Open Water Response to Geographic Nutrient Loads

Gary Shenk, Emily Trentacoste, Richard Tian, John Wolf

3/25/2019

Existing Measure of Relative Effectiveness

Key factors:

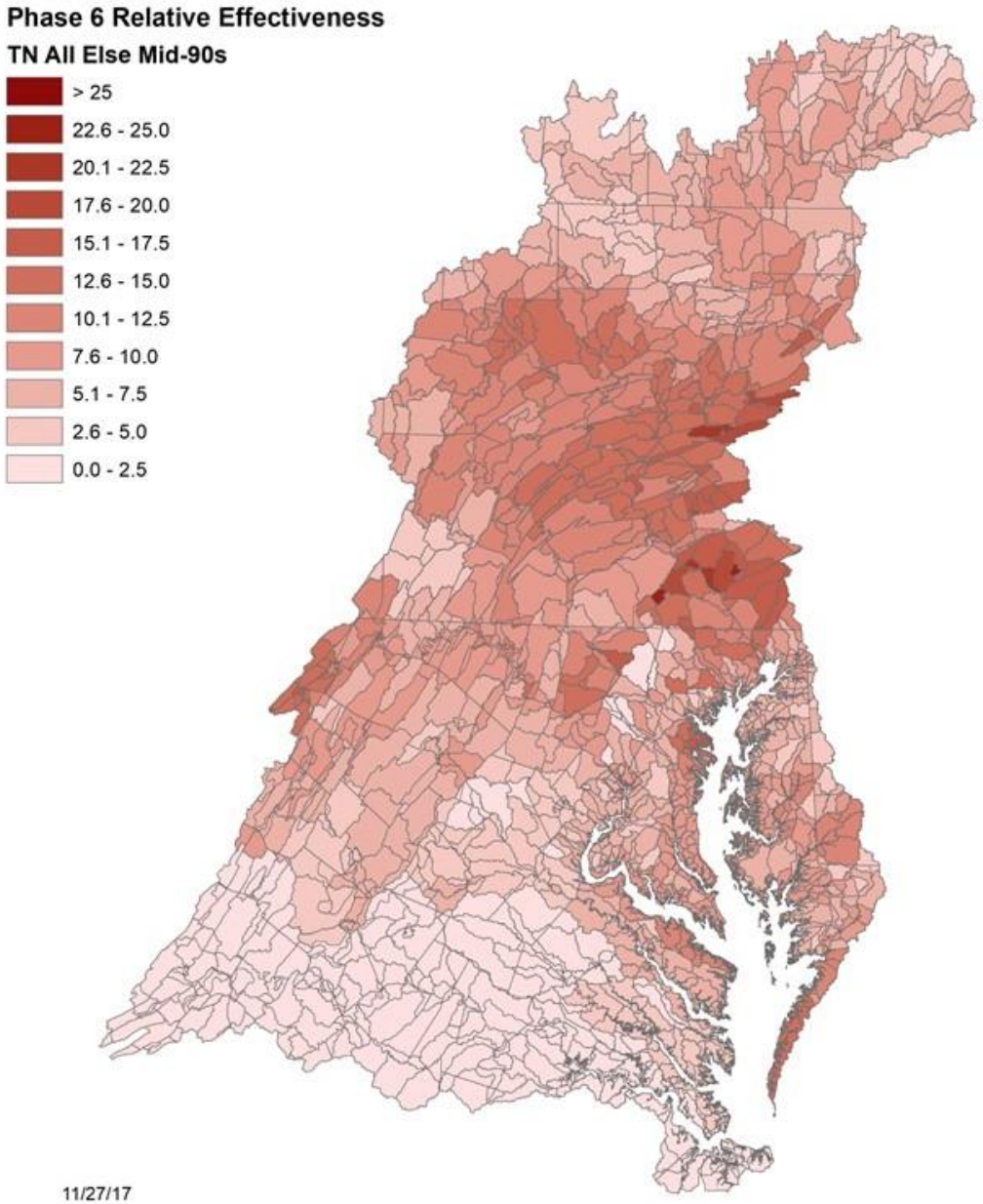
Watershed Transport

- Watershed Characteristics
- Travel time
- Existence of impoundments

Position along mainstem bay

- Estuarine circulation

Existence of riverine estuary



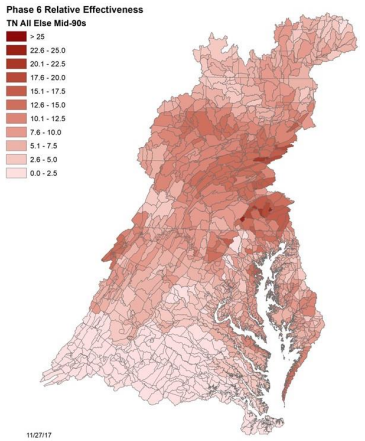
Watershed delivery:
Pound delivered per pound produced
Estuarine delivery
Oxygen reduced per pound delivered
Overall Effectiveness
Oxygen reduced per pound produced

Presented to WQGIT 10/22/2018

Expand to Open Water

- Existing relative effectiveness for planning targets:
  - Deep Water and Deep Channel
  - CB3MH, CB4MH, CB5MH, POTMH

- Goal is to provide a tool for the partnership to visualize the source of load for each Tidal Segment



Presented to WQGIT 10/22/2018

Outcome of October Meeting

- Base the visualization on Chlorophyll
  - Nutrients can increase oxygen in the surface layer due to phytoplankton growth
  - Chlorophyll is related to both oxygen and clarity
- Completion by early 2019

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Method

- 5 million lbs of N or 0.5 Mlbs/yr P added each year by an annual coefficient to the loads in that CBSEG
- Separate PS and NPS runs
- Change in Chlorophyll concentration to the depth of the long-term surface mixed layer average
- June through September

- Multiply by watershed delivery

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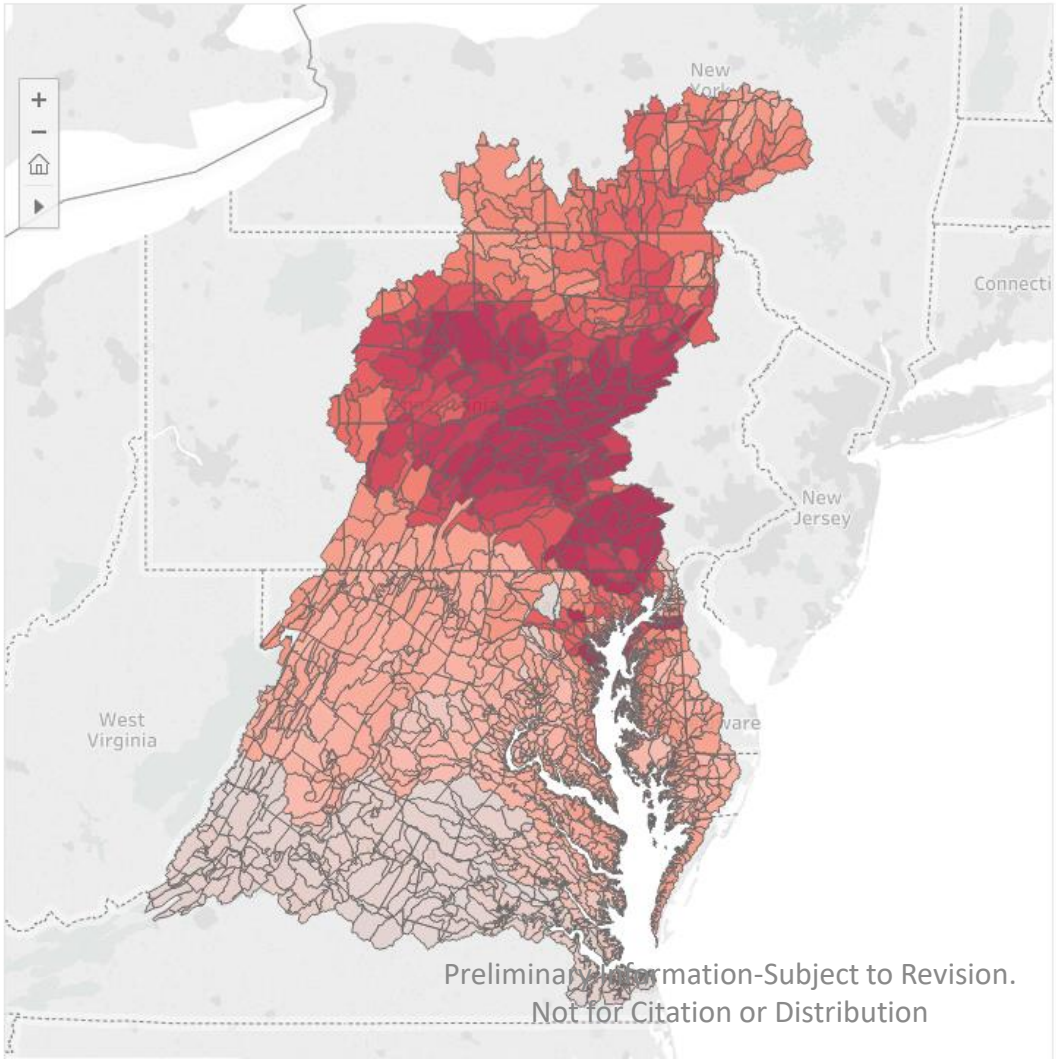

Pollutant (N or P)

P

N

Pollutant (N or P)

Source (PS or NPS)

NPS

PS

Monitoring Segment (CBSEG)

CB3MH

Total Effectiveness

-100.0 100.0

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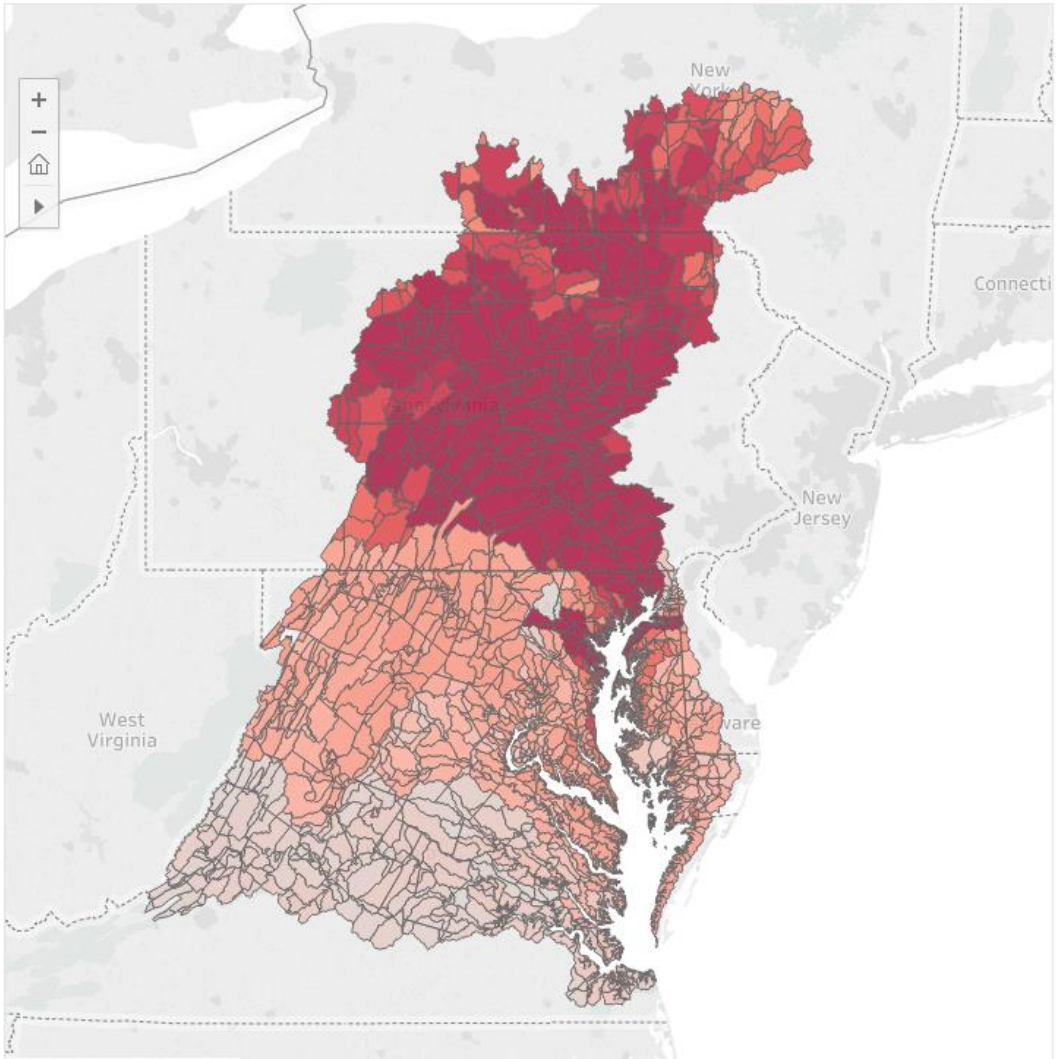

