Chesapeake Bay Nontidal Network NITROGEN AND PHOSPHORUS LOADS AND TRENDS

AN UPDATE OF RESULTS: 2011 - 2020

STAR: August 25, 2022

Chris Mason | James Colgin | Doug Moyer | James Webber

United States Geological Survey
Virginia-West Virginia Water Science Center

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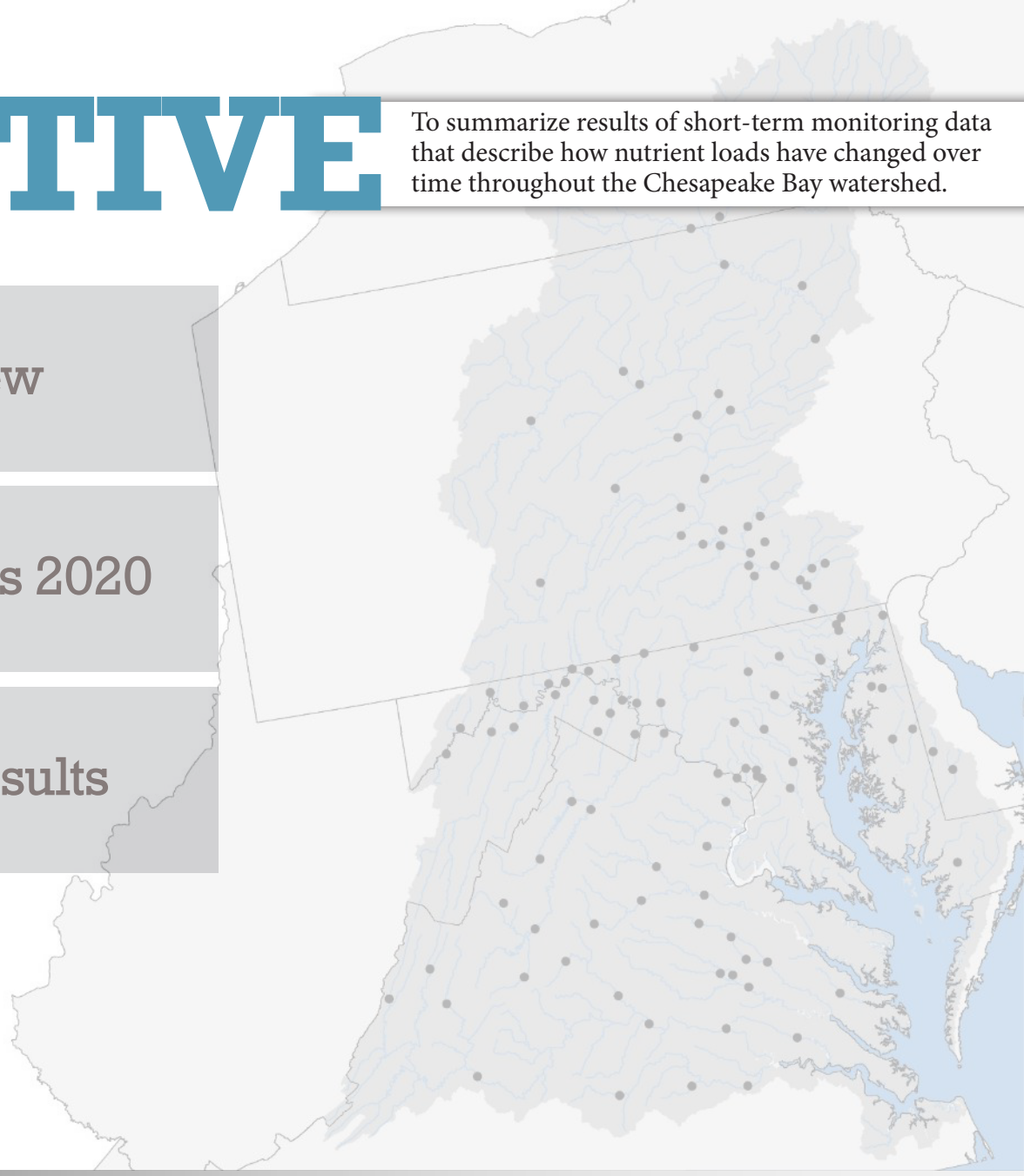
OBJECTIVE

To summarize results of short-term monitoring data that describe how nutrient loads have changed over time throughout the Chesapeake Bay watershed.

