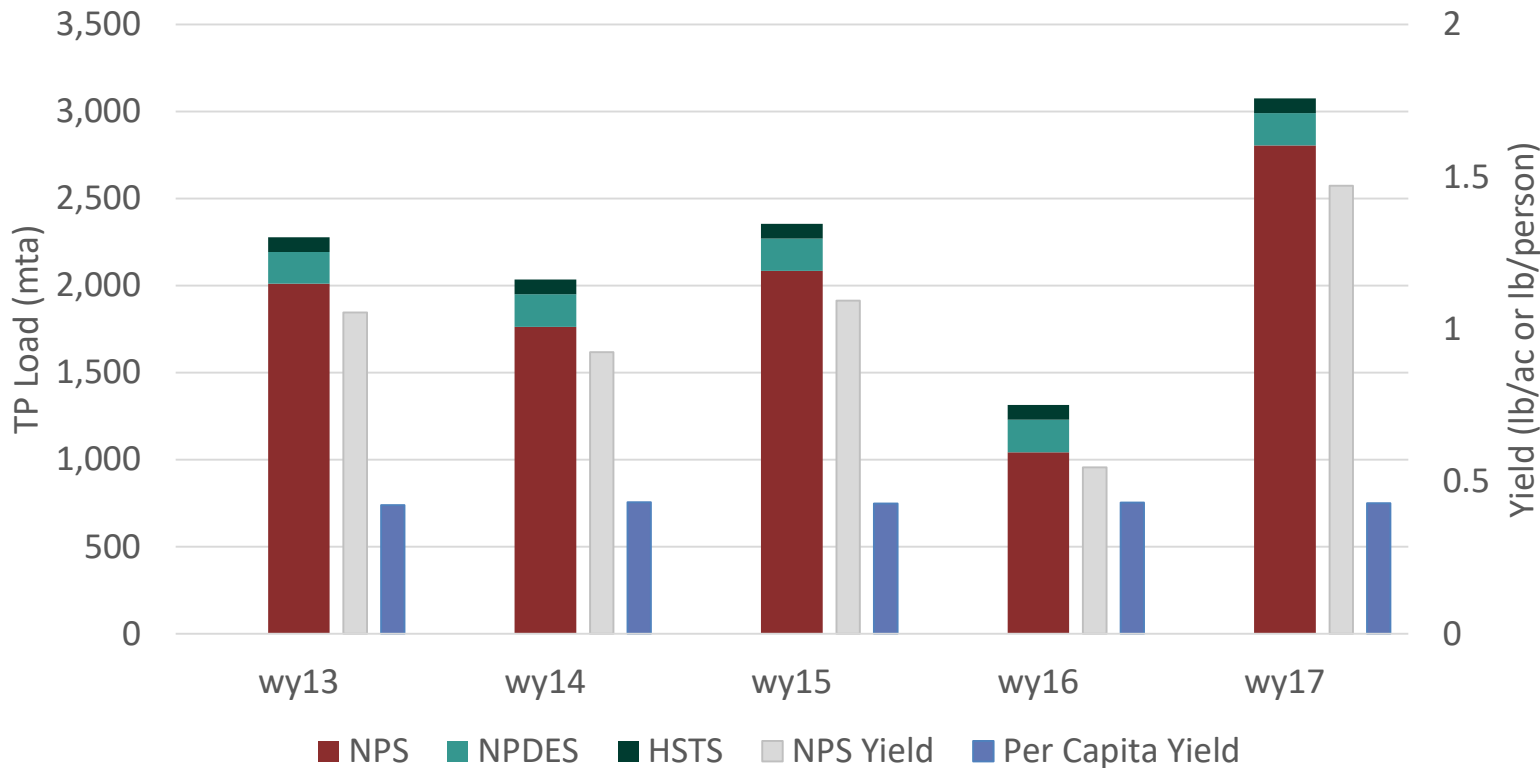
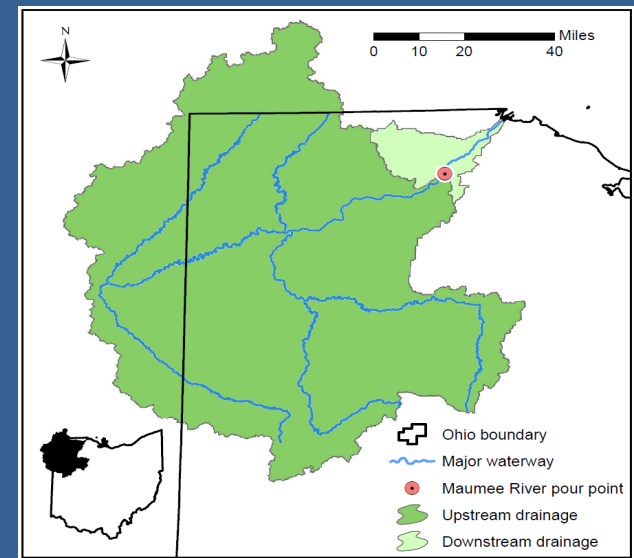


