2017 NUTRIENTS AND SUSPENDED SEDIMENT IN THE SUSQUEHANNA RIVER BASIN

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Kevin H. McGonigal
Environmental Scientist

James P. Shallenberger
Manager, Monitoring & Protection Program

This report is prepared in cooperation with the Pennsylvania Department of Environmental Protection.

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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KEY FINDINGS

<u>2017</u>

- Rainfall ranged 3.95 inches below long-term mean (LTM) at Octoraro to 8.32 inches above LTM at Saxton, with corresponding flows of 55 and 109% of LTMs, respectively.
- Discharge ranged from 51% of LTM at Pequea to 122% of LTM at Unadilla, with rainfall of -3.28 and +5.28 of LTMs, respectively.
- The highest rainfall season was spring at Penns and all NY, West Branch, Juniata, and mainstem sites. Highest rainfall in the lower Susquehanna occurred in the summer.
- Total Nitrogen, Total Phosphorus, and Suspended Sediment (TN, TP, and SS, respectively) loads generally were consistent with the established annual patterns of LTM flow, meaning that except for TP at all NY sites and SS at Saxton, which were all below the LTM. Towanda TP was above LTM while SS and TP were below.

<u>Trends (Summation of Short-Term (2005-2017) Trends in Table 1)</u>

1) Total Nitrogen
   - A. Long-term sites
     - All long-term trends were downward
     - No short-term trends in load at Towanda; all other short-term trends were downward
   - B. Enhanced sites
     - Unadilla, Cohocton, and Penns all had upward trends in concentration and load
     - No trends at Chemung
     - Wilkes-Barre had a downward concentration trend and an upward load trend
     - Karthaus had no concentration trend and an upward load trend
     - Saxton and Jersey Shore had downward concentration trends and no load trends
     - All other sites had downward trends in both concentration and load

2) Total Phosphorus
   - A. Long-term sites
     - Long-term trends
       - Towanda had a downward concentration trend and an upward 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
       - Danville had a downward concentration trend and no load trend
       - Lewisburg and Newport had downward trends in concentration and load
       - Marietta and Conestoga had downward concentration trends and no load trends
   - B. Enhanced sites
     - All NY sites, Karthaus, Jersey Shore, and Penns had downward trends for concentration and load
     - Saxton, West Conewago, and Pequea had upward trends for concentration and load

- Wilkes-Barre had a downward concentration trend and upward load trend
- Swatara had no concentration trend and an upward load trend
- Shermans had no concentration trend and a downward load trend
- Octoraro had a downward concentration trend and no load trend

3) SS

A. Long-term sites

- Long-term trends
  - Towanda had no trends
  - Danville and Lewisburg had downward concentration trends and no load trends
  - Newport, Marietta, and Conestoga had downward trends in concentration and load
- Short-term trends
  - Towanda and Danville had upward trends in concentration and load
  - Newport and Conestoga had downward trends in concentration and load
  - Lewisburg and Marietta had no concentration trends and upward load trends

B. Enhanced sites

- Cohocton and Unadilla had no trends
- Conklin and Shermans had decreasing trends
- Pequea, Conodoguinet, Wilkes-Barre, and Karthaus had upward trends in both concentration and load
- Penns, Smithboro, West Conewago, Chemung, and Jersey Shore had one downward trend and one not significant trend (NS)
- Octoraro and Saxton had one upward trend and one NS

Table 1. Short-term Trends (Mid 2000s – 2017) within Major Subbasins

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

BACKGROUND

In 1985, the Susquehanna River Basin Commission (Commission), 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 Bay watershed's other tributary river basins as well as in tidal parts of the Chesapeake Bay estuary.

The current SRB network consists of six mainstem river and 20 tributary stations as depicted in Figure 1. The Susquehanna River Basin 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.

Detailed information regarding the sample collection, processing, lab analyses, and data analyses are available at the updated program website at www.srbc.net. This report contains a summary of estimated nutrient and sediment pollutant loads and yields derived from continuous river flow estimates and pollutant concentrations measured from water samples collected during calendar year 2017 in the SRB. Additionally, the 2017 estimates of pollutant loads and yields are compared to the overall period of record. Long-term (~30-year) and short term (mid-2000s-2017) datasets are analyzed for trends. Detailed results are listed in the Appendices.

