Chesapeake Bay Program

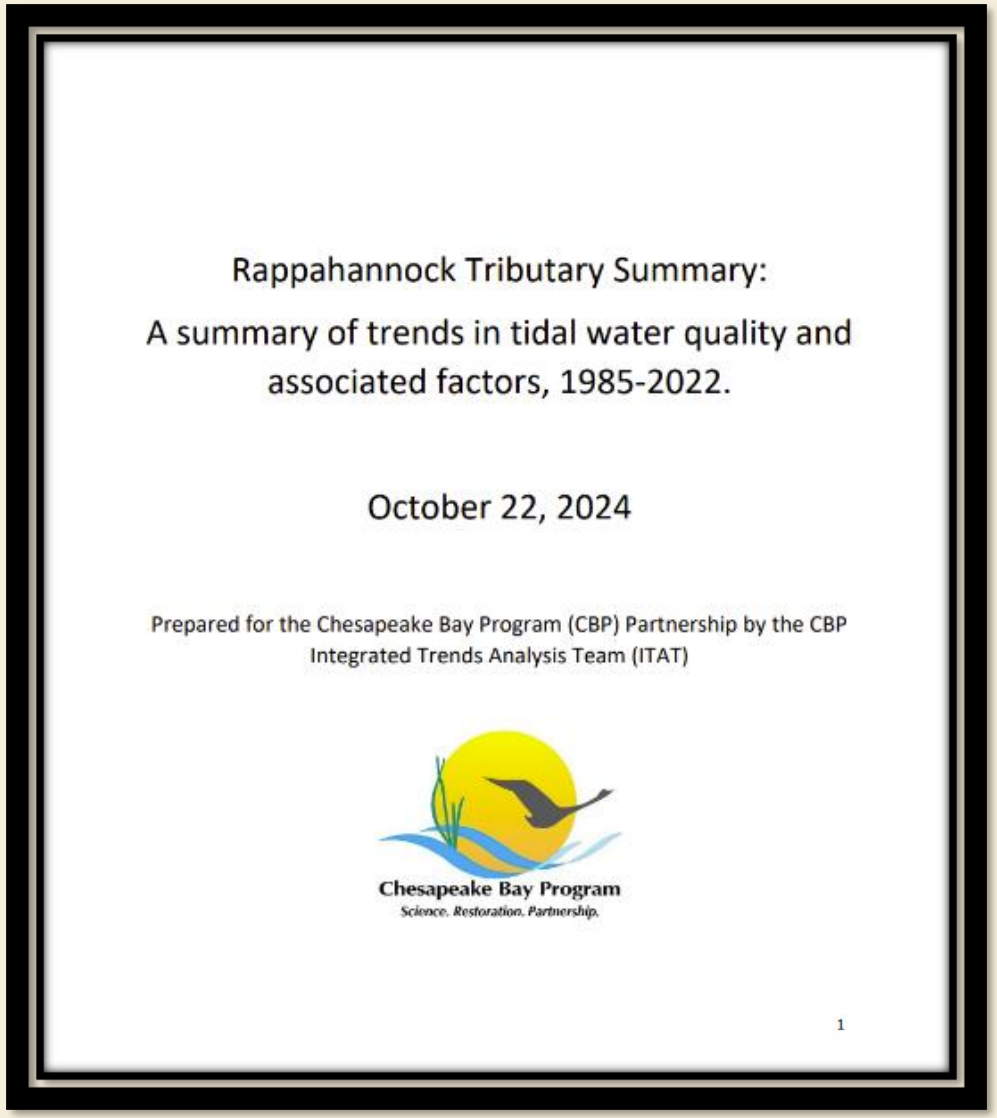
Science. Restoration. Partnership.

Tools for Tracking Water Quality Trends: ITAT Tributary Summaries and Geonarratives

Gabriel Duran, Kaylyn Gootman, Breck Sullivan

ITAT Meeting – June 25th, 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)

Chesapeake Bay Program
Science. Restoration. Partnership.

1

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 translate the reported information into a user-friendly interactive web-platform (ArcGIS Story Maps) presentation for use by resource 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 the Chesapeake Bay Program (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
- Changing Environmental Conditions

How to maximize the use of CBP Integrated Trends Analysis Team (ITAT) tools . . .

Chesapeake Bay Watershed

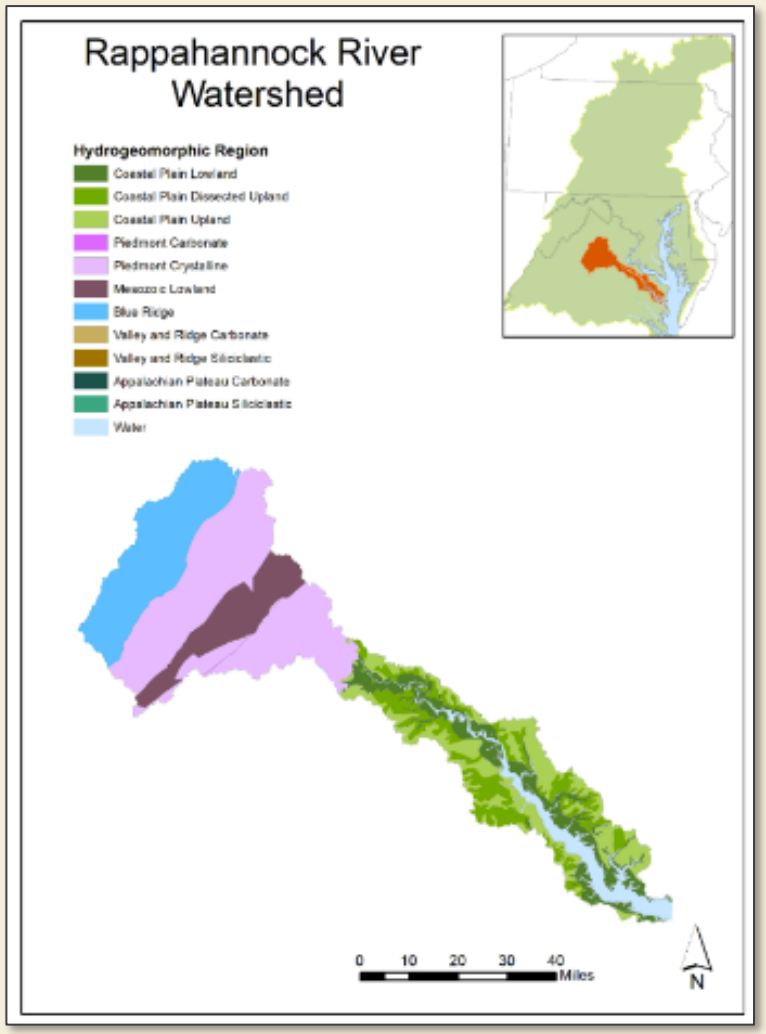
- **Maryland Mainstem** *(The 5 Chesapeake Bay mainstem segments within the MD state boundary. Drainage basins include the Susquehanna River and upper Chesapeake shorelines)*
- **Maryland Upper Eastern Shore** *(The Northeast, Bohemia, Elk, Back Creek, Sassafras, and Chester Rivers, the C&D Canal, and 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: Characterizing the Earth's surface based on the predominant landforms and features found in each region.

Effects on the watershed:

- Nutrient (Total Nitrogen & Total Phosphorus) and Sediment transport.

