NITROGEN, PHOSPHORUS, AND SUSPENDED-SEDIMENT

LOADS AND TRENDS

Long- (1985-2022) + Short-term (2013-2022)

Measured at the River Input Monitoring Stations

NTNWG 10/18/2023

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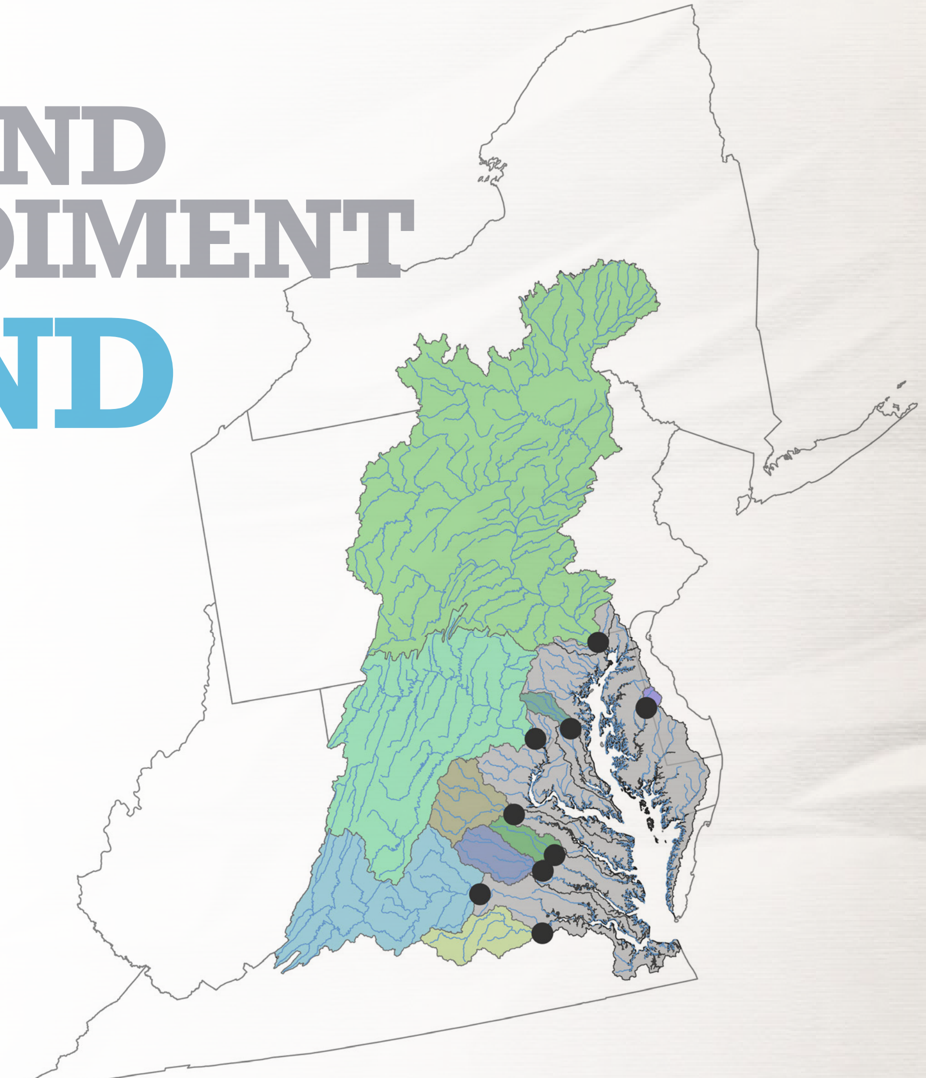
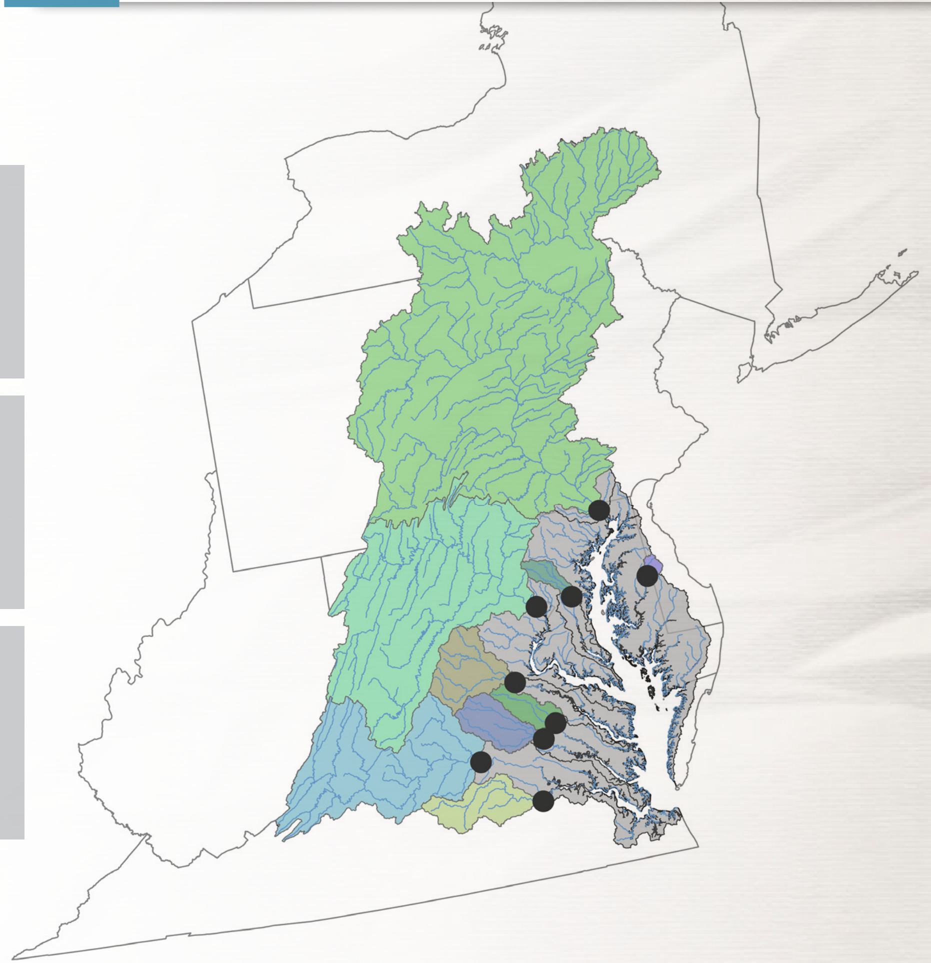


OBJECTIVE

Summarize results of updated long- and short-term RIM monitoring data that describe how nutrient and sediment loads, and trends in loads, have changed over time

Outline

- Network + QA/QC
- Trend + Yield Results
- Sharing + Communication



The Chesapeake Bay Nontidal Network (NTN) and River Input Monitoring (RIM) Network

Computing loads and trends of total nitrogen (TN), total phosphorus (TP), and suspended sediment (SS) in nontidal rivers of the Chesapeake Bay watershed (CBW).

EXPLANATION

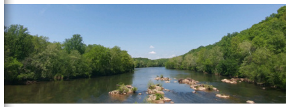
NTN status through water year 2020

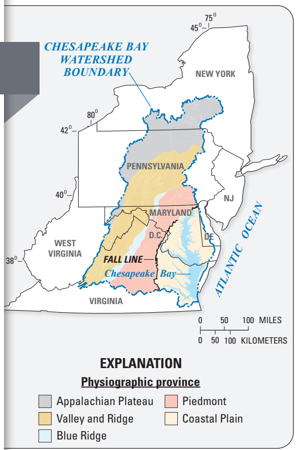
- ☆ RIM site
- Long-term site
- Short-term site
- Load-only site
- Streams

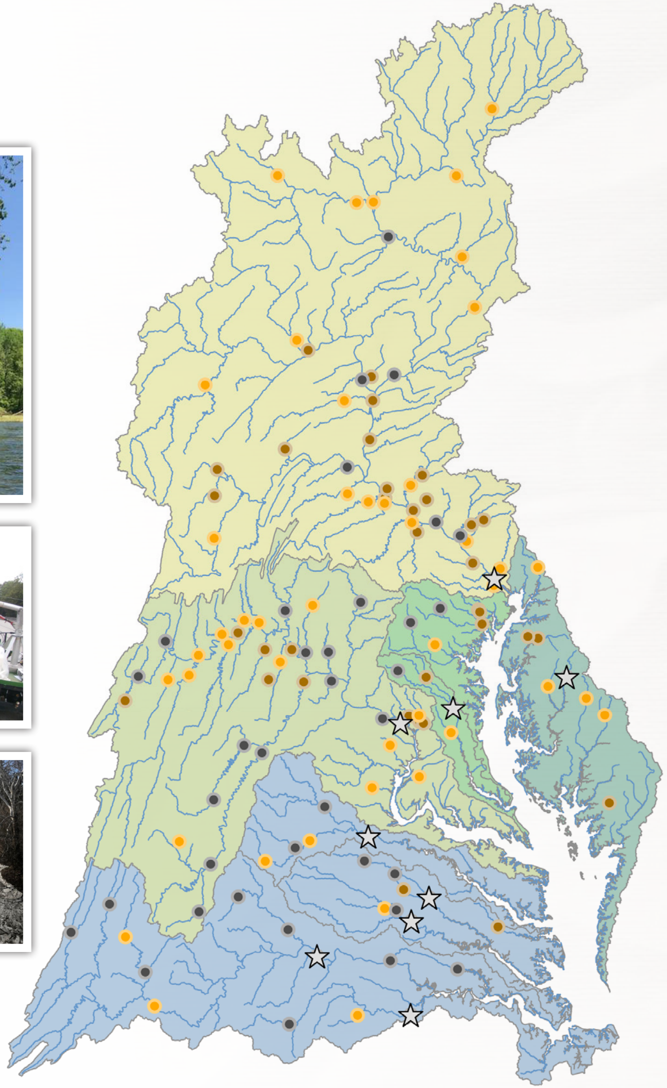
Major Basins

- Eastern Shore
- Potomac
- Susquehanna
- Virginia
- Western Shore

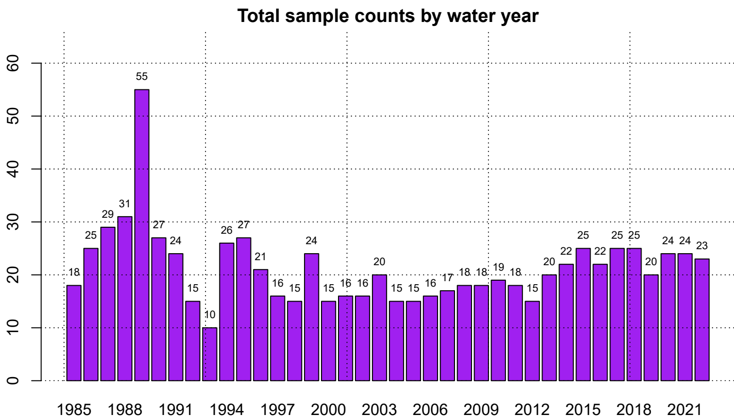
Load is the amount of nutrients or sediment in a river during a period of time (≧ 5 years of data needed). Trend is the change in load over multiple years (≧ 10 years of data needed).

