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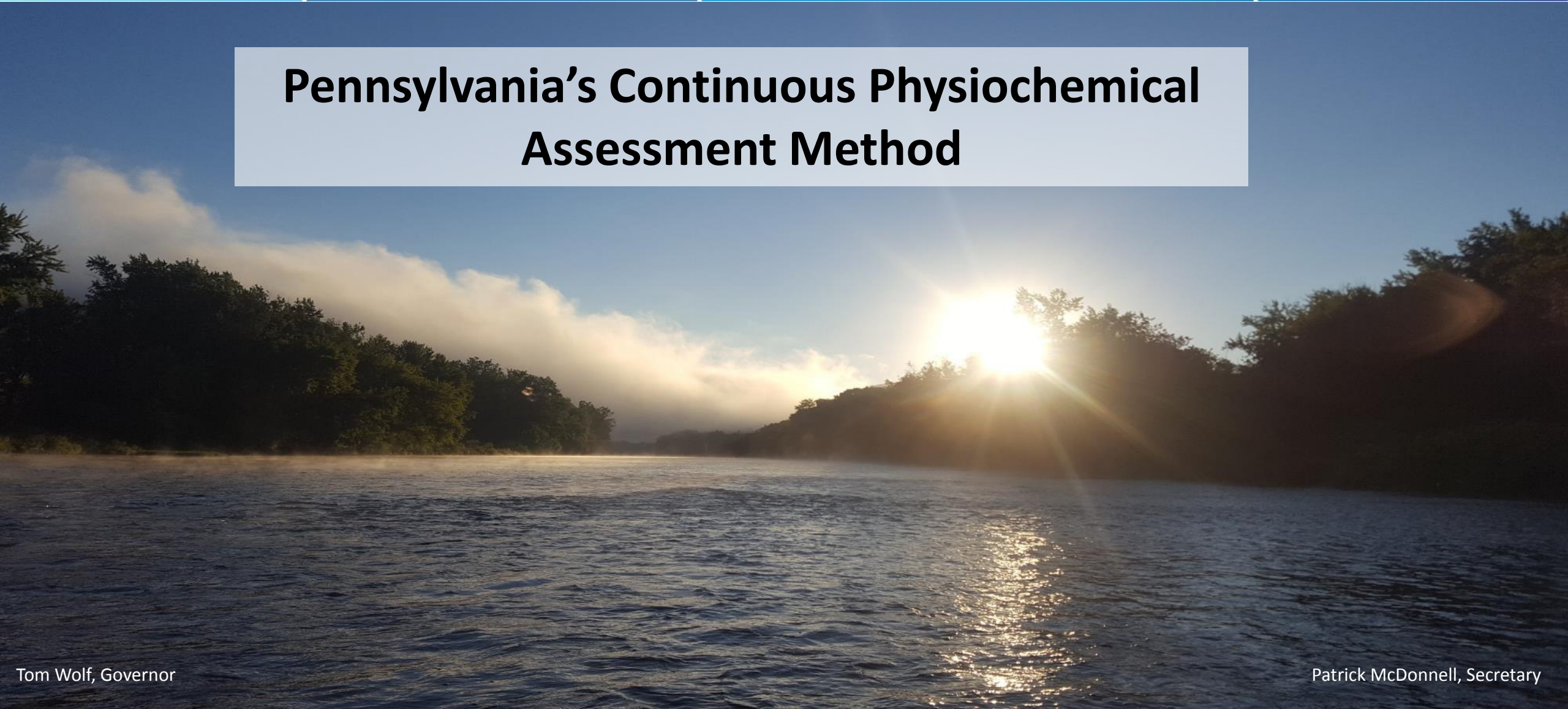
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Clean Water

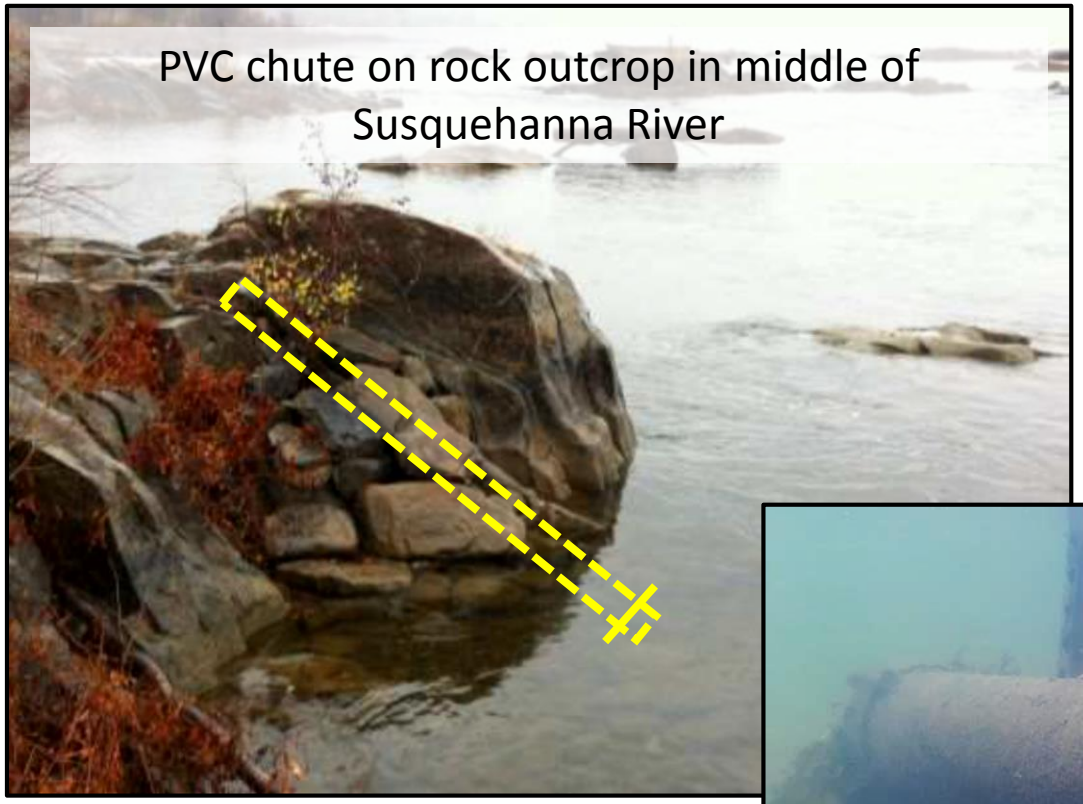
Pennsylvania's Continuous Physiochemical Assessment Method