Pollutant (N or P)
- P
- N

Source (PS or NPS)
- NPS
- PS

Monitoring Segment (CBSEG)
CB3MH

Total Effectiveness
-100.0 100.0

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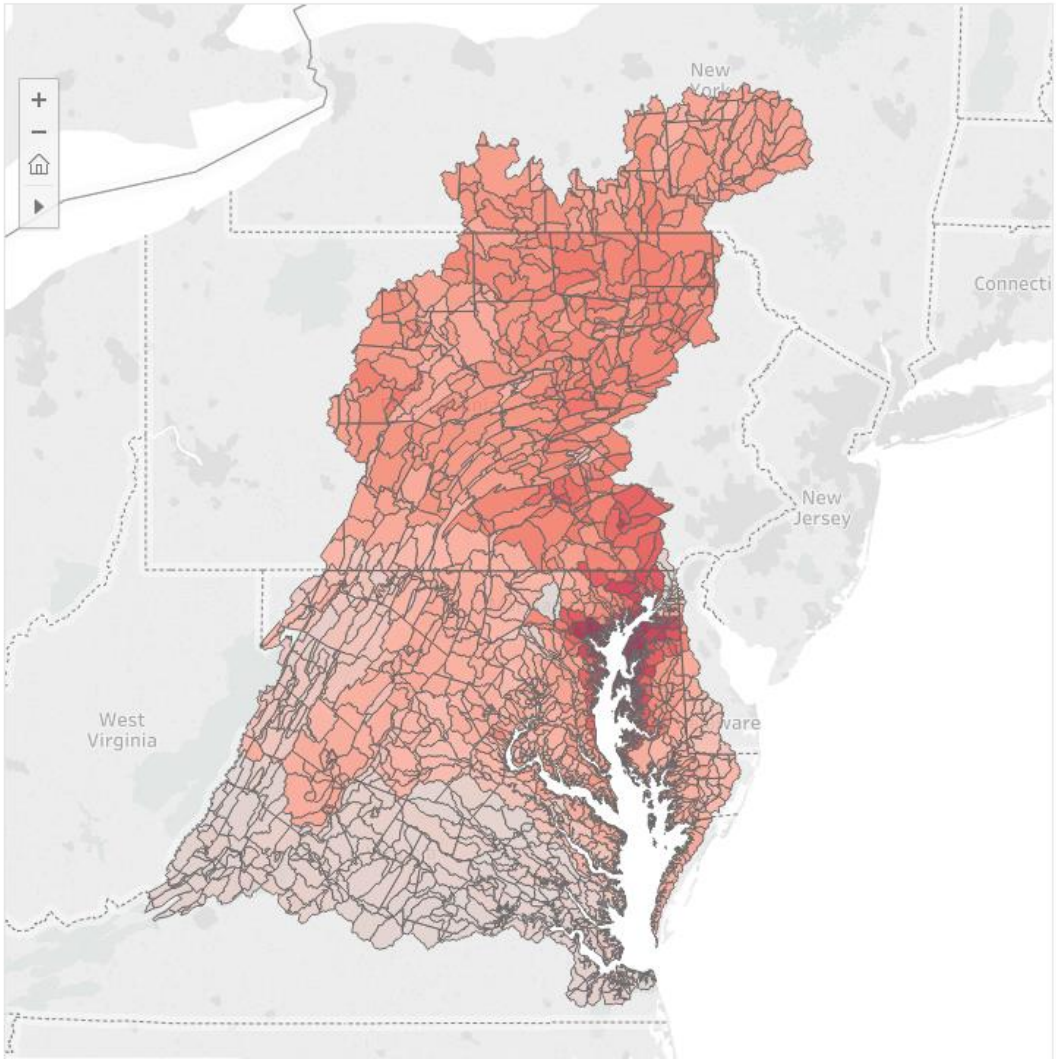

Pollutant (N or P)
- (•) P
- ( ) N

Source (PS or NPS)
- (•) NPS
- ( ) PS

Monitoring Segment (CBSEG)
CB3MH

Total Effectiveness
-100.0 — 100.0

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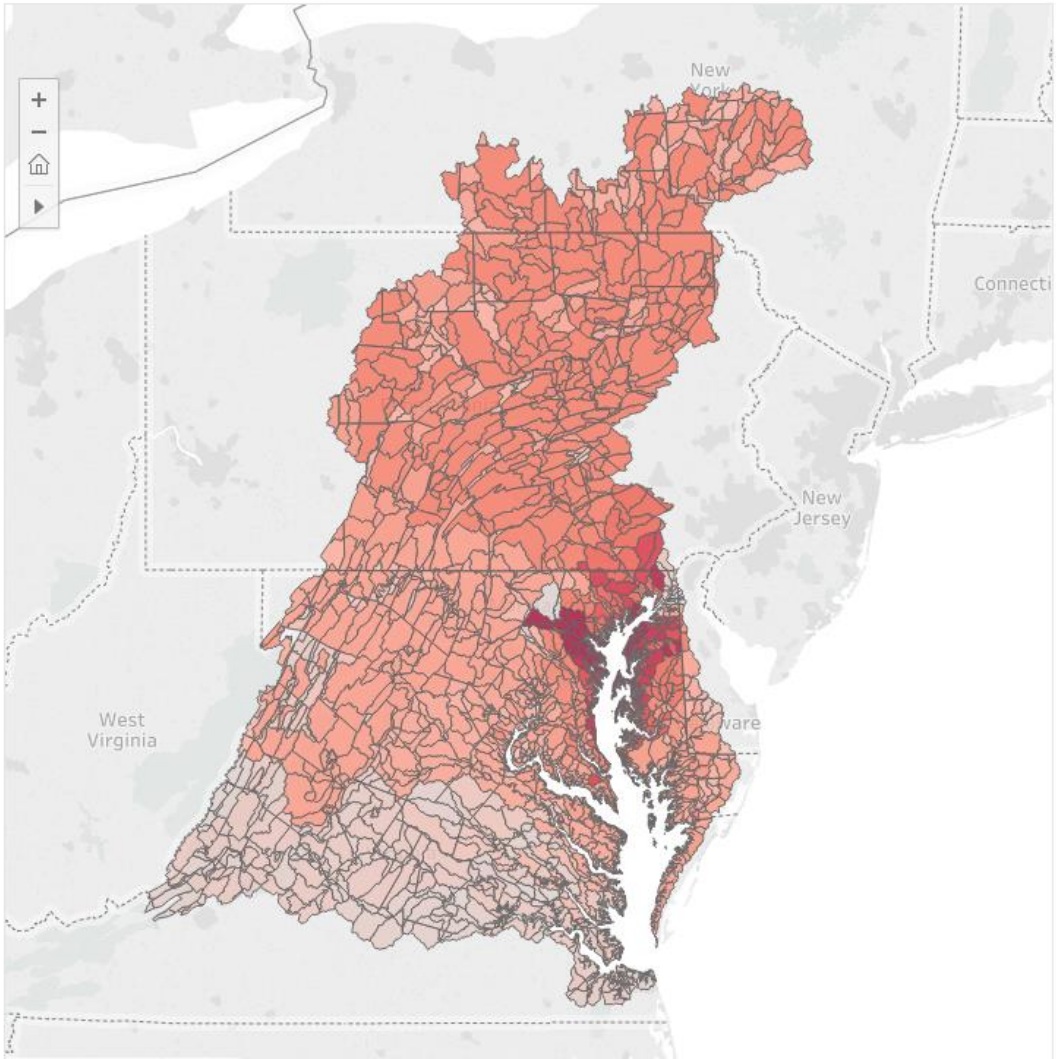

Pollutant (N or P)

- (•) P
- ( ) N

Source (PS or NPS)

- ( ) NPS
- (•) PS

Monitoring Segment (CBSEG)

CB3MH

Total Effectiveness

-100.0 — 100.0

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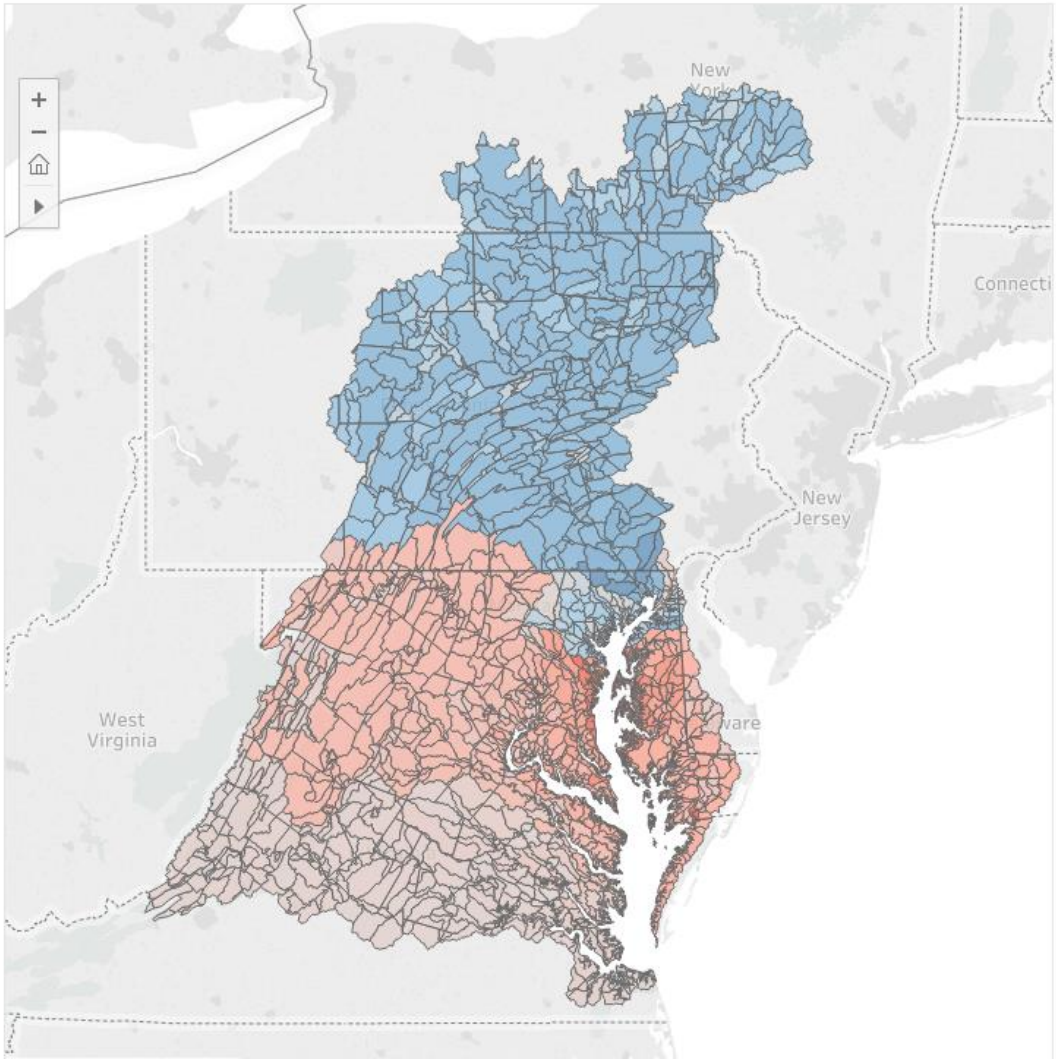

Pollutant (N or P)
- (•) P
- ( ) N

Source (PS or NPS)
- ( ) NPS
- (•) PS

Monitoring Segment (CBSEG)
CB4MH

Total Effectiveness
-100.0 100.0

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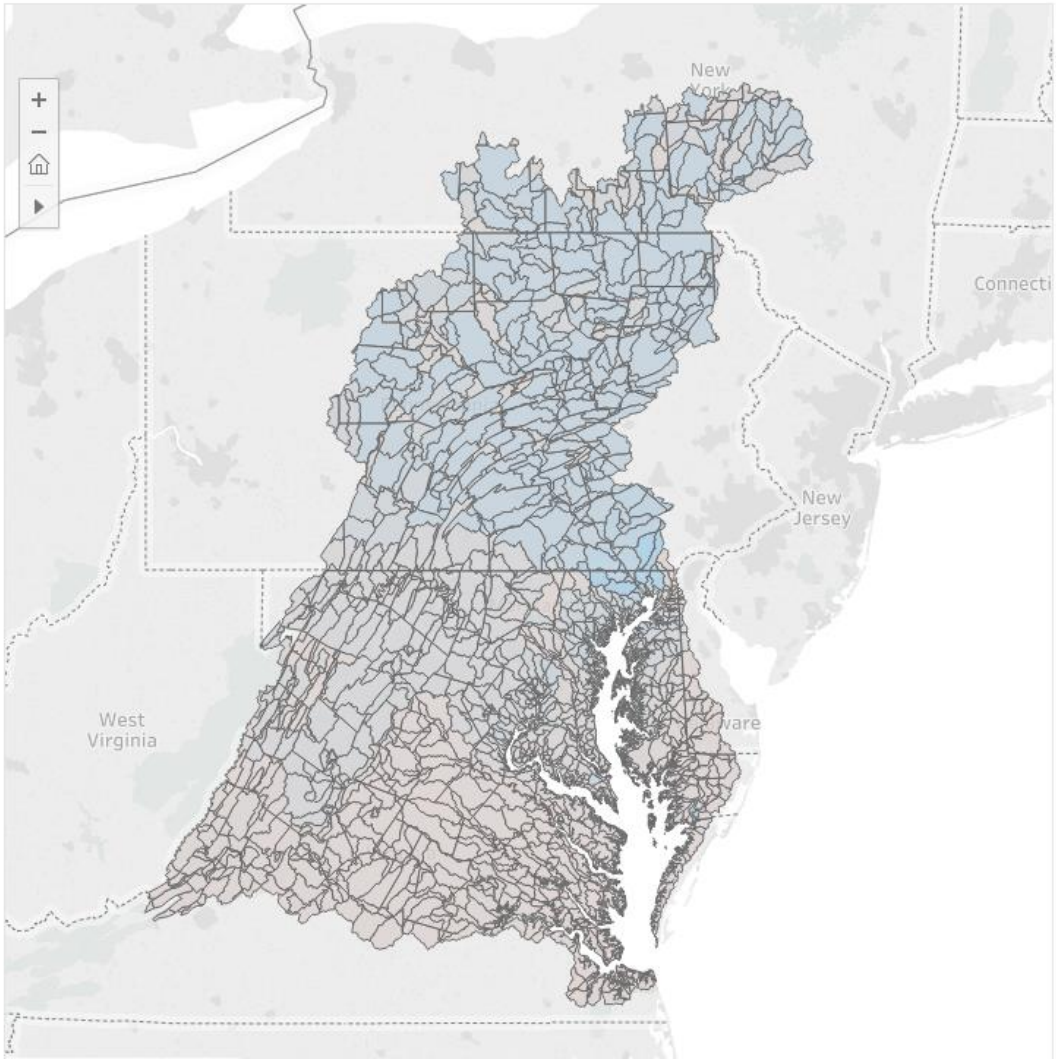


