Nutrient & Sediment Patterns In
Nontidal Water Quality Network Monitoring Stations in New York

Susquehanna River Basin Commission
December 2025

INTRODUCTION

Nutrient and sediment pollution has been linked to the declining health of the Chesapeake Bay (Bay). In 2010, the U.S. Environmental Protection Agency (USEPA) established the Chesapeake Bay Total Maximum Daily Load (TMDL) as one step in controlling nutrient and sediment pollution to restore and protect the Chesapeake Bay.

To better estimate nutrient and sediment pollution coming from contributing streams and rivers, the USEPA established the Nontidal Water Quality Monitoring Network (NTN) in 2004, consisting of 123 stations on rivers and streams throughout the Bay watershed. Water samples are collected by different resource agencies throughout the year at these stations and analyzed for various nutrient and sediment parameters. Every other year, the U.S. Geological Survey (USGS) analyzes data from all 123 stations to determine how nutrient and sediment pollution flowing to the Chesapeake Bay is changing over time. The latest USGS analysis was completed using data through 2023 (Mason et al., 2025) and focuses on five particular sediment and nutrient parameters:

- Total Nitrogen (TN)
- Dissolved Nitrite + Nitrate (DNO)
- Total Phosphorus (TP)
- Dissolved Orthophosphorus (DOP)
- Total Suspended Sediment (SED)

This document has four goals:

1. Briefly introduce the Weighted Regressions on Time, Discharge, and Season (WRTDS) model and explain the terms loads, flow-normalized loads, yields, flow-normalized yields, and trends.
2. Introduce New York NTN stations.
3. Present long-term trends of sediment and nutrient loads at the New York NTN stations.
4. Compare sediment and nutrient yields across the New York NTN stations.

SEDIMENT AND NUTRIENT CALCULATIONS

What are Loads and Yields?

Water samples are collected throughout the year at each NTN station and analyzed for nutrients and sediment. Scientists use these sediment and nutrient results, streamflow data from co-located U.S. Geological Survey (USGS) gages, and a USGS model called Weighted Regressions on Time, Discharge, and Season (WRTDS) to estimate how much nutrient and sediment pollution is contributed by each monitored watershed to the Bay. These estimates are called **loads**, and scientists calculate them at each station annually. Scientists can then also calculate **yields**, which is the amount of pollutant discharged per unit area of a watershed:

Term	Unit	Definition
Load	Pounds / Year	Amount of pollution discharged by a watershed over time
Yield	Pounds / Acre / Year	Amount of pollution discharged per unit area of a watershed over time

What are Flow-Normalized Loads and Yields?

Streamflow can vary greatly from year to year. In a year greatly affected by lots of storms, streams will have more water flowing through them and will therefore also discharge more nutrient and sediment pollution. Likewise, in a year greatly affected by drought, streams will have less water flowing through them and will discharge less pollution. These natural variations in streamflow can therefore mask the effects of any pollution reduction strategies that are occurring in the watershed.

As a result, scientists use WRTDS to remove the "noise" of these natural, year-to-year streamflow variations and estimate **flow-normalized loads**. By using flow-normalized loads (and by definition, **flow-normalized yields**), scientists can better determine the effects of best management practices, restoration activities, decreased point source loadings, and changes in land use in a watershed on pollution in a watershed. Flow-normalized loads (and yields) can only be calculated for those streams with a minimum of 10 years of data.

What are Flow-Normalized Trends?

Flow-normalized loads are then used to determine **flow-normalized trends**. These trends help show how water quality is changing at a monitored station over time, while accounting for time, streamflow, and season. Increasing trends at a station indicate that pollution from the watershed is increasing. Decreasing trends at a station mean pollution from the watershed is decreasing. Sometimes no trends are detectable. Trends can be identified for different time periods. Short-term trends can be estimated for the most recent 10 years of data, and long-term trends can be estimated for the entire period of record.