Tom Wolf, Governor

Patrick McDonnell, Secretary

Data Collection



- Few long-term continuous sites
- No telemetry

- Unique deployments
- Middle channel measurements

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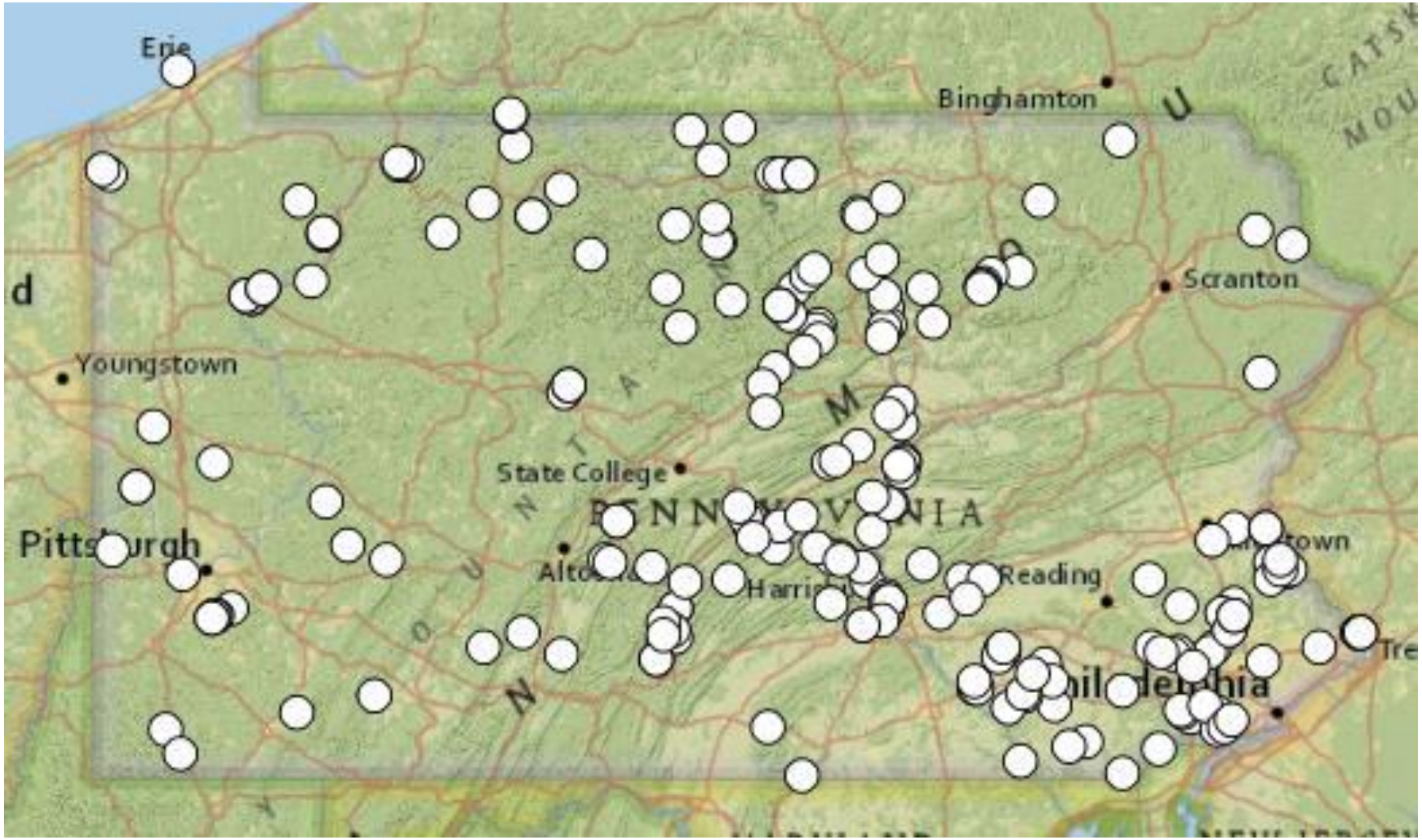
Lots of Sites



