Chesapeake Bay Program

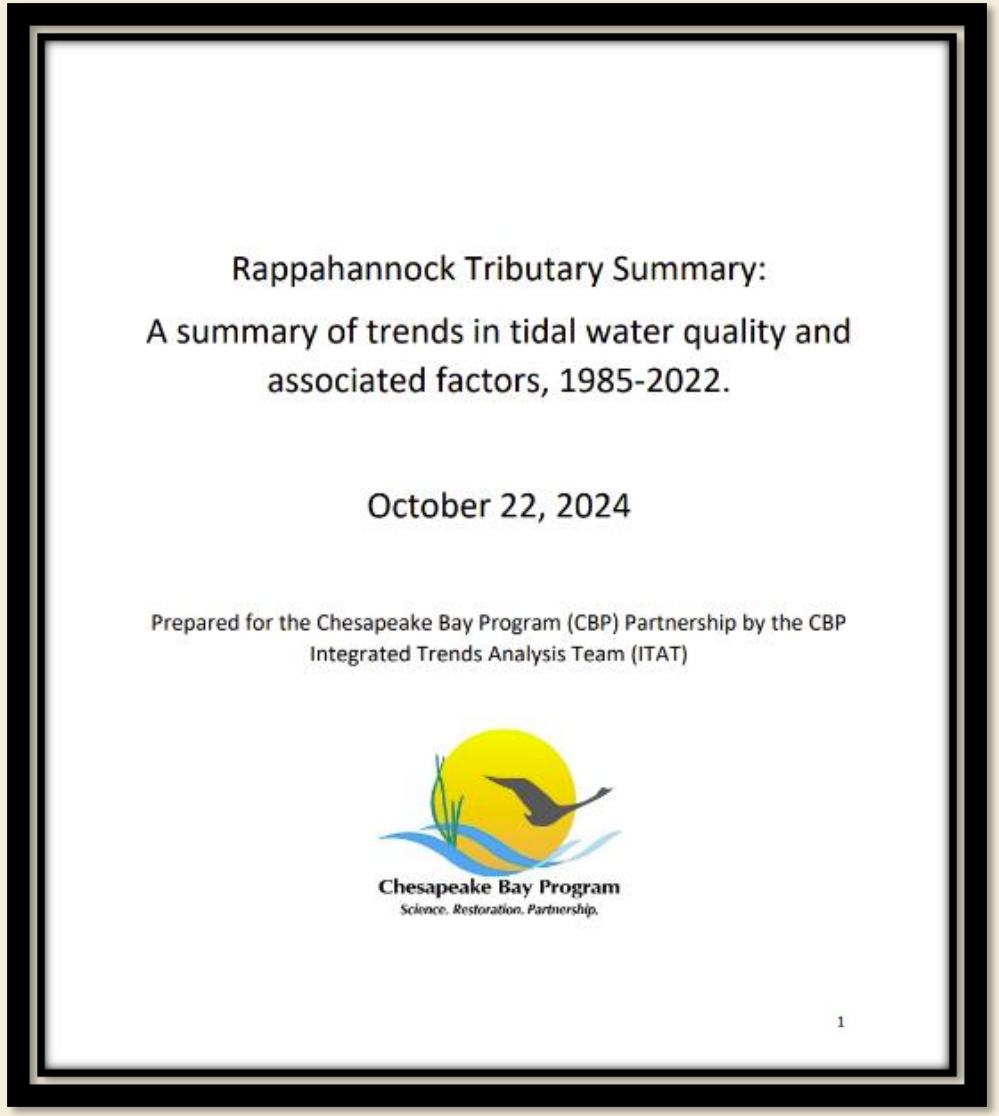
Science. Restoration. Partnership.

How-To: Water Quality Status and Trends Resources

Gabriel Duran, Kaylyn Gootman, Breck Sullivan

Local Leadership Quarterly Meeting – May 13th, 2025.

Tributary Summary Reports & . . .



Rappahannock Tributary Summary:

A summary of trends in tidal water quality and associated factors, 1985-2022.

October 22, 2024

Prepared for the Chesapeake Bay Program (CBP) Partnership by the CBP Integrated Trends Analysis Team (ITAT)

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The reports use water-quality sample data to investigate:

1. How nontidal and tidal water quality changes over time.
2. How factors drive those changes change over time.
3. Current state of the science on connecting change in aquatic conditions to its drivers.

Visit our webpage for more info.

. . . & Geonarratives

Geonarratives translates the reported information to a user-friendly interactive web-platform (ArcGIS Story Maps) for managers, the scientific community and general audiences.

Geonarratives:

- provides foundational knowledge of water-quality parameters;
- investigates how tidal water-quality have changed over time;
- shares other research products from CBP;
- and highlights local watershed organizations in the CB watershed.

What to expect:

- Chesapeake Bay Tributaries
- Physiography
- Land Use
- Water-Quality Status & Trends
- Long-Term Water-Quality Parameters
- Short-Term Water-Quality Parameters
- Factors Affecting Trends
- Climate Change

Chesapeake Bay Watershed

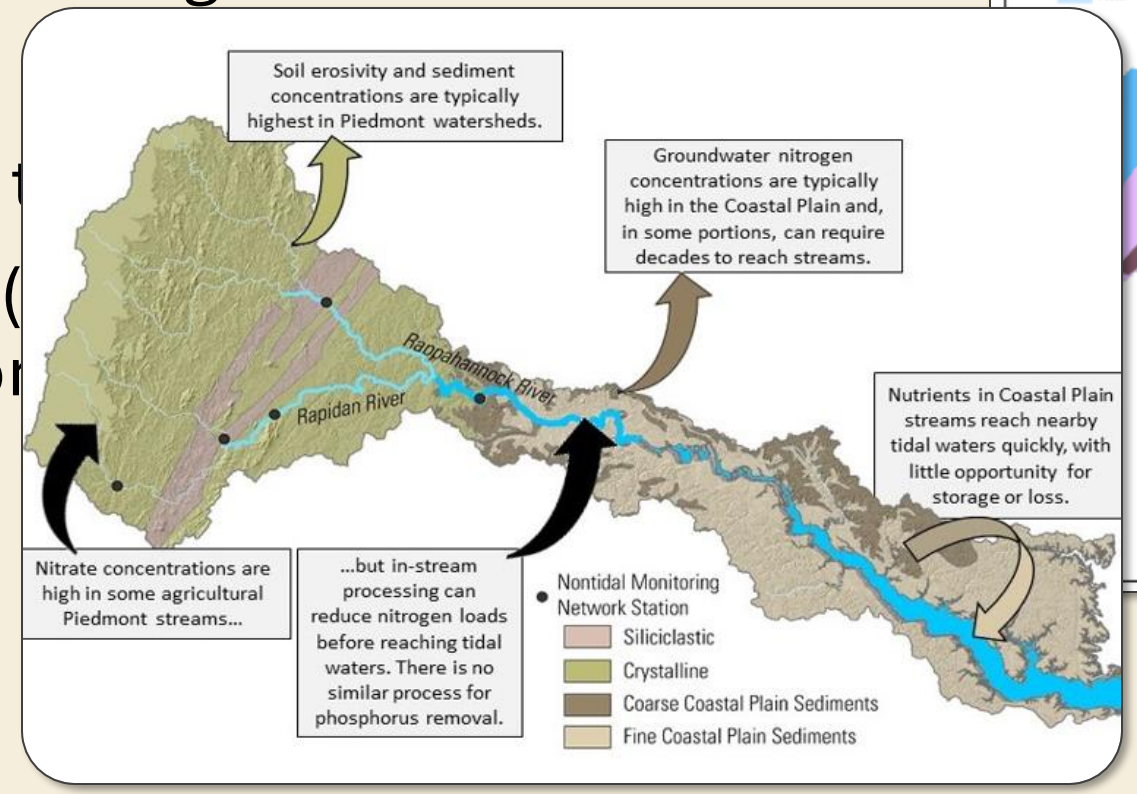
- **Maryland Mainstem** *(The 5 Chesapeake Bay mainstem segments within the MD state boundary. Drainage basins include the Susquehanna River and upper Chesapeake shorelines)*
- **Maryland Upper Eastern Shore** *(The Northeast, Bohemia, Elk, Back Creek, Sassafras, and Chester Rivers, the C&D Canal, and Eastern Bay)*
- **Choptank** *(the Choptank, Little Choptank, and Honga)*
- **Maryland Upper Western Shore** *(Bush, Gunpowder, Middle Rivers)*
- **Maryland Lower Western Shore** *(Magothy, Severn, South, Rhode, and West)*
- **Patapsco & Back Rivers**
- **Patuxent** *(includes the Western Branch tributary)*
- **Potomac**
- **Rappahannock** *(includes the Corrotoman tributary)*
- **York** *(includes the Mattaponi and Pamunkey tributaries)*
- **James** *(includes the Appomattox, Chickahominy, and Elizabeth tributaries)*
- **Lower E. Shore** *(includes the Nanticoke, Manokin, Wicomico, Big Annemessex, and Pocomoke rivers & Tangier Sound)*
- **Virginia Mainstem** *(no summary but Appendices are provided)*