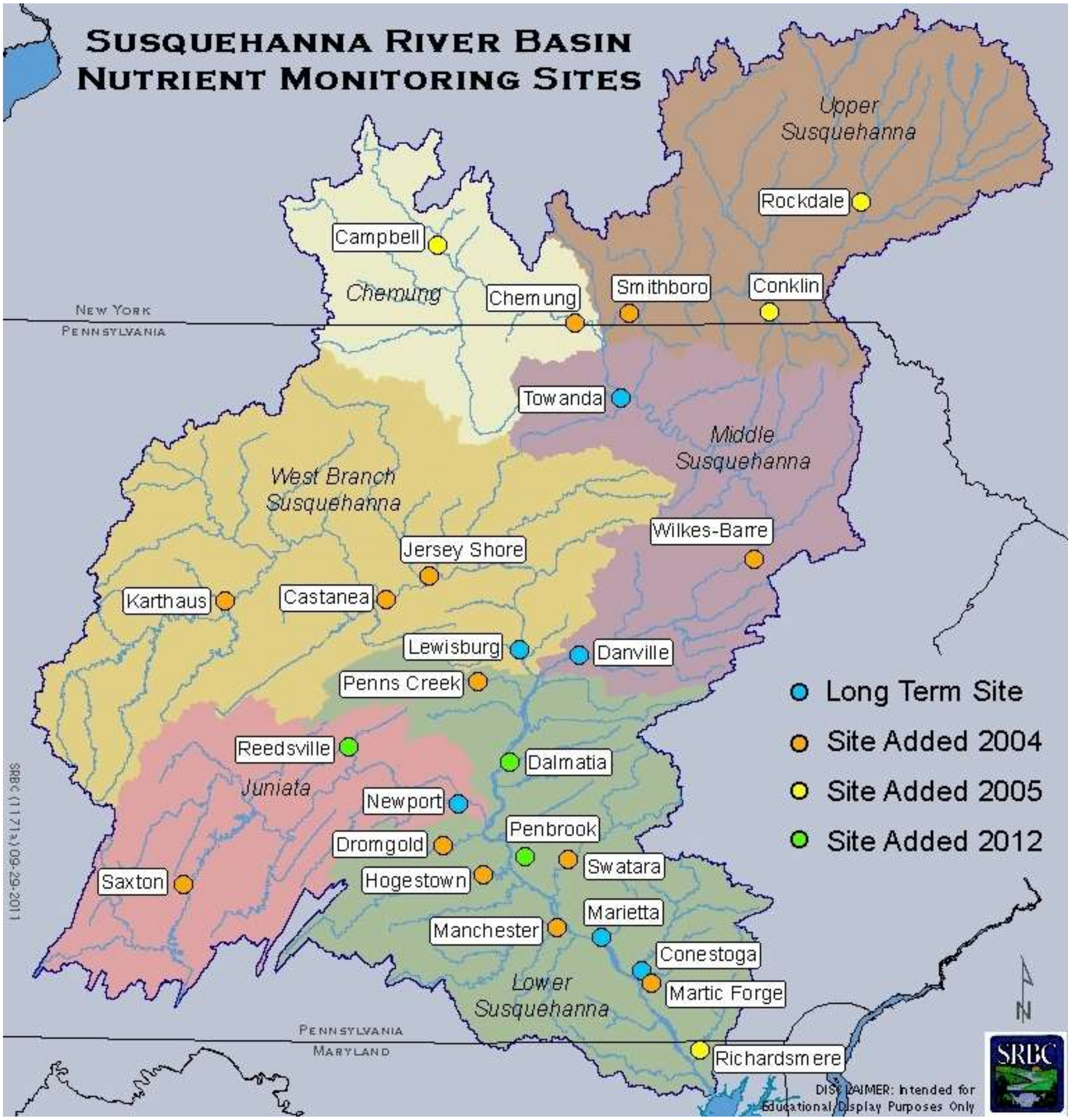

Figure 1. Sediment and Nutrient Monitoring Sites

Table 2. Data Collection Sites and 2011* Land Use Percentages

Site Location	Subbasin	USGS Site ID	Agricultural		Ag Total	Forest	Urban	Other
			Row Crops	Pasture Hay				
Richardsmere	Lower	1578475	47	20	67.33	28.07	3.75	0.85
Martic Forge	Lower	1576787	51	14	64.56	28.59	6.43	0.42
Manchester	Lower	1574000	35	18	52.40	37.38	9.13	1.09
Hogestown	Lower	1570000	30	23	52.10	39.69	7.36	0.85
Conestoga	Lower	1576754	42	9	50.38	27.49	21.25	0.88
Swatara	Lower	1573560	32	12	43.23	46.08	9.43	1.27
Dalmatia	Lower	1555500	29	13	42.06	53.86	3.32	0.75
Campbell	Chemung	1529500	17	21	38.10	58.46	1.93	1.51
Rockdale	Upper	1502500	15	21	36.36	61.50	0.85	1.29
Reedsville	Juniata	1565000	23	9	31.55	65.13	3.12	0.20
Chemung	Chemung	1531000	12	20	31.85	64.42	2.56	1.17
Wilkes-Barre	Main	1536500	11	19	29.52	65.54	3.28	1.67
Towanda	Main	1531500	10	20	30.30	65.72	2.57	1.41
Danville	Main	1540500	11	18	29.32	65.58	3.38	1.72
Smithboro	Main	1515000	9	20	28.96	66.94	2.57	1.53
Conklin	Main	1503000	9	20	28.83	67.72	1.65	1.80
Saxton	Juniata	1562000	10	17	27.17	69.83	2.50	0.49
Dromgold	Lower	1568000	15	11	25.59	72.45	1.52	0.44
Marietta	Main	1576000	13	13	25.83	68.51	4.04	1.63