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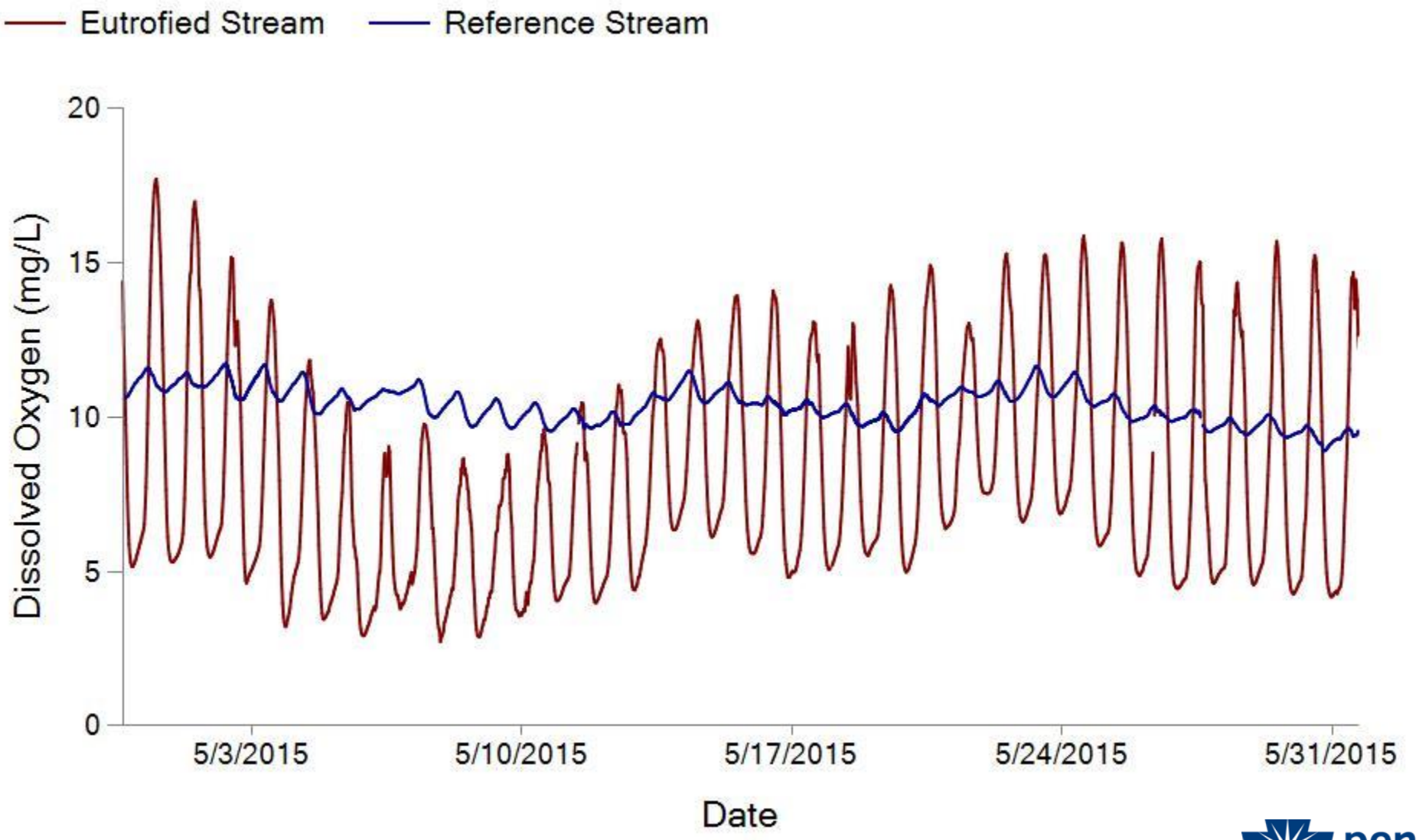
QA/QC Requirements

- Regular fouling and calibration checks
- Discrete readings with independent meter
- Corrections and removal of “bad” data
- Cross-section transects to ensure data are representative.

Uses of Continuous Data

- Characterize background/historic conditions
- Cause and effect studies
- Assessments using established ALU and PWS criteria
- Eutrophication cause determination

