2018 Nutrients and Suspended Sediment in the Susquehanna River Basin

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The Susquehanna River Basin Commission was created as an independent agency by a federal-interstate compact* among the states of Maryland and New York, the Commonwealth of Pennsylvania, and the federal government. In creating the Commission, the Congress and state legislatures formally recognized the water resources of the Susquehanna River Basin as a regional asset vested with local, state, and national interests for which all the parties share responsibility. As the single federal-interstate water resources agency with basinwide authority, the Commission's goal is to coordinate the planning, conservation, management, utilization, development, and control of Basin water resources among the public and private sectors.

**Statutory Citations: Federal - Pub. L. 91-575, 84 Stat. 1509 (December 1970); Maryland - Natural Resources Sec. 8-301 (Michie 1974); New York - ECL Sec. 21-1301 (McKinney 1973); and Pennsylvania - 32 P.S. 820.1 (Supp. 1976).*

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2018

- The highest annual rainfall since the program's inception occurred at Marietta with 62.26 inches (the next closest at Marietta was 60.27 in 2011). Corresponding flows were 72,657 and 73,418 cubic feet per second (cfs), respectively. Annual precipitation and discharge are the primary drivers of nutrient and sediment loads.
- Rainfall ranged 5.96 inches above long-term mean (LTM) at Unadilla to 30.48 inches above LTM at Swatara. Corresponding flows were 116 and 205% of LTMs, respectively.
- The highest rainfall season was summer at all sites, ranging 3.60 inches above LTM at Unadilla to 17.48 inches above LTM at Swatara.
- Annual flows were the highest at all West Branch Susquehanna and Juniata sites and Conodoguinet, Swatara, Shermans, Octoraro, Pequea, and Conestoga since monitoring began.
- Total Nitrogen, Total Phosphorus, and Suspended Sediment (TN, TP, and SS, respectively) loads were above LTMs at all sites.
- Annual TN was highest for entire period of data collection at Karthaus, Jersey Shore, Saxton, and Conodoguinet.
- Annual TP and SS were highest for entire period of data collection at Karthaus.

Flow Normalized Trends (Summation of Short-Term (2005-2018) Trends in Table 1)

Opposite trends in concentration and load: Jersey TN, Towanda TP, Saxton Dissolved Phosphorus (DP), Shermans TNO_x (Total Nitrate-nitrogen), Paxton TN.

1) Total Nitrogen

    A. Long-term Sites

        - All long-term and short-term trends were downward.

    B. Enhanced Sites

        - Unadilla, Cohocton, Karthaus, and Penns all had upward trends in concentration and load.
        - Conklin, Conodoguinet, Swatara, West Conewago, Pequea, and Octoraro had downward trends in concentration and load.
        - Jersey Shore and Shermans had downward concentration trends and upward load trends.
        - Wilkes-Barre and Saxton had no concentration trends and upward load trends.
        - Smithboro and Chemung had no trends.

2) Total Phosphorus

    A. Long-term Sites

        - Long-term Trends
            - Towanda had a downward concentration trend and no load trend.

    - All other long-term sites had downward trends in both concentration and load.
- Short-term Trends
    - Towanda had a downward concentration trend and an upward load trend.
    - All other long-term sites had downward trends in concentration and load.

B. Enhanced Sites

- All NY sites, Karthaus, Jersey Shore, Penns, and Octoraro had downward trends for concentration and load.
- Wilkes-Barre and Swatara had downward concentration trends and no load trends.
- Saxton, West Conewago, and Pequea had upward concentration trends and no load trends.
- Shermans and Conodoguinet had no concentration trends and downward load trends.

3) Suspended Sediment (SS)

A. Long-term Sites

- Long-term Trends
    - Towanda had a downward concentration trend and no load trend.
    - All other long-term sites had downward trends in both concentration and load.
- Short-term Trends
    - Towanda and Danville had upward trends in concentration and load.
    - Marietta, Newport, and Conestoga had downward trends in both concentration and load.
    - Lewisburg had a downward concentration trend and no load trend.

B. Enhanced Sites

- Smithboro, Wilkes Barre, and Pequea had upward trends in concentration and load.
- Penns and Shermans had downward trends in both concentration and load.
- Unadilla, Chemung, Karthaus, Swatara, and Octoraro had no significant trends.
- Cohocton had a downward concentration trend and no load trend.
- Saxton, Conodoguinet, and West Conewago had no concentration trends and downward load trends.

Table 1. Short-term Trends (Mid 2000s – 2018) within Major Subbasins (Trends Map Appendix A)

Subbasin (Number of sites)	Trend Type	TN			TP			SS		
		Down	NS	Up	Down	NS	Up	Down	NS	Up
Mainstem Susquehanna (6)	Concentration	4	2		6			1	1	4
	Load	4	1	1	4	1	1	1		5
Chemung and Upper (3)	Concentration		1	2	3			1	2	
	Load		1	2	3				3	
West Branch Susquehanna (3)	Concentration	2		1	3			1	2	
	Load	1		2	3				2	1
Juniata (2)	Concentration	1	1		1		1	1	1	
	Load	1		1	1	1		2		
Lower Susquehanna (8)	Concentration	7		1	4	2	2	3	4	1
	Load	6		2	5	3		5	2	1

BACKGROUND

In 1985, the Susquehanna River Basin Commission (SRBC), as part of a joint effort with partners consisting of the United States Geological Survey (USGS), Pennsylvania Department of Environmental Protection (PADEP), and United States Environmental Protection Agency (USEPA) Chesapeake Bay Program Office (CBPO), implemented the Sediment and Nutrient Assessment Program (SNAP), a rigorous sampling program to measure nutrient and sediment concentrations at strategic locations within the Susquehanna River Basin (SRB). Comparable sampling programs also were established in the Chesapeake Bay Watershed's other tributary river basins as well as in tidal parts of the Chesapeake Bay estuary.

The primary objectives for SNAP are to amass pollutant and flow data in a consistent, on-going manner for representative locations across the entire Chesapeake Bay Watershed in order to: (i) estimate pollutant contributions to local waterways as well as the Bay; and, (ii) discern relative changes to specific pollutant contributions through time. SNAP data are used to inform and support various scientific, policy, and management approaches regarding the Bay as well as local waterways. Much of the messaging pertaining to Bay condition centers on *Total Nitrogen* (TN) and *Total Phosphorus* (TP) pollution. Within this report and elsewhere related to SNAP, note that the modifying term ***Total*** refers to laboratory analyses performed on *unfiltered* samples. Moreover, the use of stand-alone N (for nitrogen) and P (for phosphorus) means that laboratory analyses did not distinguish among various chemical forms of N/P that occur in the environment. In contrast to T, the modifying term ***Dissolved*** (D) is used to distinguish samples that were filtered prior to laboratory analyses. Particular chemical forms of N, such as nitrate and nitrite (collectively abbreviated NO_x), as well as P, such as phosphate (PO_4), are used where applicable.

Detailed information regarding sample collection, processing, lab analyses, and data analyses are available at the following website: https://www.srbc.net/portals/water-quality-projects/sediment-nutrient-assessment/. This report contains a summary of estimated nutrient and sediment pollutant loads (***load*** is total pollutant mass per year) and yields (***yield*** is pollutant

load averaged over the watershed land area) derived from continuous river flow estimates and pollutant concentrations measured from water samples collected during calendar year 2018 in the SRB.

The current SRB network consists of six mainstem river and 20 tributary stations as depicted in Figure 1. The SRB Non-Tidal Network (NTN) configuration includes five stations in New York, 20 in Pennsylvania, and one in Maryland. The individual NTN stations are categorized as either ***long-term*** (e.g., 6 stations established prior to 1990) or ***enhanced*** (e.g., 20 stations established since 2004). Table 2 lists the individual SRB NTN long-term stations, along with subbasin, contributing drainage area, co-located USGS gage station number, and the distribution of major land use/land cover classes within the contributing drainage area.

The 2018 estimates of pollutant loads and yields were compared to the overall period of record. Long-term (~30-year) and short term (mid-2000s-2018) datasets are analyzed for trends. Additionally, pollutant yields averaged from the most recent three years were evaluated for inference with respect to patterns based on land use/land cover, drainage area size, and location. Detailed results are listed in the appendices.

Although human activities influence overall long-term pollutant availability, pollutant concentrations and loads measured at any instant primarily reflect recent precipitation and stream/river flow conditions. To account for short-term influences on measured concentration and load due to weather conditions, the Bay partnership makes mathematical adjustments to every measurement that allow for detection of pollution trends. Trend directions for concentrations and loads usually coincide but they can diverge. Generally, trends in concentration are driven by baseflow conditions and point-source inputs while trends in load are driven by high flow conditions and non-point source inputs (Hirsch et al., 2010). Divergence of concentration and load trends suggest differences between non-point and point source contributions may exist.

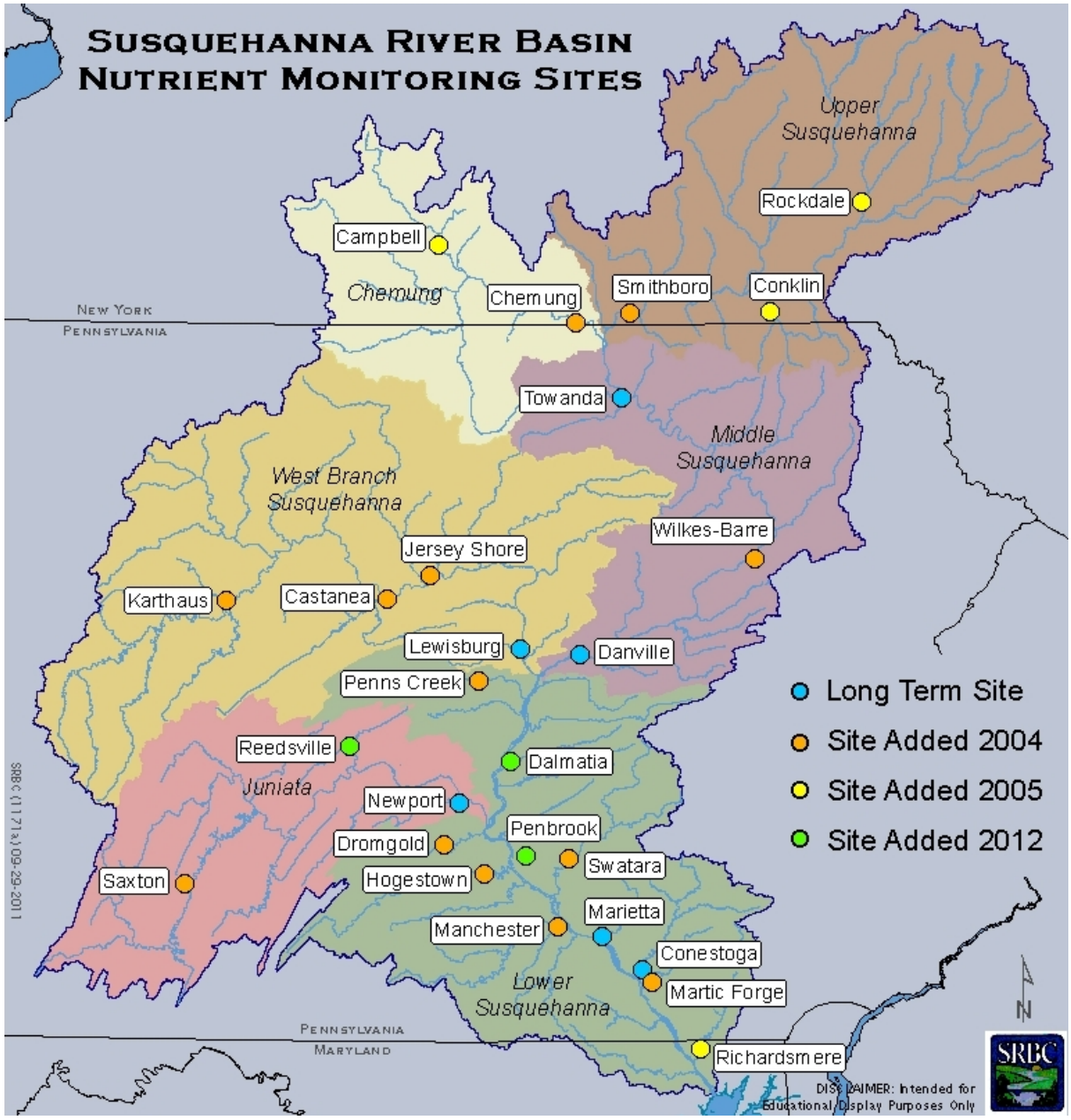

Figure 1. Sediment and Nutrient Monitoring Sites in the Susquehanna River Basin

Table 2. Data Collection Sites and Land Use Percentages from National Land Cover Database 2016

Site Name	Stream Name	Subbasin	USGS Site ID	Drainage Area (mi^2)	Agricultural		Ag Total	Forest	Urban	Other
					Row Crops	Pasture Hay				
Richardsmere	Octoraro	Lower	1578475	189	41.10	21.64	62.73	23.44	10.83	3.00
Martic Forge	Pequea	Lower	1576787	150	44.98	16.11	61.09	22.93	14.06	1.92
Manchester	W. Conewago	Lower	1574000	510	26.36	22.54	48.90	31.75	14.71	4.64
Conestoga	Conestoga	Lower	1576754	470	36.93	11.42	48.35	21.59	27.02	3.04
Hogestown	Conodoguinet	Lower	1570000	470	26.54	21.66	48.19	36.13	13.66	2.02
Dalmatia	Mahantango	Lower	1555500	162	30.80	8.50	39.30	51.28	6.70	2.73
Swatara	Swatara	Lower	1573560	483	23.85	15.31	39.16	43.43	14.04	3.38
Campbell	Cohocton	Chemung	1529500	470	13.08	21.48	34.57	53.33	6.60	5.51
Rockdale	Unadilla	Upper	1502500	520	6.61	26.50	33.11	53.68	5.05	8.15
Reedsville	Kishacoquillas	Juniata	1565000	164	20.30	10.04	30.34	61.23	7.47	0.96
Chemung	Chemung	Chemung	1531000	2,506	5.11	23.49	28.60	60.88	6.83	3.68
Towanda	Susquehanna	Main	1531500	7,790	4.38	22.95	27.34	60.51	6.62	5.53
Smithboro	Susquehanna	Main	1515000	4,773	4.06	22.00	26.06	60.79	6.49	6.66
Wilkes-Barre	Susquehanna	Main	1536500	9,960	3.68	22.33	26.00	60.56	7.42	6.02
Danville	Susquehanna	Main	1540500	11,200	4.25	21.49	25.73	60.72	7.58	5.96
Saxton	Raystown Br Juniata	Juniata	1562000	756	10.36	14.44	24.80	65.80	6.56	2.84
Conklin	Susquehanna	Main	1503000	2,232	3.27	21.48	24.75	62.04	5.64	7.57
Dromgold	Shermans	Lower	1568000	207	13.16	11.54	24.69	69.31	4.96	1.03
Marietta	Susquehanna	Main	1576000	26,000	8.12	15.00	23.12	63.88	8.19	4.82
Penns	Penns	Lower	1555000	301	13.26	9.42	22.67	70.20	5.17	1.96
Newport	Juniata	Juniata	1567000	3,354	10.68	10.60	21.29	69.16	7.08	2.47
Castanea	Bald Eagle	West	1548085	768	9.39	8.05	17.44	71.08	9.38	2.10
Lewisburg	West Br Susquehanna	West	1553500	6,820	3.85	7.50	11.35	78.38	5.62	4.65
Karthaus	West Br Susquehanna	West	1542500	1,462	2.11	9.20	11.31	75.87	6.38	6.43
Paxton	Paxton	Lower	1571000	11	2.45	8.66	11.12	24.08	64.47	0.33
Jersey Shore	West Br. Susquehanna	West	1549760	5,225	2.40	6.08	8.48	82.09	5.11	4.32

PRECIPITATION AND DISCHARGE

Precipitation and discharge are the primary drivers of annual nutrient and sediment loads. Figure 2 includes sets of charts that summarize 2018 seasonal and annual precipitation and discharge at the six long-term stations in comparison to the respective long-term (~30-year) means. For 2018, precipitation was significantly above LTMs at all sites across the SRB, as was discharge. For the SRB's six long-term stations, the highest seasonal precipitation occurred during summer. Of the long-term stations in 2018, Newport had the largest increases in both precipitation (P) and average daily flow (ADF), relative to LTM.

