

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF CLEAN WATER

Emerging Contaminants in Pennsylvania Surface Waters 2012-2024

WRAC Meeting

November 21, 2024

Joshua Shapiro, Governor

Jessica Shirley, Acting Secretary

Emerging Contaminants

Contaminants of emerging concern (CECs) are those that were either not detected previously or are now found in higher concentrations than the past. They are NOT necessarily “new” compounds. These include many categories of chemicals.

NJ Advance Media file photo/Lehigh Valley Live

Susquehanna River Study

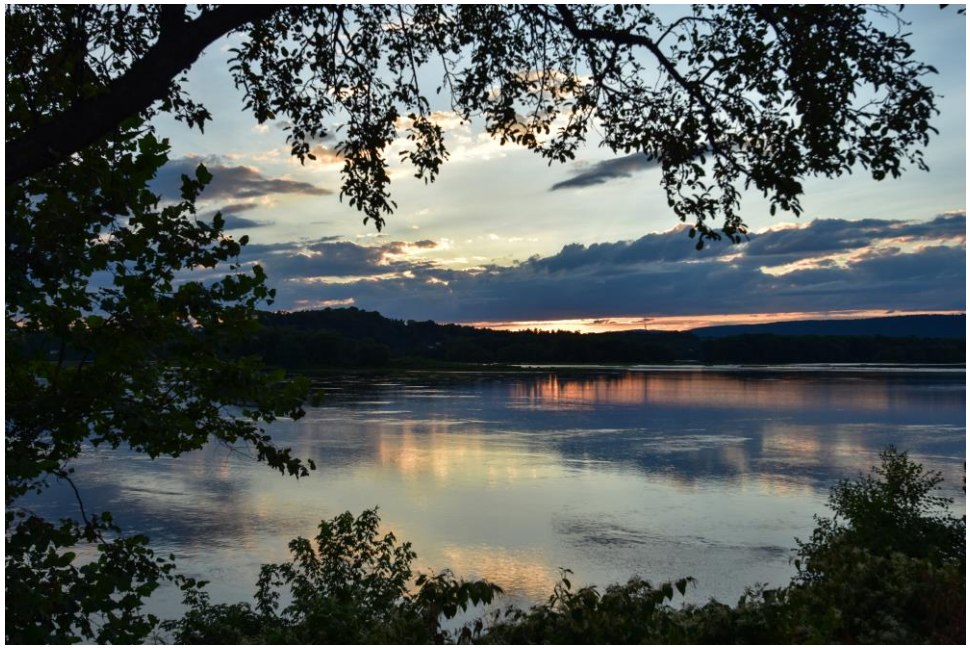
Initial purposes of study:

- Determine if emerging contaminants are contributing to smallmouth bass die-offs in Susquehanna River watershed
- Determine levels of emerging contaminants in surface waters
- Assess attainment of Aquatic Life & Recreational Uses of the mainstem Susquehanna River

Susquehanna River Study

Evolving purposes of study:

- Determine concentrations and extent of emerging contaminants in water & sediment throughout the state.
- Explore sources (i.e. sampling upstream and downstream point source discharges)

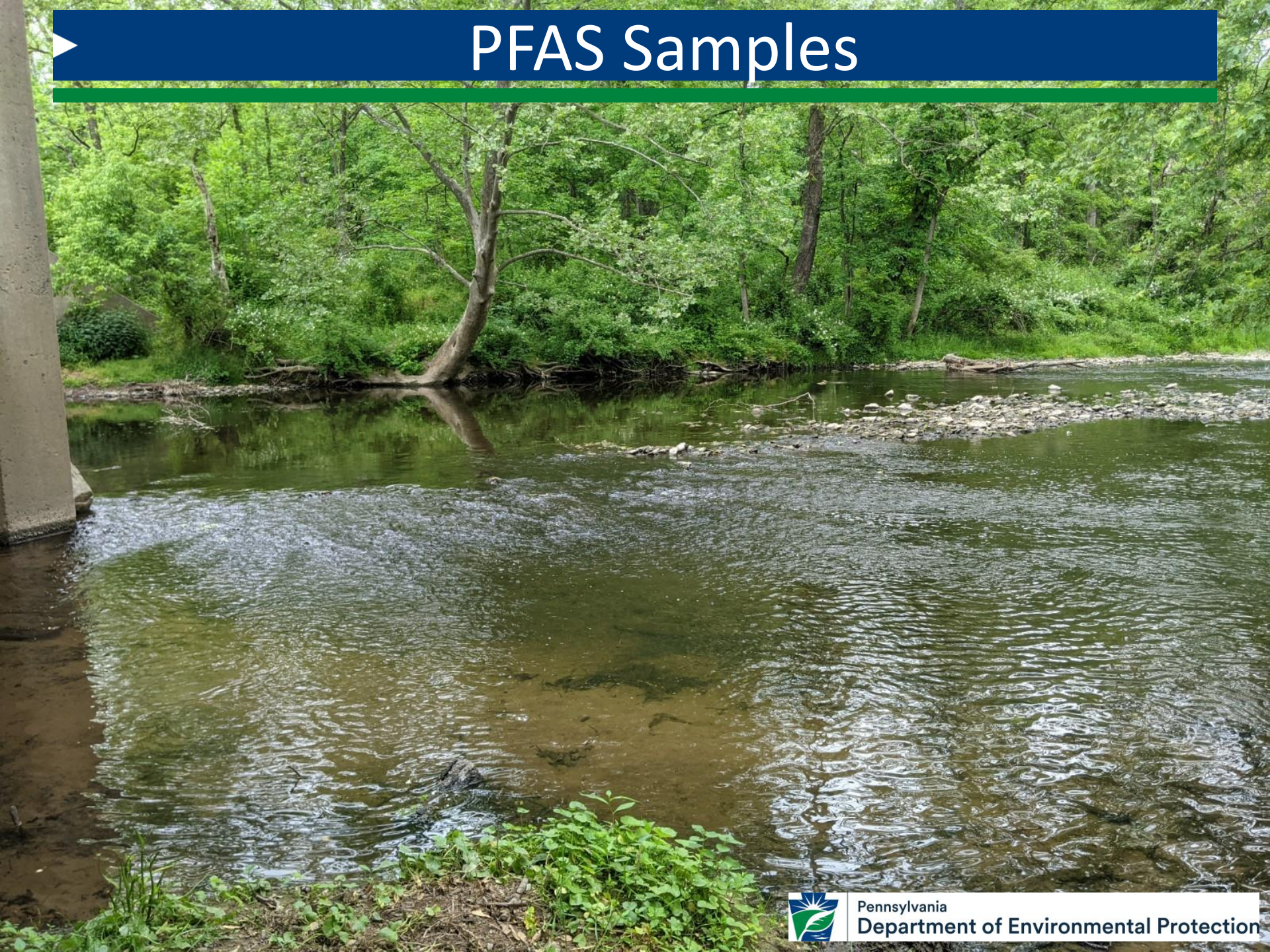


Emerging Contaminants

Emerging contaminants/endocrine disruptors among the parameters studied in:

- Passive water samples
- Sediment samples
- Water grab samples

PFAS Samples



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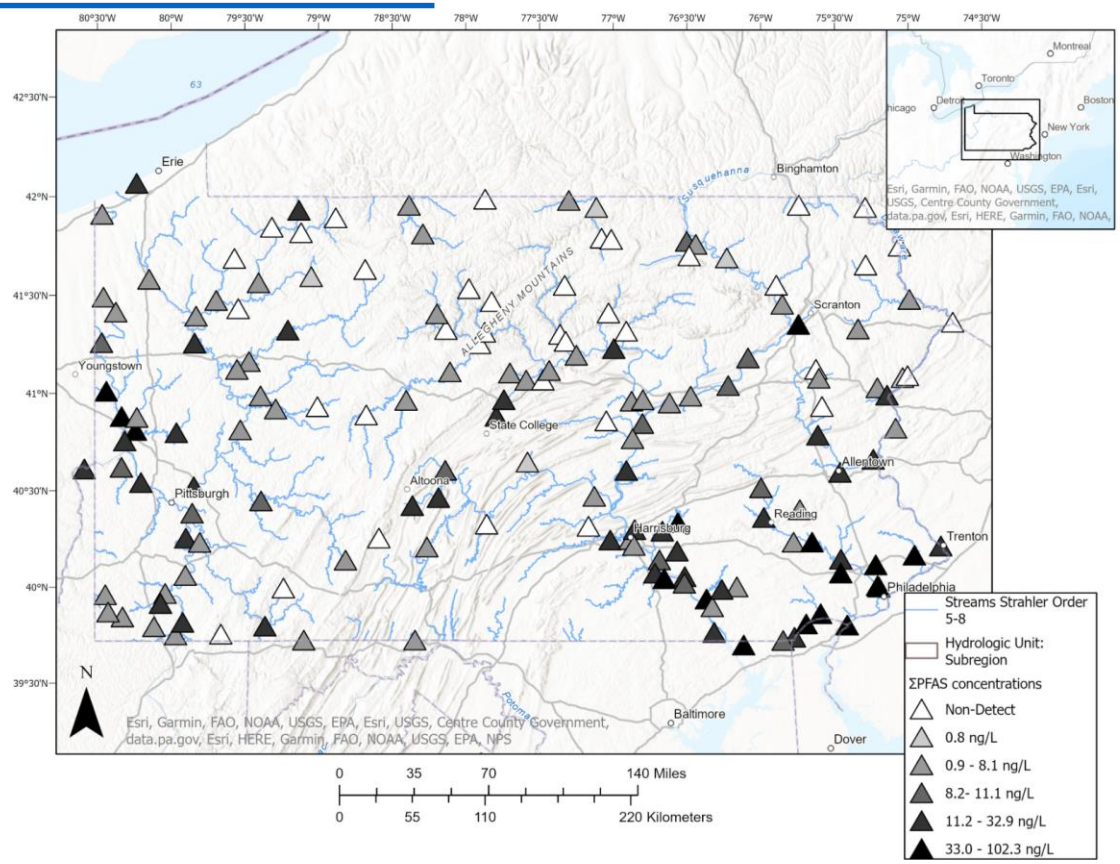
PFAS Samples 2019 - Present

- Surface Water
  - In 2019, DEP leveraged Pennsylvania's Water Quality Network to begin understanding the occurrence and distribution of PFAS chemicals in surface waters
    - Data Summary: https://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/WaterQualityPortalFiles/CECs/Surface_Water_PFAS_Summary_2019-2023.html

PFAS Samples 2019 - Present

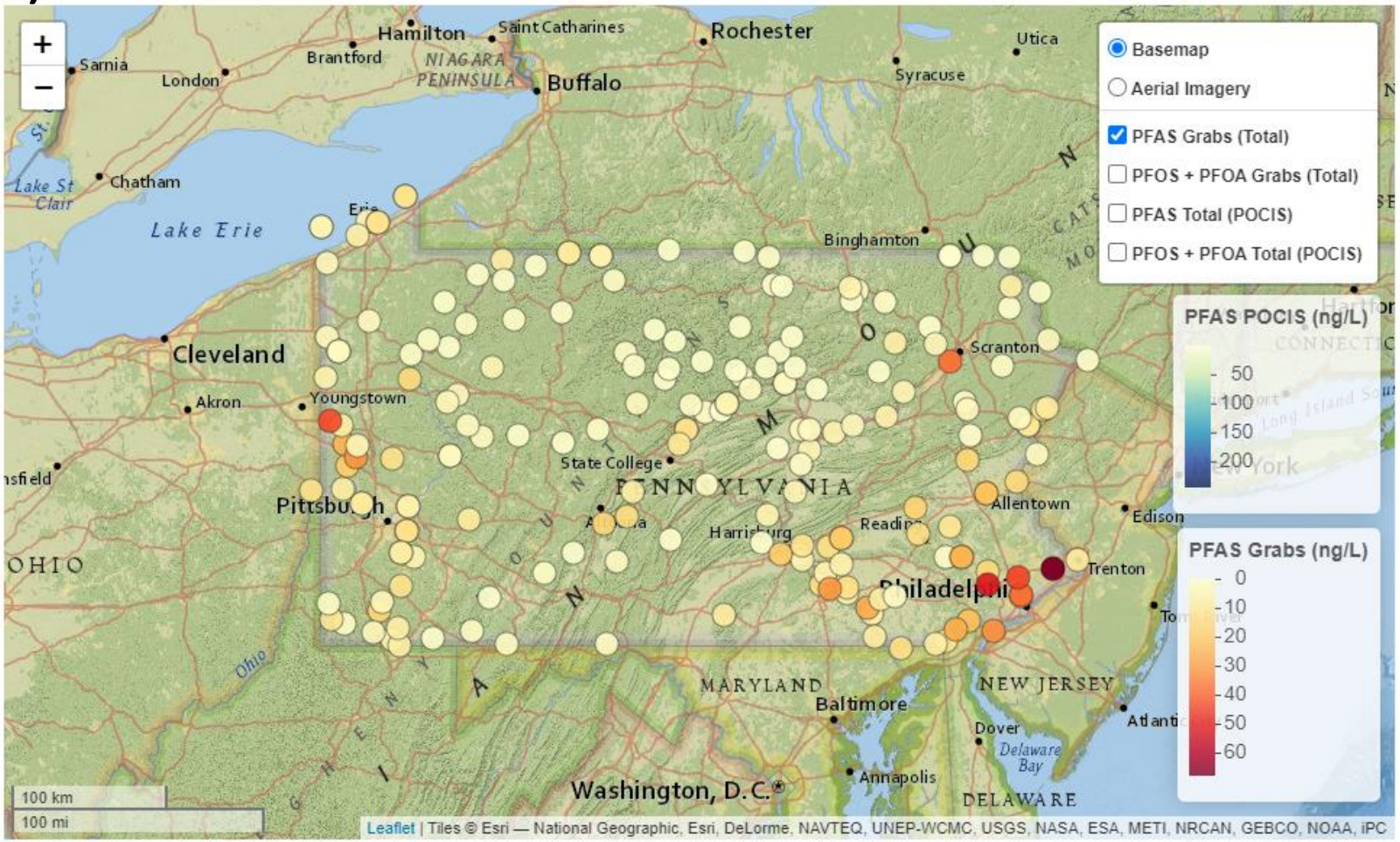
- Worked with USGS to publish data results and a source tracking journal article:

https://www.sciencedirect.com/science/article/pii/S0048969723027821



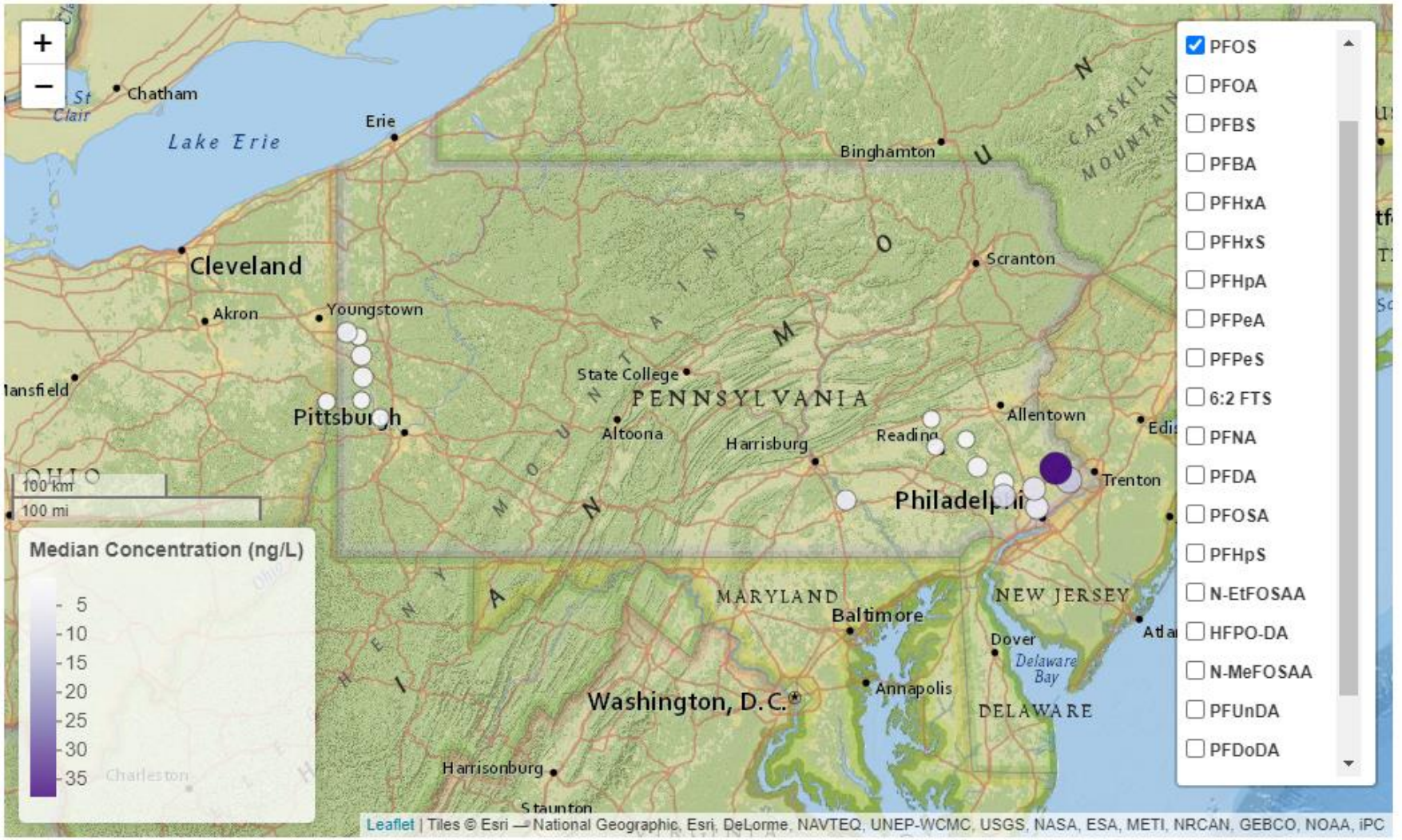
PFAS Samples 2019 - Present

Samples from all 178 WQN stations were analyzed for 33 PFAS chemicals and 19 total oxidizable precursors (TOP) in 2019.



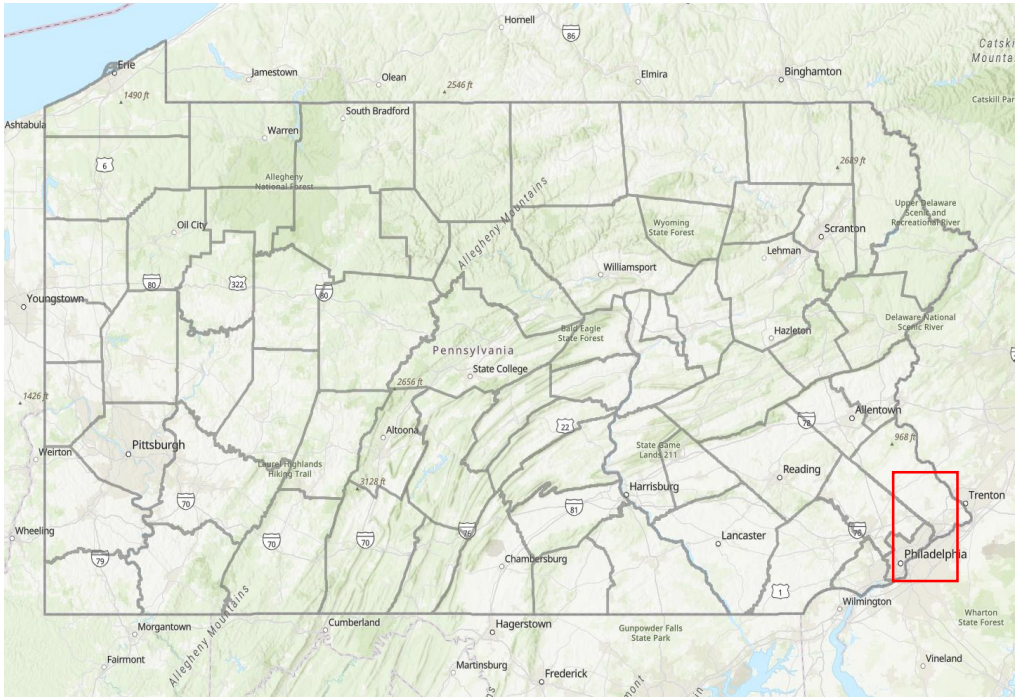
PFAS Samples 2019 - Present

A subset of the WQNs - all surface water - sampled in 2019 are being sampled from 2020 on.



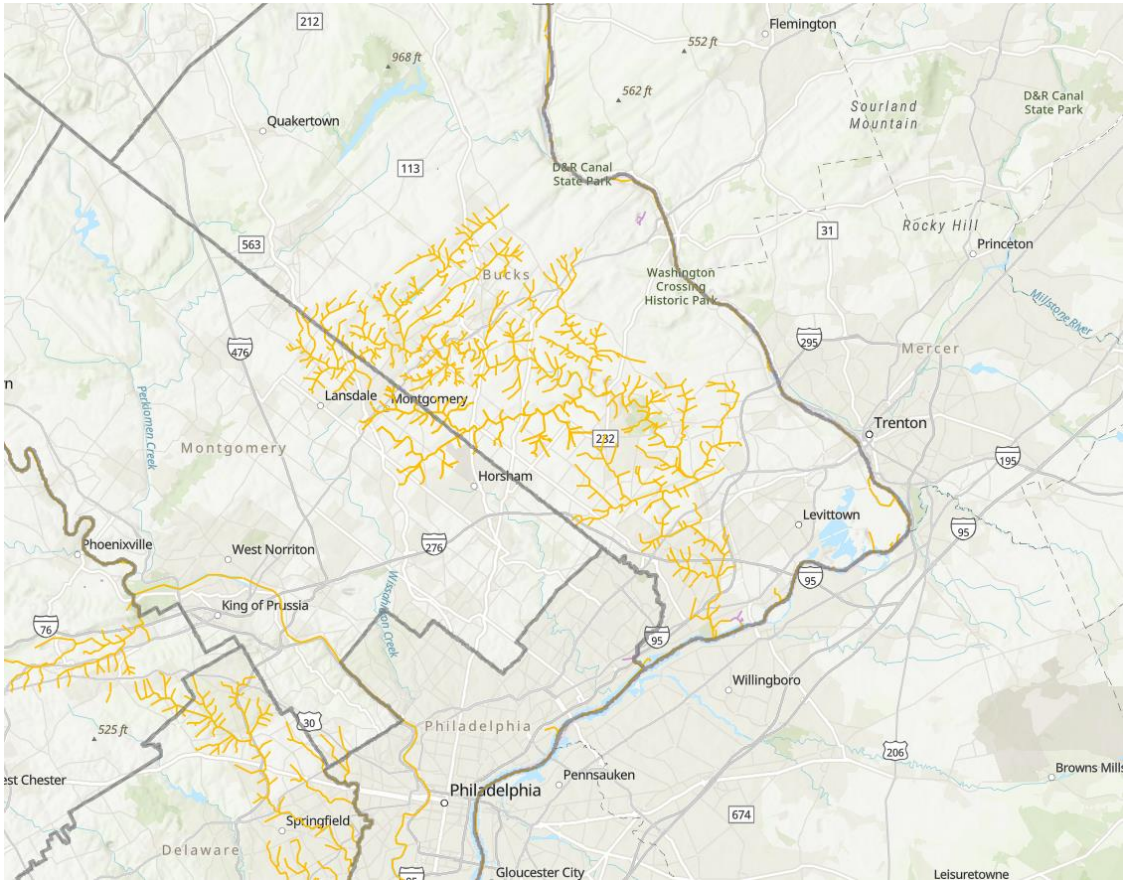
PFAS Fish Tissue Samples

- Fish Tissue
  - Many of the PFAS compounds bio-accumulate, with long-chain substances – perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) – tending to bio-accumulate more than short-chain PFAS substances
  - Pennsylvania implemented fish tissue sample analysis where elevated concentrations existed in surface water
  - Archived fish tissue samples from 2015 were analyzed for PFAS in 2021
    - Advantageous monitoring strategy for emerging contaminant monitoring (archived samples analysis)
    - Results indicated elevated levels of PFOS in tissue at Neshaminy Creek