Uses: Eutrophication Cause Determination



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Water Quality Standards

§93.7(a), Table 3

- pH: 6.0 - 9.0 units
- Dissolved Oxygen: minimum 5.0 mg/L

Model-derived parameters

- Examples: osmotic pressure (ALU), TDS (PWS)
- Account for uncertainty in model

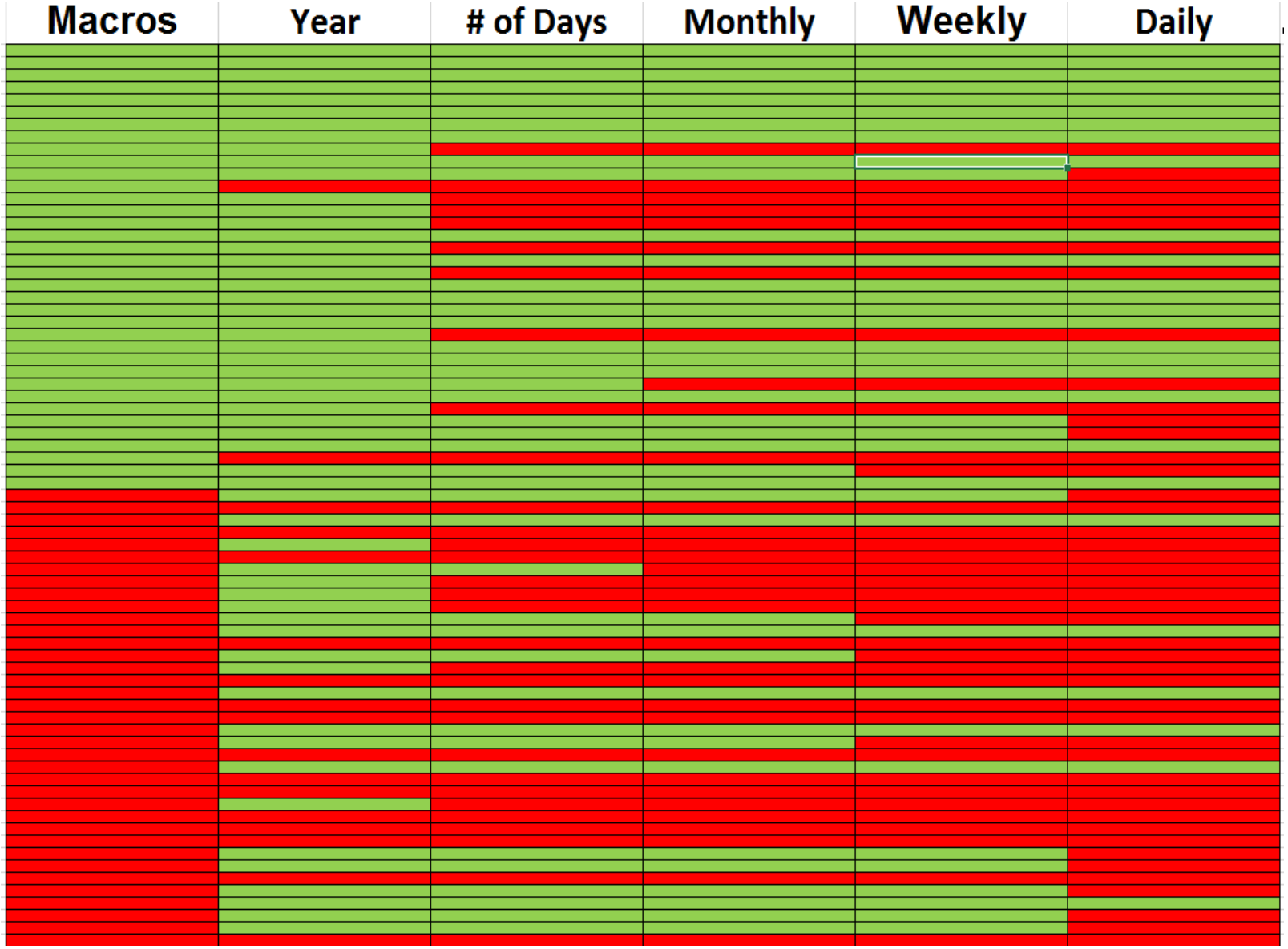
99% Rule

§96.3(c): “[criteria] shall be achieved in all surface waters at least 99% of the time”

Discrete samples

- Sample represents 1 day
- 4 samples = violation (4 days / 365 days = 1.1%)

99% Rule



- Criteria are protective of all aquatic life, not just macros
- Macros are not always the most sensitive organisms

Applying 99% rule over one year has greatest consistency with biology.

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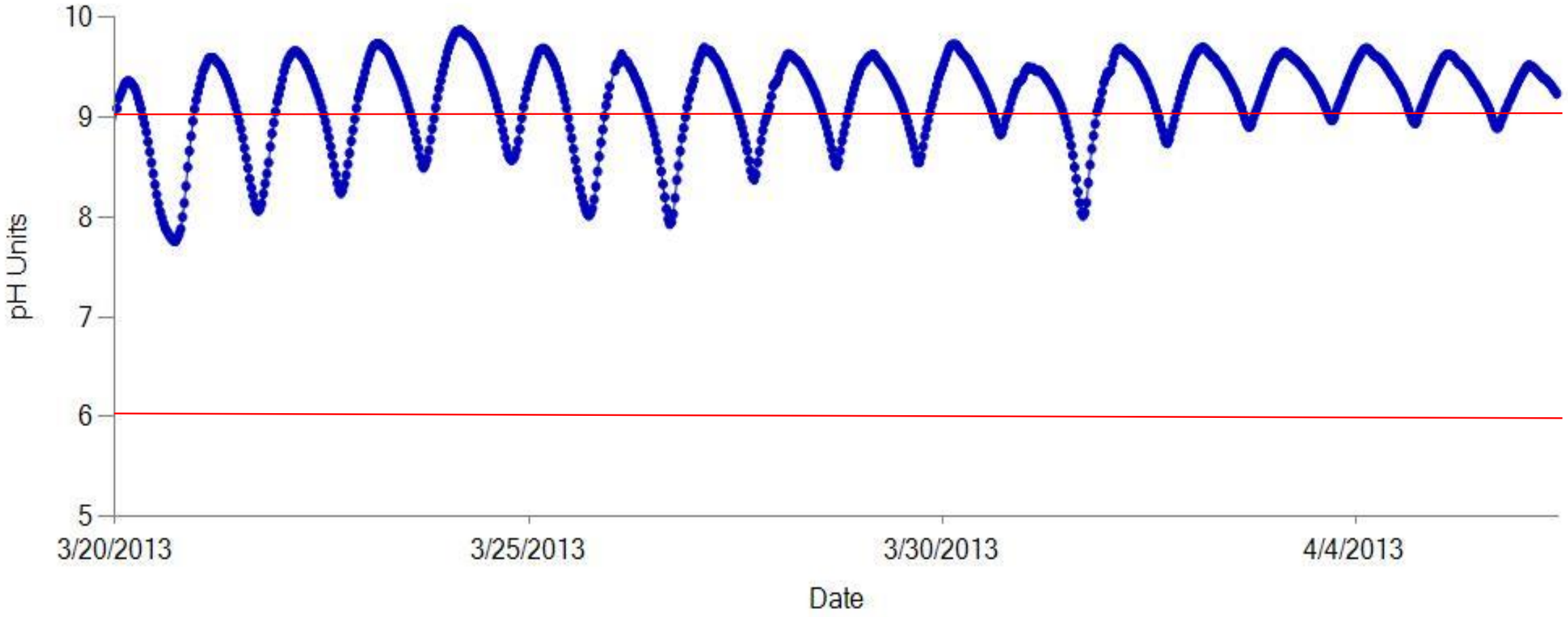
Count Exceedances