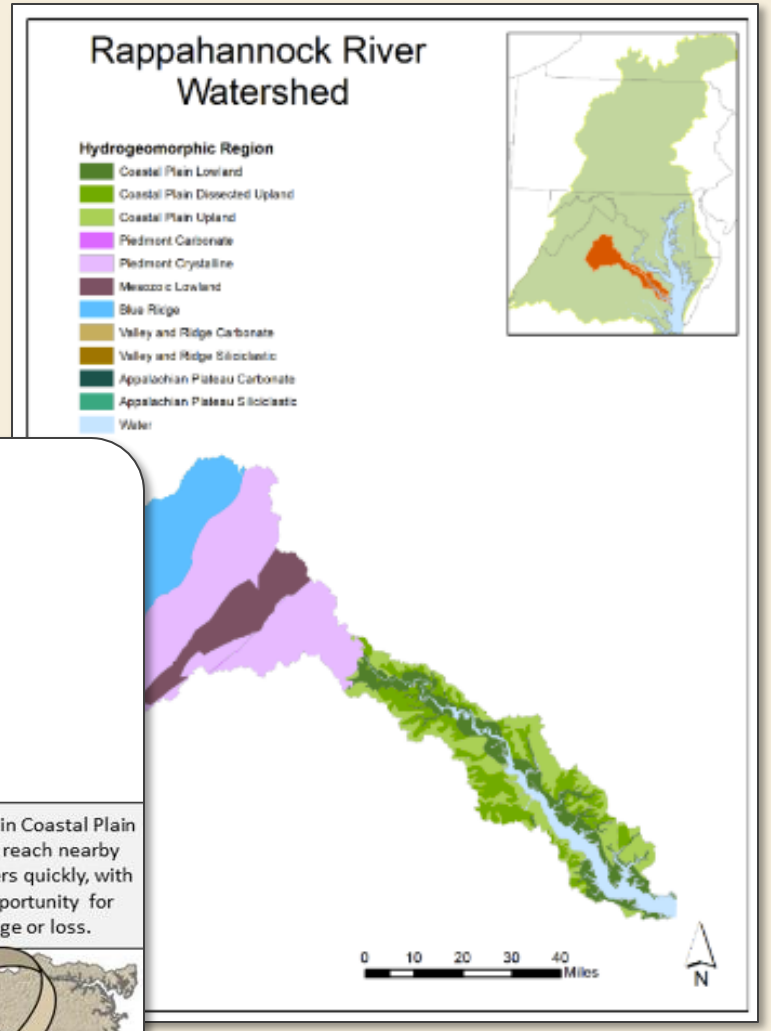
Physiography

Physiography: the Earth's surface based on the predominant types of landforms found in each region.

Effects on t

- Nutrient (
  Phosphor





Land Use

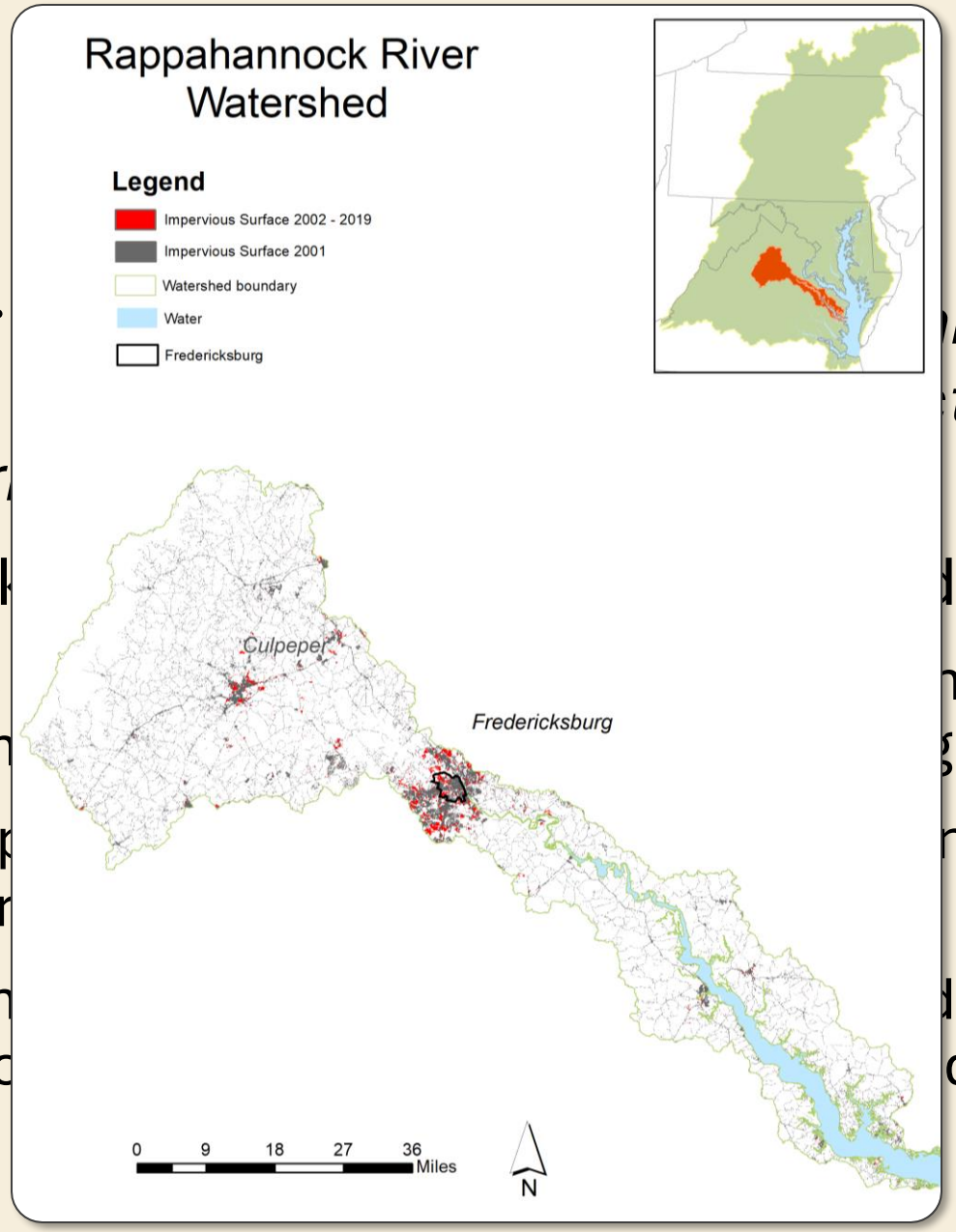
Land Use (ref): ... economic and ... place (e.g., agri...