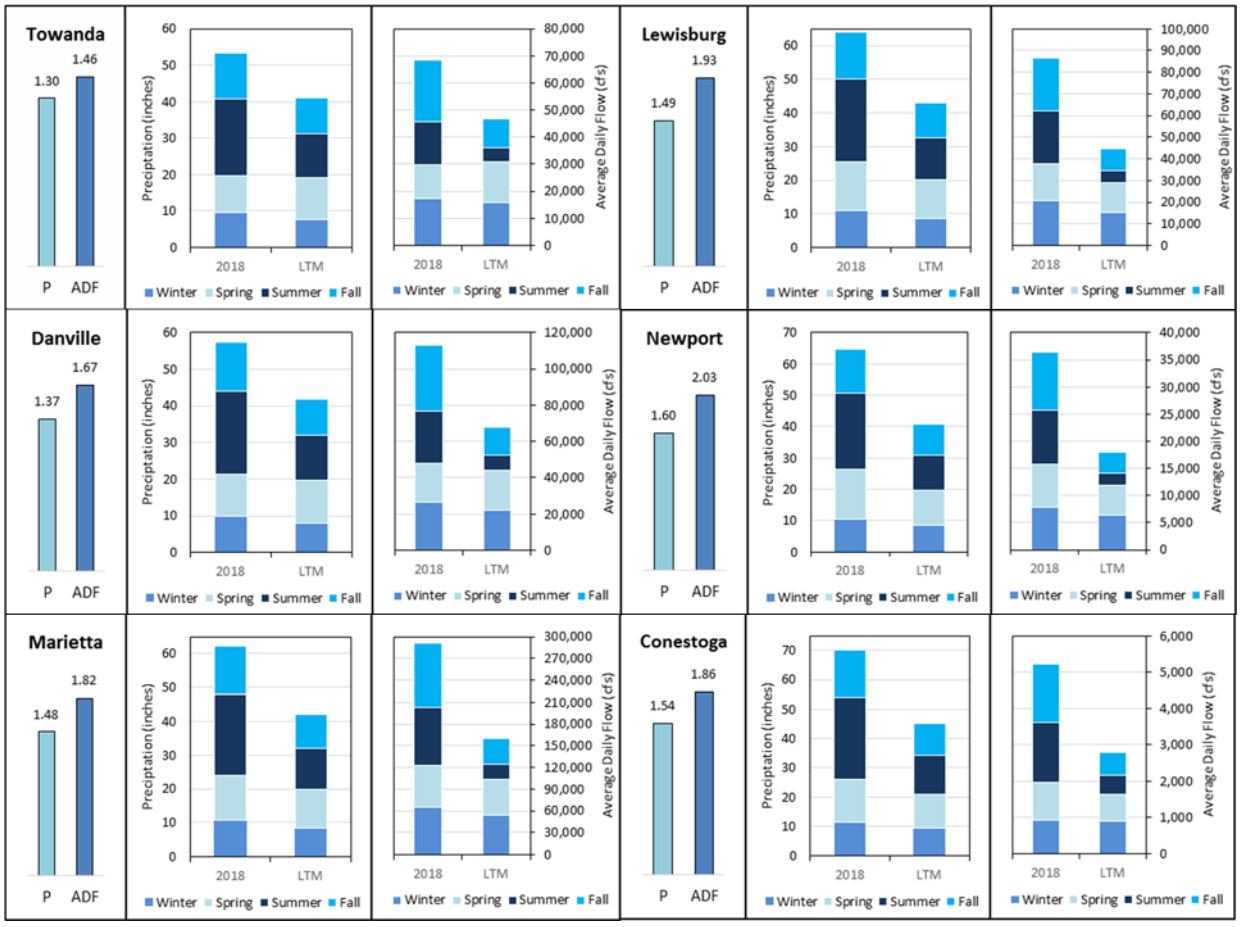

Figure 2. Precipitation (P) and Average Daily Flow (ADF) Annual and Seasonal Statistics for 2018 (Note that for Newport, annual P in 2018 was almost 60% higher than LTM, while ADF was more than double (103%) the LTM.)

NEAR-TERM PATTERNS: INFORMATION DERIVED FROM 2016-2018 AVERAGE YIELDS

Pollutant yields for each site were averaged for the three-year period of 2016-2018. The near-term, three-year average yield data formed the framework for the following discussion about general correlations between certain pollutants and particular landscape factors. Figures B13 through B18 in Appendix B summarize the 2016-2018 average and LTM for each pollutant and every station. By convention for all above-referenced figures, the sites are ordered left-to-right by decreasing SS yield based on the average 2016-2018 yield. Table 3 is a summary of near-term average yield rankings for select pollutants in the SRB.

The effect of land use/land cover on pollutant yield is readily evident through examination of Paxton Creek and Pequea Creek 2016-2018 average yield data. As well as having among the most intense land development in the SRB, these two sites have the smallest drainage areas in the NTN. And although Paxton Creek is dominated by urban development while Pequea Creek is dominated by agricultural production, Pequea ranked in the Top 3 (of 25 stations) in terms of SS, DP, and Dissolved Nitrate-nitrogen (DNO_x) yields, while Paxton ranked in the Top 3 for SS, the Top 10 for DP, and the upper half for DNO_x yields. One explanation for the high pollutant output from these intensively, although differently-utilized watersheds, could relate to the overall lack of forest land cover – both catchments are made up of less than 25% forest cover. Numerous scientific studies have demonstrated a strong relationship between the proportion of forest/natural landscape and water quality (Lintern et al., 2017).

A further examination of land cover suggests the impact of agricultural practices on pollutant yields. For sites in which the proportion of row cropping was greater than 20%, the propensity for high nutrient yields is unmistakable. Seven of the Top 10 highest yields for DP and eight of the Top 10 highest yields for DNO_x exhibited more than 20% row cropping in the drainage area in the 2016-2018 average yield data set. A link between row cropping and high nutrient yields can occur where supplemental nutrient inputs (e.g., fertilizer, manure applications) are incompletely used/retained in-place.

Compared to nutrient pollutants, the effect of land cover alone is less clear for SS yield, where the 2016-2018 average yield dataset suggests that overall watershed size and/or geographic location exert underlying influence(s) in addition to land use/land cover. With respect to SS yield, six of the Top 10 sites have drainage areas greater than 2,000 $mile^2$. Moreover, the same six Top 10 SS-yielding sites are situated on the mainstem Chemung River and Upper Susquehanna River, within or near the limit of Pleistocene glacial advance. The pattern for SS yield is not entirely unexpected because, especially in comparison to dissolved-phase pollutants, SS mobilization and transport requires physical energy sufficient to overcome inertia thresholds and larger waterways might simply maintain and sustain SS-transport energy thresholds more effectively and longer in comparison to smaller waterways. Additionally, glaciation created and placed vast accumulations of mineral particles in and near the more northerly mainstem rivers of the SRB.

Examination of near-term average pollutant yields reveals some useful general patterns for the NTN and in particular suggests the presence of one or alternative and significant factors/sources of SS yield unrelated to land cover and especially row crops. Moreover, by focusing carefully on NTN sites that contradict more generic trends, scientists and managers could uncover better understanding of more effective nutrient and sediment management strategies.

Table 3. Susquehanna River Basin NTN Sites Ranked According to Select Pollutant Yields

No.	NTN Stream, Site Name	Pollutant Yield-Based Rank			
		DNOx	DP	SS	Average
1	Pequea	3	1	1	1.7
2	Conestoga	2	2	8	4.0
3	Swatara	5	5	5	5.0
4	Mahantango	1	8	14	7.7
5	Octoraro	4	4	15	7.7
6	W. Conewago	9	3	11	7.7
7	Paxton	13	10	3	8.7
8	Shermans	8	6	22	12.0
9	Raystown Br. Juniata	10	14	13	12.3
10	Conodoguinet	6	11	20	12.3
11	Susq, Marietta	14	13	12	13.0
12	Kishacoquillas	7	9	24	13.3
13	Susq, Smithboro	19	15	7	13.7
14	Susq, Wilkes Barre	22	17	2	13.7
15	Penn's	11	7	23	13.7
16	Susq, Danville	20	18	4	14.0
17	Susq, Towanda	21	16	6	14.3
18	Juniata, Newport	12	12	19	14.3
19	Susq, Conklin	24	19	10	17.7
20	Unadilla	16	21	16	17.7
21	Chemung	25	20	9	18.0
22	W. Br Susq, Lewisburg	17	23	17	19.0
23	W. Br Susq, Karthaus	18	24	18	20.0
24	W. Br Susq, Jersey Shore	23	25	21	23.0
25	Bald Eagle	--	--	25	--
26	Cohocton	15	22	--	--

Notes:
(i) Rank based on select pollutant mean yield for period 2016-2018. Lowest numeric rank equates to highest 3-year mean yield.
(ii) Average rank is the mean of all three select pollutant yield rankings. Lowest numeric average rank represents the NTN site with highest yields for the three selected pollutants.
(iii) Yellow-shaded cells represent Top 10 ranked yields.
(iv) Green-shaded cells are NTN sites with >20% Row Crop.
(v) Blue-shaded cells are northerly mainstem sites on Susquehanna/Chemung Rivers.
(vi) Bald Eagle and Cohocton datasets deemed insufficient to calculate the specified yields.

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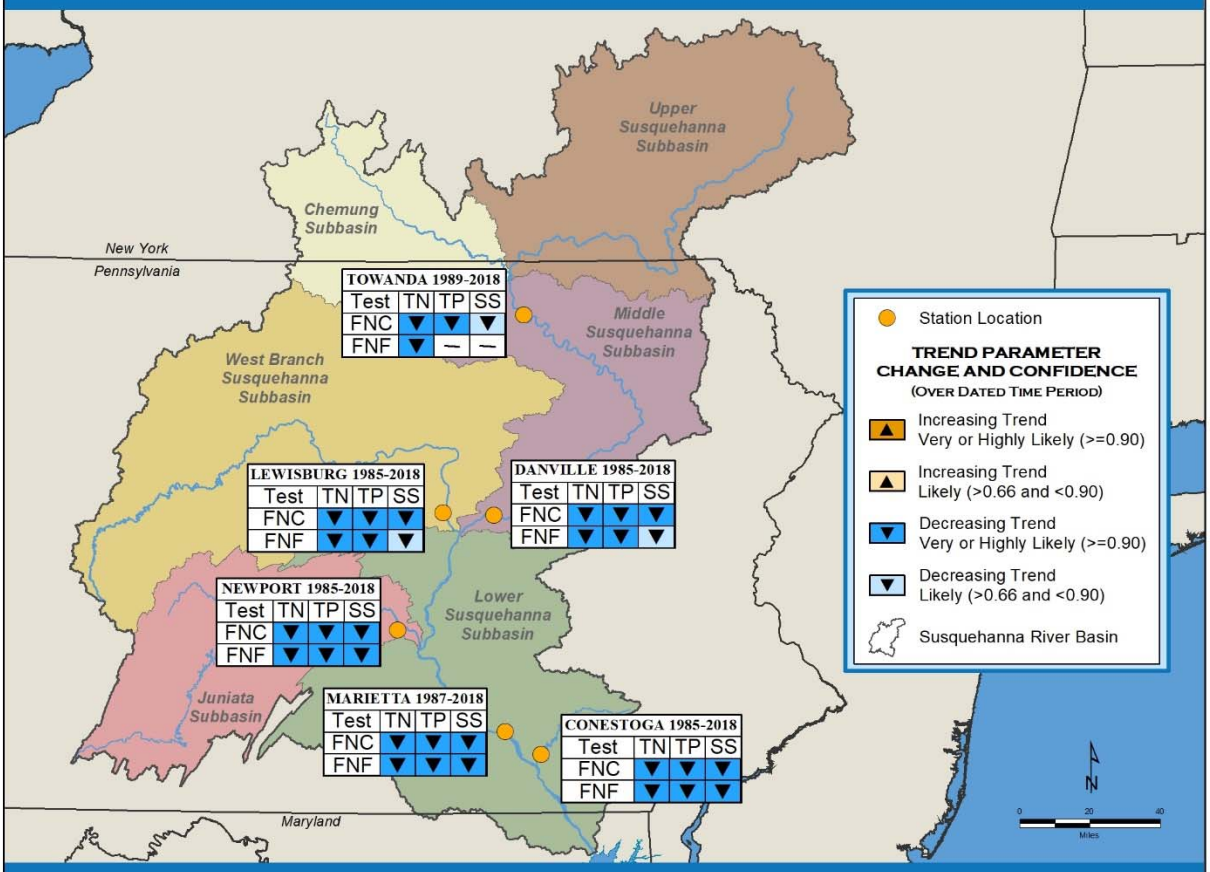
APPENDIX A

Trends Maps

Long Term Flow Normalized Trends in Total Nitrogen (TN), Total Phosphorus (TP), and Suspended Sediment (SS) Through 2018



The Susquehanna River Basin Commission estimates trends in nutrients, sediment, and flow as part of the Chesapeake Bay Program's annual trend update. 2018 trend analyses were completed using the USGS Weighted Regression on Time, Discharge, and Season (WRTDS) model*. WRTDS uses flow normalization to remove the impacts of flow resulting in trends in Flow Normalized Concentration (FNC) and Flow Normalized Flux (FNF).

The map displays trend direction (arrow). The chart below lists the magnitude of the trend in mg/L (FNC) and annual tons (FNF). For example, TN concentrations were reduced by 0.567 mg/L and annual TN loads were reduced by 7,141 tons over the period of record at Towanda.

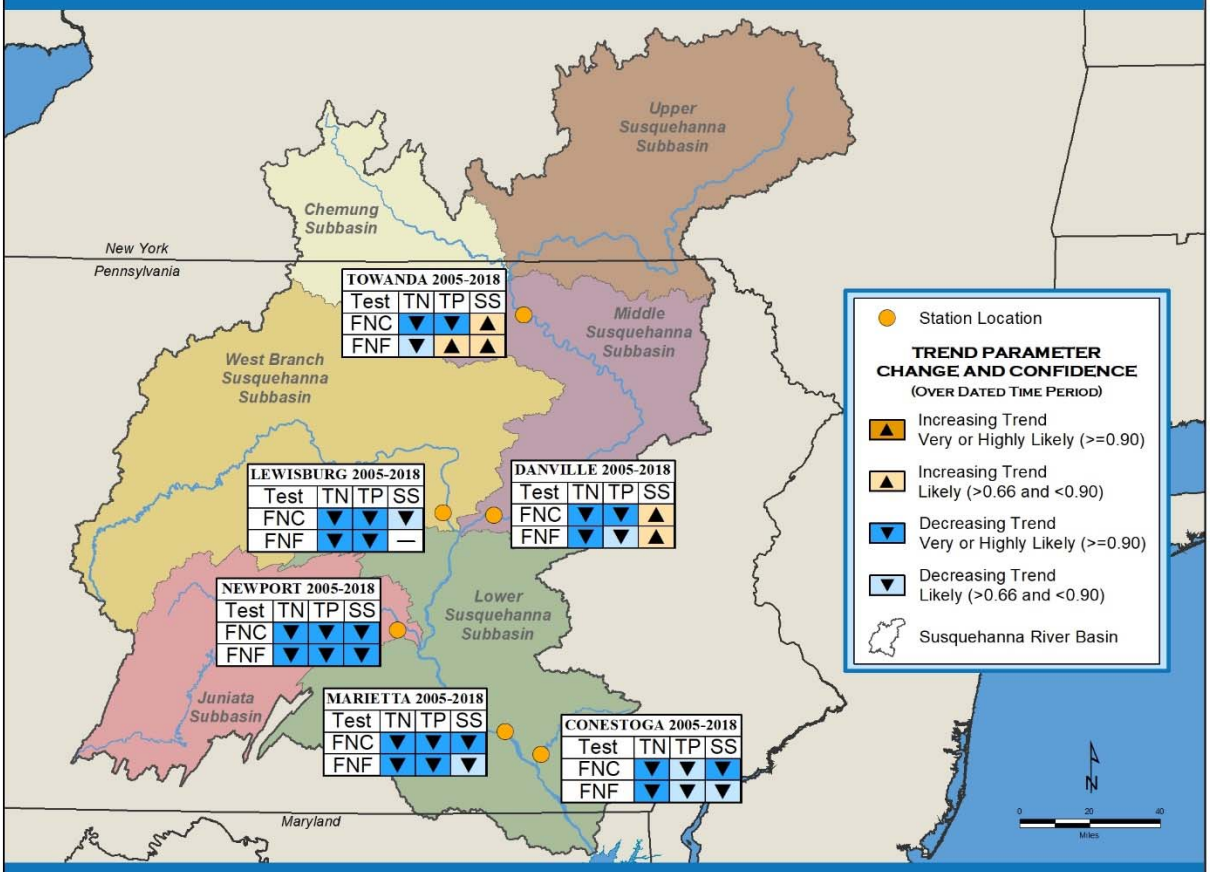
Additionally, WRTDS uses a likelihood factor for describing the confidence in detected trends. This likelihood is represented in the map by the background color behind the trend direction triangles with each color corresponding to a particular percent confidence. For example, the downward FNC trend for TN at Towanda falls within the "Very or Highly Likely" category (>=90% confidence). Alternately, the downward FNC trend for SS at Towanda falls within the "Likely" category (>66% and <90% confidence).