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99% with CIM

$$\%Y=100\left[\frac{n*i}{k}\right]$$

Interval	# Readings > 1% of Year
15 min	351
30 min	176
60 min	88

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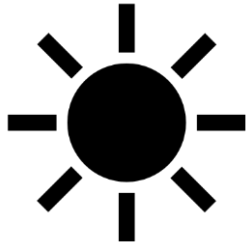
Critical Periods



- Open canopy vs closed
- Pre- vs post-leaf emergence

- Solubility of oxygen

- Moderates conditions
- Scour of photosynthetic organisms

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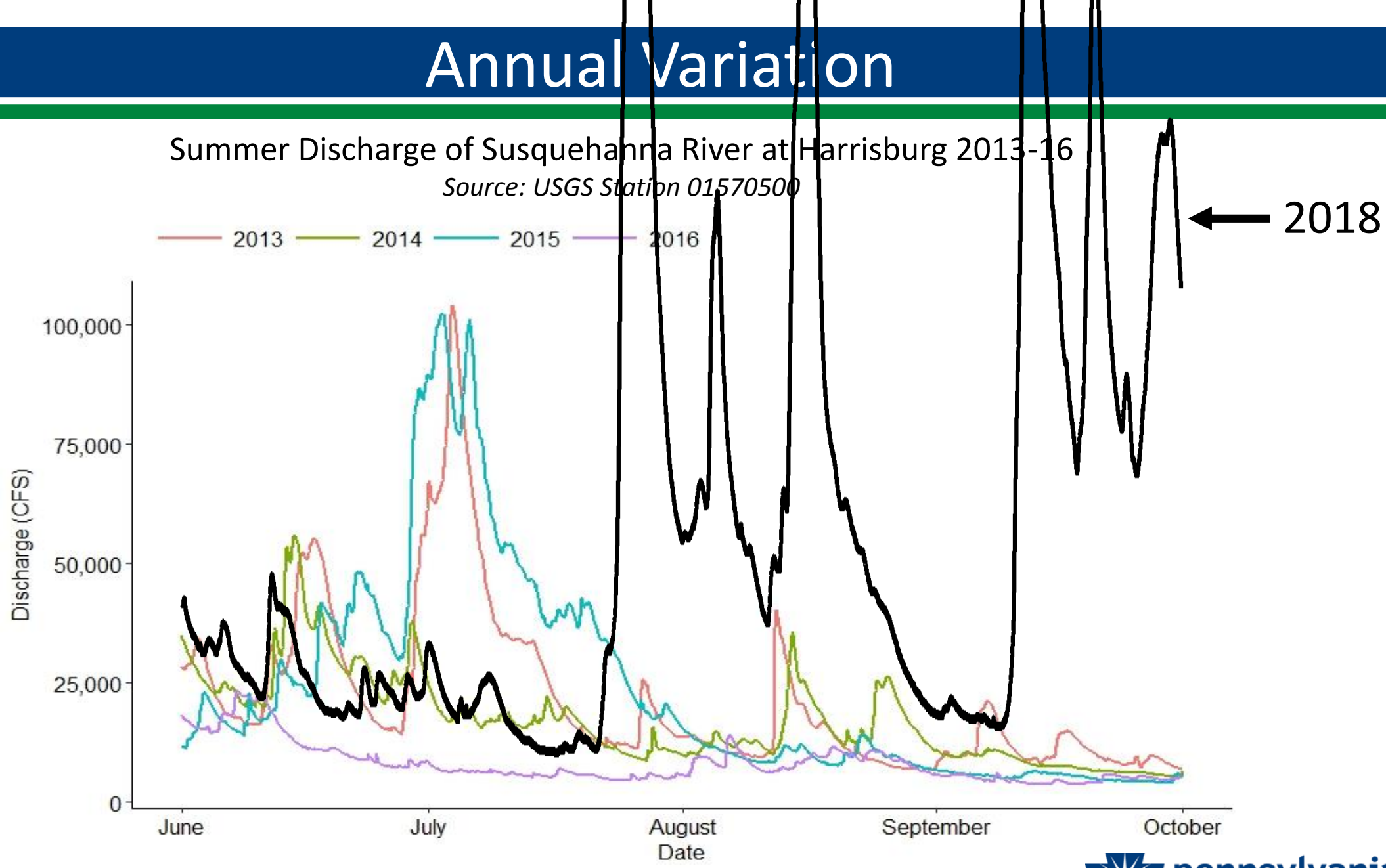
Annual Variation

Summer Discharge of Susquehanna River at Harrisburg 2013-16

Source: USGS Station 01570500



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Model-Derived Parameters

Specific Conductance *Temperature* *Turbidity* *Streamflow* *Julian-day*

Actinomycetes
Alkalinity
Atrazine
Bicarbonate
Boron
Calcium
Chloride
Dissolved nitrate
Dissolved nitrate + nitrite
Dissolved orthophosphorus

Dissolved phosphorus
Dissolved solids
E. coli
Enterococci bacteria
Fecal coliform bacteria
Fluoride
Hardness
Magnesium
Particulate phosphorus
Sodium