Land Use



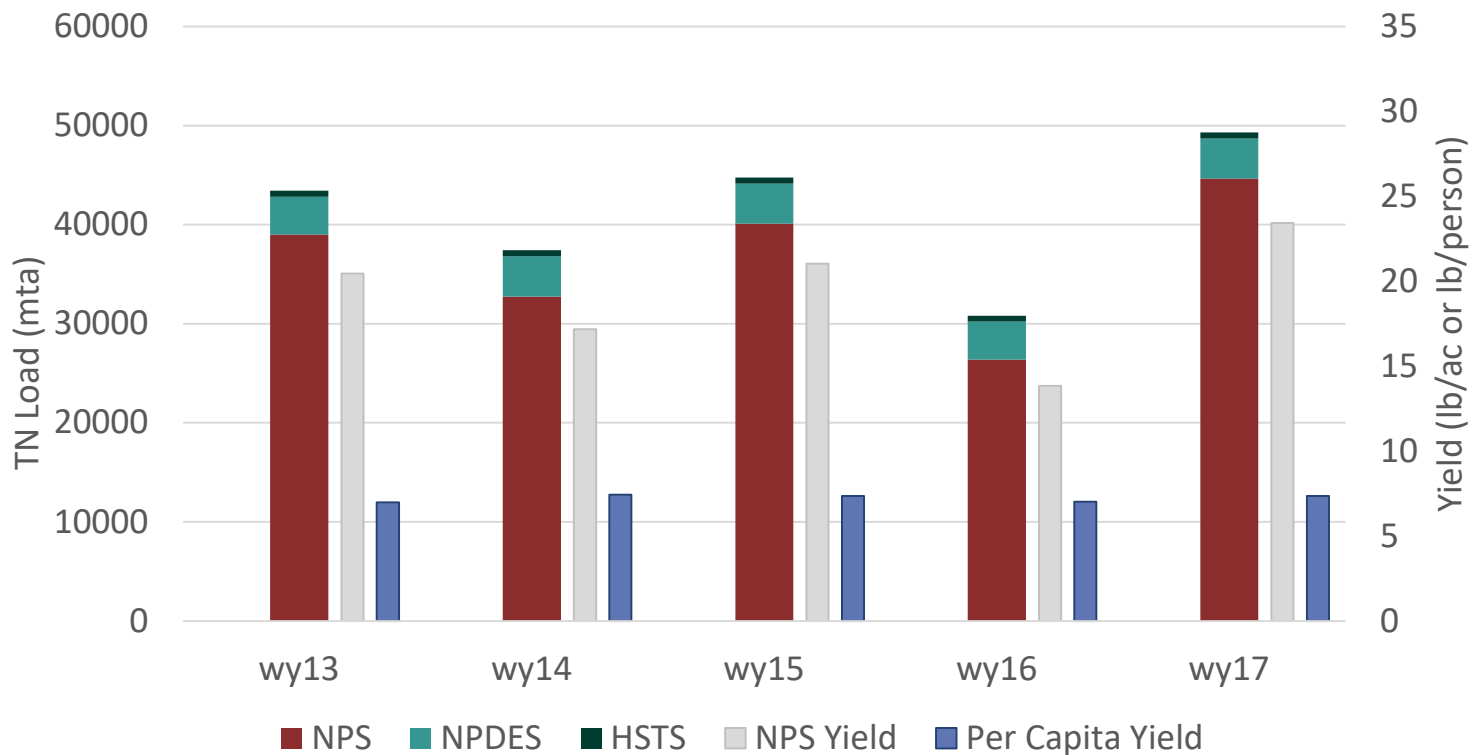
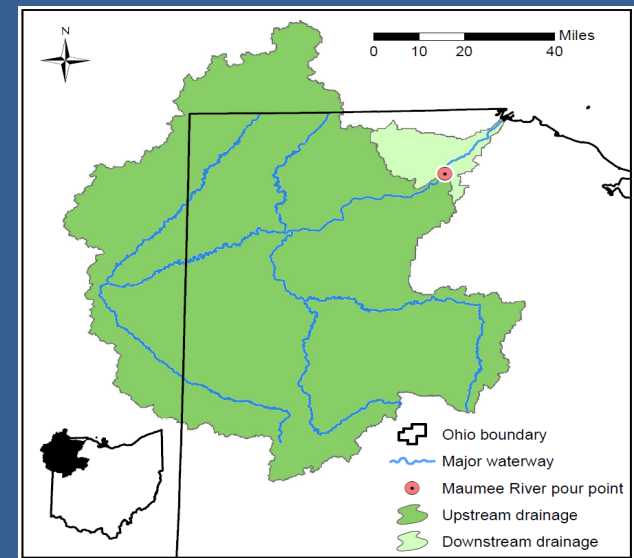
Loading Breakdown - Maumee