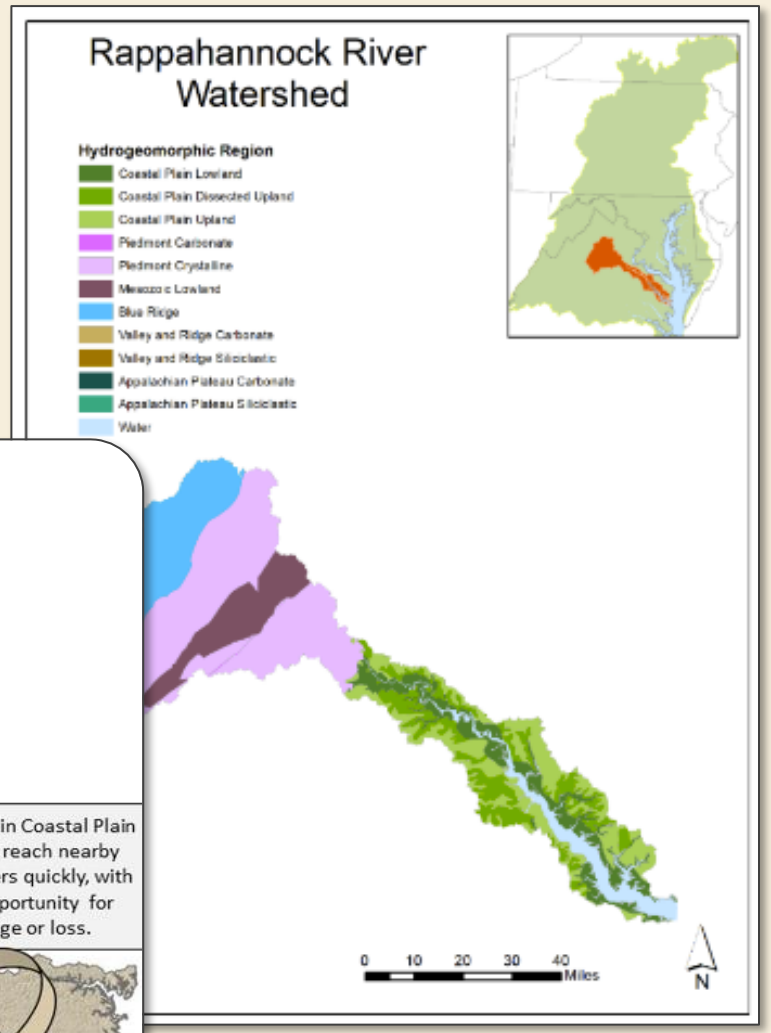


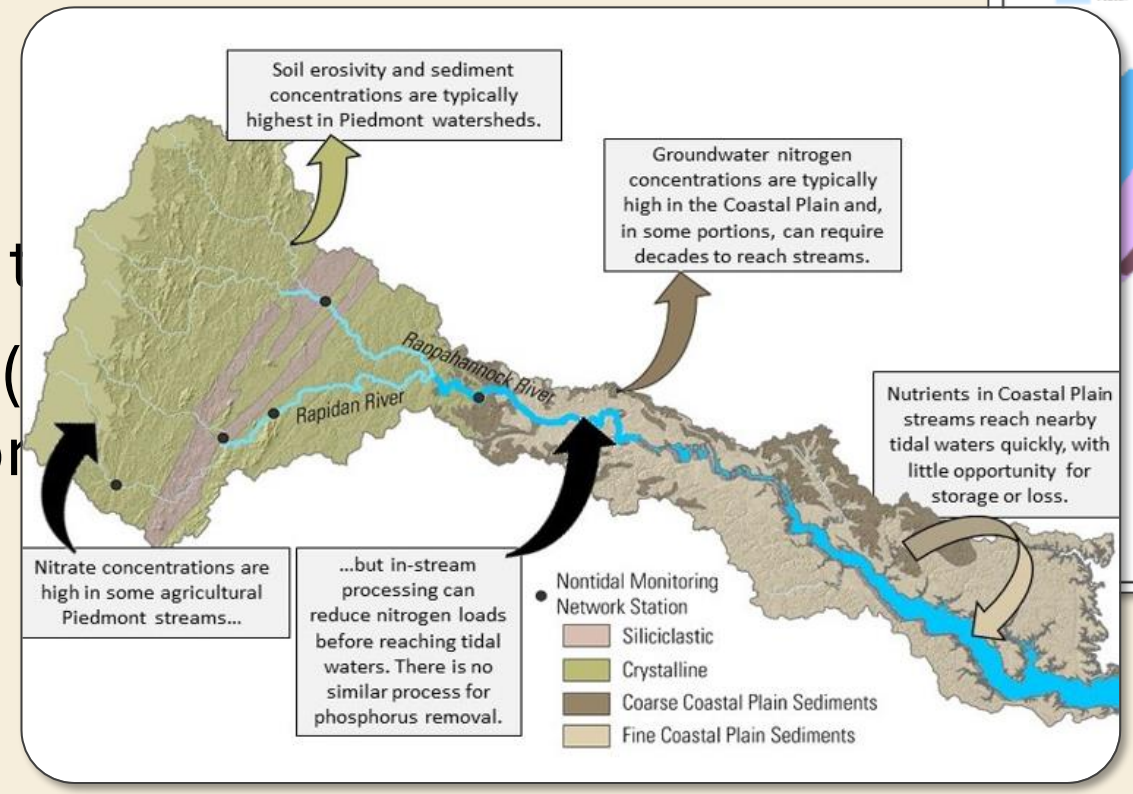
Physiography

Physiography: Characterizing the Earth's surface based on the predominant landforms and features found in each region.

Effects on t

- Nutrient (
  Phosphor





Land Use

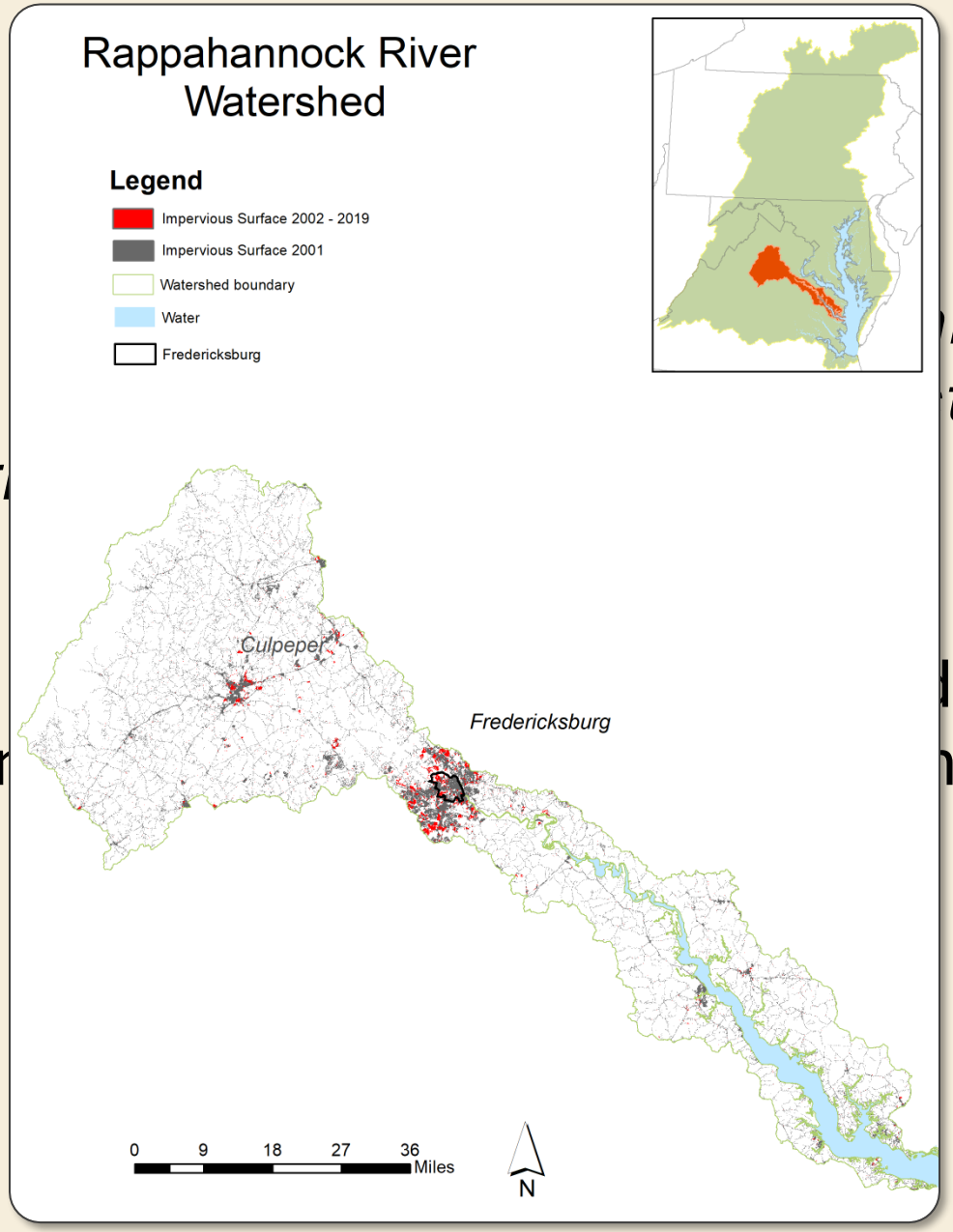
Land Use (ref): describes the human use of land. It represents the economic and cultural activities that are practiced at a given place (e.g., agricultural, developed, natural).