Monitored NTN Watersheds in New York

The Susquehanna River provides about 50 percent of the fresh water to the Chesapeake Bay, flowing from New York, through Pennsylvania, to Maryland. Consequently, nutrient and sediment pollution contributed by the Susquehanna River is among the most impactful to the Bay. The headwaters of the Susquehanna River in New York State comprise about 23 percent of the Susquehanna River Basin's 27,510 square miles.

The Susquehanna River Basin Commission (SRBC) collects water samples at 27 of the 123 NTN stations, which can be viewed at this SRBC NTN Station Location Map. Five of these 27 stations are located in the New York portion of the basin. These stations are located on the following rivers, with the station name indicated in parentheses:

- Chemung River Subbasin:
  - Cohocton River at Campbell (Cohocton)
  - Chemung River at Chemung (Chemung)
- Upper Susquehanna River Subbasin:
  - Unadilla River at Rockdale (Unadilla)
  - Susquehanna River at Conklin (Conklin)
  - Susquehanna River at Waverly (Waverly)

More information on these individual stations can be found by following the links presented in Appendix A.

Sediment and Nutrient Calculations in New York

While the USGS runs a WRTDS analysis at all NTN stations every other year, SRBC runs a WRTDS analysis each year at the SRBC-sampled NTN stations. This analysis results in the calculation of many statistics, including long-term trends, loads (and flow-normalized loads), and yields (and flow-normalized yields). The results of the most recent SRBC analysis uses data through 2024.

The following sections present the long-term trends, yields, and flow-normalized yields for five sediment and nutrient parameters at these five New York NTN stations.

Trends from 2005/2006 through 2024

SRBC calculated flow-normalized loads through 2024 at each of the five New York stations. These flow-normalized loads were then analyzed for trends since 2005/2006 to determine the likelihood that loads are increasing (up arrow), decreasing (down arrow), or staying the same at each station over the past 20 years (Figure 1).