Penns	Lower	1555000	14	9	22.99	74.82	1.72	0.47
Newport	Juniata	1567000	13	9	22.60	73.17	3.17	1.06
Paxton	Lower	1571000	9	11	19.59	28.65	51.50	0.26
Castanea	West	1548085	11	7	18.14	75.95	4.97	0.94
Karthaus	West	1542500	6	7	13.64	81.14	2.57	2.65
Lewisburg	West	1553500	6	7	13.04	83.55	2.08	1.34
Jersey Shore	West	1549760	4	5	9.70	87.15	1.76	1.38

* 2006 land use was used to show row crops and pasture/hayland

PRECIPITATION AND DISCHARGE

Annual precipitation and discharge are the primary drivers of nutrient and sediment loads. Figure 2 includes a set of charts that summarize 2017 seasonal and annual precipitation and discharge at the six long-term stations in comparison to the respective long-term (~30-year) means. Most precipitation fell in the middle to northern portion of the basin with the West Branch, Middle, and Upper Susquehanna and Chemung river basins receiving above LTMs. The largest rainfall in these regions occurred in spring. Conversely, the Juniata and Lower Susquehanna sites received below LTM precipitation with summer receiving the most. Exceptions were Saxton and Swatara, which both had above LTM rainfall. Discharge was lowest in the Lower Susquehanna sites including Conestoga, Pequea, and Octoraro.