...nd. It represents the ...ticed at a given

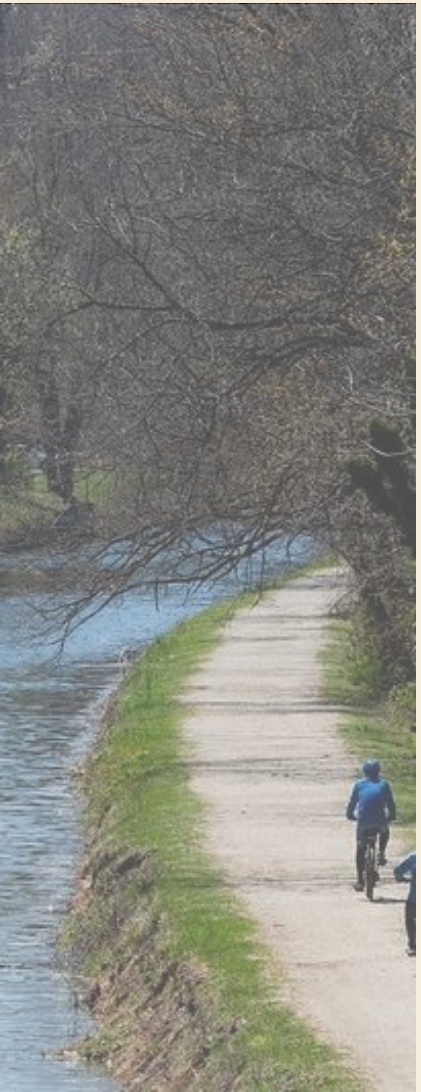
The Chesapeak... ...d to:

1. Measure rate ... ...nversion and the extent and rate of ch... ...ge.
2. Quantify the p... ...n to water quality, healthy water...

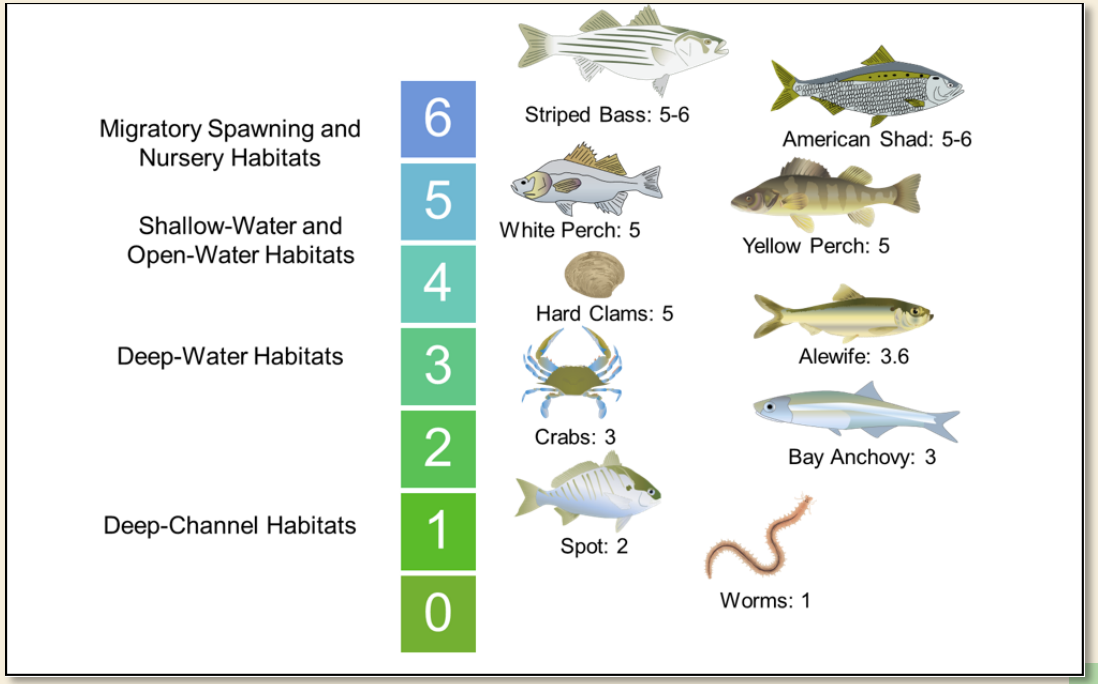
In general, an... ...d surfaces increases stormwater runo... ...diments entering rivers



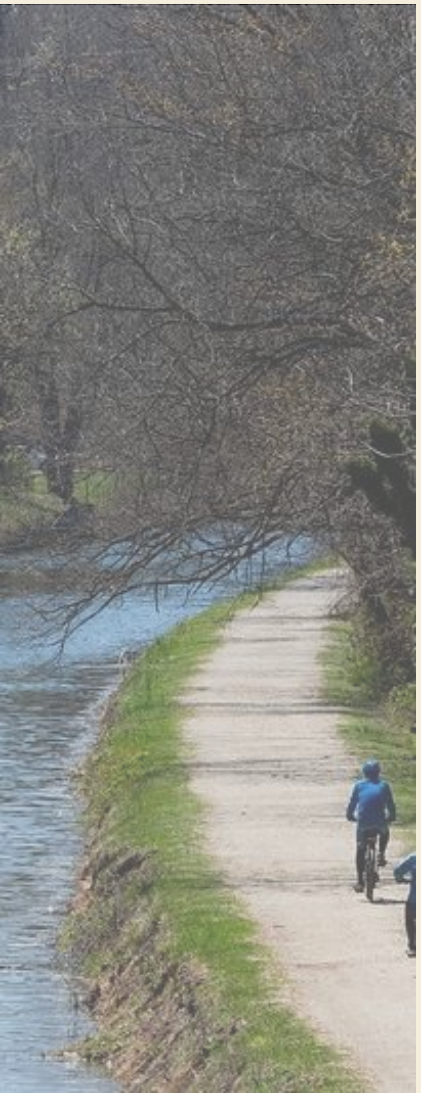
Water-Quality Status & Trends



Multiple water-quality standards have been developed for tidal waters to protect aquatic living resources' habitats: Dissolved Oxygen (DO), Chlorophyll *a* (Chl-*a*), and water clarity/underwater bay grasses (Turbidity).