Sulfate
Suspended sediment
Total nitrogen
Total organic carbon
Total organic N + NH3
Total phosphorus
Total suspended solids

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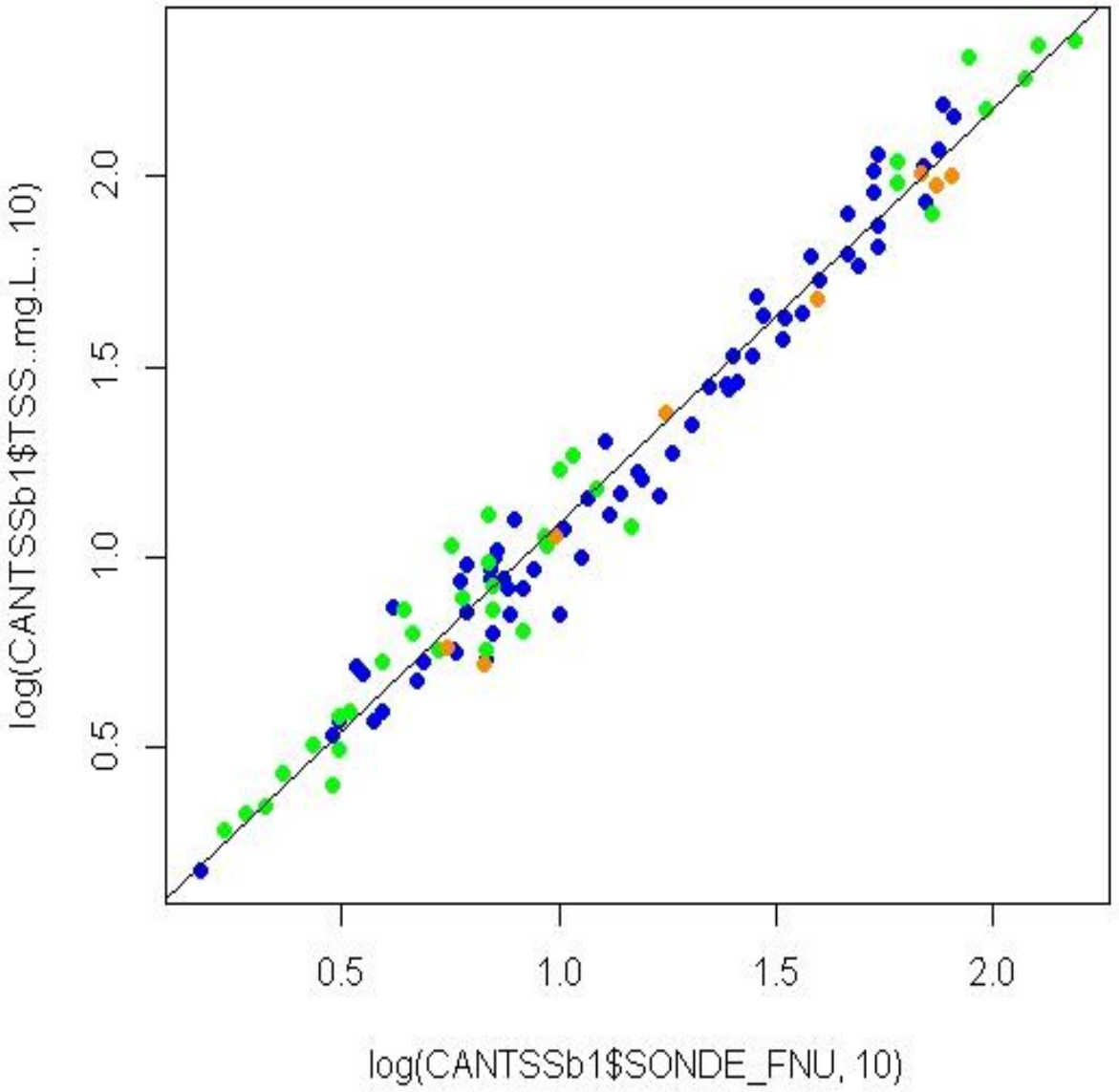
Model-Derived Parameters



- EPA supported
- USGS guidelines
- Discrete samples
  - Over-top of sonde
  - Cover range of values
- Site specific