Pollutant (N or P)
- (•) P
- ( ) N

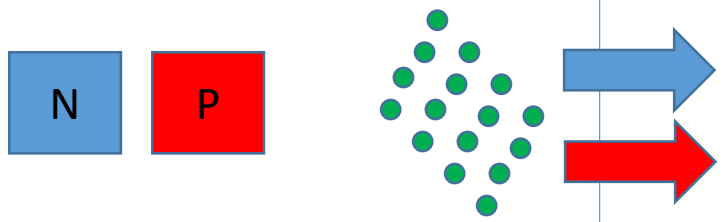
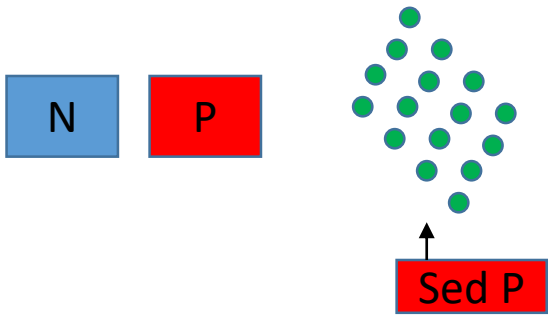
Source (PS or NPS)
- ( ) NPS
- (•) PS

Monitoring Segment (CBSEG)
CB8PH

Total Effectiveness
-100.0 100.0

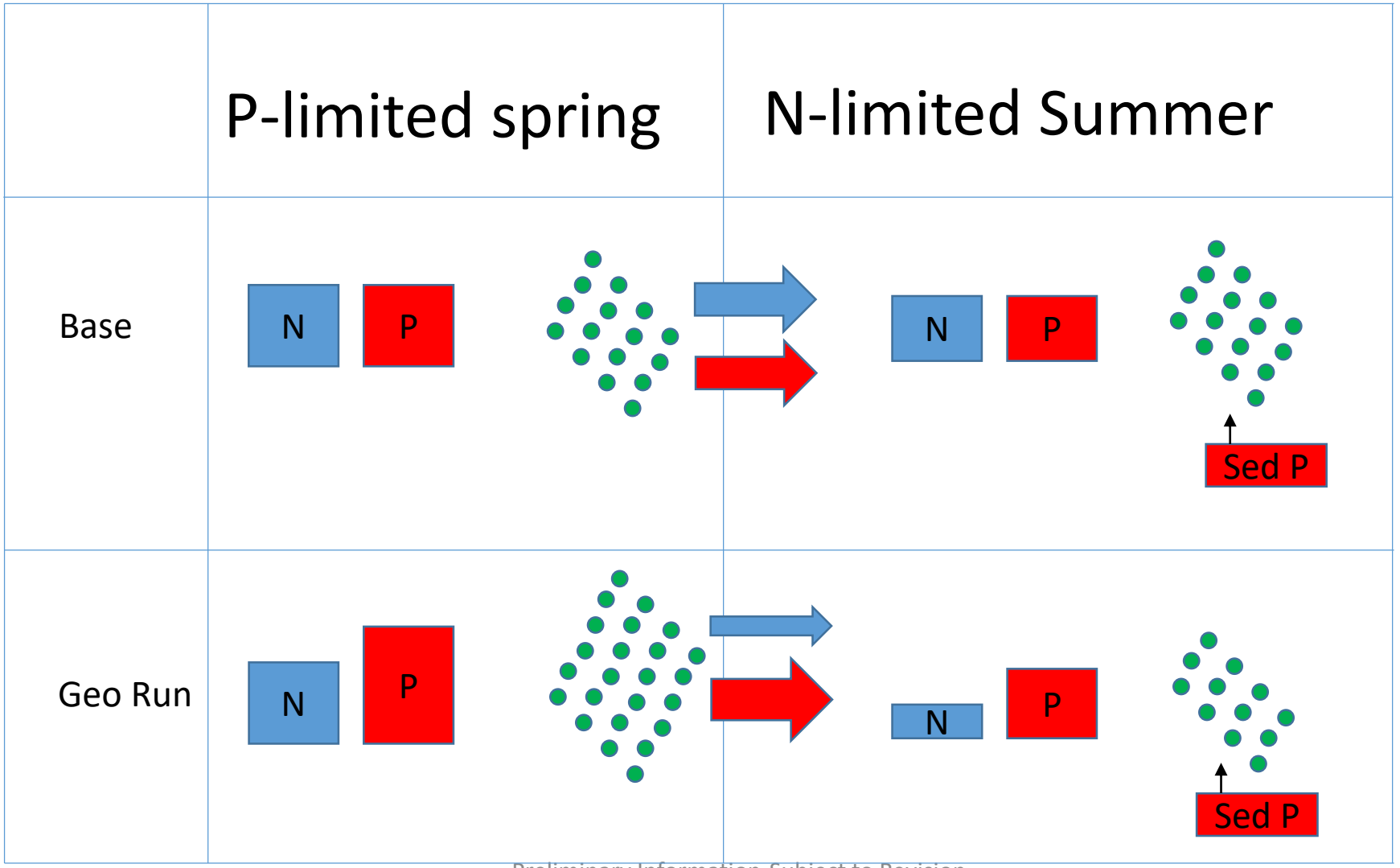
Ideas from Rebecca Murphy, Jeremy Testa, Danny Kaufman and others

Possible temporal limitation effect

	P-limited spring	N-limited Summer
Base		

Ideas from Rebecca Murphy, Jeremy Testa, Danny Kaufman and others

Possible temporal limitation effect



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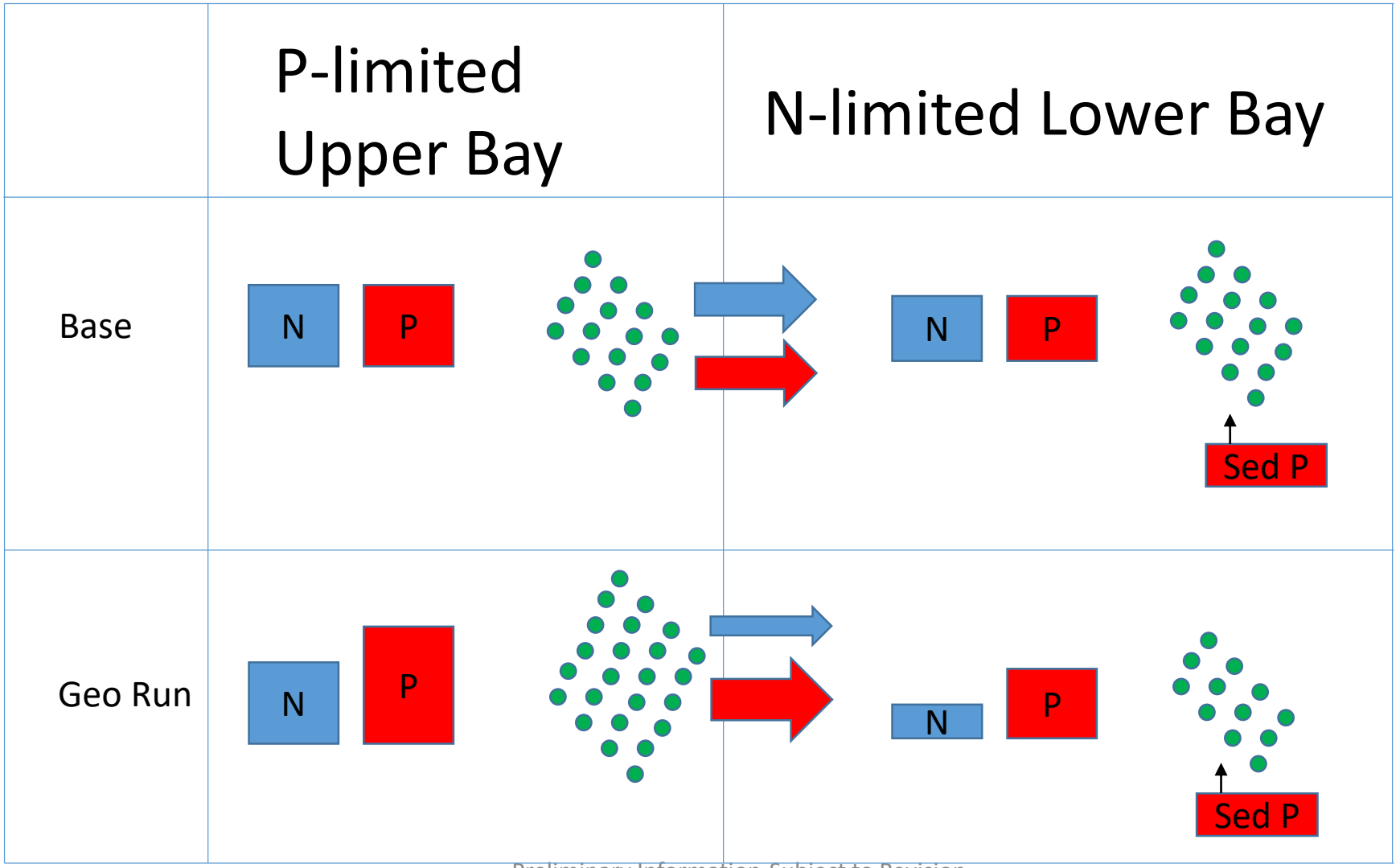
Possible spatial limitation effect



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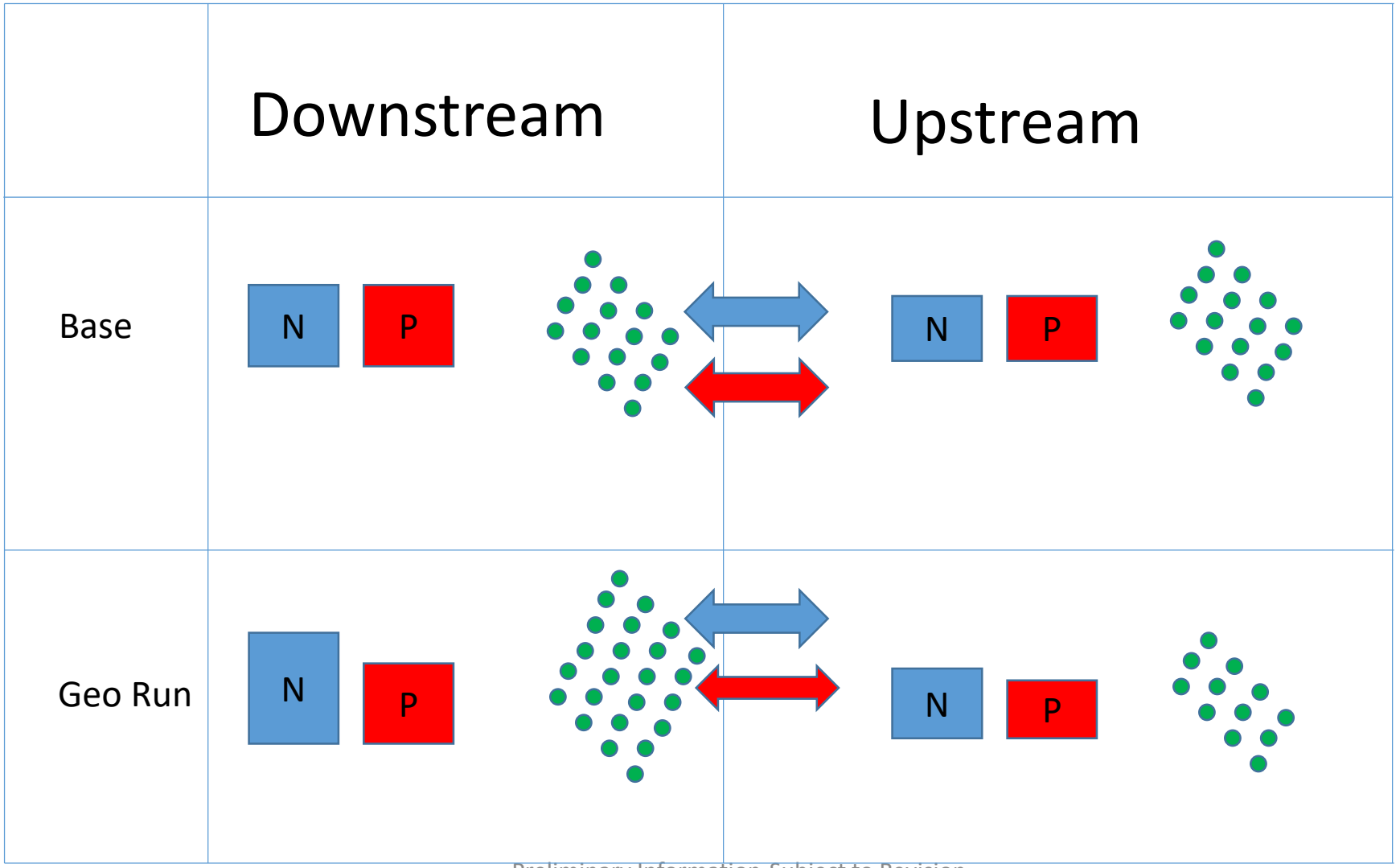
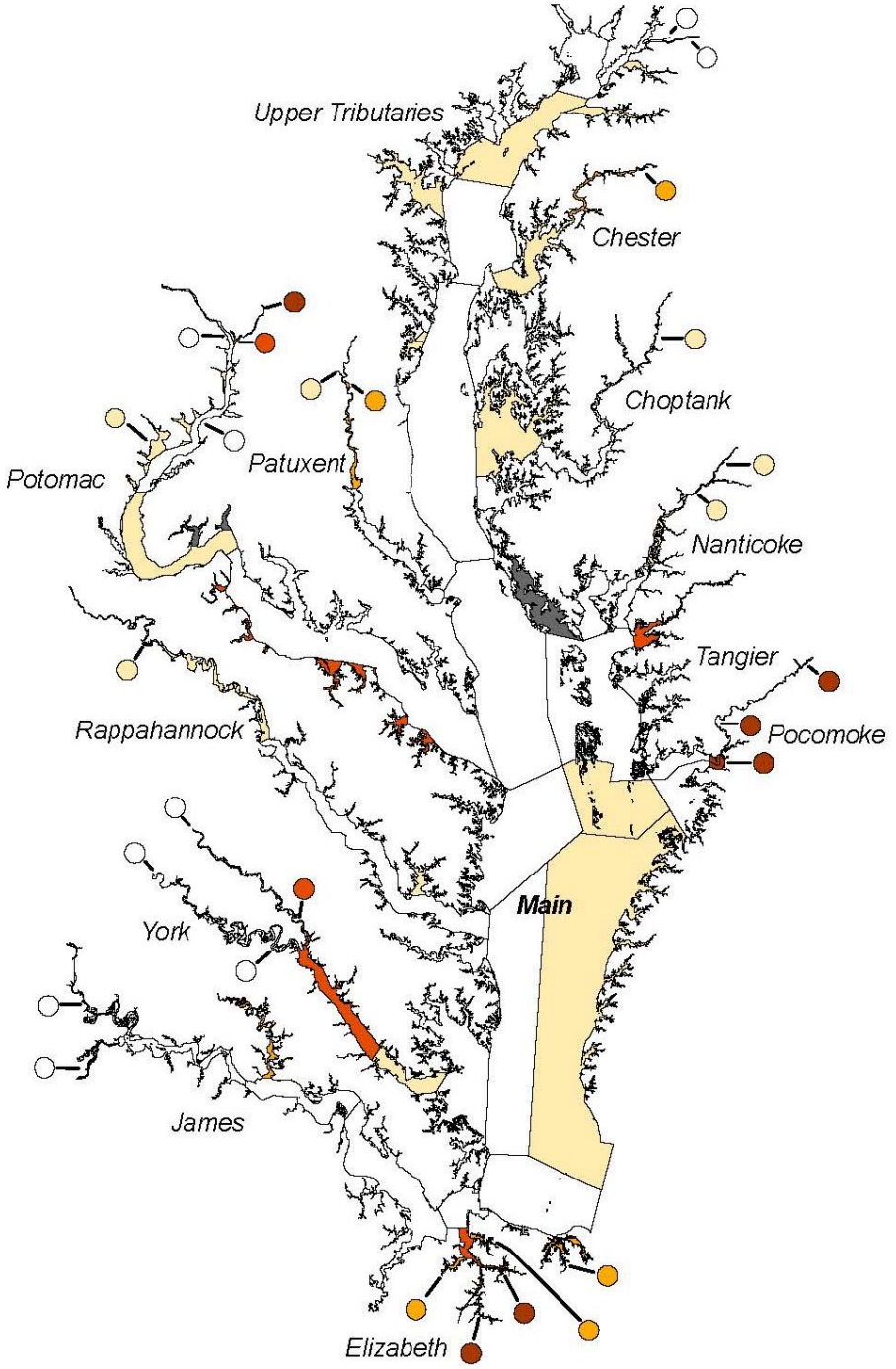
Works for downstream as well