Water-Quality Status & Trends



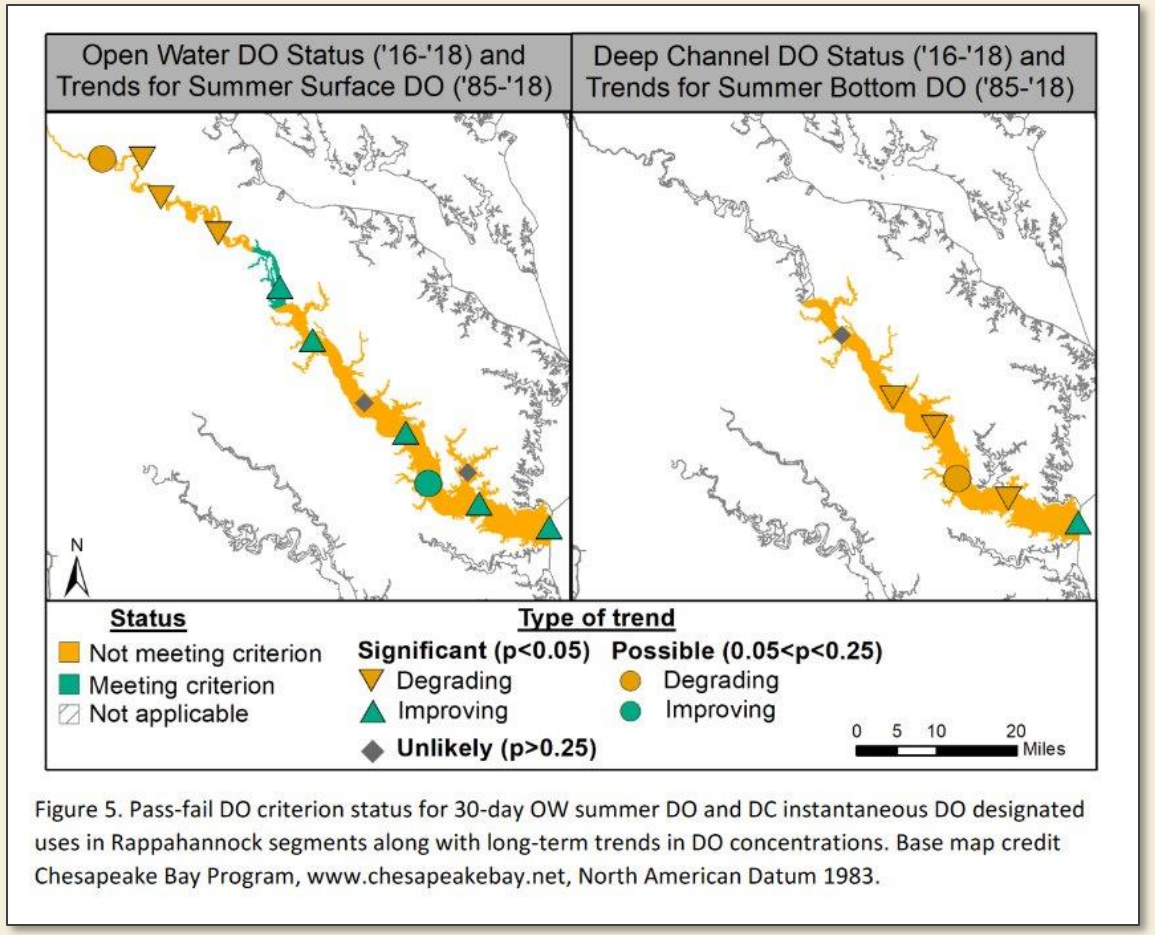
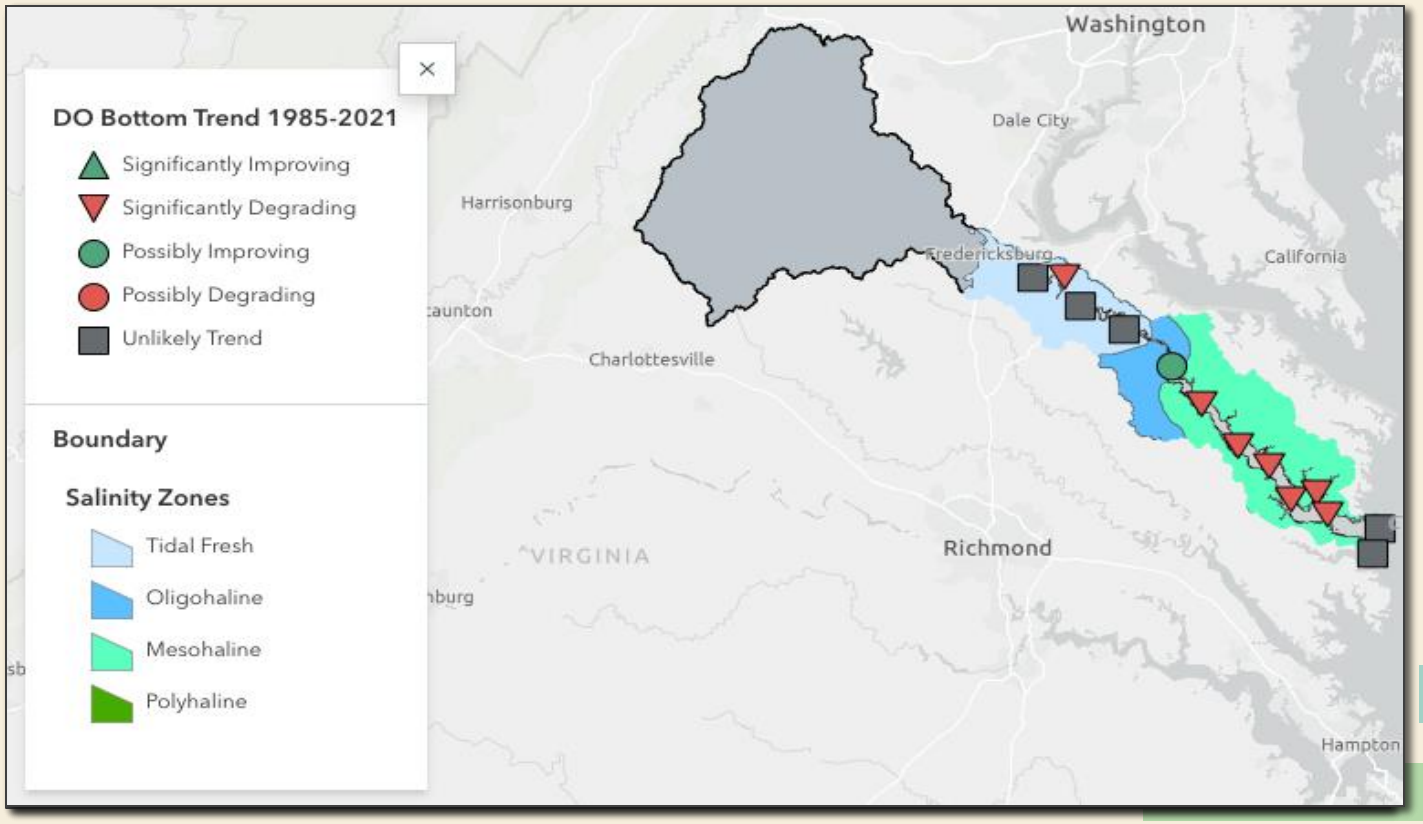


Figure 5. Pass-fail DO criterion status for 30-day OW summer DO and DC instantaneous DO designated uses in Rappahannock segments along with long-term trends in DO concentrations. Base map credit Chesapeake Bay Program, www.chesapeakebay.net, North American Datum 1983.