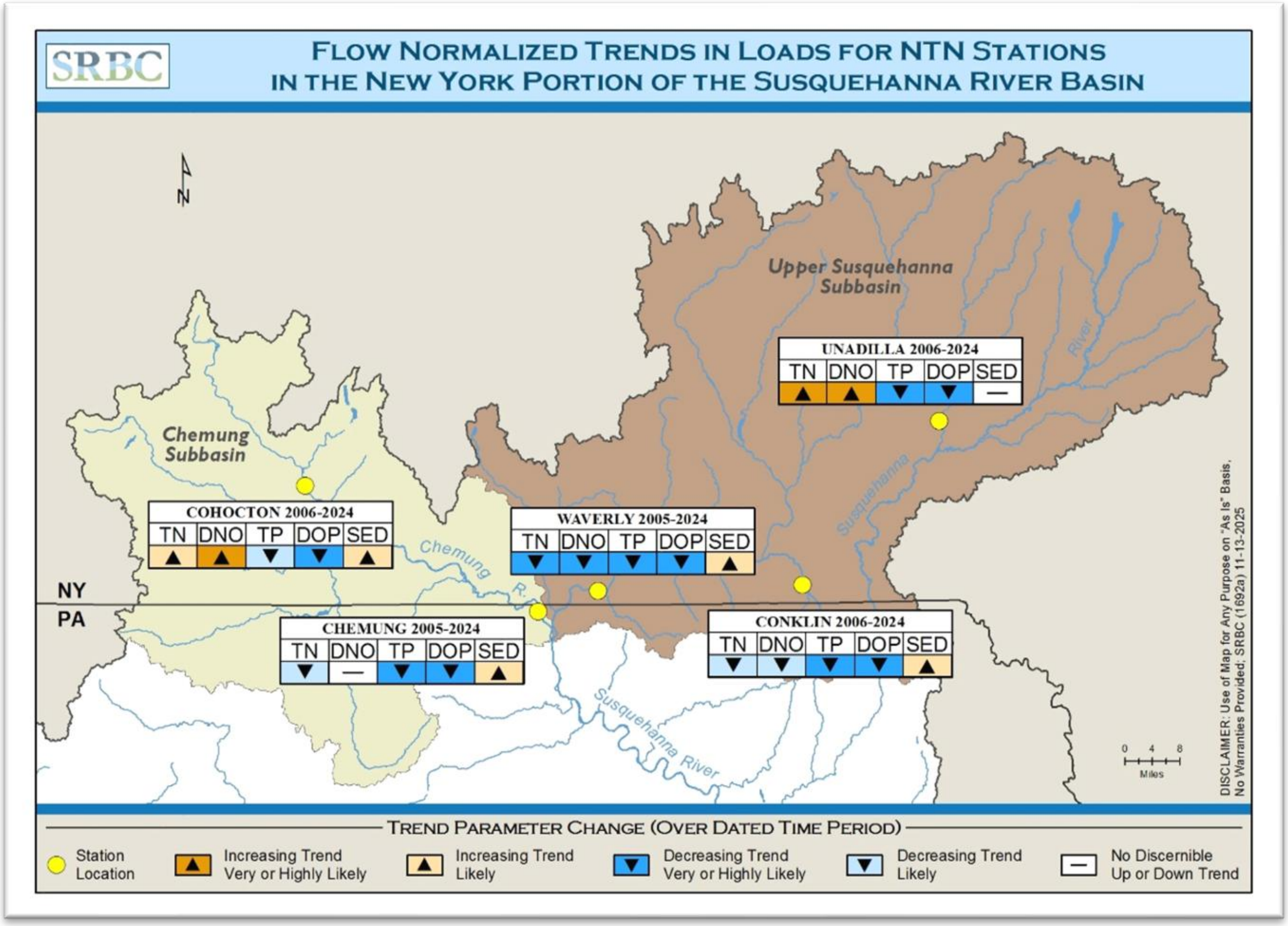

Figure 1. Flow-Normalized Trends through 2024 for New York-Based NTN Stations

Sediment (SED) loads appear to be increasing at all stations, except for Unadilla, where no trend is seen. Total phosphorus (TP) and Dissolved Orthophosphorus (DOP) loads appear to be decreasing at all stations. The most variability in trends among stations occurs with Total Nitrogen (TN) and Dissolved Nitrate + Nitrite (DNO). TN and DNO loads appear to be increasing at both Cohocton and Unadilla, the two most upstream stations in both subbasins. But TN and DNO appear to be decreasing as water flows downstream in both subbasins. No trend in DNO loads is seen at Chemung.

While trend analyses are helpful to show likely directional changes in sediment and nutrient loads at these sites through time, these analyses are not entirely comparable among stations. As a result, SRBC calculated yields and flow-normalized yields across this period of record to allow these comparisons.

Yield Comparisons

As previously discussed, annual yields estimate the amount of sediment and nutrient pollution that is being contributed per unit of watershed area upstream of a monitoring point.

Yields can be calculated based on the actual data, and they can also be standardized ("flow-normalized") to remove variability from seasonal flow variations. Table 1 shows the flow-normalized yields for 2024 for each of the five stations. These values are helpful for stakeholders in the watersheds upstream of these stations to understand the per acre contribution of these pollutants.

Table 1. Calculated 2024 Flow-Normalized Yields (SED = Suspended Sediment, TN = Total Nitrogen, DNO = Dissolved Nitrate + Nitrite, TP = Total Phosphorus, & DOP = Dissolved Orthophosphorus)

Subbasin	River	Station	Drainage Area (sq mi)	Flow-Normalized Yield (lbs/acre) in 2024				
				SED	TN	DNO	TP	DOP
Chemung	Cohocton River @ Campbell, NY	Cohocton	470	446	5.7	3.8	0.28	0.03
	Chemung River @ Chemung, NY	Chemung	2,507	680	4.3	2.4	0.40	0.03
Upper Susquehanna	Unadilla River @ Rockdale, NY	Unadilla	520	329	**6.5**	**4.1**	0.37	**0.05**
	Susquehanna River @ Conklin, NY	Conklin	2,230	870	4.9	2.6	**0.47**	0.04
	Susquehanna River @ Waverly, NY	Waverly	4,734	**901**	5.4	2.9	0.40	0.04