Current Open Water DO Attainment 2014-2016

Attainment Deficit (2014-2016)

- No data
- Attaining (no deficit)
- -0.1 to -5%
- -5.1% to -15%
- -15.1% to -25%
- -25.1% to -85%
- Designated use N/A



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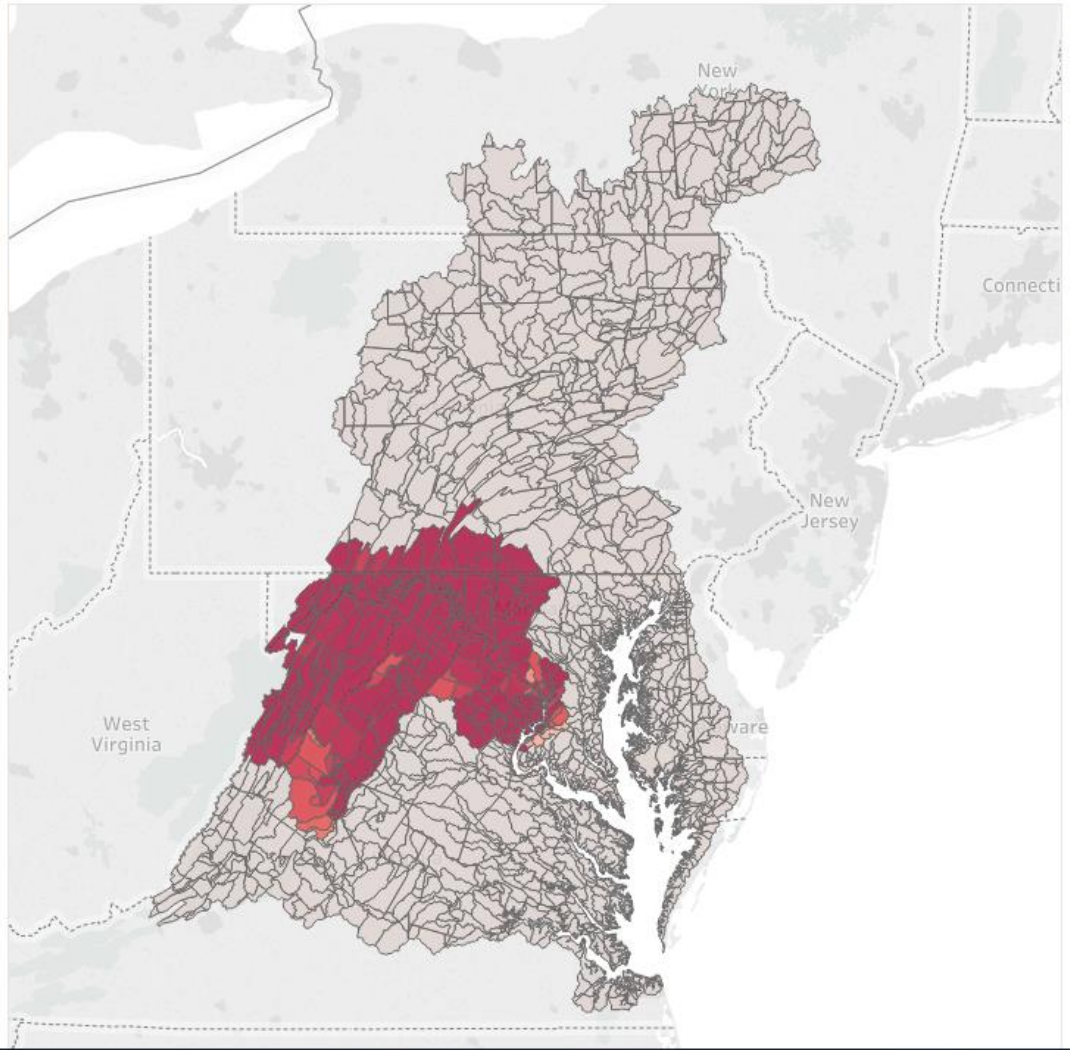

Pollutant
P
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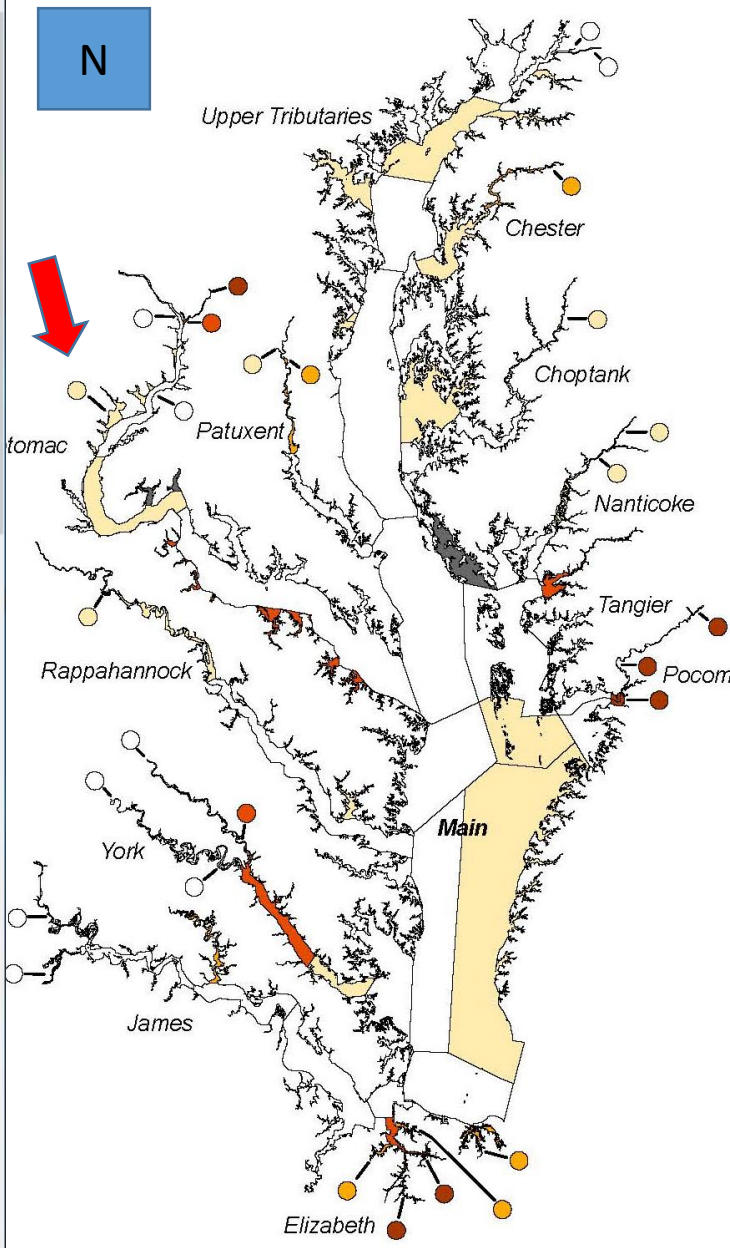
Source (PS
NPS
PS

Monitorin
POVTF

Total Effe
-100.0

Potomac TF VA



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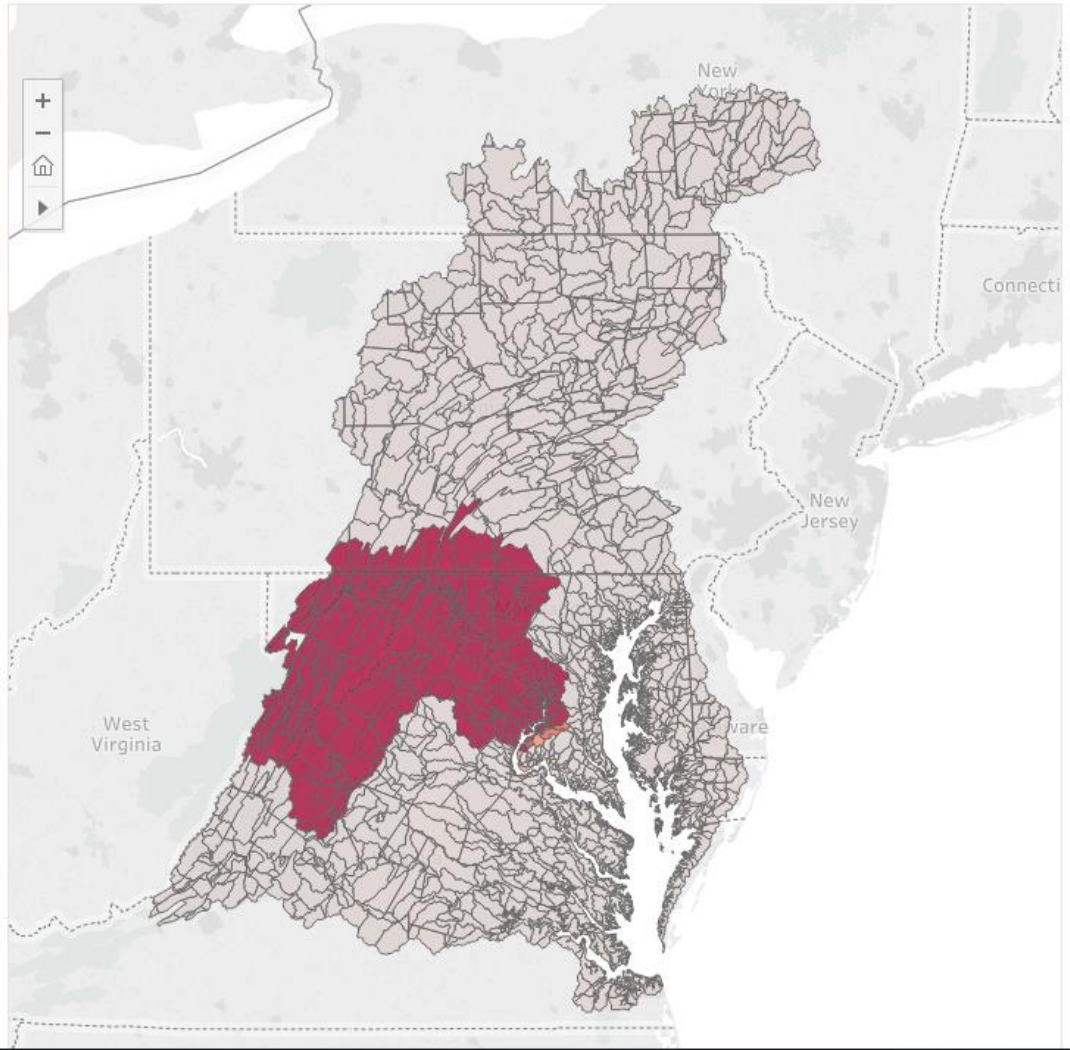

Pollutant
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Source (P
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Monitorin
POVTF