Total P – by Water Year



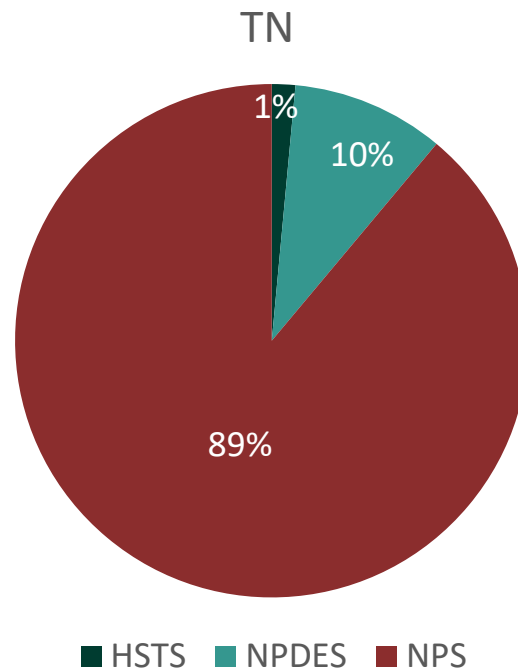
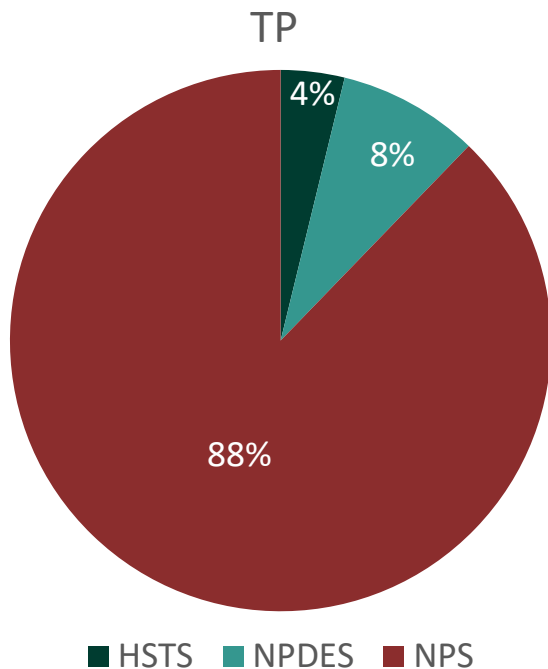
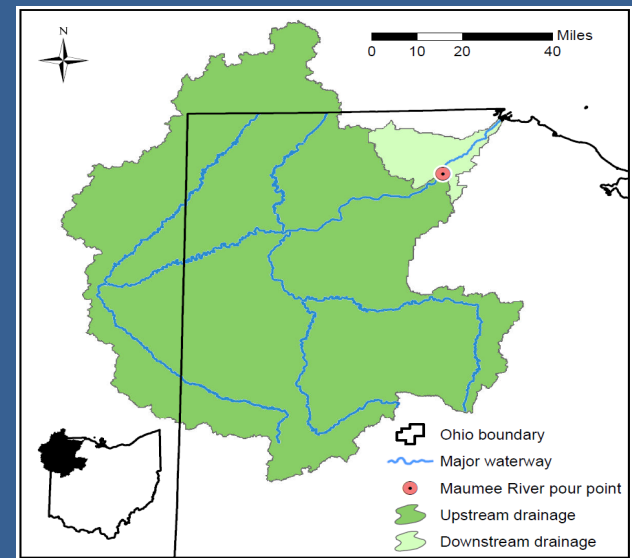
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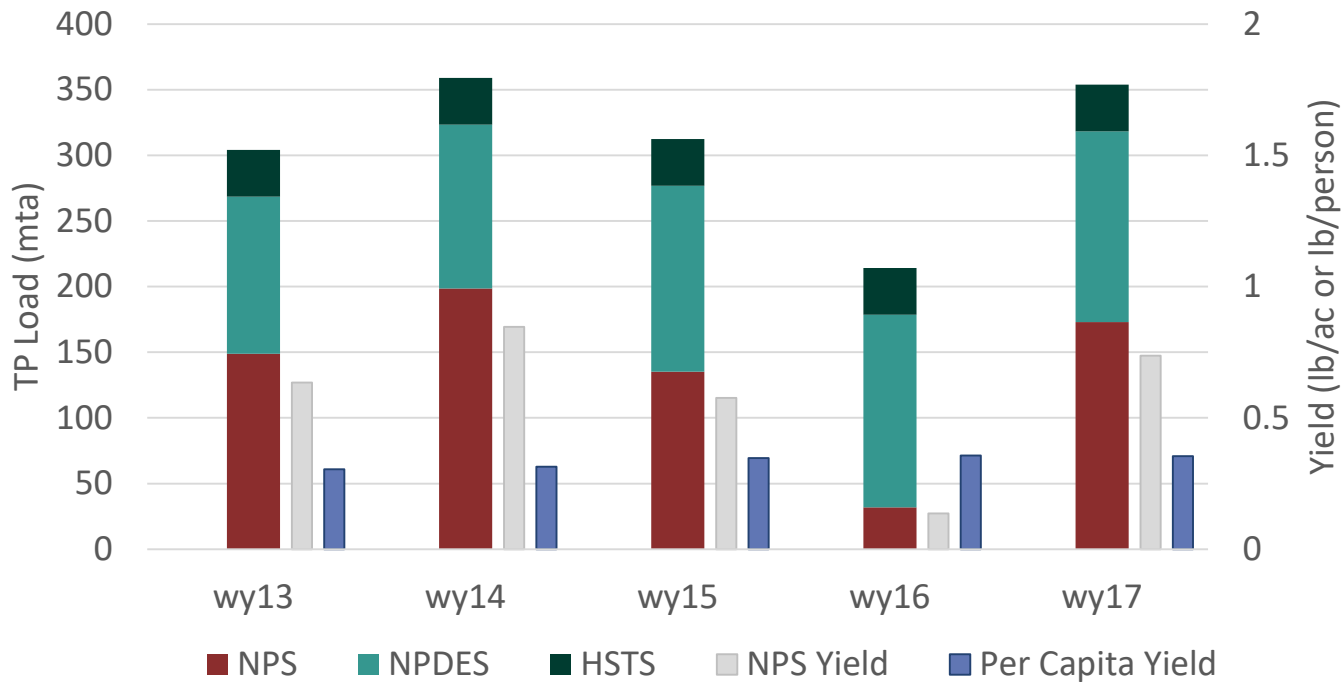
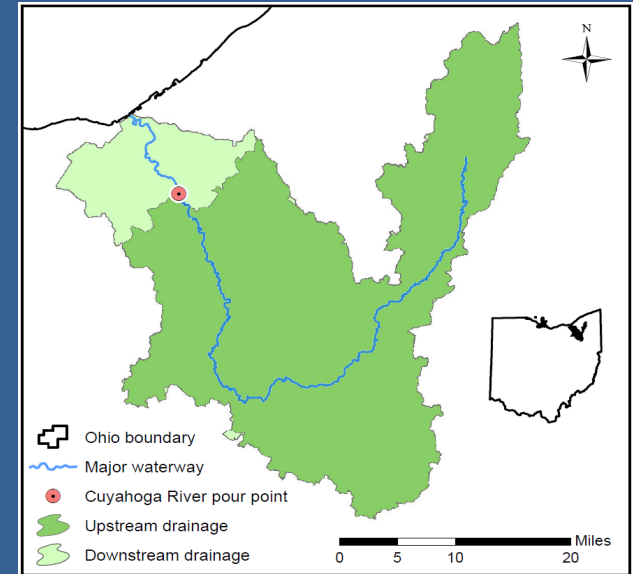
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Proportions of Total P and Total N
Average of 5 years