Outline

- Overview
- Trend Results 2020
- Sharing Results



Nontidal Network

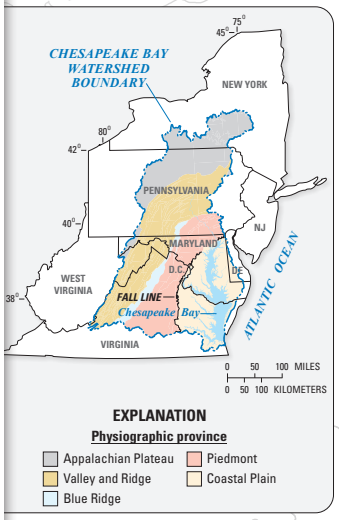
2020 status

EXPLANATION

- *Load-only Site*
- *Short-term Trend Site*
- *Long-term Trend Site*
- *RIM Site*

Major Basins

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



BASIN	n Stations	TN Loads	TN Short	TP Loads	TP Short
SUSQUEHANNA	42	42	26	42	26
EASTERN SHORE	8	8	5	8	5
WESTERN SHORE	10	10	6	10	6
POTOMAC	37	37	28	34	22
VIRGINIA	26	26	24	16	11

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Summary of trends in load through 2020

Total Nitrogen

Since ~1985, 52% of stations improved

- Trends Since 2011 -

- 37% of stations improved
- 4/9 River Input stations improved: the Susquehanna, Potomac, James, and Patuxent; representing three of the largest RIM watersheds
- About 35% of Susquehanna stations improved, mostly located in lower portion of the watershed
- 4/6 Western Shore stations improved while 4/5 Eastern Shore stations degraded
- About the same number Potomac stations improved as degraded
- Most Virginia watershed stations had no trend

Total Phosphorus

Since ~1985, 67% of stations improved

- Trends Since 2011 -

- 44% of stations improved
- 4/9 River Input stations improved: the Susquehanna, James, Patuxent, and Pamunkey
- About 42% of Susquehanna stations improved, located in the upper and lower portion of the watershed
- 3/6 Western Shore stations improved while 4/5 Eastern Shore stations degraded
- 50% of Potomac stations improved
- 54% of Virginia watershed stations improved

Trends in total nitrogen and phosphorus are influenced by changes in dissolved and particulate material

- Since 2011, nitrate degraded at 69% of stations while orthophosphate improved at 66% of stations
- Since 2011, suspended sediment improved at only 18% of stations

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How do high yield sites compare to their respective trend direction?

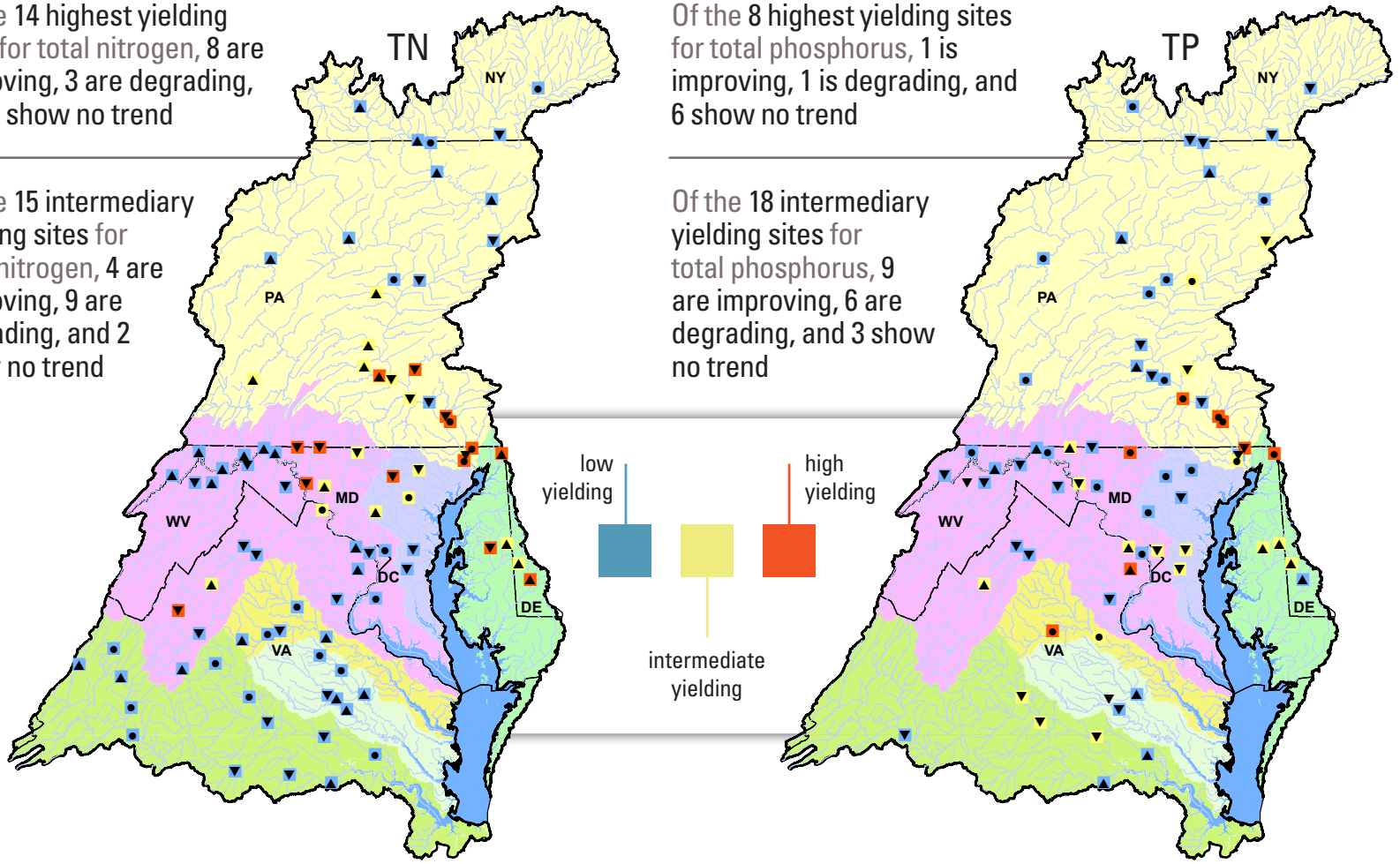
~ A BROAD OVERVIEW OF SHORT-TERM LOADS, WITH KALMAN-FILTER, VERSUS TREND DIRECTION ~