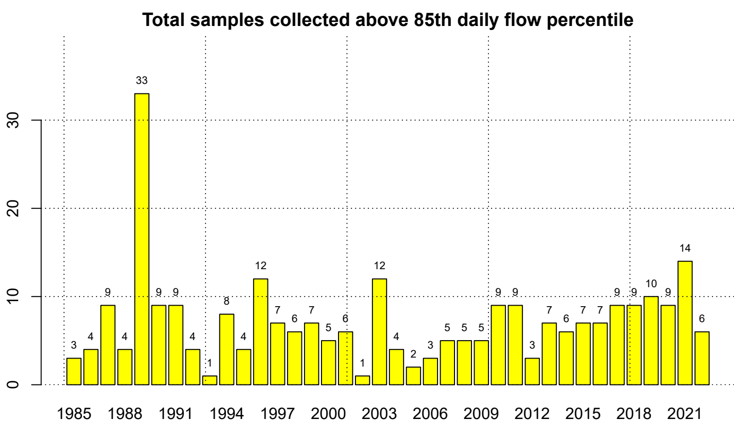






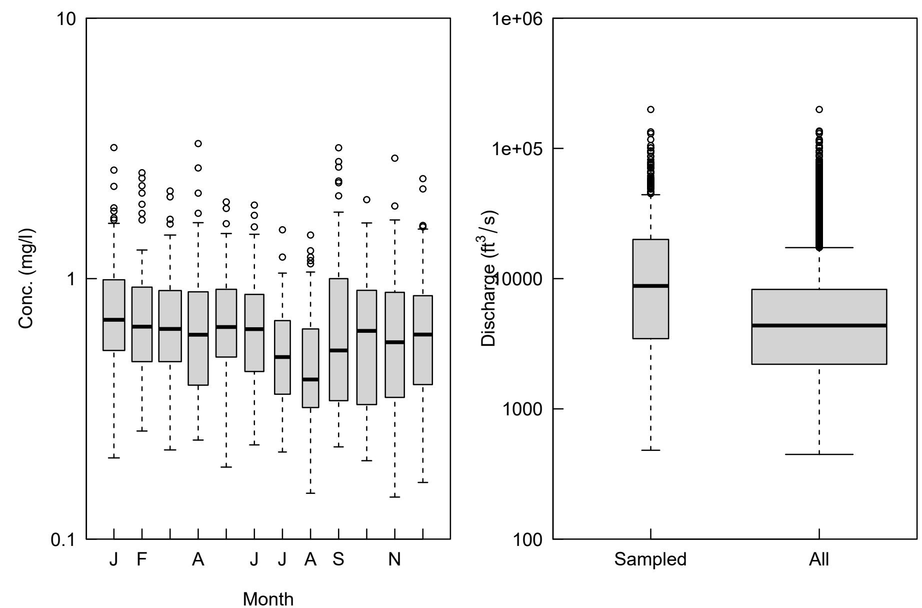
Example of Discrete Sampling Summaries





WRTDS uses observed data: over 180 water quality samples are collected throughout the RIM network each year.

The RIM network is a collaborative effort between the USGS, EPA, and agencies in Chesapeake Bay states (MD DNR, VA DEQ, and more).



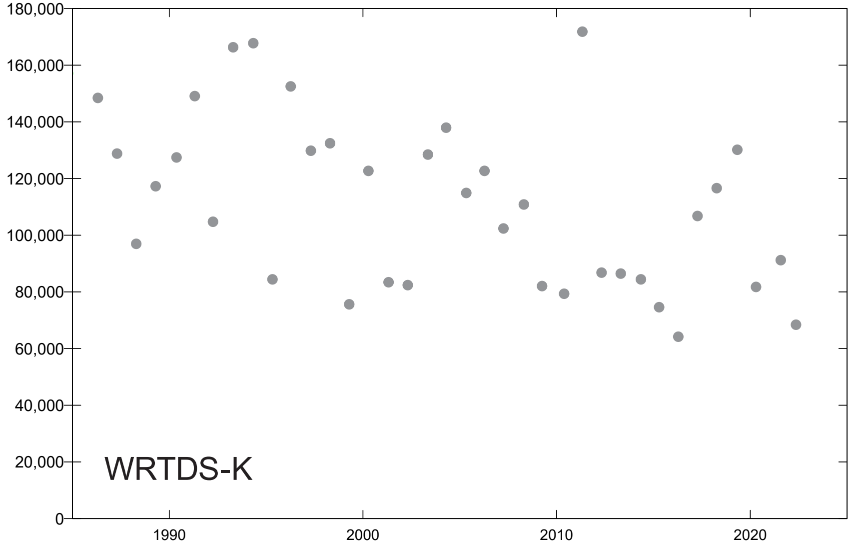
Load and trend results have been computed through 2022 to provide timely information available for decision making

Load is a measure of
the total amount of nutrients or sediment that is mobilized in a given time period (monthly, annually, …). Important for understanding receiving water response

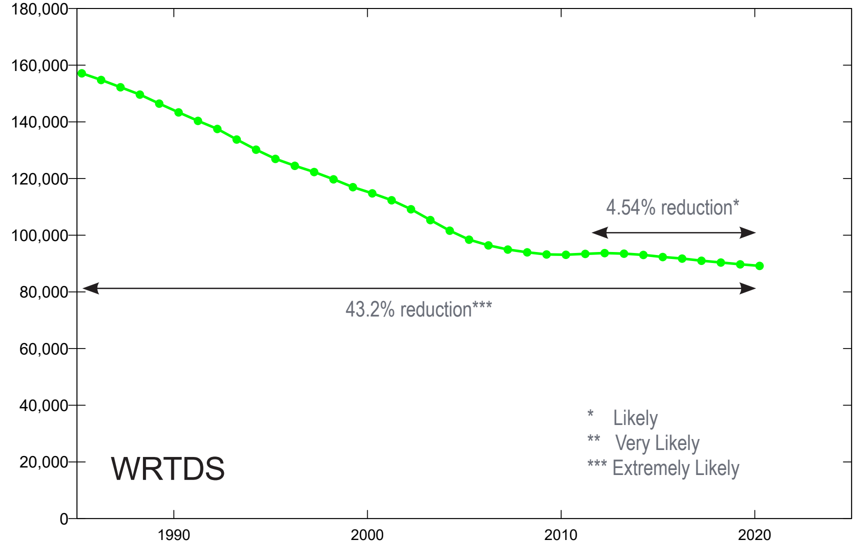
Flow-normalized (FN) loads remove
most of the hydrologic variability associated with loads. Important for understanding water-quality responses to watershed changes

A trend is reported when
the likelihood estimate of a trend existing is greater than 0.67 after at most 100 bootstrap re-samples and a 90% confidence interval

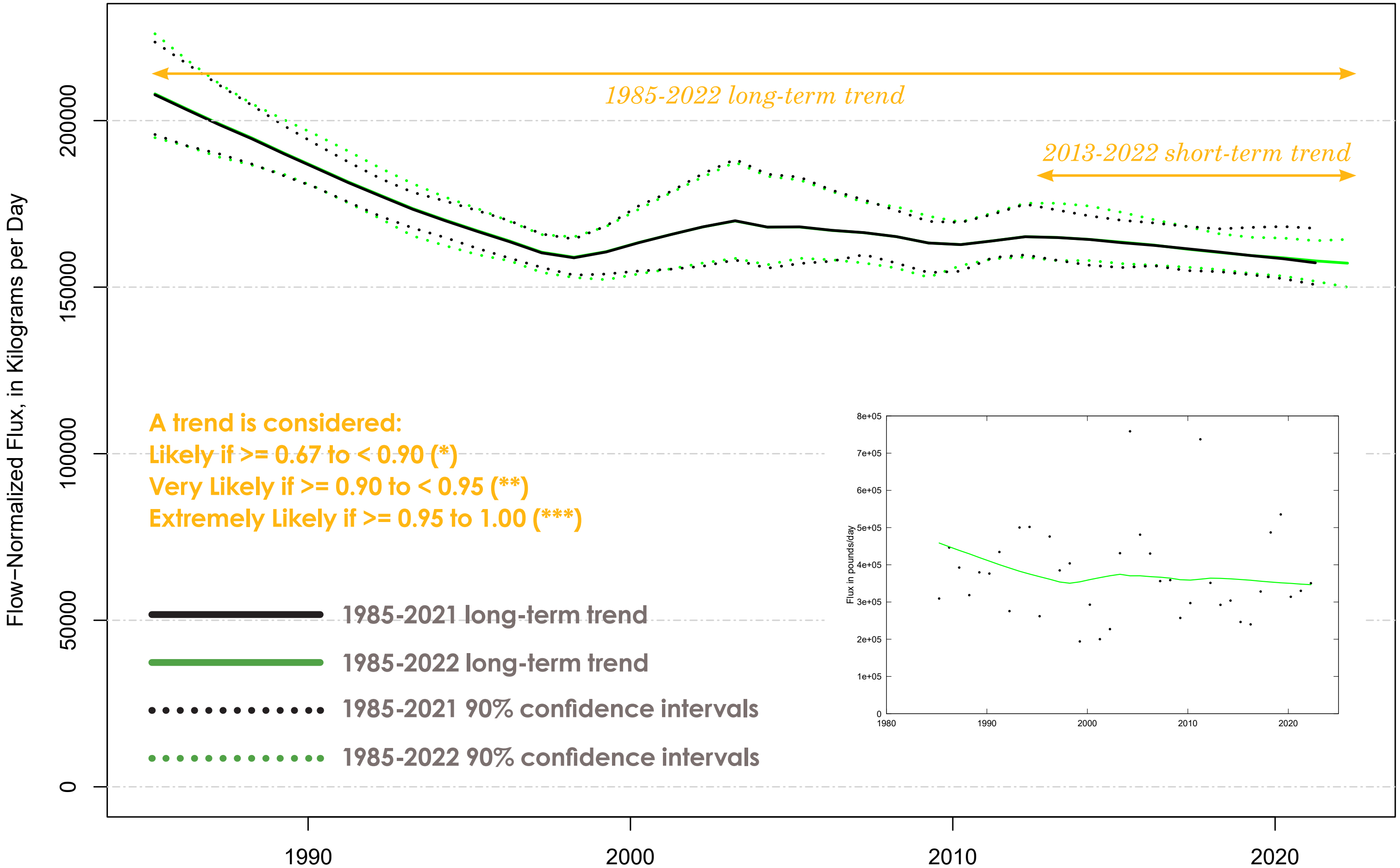
RIM River Example, Total Nitrogen
Annual mean, pounds/year