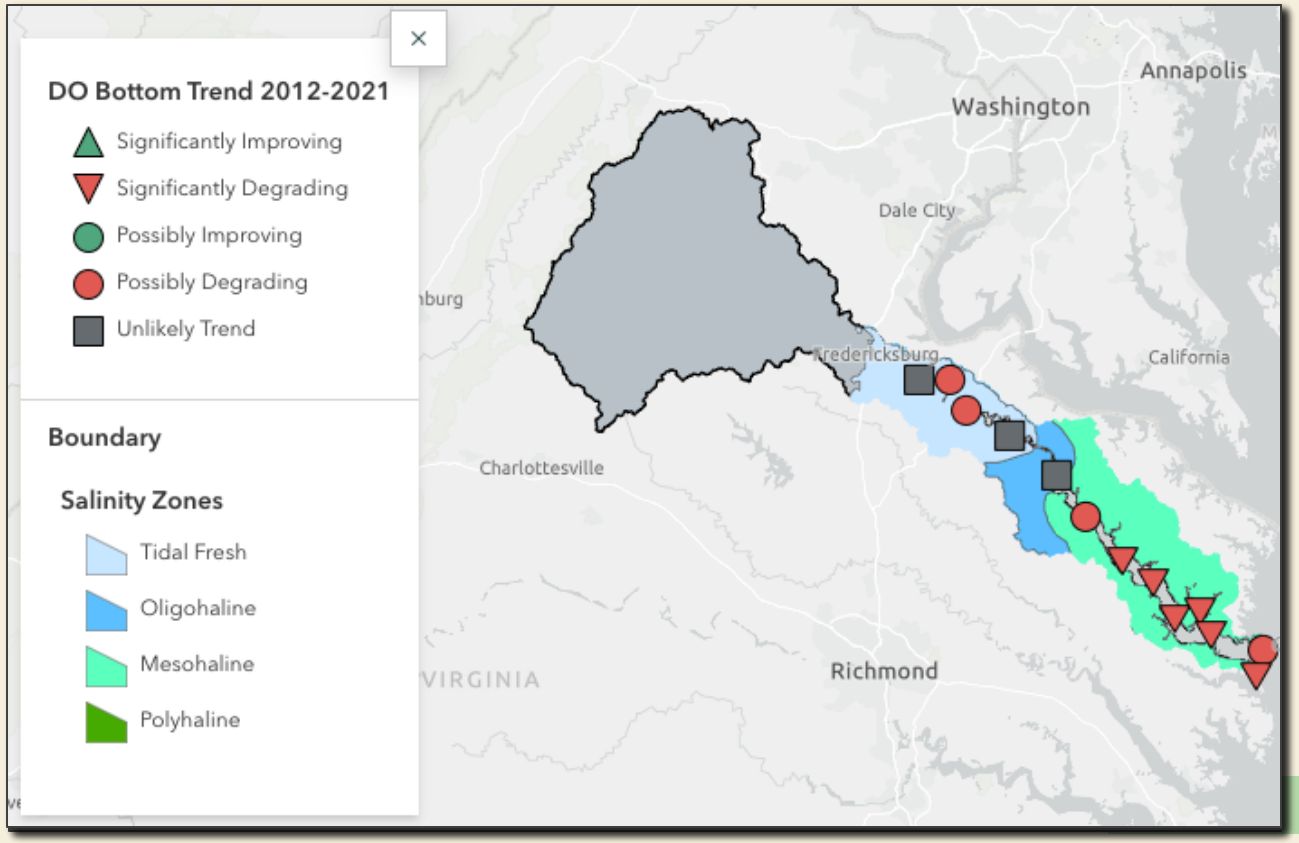
Long-Term Water-Quality Parameters

Water-Quality Parameters reported here include TN, TP, DO, Chl-*a*, and Turbidity (Secchi Disk Depth) between 1985-2021.



Short-Term Water-Quality Parameters

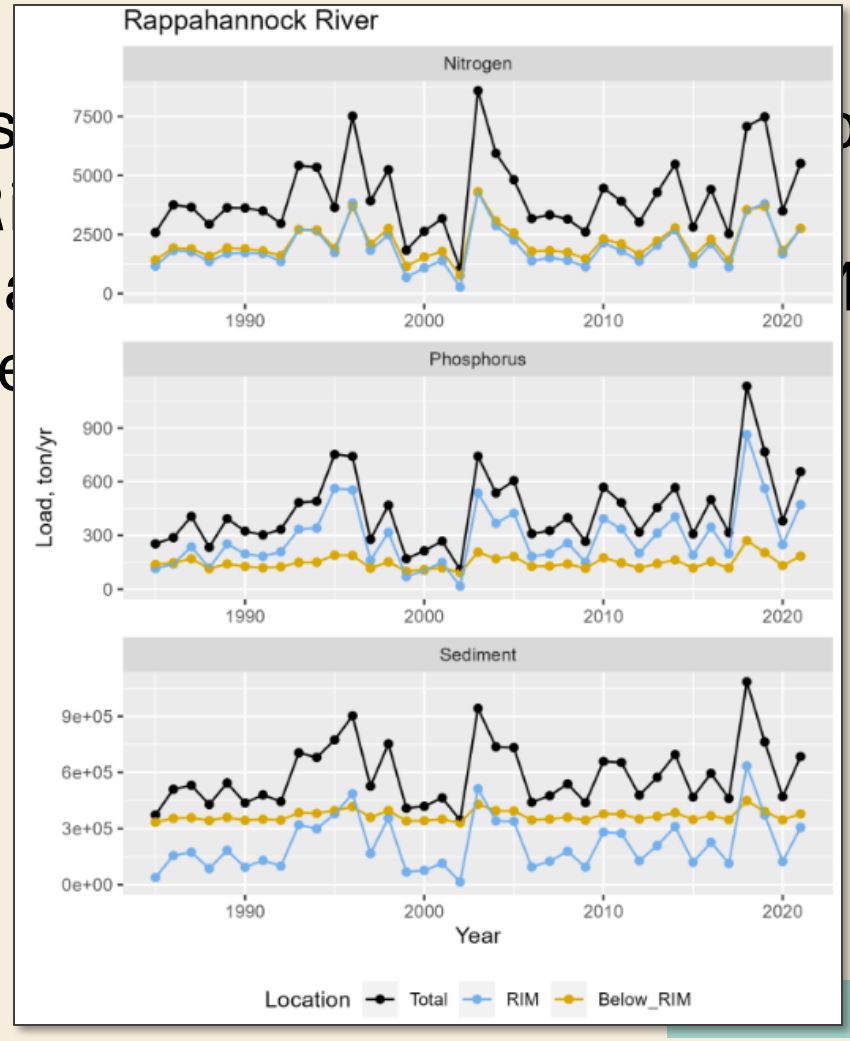
Water-Quality Parameters reported here include TN, TP, DO, Chl-*a*, and Turbidity (Secchi Disk Depth) between 2012-2021.