PFAS Fish Tissue Samples

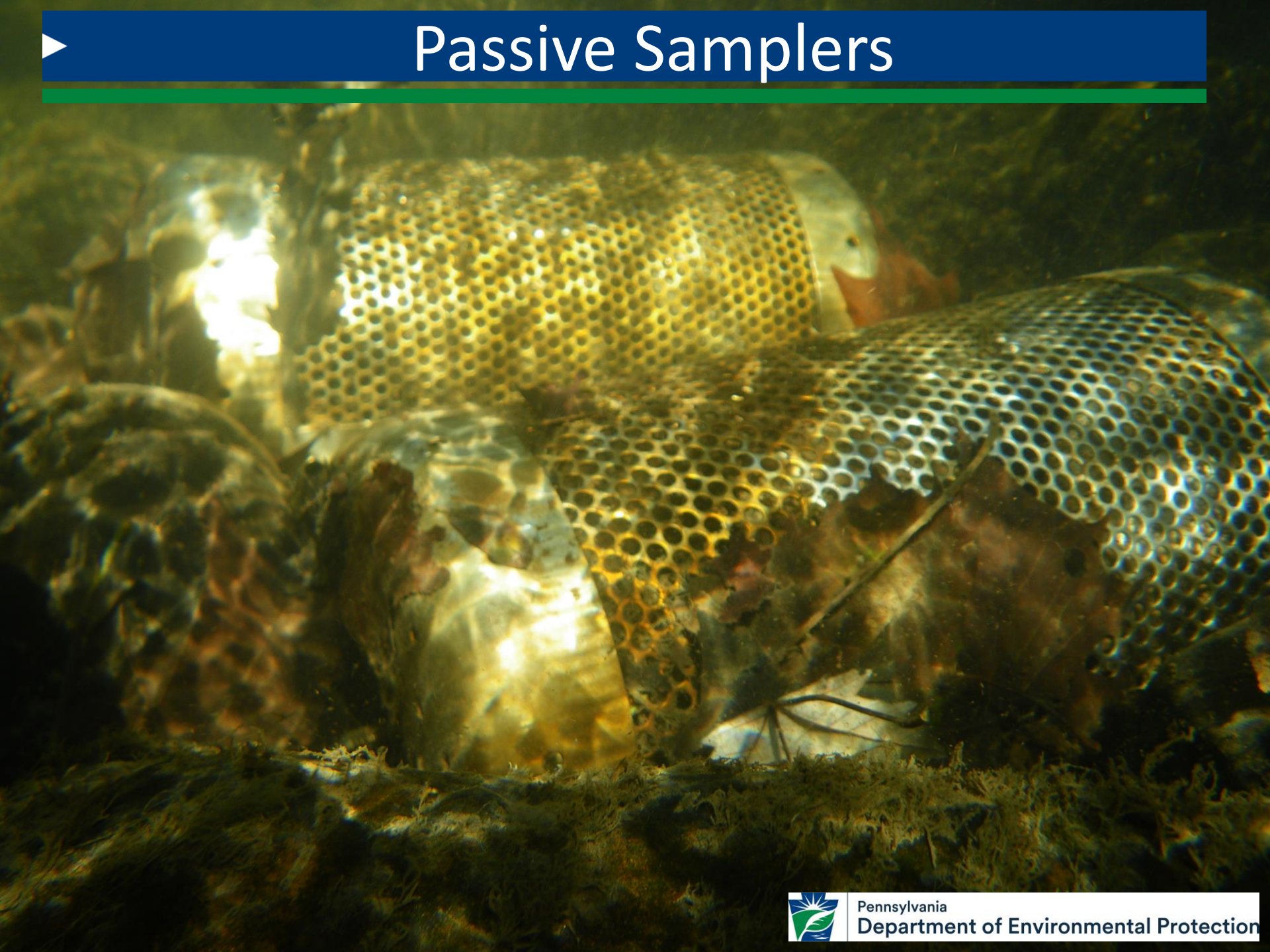
- Neshaminy Creek
  - Fish tissue results for multiple species exceeded “Do Not Eat” PFOS thresholds throughout the Neshaminy Creek basin
  - Assessment delineation extended to the entire Neshaminy Creek basin due to the mobility of these fish species
  - The Neshaminy Creek basin was impaired for PFOS in the 2022 Integrated Report



PFAS Fish Tissue Samples

- Some Points
  - From 2019 to 2022 (≈ 3 years)
    - Statewide monitoring was implemented
    - Archived tissue samples were analyzed
    - Assessment method that applied narrative criteria was developed for PFOS
    - Impairment decisions and consumption advisories were available to the public
  - No PFAS TMDL has been developed yet, but it would likely follow the same process Pennsylvania took for PCBs (apply bio-accumulation factors to arrive at an instream concentrations and loads) if no surface water criteria are developed

Passive Samplers



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Passive Water Samplers

Polar Organic Chemical Integrated Sampler (POCIS):

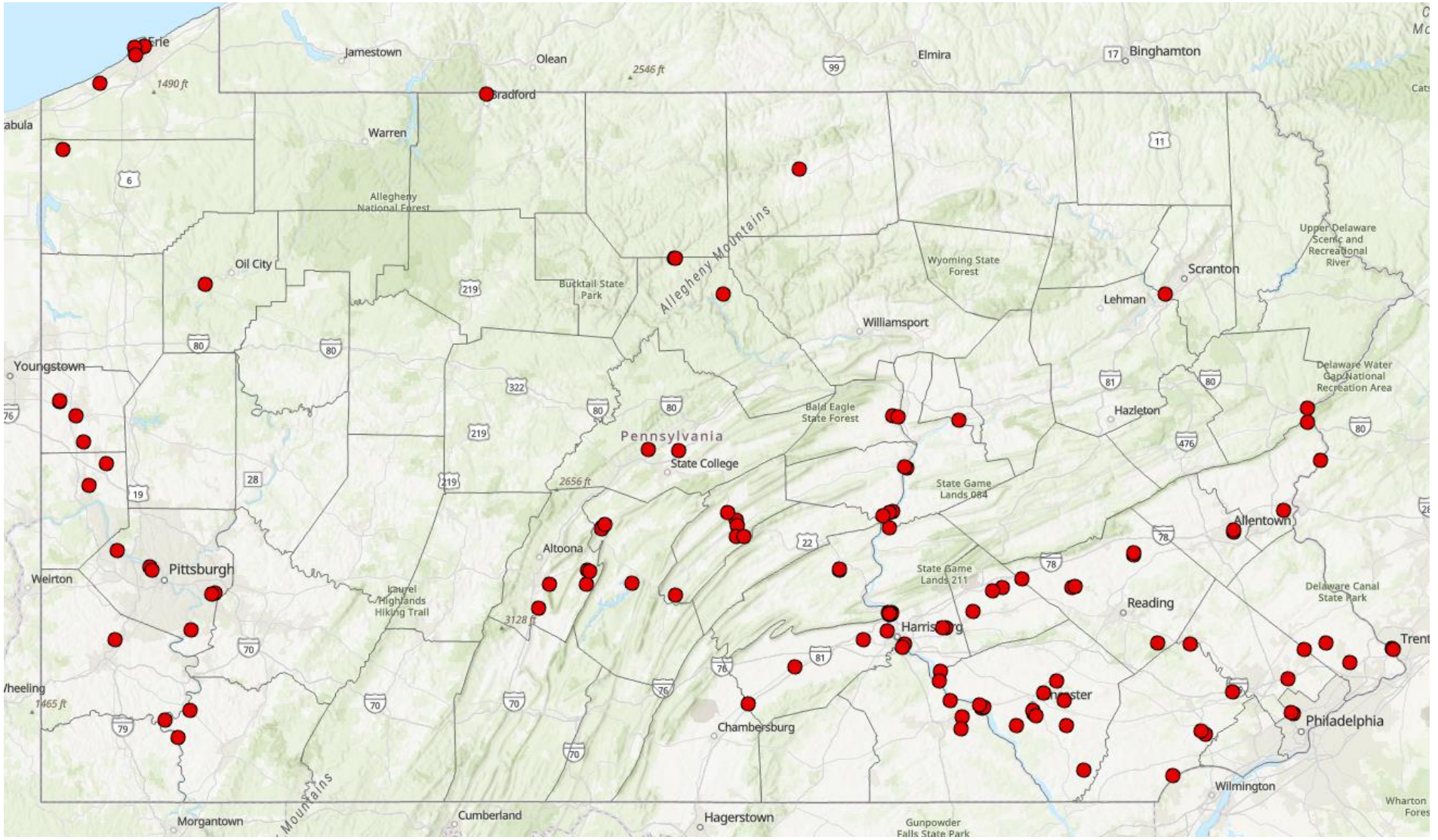
Semi-Permeable Membrane Device (SPMD):

Photos: Environmental Sampling Technologies, Inc.