Of the 14 highest yielding sites for total nitrogen, 8 are improving, 3 are degrading, and 3 show no trend

Of the 15 intermediary yielding sites for total nitrogen, 4 are improving, 9 are degrading, and 2 show no trend

Of the 8 highest yielding sites for total phosphorus, 1 is improving, 1 is degrading, and 6 show no trend

Of the 18 intermediary yielding sites for total phosphorus, 9 are improving, 6 are degrading, and 3 show no trend



Trend Direction, 2011-2020

Degrading

Improving

No Trend

Percent change in flow-normalized load (numbers) at the nontidal network

Constituents from left-to-right: TN (total nitrogen), N+N (nitrate plus nitrite), TP (total phosphorus), DIP (orthophosphate), SS (suspended sediment)

EASTERN SHORE

	TN	N+N	TP	DIP	SS
01487000	7.05	21.9	58.2	-11.8	80.8
01488500	22	26.5	61.7	62.6	63.6
01491000	5.98	1.7	37.8	51	24
01491500	-4.33	-7.64	32.3	38.9	36.2
01495000	5.6	3.98	0.112	-16.8	24.7

WESTERN SHORE

	TN	N+N	TP	DIP	SS
01582500	-2.97	-2.46	8.36	-26.1	49.5
01586000	-5.62	-4.17	-8.61	-12.8	8.42
01589300	-3.4	9.24	-11.6	-27.9	9.72
01591000	10.4	9.83	3.26	17.2	33.1
01594440	-16.6	-18.8	-26.8	-20.4	-27.4
01594526	-4.43	9.34	-9.17	-6.51	-0.887

SUSQUEHANNA

	TN	N+N	TP	DIP	SS
01502500	1.97	13.1	-25	-38.5	-1.55
01503000	-2.81	1.31	-2.19	-54.5	98.2
01515000	2.88	5.13	-16	-41.8	104
01529500	6.16	21.5	-14.6	-49.9	8.94
01531000	9.12	13.2	-24.8	-60.1	70.8
01531500	4.05	5.49	25.6	-53.3	90.4
01534000	16.8	21.4	22.3	25.7	91.7
01536500	-1.36	5.07	-7.64	-42.2	12.2
01540500	-4.54	0.516	-0.901	-54	31
01542500	6.1	17.3	-6.02		-1.49
01549700	19.6	43	29.5		72.2
01553500	-0.754	5.03	-3.97	-34	25.3
01555000	7.33	11	1.47	12.1	-17.5
01562000	15.1	19.6	12.1	2.08	28.7
01567000	9.41	15.6	-16.2	-19.6	-1.89
01568000	15.8	18.6	23.1	22.8	32.8
01570000	3.45	2.96	-11.8	-12	-13.9
01571500	-5.65	-8.92	10.1	16	31.6
01573560	-6.9	-9.61	-13.2	-18.6	-15
01574000	-1.97	-7.3	5.67	9.52	16.1
01576000	-6.01	-1.64	-13.4	-13.2	0.774
01576754	-7.09	-9.25	-3.17	-13.3	18.7
01576787	-2.9	-5.45	9.15	-10.4	20
01578310	-3.24	7.64	-25	-14.1	-34.4
01578475	-0.357	0.929	-13.2	-23	5.87
01580520	-0.173	0.934	5.19	-29	40.2