The two Chemung stations had the lowest yields for the five parameters in 2024. TN, DNO, and DOP yields for 2024 were highest at Unadilla. TP yields were highest at Conklin, and sediment yields were highest at Waverly. The Chemung station is the most downstream station on the Chemung River, about 12 miles upstream of the confluence with the Susquehanna River below Sayre, PA. Likewise, the Waverly station is the most downstream station on the Upper Susquehanna River, about 14 miles upstream of the confluence with the Chemung River. The data for these two stations in Table 1 indicate that the Upper Susquehanna watershed had higher yields for nearly all parameters compared to the Chemung watershed, except for DNO.

Individual Parameters

Flow-normalized yields are instrumental in determining trends across time, but it can also be useful to juxtapose those against the actual yields for each individual year. The actual yields can reflect both the effects of local or regional storm events. Ideally, the effects of restoration practices being put in place in the watersheds to reduce nutrient and sediment pollution would be seen in yield calculations, but these effects cannot be seen at the scale of the NTN monitoring and modeling.

Figures 2 to 6 show both the actual yields (black dots) and flow-normalized yields (black lines) for each station's period of record through 2024. The USGS evaluates and ranks annual streamflows throughout the nation and has determined that 2006 and 2011 (Tropical Storm Lee) were two of the wettest years for New York State in the past 90 years (USGS WaterWatch Summaries). Many times, the actual yields for those years are among the highest yields calculated for those stations.

The directional trend arrows from Figure 1 are also embedded in Figures 2 to 6. The slopes of the black lines correspond to these directional trend arrows. Sometimes the slopes unmistakably match the arrow directions, but sometimes the slopes seem flatter than the directional arrows indicate. It is key then to remember that the trends are calculated statistically and may exist on a finer scale than can be interpreted to the naked eye.

Suspended Sediment

Suspended sediment yields through 2024 are shown in Figure 1. Unadilla and Cohocton had the lowest yields in 2024 (Table 1), and these graphs show that these sites consistently have the lowest suspended sediment yields out of all stations. The wet years of 2006 and 2011 are also the most obvious in the Conklin and Unadilla graphs. The actual yields for those stations in those years are much higher than in other years, yet the flow-normalizing process smooths out the effects of extreme storm events such as these.