Site	Trend (Change**) Time Period	Flow Normalized Concentration Change (mg/L)			Flow Normalized Load Change (Annual Tons)		
		Total Nitrogen	Total Phosphorous	Suspended Sediment	Total Nitrogen	Total Phosphorous	Suspended Sediment
Towanda	1989-2018	-0.567	-0.033	-1.520	-7,141	-	-
Danville	1985-2018	-0.797	-0.051	-13.500	-13,569	-424	-256,175
Marietta	1987-2018	-0.758	-0.051	-24.100	-31,735	-1,718	-1,716,281
Lewisburg	1985-2018	-0.618	-0.040	-6.670	-5,817	-239	-87,280
Newport	1985-2018	-0.476	-0.069	-21.400	-2,190	-293	-211,201
Conestoga	1985-2018	-2.770	-0.323	-103.000	-2,224	-252	-195,107

*Hirsch, R.M., and De Cicco, L.A., 2015, User guide to Exploration and Graphics for RivEr Trends (EGRET) and dataRetrieval: R packages for hydrologic data (version 2.0, February 2015): U.S. Geological Survey Techniques and Methods book 4, chap. A10, 93 p., http://dx.doi.org/10.3133/tm4A10

**Change is the difference between the starting and ending years. DISCLAIMER: Use of Map for Any Purpose on "As Is" Basis, No Warranties Provided; SRBC (725a) 08-16-2019

Short Term Flow Normalized Trends in Total Nitrogen (TN), Total Phosphorus (TP), and Suspended Sediment (SS) Through 2018



The Susquehanna River Basin Commission estimates trends in nutrients, sediment, and flow as part of the Chesapeake Bay Program's annual trend update. 2018 trend analyses were completed using the USGS Weighted Regression on Time, Discharge, and Season (WRTDS) model*. WRTDS uses flow normalization to remove the impacts of flow resulting in trends in Flow Normalized Concentration (FNC) and Flow Normalized Flux (FNF).

The map displays trend direction (arrow). The chart below lists the magnitude of the trend in mg/L (FNC) and annual tons (FNF). For example, TN concentrations were reduced by 0.045 mg/L and annual TN loads were reduced by 108 tons over the period of record at Towanda.

Additionally, WRTDS uses a likelihood factor for describing the confidence in detected trends. This likelihood is represented in the map by the background color behind the trend direction triangles with each color corresponding to a particular percent confidence. For example, the downward FNC trend for TN at Towanda falls within the "Very or Highly Likely" category (>=90% confidence). Alternately, the downward FNF trend for TN at Towanda falls within the "Likely" category (>66% and <90% confidence).

Site	Trend (Change**) Time Period	Flow Normalized Concentration Change (mg/L)			Flow Normalized Load Change (Annual Tons)		
		Total Nitrogen	Total Phosphorous	Suspended Sediment	Total Nitrogen	Total Phosphorous	Suspended Sediment
Towanda	2005-2018	-0.045	-0.019	9.710	-108	247	502,649
Danville	2005-2018	-0.152	-0.022	12.000	-1,035	-82	862,660
Marietta	2005-2018	-0.342	-0.018	-6.680	-8,880	-720	-429,677
Lewisburg	2005-2018	-0.314	-0.022	-3.110	-1,856	-188	-
Newport	2005-2018	-0.182	-0.030	-7.210	-454	-136	-77,260
Conestoga	2005-2018	-1.670	-0.023	-20.900	-1,078	-13	-15,620

*Hirsch, R.M., and De Cicco, L.A., 2015, User guide to Exploration and Graphics for RivEr Trends (EGRET) and dataRetrieval: R packages for hydrologic data (version 2.0, February 2015): U.S. Geological Survey Techniques and Methods book 4, chap. A10, 93 p., http://dx.doi.org/10.3133/tm4A10

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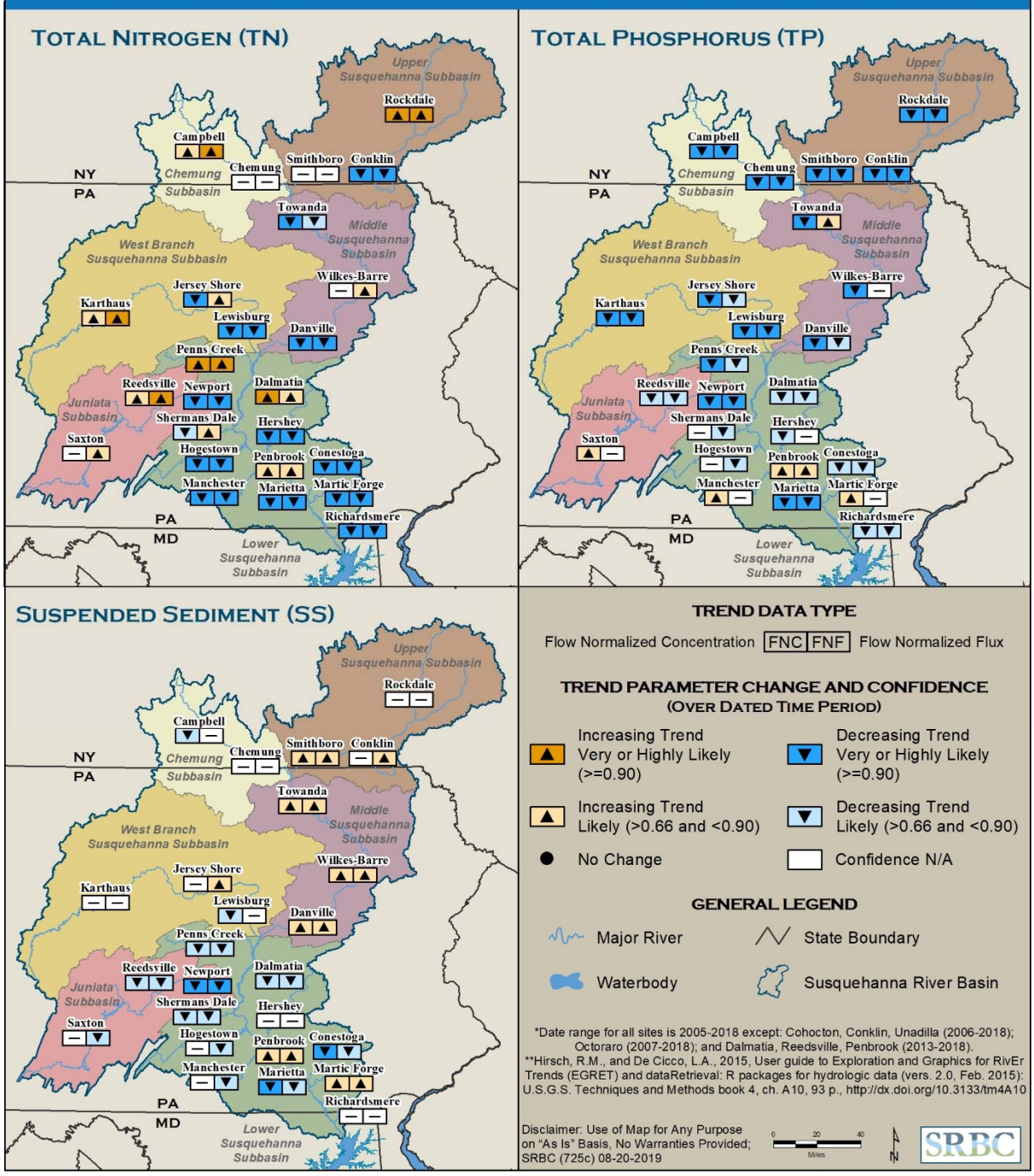
Flow Normalized Flux/Load (FNF) and Concentration (FNC) Trends in the Susquehanna River Basin, 2004 - 2018*

The Susquehanna River Basin Commission estimates trends in nutrients, sediment, and flow as part of the Chesapeake Bay Program's annual trend update. 2018 trend analyses were completed using the USGS Weighted Regression on Time, Discharge, and Season (WRTDS) model**. WRTDS uses flow normalization to remove the impacts of flow resulting in trends in Flow Normalized Concentration (FNC) and Flow Normalized Flux (FNF). The map displays trend direction (arrow) for each of the 2018 trends.



*Date range for all sites is 2005-2018 except: Cohocton, Conklin, Unadilla (2006-2018); Octoraro (2007-2018); and Dalmatia, Reedsville, Penbrook (2013-2018).

**Hirsch, R.M., and De Cicco, L.A., 2015, User guide to Exploration and Graphics for RivEr Trends (EGRET) and dataRetrieval: R packages for hydrologic data (vers. 2.0, Feb. 2015): U.S.G.S. Techniques and Methods book 4, ch. A10, 93 p., http://dx.doi.org/10.3133/tm4A10

Disclaimer: Use of Map for Any Purpose on "As Is" Basis, No Warranties Provided; SRBC (725c) 08-20-2019

APPENDIX B

Figures Referenced in 2016-2018 Average Yields Section

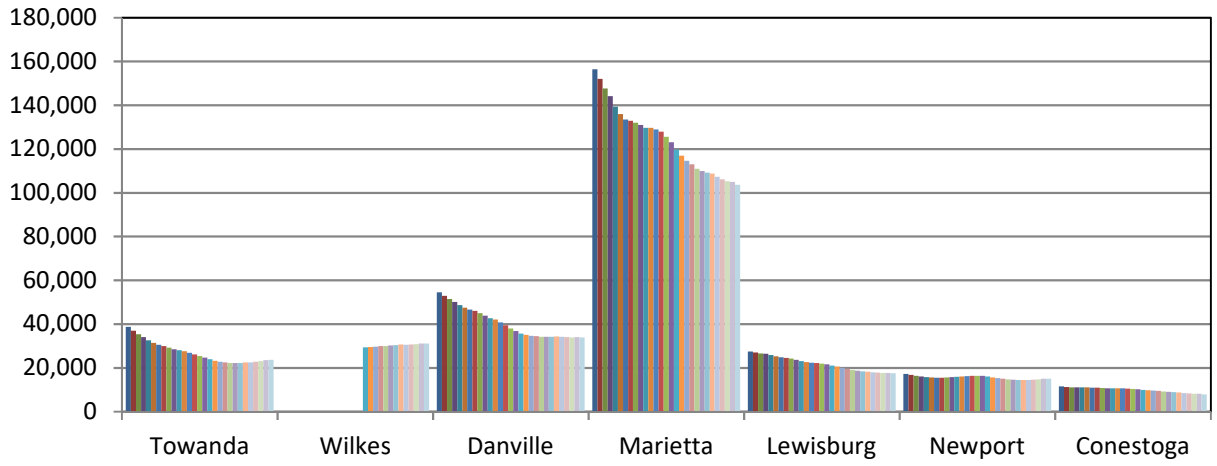


Figure B1. ***Annual Flow Normalized Loads of Total Nitrogen (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))***

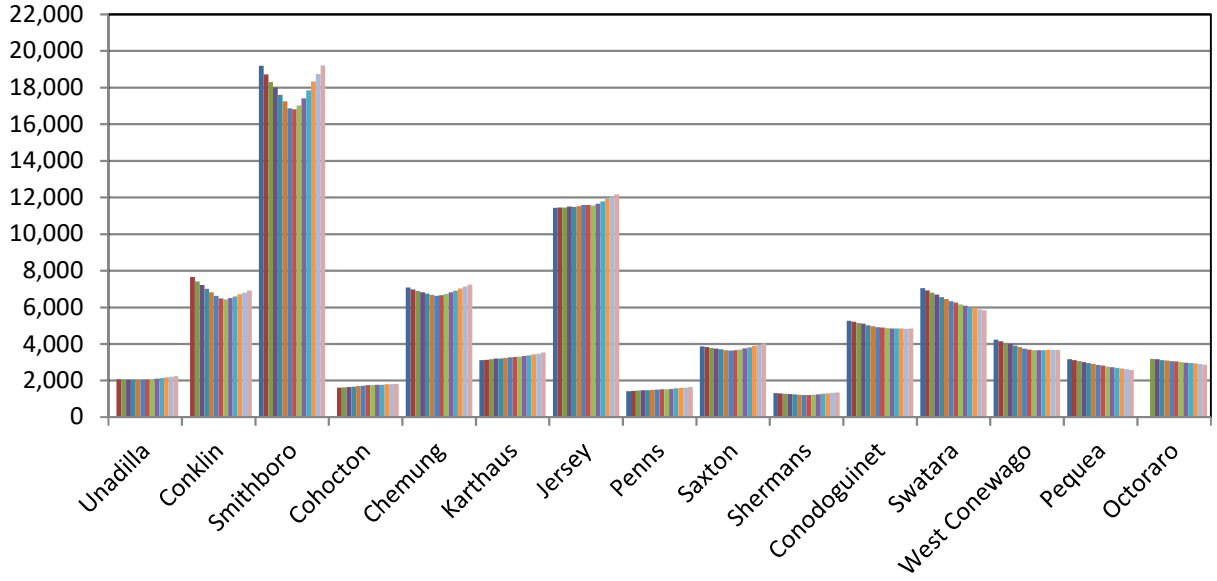


Figure B2. ***Annual Flow Normalized Loads of Total Nitrogen (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))***

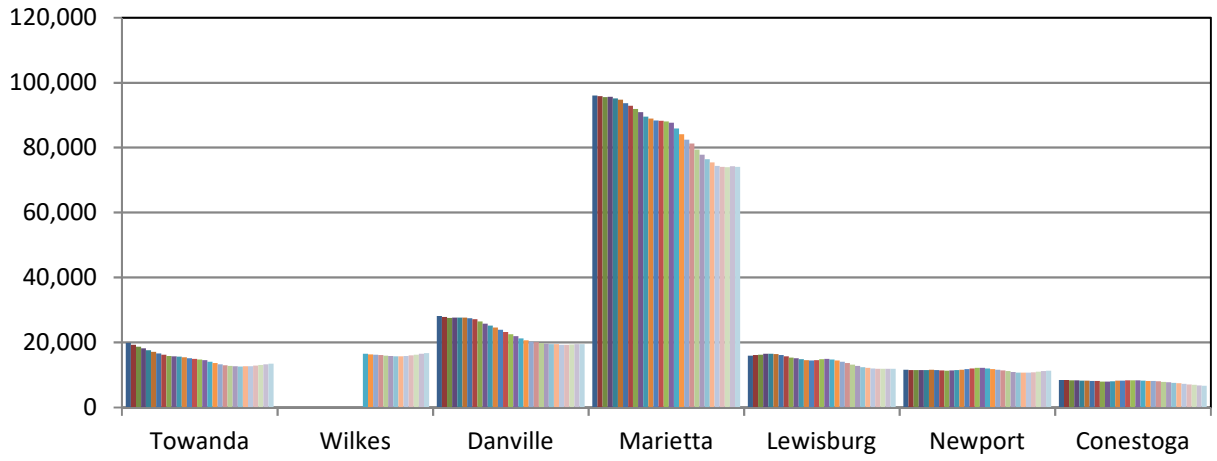


Figure B3. ***Annual Flow Normalized Loads of Dissolved Nitrate plus Nitrite Nitrogen (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))***