POTOMAC

	TN	N+N	TP	DIP	SS
01599000	3.46	16.3	-23	-42.6	-10.3
01601500	29.1	33.9	4.03	-33.1	33
01604500	-5.39	-0.852	-53.8	-34.5	-16.4
01608500	8.52	3.26	-47.2	-83.5	41.5
01609000	23	34.1	62.2		24.8
01610155	7.94	36.2			
01611500	-10.2	-14.2	-33.1		4.36
01613095	31.9	41.1	21.7		8.43
01613525	20.6	18.4	-6.51	-38.8	-55.7
01614500	-3.56	-8.07	34.4	-1.34	15.6
01616500	-9.42	-7.05	-58.2	-78.5	39.5
01619000	-11.6	-14.8	-24.9	-43.7	-5.16
01619500	-8.86	-14.1	-10.5	-41.6	67.4
01621050	-7.62	-9.76			
01626000	21.7	29.7			
01628500	-4.45	4.2			
01631000	-5.28	9.98	-26.2	-23.9	-23.6
01632900	6.88	8.11	31.7	-22.4	73.9
01634000	-1.27	10.4	-43.5	-38.4	-49.7
01637500	15.6	21.6	1.33	-13.3	29.6
01638480	2.49	13.7			
01639000	-5.49	5.45	-7.23	2.34	-9.79
01646000	11.5	21.2	65	43.6	128
01646580	-4.14	3.64	-6.06	-30.6	6
01651000	-7.09	12.9	-15.4	-1.26	19.1
01654000	7.76	-7.64	99.9	37.9	267
01658000	2.66	-8.19			
01658500	-11.3	-6.14	-10.7	27.5	-6.94

VIRGINIA

	TN	N+N	TP	DIP	SS
01664000	-0.294	7.25			
01665500	6.08	21.7			
01666500	8.11	21.8			
01667500	-10.8	5.15	-2.21	14.2	0.557
01668000	5.5	14.8	13.7	6.77	16.1
01671020	3.57	48.2	-5.08		-13.1
01671100	-15.6	5.19			
01673000	6.29	22.7	-5.22	-10.3	-16.4
01673800	2.36	16.7			
01674000	1.68	28.3			
01674500	10.5	45.7	6.24	-0.538	25
02011500	16.9	28.1			
02015700	14.7	28.7			
02020500	24.8	39.8			
02024000	1.55	18.5			
02024752	-2.53	19.4	-10.5	-12.2	-12.6
02031000	1.7	22.4			
02034000	-6.7	-14.7	-18.8	-19.2	-22.1
02035000	-6.17	3.86	-14.2	-11.1	-11
02037500	-14.9	6.41	-4.01		4.49
02039500	-7.66	23.2			
02041000	-3.22	12.8			
02041650	17.1	28.4	24.5	48.3	29.7
02042500	-0.175	144	8.75		25.5

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Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay Nontidal Network stations: Water years 1985-2020

View

Dates

Publication Date : 2022-07-25
Start Date : 1984-10-01
End Date : 2020-09-30

Citation

Mason, C.A., Colgin, J.E., and Moyer, D.L., 2022, Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay Nontidal Network stations: Water years 1985-2020: U.S. Geological Survey data release, https://doi.org/10.5066/P96H2BDO.

Summary

Nitrogen, phosphorus, and suspended-sediment loads, and changes in loads, in major rivers across the Chesapeake Bay watershed have been calculated using monitoring data from the Chesapeake Bay Nontidal Network (NTN) stations for the period 1985 through 2020. Nutrient and suspended-sediment loads and changes in loads were determined by applying a weighted regression approach called WRTDS (Weighted Regression on Time, Discharge, and Season). The load results represent the total mass of nitrogen, phosphorus, and suspended sediment that was exported from each of the NTN watersheds and were estimated using the WRTDS method with Kalman filtering. To determine the trend in loads, the annual load results are flow normalized to integrate out the year-to-year variability in river discharge. The trend in load is derived from the flow-normalized load timeseries and represents the change in load resulting from changes in sources, delays associated with storage or transport of historical inputs, and (or) implemented management actions. Four data tables are provided that describe nitrogen, phosphorus, and suspended-sediment conditions across the NTN: (1) Annual Loads, (2) Monthly Loads, (3) Trends in Annual Loads, and (4) Average Yield (mass per unit area). Additionally, essential WRTDS Input and Output files are provided.