Total Effe
-100.0

Potomac TF VA

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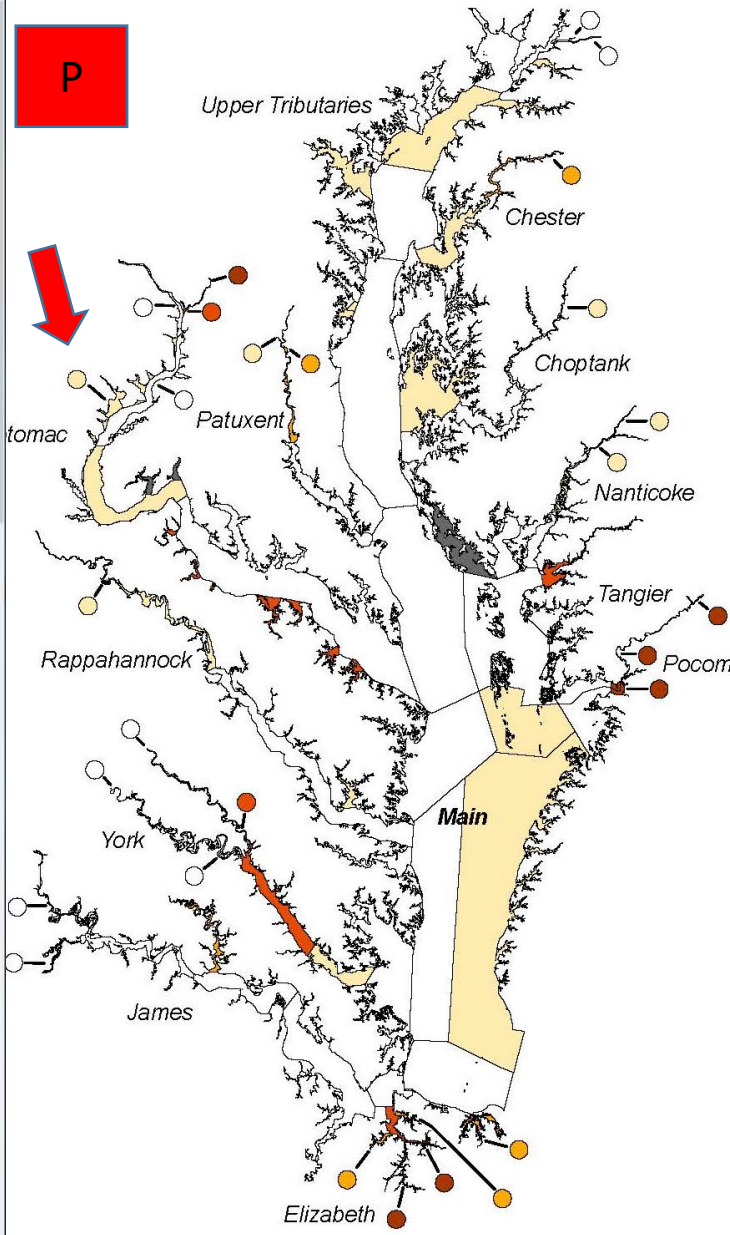
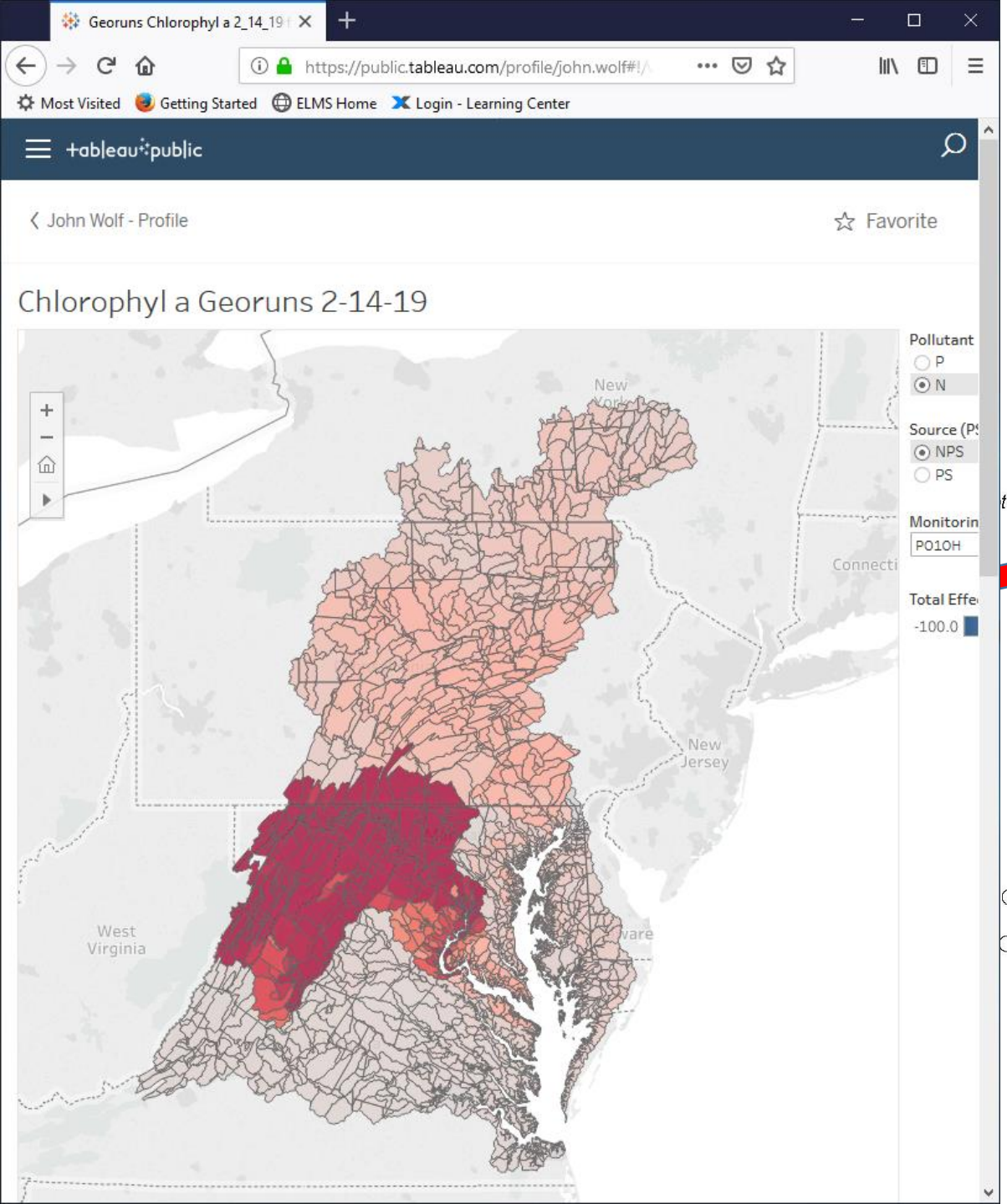
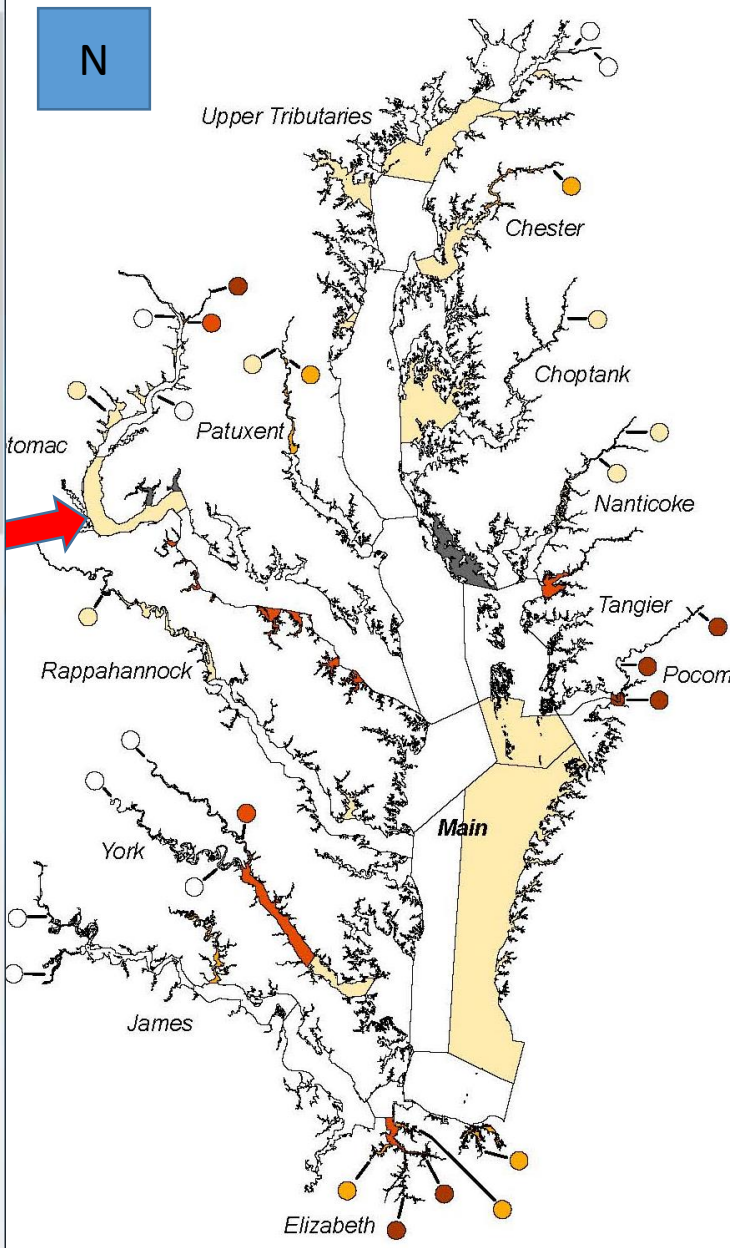