RIM River Example, Total Nitrogen
Flow-normalized Flux, pounds/year



WRTDS Methods + QA/QC



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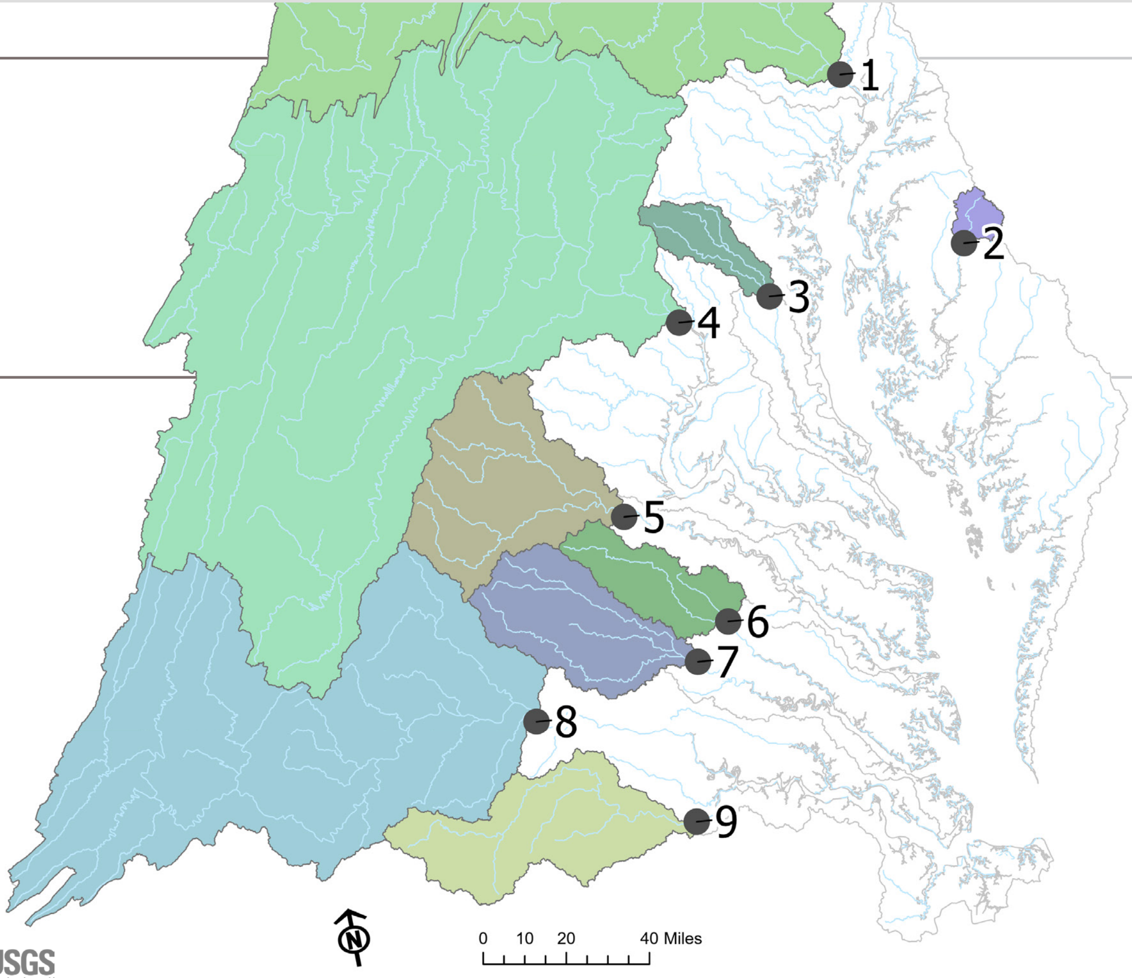
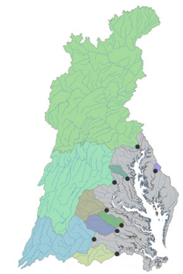
RIM Network Basins + Stations



~78% of CBW



1. Susquehanna River at Conowingo, MD {701,620 km^2}

2. Choptank River near Greensboro, MD {292 km^2}

3. Patuxent River near Bowie, MD {906 km^2}

4. Potomac River at Chain Bridge, DC {29,973 km^2}

5. Rappahannock River near Fredericksburg, VA {4,131 km^2}

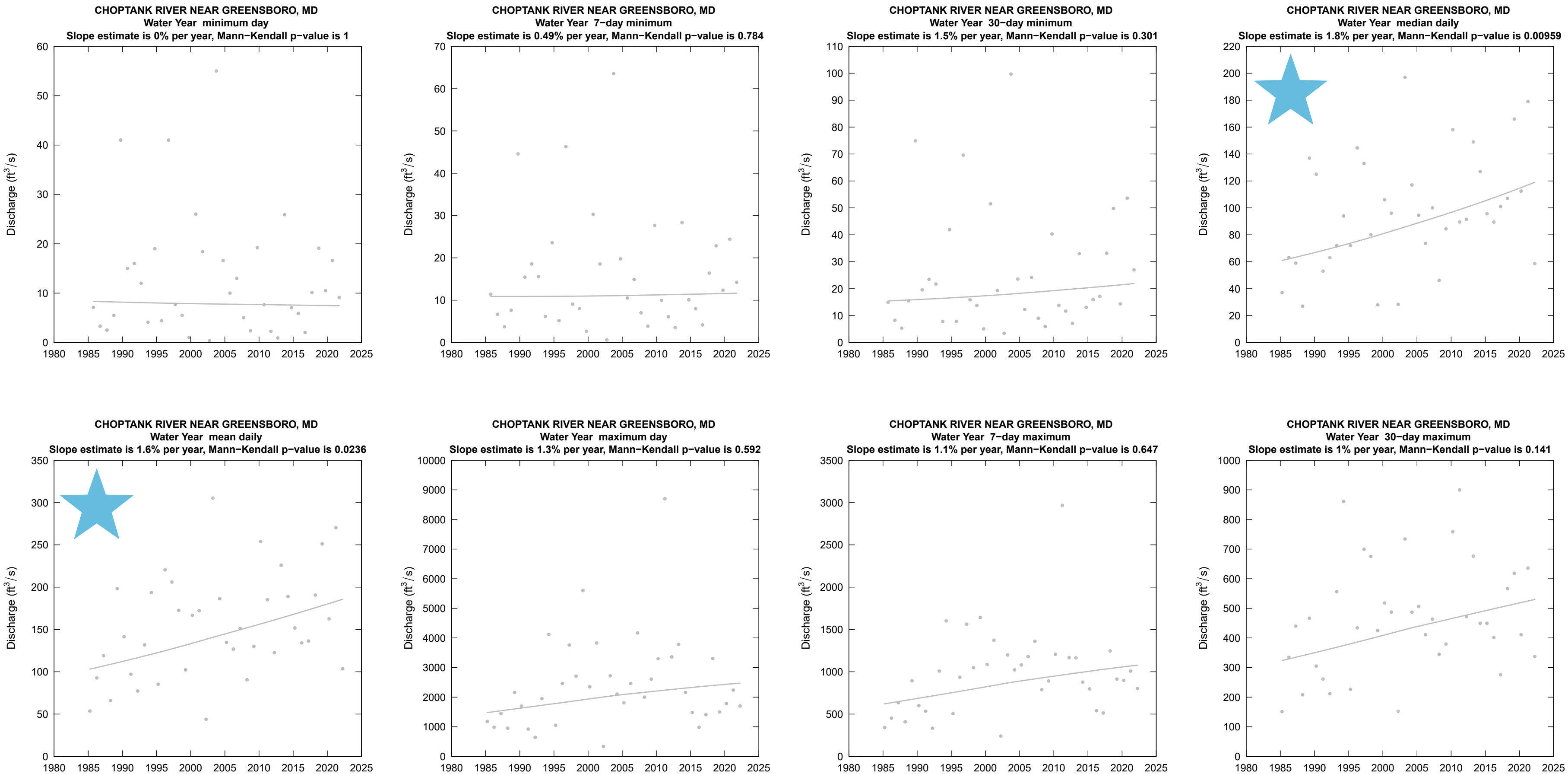
6. Mattaponi River near Beulahville, VA {1,554 km^2}

7. Pamunkey River near Hanover, VA {2,796 km^2}

8. James River at Cartersville, VA {16,207 km^2}

9. Appomattox River at Matoaca, VA {3,482 km^2}

Do any sites have significant Q trends?