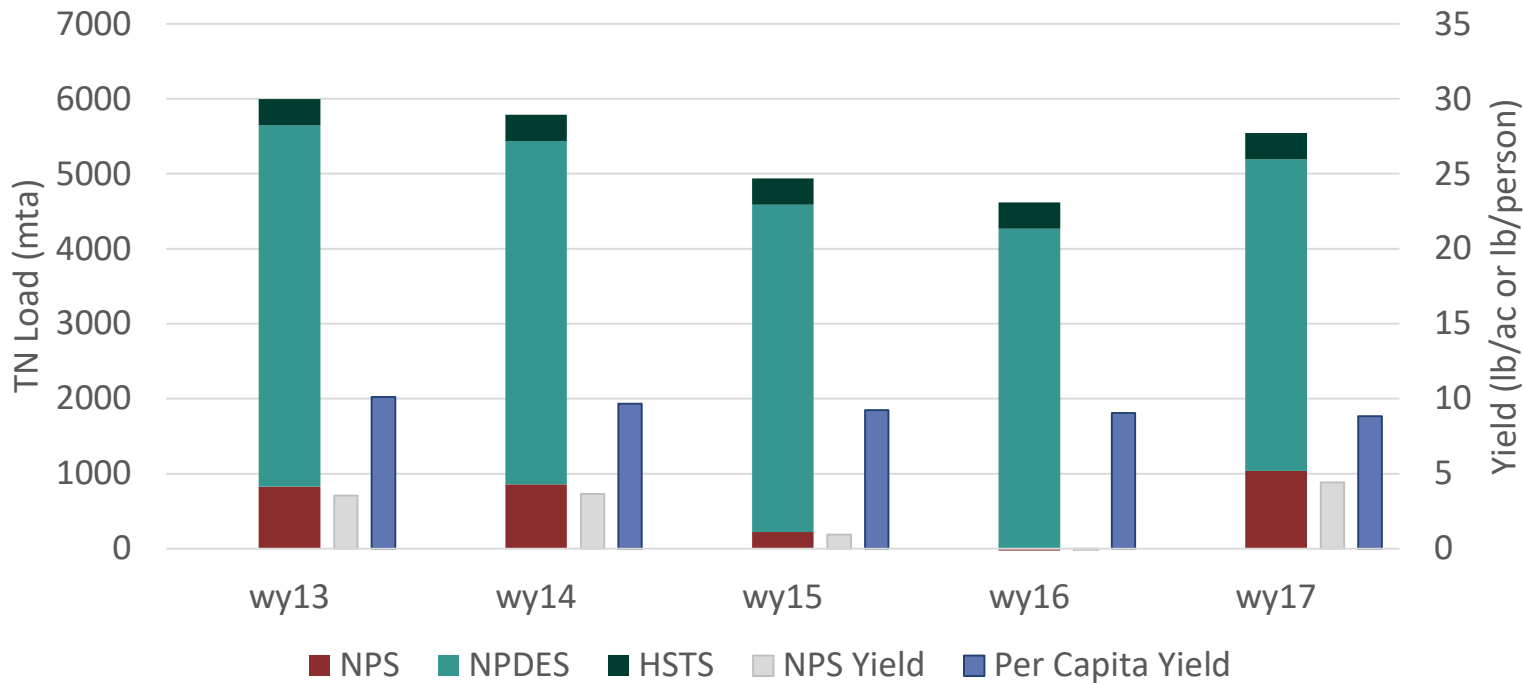
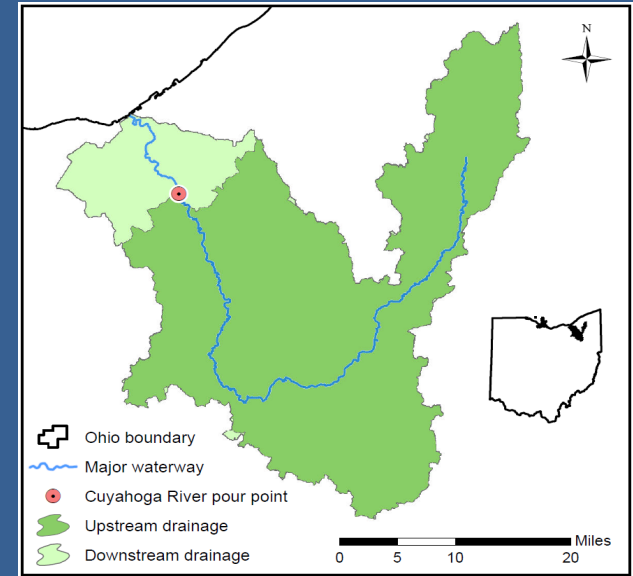
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Total P – by Water Year