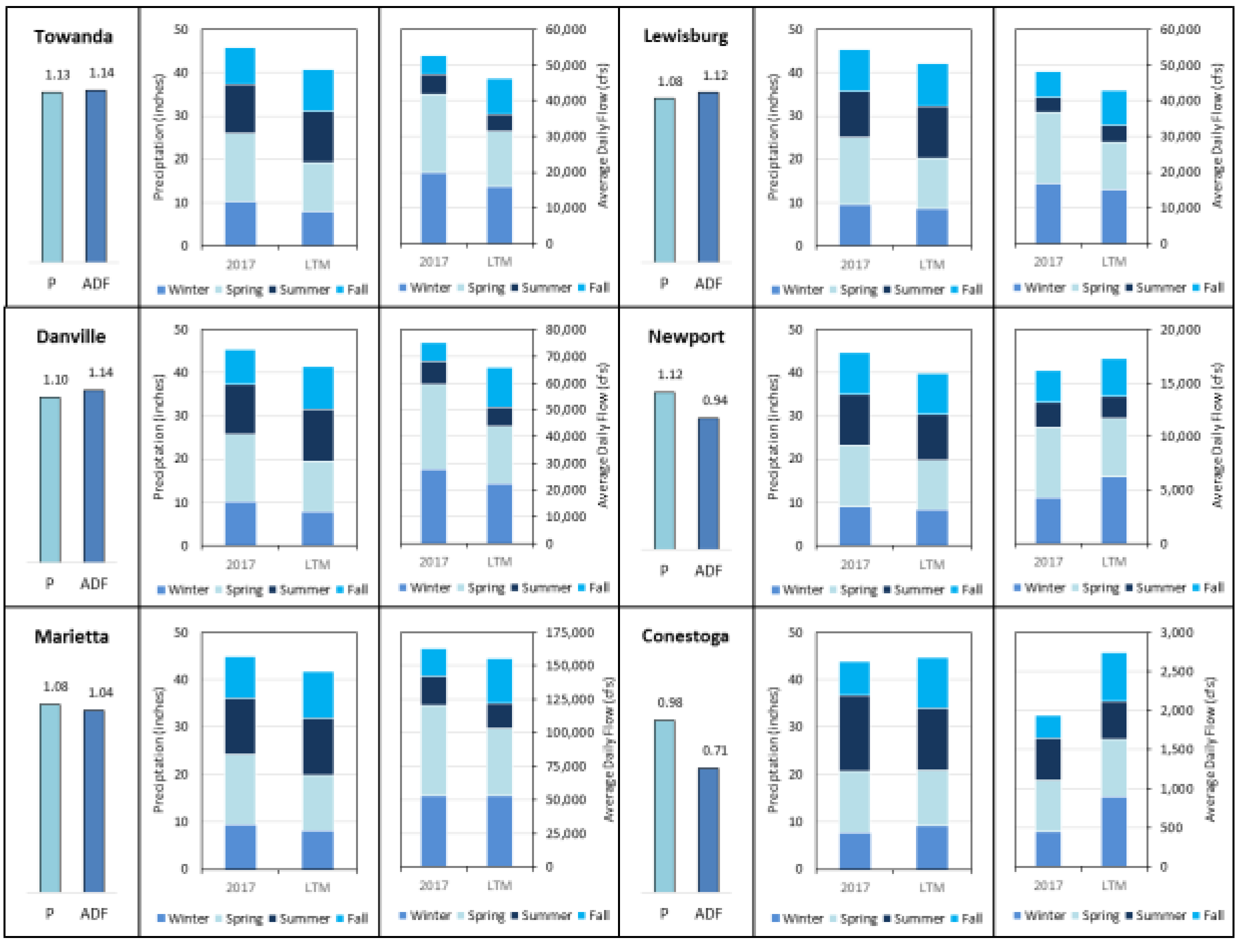

Figure 2. Precipitation and Average Daily Flow (ADF) Seasonal and Annual Statistics for 2017

DISCUSSION

2017 represents the mid-point of Chesapeake Bay restoration efforts towards full implementation by 2025. The midpoint milestone was expected to accomplish implementation of 60 percent of the pollutant load reduction actions expected to restore a healthy Bay ecosystem. The Bay Journal recently reported output from the Chesapeake Bay Program Phase 6 Watershed Models assessment that TP is on target, if not ahead of the 2025 goal, but TN is far from achieving the 2025 goal and the majority of the TN shortfall is within the SRB.

Historically, total nitrogen has shown the most consistent long-term downward trends at the six long-term SNAP sites. Figures A1 and A2 (shown in the Appendix, as are all figures mentioned hereafter) show the loads of TN at all SNAP monitoring sites. Although long-term reductions have occurred throughout the duration of sampling at the longest monitored sites, the reductions have fallen short of 2025 goals. TN loads appear to be increasing over the near term at several sites including all NY sites, Towanda, Wilkes-Barre, Danville, Karthaus, Penns, and Saxton, while the largest TN yielding stations, Pequea, Conestoga, Swatara, Octoraro, Conodoguinet, and West Conewago, all continue to show decreasing loads.

SS, has also historically shown downward trends, but has begun showing dramatic increases in recent years. Although downward long-term trends are still found at Newport, Marietta, and Conestoga, Figure A3 shows that all sites are showing recent increasing loads. Figure A4 shows that the same finding occurs at the majority of enhanced sites. With recent sediment rises and the accepted principle that sediment binds to phosphorus, these increases could threaten the one parameter that is on target for 2025.

The nomenclature of environmental phosphorus is complicated because it: (i) occurs as both dissolved and particulate fractions; (ii) is made up of a wide variety of chemical forms; and, (iii) ranges from unavailable to highly-bioavailable. Fundamentally, TP is the sum of dissolved phosphorus (DP) plus particulate phosphorus (PP), with the difference operationally defined by a 0.45µm filter – DP passes the filter, whereas PP does not. DP exists in the form of phosphate groups including orthophosphates ($H_2PO_4^-$, HPO_4^{2-}, and PO_4^{3-}), inorganic condensed phosphates, and organic condensed phosphates (e.g., ATP) as well as other organic forms associated with plant, animal, and microbial cellular matter such as sugars, fats, and proteins. Organic molecules associated with plant and animal tissues also occur as PP. Moreover, forms of PP may be integrated into mineral phases, adsorbed to clays, or complexed with an array of organic and inorganic substances. Capping the confusion about environmental phosphorus: some forms readily transfer between the PP and DP phases.