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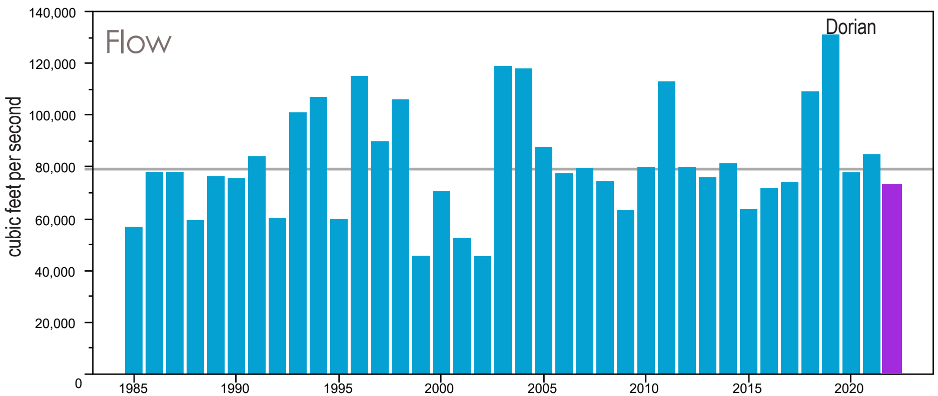
2022 delivery of freshwater flow and loads

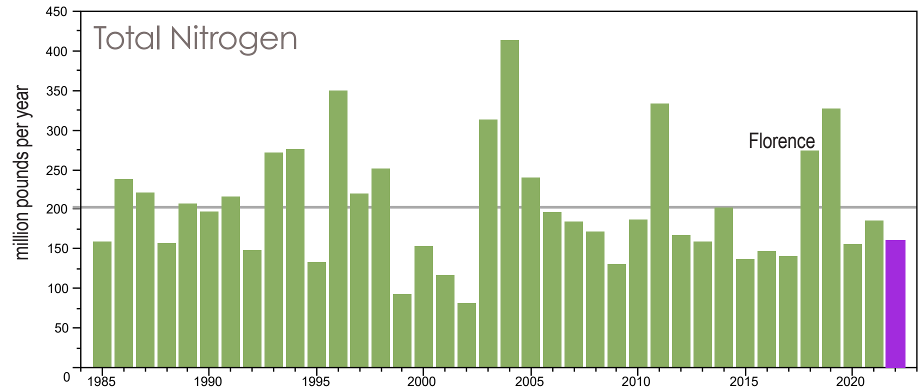
An average flow year to the bay since 1985, 10% below long-term mean of 81,470 cubic feet per second

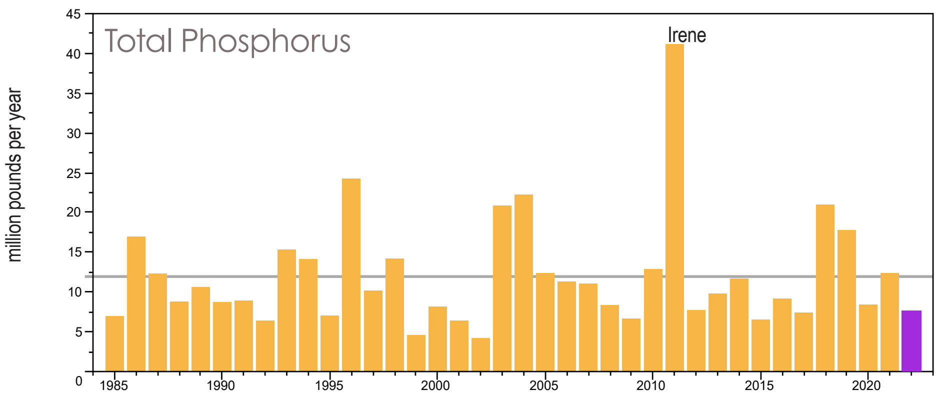
Total Nitrogen load for 2022 was 43 million pounds less than the long-term mean of 203

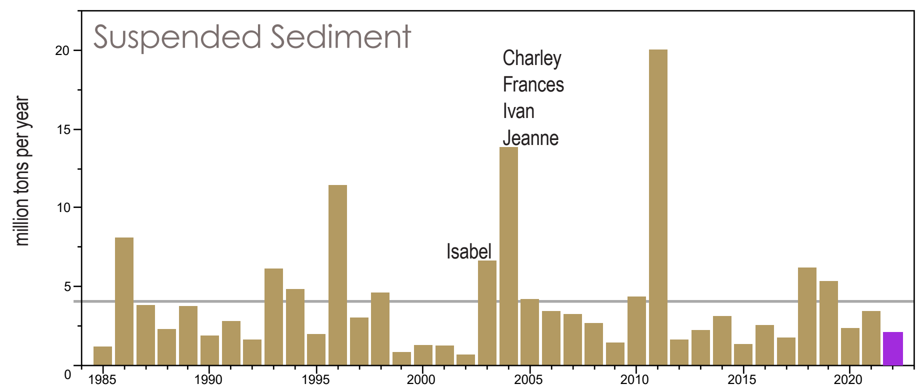
Total Phosphorus load for 2022 was 4.4 million pounds less than the long-term mean of 11.9

Total Suspended-Sediment load for 2022 was 2 million tons less than the long-term mean of 4









2022 summary of long- and short-term trends

RIVER INPUT MONITORING STATION *Summary of long-term (1985-2022) and short-term (2013-2022) trends in nitrogen, phosphorus, and suspended- sediment loads for the River Input Monitoring stations. Improving or degrading trends classified as likelihood estimates greater than or equal to 67 percent.*	**TOTAL NITROGEN LOAD**		**TOTAL PHOSPHORUS LOAD**		**SUSPENDED-SEDIMENT LOAD**	
	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term
SUSQUEHANNA RIVER AT CONOWINGO, MD	*Improving*	*Improving*	*No Trend*	*Improving*	*Degrading*	*Improving*
POTOMAC RIVER AT CHAIN BRIDGE, MD	*Improving*	*Improving*	*Improving*	*Improving*	*Improving*	*No Trend*
JAMES RIVER AT CARTERSVILLE, VA	*Improving*	*Improving*	*Improving*	*No Trend•*	*No Trend*	*No Trend•*
RAPPAHANNOCK RIVER NEAR FREDERICKSBURG, VA	*Improving*	*Degrading*	*Degrading*	*Degrading••*	*Degrading*	*Degrading••*
APPOMATTOX RIVER AT MATOACA, VA	*Degrading*	*Degrading*	*Degrading*	*Degrading*	*Degrading*	*Degrading*
PAMUNKEY RIVER NEAR HANOVER, VA	*No Trend*	*No Trend*	*Degrading*	*No Trend•*	*Degrading*	*Improving*
MATTAPONI RIVER NEAR BEULAHVILLE, VA	*Improving*	*Degrading*	*No Trend*	*No Trend•*	*Degrading••*	*Degrading*
PATUXENT RIVER AT BOWIE, MD	*Improving*	*Improving*	*Improving*	*Improving*	*Improving*	*Improving*
CHOPTANK RIVER NEAR GREENSBORO, MD	*Degrading*	*Degrading*	*Degrading*	*Degrading*	*Improving*	*Degrading*

Additional markers denote change between 2021 and 2022 long-term (1985-2021 vs. 1985-2022) and 2021 and 2022 short-term (2012-2021 vs. 2013-2022) trend estimation results. A "•" marker indicates a downward/degrading shift from either (1) Improving to No Trend [•] or, (2) No Trend to Degrading [••].