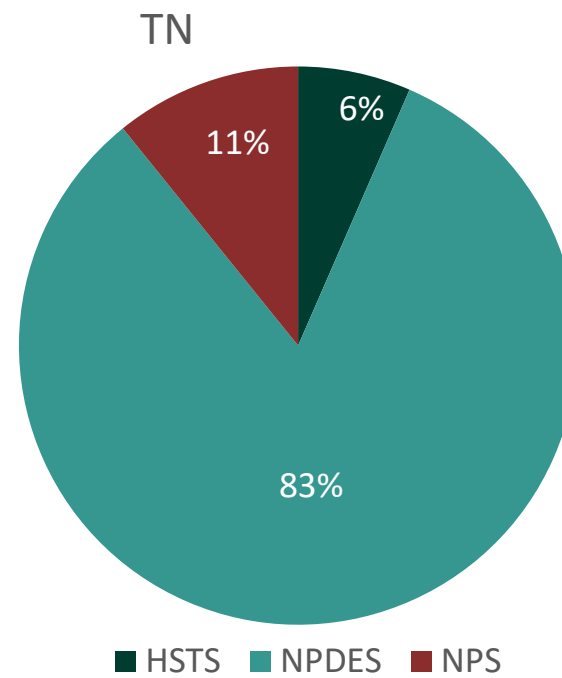
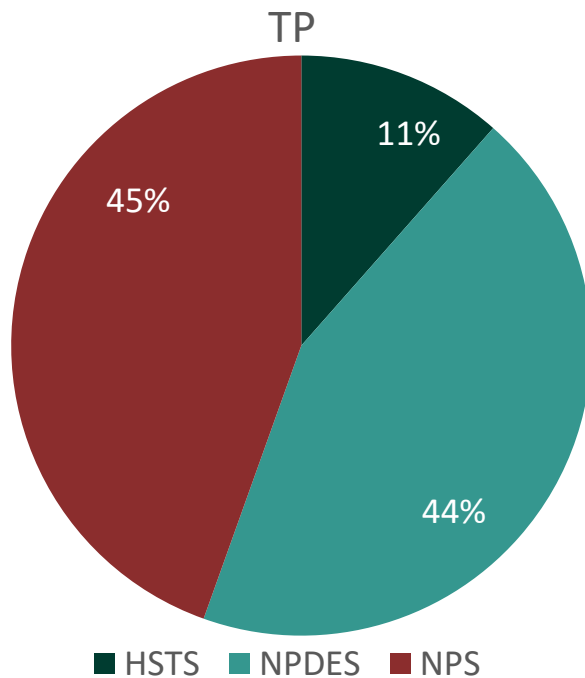
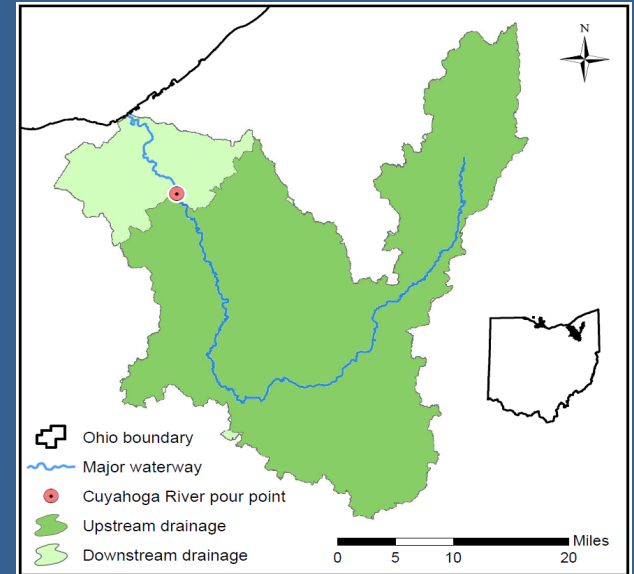
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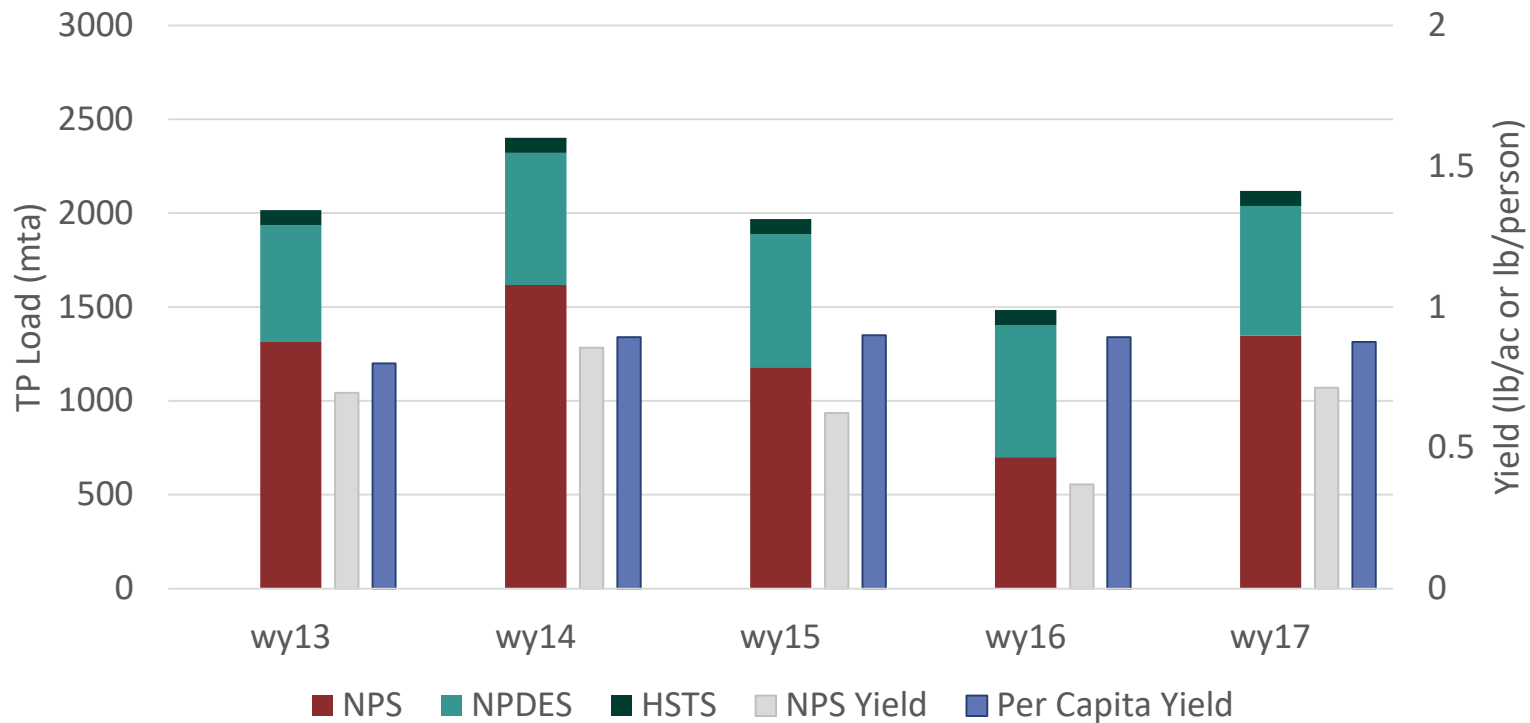
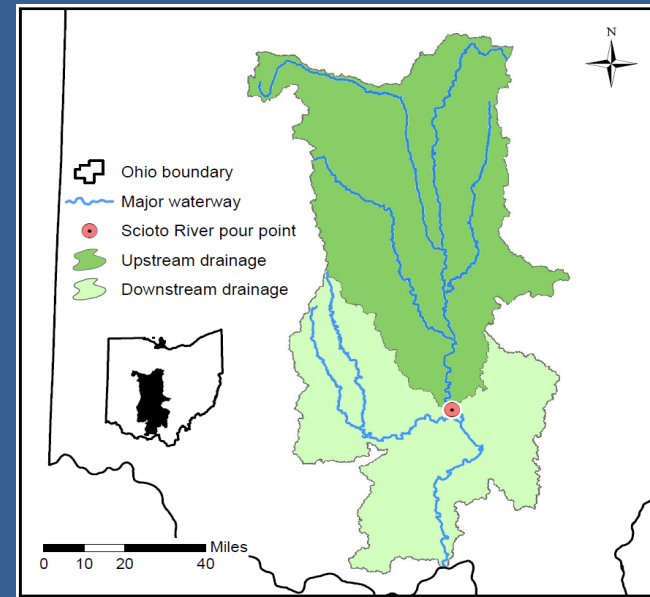
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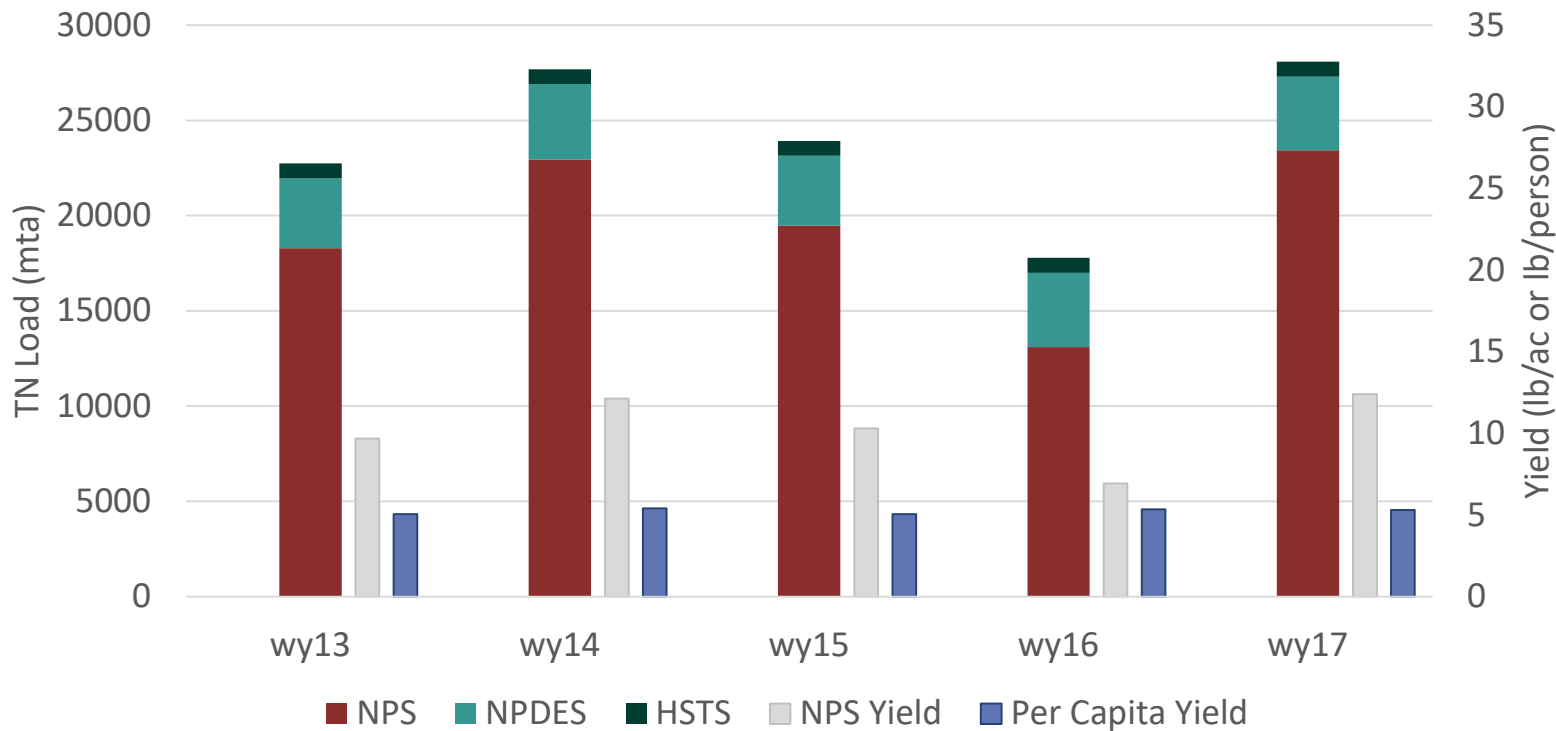
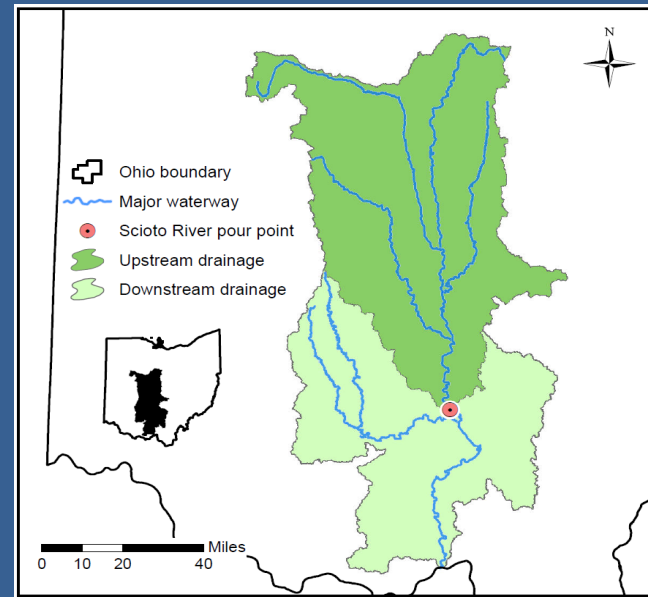
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Total P – by Water Year