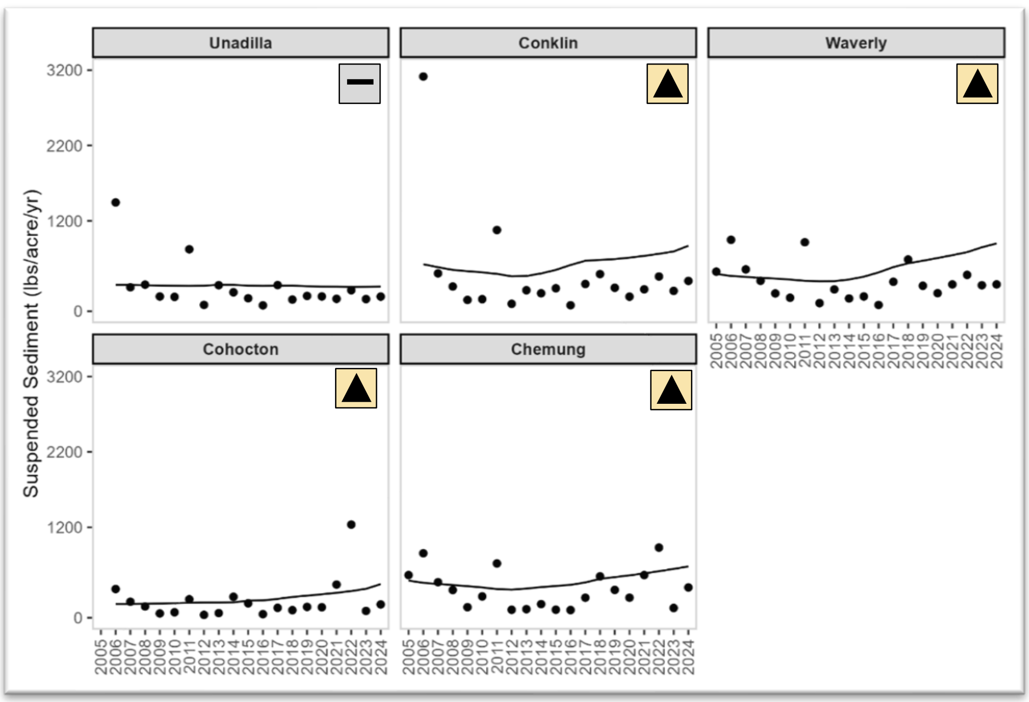

Figure 2. Suspended Sediment through 2024 for New York-Based NTN Stations (black line = Flow-Normalized Yields, black dots = Actual Yields, arrows = Directional Trends)

Total Nitrogen

Total Nitrogen (TN) yields through 2024 are shown in Figure 3. Conklin and Chemung had the lowest yields in 2024 (Table 1), and Figure 3 shows that these sites consistently have the lowest TN yields of all stations. Increasing and decreasing trends are not obviously reflective of the directional trend arrows. The 2006 and 2011 storms are easy to notice as outliers in Unadilla, Conklin, and Waverly graphs (all Upper Susquehanna stations).

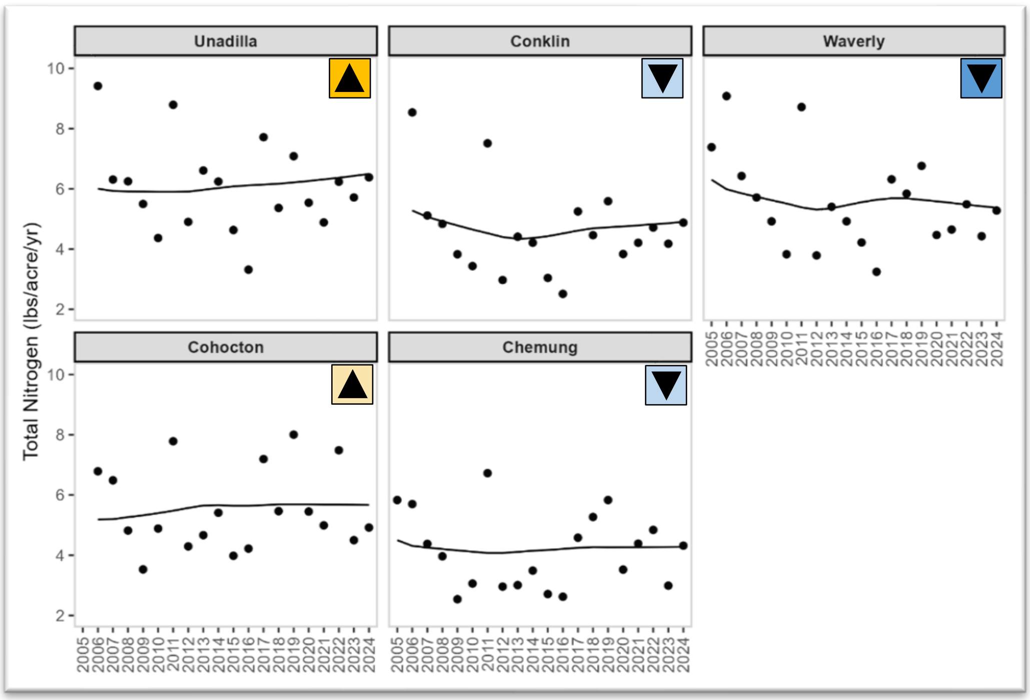

Figure 3. Total Nitrogen through 2024 for New York-Based NTN Stations (black line = Flow-Normalized Yields, black dots = Actual Yields, arrows = Directional Trends)