In general, forest conversion to urban and agriculture land increases nutrient and sediment loads entering rivers and streams.

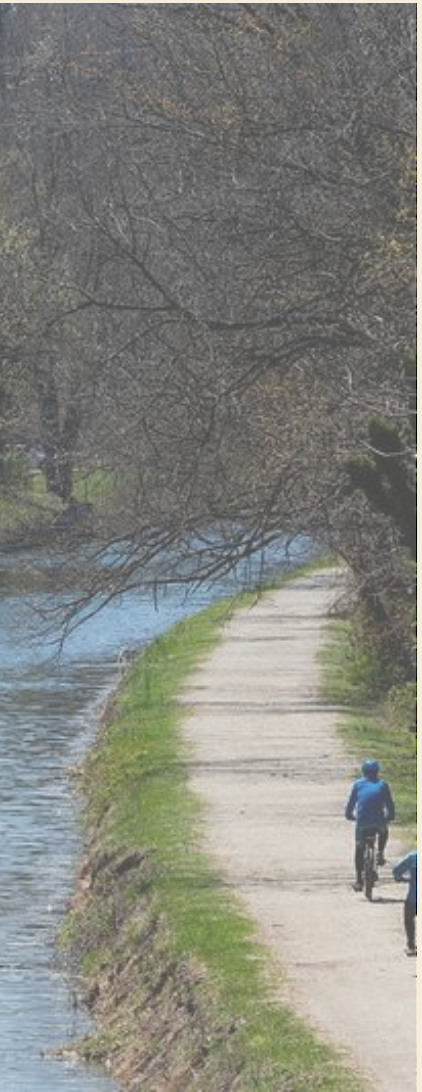
Land Use

Land Use (ref): nd. It represents the economic and ticed at a given place (e.g., agri

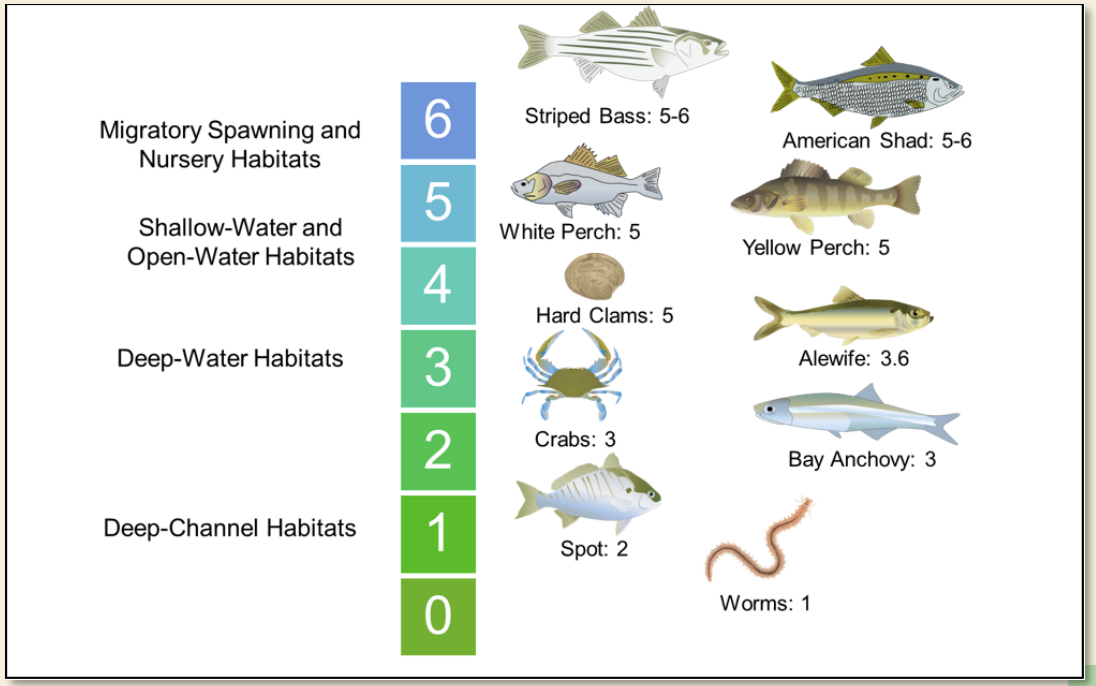
In general, l agriculture land increases n ntering rivers and



Water-Quality Criteria



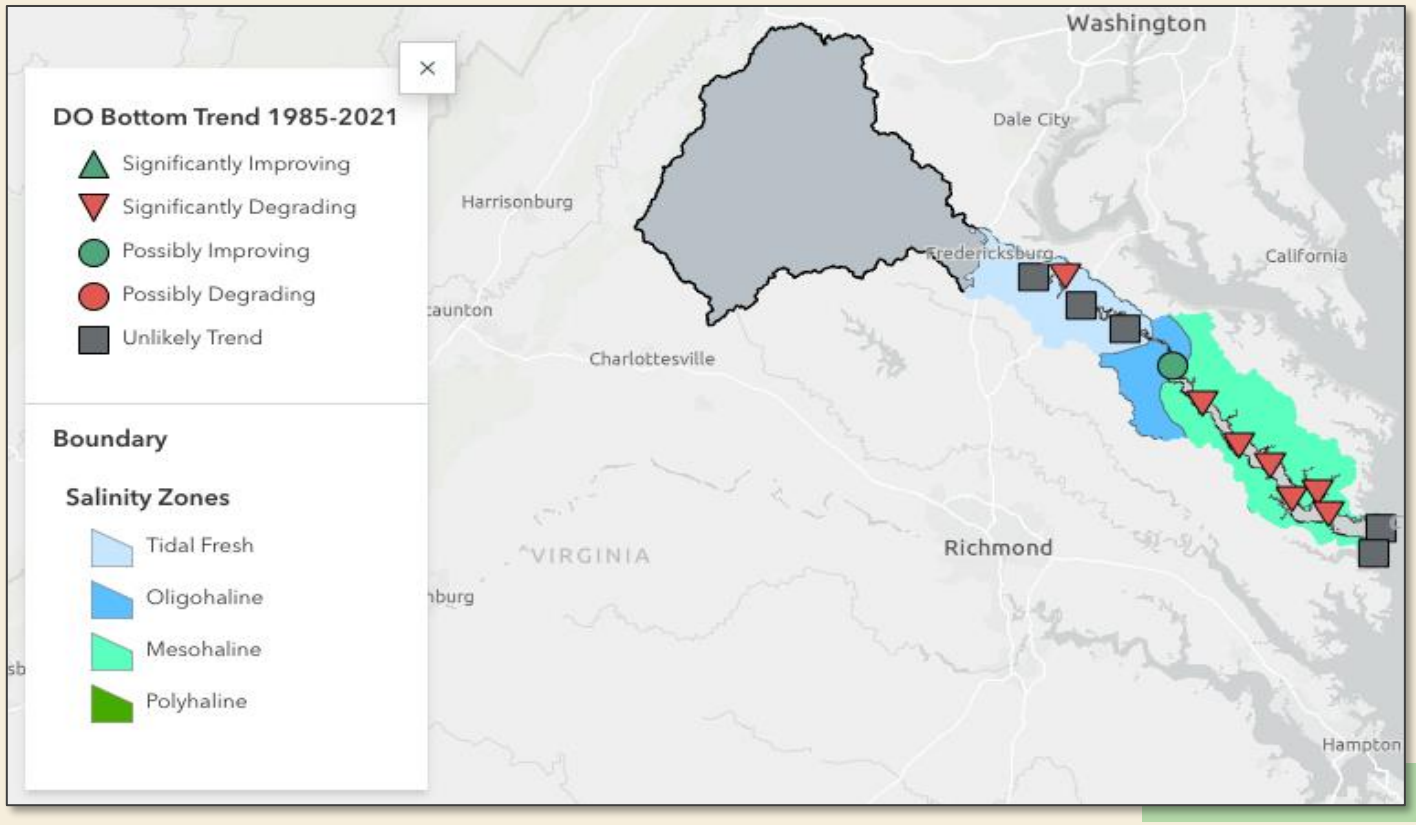
Science-based Dissolved Oxygen (DO), Chlorophyll *a* (Chl-*a*), and water clarity/underwater bay grasses (Turbidity) criteria were developed to protect aquatic living resources in our tidal waters. The criteria have been adopted into water quality standards.