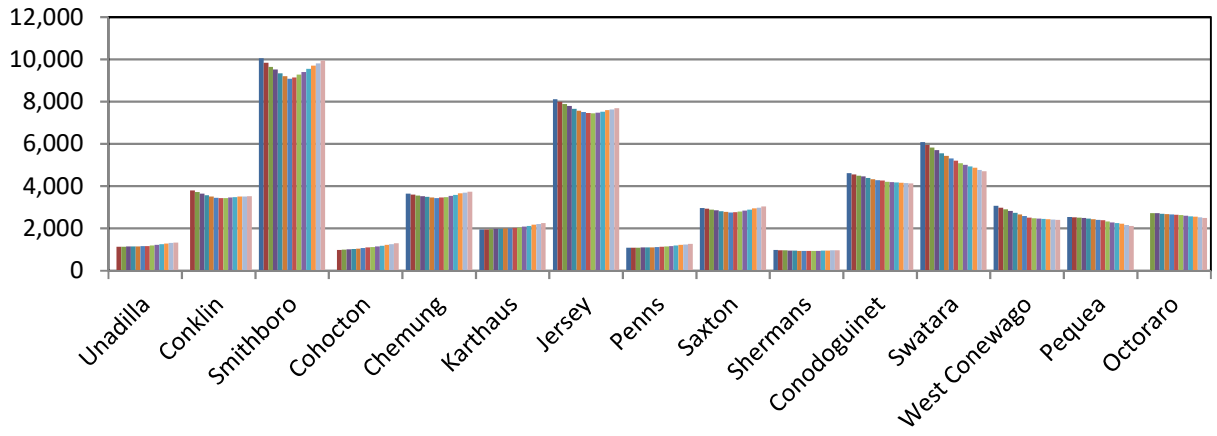


Figure B4. ***Annual Flow Normalized Loads of Dissolved Nitrate plus Nitrite Nitrogen (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))***

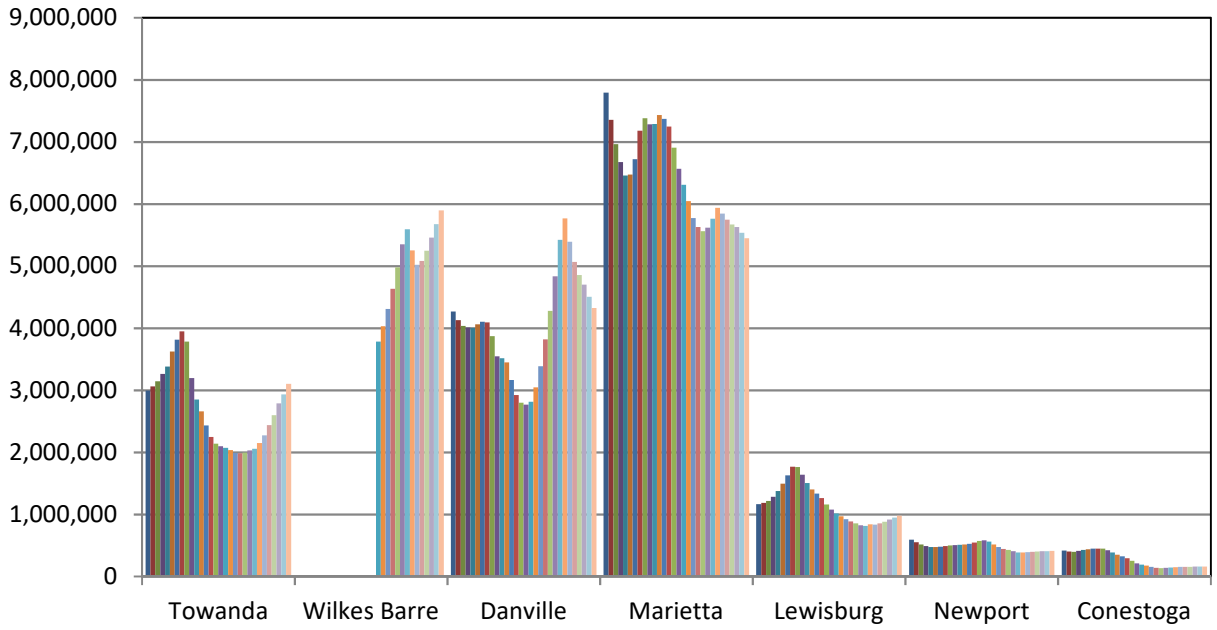


Figure B5. ***Annual Flow Normalized Loads of Suspended Sediment (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))***

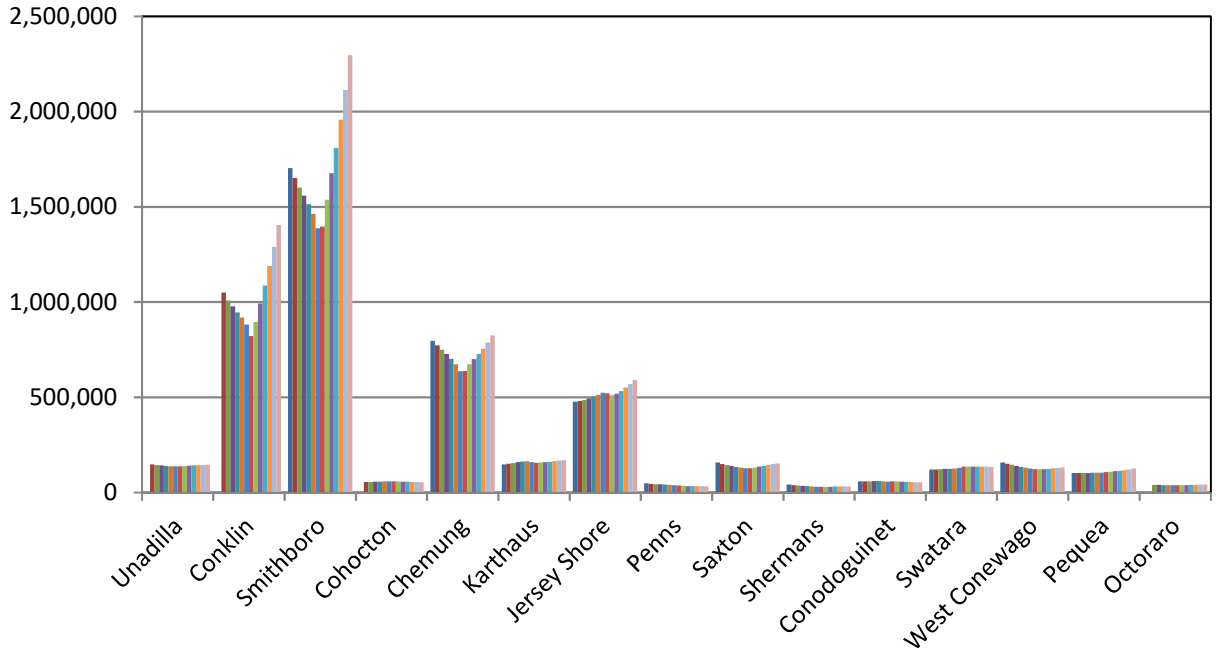


Figure B6. ***Annual Flow Normalized Loads of Suspended Sediment (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))***

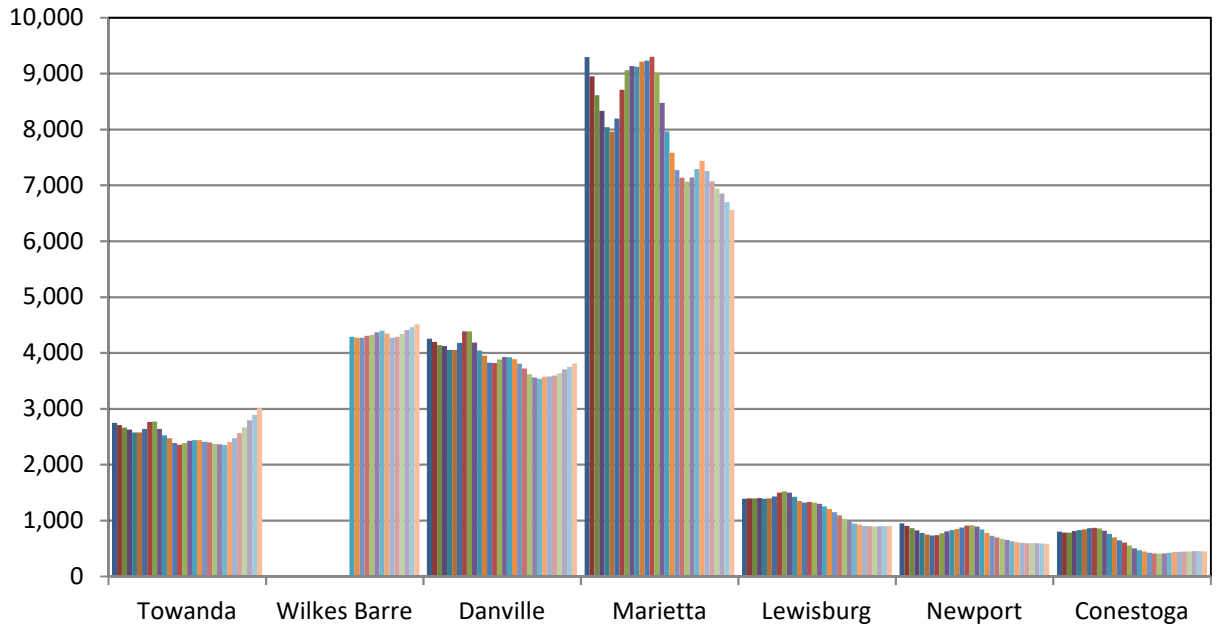


Figure B7. Annual Flow Normalized Loads of Total Phosphorus (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))

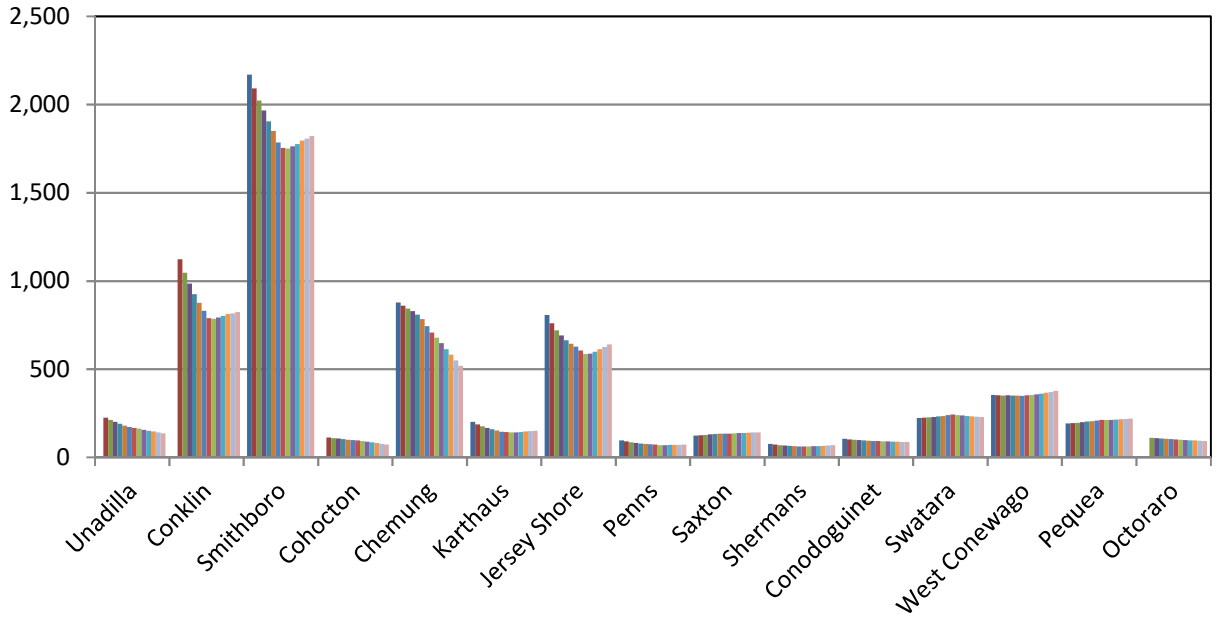


Figure B8. Annual Flow Normalized Loads of Total Phosphorus (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))

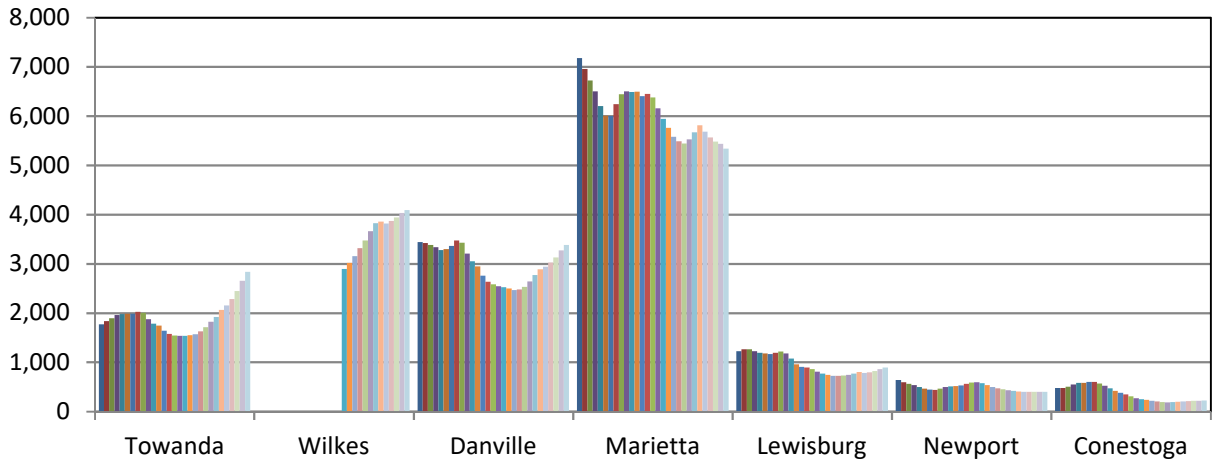


Figure B9. Annual Flow Normalized Loads of Particulate Phosphorus (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))

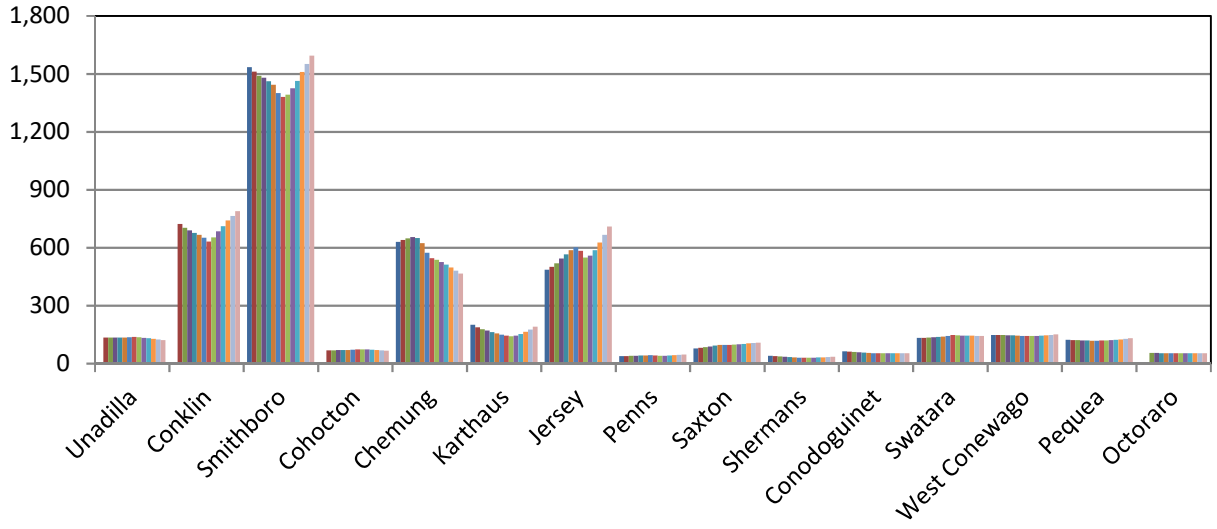


Figure B10. Annual Flow Normalized Loads of Particulate Phosphorus (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))