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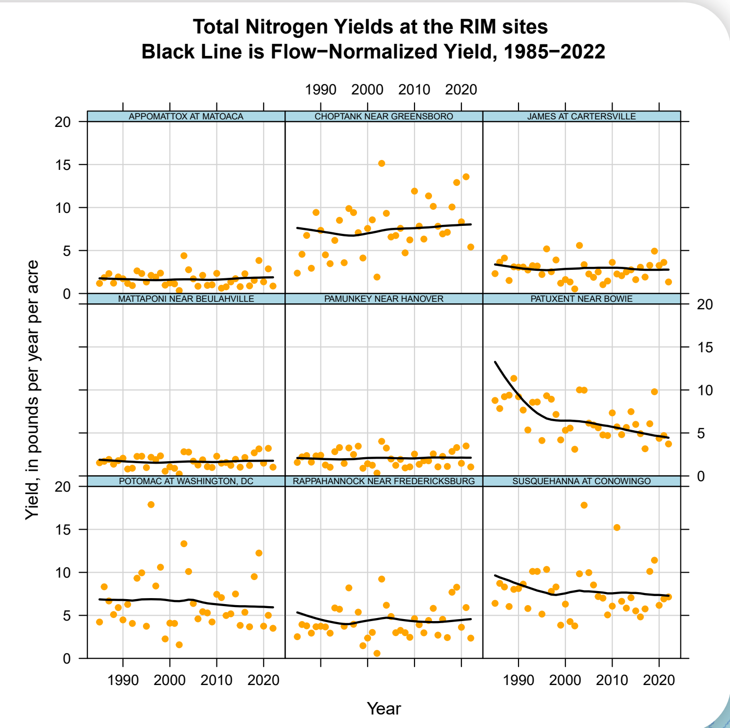
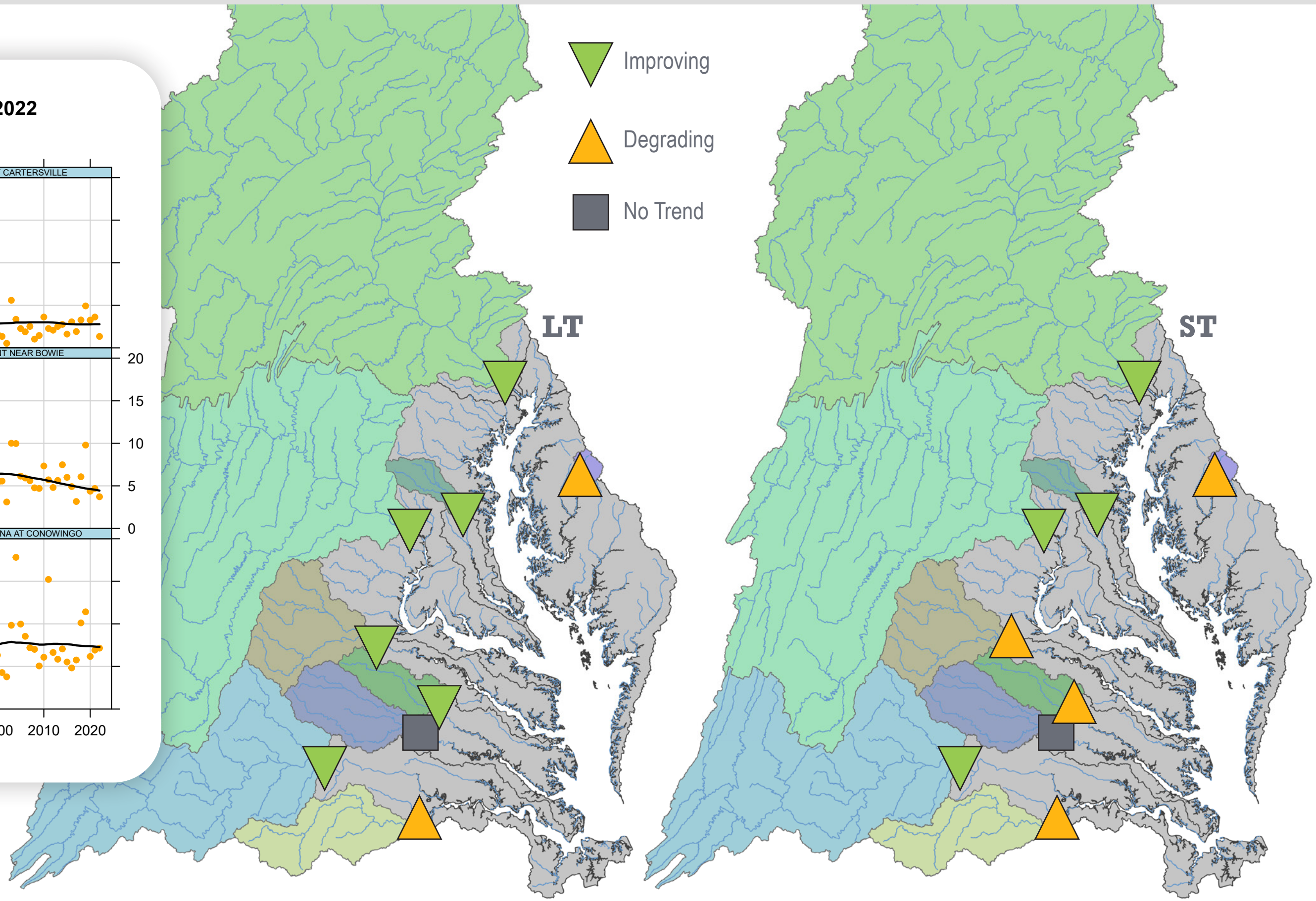
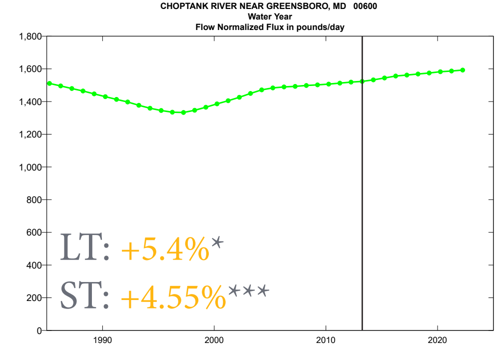
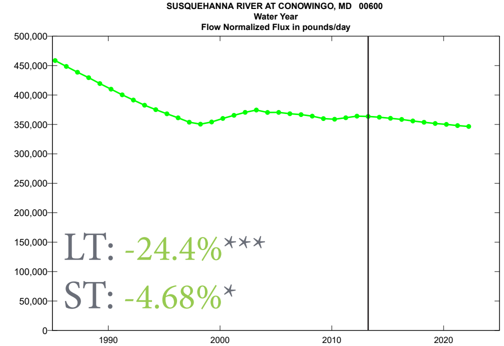
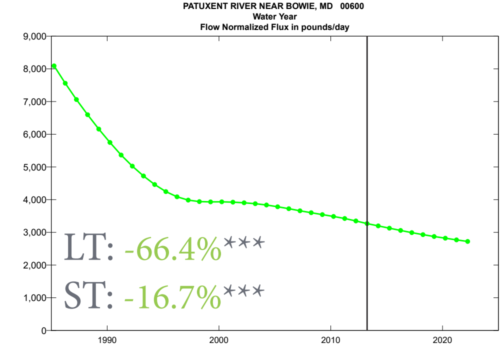
Total Nitrogen Loads and Trends (1985-2022, 2013-2022)