Potomac OH MD



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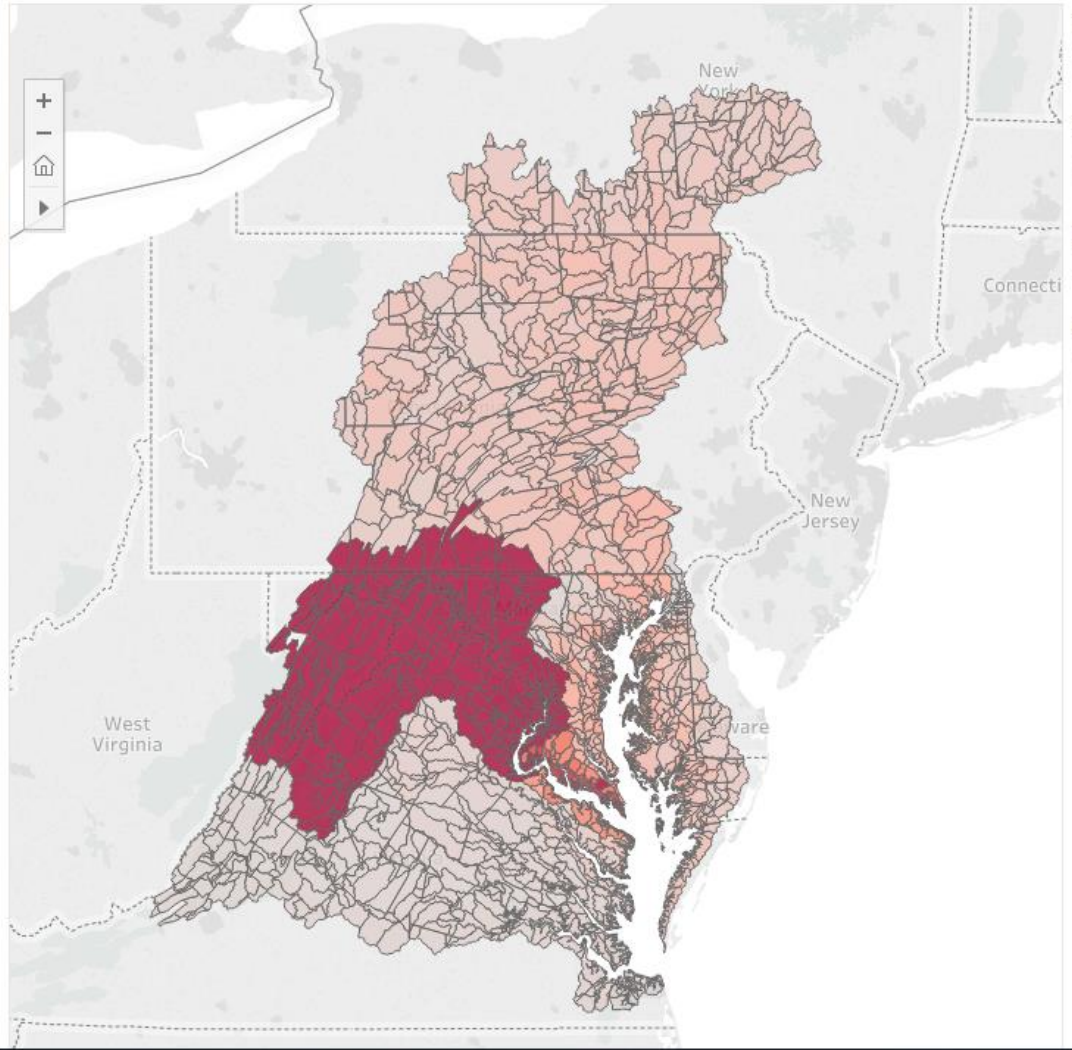
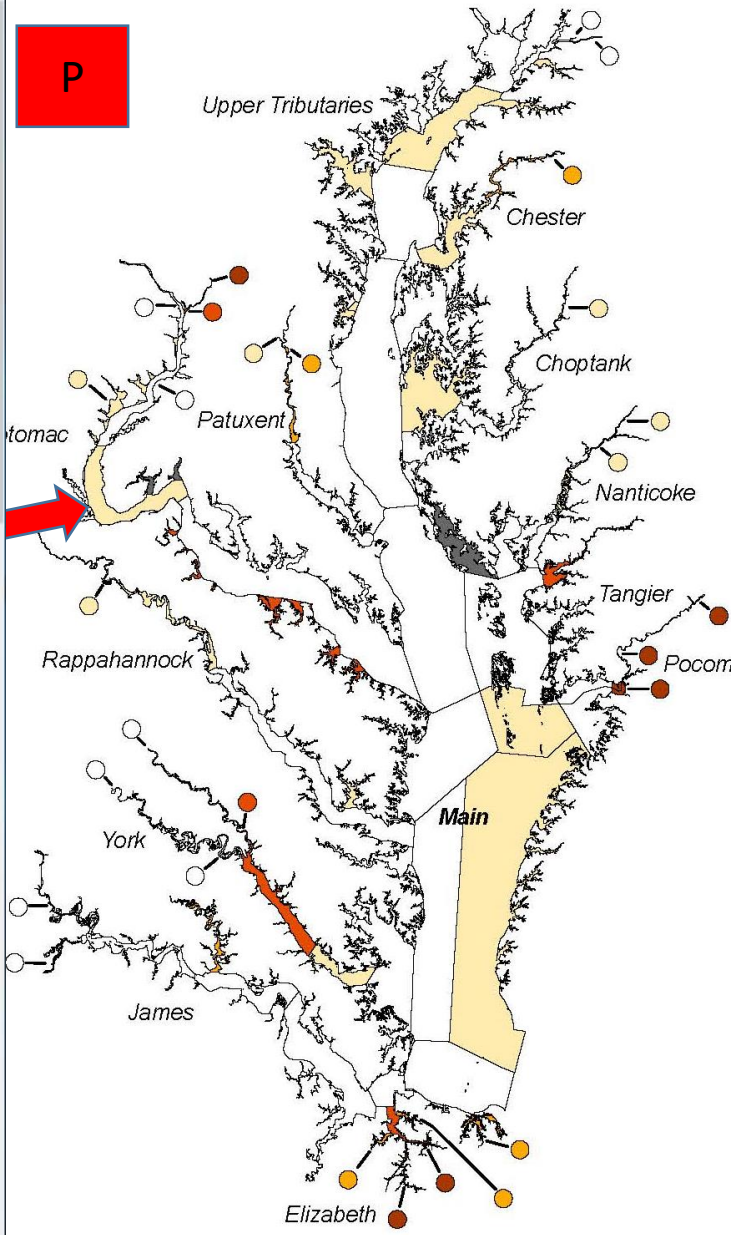
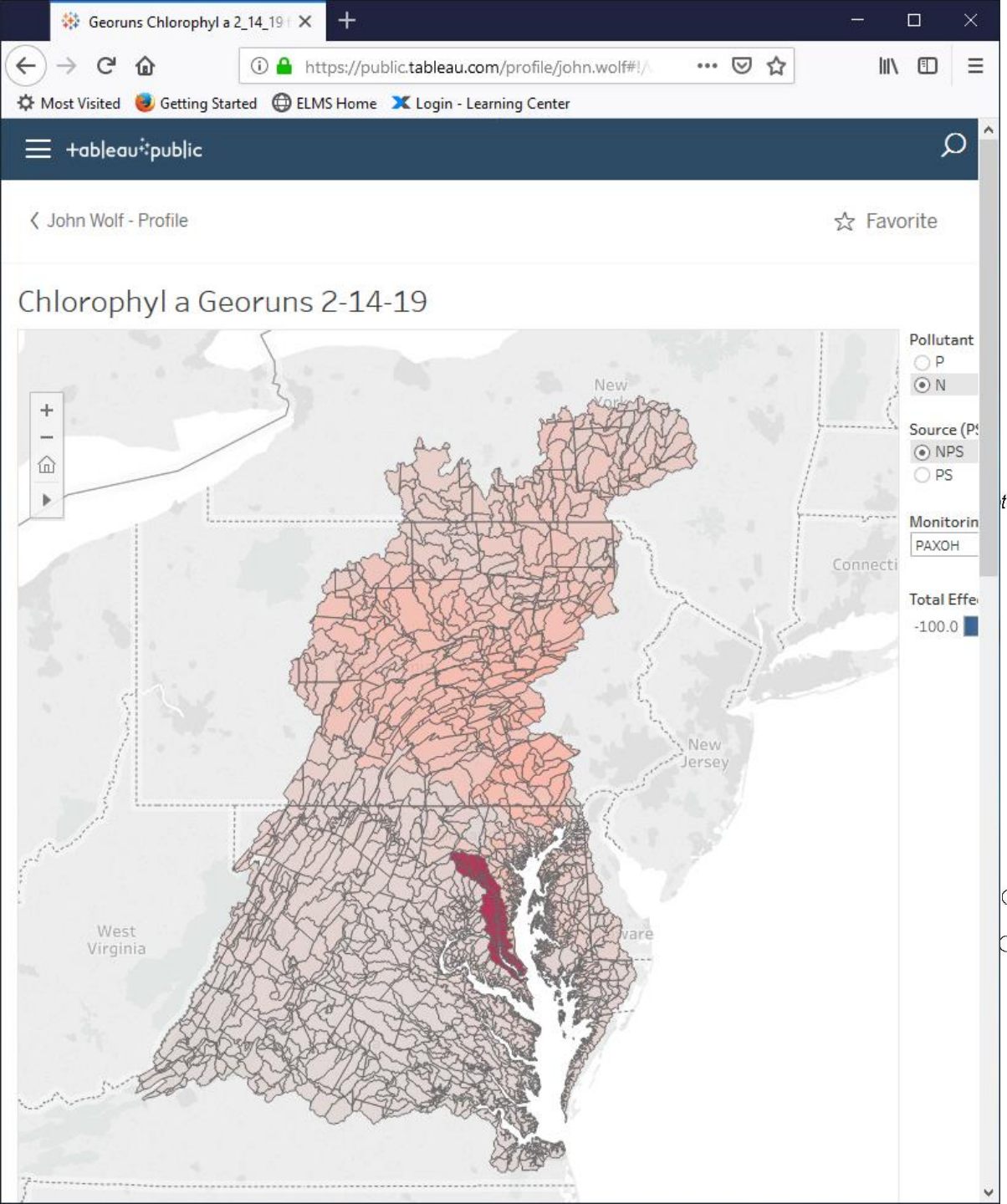
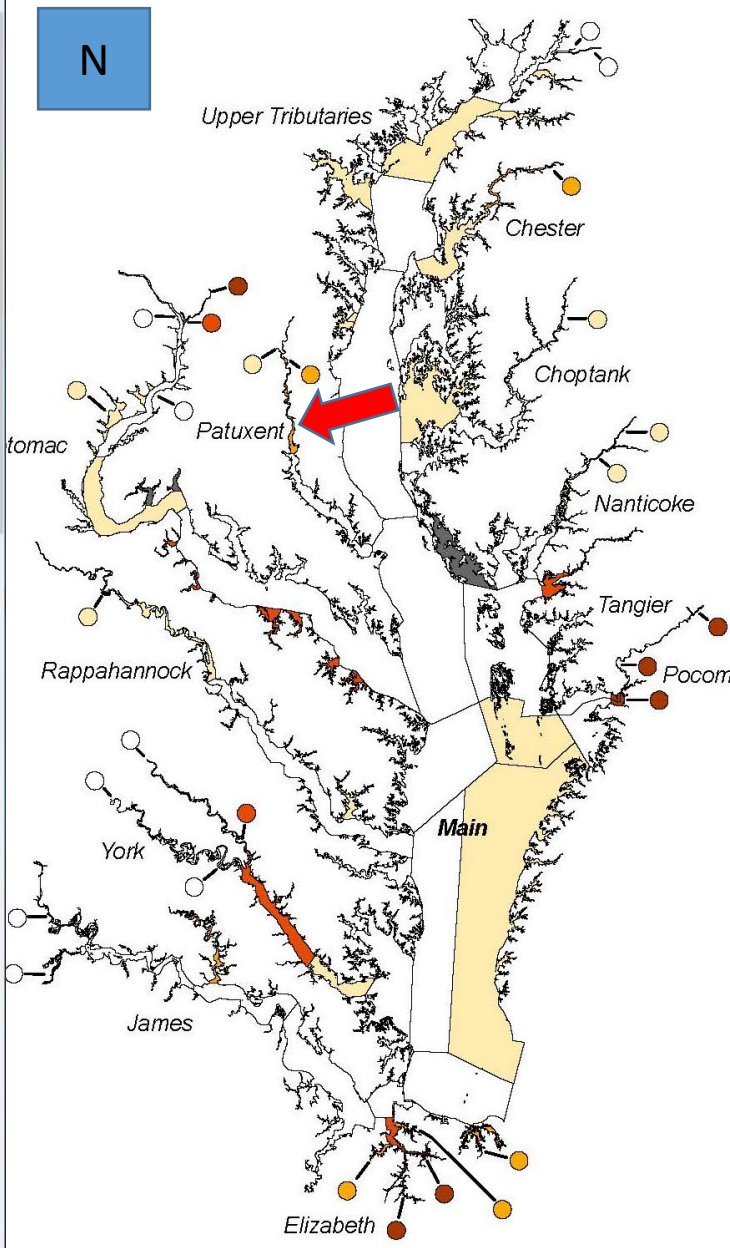


Potomac OH MD





Patuxent OH MD



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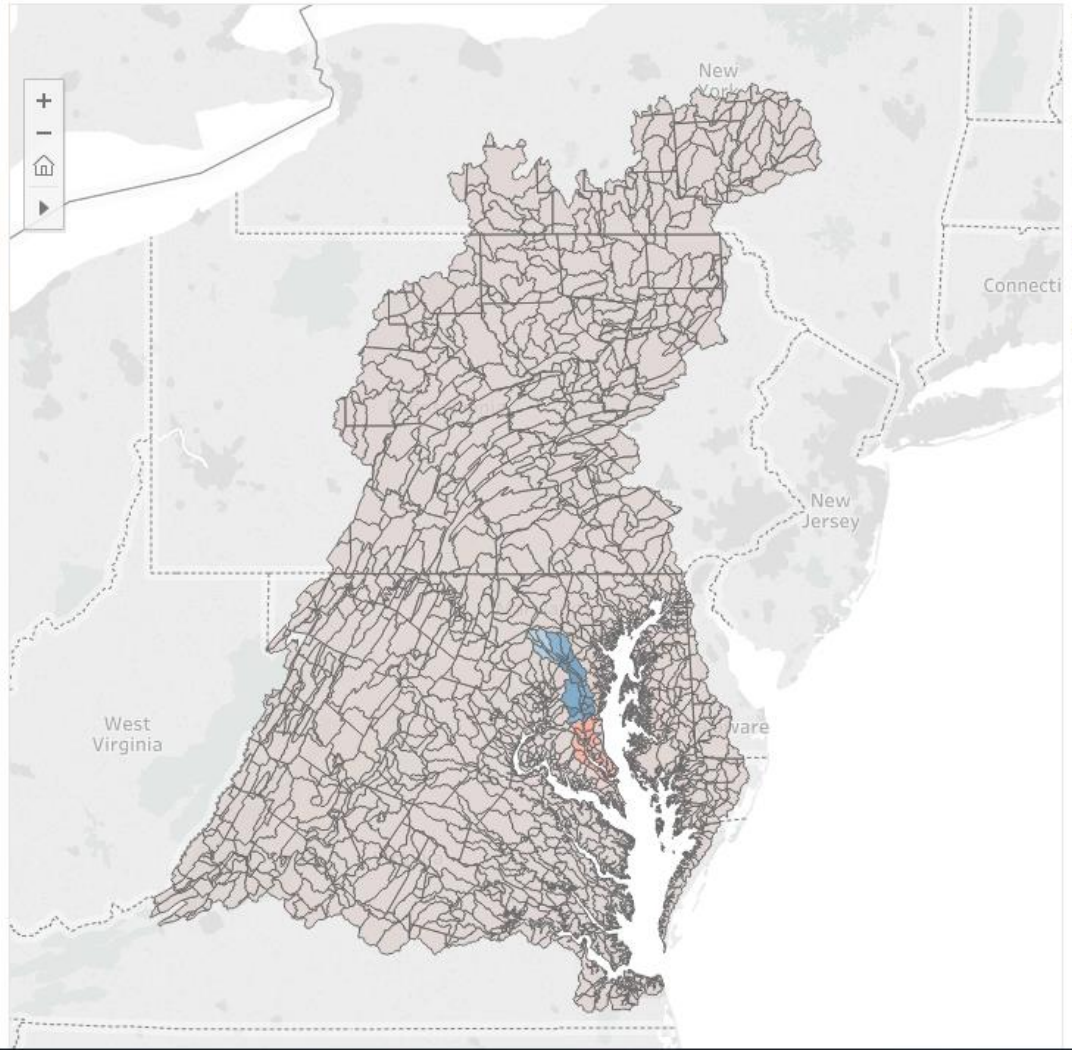

Pollutant
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Source (PS
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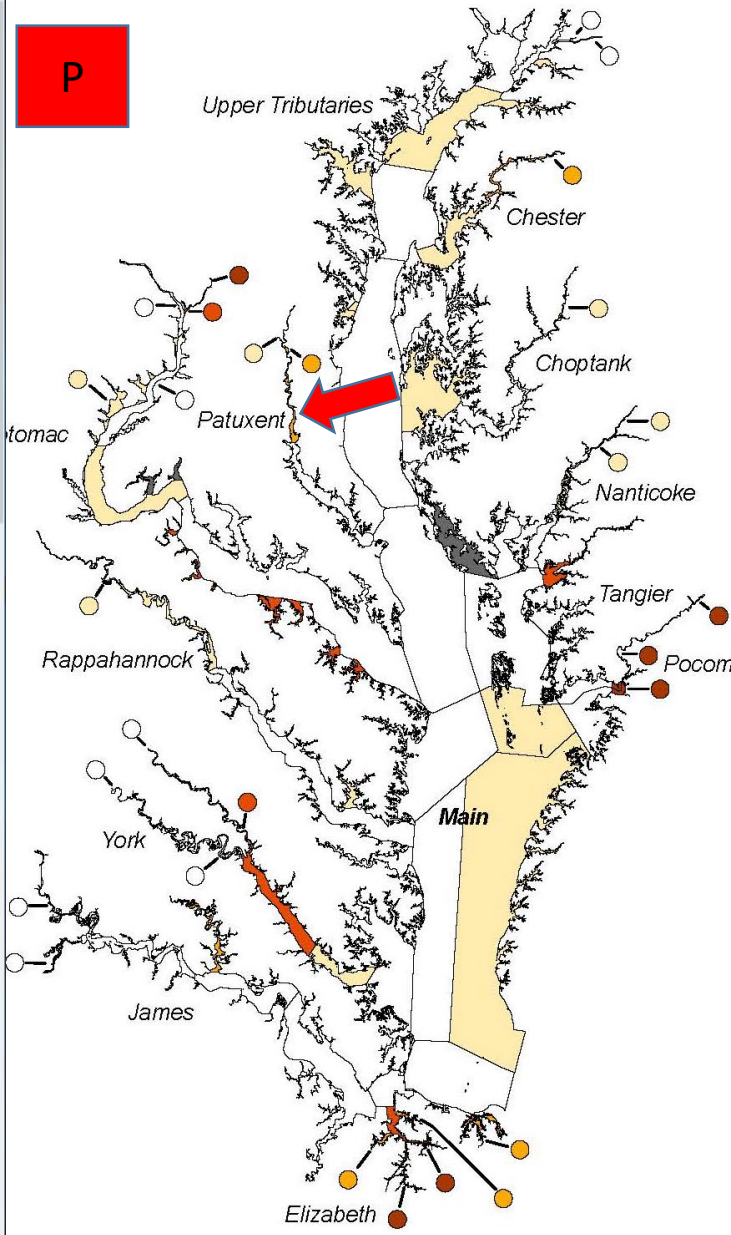
PS