Passive Samplers-Compounds Sampled

- Total Estrogenicity & hormones
- Pharmaceuticals
- Various wastewater compounds
- Pesticides (current & historical)
- PCBs
- PBDEs
- PAHs
- PFAS (2019 - 2023)

Passive Sampler Sites 2013-2023



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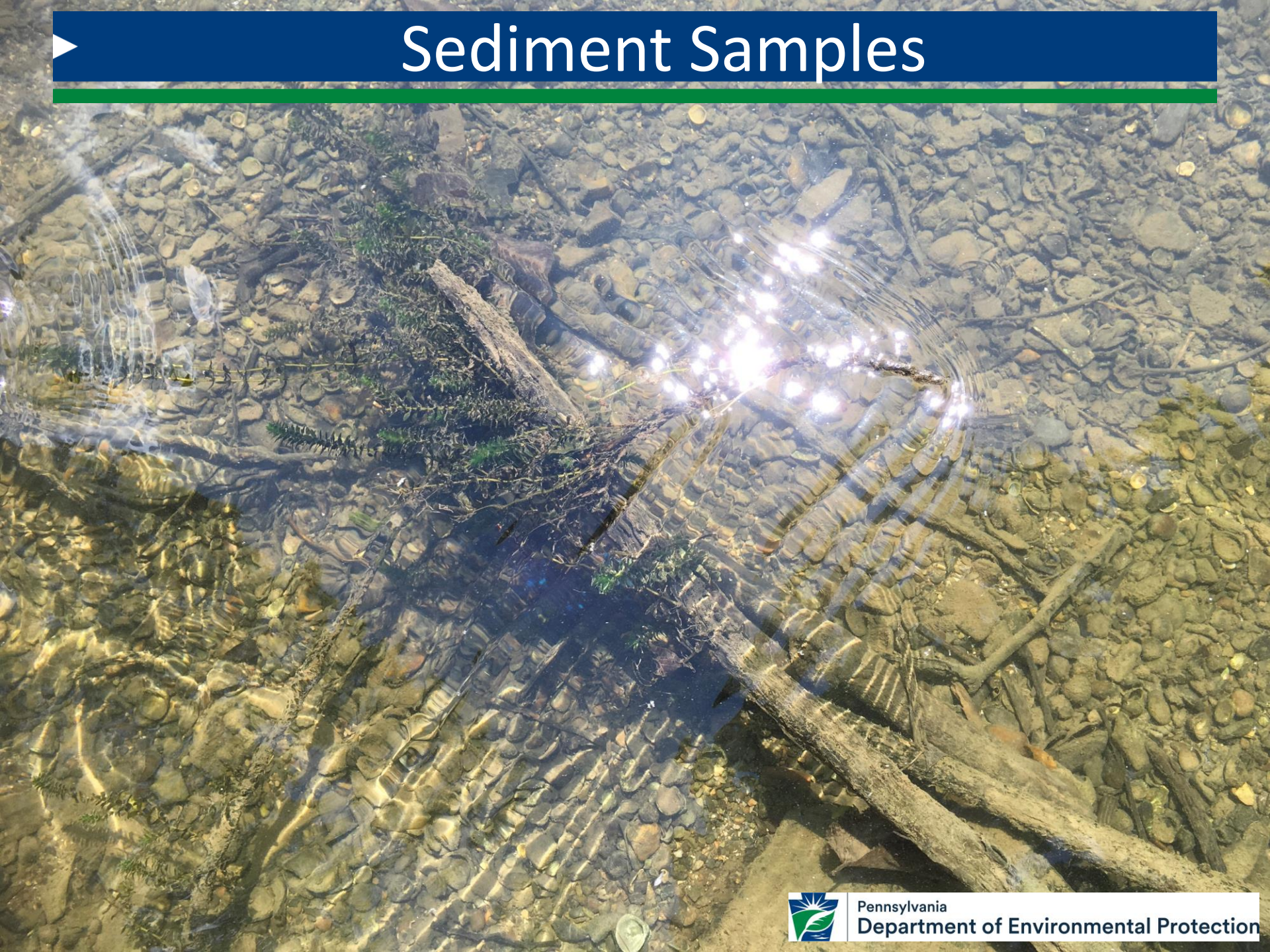
Passive Sampler Document (#1)

- Data from 2013 through 2017
- Data analyses divided into five sections:
  - Quality Control, Occurrence, and Distribution Analyses
  - Explanatory Variable Analyses
  - Local Scale Pattern Analyses
  - Temporal Analyses
  - Comparison to Sediment Samples
- All Clean Water CEC documents: https://www.dep.pa.gov/Business/Water/CleanWater/WaterQuality/Pages/CECs.aspx

Sediment Samples



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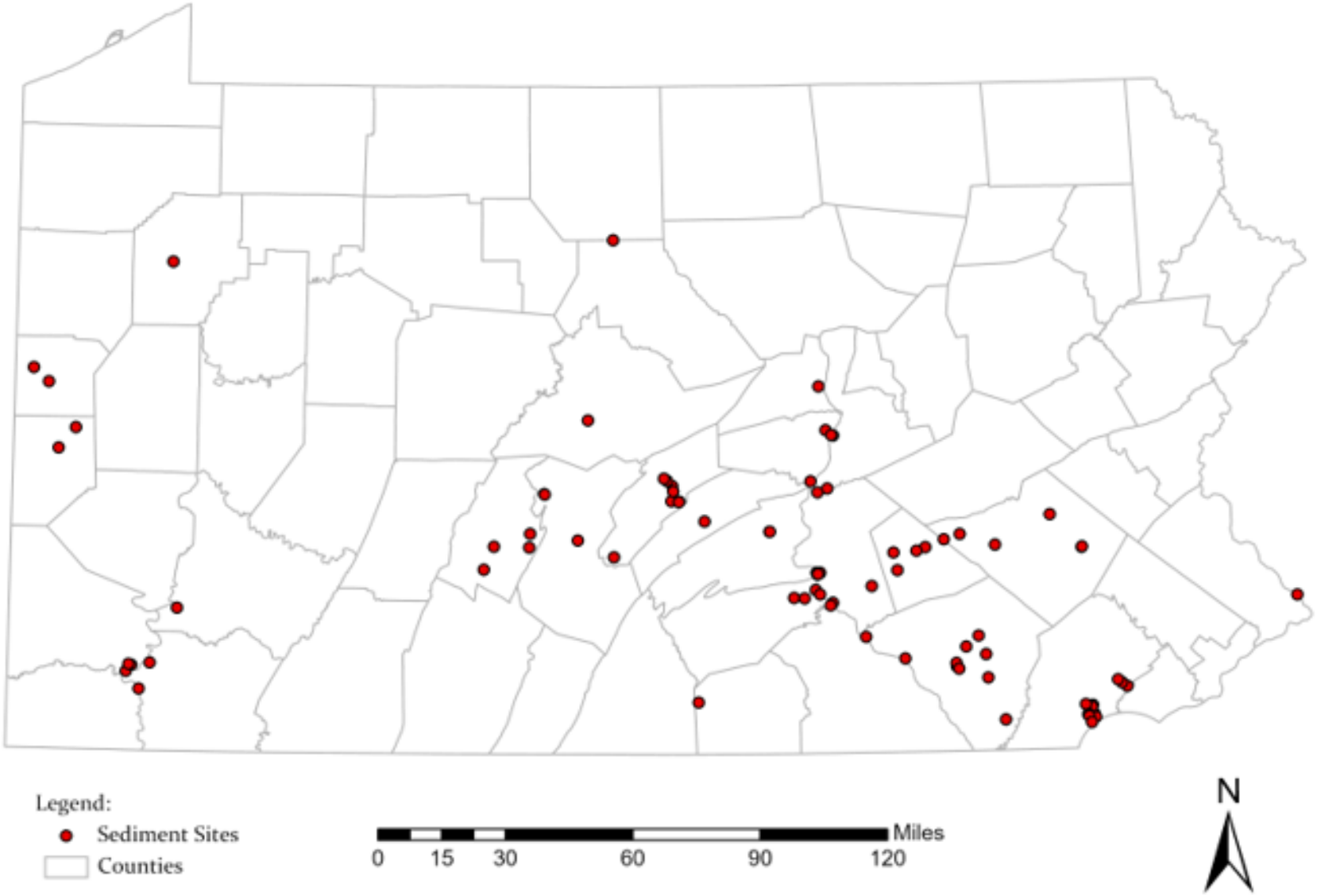
Sediment - Compounds Sampled