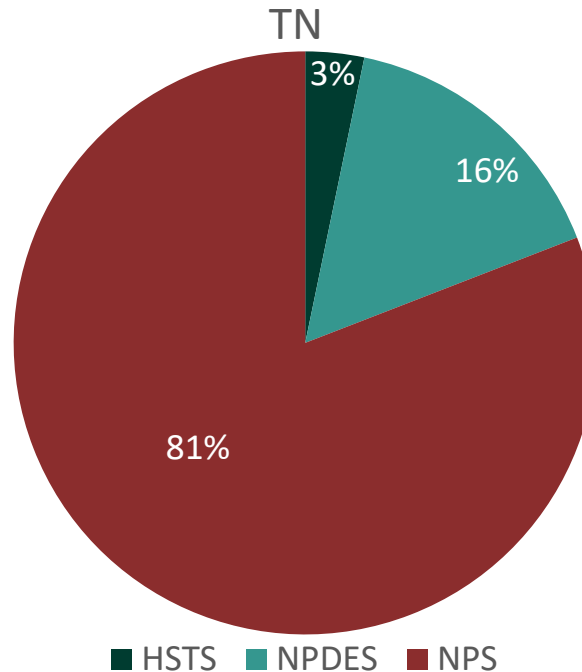
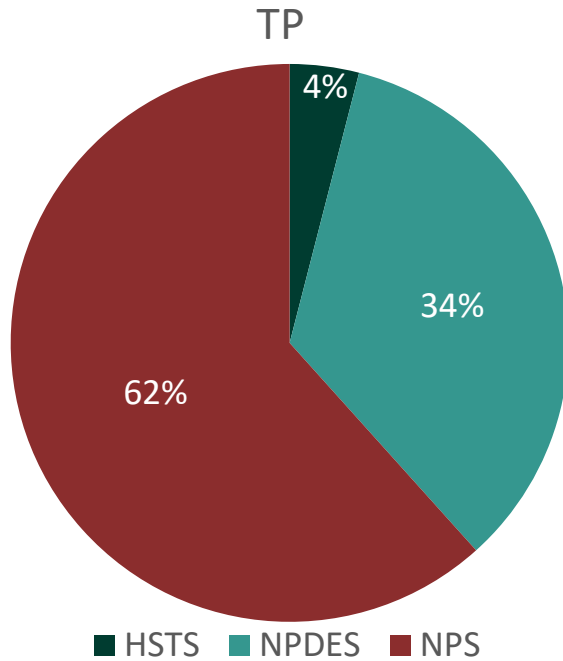
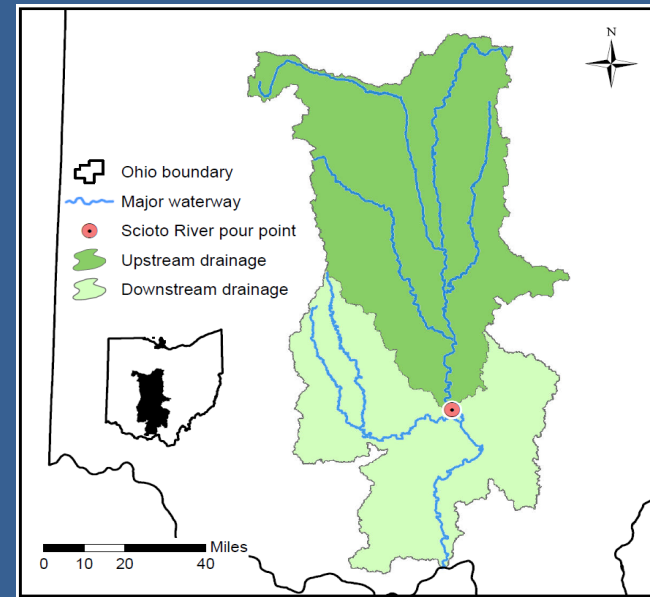
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Total N – by Water Year