U.S. EPA 2003

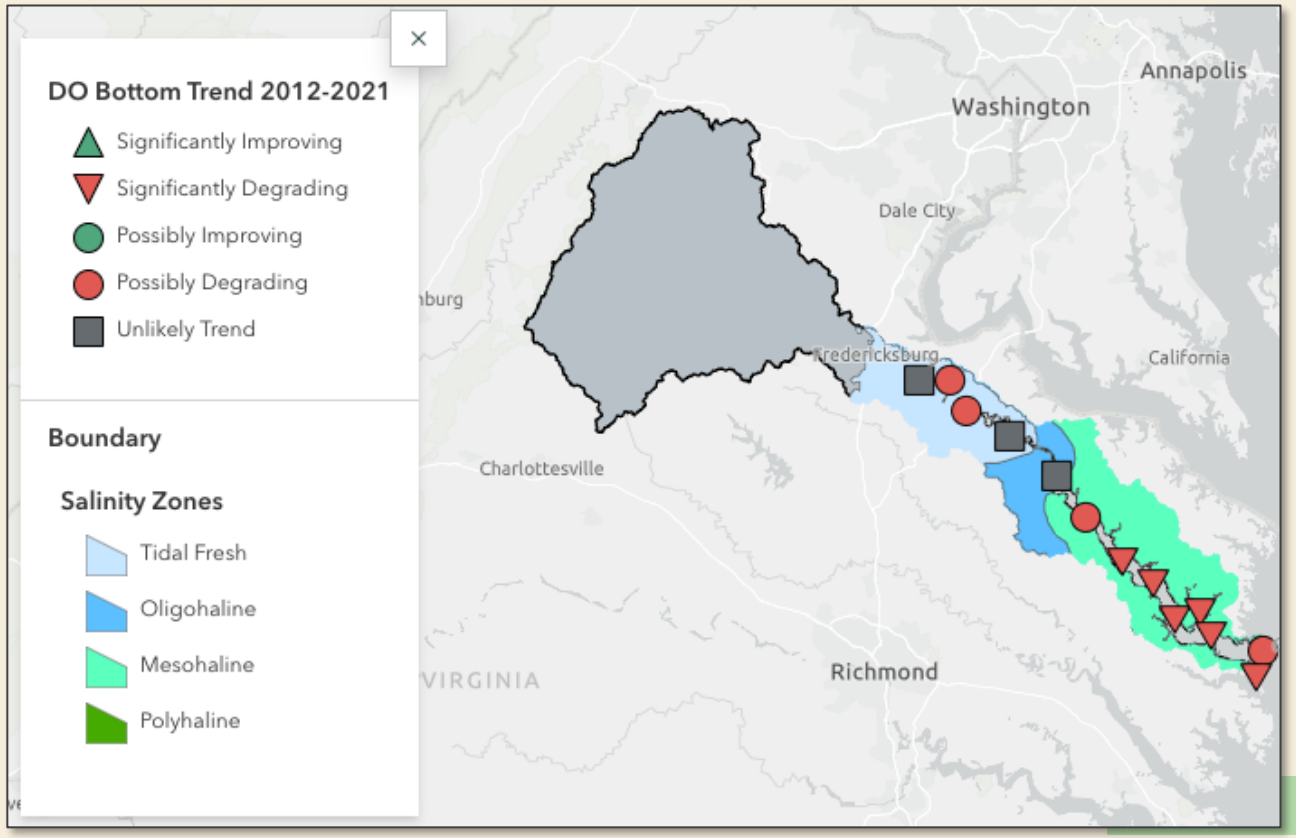
Long-Term Water-Quality Parameters

Water-Quality Parameters reported here include Total Nitrogen (TN), Total Phosphorus (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.



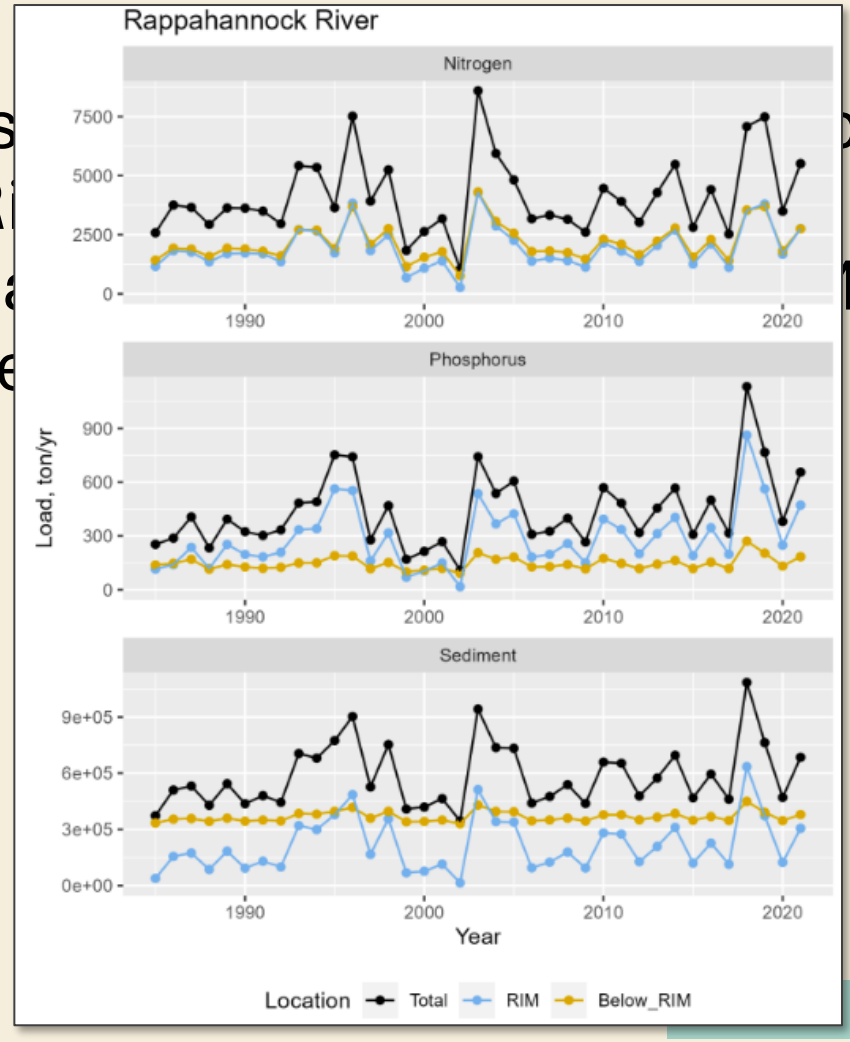
Factors Affecting Trends – Watershed Loads

Nutrient and sediment loads are estimated from monitored loads at U.S. Geological Survey (USGS) River Input Monitoring (RIM) stations located at the nontidal-tidal interface and below-RIM simulated loads from the CBP Watershed Model.

Factors Affecting Trends – Watershed Loads

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.



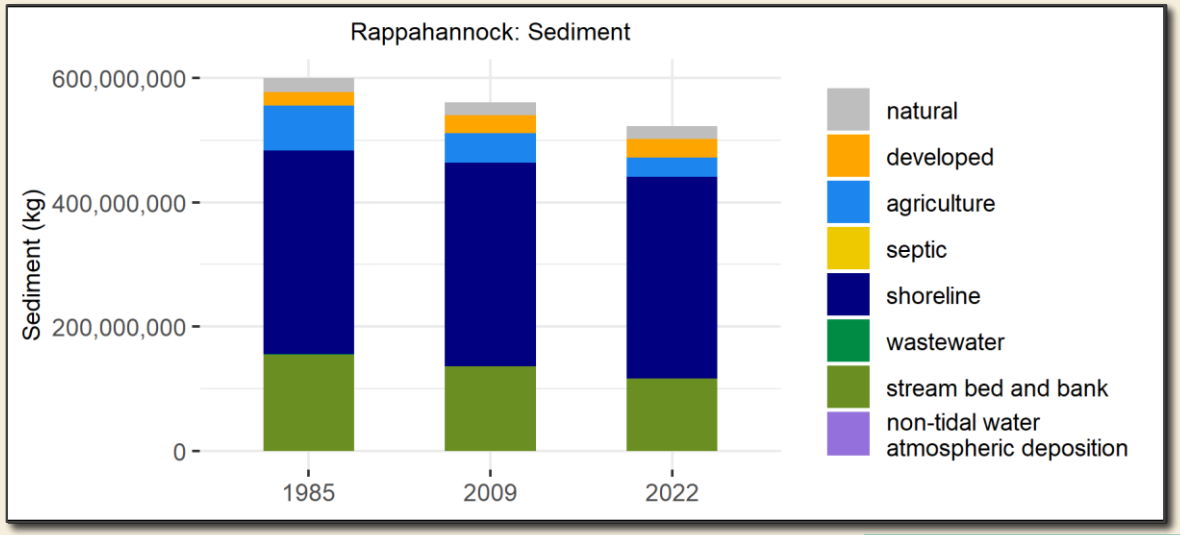
Factors Affecting Trends – Load Sources

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.