- Pesticides
- Various wastewater compounds
- Hormones
- Metals

Sediment Sites 2013 - 2017



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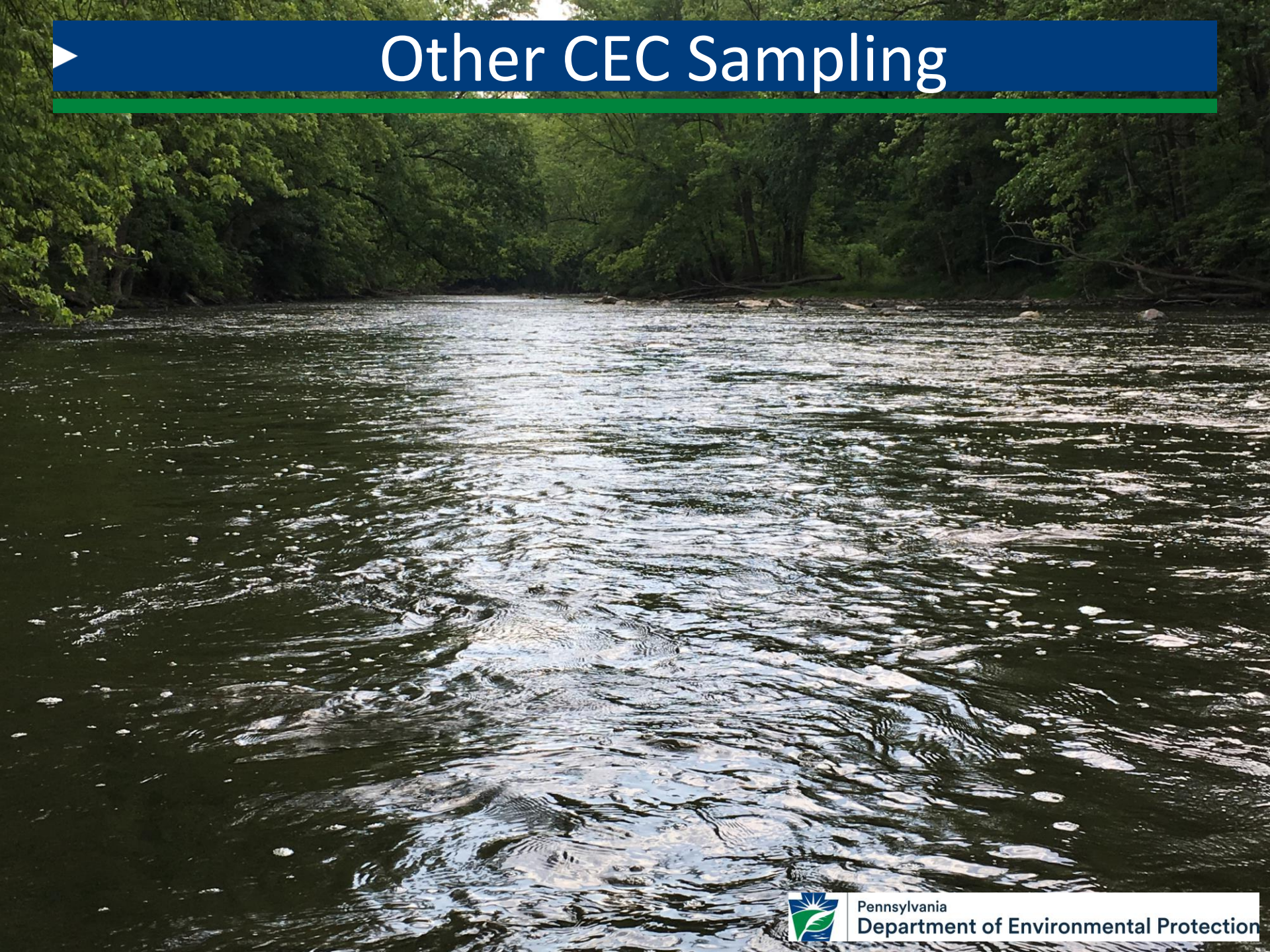
Other CEC Sampling



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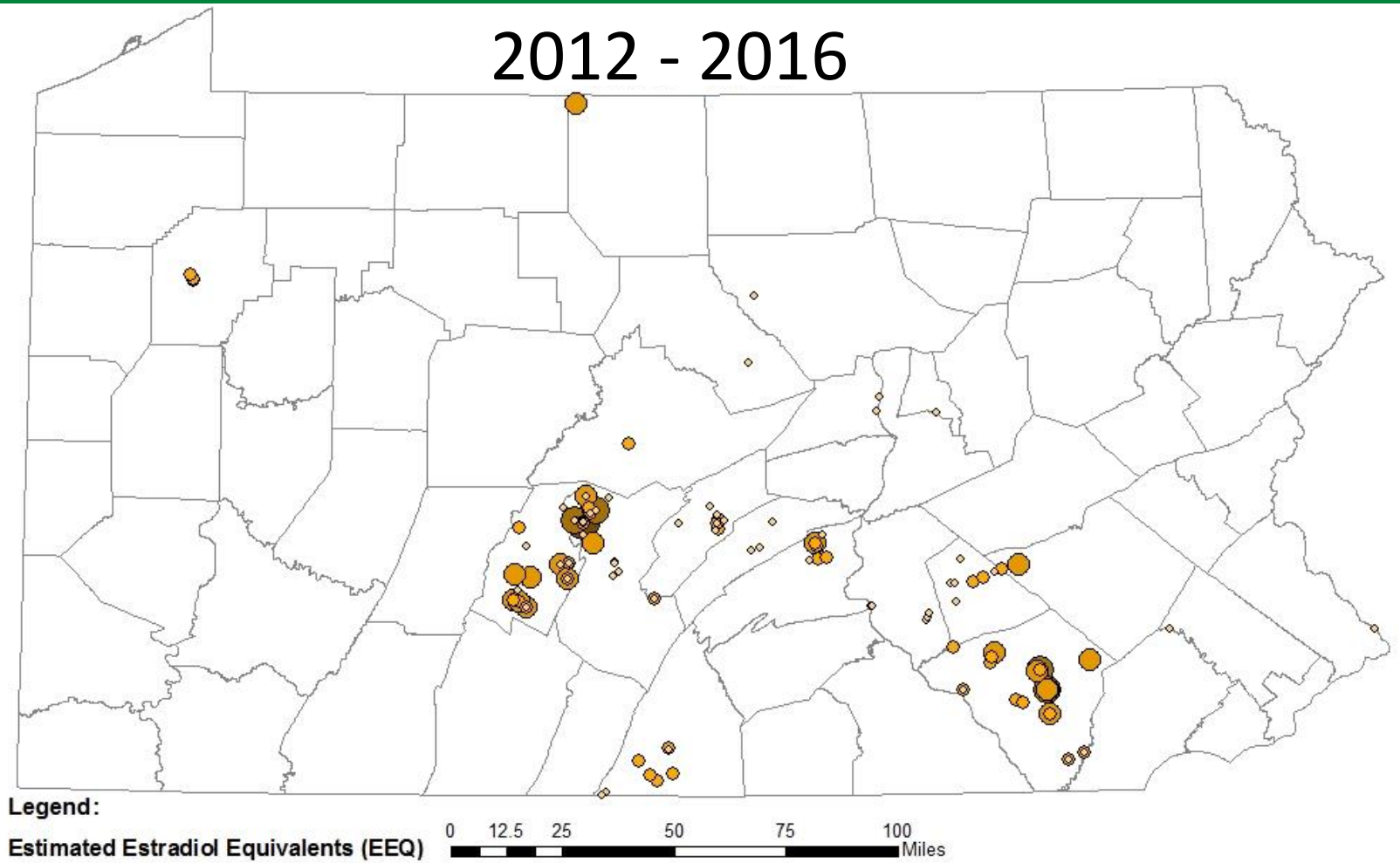
Total Estrogenicity Grab Samples