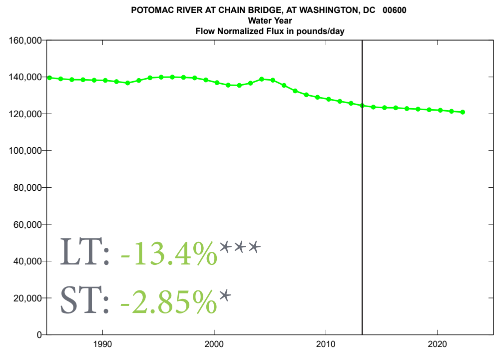


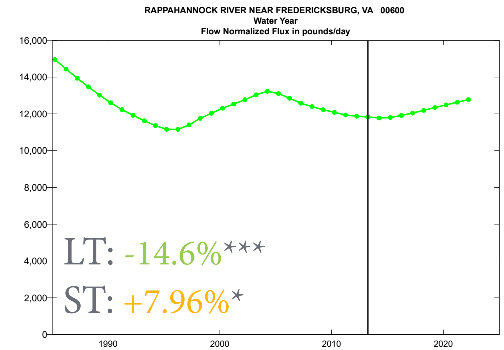


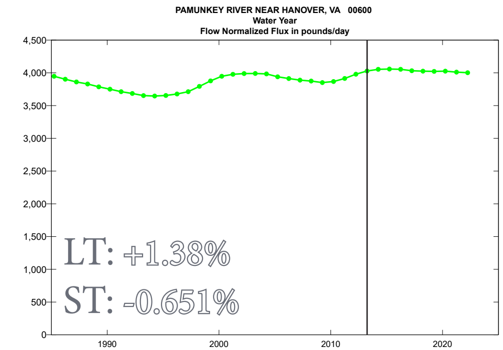


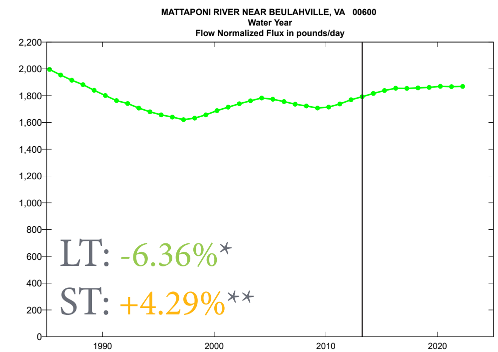


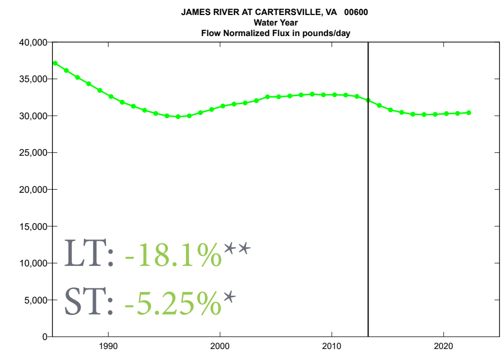


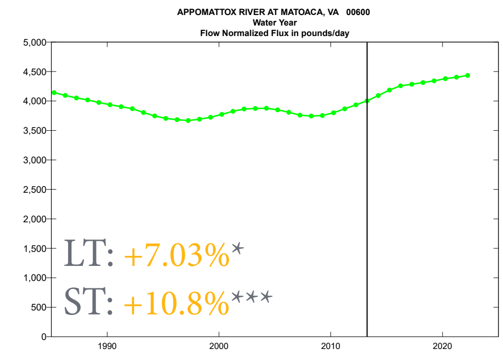












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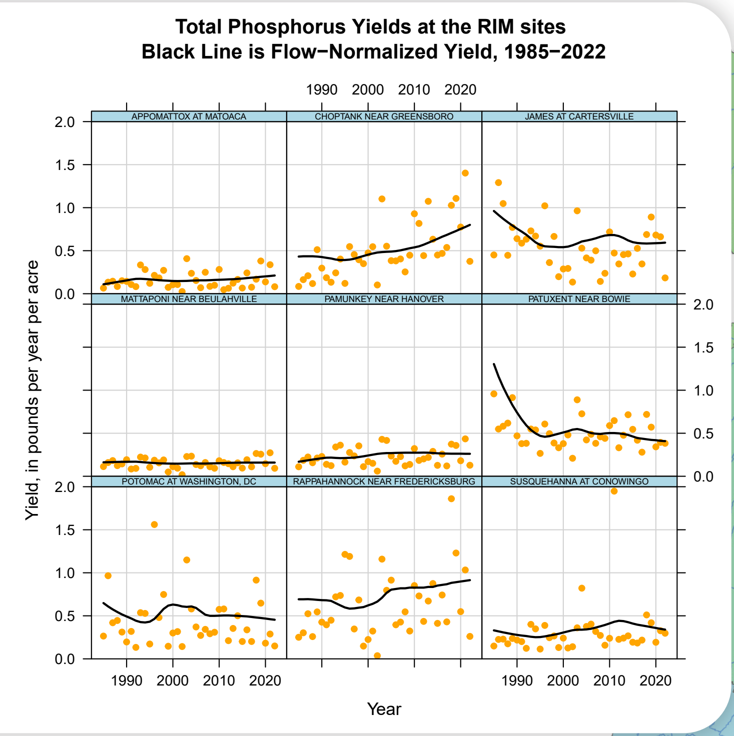
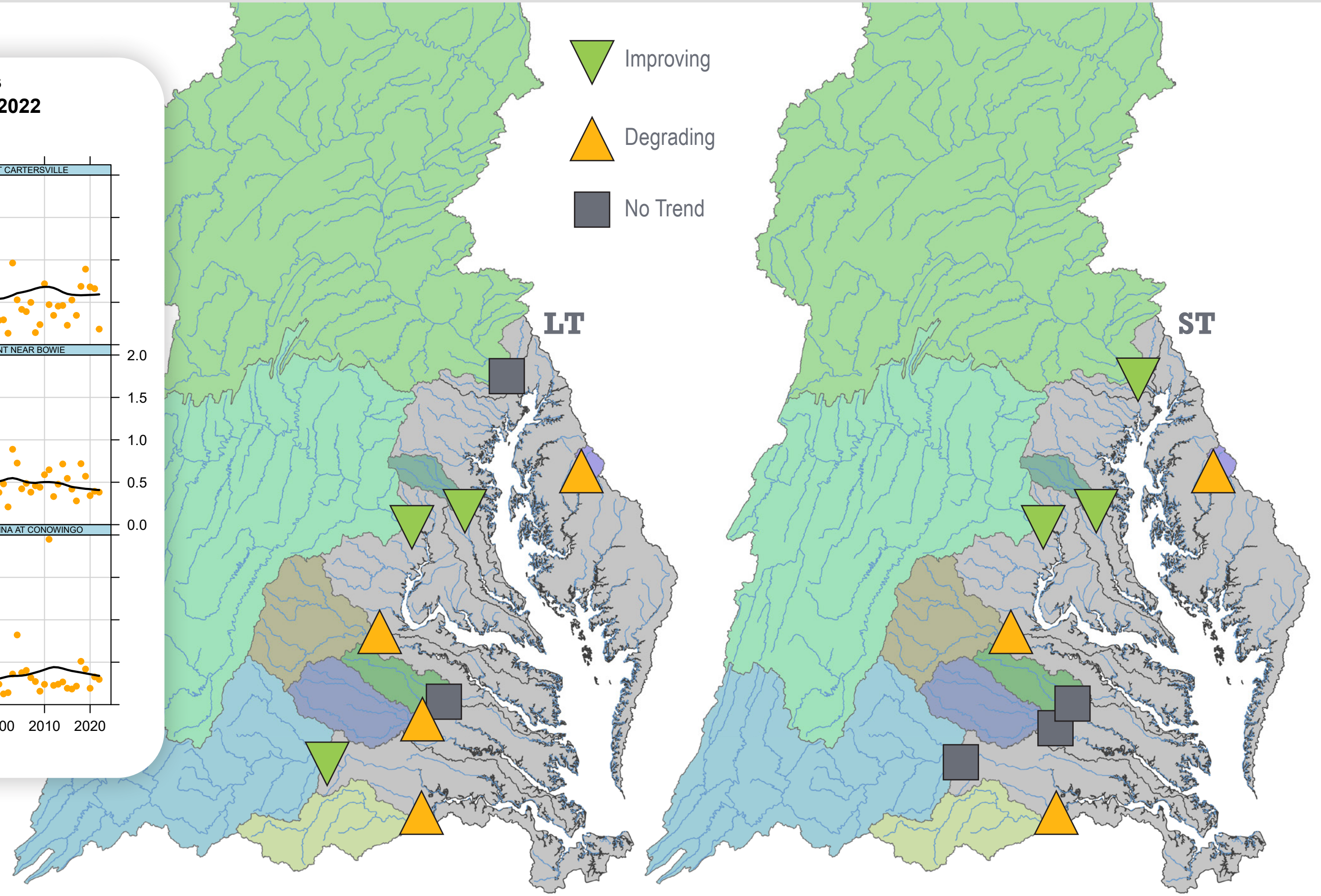
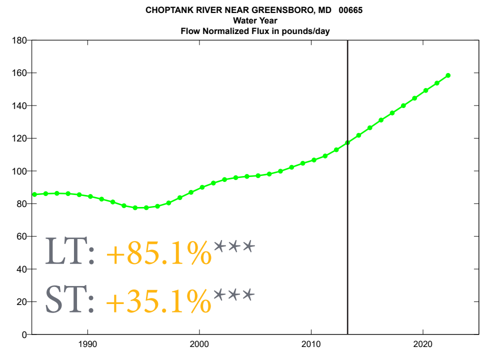
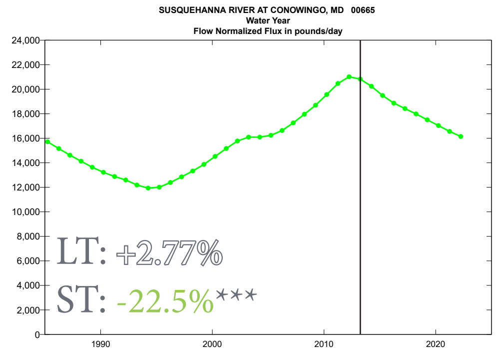
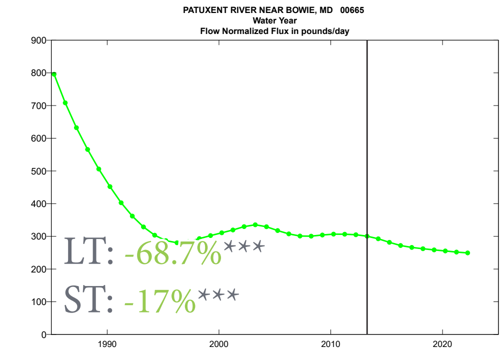
Total Phosphorus Loads and Trends (1985-2022, 2013-2022)