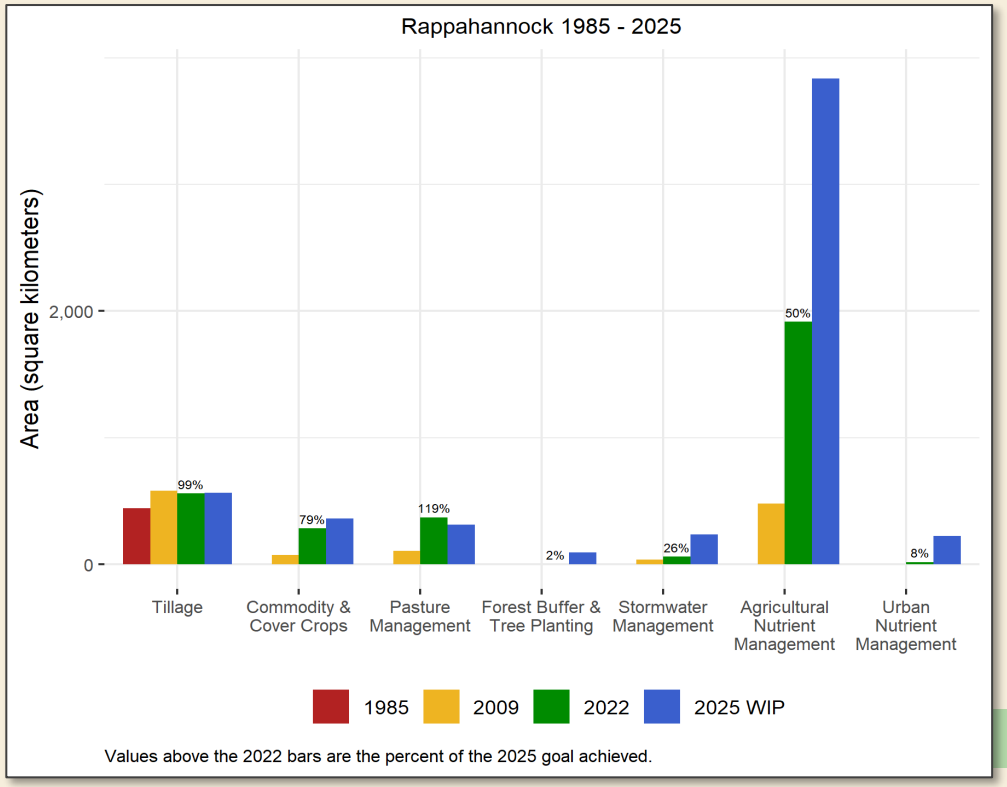
Between 1985-2019 changes in population size, land use and pollution management reduced loads by:

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



Factors Affecting Trends – Best Management Practices (BMPs)

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

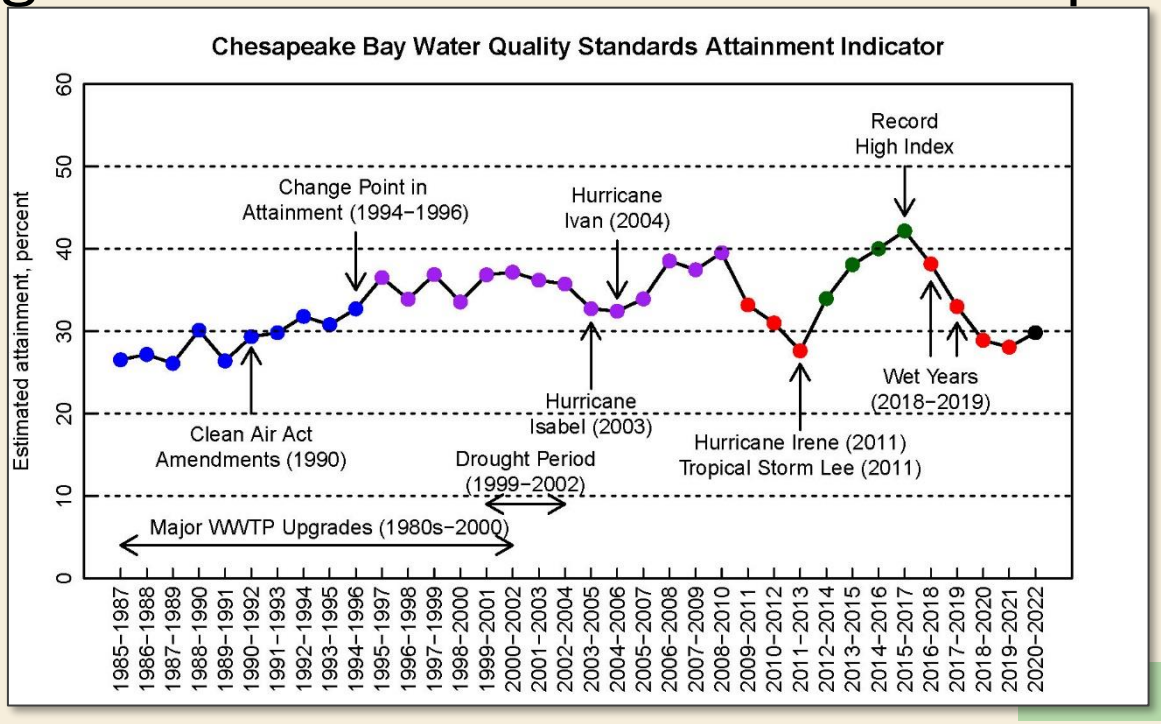


Data on BMP Implementation.

BMP Reference Guide

Changing Environmental Conditions

- 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 towards understanding the rate of attainment of water-quality standards.