Child Items (6)

- Chesapeake Bay Nontidal Network 1985-2020: Annual loads
- Chesapeake Bay Nontidal Network 1985-2020: Average annual yields
- Chesapeake Bay Nontidal Network 1985-2020: Monthly loads
- Chesapeake Bay Nontidal Network 1985-2020: Short- and long-term trends
- Chesapeake Bay Nontidal Network 1985-2020: WRTDS input data
- Chesapeake Bay Nontidal Network 1985-2020: WRTDS output data

Map »

Spatial Services

ScienceBase WMS :
https://www.sciencebase.gov/catal

Communities

- USGS Data Release Products

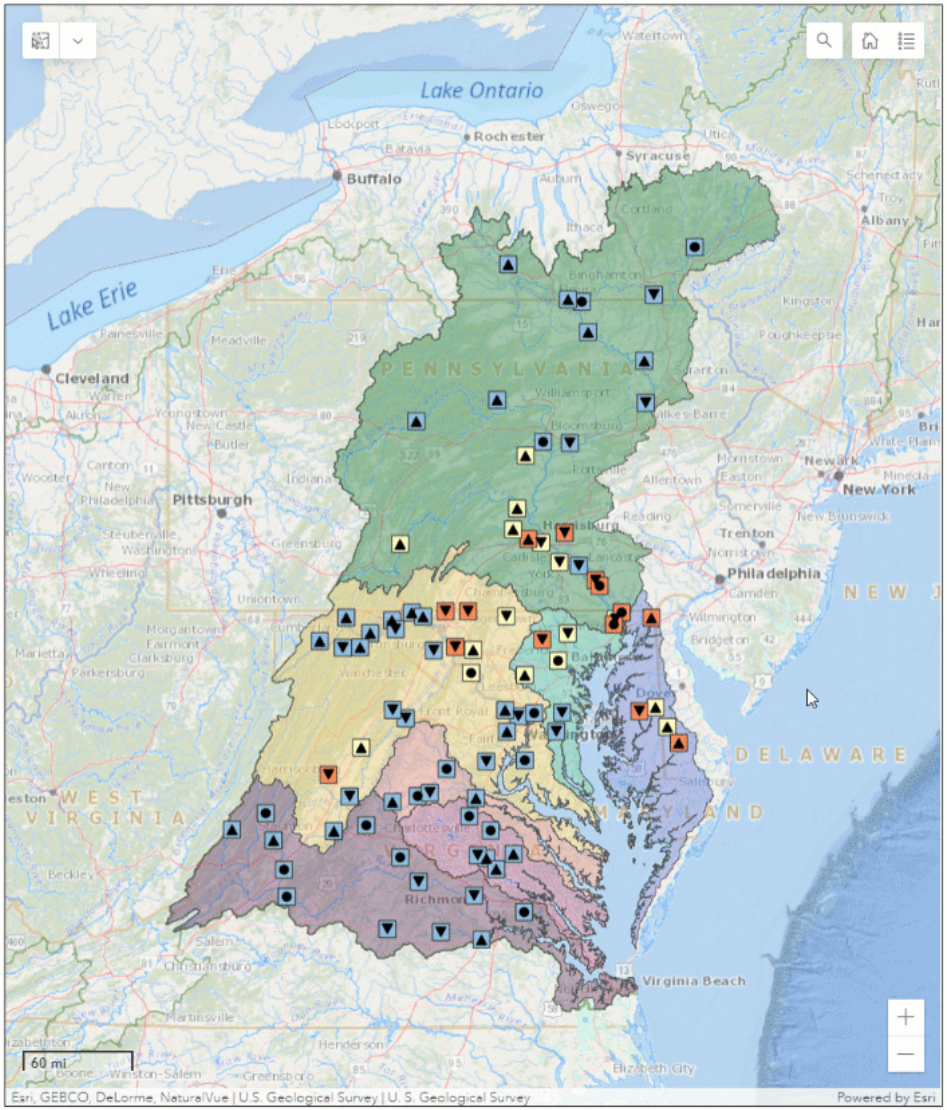
Tags

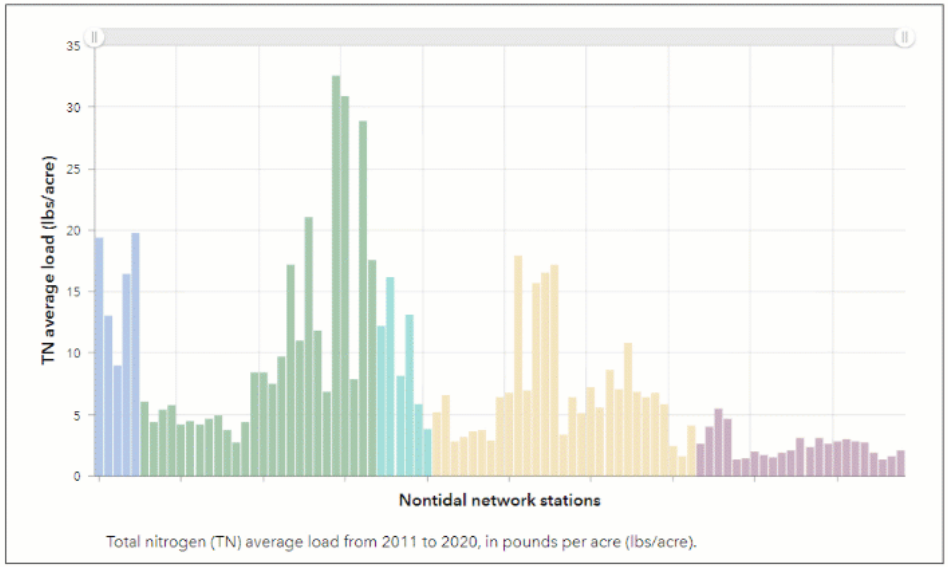
Harvest Set : USGS Science Data Catalog (SDC)