Dissolved Nitrate + Nitrite

Figure 4 displays a dissolved fraction of the Total Nitrogen yields—Dissolved Nitrate + Nitrite (DN)—through 2024. Like with TN, Chemung and Cohocton again consistently have the lowest DN yields of all stations. Unadilla and Cohocton have the highest yields and appear to be increasing through time. Waverly has a visually decreasing slope that aligns with the decreasing trend line, but Conklin and Chemung slopes are not as obvious.

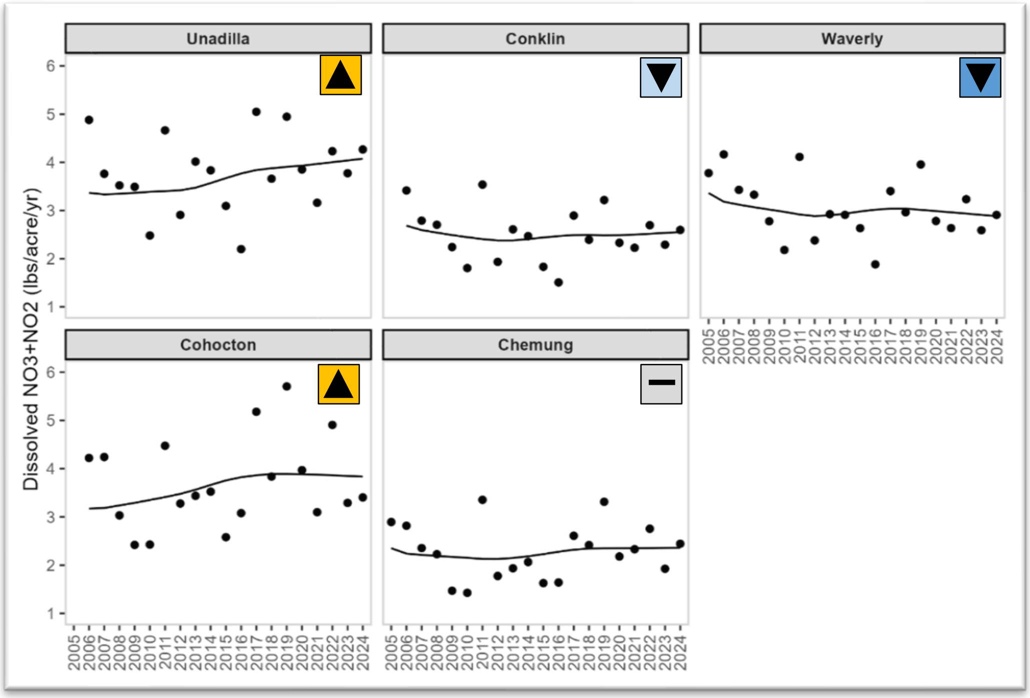

Figure 4. Dissolved Nitrate + Nitrite through 2024 for New York-Based NTN Stations (black line = Flow-Normalized Yields, black dots = Actual Yields, arrows = Directional Trends)

Total Phosphorus

Total Phosphorus (TP) yields through 2024 are shown in Figure 5. Nearly all stations show higher than normal TP yields from 2006 and 2011 storm events, but all five sites have decreasing trends, and nearly all sites show storm effects in 2006 and 2011.