Monitorin
PAXOH

Total Effe
-100.0

Patuxent OH MD



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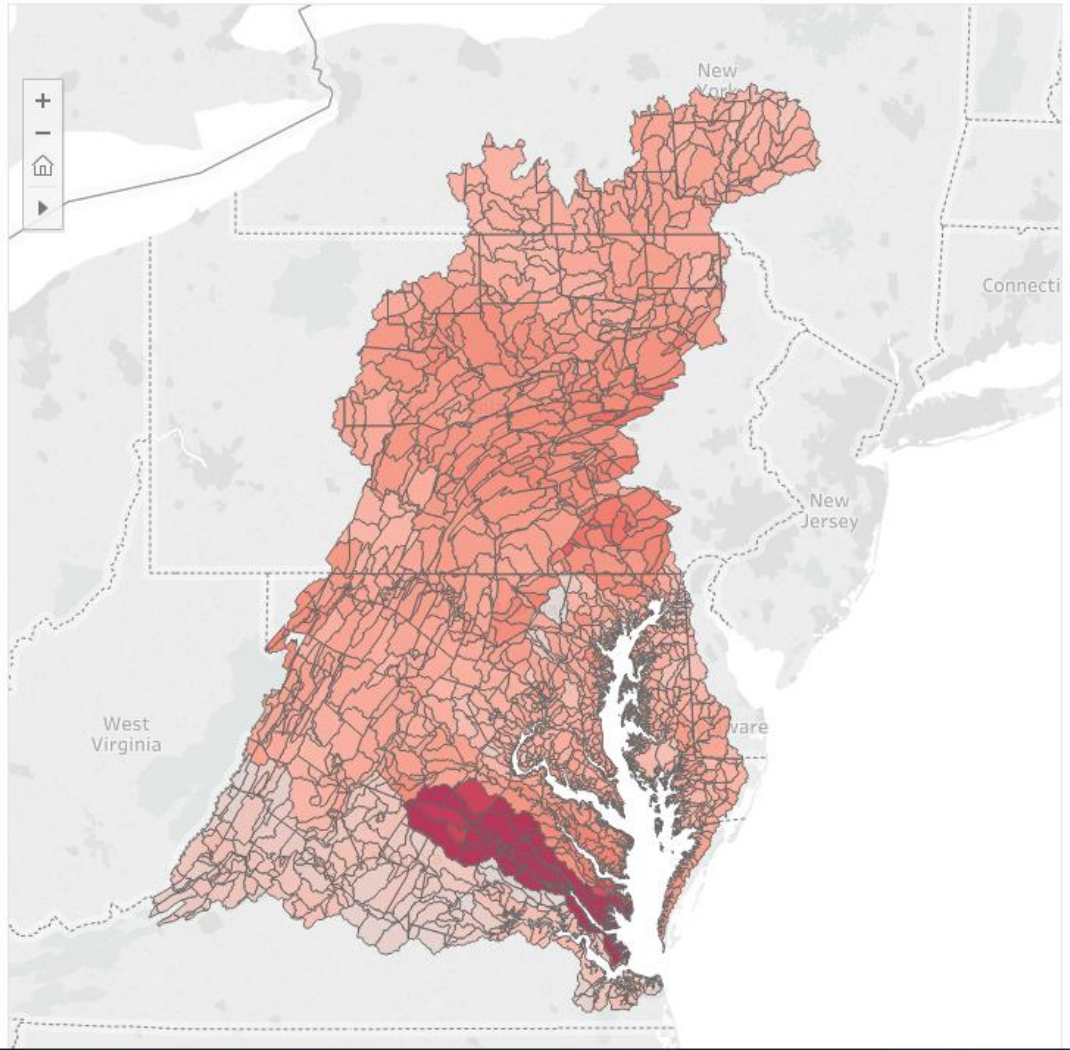

Pollutant
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Source (P
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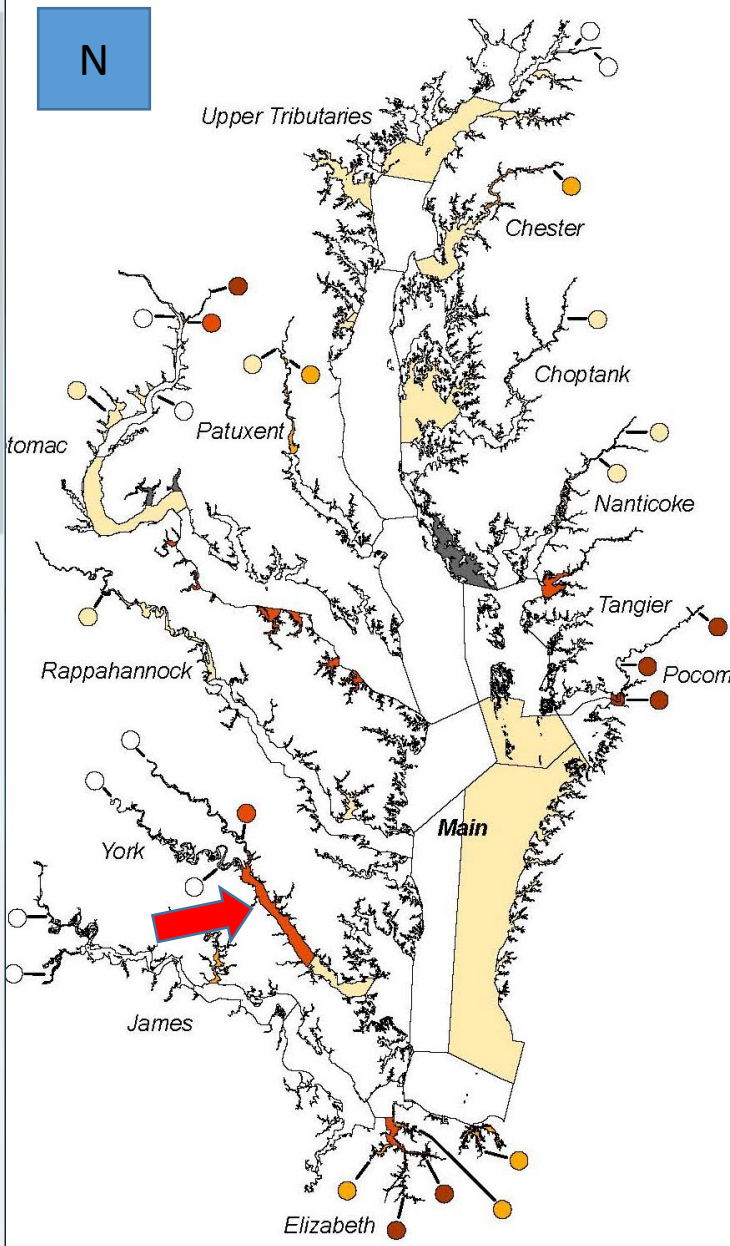
Monitorin
YRKMH