Theme : Kalman filtering, WRTDS, WRTDS-K, load analysis, nitrogen, nutrients, phosphorus, rivers, suspended sediment, trends, water quality, weighted regression
Place : Chesapeake Bay Watershed, Delaware, Maryland, New York, Pennsylvania, United States, Virginia, Washington DC, West Virginia
USGS Scientific Topic Keyword : Hydrology, Water Quality, Water Resources

Interactive web page with data dashboards for TN, TP, and SS

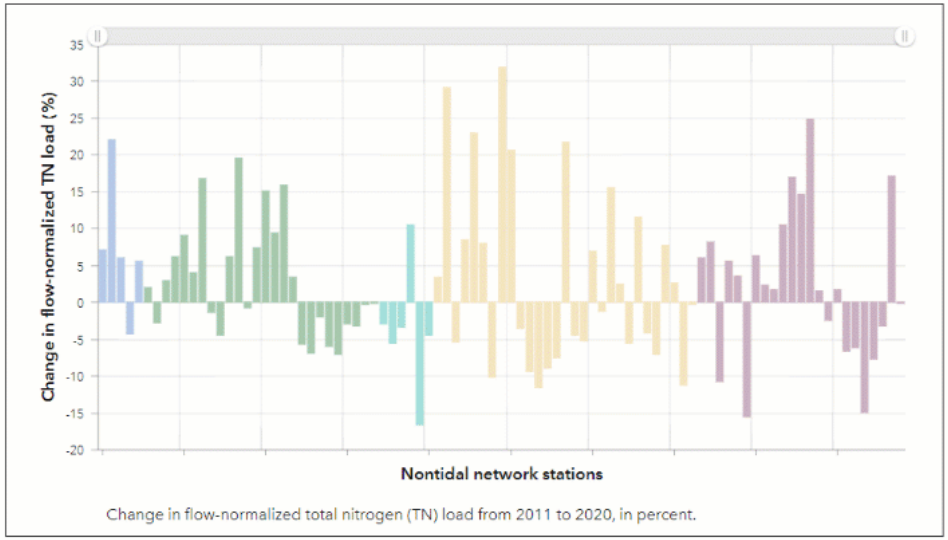
va.water.usgs.gov/geonarratives/ntn

Graph tool | Query tool





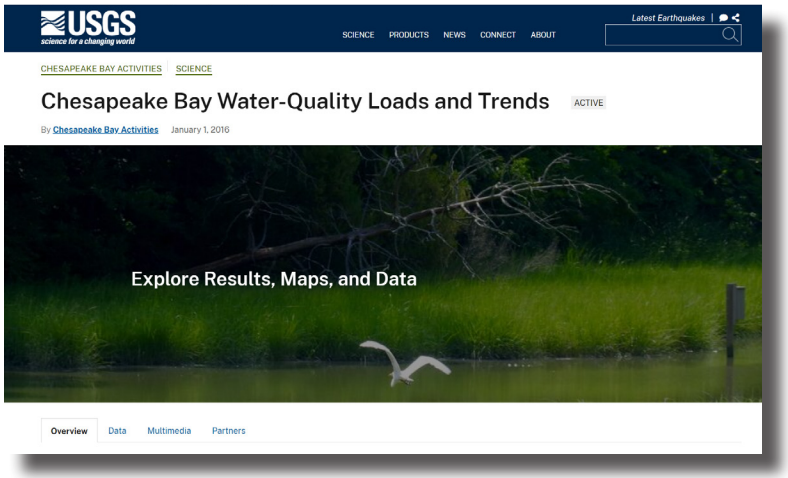
Total nitrogen (TN) average load from 2011 to 2020, in pounds per acre (lbs/acre).