In the water column the dominant share of TP is PP, thus a similar pattern exists between SS and TP loads. Although the magnitude of TP load is dominated by PP, DP forms are far more likely to contribute to water quality impacts. The more available a form of phosphorus (or any nutrient) is for uptake by biota (i.e., having higher bioavailability), the more likely that excess loading will result in detrimental water quality effects. Bioavailability is highest for dissolved organic phosphorus, dissolved orthophosphates (DOP, also known as dissolved reactive phosphorus, DRP), and among certain inorganic iron and aluminum-bound PP fractions that tend to readily dissolve under alkaline conditions.

Emphasis on sediment-bound phosphorus drives the conventional paradigm for phosphorus management; i.e., to reduce erosion. A shortcoming of the current approach for phosphorus management lies with the complexity of TP in all of its forms. As described below, long-term monitoring data suggest that TP management may best be accomplished by considering DP and PP fractions separately.

> *"Most P in soils is in particulate form … this has led to the misconception that controlling soil erosion will effectively control P export from agricultural land, but recent developments have shown that a significant portion of P losses can be in the dissolved form."*
> *(Reid et al., 2018)*

Although the association of phosphorus with sediment/particulates (e.g., PP) is well-established and PP forms the dominant part of TP loads overall, owing to its higher bioavailability, forms of DP ultimately drive water quality impacts. For example, Lake Erie had severe phosphorus-caused algal blooms in the mid-1970s, but algal blooms largely were kept in check by management strategies that focused on reducing TP levels. Beginning in the early 1990s, DOP trends began to increase following decades of decline in the Lake Erie Watershed. Moreover, the DOP trends increased simultaneous to declining TP and PP trends. A resurgence of Lake Erie algal impacts occurred in the middle 1990s that coincided with increases in DOP, even though the TP and PP loads were well below the historic high levels that existed during the 1970s.

An important finding in the Lake Erie Watershed was that rises in DOP coincided with increasing implementation of erosion-based conservation efforts including conservation tillage and no-till practices (OEPA, 2013). It is noteworthy that Logan and Adams (1981) predicted that no-till implementation would:

1) Increase runoff of DOP, due in part to the buildup of P levels at the surface of soil;

2) Be more effective at reducing SS loads than PP loads as the conservation tillage practices are most effective at minimizing erosion of coarser sediment particles that have lower PP levels; and

3) Increase the total volume of surface runoff from the region's fine-textured soils (i.e., soil types more likely to accrue PP).

The PP loads at Towanda, Danville, Lewisburg, and Newport (i.e., all mainstem river locations in middle parts of the SRB) each have increased, similar to the SS loads at these stations, while the corresponding DP loads all decreased. In comparison to mainstem river stations located in middle parts of the Basin, the mainstem Marietta station in the lower part of the SRB also had recent PP increases, yet DP has remained largely unchanged for approximately eight years. A largely unchanged DP load in the lower part of SRB suggests that subwatersheds in the lower SRB region were/are contributing sufficiently high DP loads to erase the downward DP trends observed in each of the major middle subbasin regions.

Figures A7–A10 show DOP and PP at long-term and enhanced sites. Both of these parameters are showing recent increases in loads depending on the location, with NY sites showing decreasing loads of DOP and increasing loads of PP while certain lower Susquehanna sites (e.g., Swatara, West Conewago, Pequea, Conestoga, and Marietta) are showing increases in both. Critical to this comparison are the changes in PP and DOP that have occurred over the long-term as seen in Figures A7 and A8. "Spikes" in both parameters occurred near the late 1990s and early 2000s. Additionally, after the spike in DOP in the early 2000s, levels dropped off, but still remained above levels in the mid-1980s. Likewise, PP loads dropped precipitously after their initial spike, but most recently are increasing dramatically at mainstem Susquehanna sites including Conklin, Smithboro, Towanda, Danville, and Marietta.

Figure 11A shows DP time series data for two agriculture-dominated Lake Erie Watersheds, Sandusky River and Maumee River, along with the agriculture-dominated Conestoga River watershed in the SRB. Of note are the similar DP patterns between the Lake Erie watersheds and the Conestoga River, with emphasis on the shared increasing DP trend that followed steady improvements. Figure A12 shows TP, DOP, and PP levels for the Cuyahoga River as compared to Marietta and Conestoga.

Unique to the SRB watersheds was that PP and SS also had spikes similar to DOP whereas Lake Erie watersheds showed decreasing levels of PP and SS during the DOP increases, leading to the conclusion that the processes affecting DOP and PP on agricultural lands in Lake Erie watersheds were "decoupled". The ultimate conclusion and recommendation based on decoupling of DP and PP fractions was that focusing management on a TP target load should be avoided and that DOP and PP warrant treatment as distinct parameters (Jarvie et al., 2017).