2012 - 2016



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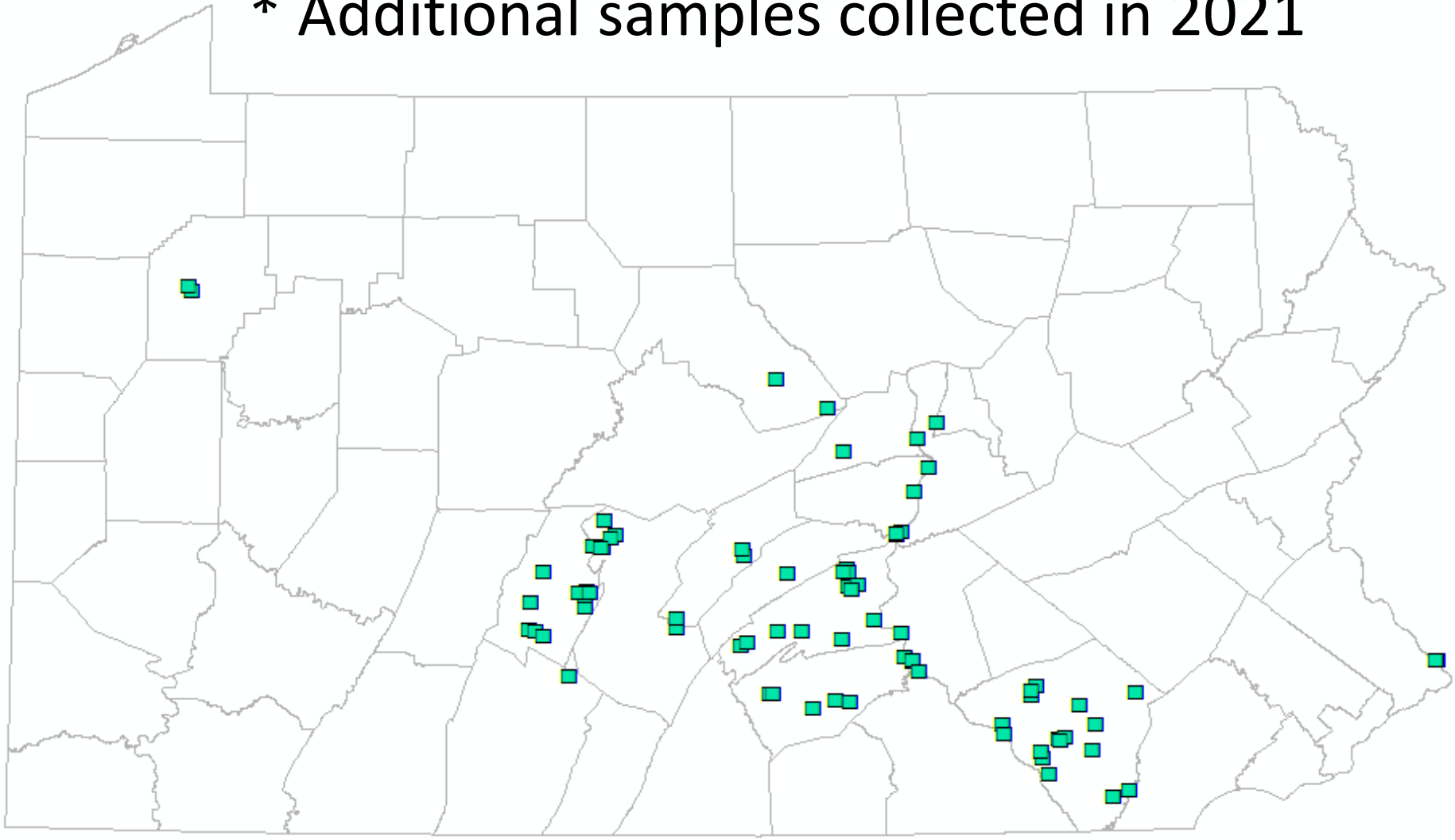
Pesticide Grab Samples 2013 - 2019

* Additional samples collected in 2021



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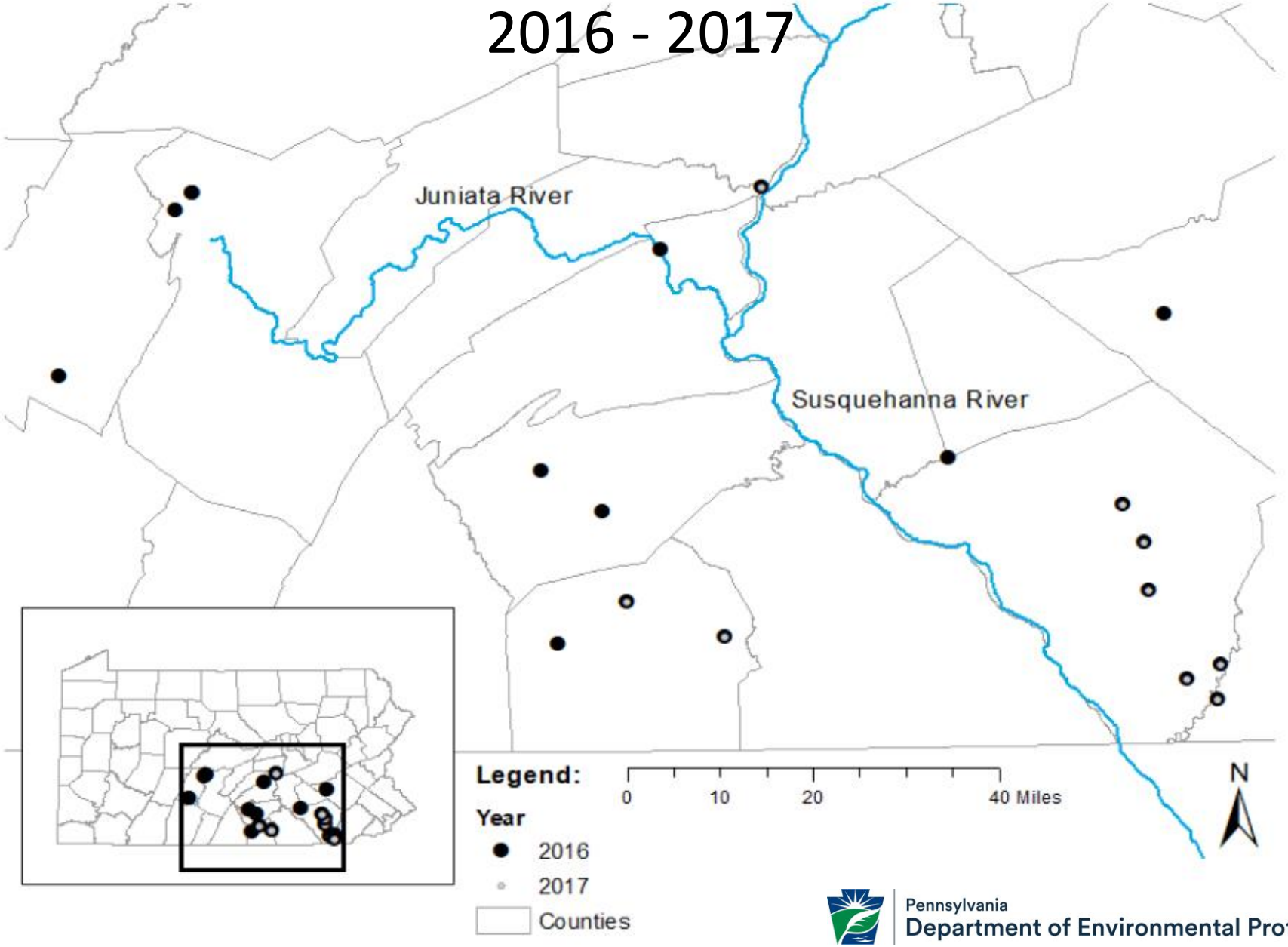
Pesticide Grab Samples 2013 - 2019

- 30 out of 51 pesticides sampled were detected
- 234 out of 244 samples had at least one pesticide detection
- Most commonly detected pesticides were metolachlor, atrazine, CIAT, simazine, prometon, acetochlor
- Highest concentration of a pesticide found at Cold Run, Harteton PA – simazine = 13.6 ug/L (lower than EPA AL acute benchmark)
- Next highest concentrations were atrazine
- Most detections <1 ug/L