Change in flow-normalized total nitrogen (TN) load from 2011 to 2020, in percent.

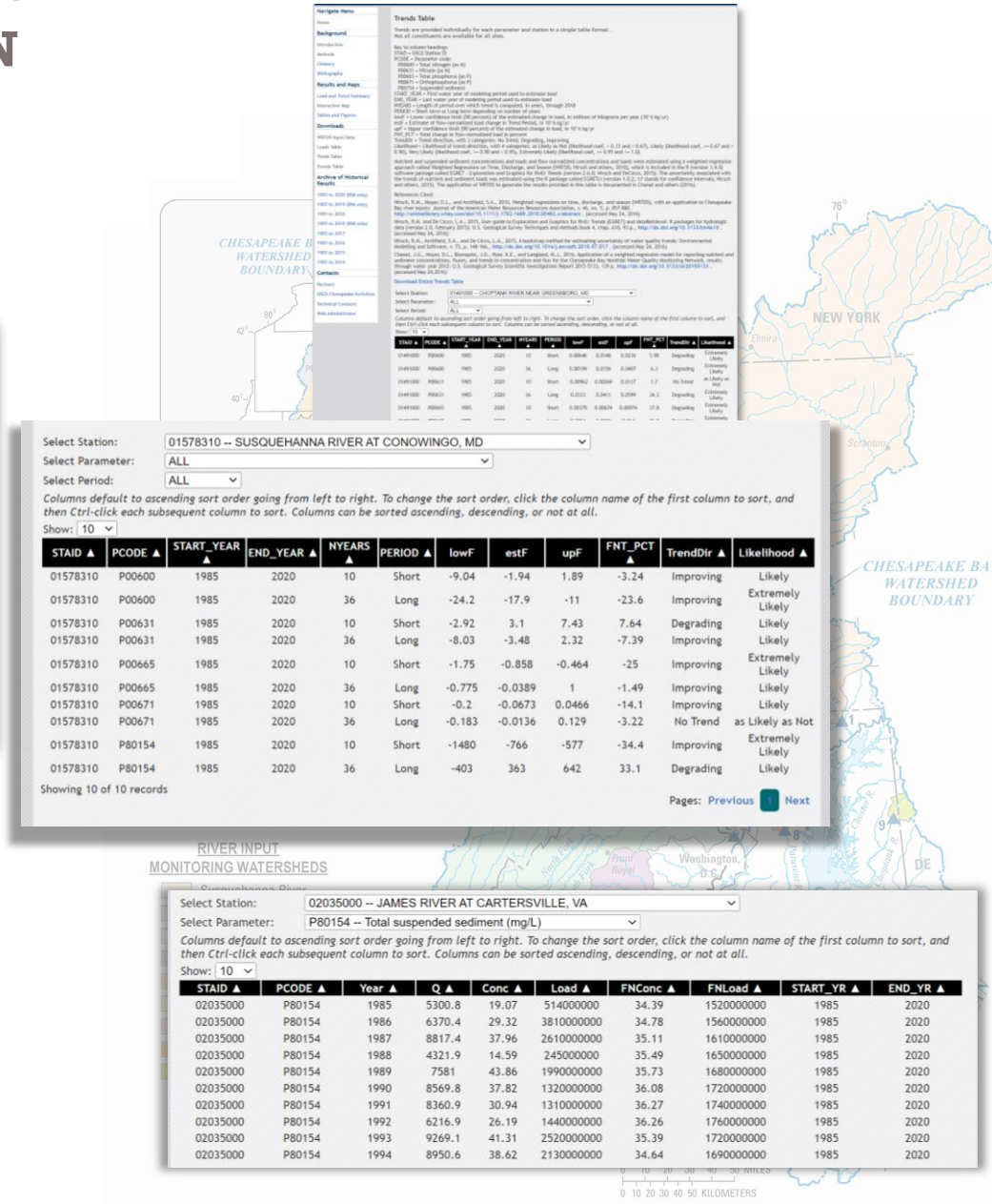
The monitoring webpage has been updated with 2020 RIM and NTN results and a new URL