Although, as previously mentioned, SRB watersheds have not shown the same decoupling of upward DOP loads with downward PP loads; the data suggest that DOP is disconnected from PP. Figures A13-A18 show SS, TP, PP, DP, DOP, and TN yields that are all sorted by diminishing long-term SS yields (Figure A13). Of note is that four of the top five highest sediment yielding sites are mainstem Susquehanna sites–a pattern noted above with respect to PP. Figure A14 shows that TP yields do not fully coincide with SS, wherein several lower SS yielding watersheds are among the higher TP yielding sites. Figures A15-A17 split TP up into PP, DP, and DOP showing that the PP portion is well aligned with SS while the DP and DOP yields show an exacerbation of the TP differences in Figure A14. The DP and DOP yields actually follow the same pattern as the TN yields shown in Figure A18. Land use in Figure A19 sorted with the same decreasing SS yields shows that the high SS yielding sites do not have consistent land use pattern whereas highest DP and TN yielding sites also are those with the highest proportion of agricultural row crops.

The finding that DP and TN patterns align suggests the same conclusion from Lake Erie is applicable to SRB; i.e., that successful management of phosphorus cannot focus solely on erosion control, but must address DP, which although smaller in magnitude, is much more detrimental to water quality. Although estimating bioavailability is rather complex, estimates from Ellison and Brett (2006) and Baker et al. (2014) suggest between 17 and 30% of PP is bioavailable. As emphasis for this point, the charts in Figure A20 depict TP, DP, and assumed bioavailable PP loads through time for five stations in the lower Susquehanna where DP is increasing. The bioavailable PP fraction was estimated as the conservative (i.e., high-end) assumption that 30% of PP is available for biological uptake. When factoring bioavailability, PP diminishes in its effects as compared to the nearly completely bioavailable DP. Thus, focus on DP appears to not only be necessary, but critical to insuring that phosphorus loads remain on target, especially considering that some erosion control practices may have detrimental effects on DP, including phosphorus accumulation at the soil surface.

Although DP accounts for only a fraction of the TP load, the importance of addressing the bioavailability of phosphorus as it relates to nutrient management outcomes cannot be overstated. With PP and SS loads increasing, increased focus on erosion reduction practices are inevitable. Ideally those efforts will consider DP at the same time so as to avoid a similar re-eutrophication process as occurred in Lake Erie. Lack of management focus on DP runs the risk of reducing SS load while increasing DP load. Although the outcome may meet an overall TP Total Maximum Daily Load (TMDL) target, it could coincide with debilitating levels of bioavailable phosphorus. With the TMDL midpoint shortfall in TN load reduction activities, focus on DP makes additional sense as data suggest that the management of DP will bring TN reductions much like reductions in SS simultaneously attain reductions in PP.

Figure A21 shows daily flow normalized concentrations of TN, PP, and DP at Marietta and DP at Conestoga. The charts show that these parameters have different annual maxima periods. PP levels are consistently highest at Marietta during March, April, and May, with inconsistent peaks during September, November, and December. Conversely, DP is at its lowest levels during spring and highest levels during summer, fall, and early winter. This is also the case for Conestoga. Additionally, TN follows a similar pattern of highest concentrations during fall and winter. The findings in Lake Erie led to the recommendation that Agricultural Best Management Practices (BMPs) should be identified and implemented that reduce DP loading and those BMPs that reduce erosion should be evaluated in terms of their impacts on DP export (Baker et al., 2014). Both nutrient management and tillage may be able to take advantage of these seasonal patterns to minimize both PP and DP. No-till farming practices coupled with strategically timed tillage to reduce the stratification of phosphorus at the soil surface are one possibility. Another possibility is increased implementation of phosphorus-based nutrient management planning, a strategy already implemented in Maryland with the phosphorus management tool where increasing the number of acres under phosphorus nutrient management aims to reduce the amount of phosphorus being applied. This effort is based on an extensive site analysis to determine threat of phosphorus loss to surface waters. Not only can this help reduce the amount of phosphorus going on to the land, but it can help to insure that the phosphorus is utilized. With additional practices, such as commodity cover crops, reduction of existing phosphorus soil levels can occur.