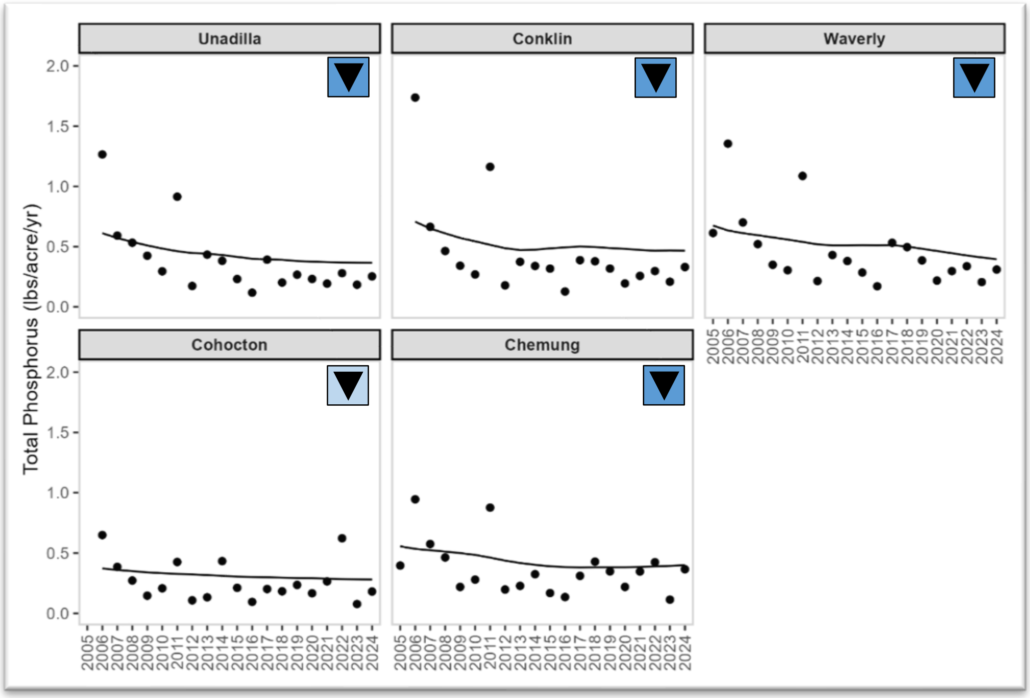

Figure 5. Total Phosphorus through 2024 for New York-Based NTN Stations (black line = Flow-Normalized Yields, black dots = Actual Yields, arrows = Directional Trends)

Dissolved Orthophosphorus

Figure 6 shows Dissolved Orthophosphorus (DP) yields for all five stations through 2024. All five stations show strongly decreasing slopes, which align with the decreasing trend arrows. There is very little variability in DP yields in more recent years, and there is only a slight difference in recent years among the stations (Table 1).