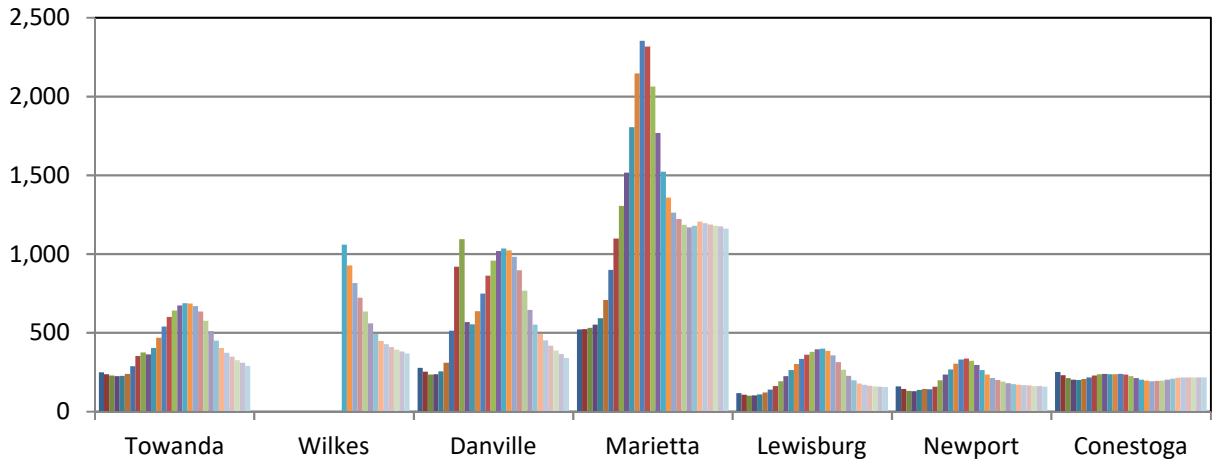


Figure B11. Annual Flow Normalized Loads of Dissolved Orthophosphate (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))

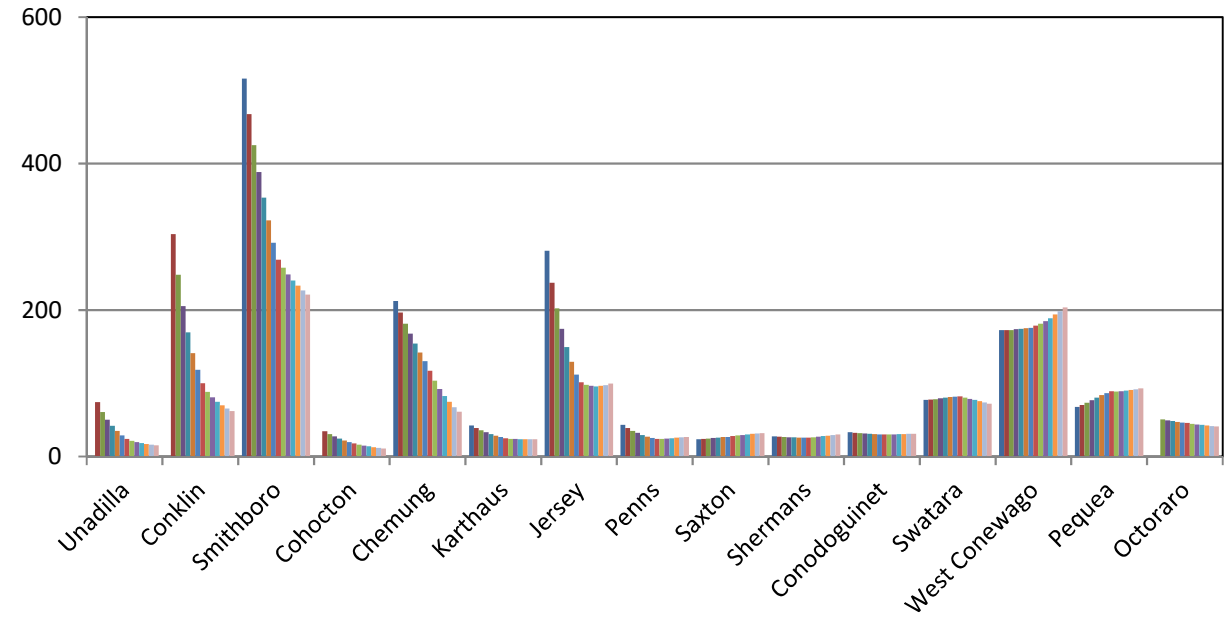


Figure B12. Annual Flow Normalized Loads of Dissolved Orthophosphate (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))

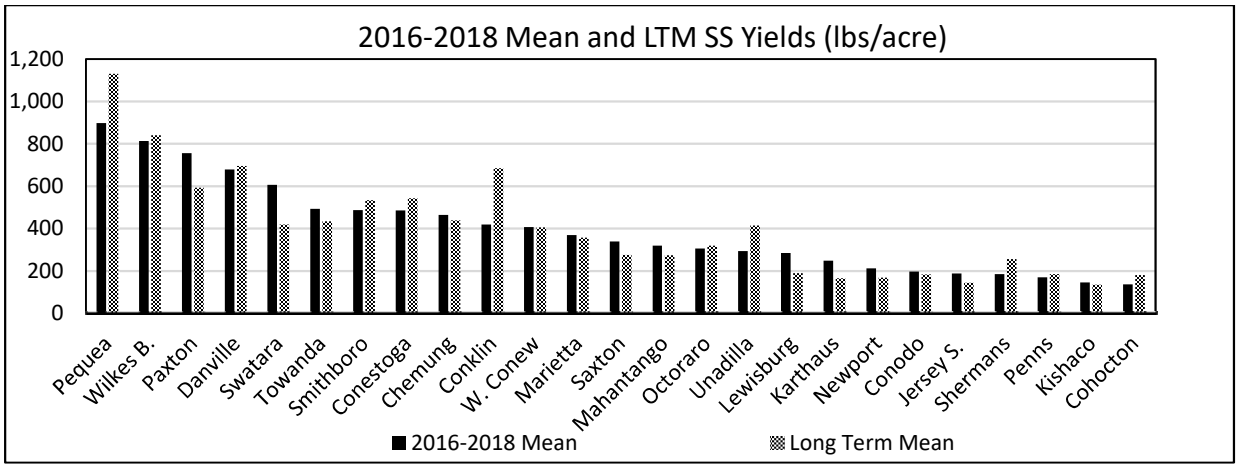


Figure B13. Suspended Sediment Yields Sorted by Decreasing 2016-2018 Mean Suspended Sediment

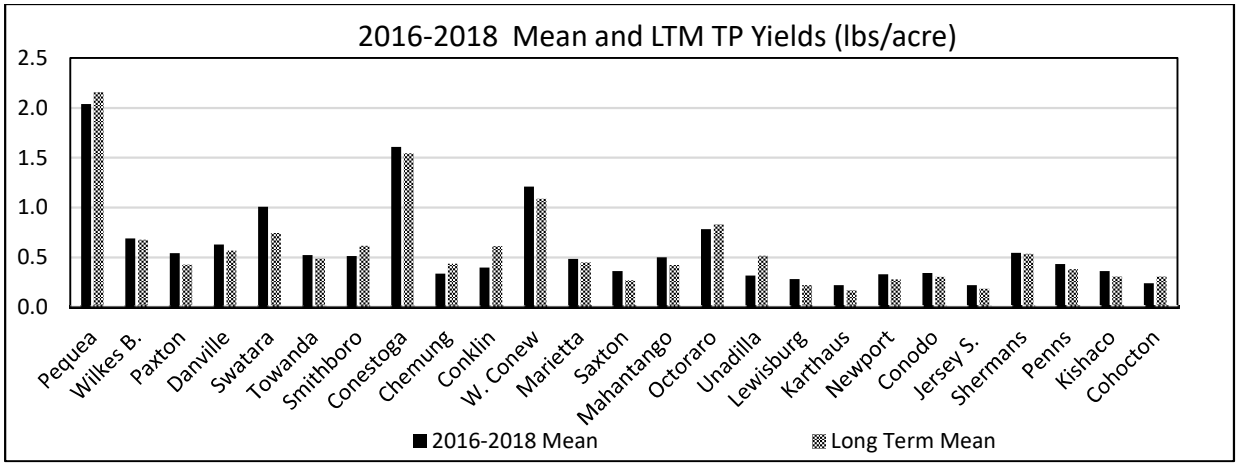


Figure B14. Total Phosphorus Yields Sorted by Decreasing 2016-2018 Mean Suspended Sediment

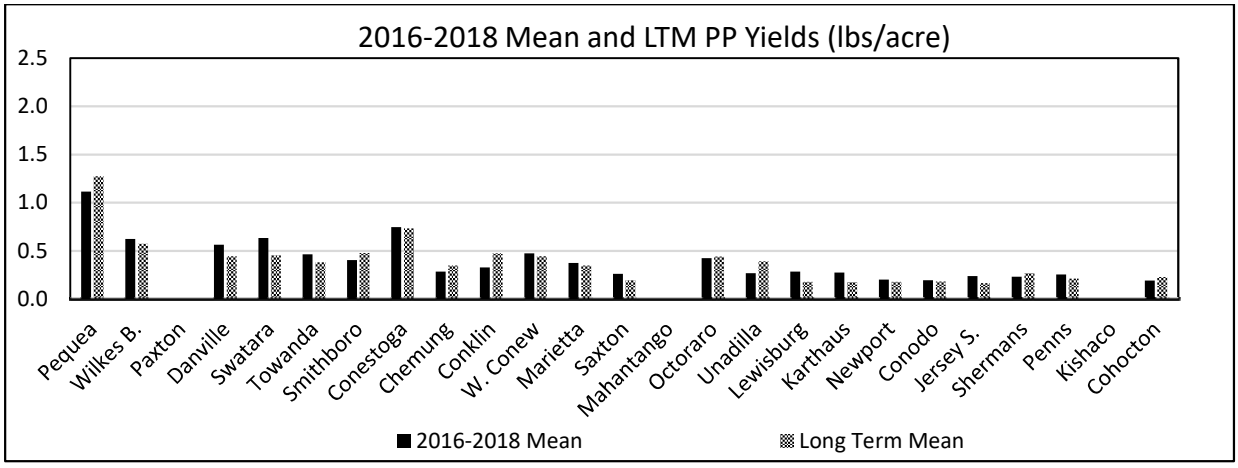


Figure B15. Particulate Phosphorus Yields Sorted by Decreasing 2016-2018 Mean Suspended Sediment

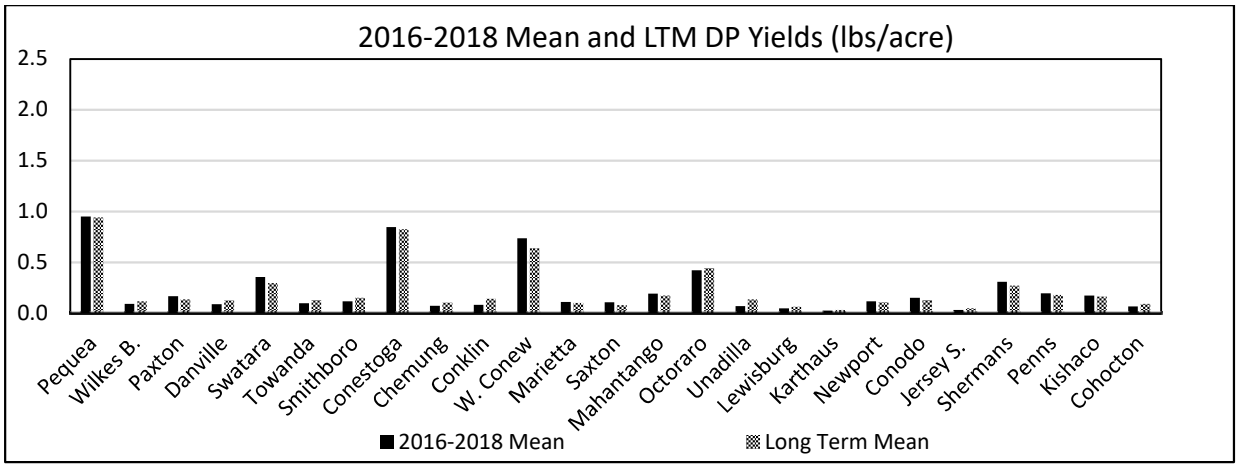


Figure B16. Dissolved Phosphorus Yields Sorted by Decreasing 2016-2018 Mean Suspended Sediment

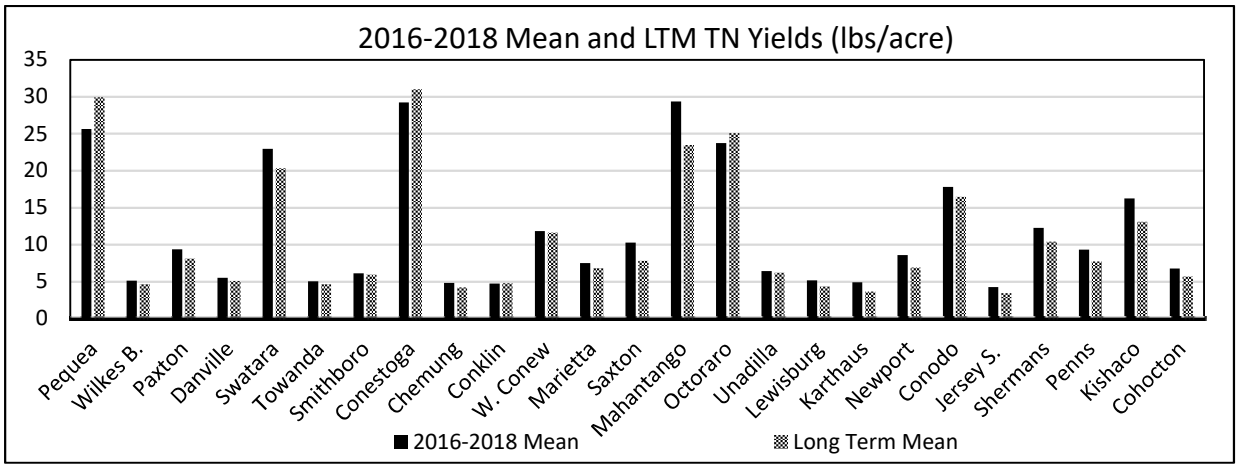


Figure B17. Total Nitrogen Yields Sorted by Decreasing 2016-2018 Mean Suspended Sediment

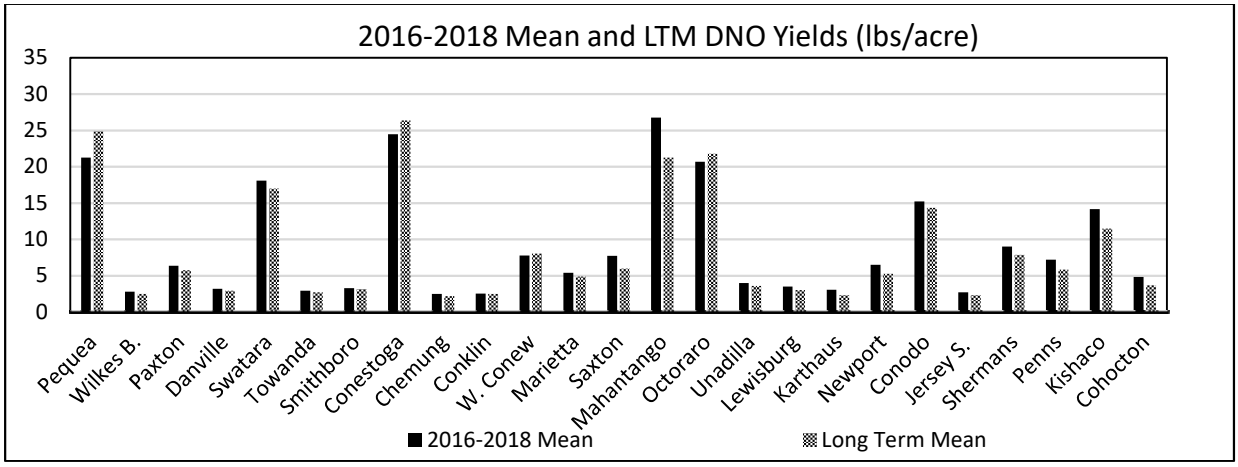


Figure B18. Dissolved Nitrate Plus Nitrite Nitrogen Yields Sorted by Decreasing 2016-2018 Mean Suspended Sediment