Factors Affecting Trends

Nutrient and sediment loads are es oads at U.S. Geological Survey (USGS) R stations located at the nontidal-tida 1 simulated loads from the CBP Wate

- Nitrogen loads showed an overall increase of 21 ton/yr between 1985-2021.
- Phosphorus loads showed an overall increase of 5.7 ton/yr between 1985-2021.
- Sediment loads showed an overall increase of 2,800 ton/yr between 1985-2021.



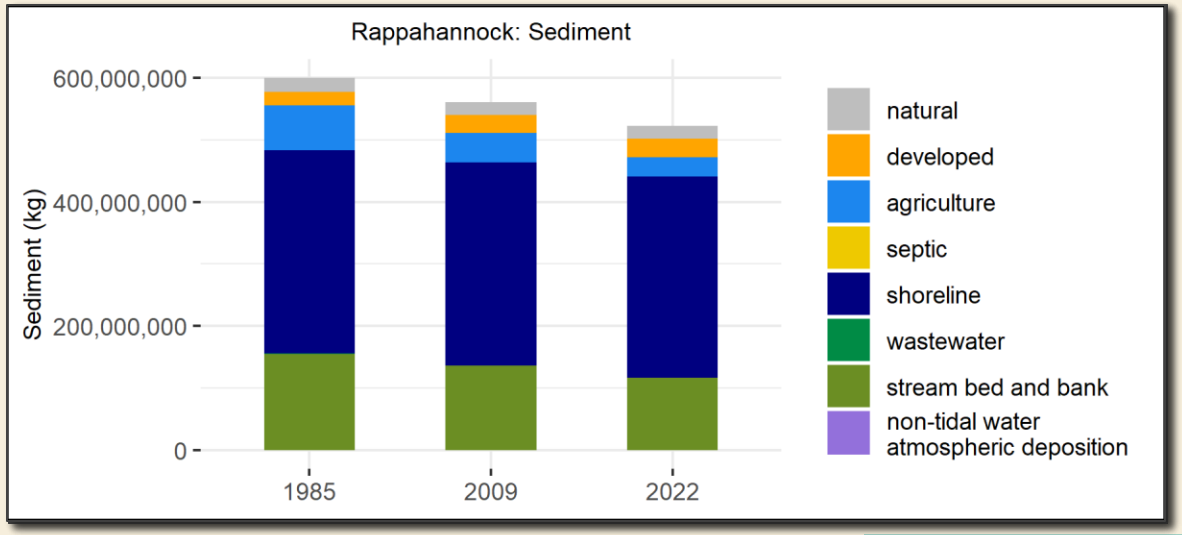
Factors Affecting Trends

The Chesapeake Assessment Scenario Tool (CAST, ref) helps researchers understand where sediment, nitrogen and phosphorus come from.

It is important to know the sources of nutrients polluting the Bay so that management efforts can be directed to the right place.

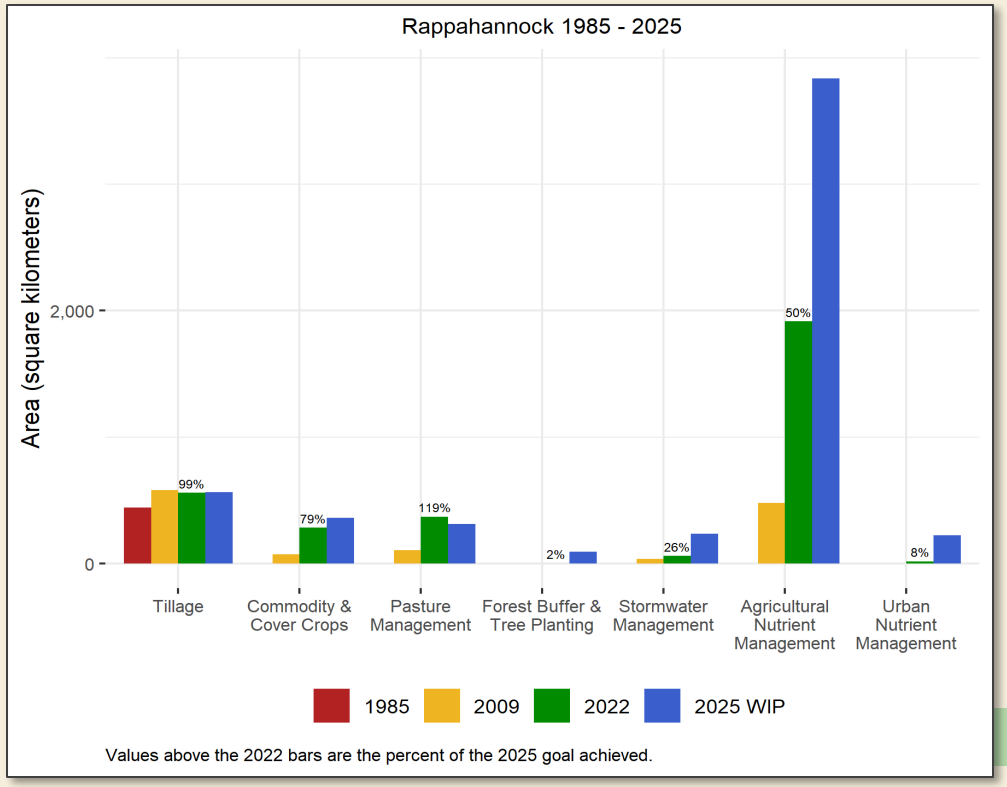
Between 1985-2019 changes in population size, land use and pollution management reduced loads by:

- -12% in nitrogen loads.
- -33% in phosphorus loads.
- -13% in sediment loads.



Factors Affecting Trends

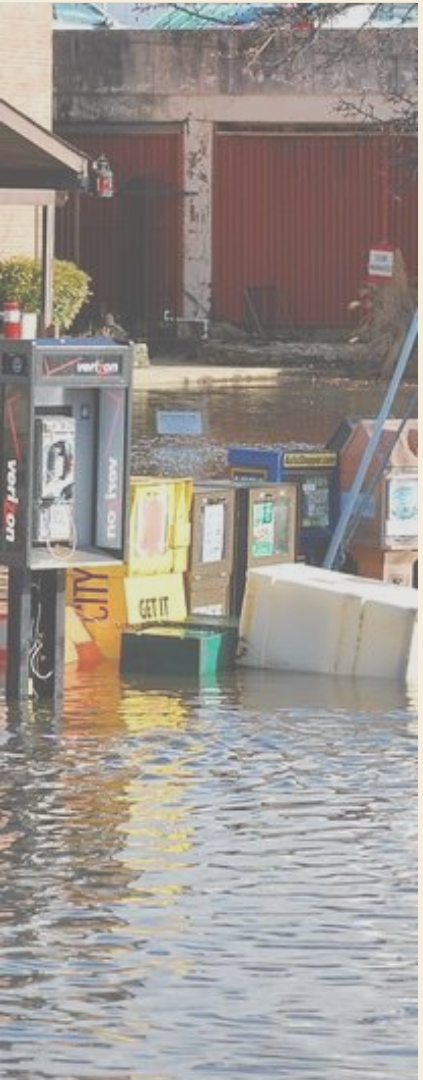
With the estimated nutrient and sediment sources and loads are identified, we can support policymakers with the facilitation of the adoption of best management practices (BMPs) to lower the amount of nutrients produced by each source sector (agricultural, urban stormwater, etc.).