usgs.gov/CB-wq-loads-trends



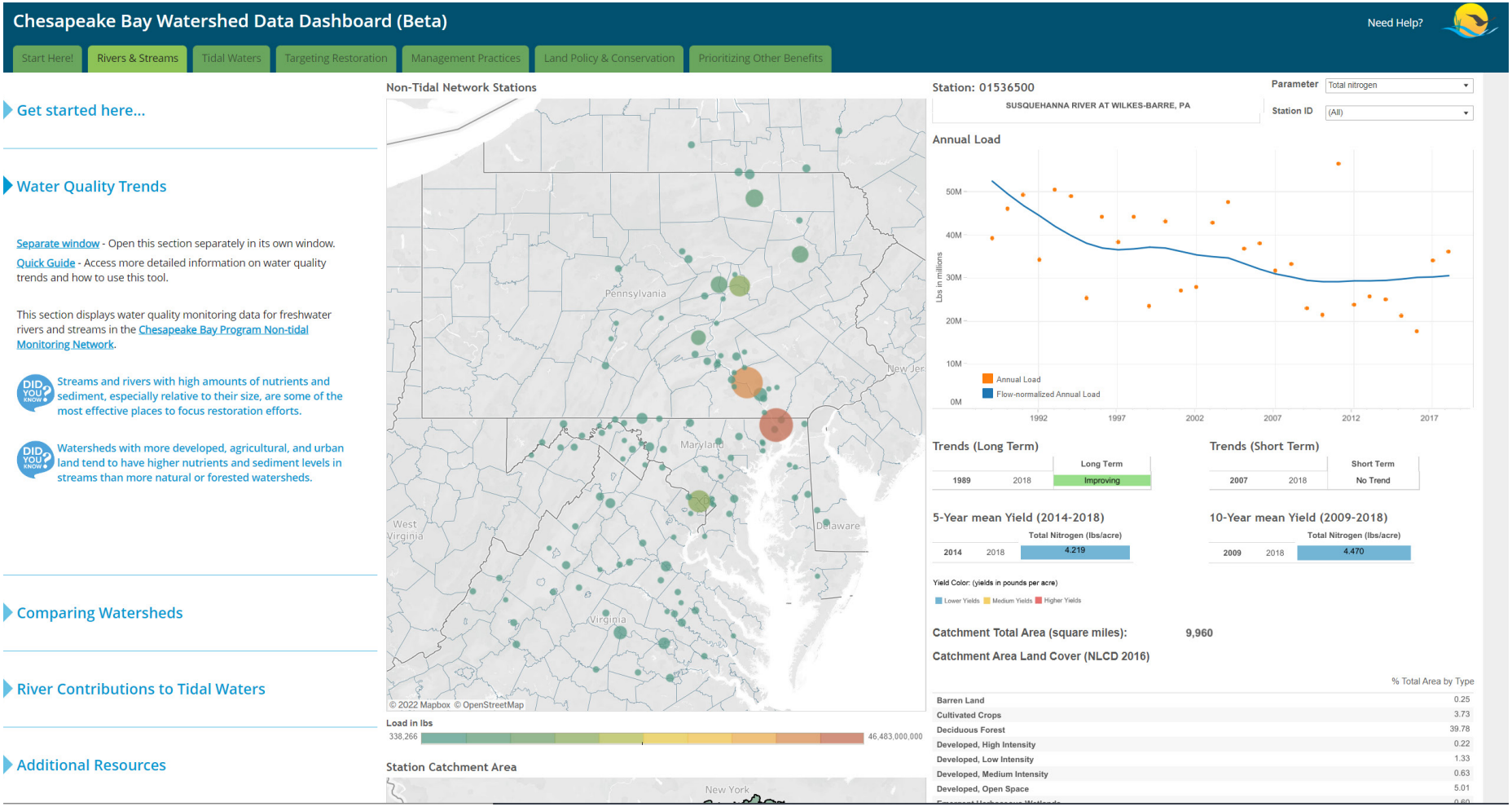
Secondary link is still active:
cbrim.er.usgs.gov

The websites contain load, yield, and trend results for Total Nitrogen, Nitrate/ Nitrite, Total Phosphorus, Orthophosphate, and Suspended Sediment at individual monitoring stations.



The Chesapeake Bay Watershed Data Dashboard is currently being updated

gis.chesapeakebay.net/wip/dashboard



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Questions?

CITATION:

Mason, C.A., Colgin, J.E., and Moyer, D.L., 2022, Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay Nontidal Network stations: Water years 1985-2020: U.S. Geological Survey data release, https://doi.org/10.5066/P96H2BDO

SHARED RESOURCES:

USGS NTN 2020 ScienceBase data release (above citation)

USGS NTN 2020 Interactive webpage

USGS NTN Loads and Trends website (current and historic)

Chesapeake Bay dashboard