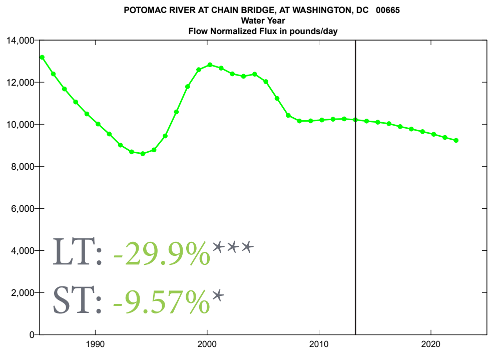


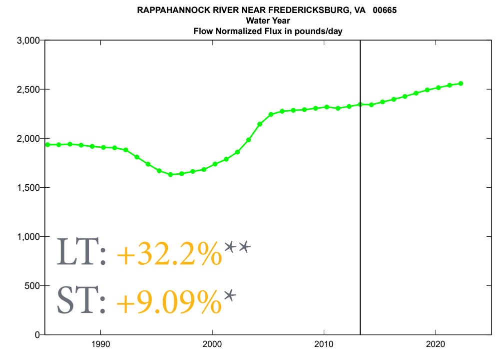


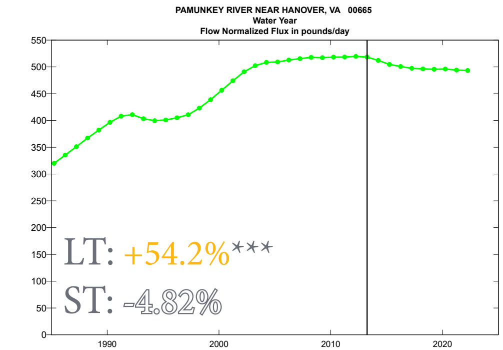


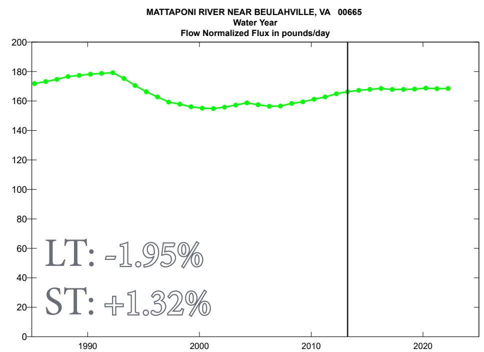


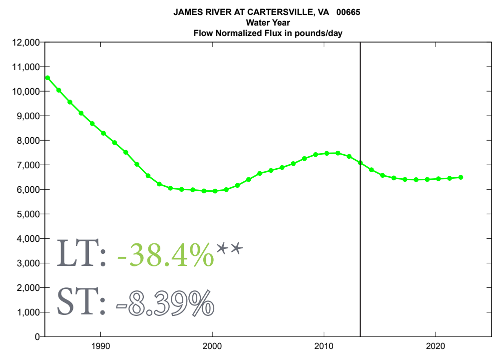


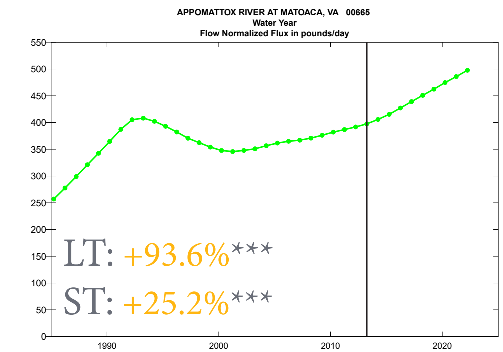












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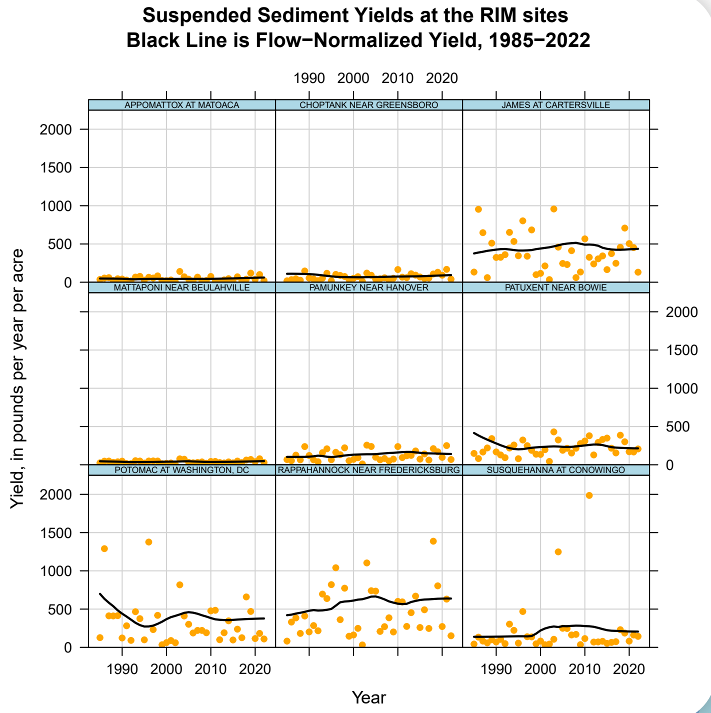
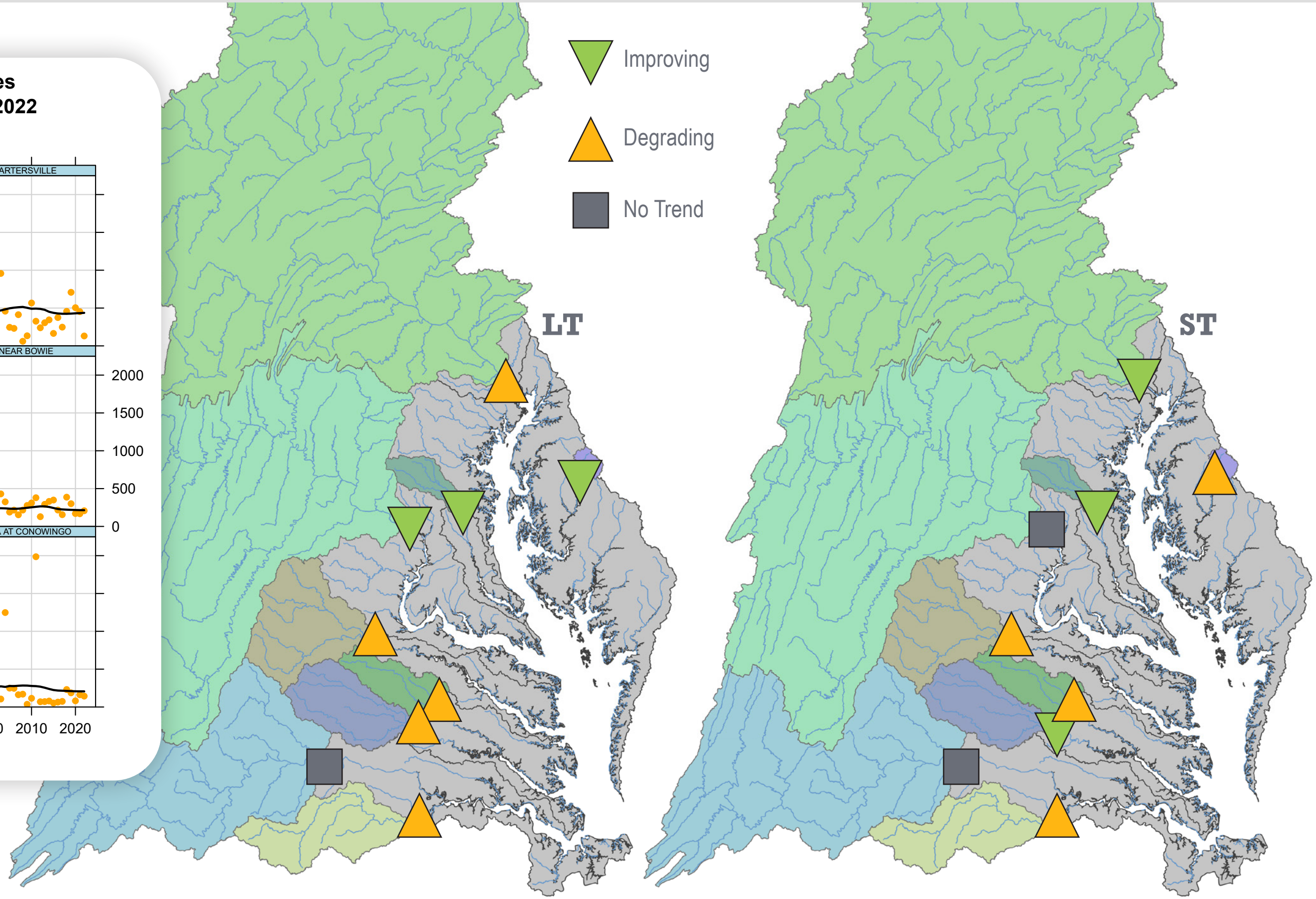
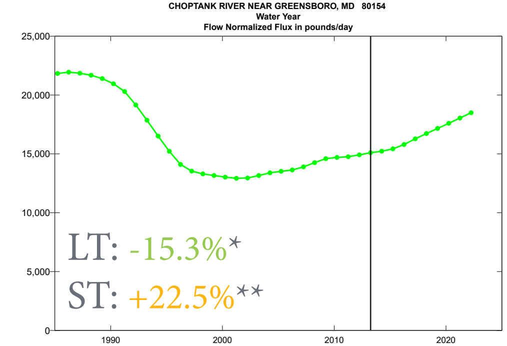
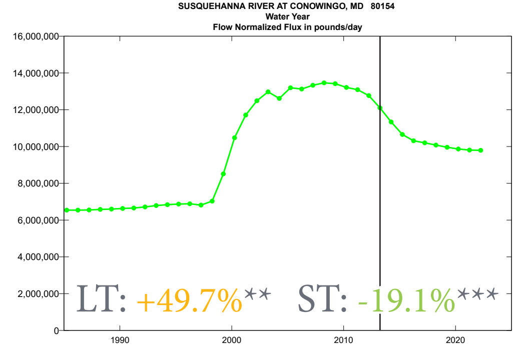
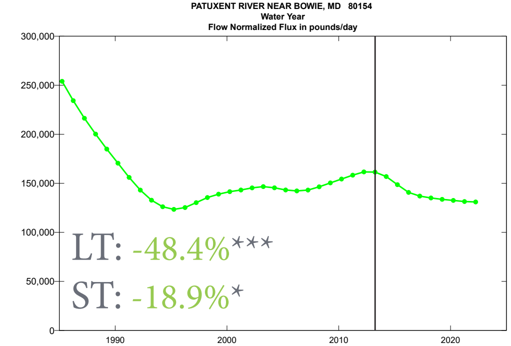
Suspended Sediment Loads and Trends (1985-2022, 2013-2022)