Total Effe
-100.0

York MH VA



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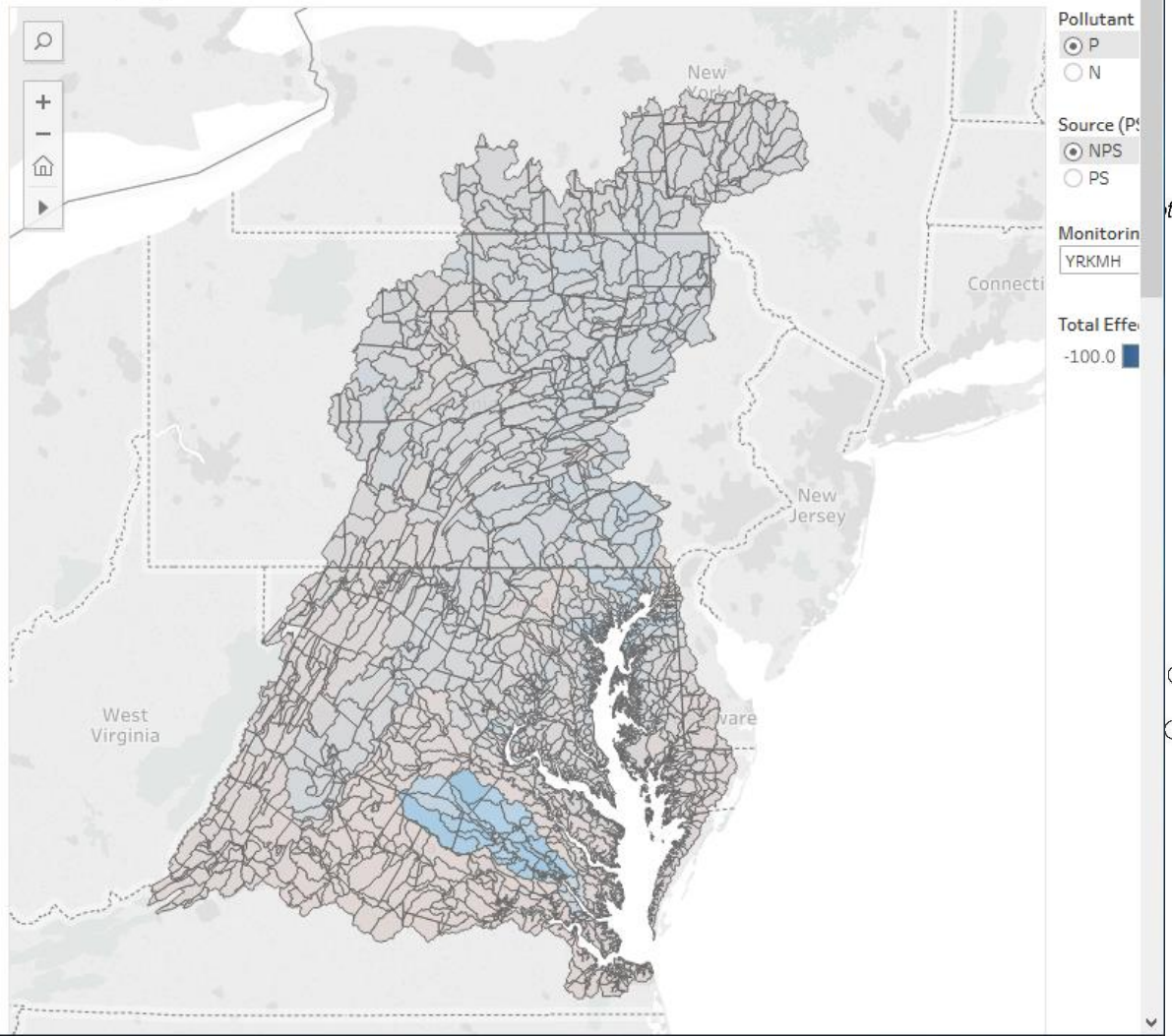
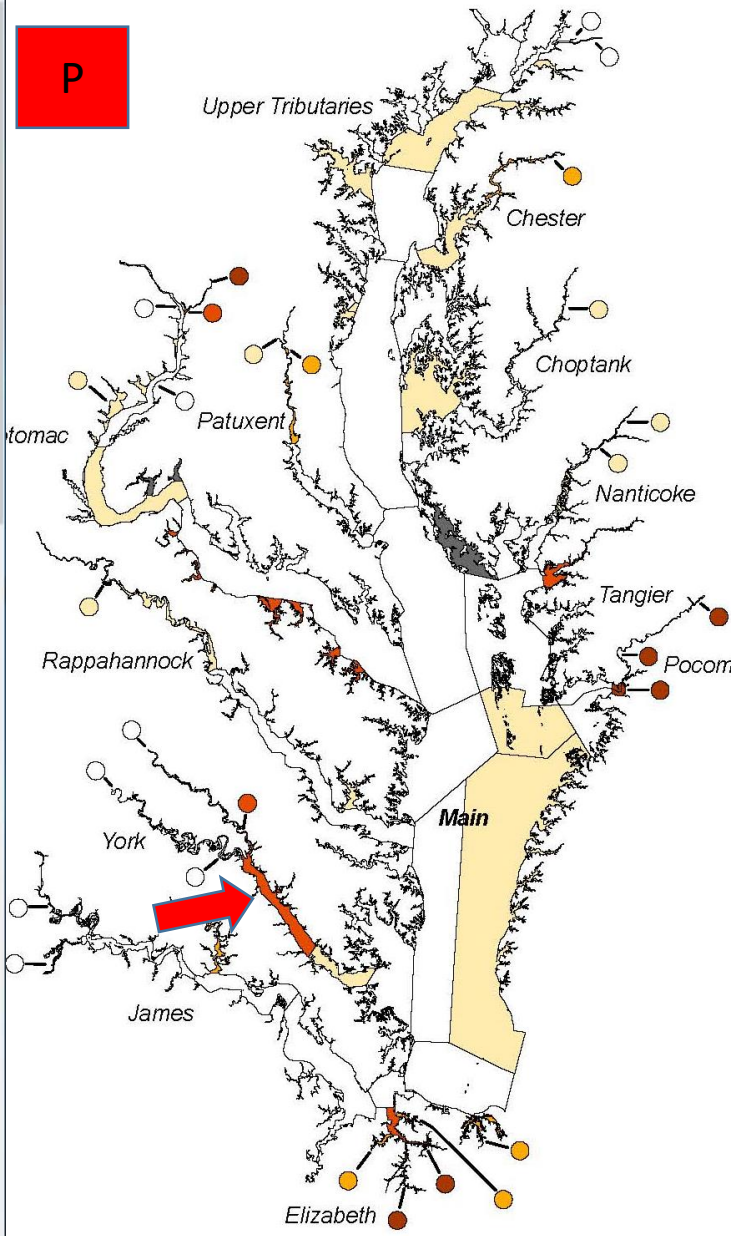
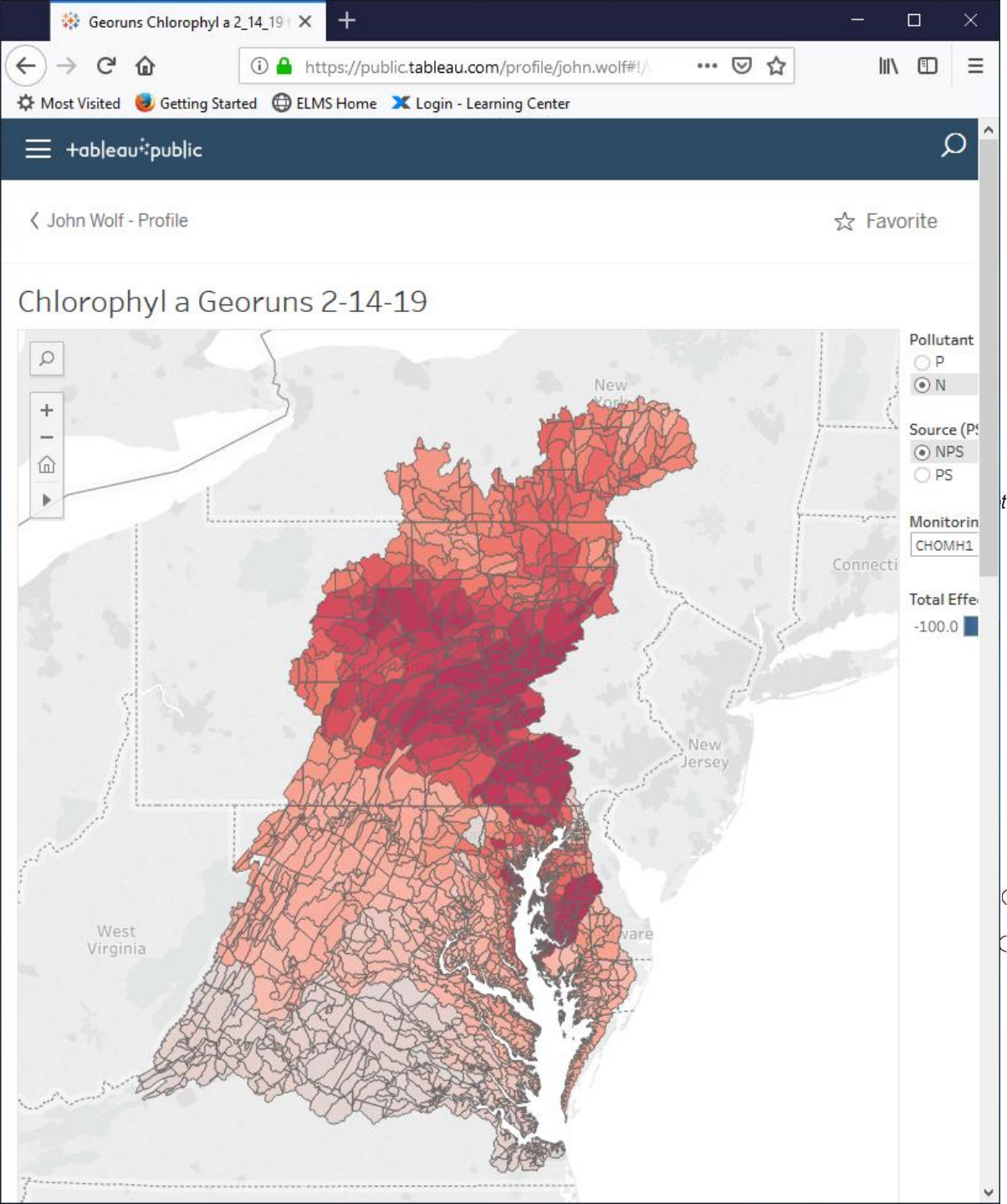
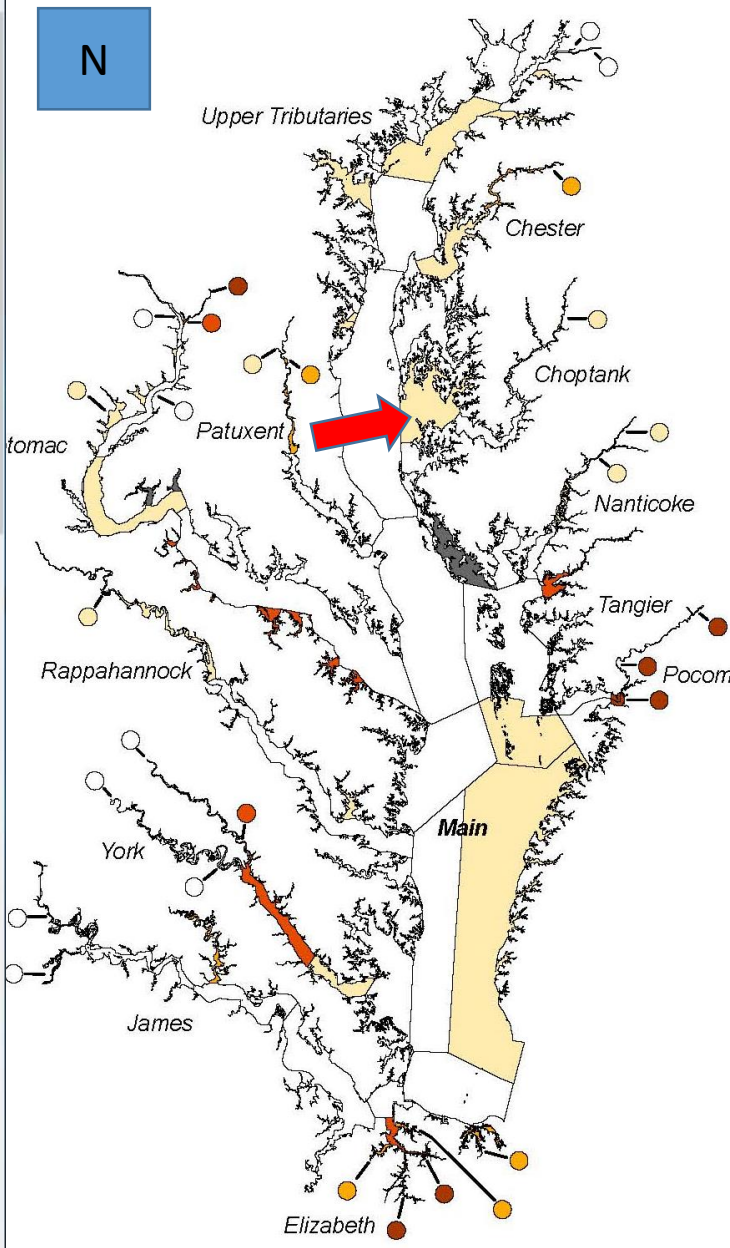


York MH VA





Choptank MH1 MD



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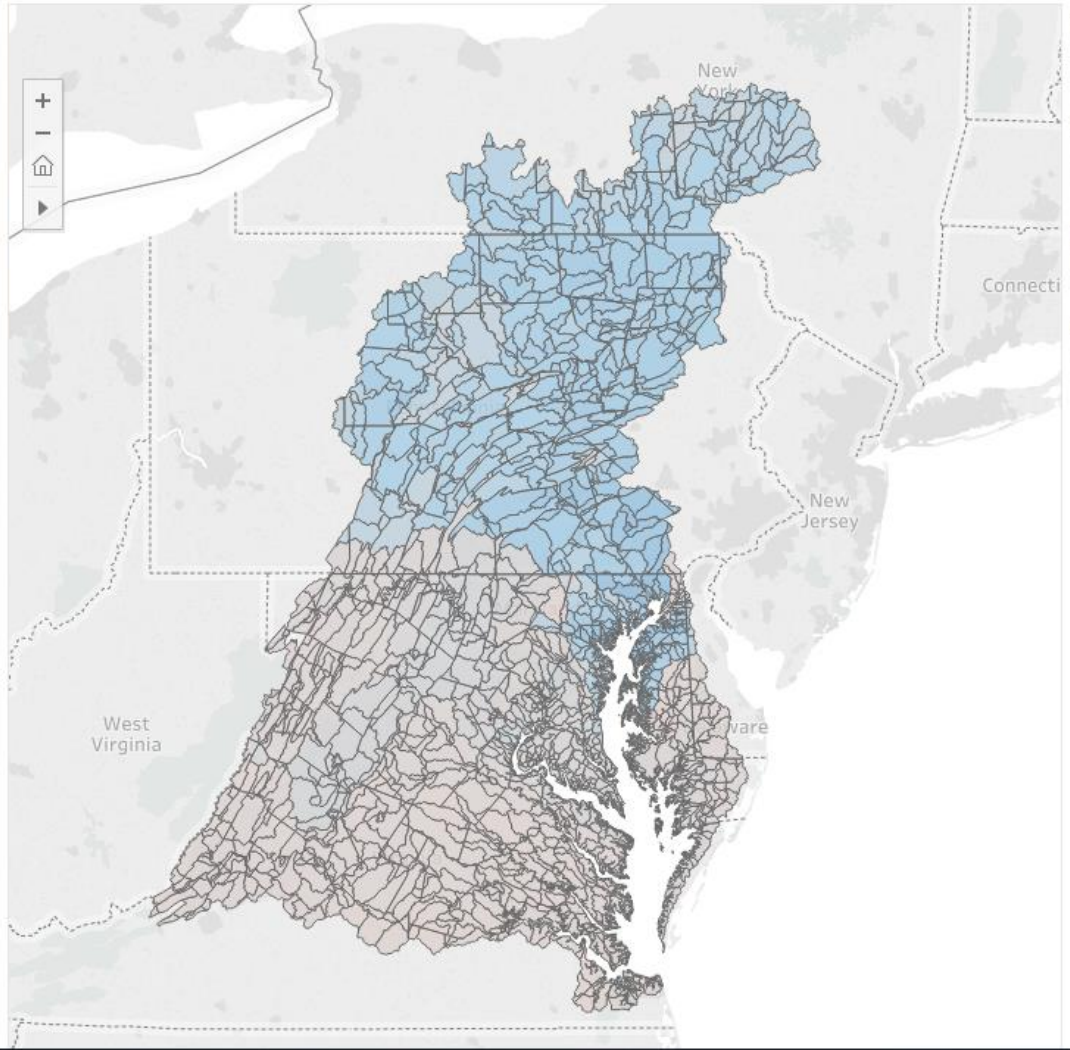

Pollutant
P
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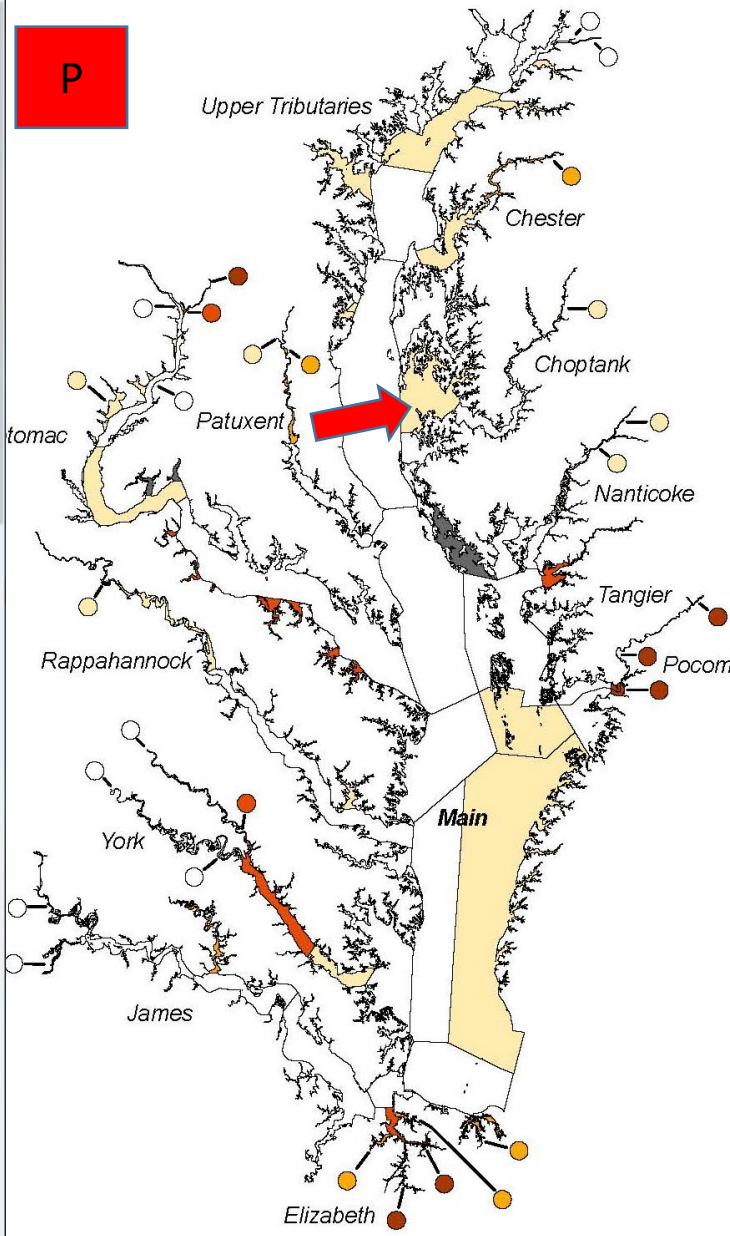
Source (P
NPS
PS

Monitorin
CHOMH1

Total Effe
-100.0

Choptank MH1 MD



Dual Nutrient Control

- N and P reductions from anywhere reduce deep water and deep channel hypoxia
- P important in tidal and non-tidal freshwaters
- Nutrient imbalances can lead to harmful algal blooms
- Predicted chlorophyll increases due to reductions are low in magnitude

Summary

- Visualization of Chlorophyll response
  - Related to oxygen and clarity
- Visualization only
  - No nutrient exchanges based on these runs
- Shows primacy of local watersheds to small bays

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