Neonicotinoid & Sulfoximine Grabs



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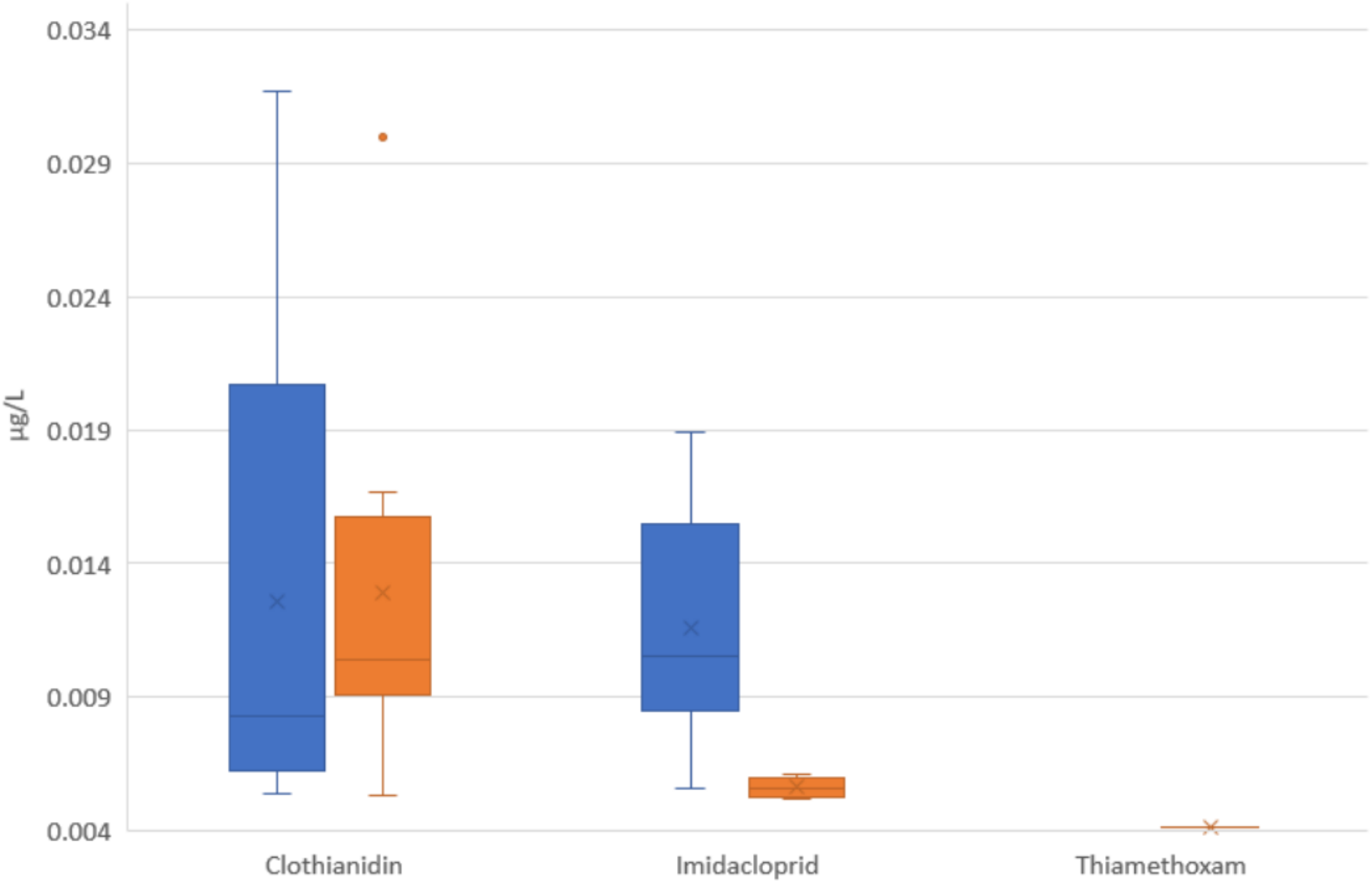
Neonicotinoid & Sulfoximine Grabs



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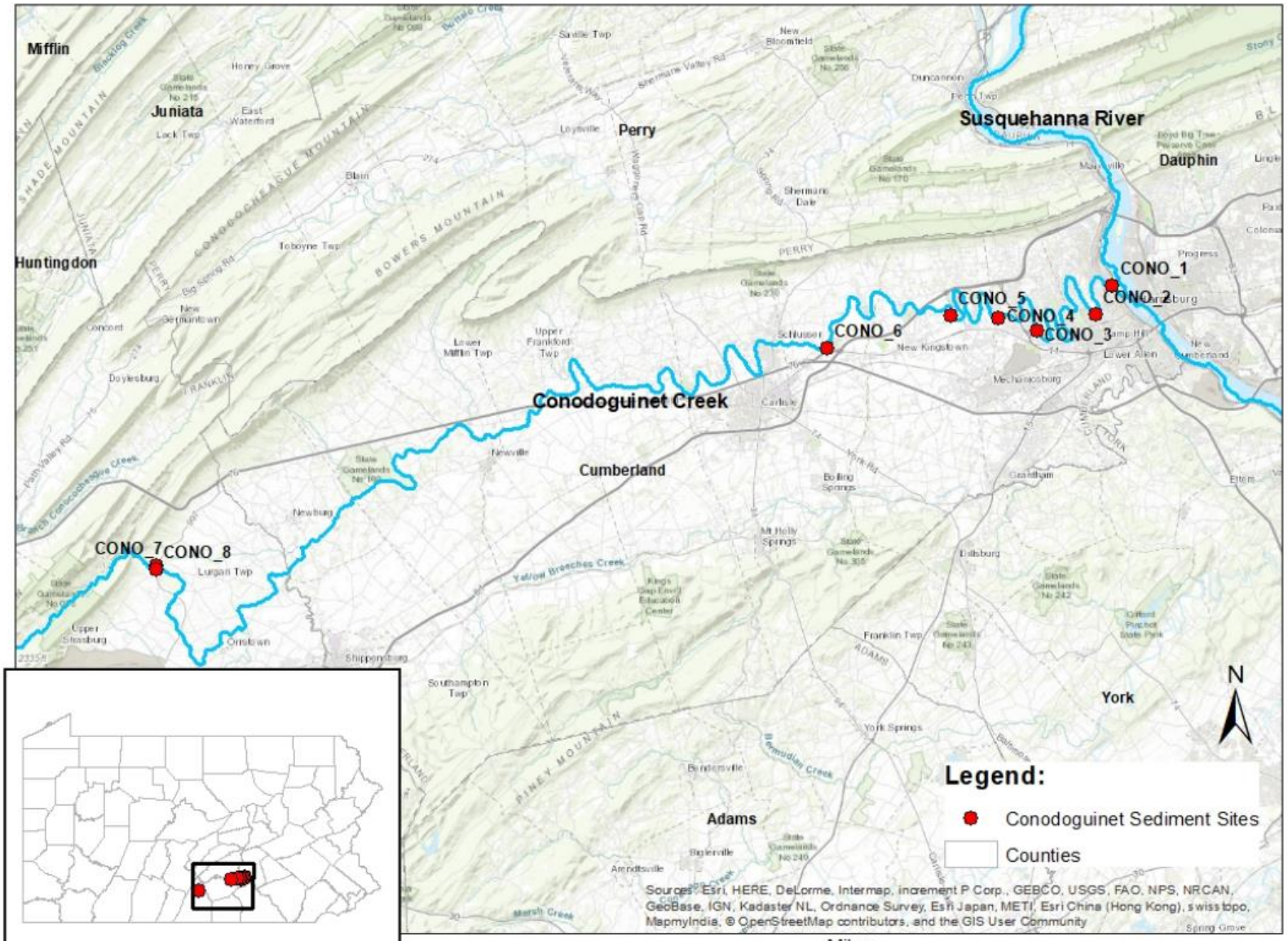
PAH Sediment Samples 2014 & 2016



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PAH Sediment Samples 2014 & 2016

Test Description	Average Concentration of Detects – 2016 (ug/kg)
1-Methylnaphthalene	10.4
2-Methylnaphthalene	14.9
Acenaphthene	15.9
Acenaphthylene	31.5
Anthracene	52.8
Benz(a)anthracene	207.5
Benzo(a)pyrene	233.3
Benzo(b&j)fluoranthenes	296.8
Benzo(e)pyrene	176.1
Benzo(g,h,i)perylene	180.4
Benzo(k)fluoranthene	104.7
Chrysene	282.2
Dibenzo(a,h)anthracene	35.7
Dibenzofuran	13.4
Fluoranthene	490.9
Fluorene	18.3
Indeno[1,2,3-cd]pyrene	196.3
Naphthalene	16.8
Phenanthrene	167.8
Pyrene	446.6

Average concentration of detected PAHs, 2016. Thirteen of these had detections above the USEPA Freshwater Sediment Benchmarks.



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Questions?

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