Probability of Exceedance ***≥ 90%***

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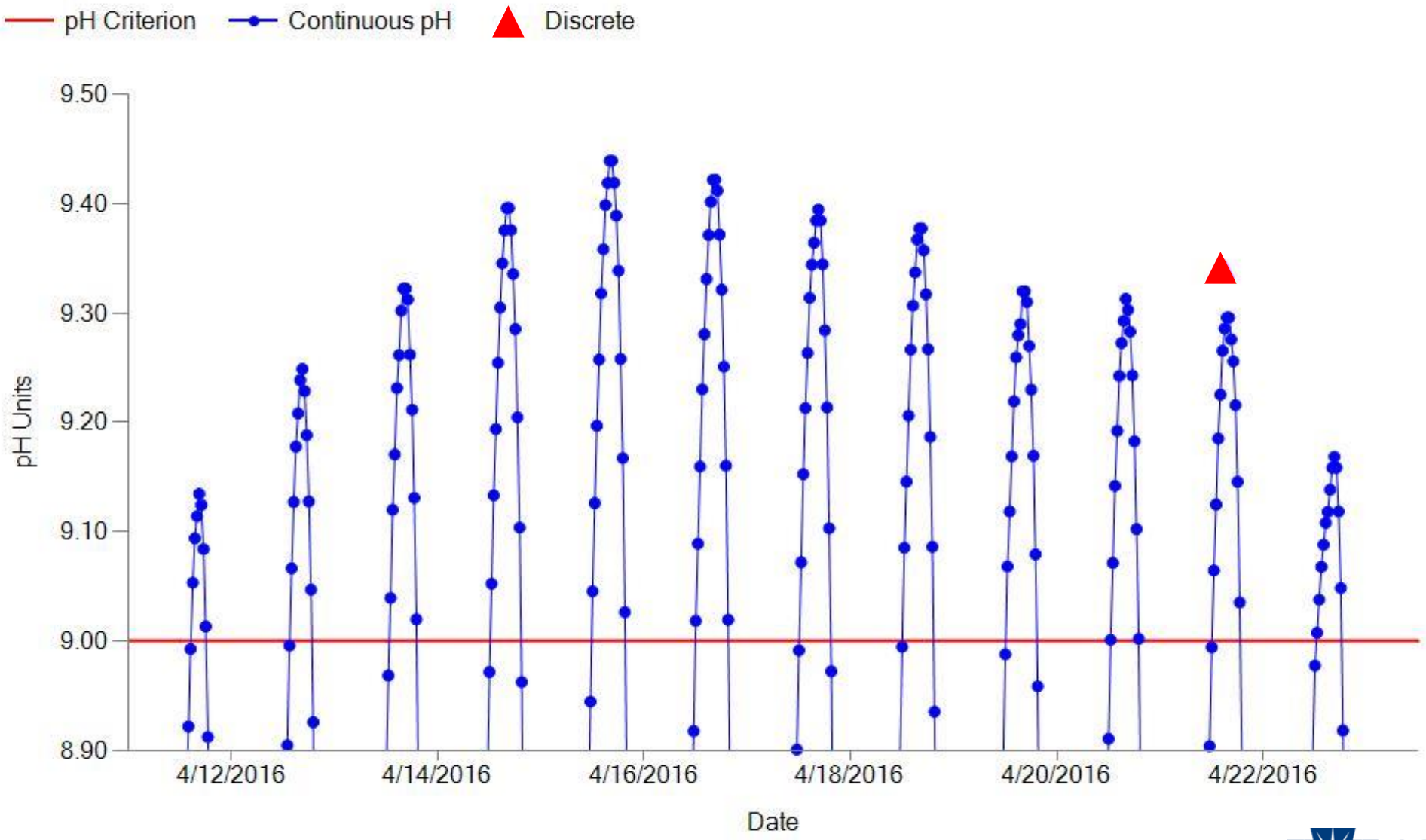
Delineating Spatial Extent



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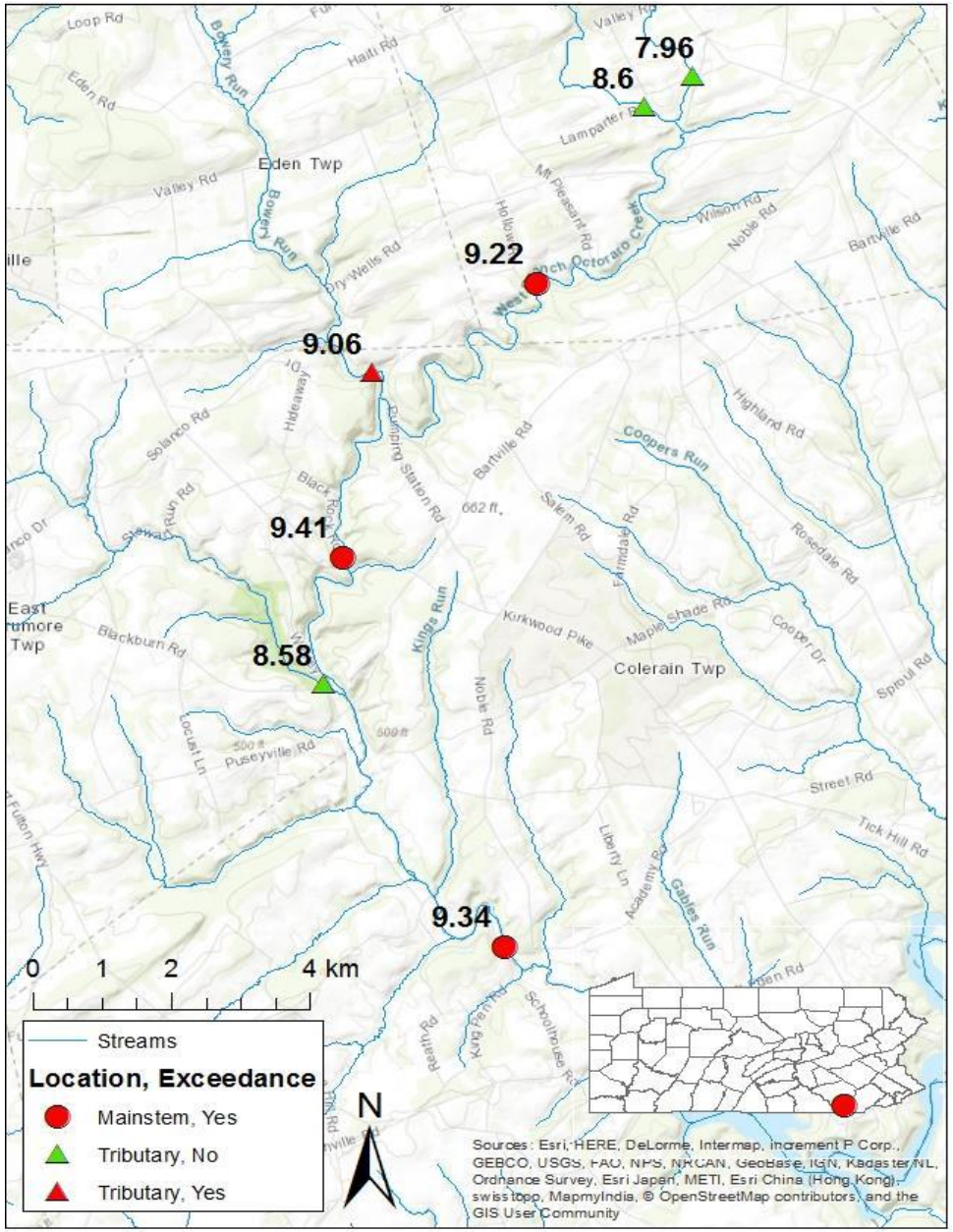
Delineating Spatial Extent