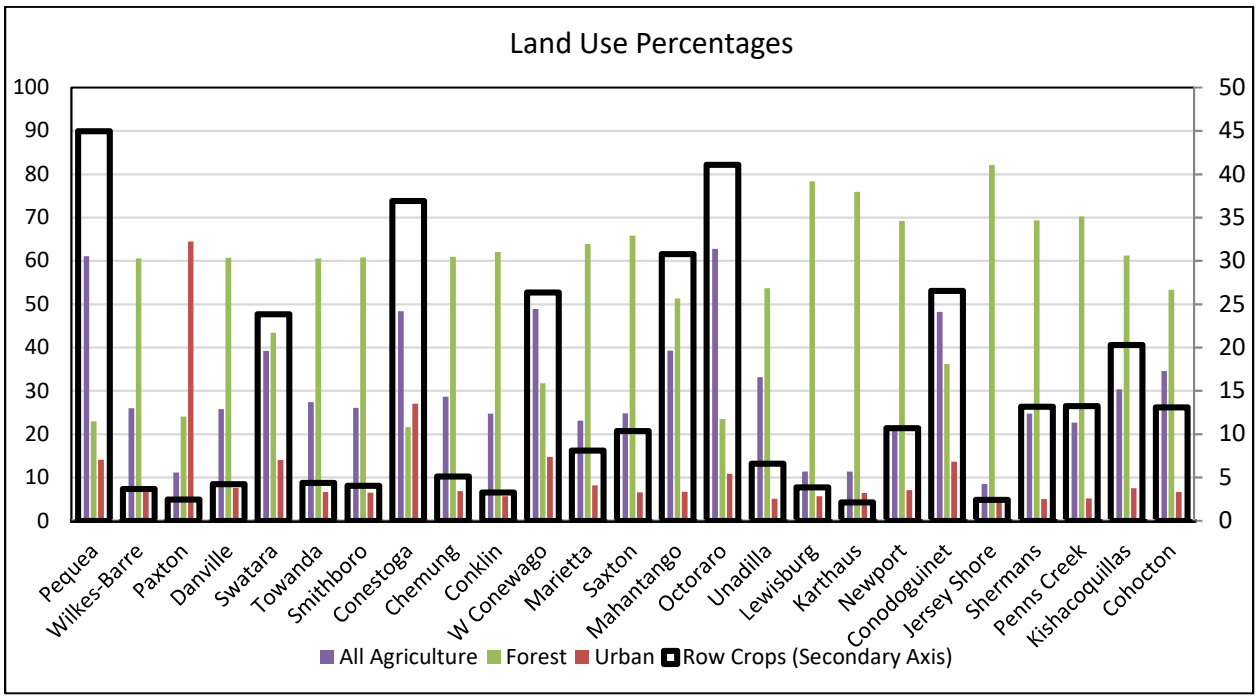


Figure B19. 2016 Land Use Percentages Sorted By Decreasing 2016-2018 Mean Suspended Sediment

APPENDIX C

Individual Site Data

Table C1. 2018 Annual and Seasonal Precipitation and Discharge at Towanda

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	9.58	7.78	1.80	17,261	15,893	1.09
April-June (Spring)	10.16	11.41	-1.25	12,605	15,363	0.82
July-September (Summer)	20.98	12.10	8.88	15,710	5,230	3.00
October-December (Fall)	12.67	9.83	2.84	22,760	10,573	2.15
Annual Total	53.39	41.12	12.27	17,084	11,765	1.45

Table C2. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Towanda

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	34,330	129%	6.89	0.961	0.931
TNO_x	18,709	123%	3.76	0.572	0.587
TNH_3	1,458	115%	0.29	0.039	0.037
DN	26,666	118%	5.35	0.789	0.784
DNO_x	18,590	124%	3.73	0.570	0.585
DNH_3	1,262	120%	0.25	0.035	0.034
TP	4,290	173%	0.86	0.081	0.058
DP	745	101%	0.15	0.019	0.015
DOP	460	109%	0.09	0.012	0.009
TOC	135,138	159%	27.14	3.483	3.027
TSS	3,898,249	206%	782.81	55.594	34.929
SSC	4,256,261	170%	854.70	64.394	39.472

Table C3. Flow Normalized Trends at Towanda

Towanda Flow Normalized Trends	1989-2018				2005-2018			
	Concentration		Load		Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼	VL	▼	L	▼
Nitrate/Nitrite	HL	▼	HL	▼	ALAN	-	VL	▼
Ammonia	HL	▼	VL	▼	L	▼	L	▼
Dissolved Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼	ALAN	-	L	▼
Ammonia	HL	▼	HL	▼	L	▼	HL	▼
Total Phosphorus	HL	▼	ALAN	-	HL	▼	L	△
Particulate Phosphorus	L	▼	VL	△	L	△	VL	△
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	L	▼	L	△	HL	▼	HL	▼
Total Organic Carbon	HL	▼	L	▼	HL	▼	ALAN	-
Total Suspended Solids	HL	△	L	△	VL	△	L	△
Suspended Sediment	L	▼	ALAN	-	L	△	L	△

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C4. 2018 Annual and Seasonal Precipitation and Discharge at Danville

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	9.96	7.94	2.02	26,296	22,338	1.18
April-June (Spring)	11.30	11.62	-0.31	21,876	21,542	1.02
July-September (Summer)	22.76	12.37	10.39	28,725	7,884	3.64
October-December (Fall)	13.31	10.00	3.30	36,213	15,613	2.32
Annual Total	57.33	41.94	15.40	28,277	16,844	1.68

Table C5. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Danville

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	59,355	143%	8.26	0.971	0.850
TNO_x	32,571	139%	4.54	0.562	0.516
TNH_3	2,100	109%	0.29	0.034	0.030
DN	44,535	130%	6.20	0.762	0.704
DNO_x	32,545	138%	4.53	0.562	0.517
DNH_3	1,796	107%	0.25	0.029	0.026
TP	8,485	215%	1.18	0.100	0.057
DP	1,046	108%	0.15	0.015	0.011
DOP	688	127%	0.10	0.010	0.007
TOC	218,767	182%	30.46	3.431	2.863
TSS	8,732,566	284%	1215.88	80.980	37.168
SS	9,985,310	256%	1390.31	92.840	39.244

Table C6. Flow Normalized Trends at Danville

Danville Flow Normalized Trends	1985-2018				2005-2018			
	Concentration		Load		Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼	HL	▼	VL	▼
Nitrate/Nitrite	HL	▼	HL	▼	HL	▼	HL	▼
Ammonia	HL	▼	HL	▼	HL	▼	HL	▼
Dissolved Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼	HL	▼	HL	▼
Ammonia	HL	▼	HL	▼	HL	▼	HL	▼
Total Phosphorus	HL	▼	VL	▼	HL	▼	L	▼
Particulate Phosphorus	HL	▼	L	▼	L	△	L	△
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	L	▼	ALAN	-	HL	▼	HL	▼
Total Organic Carbon	HL	▼	HL	▼	HL	▼	L	▼
Total Suspended Solids	L	△	L	△	L	△	L	△
Suspended Sediment	HL	▼	L	▼	L	△	L	△

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C7. 2018 Annual and Seasonal Precipitation and Discharge at Marietta

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	10.58	8.29	2.29	64,883	53,499	1.21
April-June (Spring)	13.40	11.59	1.81	57,972	50,286	1.15
July-September (Summer)	24.17	12.28	11.89	79,447	20,181	3.94
October-December (Fall)	14.11	10.04	4.08	88,326	35,906	2.46
Annual Total	62.26	42.20	20.07	72,657	39,968	1.82

Table C8. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Marietta

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	209,036	168%	12.56	1.320	1.081
TNO_x	148,806	173%	8.94	0.959	0.791
TNH_3	5,217	124%	0.31	0.033	0.030
DN	172,539	162%	10.37	1.125	0.963
DNO_x	148,502	173%	8.93	0.956	0.789
DNH_3	4,388	120%	0.26	0.028	0.025
TP	15,960	198%	0.96	0.081	0.047
DP	3,306	154%	0.20	0.020	0.015
DOP	2,947	239%	0.18	0.017	0.012
TOC	539,435	206%	32.42	3.368	2.801
TSS	9,960,784	182%	598.70	46.115	22.637
SS	13,210,300	214%	794.01	56.195	24.561

Table C9. Flow Normalized Trends at Marietta

Marietta Flow Normalized Trends	1987-2018				2005-2018			
	Concentration		Load		Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼	HL	▼	HL	▼
Ammonia	VL	▼	HL	▼	HL	▼	HL	▼
Dissolved Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼	HL	▼	HL	▼
Ammonia	HL	▼	HL	▼	HL	▼	HL	▼
Total Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Particulate Phosphorus	HL	▼	L	▼	HL	▼	L	▼
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	HL	△	HL	△	HL	▼	HL	▼
Total Organic Carbon	HL	▼	HL	▼	L	▼	ALAN	-
Total Suspended Solids	L	▼	HL	▼	VL	▼	HL	▼
Suspended Sediment	HL	▼	VL	▼	HL	▼	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C10. 2018 Annual and Seasonal Precipitation and Discharge at Lewisburg

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.02	8.50	2.52	20,533	15,150	1.36
April-June (Spring)	14.58	11.70	2.88	17,184	13,389	1.28
July-September (Summer)	24.45	12.52	11.93	24,367	5,546	4.39
October-December (Fall)	13.90	10.13	3.78	24,454	10,273	2.38
Annual Total	63.95	42.85	21.10	21,634	11,090	1.95

Table C11. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Lewisburg

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	37,873	169%	8.67	0.801	0.686
TNO_x	24,317	170%	5.57	0.557	0.511
TNH_3	908	98%	0.21	0.019	0.017
DN	29,468	152%	6.75	0.664	0.609
DNO_x	24,238	168%	5.55	0.556	0.510
DNH_3	737	92%	0.17	0.016	0.016
TP	2,524	201%	0.58	0.038	0.021
DP	360	87%	0.08	0.007	0.006
DOP	337	157%	0.08	0.007	0.006
TOC	116,975	242%	26.78	2.209	1.660
TSS	2,175,822	293%	498.13	27.778	11.274
SS	2,830,768	232%	648.07	35.094	13.452

Table C12. Flow Normalized Trends at Lewisburg

Lewisburg Flow Normalized Trends	1985-2018				2005-2018			
	Concentration		Load		Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼	▼	HL	▼	HL
Nitrate/Nitrite	HL	▼	HL	▼	▼	HL	▼	HL
Ammonia	HL	▼	HL	▼	▼	HL	▼	HL
Dissolved Nitrogen	HL	▼	HL	▼	▼	HL	▼	HL
Nitrate/Nitrite	HL	▼	HL	▼	▼	HL	▼	HL
Ammonia	HL	▼	HL	▼	▼	HL	▼	HL
Total Phosphorus	HL	▼	HL	▼	▼	HL	▼	HL
Particulate Phosphorus	HL	▼	L	▼	-	ALAN	-	ALAN
Dissolved Phosphorus	HL	▼	HL	▼	▼	HL	▼	HL
Orthophosphorus	HL	▼	L	▼	▼	HL	▼	HL
Total Organic Carbon	HL	▼	L	▼	▼	HL	▼	L
Total Suspended Solids	L	▼	L	▼	▼	L	▼	L
Suspended Sediment	HL	▼	L	▼	▼	L	-	ALAN

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C13. 2018 Annual and Seasonal Precipitation and Discharge at Newport

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	10.57	8.37	2.20	7,847	6,275	1.25
April-June (Spring)	15.92	11.41	4.51	8,005	5,569	1.44
July-September (Summer)	24.08	11.14	12.94	9,873	2,222	4.44
October-December (Fall)	14.28	9.71	4.57	10,747	3,807	2.82
Annual Total	64.86	40.64	24.22	9,118	4,468	2.04

Table C14. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Newport

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	33,877	215%	15.79	1.756	1.435
TNO_x	25,259	218%	11.77	1.362	1.112
TNH_3	630	169%	0.29	0.032	0.027
DN	29,447	209%	13.73	1.586	1.336
DNO_x	25,274	220%	11.78	1.363	1.111
DNH_3	563	175%	0.26	0.029	0.026
TP	1,492	193%	0.70	0.059	0.035
DP	510	156%	0.24	0.023	0.015
DOP	440	214%	0.21	0.020	0.013
TOC	64,115	213%	29.89	3.086	2.630
TSS	763,188	200%	355.75	23.464	10.058
SS	1,034,961	215%	482.44	31.543	14.253

Table C15. Flow Normalized Trends at Newport

Newport Flow Normalized Trends	1985-2018				2005-2018			
	Concentration		Load		Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	VL	▼	L	▼	HL	▼	VL	▼
Ammonia	HL	▼	HL	▼	HL	▼	HL	▼
Dissolved Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	VL	▼	L	▼	HL	▼	L	▼
Ammonia	HL	▼	HL	▼	HL	▼	HL	▼
Total Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Particulate Phosphorus	HL	▼	L	▼	HL	▼	HL	▼
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	HL	▼	L	▼	HL	▼	HL	▼
Total Organic Carbon	HL	▼	HL	▼	HL	▼	L	▼
Total Suspended Solids	HL	▼	L	▼	HL	▼	HL	▼
Suspended Sediment	HL	▼	VL	▼	HL	▼	VL	▼

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C16. 2018 Annual and Seasonal Precipitation and Discharge at Conestoga

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.33	9.17	2.16	926	896	1.03
April-June (Spring)	14.88	11.73	3.15	1,045	741	1.41
July-September (Summer)	27.87	13.52	14.35	1,654	518	3.19
October-December (Fall)	15.89	10.92	4.97	1,598	656	2.44
Annual Total	69.97	45.33	24.64	1,306	703	1.86

Table C17. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Conestoga

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	14,004	140%	46.56	5.654	5.783
TNO_x	11,201	138%	37.24	4.766	5.141
TNH_3	304	136%	1.01	0.103	0.080
DN	12,570	138%	41.79	5.274	5.595
DNO_x	11,217	141%	37.29	4.777	5.152
DNH_3	295	144%	0.98	0.100	0.075
TP	974	162%	3.24	0.276	0.221
DP	458	174%	1.52	0.156	0.164
DOP	429	191%	1.43	0.146	0.159
TOC	11,350	156%	37.73	3.806	3.213
TSS	330,039	155%	1097.21	59.448	26.522
SS	337,873	130%	1123.25	63.062	26.122

Table C18. Flow Normalized Trends at Conestoga

Conestoga Flow Normalized Trends	1985-2018				2005-2018			
	Concentration		Load		Concentration		Load	
Parameter	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼	HL	▼	HL	▼
Ammonia	HL	▼	HL	▼	ALAN	-	ALAN	-
Dissolved Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼	HL	▼	HL	▼
Ammonia	HL	▼	HL	▼	ALAN	-	ALAN	-
Total Phosphorus	HL	▼	HL	▼	L	▼	L	▼
Particulate Phosphorus	HL	▼	L	▼	VL	▼	ALAN	-
Dissolved Phosphorus	HL	▼	HL	▼	ALAN	-	ALAN	-
Orthophosphorus	HL	▼	HL	▼	L	△	ALAN	-
Total Organic Carbon	HL	▼	HL	▼	HL	▼	HL	▼
Total Suspended Solids	HL	▼	VL	▼	HL	▼	L	▼
Suspended Sediment	HL	▼	HL	▼	HL	▼	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C19. 2018 Annual and Seasonal Precipitation and Discharge at Unadilla

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	10.71	8.69	2.02	1,578	1,315	1.20
April-June (Spring)	10.00	12.12	-2.13	1,029	1,228	0.84
July-September (Summer)	16.40	12.70	3.69	421	534	0.79
October-December (Fall)	13.26	10.87	2.38	1,709	1,028	1.66
Annual Total	50.36	44.39	5.96	1,184	1,026	1.15

Table C20. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Unadilla

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	2,585	125%	7.77	1.014	1.000
TNO_x	1,559	130%	4.68	0.635	0.644
TNH_3	42	63%	0.13	0.016	0.016
DN	2,304	131%	6.92	0.938	0.934
DNO_x	1,559	131%	4.69	0.634	0.647
DNH_3	42	69%	0.13	0.017	0.017
TP	129	75%	0.39	0.034	0.030
DP	29	67%	0.09	0.010	0.009
DOP	18	54%	0.05	0.006	0.006
TOC	8,101	118%	24.34	3.103	2.926
TSS	110,728	91%	332.72	23.589	20.036
SS	129,576	94%	389.35	27.188	22.698