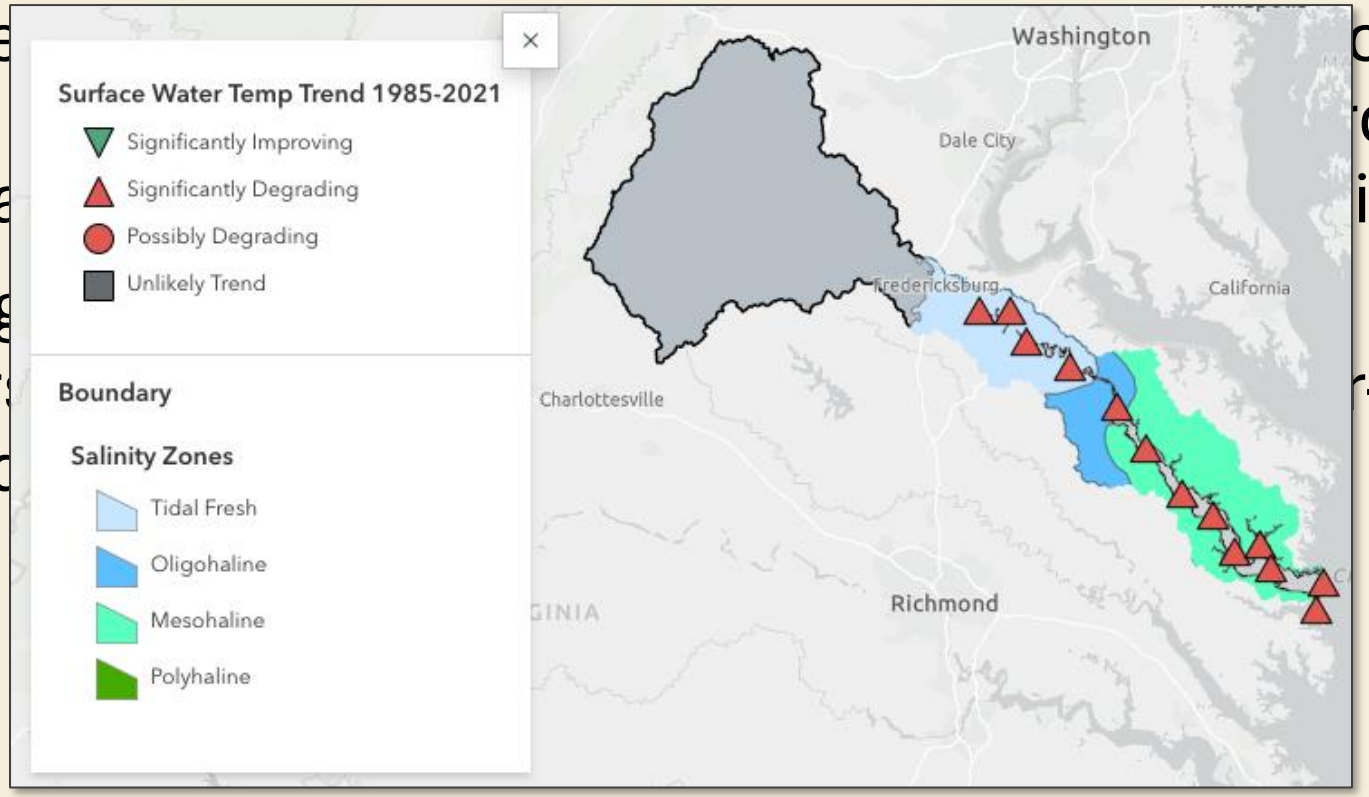


Changing Environmental Conditions

- 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 towards understanding the rate of attainment of water-quality standards.
- Warming temperatures and marine heat waves are known stressors for many of the living resources the water-quality standards were developed to support and protect.

Changing Environmental Conditions

- Extremes in rainfall – whether too much or too little – can have varying e cipitation and extreme ds understa ity standards.
- Warming known stressors r-quality standard

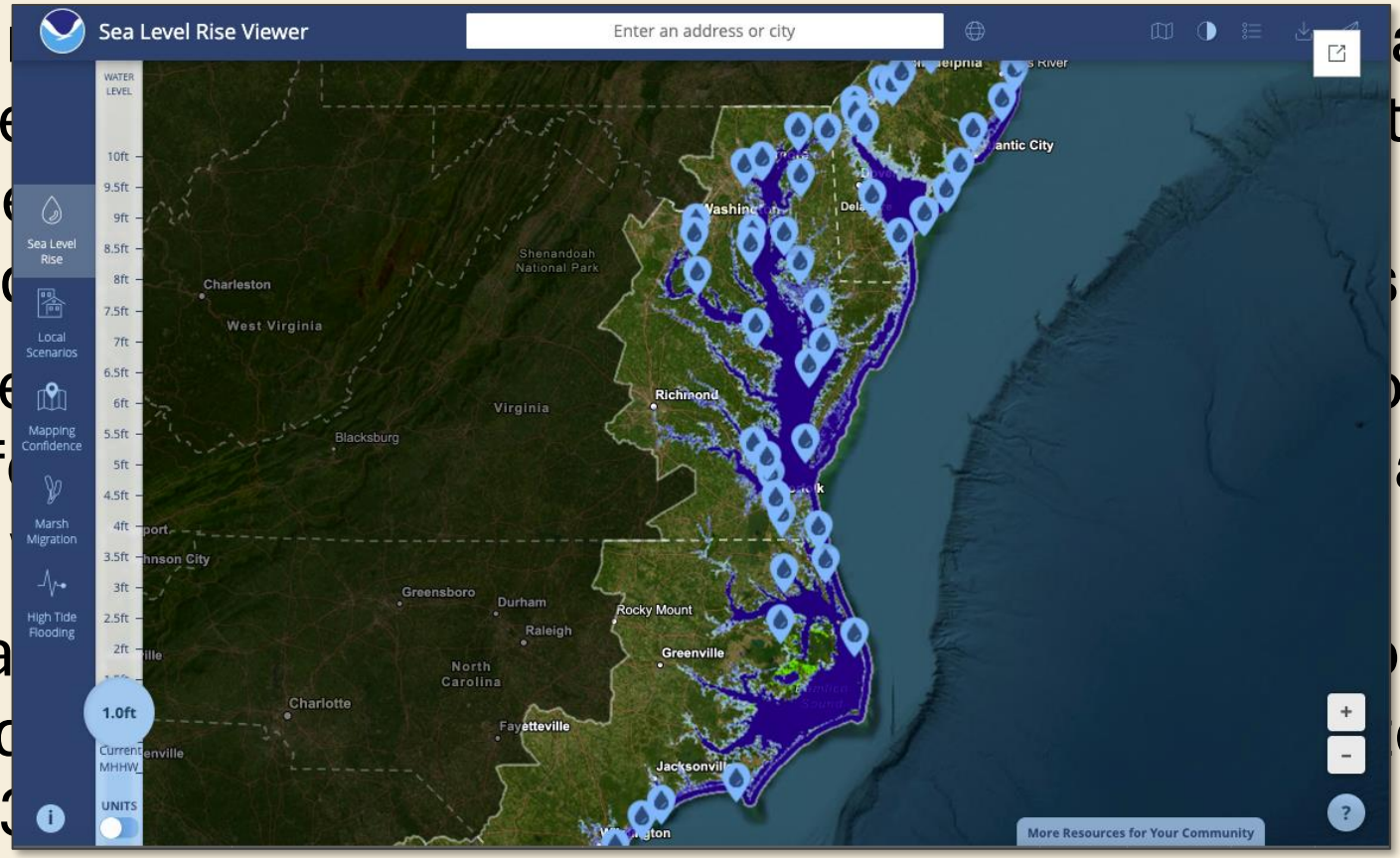


Changing Environmental Conditions

- 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 towards understanding the rate of attainment of water-quality standards.
- Warming temperatures and marine heat waves are known stressors for many of the living resources the water-quality standards were developed to support and protect.
- Over the last century, Bay waters have risen by about one foot, and according to a USGS study, Bay waters are predicted to rise another 1.3-5.2 ft over the next 100 years.

Changing Environmental Conditions

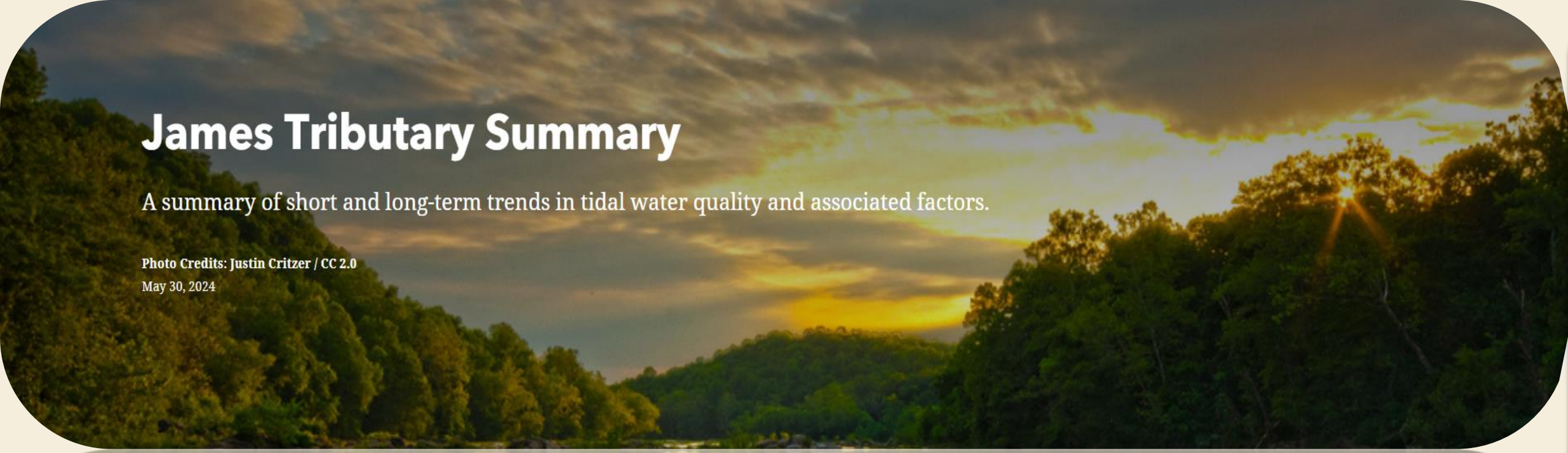
- Extremes i… an have varying effe… tation and extreme we… understand… standards.
- Warming te… own stressors f… ality standards …
- Over the la… ne foot, and accord… ed to rise another 1.3…



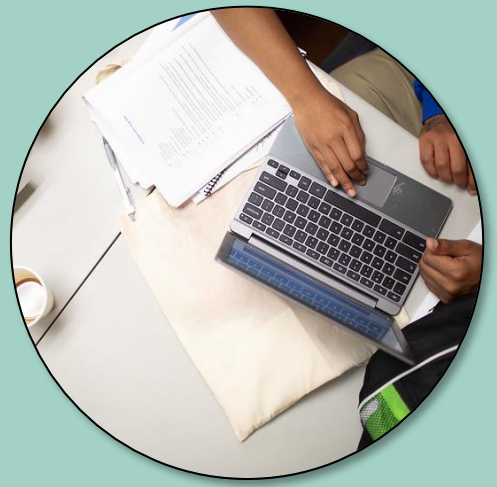
For the Community

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

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



How to maximize the use of ITAT tools . . .