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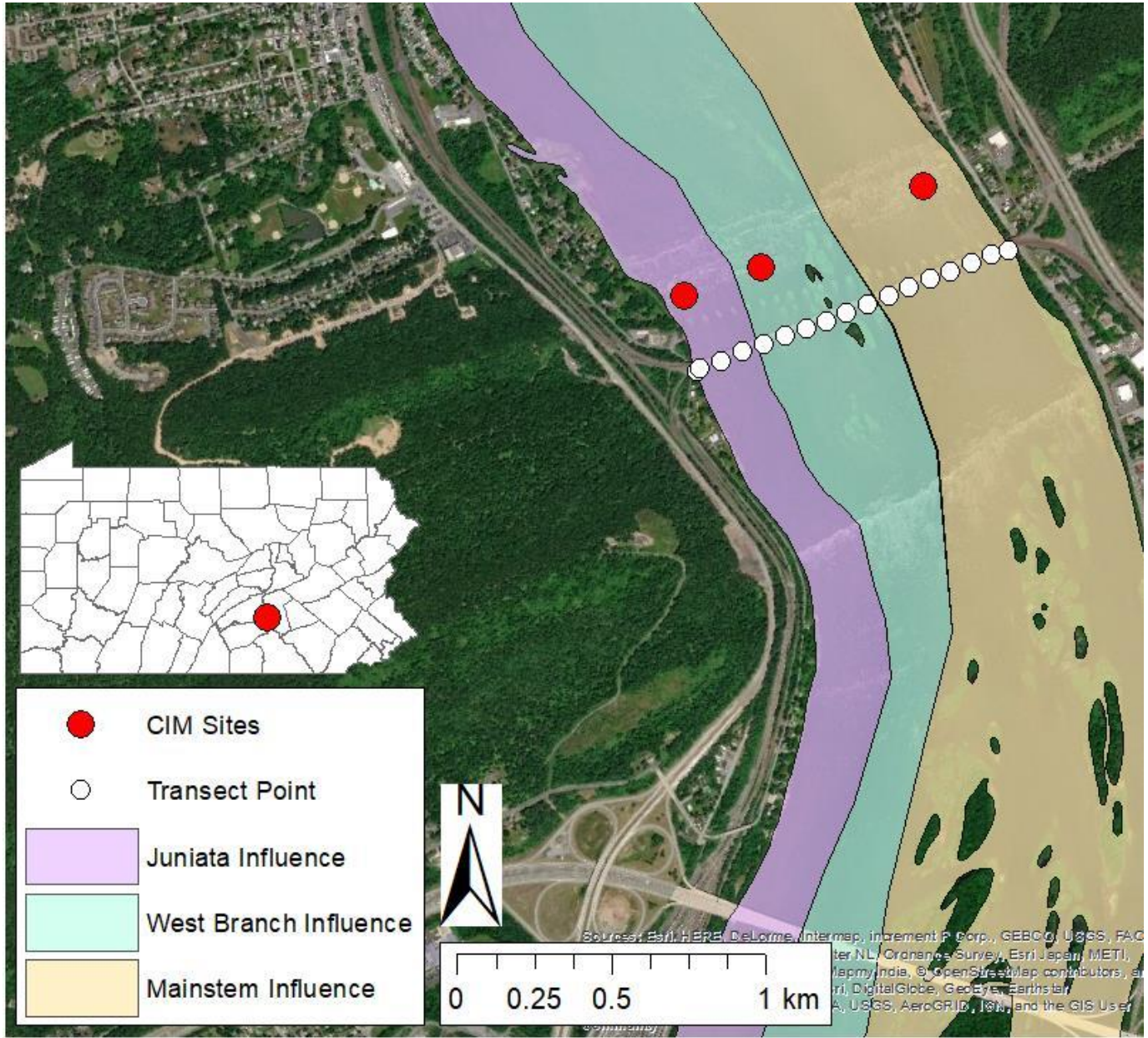
Delineating Spatial Extent – Non-Mixed Rivers



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Method Summary

1. Collect CIM data
2. QA procedures (corrections, transects, etc.)
3. Assessment decision
   - Count exceedances of criterion
   - Convert to percentage of a year
   - Not attaining if > 1% of a year
4. Determine spatial extent through discrete data
5. Characterize conditions for reference in future surveys or reassessments

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Questions or Comments

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Bureau of Clean Water
Division of Water Quality

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Finalized continuous data available at:
https://www.depgreenport.state.pa.us/Data/

Protocols and methods can be found in Pennsylvania's Monitoring and Assessment books at:
https://www.dep.pa.gov/Business/Water/CleanWater/WaterQuality/