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APPENDIX A

Figures Referenced in Discussion Section

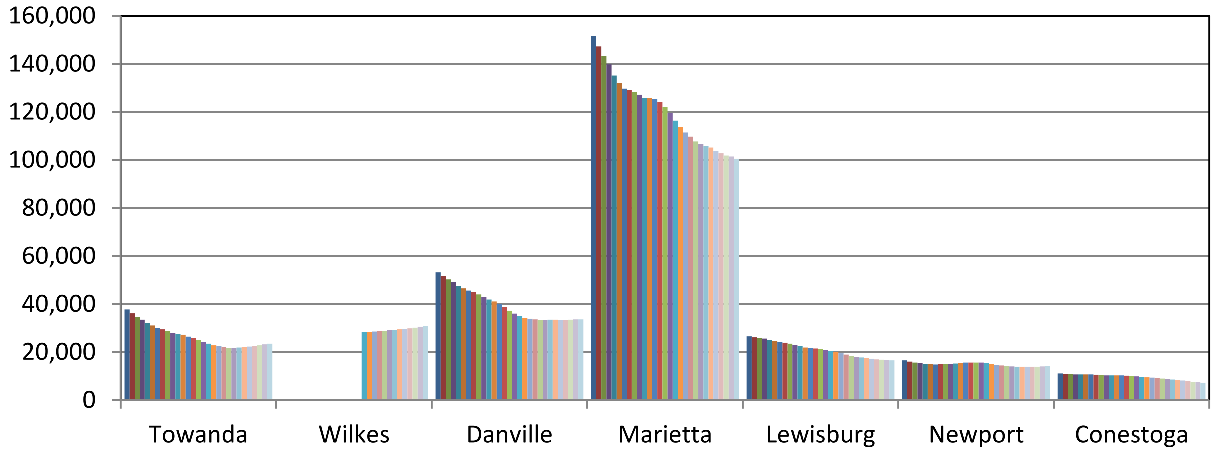

Figure A1. Annual Flow Normalized Loads of Total Nitrogen (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))

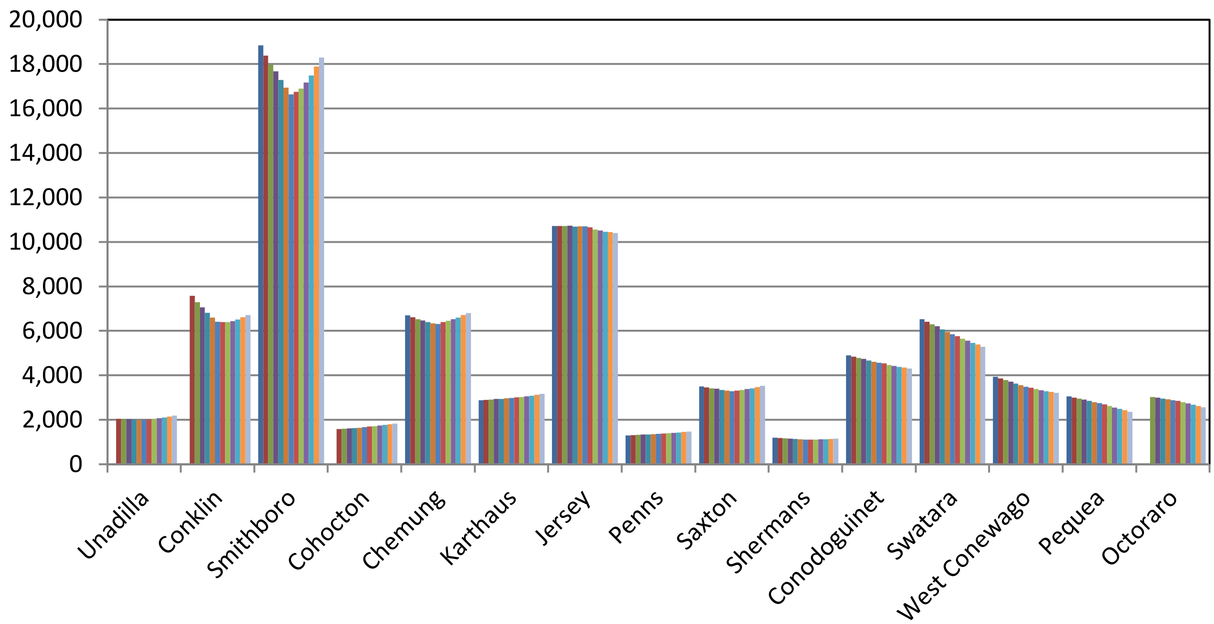

Figure A2. Annual Flow Normalized Loads of Total Nitrogen (1000's of Pounds) (Note: Each vertical bar represents the annual load sequentially from past (left) to present (right))