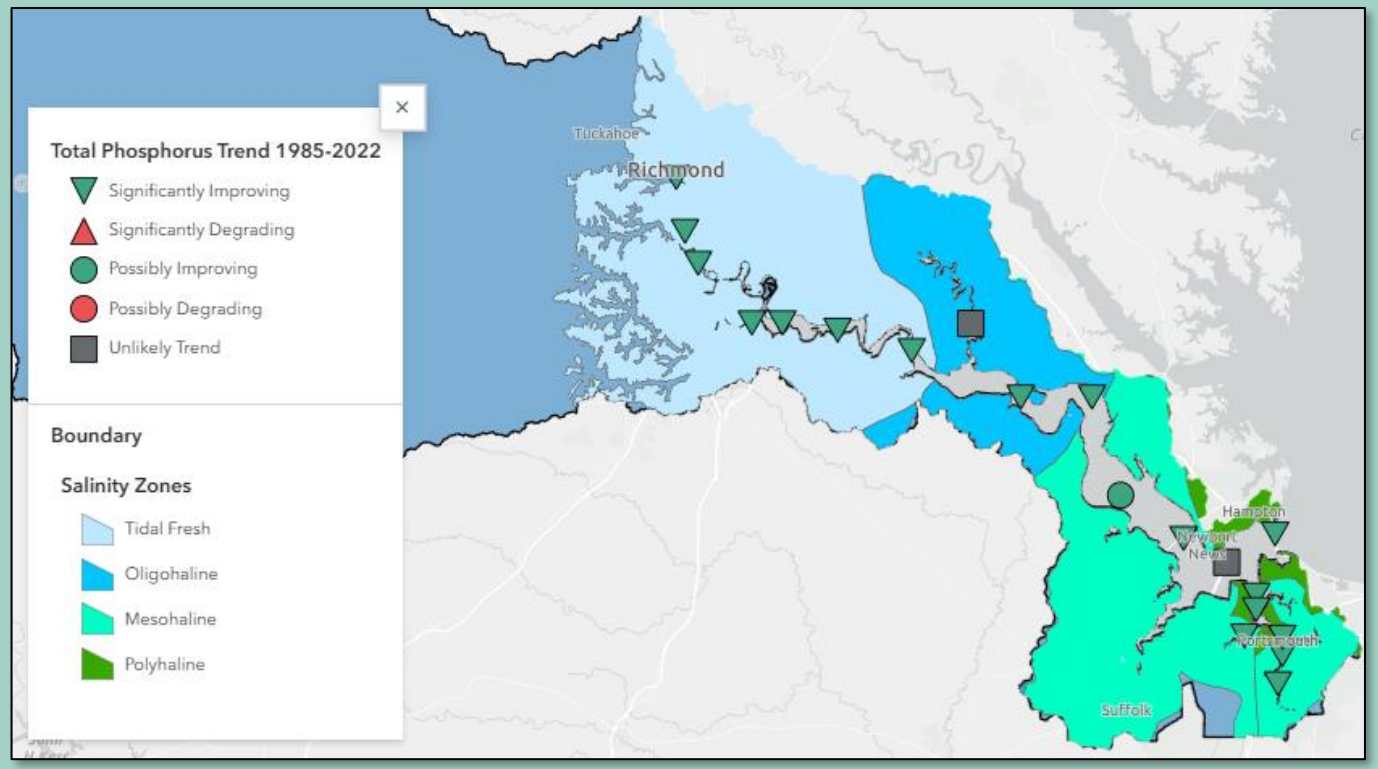


Communicating Environmental Progress to the Public

Informing Partner Coordination

Communicating Environmental Progress to the Public

Potential example: a local government could use the Geonarrative in public meetings to showcase water-quality improvements from conservation investment. This could foster community pride and support for clean water initiatives.

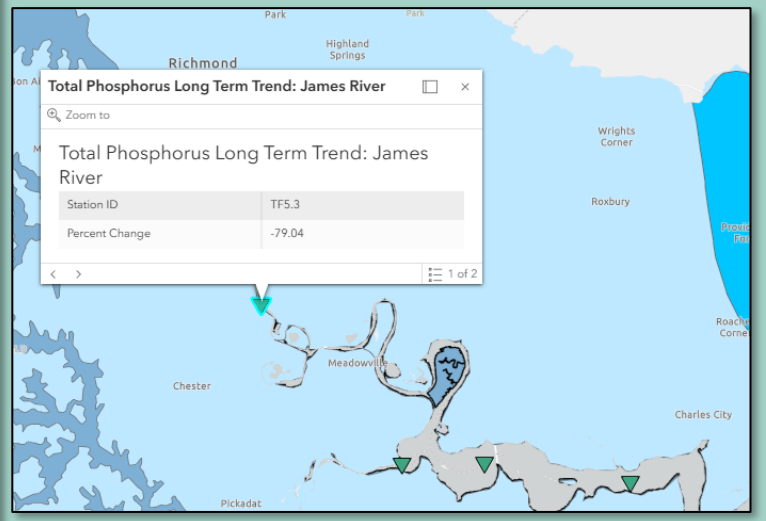


Communicating Environmental Progress to the Public

Use the Geonarratives alongside the Tributary Summary Reports:

- Utilize Tidal status and trends alongside Nontidal data to capture a whole watershed perspective.