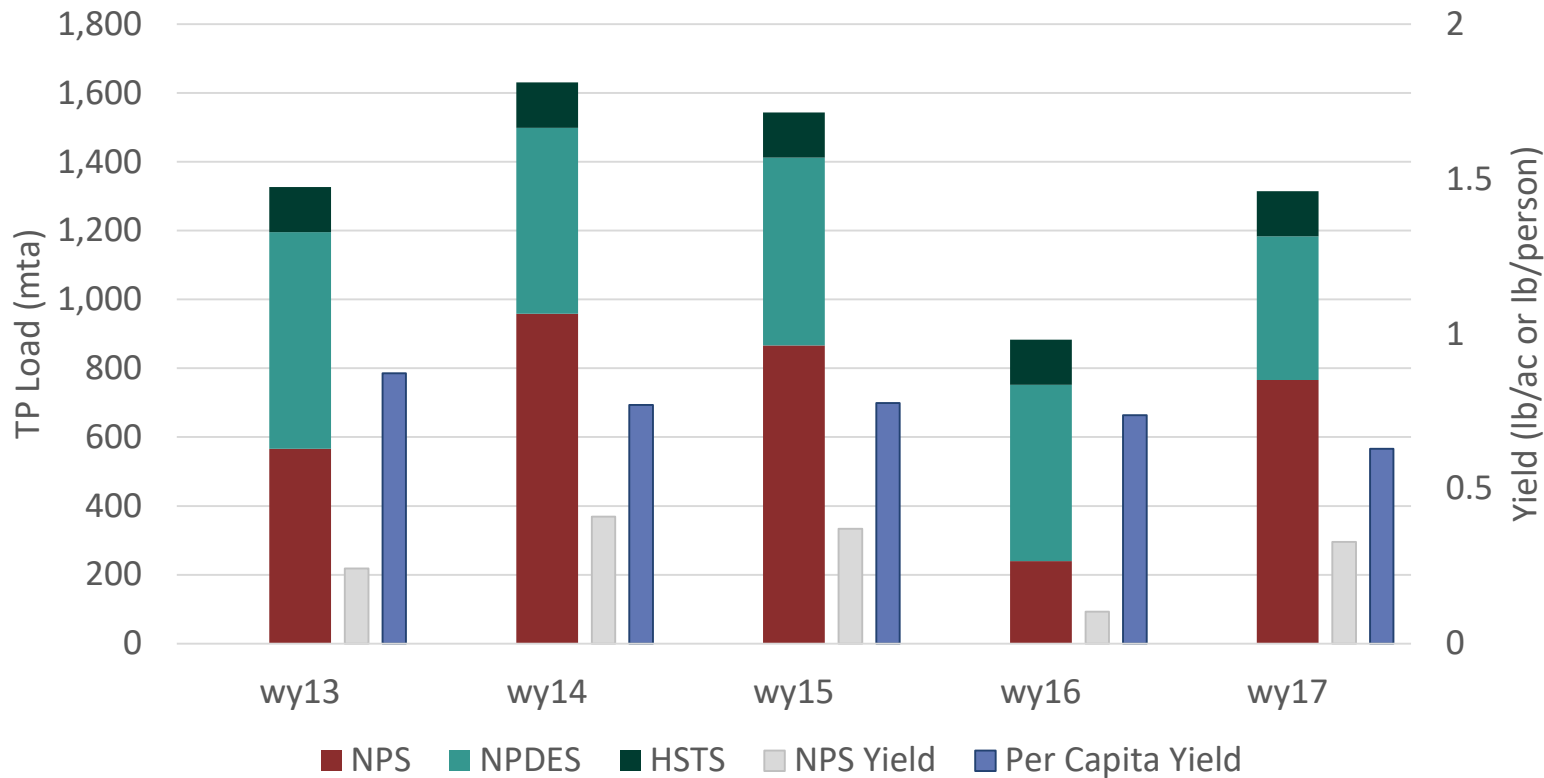
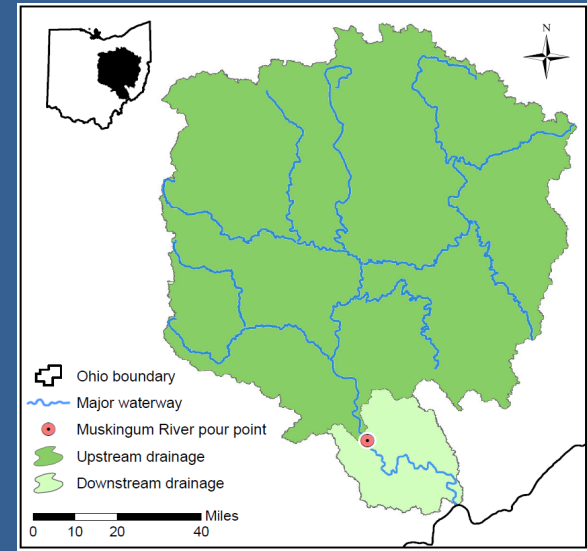
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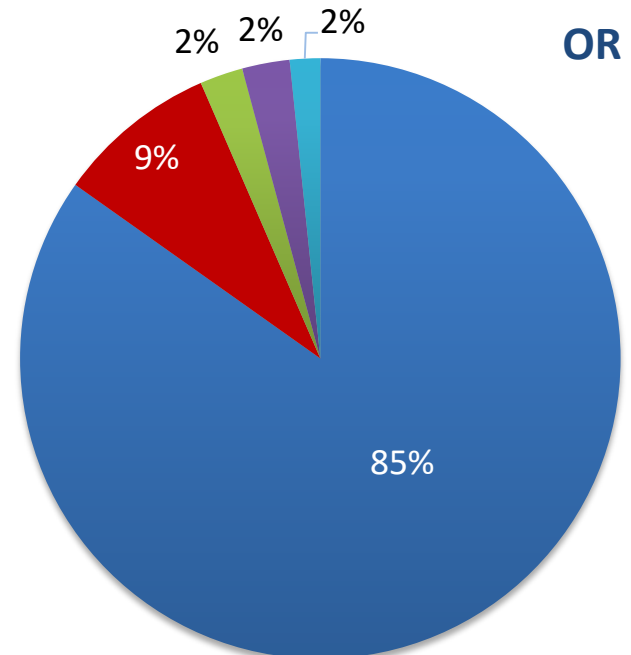
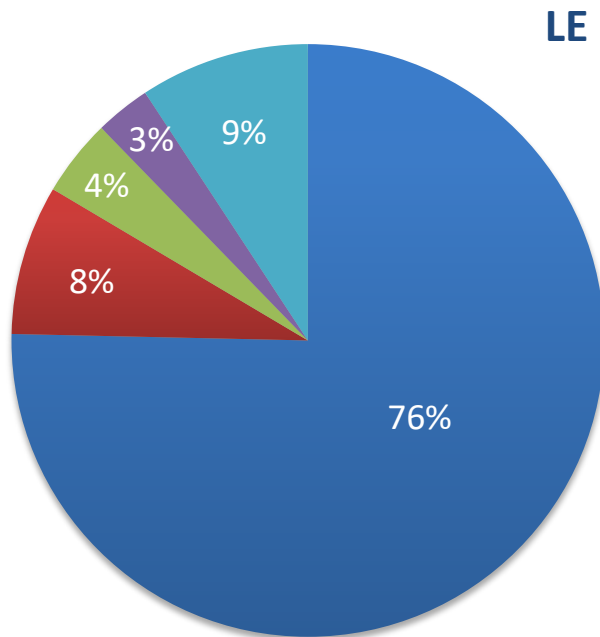