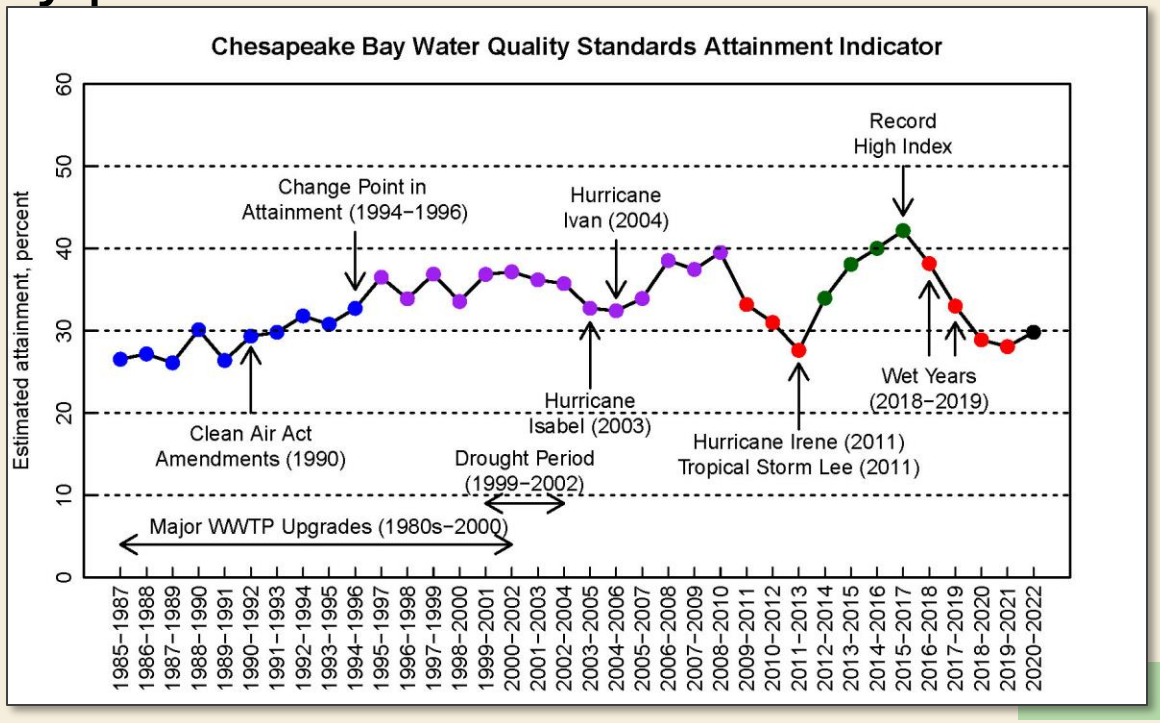
Data on BMP Implementation.

BMP Reference Guide

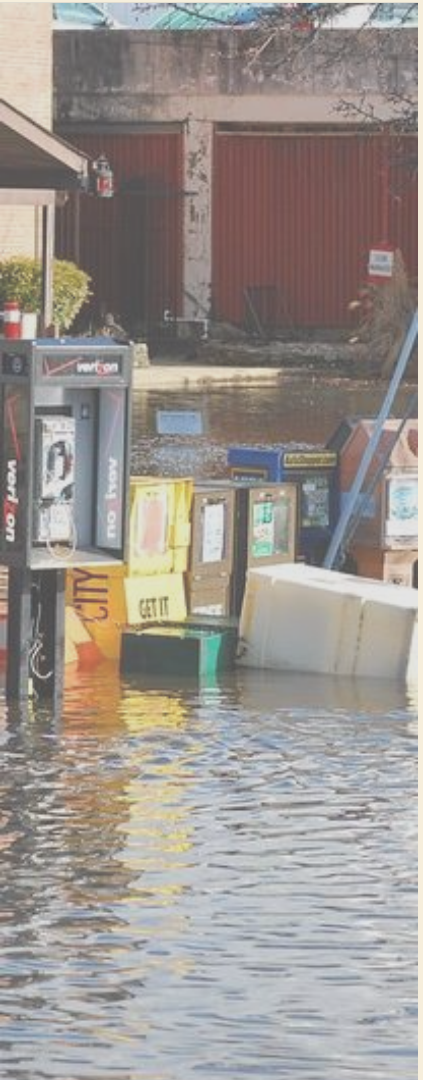
Climate Change



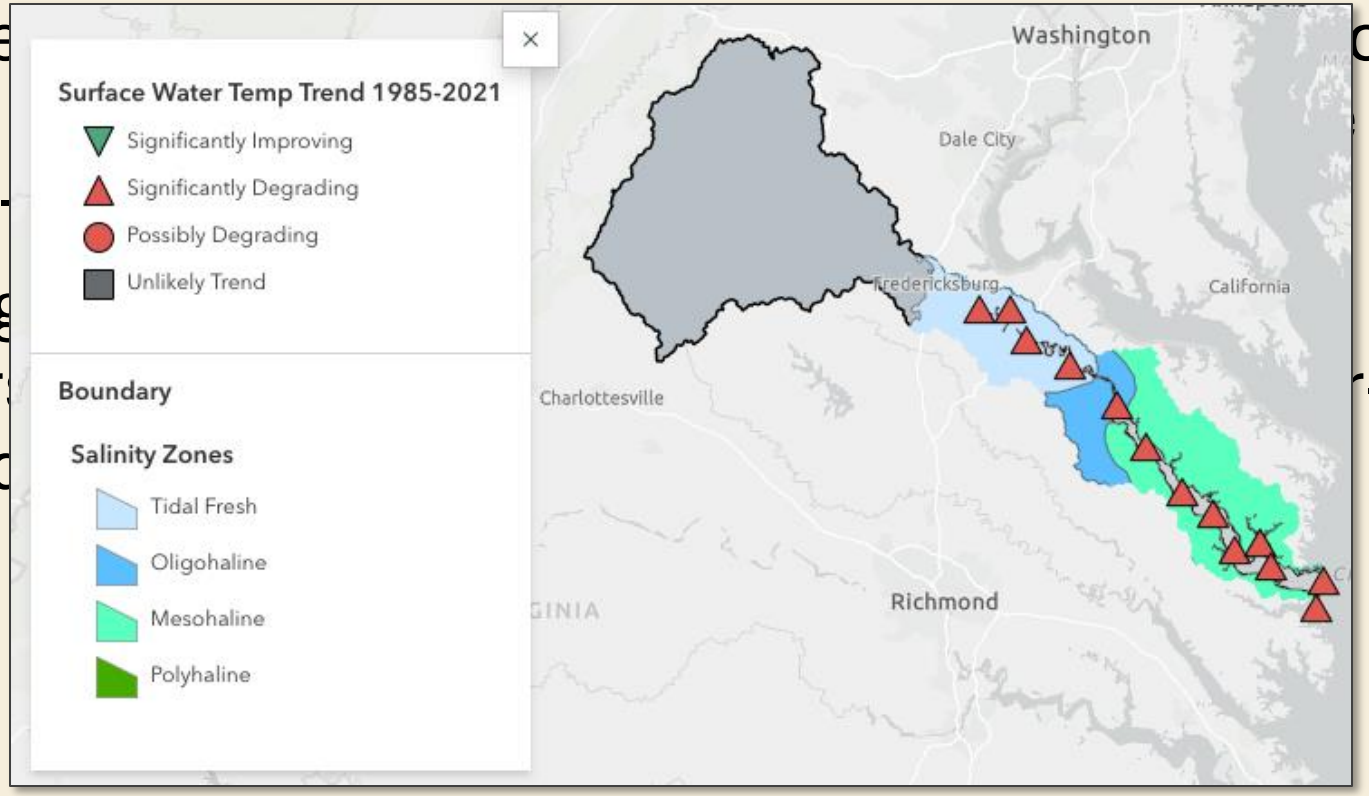
- Extremes in rainfall – whether too much or too little – can have varying effects on the Bay ecosystem. Tracking precipitation and extreme weather events can provide insights to the attainment of water-quality parameters.