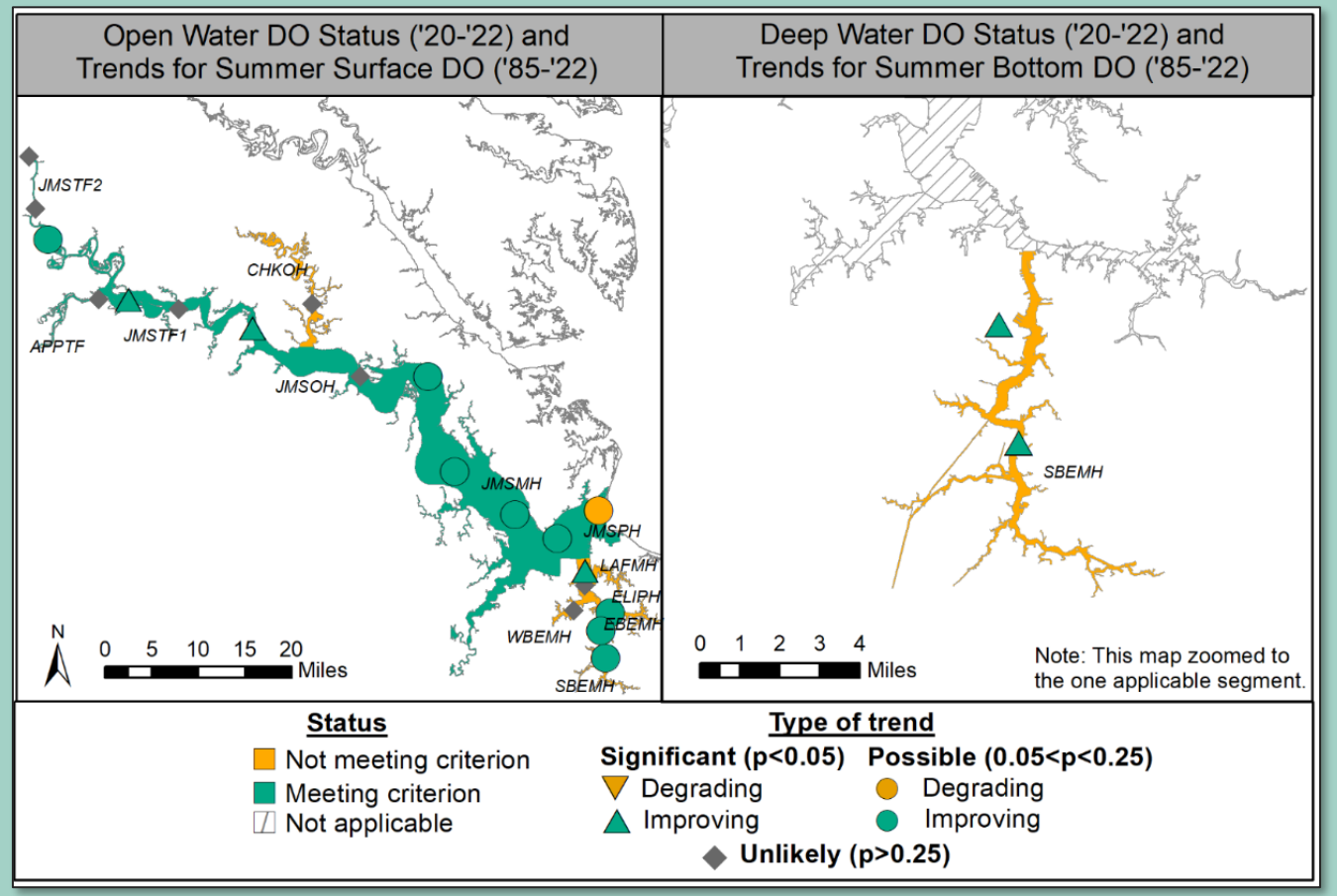
USGS Station ID	USGS Station Name	Trend start water year	Percent change in FN load, through water year 2020		
			TN	TP	SS
02011500	BACK CREEK NEAR MOUNTAIN GROVE, VA	1985	6.95	-	-
		2011	16.9	-	-
02015700	BULLPASTURE RIVER AT WILLIAMSVILLE, VA	1985	15.1	-	-
		2011	3.06	-	-
02020500	CALFPASTURE RIVER ABV MILL CREEK AT GOSHEN, VA	2011	24.8	-	-
02024000	MAURY RIVER NEAR BUENA VISTA, VA	1985	31.9	-	-
		2011	1.55	-	-
02024752	JAMES RIVER AT BLUE RIDGE PKWY NR BIG ISLAND, VA	2011	-2.53	-10.5	-12.6
02031000	MECHUMS RIVER NEAR WHITE HALL, VA	1985	-14.9	-	-
		2011	1.7	-	-
02034000	RIVANNA RIVER AT PALMYRA, VA	1985	-23	-	-
		2011	-21	-18.8	-22.1
02035000	JAMES RIVER AT CARTERSVILLE, VA	1985	-17.2	-39.2	15.9
		2011	-6.17	-14.2	-11
02037500	JAMES RIVER NEAR RICHMOND, VA	1985	-22.7	-	-
		2011	-19.2	-4.01	4.49
02039500	APPOMATTOX RIVER AT FARMVILLE, VA	1985	-2.12	-	-
		2011	-7.66	-	-
02041000	DEEP CREEK NEAR MANNBORO, VA	2011	-3.22	-	-



Communicating Environmental Progress to the Public

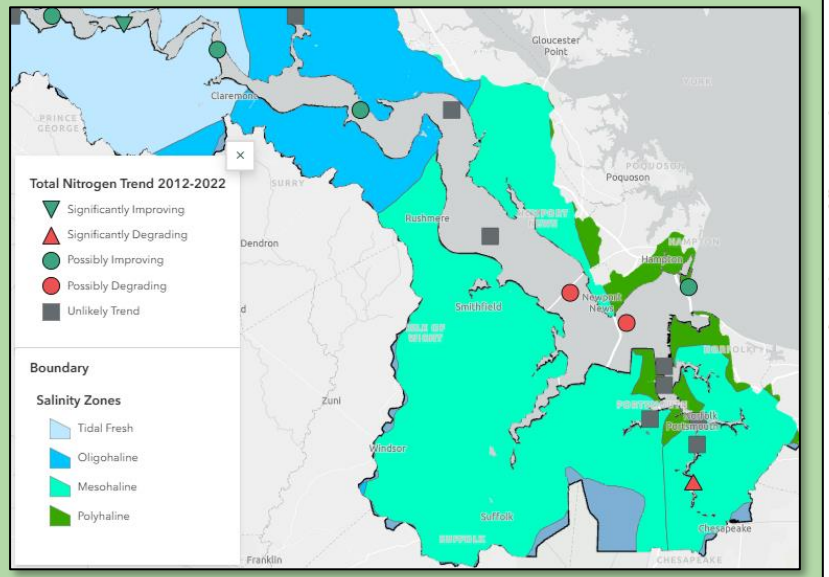
How you can use it:

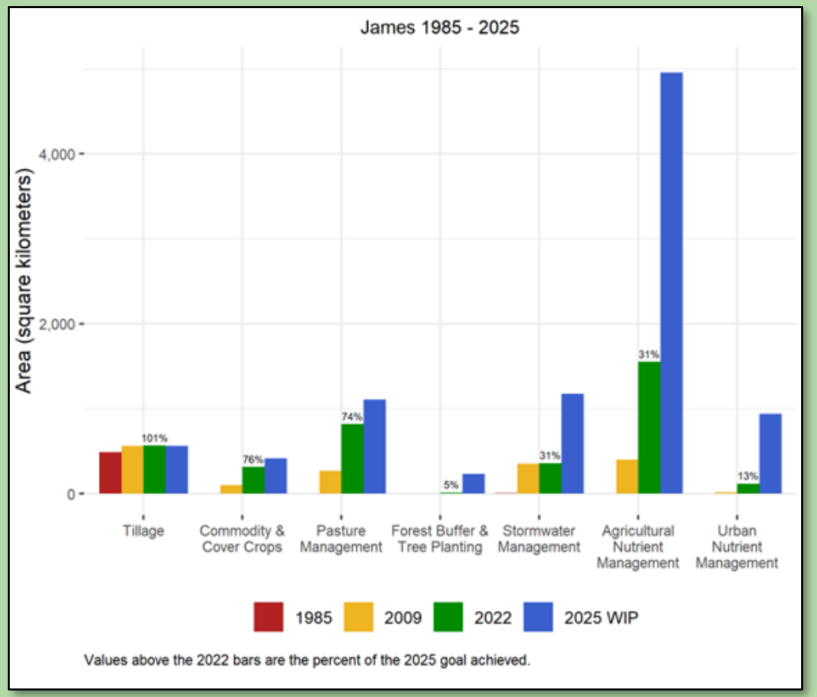
- Educate residents about your community's progress.
- Increase transparency and build trust in environmental policy decisions.



Informing Partner Coordination

Potential example: Regional watershed groups and county stormwater managers could collaborate using the Geonarratives to understand water-quality patterns and target management actions.





Informing Partner Coordination

How you can use it:

- Provide background information for grant applications.
- Set measurable, science-based goals in regional watershed implementation plans.

Discussion Questions:

1. *How do you use the ITAT tools? How do you use the tidal monitoring data?*
2. *How can we better track the use of Tributary Summaries and Geonarratives?*
3. *How can we attract more audiences? Similarly, what audiences should we be targeting more? What organizations should we be reaching out to for our "For the Community" section?*
4. *How can the items within the Tributary Summaries and Geonarratives be improved?*
5. *Are there other products that would be helpful for sharing the work of ITAT? Maybe a tidal Monitoring network fact sheet?*

Thank you!

Gabriel Duran (gduran@chesapeakebay.net)

Kaylyn Gootman (gootman.kaylyn@epa.gov)

Breck Sullivan (bsullivan@chesapeakebay.net)

Alex Gunnerson (agunnerson@chesapeakebay.net)

Sarah Betts (sbetts@fandm.edu)

Eva Smith (elsbells2013@gmail.com)

Photo credit: Matt Rath, Will Parson, Caitlyn Johnstone, Justin Critzer/CBP

Scan to access the Rappahannock Geonarrative here!

Chesapeake Bay Program
Science. Restoration. Partnership.

USGS science for a changing world

EPA

NOAA

University of Maryland
Center for Environmental Science

Respond to the Menti:

Link here: Mentimeter poll
Vote code: 1727 7427