Loading Breakdown - Muskingum

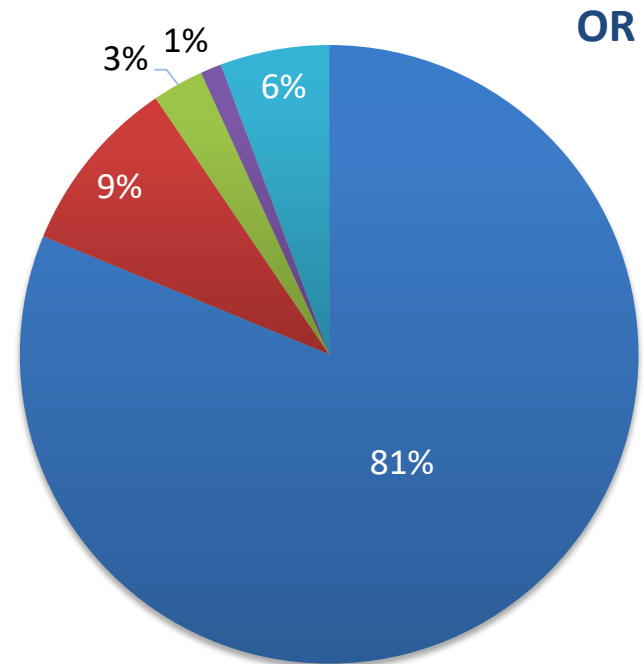
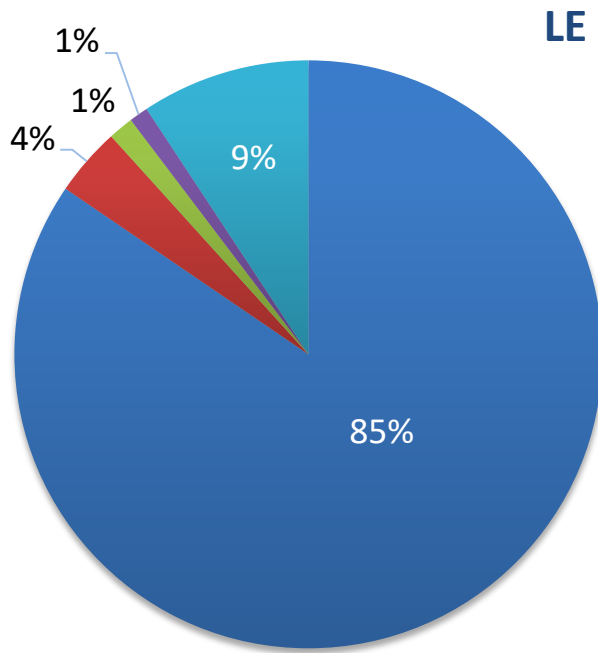
Total P – by Water Year



NPDES – Lake Erie vs. Ohio River Total P



NPDES – Lake Erie vs. Ohio River Total N



Future Work

- Continue to expand the domain (Ohio) covered by mass balance calculations
- 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.

Nutrient Mass Balance Study for Ohio's Major Rivers



Thank You!