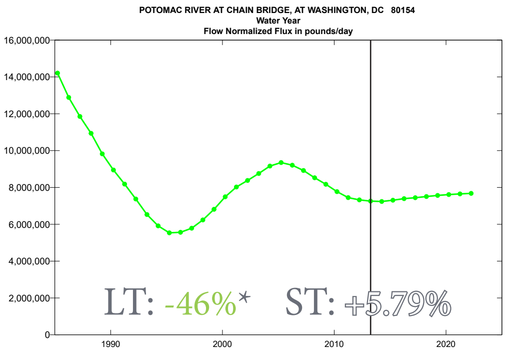


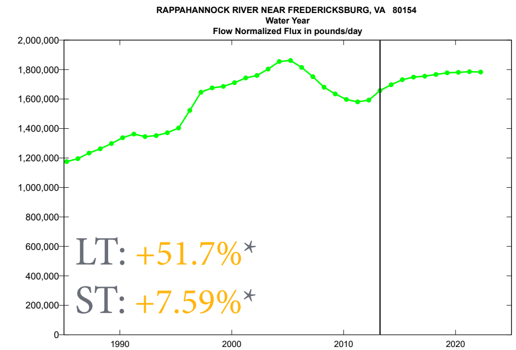


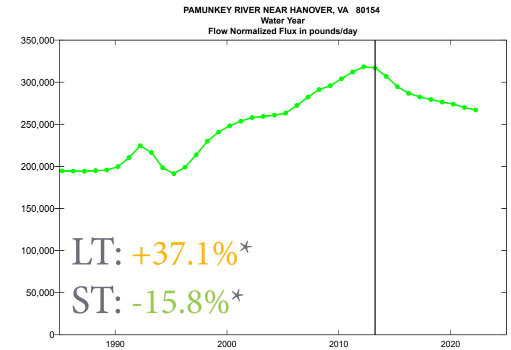


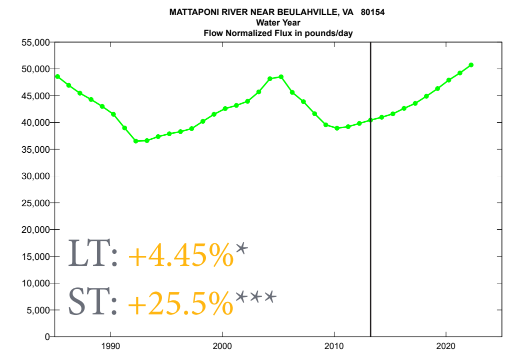


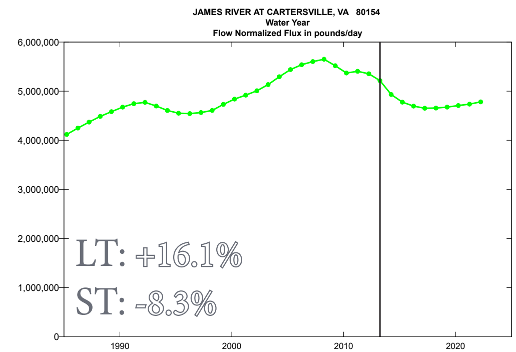


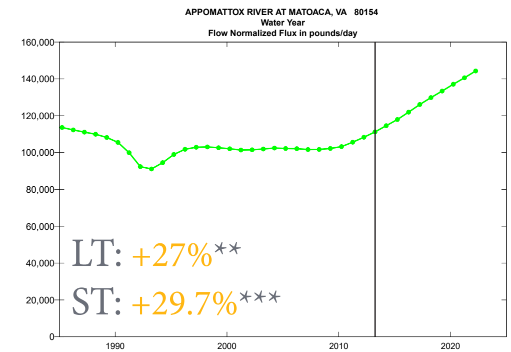












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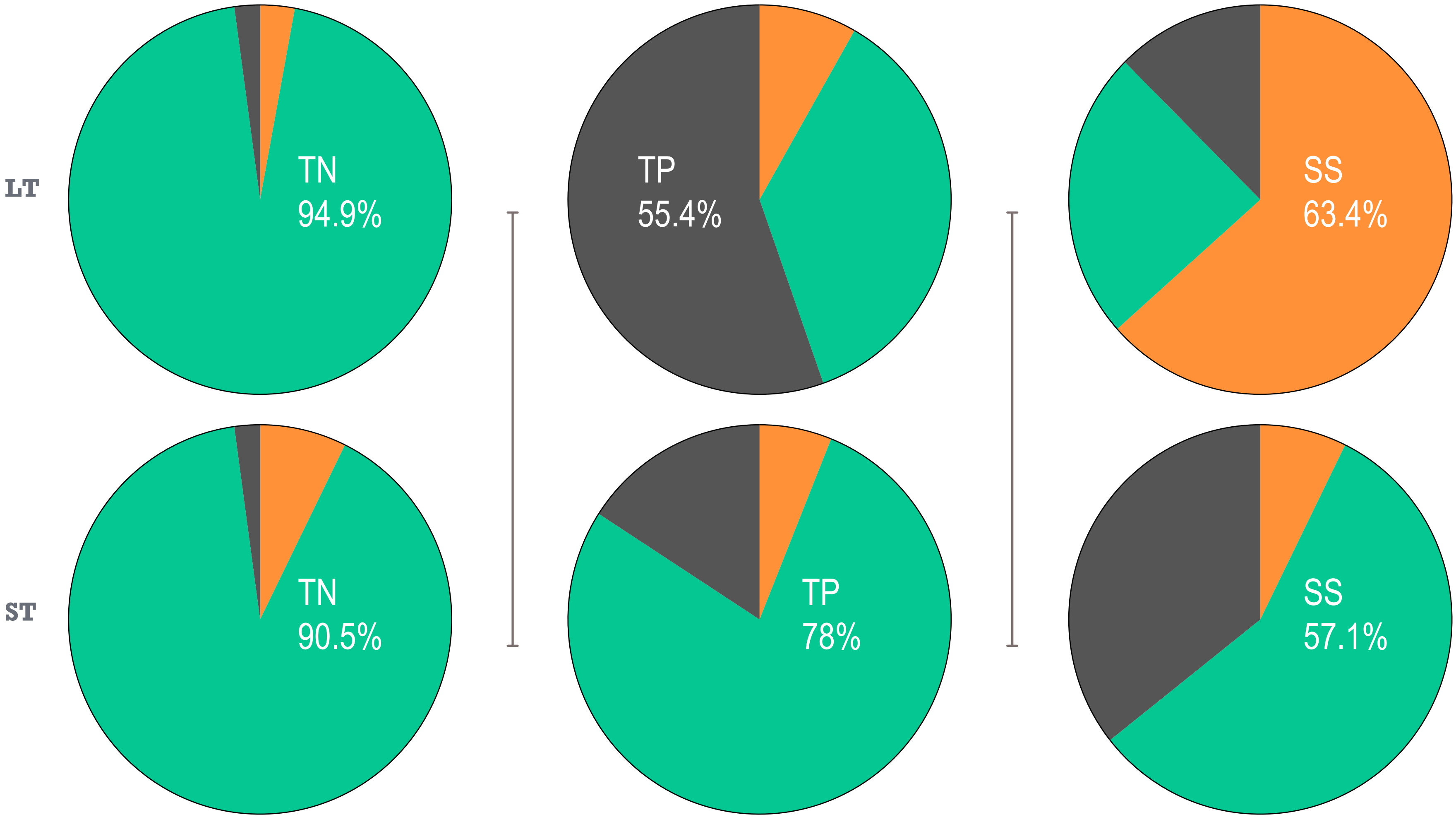
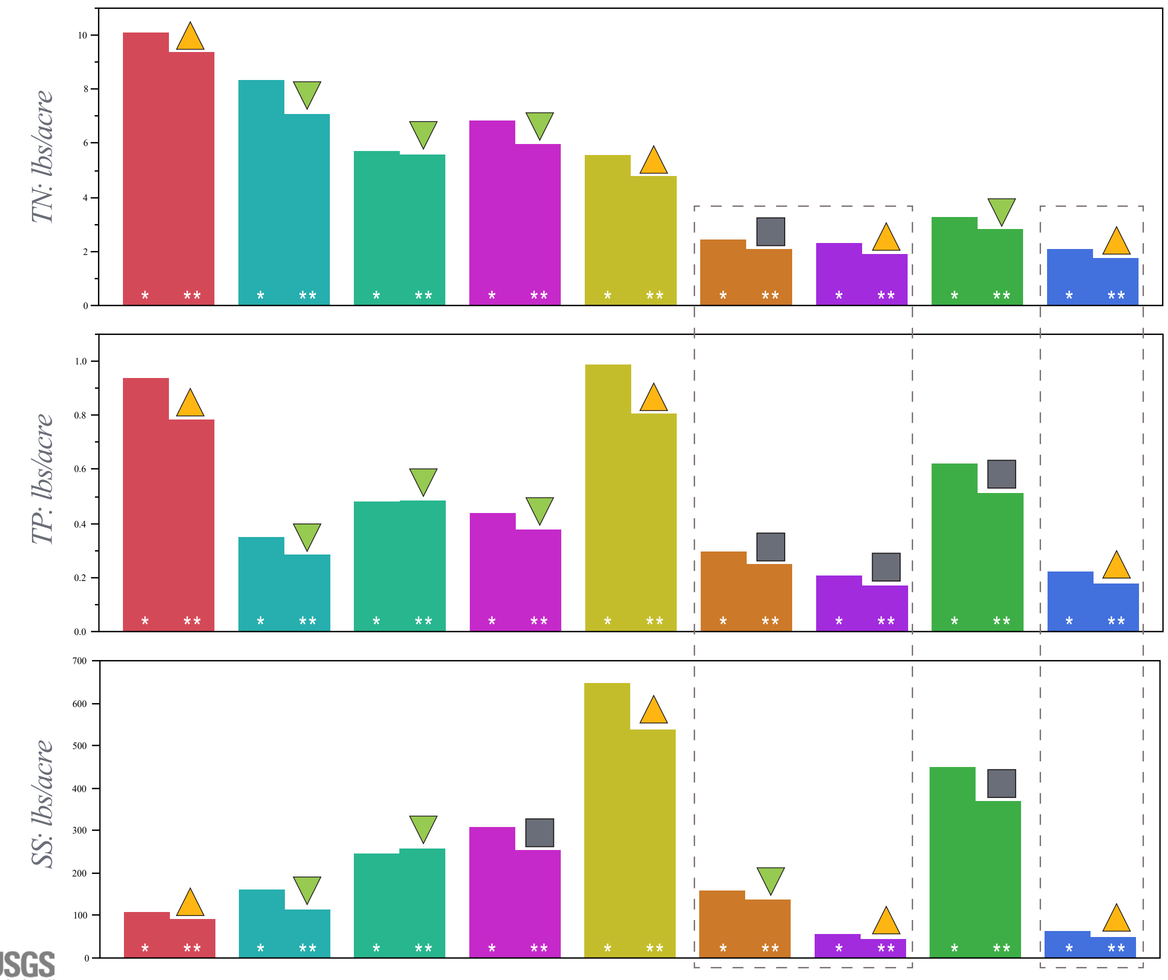
Dominant trend direction by percent of total RIM watershed



5- and 10-year Yields (2018-2022, 2013-2022)



- *Choptank River near Greensboro, MD {292 km²}*
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- *James River at Cartersville, VA {16,207 km²}*
- *Appomattox River at Matoaca, VA {3,483 km²}*

SUMMARY

- Choptank, while the smallest drainage area (DA), has the largest TN yield and second largest TP yield
- Rappahannock, 4th largest DA, has the largest TP and SS yields
- Susquehanna, largest DA, 2nd largest TN yields
- Mattaponi (TP and SS) and Appomattox (TN) had the lowest 5- and 10-year yields with 7th and 5th largest DAs, respectively
- All sites' 5-year yields were larger than their 10-year yields, except for the Patuxent's TP and SS
- 5-year RIM network yield means: TN 5.2, TP 0.5, SS 244
- 10-year RIM network yield means: TN 4.6, TP 0.4, SS 206

** 5-year mean yield (lbs/acre)   ** 10-year mean yield (lbs/acre)*

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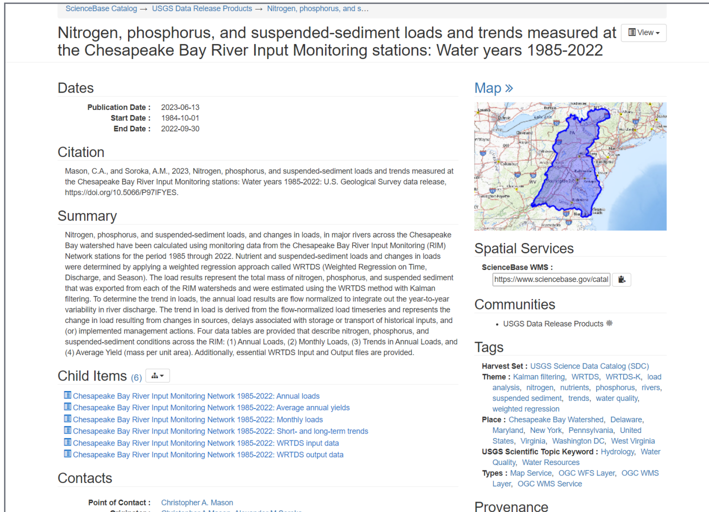
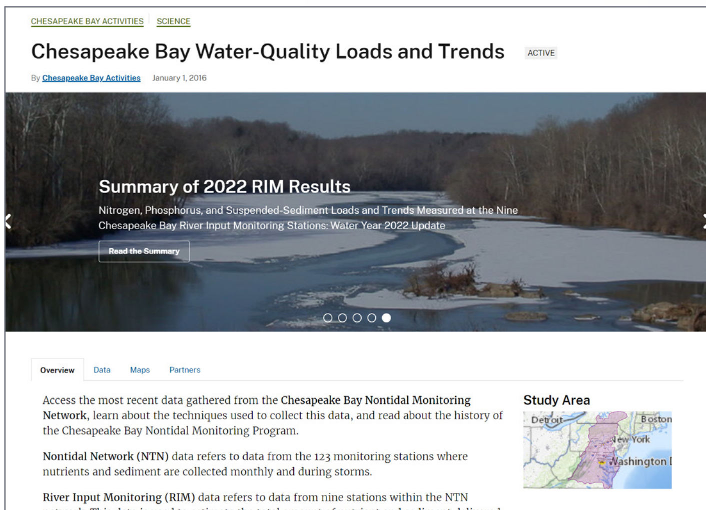


USGS data release

doi.org/10.5066/P97IFYES

Mason, C.A. and Soroka, A.M., 2023, Nitrogen, Phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay River Input Monitoring stations: Water years 1985-2022: U.S. Geological Survey data release, doi.org/10.5066/P97IFYES.



USGS monitoring website

usgs.gov/CB-wq-loads-trends