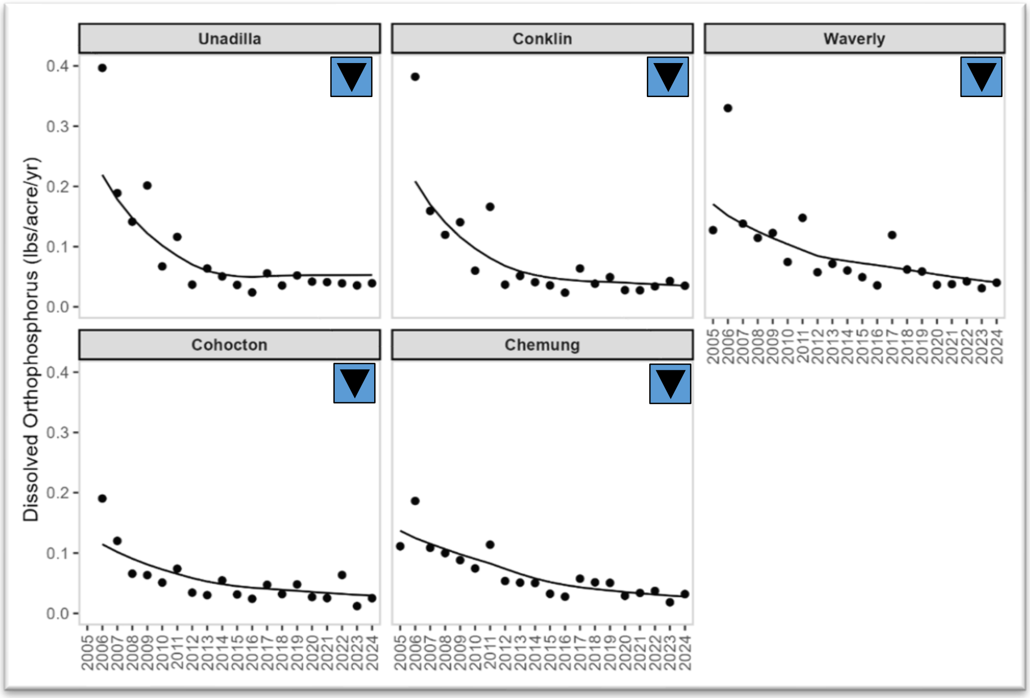

Figure 6. Dissolved Orthophosphorus through 2024 for New York-Based NTN Stations (black line = Flow-Normalized Yields, black dots = Actual Yields, arrows = Directional Trends)

CONCLUSIONS

In addition to the five parameters that were the focus of this report, similar analyses have been conducted on Total Nitrate + Nitrite, Total Ammonia, Total Organic Carbon, Dissolved Nitrogen, Dissolved Phosphorus, and Dissolved Ammonia and are available at the Sediment & Nutrient Assessment Program data portal. In addition to yields, this data portal can also provide loads and concentrations as well as flow-normalized loads and concentrations.

SRBC continues to collect data at the 27 NTN Stations and will be running WRTDS on data collected through 2025 in Summer 2026.

REFERENCES

Mason, C.A., J.E. Colgin, J.S. Webber, and A.M. Soroka. 2025. Nitrogen, phosphorus, and suspended-sediment loads and trends measured at the Chesapeake Bay Nontidal Network stations: Water years 1985-2023: U.S. Geological Survey data release, https://doi.org/10.5066/P13P4TWR.

SRBC. 2024. Comprehensive Analysis of Non-Tidal Tributaries. https://www.srbc.gov/portals/water-quality-projects/sediment-nutrient-assessment/docs/2024-117e-trends-deliverables.pdf

USGS. WaterWatch. https://waterwatch.usgs.gov/index.php?id=ww_annual_summary.

APPENDIX A

Station Reference Pages

Unadilla River at Rockdale, NY (01502500)

County: Chenango **Drainage Area**: 520 mi^2
Latitude: 42.379° **Longitude**: -75.406°

https://www.srbc.gov/portals/water-quality-projects/sediment-nutrient-assessment/sites/unadilla-river-rockdale.html

Susquehanna River at Conklin, NY (01503000)

County: Broome **Drainage Area**: 2,230 mi^2
Latitude: 42.036° **Longitude**: -75.803°

https://www.srbc.gov/portals/water-quality-projects/sediment-nutrient-assessment/sites/susquehanna-river-conklin.html

Susquehanna River at Waverly, NY (01515000)

County: Tioga **Drainage Area**: 4,734 mi^2
Latitude: 42.028° **Longitude**: -75.384°

https://www.srbc.gov/portals/water-quality-projects/sediment-nutrient-assessment/sites/susquehanna-river-smithboro.html

Cohocton River at Campbell, NY (01529500)

County: Steuben **Drainage Area**: 470 mi^2
Latitude: 42.253° **Longitude**: -77.217°

https://www.srbc.gov/portals/water-quality-projects/sediment-nutrient-assessment/sites/cohocton-river-campbell.html

Chemung River at Chemung, NY (01531000)

County: Chemung **Drainage Area**: 2,507 mi^2
Latitude: 42.003° **Longitude**: -76.635°

https://www.srbc.gov/portals/water-quality-projects/sediment-nutrient-assessment/sites/chemung-river-chemung.html