Table C21. Flow Normalized Trends at Unadilla

Unadilla Flow Normalized Trends	2006-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	VL	△	HL	△
Nitrate/Nitrite	L	△	L	△
Ammonia	HL	▼	HL	▼
Dissolved Nitrogen	VL	△	L	△
Nitrate/Nitrite	HL	△	HL	△
Ammonia	HL	▼	HL	▼
Total Phosphorus	HL	▼	HL	▼
Particulate Phosphorus	L	▼	L	▼
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	ALAN	-	L	△
Total Suspended Solids	ALAN	-	ALAN	-
Suspended Sediment	ALAN	-	ALAN	-

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C22. 2018 Annual and Seasonal Precipitation and Discharge at Conklin

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.21	8.84	2.37	6,296	5,373	1.17
April-June (Spring)	11.28	12.30	-1.02	4,630	5,012	0.92
July-September (Summer)	20.06	12.88	7.17	3,866	2,314	1.67
October-December (Fall)	13.37	10.81	2.55	7,222	4,045	1.79
Annual Total	55.92	44.84	11.07	5,503	4,186	1.31

Table C23. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Conklin

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	9,241	135%	6.47	0.770	0.722
TNO_x	4,419	126%	3.10	0.397	0.402
TNH_3	186	69%	0.13	0.015	0.014
DN	7,741	139%	5.42	0.684	0.661
DNO_x	4,597	131%	3.22	0.410	0.413
DNH_3	180	70%	0.13	0.015	0.014
TP	883	101%	0.62	0.052	0.039
DP	175	88%	0.12	0.013	0.010
DOP	96	70%	0.07	0.007	0.005
TOC	38,273	145%	26.82	3.129	2.739
TSS	866,312	118%	607.00	43.306	33.810
SS	969,877	99%	679.57	47.526	36.936

Table C24. Flow Normalized Trends at Conklin

Conklin Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	VL	▼
Nitrate/Nitrite	VL	▼	VL	▼
Ammonia	HL	▼	HL	▼
Dissolved Nitrogen	L	▼	L	▼
Nitrate/Nitrite	L	▼	L	▼
Ammonia	HL	▼	HL	▼
Total Phosphorus	HL	▼	HL	▼
Particulate Phosphorus	L	▼	ALAN	-
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	VL	▼	ALAN	-
Total Suspended Solids	VL	△	VL	△
Suspended Sediment	ALAN	-	L	△

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C25. 2018 Annual and Seasonal Precipitation and Discharge at Smithboro

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	10.77	8.59	2.18	12,268	11,882	1.03
April-June (Spring)	10.64	12.03	-1.40	9,046	10,639	0.85
July-September (Summer)	20.59	12.68	7.90	9,403	4,827	1.95
October-December (Fall)	13.47	10.67	2.80	15,527	9,156	1.70
Annual Total	55.47	43.98	11.49	11,561	9,126	1.27

Table C26. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Smithboro

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	24,843	138%	8.20	1.037	0.997
TNO_x	11,706	125%	3.86	0.551	0.586
TNH_3	936	118%	0.31	0.044	0.044
DN	19,492	129%	6.43	0.878	0.883
DNO_x	12,264	129%	4.05	0.566	0.581
DNH_3	894	118%	0.30	0.041	0.043
TP	2,441	131%	0.81	0.072	0.055
DP	480	105%	0.16	0.019	0.018
DOP	325	101%	0.11	0.013	0.011
TOC	88,123	144%	29.09	3.470	3.120
TSS	2,377,645	176%	784.76	53.082	37.612
SS	2,666,713	165%	880.17	58.329	38.954

Table C27. Flow Normalized Trends at Smithboro

Smithboro Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	ALAN	-	ALAN	-
Nitrate/Nitrite	ALAN	-	L	▼
Ammonia	ALAN	-	L	▼
Dissolved Nitrogen	ALAN	-	L	▼
Nitrate/Nitrite	ALAN	-	L	▼
Ammonia	ALAN	-	L	▼
Total Phosphorus	HL	▼	VL	▼
Particulate Phosphorus	HL	▼	ALAN	-
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	VL	▼	HL	▼
Total Organic Carbon	ALAN	-	L	△
Total Suspended Solids	HL	△	HL	△
Suspended Sediment	L	△	L	△

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C28. 2018 Annual and Seasonal Precipitation and Discharge at Cohocton

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	7.59	6.25	1.34	883	786	1.12
April-June (Spring)	8.91	10.56	-1.64	613	638	0.96
July-September (Summer)	17.58	11.76	5.82	357	198	1.81
October-December (Fall)	10.98	8.77	2.21	1,184	473	2.50
Annual Total	45.07	37.26	7.80	759	524	1.45

Table C29. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Cohocton

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	2,810	164%	9.34	1.696	1.597
TNO_x	1,924	176%	6.40	1.214	1.195
TNH_3	27	69%	0.09	0.016	0.014
DN	2,605	173%	8.66	1.645	1.573
DNO_x	1,953	177%	6.49	1.235	1.214
DNH_3	31	78%	0.10	0.018	0.017
TP	112	121%	0.37	0.043	0.030
DP	31	113%	0.10	0.015	0.010
DOP	21	107%	0.07	0.010	0.007
TOC	7,346	155%	24.42	4.268	3.698
TSS	54,981	110%	182.78	17.535	12.782
SS	58,801	109%	195.48	18.667	13.679

Table C30. Flow Normalized Trends at Cohocton

Cohocton Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	△	HL	△
Nitrate/Nitrite	HL	△	HL	△
Ammonia	HL	▼	HL	▼
Dissolved Nitrogen	HL	△	HL	△
Nitrate/Nitrite	HL	△	HL	△
Ammonia	HL	▼	HL	▼
Total Phosphorus	HL	▼	HL	▼
Particulate Phosphorus	L	▼	ALAN	-
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	L	▼	ALAN	-
Total Suspended Solids	ALAN	-	ALAN	-
Suspended Sediment	L	▼	ALAN	-

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C31. 2018 Annual and Seasonal Precipitation and Discharge at Chemung

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	7.64	6.41	1.24	4,097	4,304	0.95
April-June (Spring)	9.25	10.36	-1.12	3,241	3,417	0.95
July-September (Summer)	21.27	11.17	10.10	4,906	1,154	4.25
October-December (Fall)	11.30	8.45	2.85	6,362	2,625	2.42
Annual Total	49.46	36.40	13.06	4,652	2,875	1.62

Table C32. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Chemung

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	12,161	176%	7.40	1.218	1.150
TNO_x	5,689	158%	3.46	0.699	0.743
TNH_3	344	146%	0.21	0.031	0.027
DN	8,987	161%	5.47	1.046	1.055
DNO_x	5,342	150%	3.25	0.676	0.717
DNH_3	261	117%	0.16	0.028	0.027
TP	949	132%	0.58	0.060	0.043
DP	184	109%	0.11	0.018	0.016
DOP	122	96%	0.07	0.012	0.010
TOC	45,119	194%	27.46	3.908	3.282
TSS	1,317,715	236%	802.08	55.752	27.419
SS	1,620,179	225%	986.18	66.313	32.545

Table C33. Flow Normalized Trends at Chemung

Chemung Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	ALAN	-	ALAN	-
Nitrate/Nitrite	L	△	L	△
Ammonia	L	▼	L	▼
Dissolved Nitrogen	ALAN	-	ALAN	-
Nitrate/Nitrite	ALAN	-	ALAN	-
Ammonia	L	▼	L	▼
Total Phosphorus	HL	▼	HL	▼
Particulate Phosphorus	HL	▼	L	▼
Dissolved Phosphorus	VL	▼	HL	▼
Orthophosphorus	L	▼	HL	▼
Total Organic Carbon	ALAN	-	L	△
Total Suspended Solids	ALAN	-	L	△
Suspended Sediment	ALAN	-	ALAN	-

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C34. 2018 Annual and Seasonal Precipitation and Discharge at Wilkes-Barre

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	9.78	7.87	1.90	21,605	20,830	1.04
April-June (Spring)	10.86	11.51	-0.64	18,077	18,157	1.00
July-September (Summer)	22.03	12.21	9.82	24,118	8,189	2.95
October-December (Fall)	12.91	9.91	3.01	30,561	14,970	2.04
Annual Total	55.59	41.49	14.09	23,590	15,537	1.52

Table C35. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Wilkes-Barre

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	48,048	160%	7.40	0.950	0.882
TNO_x	24,521	150%	3.78	0.538	0.534
TNH_3	1,962	142%	0.30	0.039	0.039
DN	34,831	145%	5.36	0.740	0.726
DNO_x	24,207	150%	3.73	0.532	0.529
DNH_3	1,699	137%	0.26	0.035	0.037
TP	8,459	192%	1.30	0.106	0.067
DP	925	124%	0.14	0.017	0.014
DOP	651	114%	0.10	0.011	0.009
TOC	192,057	163%	29.57	3.530	3.001
TSS	7,353,447	177%	1132.33	73.585	36.058
SS	11,513,071	211%	1772.86	101.152	47.984

Table C36. Flow Normalized Trends at Wilkes-Barre

Wilkes-Barre Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	ALAN	-	L	△
Nitrate/Nitrite	L	△	ALAN	-
Ammonia	L	▼	L	▼
Dissolved Nitrogen	L	▼	ALAN	-
Nitrate/Nitrite	L	△	ALAN	-
Ammonia	L	▼	L	▼
Total Phosphorus	HL	▼	ALAN	-
Particulate Phosphorus	L	△	L	△
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	HL	▼	L	▼
Total Suspended Solids	ALAN	-	ALAN	-
Suspended Sediment	L	△	L	△

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C37. 2018 Annual and Seasonal Precipitation and Discharge at Karthaus

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	12.96	9.02	3.94	4,844	3,647	1.33
April-June (Spring)	17.16	12.04	5.12	4,092	2,664	1.54
July-September (Summer)	22.51	12.19	10.32	4,306	1,151	3.74
October-December (Fall)	14.46	10.25	4.21	4,830	2,163	2.23
Annual Total	67.09	43.50	23.59	4,518	2,406	1.88

Table C38. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Karthaus

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	7,240	223%	8.13	0.731	0.580
TNO_x	4,238	205%	4.76	0.454	0.389
TNH_3	286	146%	0.32	0.031	0.030
DN	5,375	195%	6.04	0.574	0.493
DNO_x	4,246	207%	4.77	0.456	0.392
DNH_3	248	142%	0.28	0.027	0.025
TP	397	265%	0.45	0.030	0.016
DP	32	122%	0.04	0.003	0.003
DOP	43	152%	0.05	0.005	0.005
TOC	27,243	253%	30.60	2.511	1.713
TSS	377,663	325%	424.23	24.534	11.363
SS	481,957	329%	541.38	30.781	14.026

Table C39. Flow Normalized Trends at Karthaus

Karthaus Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	△	VL	△
Nitrate/Nitrite	ALAN	-	HL	△
Ammonia	HL	▼	HL	▼
Dissolved Nitrogen	ALAN		L	△
Nitrate/Nitrite	L	△	HL	△
Ammonia	HL	▼	HL	▼
Total Phosphorus	HL	▼	VL	▼
Particulate Phosphorus	VL	▼	L	▼
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	ALAN	-	ALAN	-
Total Suspended Solids	ALAN	-	ALAN	-
Suspended Sediment	ALAN	-	ALAN	-

- No trend
△ Increasing trend
▼ Decreasing trend
N/A Unable to be analyzed

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C40. 2018 Annual and Seasonal Precipitation and Discharge at Jersey Shore

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.37	8.51	2.86	15,025	12,366	1.22
April-June (Spring)	14.80	11.71	3.09	12,586	9,673	1.30
July-September (Summer)	22.83	12.24	10.59	15,398	3,686	4.18
October-December (Fall)	13.92	10.08	3.84	16,951	7,873	2.15
Annual Total	62.93	42.54	20.39	14,990	8,400	1.78

Table C41. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Jersey Shore

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	23,481	204%	7.02	0.724	0.649
TNO_x	14,114	184%	4.22	0.463	0.441
TNH_3	713	151%	0.21	0.023	0.022
DN	17,796	182%	5.32	0.586	0.561
DNO_x	14,054	184%	4.20	0.462	0.440
DNH_3	477	122%	0.14	0.016	0.016
TP	1,490	240%	0.45	0.033	0.019
DP	175	113%	0.05	0.005	0.005
DOP	182	132%	0.05	0.006	0.005
TOC	75,980	225%	22.70	2.121	1.650
TSS	1,295,969	337%	387.25	20.900	8.699
SS	1,420,694	296%	424.52	23.963	10.614

Table C42. Flow Normalized Trends at Jersey Shore

Jersey Shore Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	▼	L	△
Nitrate/Nitrite	L	▼	ALAN	-
Ammonia	VL	▼	L	▼
Dissolved Nitrogen	L	▼	ALAN	-
Nitrate/Nitrite	L	▼	ALAN	-
Ammonia	HL	▼	HL	▼
Total Phosphorus	HL	▼	L	▼
Particulate Phosphorus	ALAN	-	L	△
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	L	▼	ALAN	-
Total Suspended Solids	ALAN	-	L	△
Suspended Sediment	ALAN	-	L	△

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C43. 2018 Annual and Seasonal Precipitation and Discharge at Penns Creek

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.47	8.81	2.66	890	656	1.36
April-June (Spring)	15.18	12.01	3.18	698	586	1.19
July-September (Summer)	26.03	12.95	13.08	1,166	275	4.23
October-December (Fall)	15.75	10.50	5.25	1,168	456	2.56
Annual Total	68.42	44.26	24.17	980	493	1.99

Table C44. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Penns Creek

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	3,488	232%	17.87	1.695	1.443
TNO_x	2,629	232%	13.47	1.332	1.153
TNH_3	59	180%	0.30	0.027	0.025
DN	3,081	225%	15.79	1.547	1.361
DNO_x	2,644	232%	13.54	1.338	1.157
DNH_3	48	165%	0.25	0.022	0.022
TP	187	251%	0.96	0.063	0.039
DP	84	241%	0.43	0.029	0.019
DOP	75	270%	0.38	0.026	0.016
TOC	7,989	240%	40.93	3.337	2.642
TSS	66,331	233%	339.81	17.708	9.397
SS	73,907	204%	378.62	20.463	11.141

Table C45. Flow Normalized Trends at Penns Creek

Penns Creek Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	△	HL	△
Nitrate/Nitrite	HL	△	HL	△
Ammonia	VL	▼	L	▼
Dissolved Nitrogen	HL	△	HL	△
Nitrate/Nitrite	HL	△	HL	△
Ammonia	VL	▼	VL	▼
Total Phosphorus	HL	▼	L	▼
Particulate Phosphorus	L	△	ALAN	-
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	VL	▼
Total Organic Carbon	L	▼	L	▼
Total Suspended Solids	L	▼	L	▼
Suspended Sediment	L	▼	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C46. 2018 Annual and Seasonal Precipitation and Discharge at East Mahantango

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.96	9.07	2.89	451	301	1.50
April-June (Spring)	14.74	12.44	2.30	406	281	1.45
July-September (Summer)	30.37	13.86	16.51	688	218	3.15
October-December (Fall)	17.80	11.03	6.77	670	211	3.18
Annual Total	74.87	46.40	28.47	554	253	2.19

Table C47. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at East Mahantango

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	5,850	240%	56.43	5.054	4.197
TNO_x	5,178	234%	49.94	4.451	3.642
TNH_3	47	214%	0.45	0.037	0.036
DN	5,704	242%	55.02	4.988	4.167
DNO_x	5,320	241%	51.31	4.672	3.892
DNH_3	39	200%	0.37	0.030	0.030
TP	104	236%	1.00	0.065	0.059
DP	38	212%	0.36	0.030	0.034
DOP	33	210%	0.32	0.027	0.031
TOC	3,482	237%	33.59	2.467	2.053
TSS	52,656	240%	507.87	17.023	9.244
SS	68,649	242%	662.12	23.447	11.901

Table C48. Flow Normalized Trends at East Mahantango

East Mahantango Flow Normalized Trends	2012-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	△	L	△
Nitrate/Nitrite	L	△	ALAN	-
Ammonia	ALAN	-	L	▼
Dissolved Nitrogen	HL	△	L	△
Nitrate/Nitrite	HL	△	L	△
Ammonia	ALAN	-	L	▼
Total Phosphorus	L	▼	L	▼
Particulate Phosphorus	L	▼	L	▼
Dissolved Phosphorus	L	▼	L	▼
Orthophosphorus	L	▼	L	▼
Total Organic Carbon	VL	▼	L	▼
Total Suspended Solids	ALAN	-	ALAN	-
Suspended Sediment	L	▼	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend
N/A Unable to be analyzed