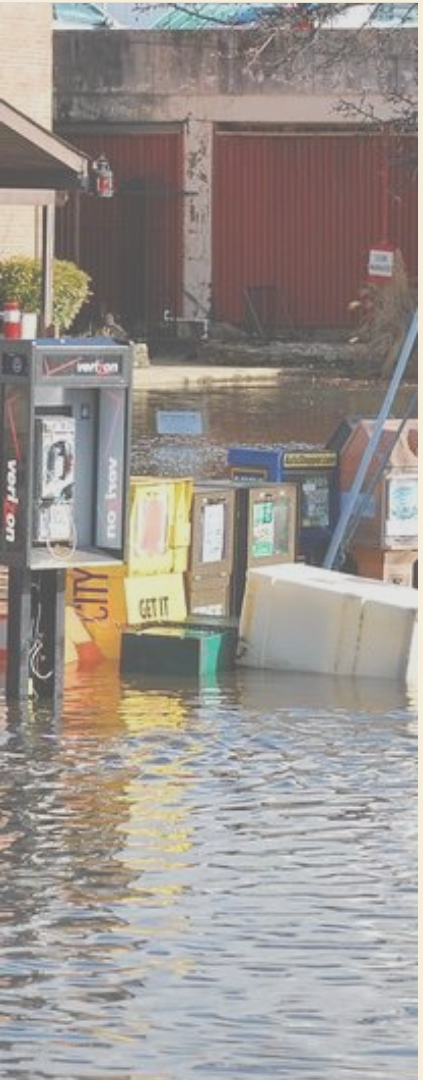
Climate Change



- Extremes in rainfall – whether too much or too little – can have varying e cipitation and extreme attainment of water-
- Warming known stressor -quality standard



Climate Change



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- Warming te… …own stressors f… …ality standards …
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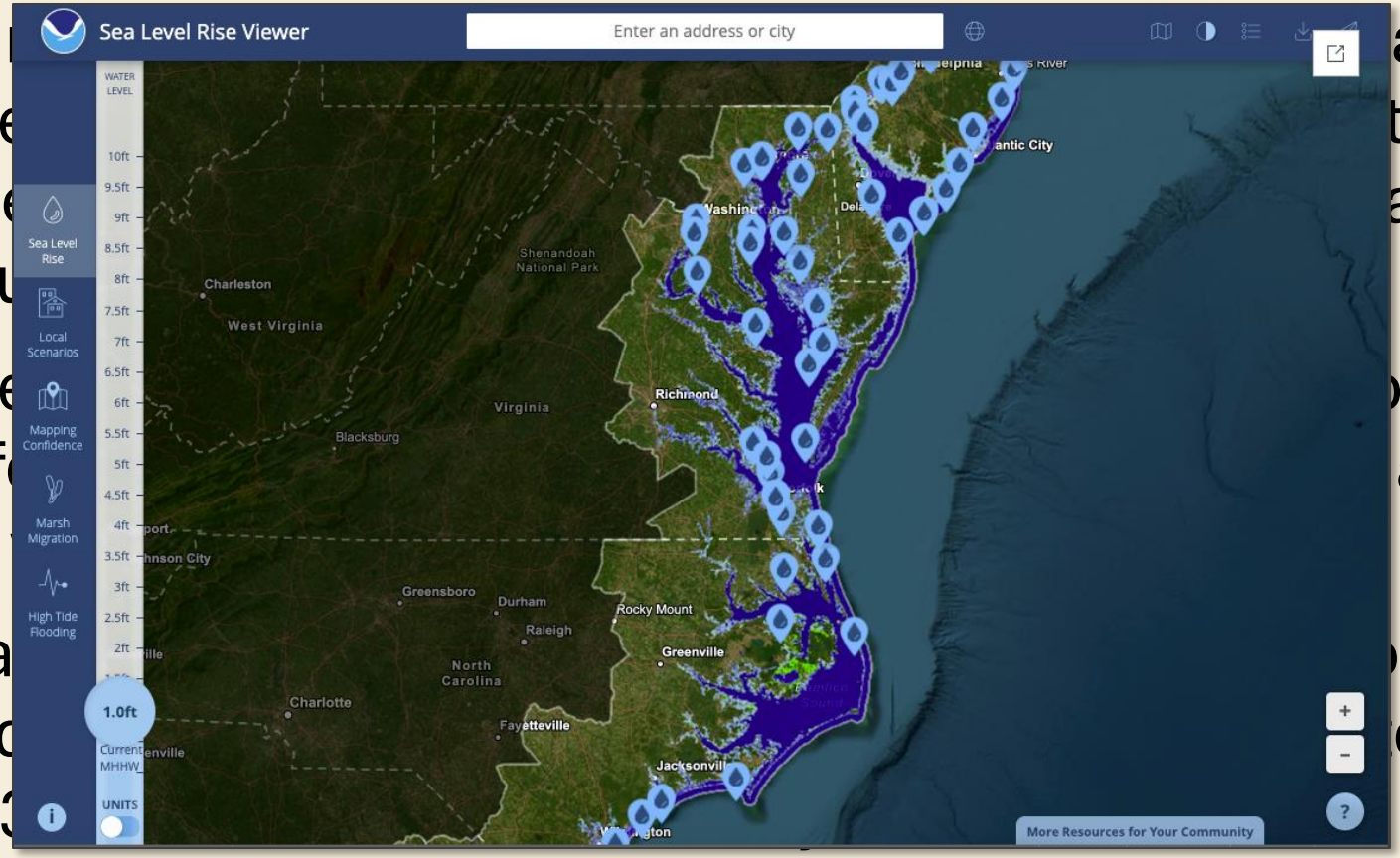

For the Community

Beyond the work at CBP, many other conservation and watershed organizations are working towards a healthier Chesapeake Bay.

Please contact ITAT Leaders if interested in being featured in the Tributary Summary Geonarratives.

Thank you!

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Photo credit: Matt Rath & Will Parson/CBP

Scan to access the Rappahannock Geonarrative here!

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USGS science for a changing world

EPA

NOAA

University of Maryland
Center for Environmental Science