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C49. 2018 Annual and Seasonal Precipitation and Discharge at Saxton

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	10.16	8.14	2.01	1,705	1,373	1.24
April-June (Spring)	17.90	11.32	6.58	2,028	1,214	1.67
July-September (Summer)	23.95	10.51	13.44	2,178	406	5.37
October-December (Fall)	13.94	9.20	4.74	2,285	772	2.96
Annual Total	65.95	39.18	26.77	2,049	941	2.18

Table C50. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Saxton

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	9,043	240%	18.74	2.160	2.057
TNO_x	6,609	230%	13.70	1.707	1.709
TNH_3	141	204%	0.29	0.031	0.028
DN	7,639	227%	15.83	1.936	1.922
DNO_x	6,595	230%	13.67	1.704	1.708
DNH_3	121	194%	0.25	0.027	0.026
TP	373	287%	0.77	0.057	0.037
DP	104	276%	0.21	0.019	0.015
DOP	87	319%	0.18	0.017	0.012
TOC	15,780	243%	32.70	3.116	2.439
TSS	309,087	239%	640.52	35.983	16.874
SS	373,890	281%	774.80	41.910	19.450

Table C51. Flow Normalized Trends at Saxton

Saxton Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	ALAN	-	L	△
Nitrate/Nitrite	ALAN	-	ALAN	-
Ammonia	L	▼	L	▼
Dissolved Nitrogen	ALAN	-	ALAN	-
Nitrate/Nitrite	ALAN	-	ALAN	-
Ammonia	ALAN	-	L	▼
Total Phosphorus	L	△	ALAN	-
Particulate Phosphorus	L	△	L	△
Dissolved Phosphorus	L	△	L	▼
Orthophosphorus	HL	△	L	△
Total Organic Carbon	HL	▼	L	▼
Total Suspended Solids	L	▼	L	▼
Suspended Sediment	ALAN	-	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C52. 2018 Annual and Seasonal Precipitation and Discharge at Kishacoquillas

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.04	8.53	2.50	469	275	1.70
April-June (Spring)	15.19	11.47	3.72	370	290	1.28
July-September (Summer)	23.64	11.36	12.28	502	174	2.88
October-December (Fall)	15.23	9.87	5.36	560	189	2.96
Annual Total	65.10	41.24	23.86	475	232	2.05

Table C53. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Kishacoquillas

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	2,937	215%	28.15	3.265	3.425
TNO_x	2,521	211%	24.17	2.878	3.084
TNH_3	26	209%	0.25	0.027	0.025
DN	2,749	212%	26.35	3.127	3.358
DNO_x	2,519	211%	24.15	2.881	3.098
DNH_3	23	191%	0.22	0.024	0.023
TP	71	221%	0.68	0.056	0.048
DP	31	181%	0.30	0.028	0.028
DOP	33	205%	0.32	0.031	0.029
TOC	2,484	207%	23.81	2.216	1.772
TSS	27,576	245%	264.34	15.115	6.722
SS	29,923	212%	286.84	17.292	9.211

Table C54. Flow Normalized Trends at Kishacoquillas

Kishacoquillas Flow Normalized Trends	2012-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	△	VL	△
Nitrate/Nitrite	L	△	L	△
Ammonia	ALAN	-	ALAN	-
Dissolved Nitrogen	L	△	L	△
Nitrate/Nitrite	L	△	L	△
Ammonia	L	▼	L	▼
Total Phosphorus	L	▼	L	▼
Particulate Phosphorus	ALAN	-	ALAN	-
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	L	▼
Total Organic Carbon	L	▼	L	▼
Total Suspended Solids	L	▼	L	▼
Suspended Sediment	L	▼	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend
N/A Unable to be analyzed

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C55. 2018 Annual and Seasonal Precipitation and Discharge at Shermans

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.23	8.86	2.37	513	418	1.23
April-June (Spring)	14.88	11.70	3.18	493	373	1.32
July-September (Summer)	25.44	11.97	13.47	764	170	4.50
October-December (Fall)	16.09	10.19	5.90	806	332	2.43
Annual Total	67.65	42.72	24.93	644	323	1.99

Table C56. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Shermans

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	2,800	223%	23.27	1.980	1.660
TNO_x	2,133	221%	17.73	1.606	1.366
TNH_3	57	189%	0.48	0.033	0.030
DN	2,527	220%	21.00	1.852	1.582
DNO_x	1,996	212%	16.59	1.507	1.280
DNH_3	49	173%	0.41	0.029	0.028
TP	143	221%	1.19	0.063	0.042
DP	81	250%	0.67	0.038	0.025
DOP	73	273%	0.61	0.035	0.023
TOC	5,515	223%	45.84	3.211	2.433
TSS	32,333	155%	268.73	11.527	6.551
SS	48,795	158%	405.54	16.288	8.958

Table C57. Flow Normalized Trends at Shermans

Shermans Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	▼	L	△
Nitrate/Nitrite	L	▼	L	△
Ammonia	L	▼	ALAN	-
Dissolved Nitrogen	L	▼	ALAN	-
Nitrate/Nitrite	L	▼	ALAN	-
Ammonia	L	▼	L	▼
Total Phosphorus	ALAN	-	L	▼
Particulate Phosphorus	ALAN	-	L	▼
Dissolved Phosphorus	ALAN	-	ALAN	-
Orthophosphorus	L	△	ALAN	-
Total Organic Carbon	L	▼	L	▼
Total Suspended Solids	VL	▼	L	▼
Suspended Sediment	L	▼	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C58. 2018 Annual and Seasonal Precipitation and Discharge at Conodoguinet

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	10.94	8.96	1.97	1,013	827	1.22
April-June (Spring)	14.94	11.83	3.11	955	756	1.26
July-September (Summer)	26.66	11.95	14.71	1,627	430	3.78
October-December (Fall)	16.46	10.12	6.35	1,711	666	2.57
Annual Total	69.01	42.87	26.14	1,327	670	1.98

Table C59. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Conodoguinet

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	9,536	194%	31.91	3.660	3.597
TNO_x	8,010	187%	26.80	3.152	3.184
TNH_3	120	196%	0.40	0.041	0.036
DN	8,989	190%	30.08	3.509	3.501
DNO_x	8,002	187%	26.77	3.150	3.183
DNH_3	115	200%	0.38	0.039	0.035
TP	222	243%	0.74	0.059	0.037
DP	96	255%	0.32	0.028	0.019
DOP	84	278%	0.28	0.025	0.017
TOC	10,191	223%	34.10	3.279	2.587
TSS	112,586	229%	376.69	24.407	12.393
SS	131,538	240%	440.10	28.536	14.075

Table C60. Flow Normalized Trends at Conodoguinet

Conodoguinet Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	VL	▼
Ammonia	L	▼	L	▼
Dissolved Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	L	▼
Ammonia	ALAN	-	L	▼
Total Phosphorus	ALAN	-	L	▼
Particulate Phosphorus	ALAN	-	L	▼
Dissolved Phosphorus	ALAN	-	L	▼
Orthophosphorus	ALAN	-	L	▼
Total Organic Carbon	L	▼	VL	▼
Total Suspended Solids	ALAN	-	ALAN	-
Suspended Sediment	ALAN	-	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C61. 2018 Annual and Seasonal Precipitation and Discharge at Paxton

Season	Discharge (cfs)		
	2018	LTM	% LTM
January-March (Winter)	28	21	1.36
April-June (Spring)	25	20	1.29
July-September (Summer)	52	18	2.91
October-December (Fall)	40	17	2.33
Annual Total	36	19	1.93

Table C62. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Paxton

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	127	205%	16.59	1.650	1.455
TNO_x	83	187%	10.78	1.228	1.139
TNH_3	4	248%	0.48	0.034	0.027
DN	103	192%	13.38	1.468	1.354
DNO_x	82	187%	10.71	1.223	1.136
DNH_3	3	244%	0.45	0.031	0.024
TP	9	273%	1.17	0.057	0.037
DP	3	248%	0.34	0.022	0.016
DOP	2	233%	0.27	0.019	0.015
TOC	313	211%	40.79	3.158	2.574
TSS	18,018	317%	2346.13	45.107	24.267
SS	13,804	304%	1797.35	46.317	26.258

Table C63. Flow Normalized Trends at Paxton

Paxton Flow Normalized Trends	2012-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	△	L	△
Nitrate/Nitrite	ALAN	-	L	▼
Ammonia	ALAN	-	HL	△
Dissolved Nitrogen	L	△	L	▼
Nitrate/Nitrite	ALAN	-	L	▼
Ammonia	ALAN	-	L	△
Total Phosphorus	L	△	L	△
Particulate Phosphorus	L	△	L	△
Dissolved Phosphorus	ALAN	-	ALAN	-
Orthophosphorus	ALAN	-	ALAN	-
Total Organic Carbon	L	▼	L	▼
Total Suspended Solids	L	△	L	△
Suspended Sediment	L	△	L	△

- No trend
△ Increasing trend
▼ Decreasing trend
N/A Unable to be analyzed

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C64. 2018 Annual and Seasonal Precipitation and Discharge at Swatara

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	12.72	9.44	3.28	1,517	1,095	1.39
April-June (Spring)	17.27	12.58	4.69	1,357	938	1.45
July-September (Summer)	31.78	14.30	17.48	2,901	786	3.69
October-December (Fall)	16.49	11.46	5.03	2,086	898	2.32
Annual Total	78.26	47.78	30.48	1,965	929	2.12

Table C65. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Swatara

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	12,122	193%	39.13	3.203	3.249
TNO_x	9,235	174%	29.81	2.634	2.849
TNH_3	279	207%	0.90	0.052	0.042
DN	10,816	183%	34.92	2.987	3.148
DNO_x	9,154	174%	29.55	2.618	2.836
DNH_3	262	205%	0.84	0.048	0.039
TP	653	284%	2.11	0.101	0.061
DP	221	244%	0.71	0.041	0.031
DOP	188	246%	0.61	0.034	0.026
TOC	17,155	246%	55.38	3.349	2.452
TSS	280,780	273%	906.44	33.563	13.459
SS	408,687	315%	1319.37	46.013	18.383

Table C66. Flow Normalized Trends at Swatara

Swatara Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	HL	▼	ALAN	-
Dissolved Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	L	▼	ALAN	-
Total Phosphorus	L	▼	ALAN	-
Particulate Phosphorus	ALAN	-	ALAN	-
Dissolved Phosphorus	HL	▼	L	▼
Orthophosphorus	VL	▼	L	▼
Total Organic Carbon	L	▼	L	▼
Total Suspended Solids	ALAN	-	ALAN	-
Suspended Sediment	ALAN	-	ALAN	-

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C67. 2018 Annual and Seasonal Precipitation and Discharge at West Conewago

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.38	9.53	1.85	1,126	1,018	1.11
April-June (Spring)	15.22	11.86	3.36	1,042	738	1.41
July-September (Summer)	26.55	12.79	13.76	1,629	430	3.79
October-December (Fall)	16.29	10.60	5.69	1,758	788	2.23
Annual Total	69.44	44.78	24.66	1,389	743	1.87

Table C68. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at West Conewago

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	7,090	186%	21.64	2.374	2.037
TNO_x	4,546	171%	13.87	1.668	1.468
TNH_3	242	198%	0.74	0.068	0.063
DN	6,128	181%	18.70	2.159	1.895
DNO_x	4,522	172%	13.80	1.661	1.463
DNH_3	225	195%	0.69	0.062	0.057
TP	824	231%	2.51	0.198	0.146
DP	506	243%	1.54	0.138	0.111
DOP	461	253%	1.41	0.124	0.098
TOC	18,687	203%	57.03	5.585	4.687
TSS	218,659	197%	667.29	32.803	17.484
SS	269,315	203%	821.88	42.260	22.463

Table C69. Flow Normalized Trends at West Conewago

West Conewago Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	L	△	L	△
Dissolved Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	L	△	L	△
Total Phosphorus	L	△	ALAN	-
Particulate Phosphorus	L	△	ALAN	-
Dissolved Phosphorus	L	△	ALAN	-
Orthophosphorus	L	△	L	△
Total Organic Carbon	L	▼	L	▼
Total Suspended Solids	ALAN	-	HL	▼
Suspended Sediment	ALAN	-	L	▼

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C70. 2018 Annual and Seasonal Precipitation and Discharge at Pequea

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	10.89	9.42	1.47	182	249	0.73
April-June (Spring)	14.33	11.55	2.78	259	219	1.18
July-September (Summer)	26.63	13.09	13.55	387	145	2.67
October-December (Fall)	16.37	11.05	5.32	471	206	2.29
Annual Total	68.23	45.10	23.12	325	205	1.58

Table C71. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Pequea

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	4,007	141%	42.02	6.479	6.459
TNO_x	3,124	131%	32.76	5.415	5.689
TNH_3	107	193%	1.12	0.131	0.102
DN	3,543	133%	37.16	5.987	6.172
DNO_x	3,126	132%	32.78	5.413	5.684
DNH_3	101	192%	1.06	0.126	0.100
TP	443	216%	4.64	0.461	0.287
DP	198	221%	2.08	0.232	0.167
DOP	202	244%	2.11	0.232	0.158
TOC	3,605	178%	37.81	4.385	3.337
TSS	153,933	167%	1614.23	124.747	57.353
SS	207,954	193%	2180.72	158.575	73.202

Table C72. Flow Normalized Trends at Pequea

Pequea Flow Normalized Trends	2005-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	VL	△	L	△
Dissolved Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	VL	▼
Ammonia	VL	△	L	△
Total Phosphorus	L	△	ALAN	-
Particulate Phosphorus	L	△	ALAN	-
Dissolved Phosphorus	VL	△	L	△
Orthophosphorus	HL	△	L	△
Total Organic Carbon	ALAN	-	L	▼
Total Suspended Solids	ALAN	-	ALAN	-
Suspended Sediment	L	△	L	△

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66

Table C73. 2018 Annual and Seasonal Precipitation and Discharge at Octoraro

Season	Precipitation (inches)			Discharge (cfs)		
	2018	LTM	LTM Departure	2018	LTM	% LTM
January-March (Winter)	11.38	10.18	1.20	234	295	0.79
April-June (Spring)	13.46	11.82	1.64	313	244	1.28
July-September (Summer)	27.34	13.89	13.45	522	200	2.61
October-December (Fall)	16.65	11.42	5.23	577	219	2.63
Annual Total	68.83	47.32	21.51	411	239	1.72

Table C74. 2018 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Octoraro

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	4,894	161%	40.46	6.041	5.733
TNO_x	4,178	158%	34.54	5.298	5.115
TNH_3	98	161%	0.81	0.089	0.064
DN	4,607	158%	38.09	5.796	5.586
DNO_x	4,169	158%	34.47	5.300	5.128
DNH_3	96	161%	0.79	0.088	0.064
TP	208	207%	1.72	0.166	0.101
DP	111	208%	0.92	0.098	0.063
DOP	96	212%	0.80	0.083	0.053
TOC	3,688	179%	30.49	3.787	3.194
TSS	56,476	208%	466.90	34.392	16.471
SS	87,019	225%	719.41	45.745	20.595

Table C75. Flow Normalized Trends at Octoraro

Octoraro Flow Normalized Trends	2007-2018			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	L	▼
Nitrate/Nitrite	HL	▼	L	▼
Ammonia	L	▼	L	▼
Dissolved Nitrogen	HL	▼	VL	▼
Nitrate/Nitrite	HL	▼	L	▼
Ammonia	L	▼	L	▼
Total Phosphorus	VL	▼	L	▼
Particulate Phosphorus	ALAN	-	ALAN	-
Dissolved Phosphorus	HL	▼	L	▼
Orthophosphorus	HL	▼	L	▼
Total Organic Carbon	VL	▼	L	▼
Total Suspended Solids	ALAN	-	L	▼
Suspended Sediment	ALAN	-	ALAN	-

- No trend
△ Increasing trend
▼ Decreasing trend

HL – Highly Likely ≥0.95 and ≤1.00
VL – Very Likely ≥0.90 and <0.95
L – Likely ≥0.66 and <0.90
ALAN – About as Likely as Not >0.33 and <0.66