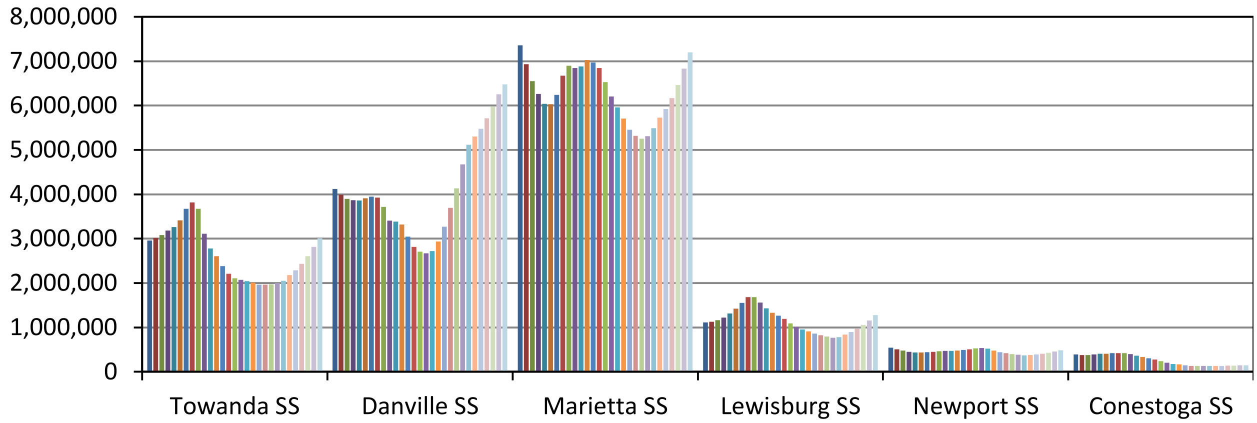

Figure A3. Annual Flow Normalized Loads of Suspended Sediment (1000's of Pounds)

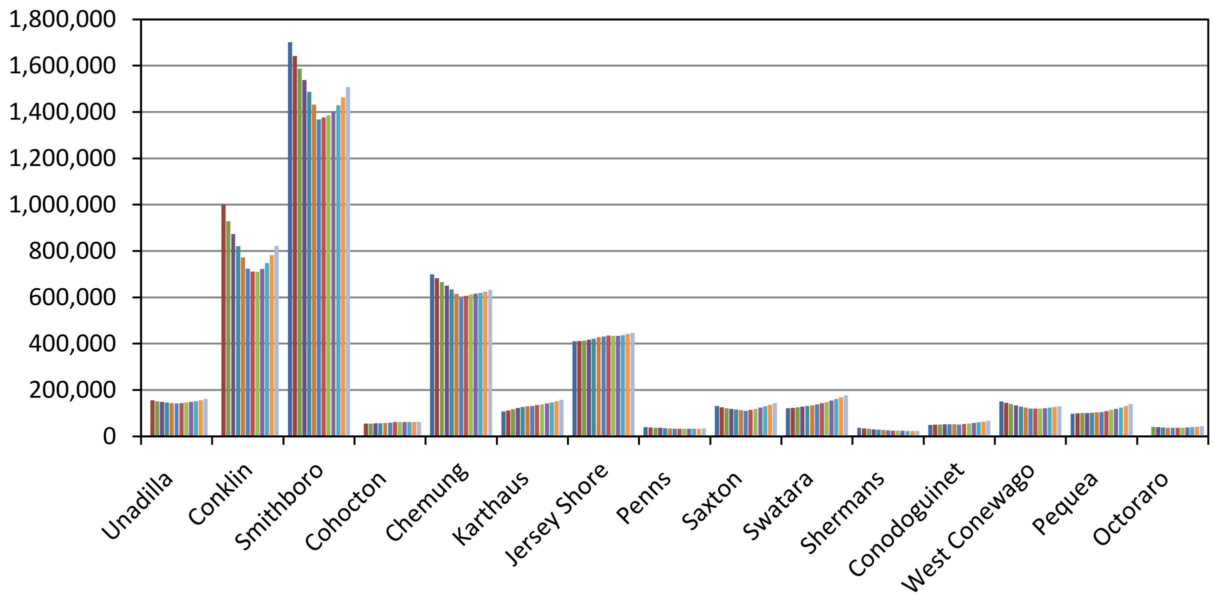

Figure A4. Annual Flow Normalized Loads of Suspended Sediment (1000's of Pounds)

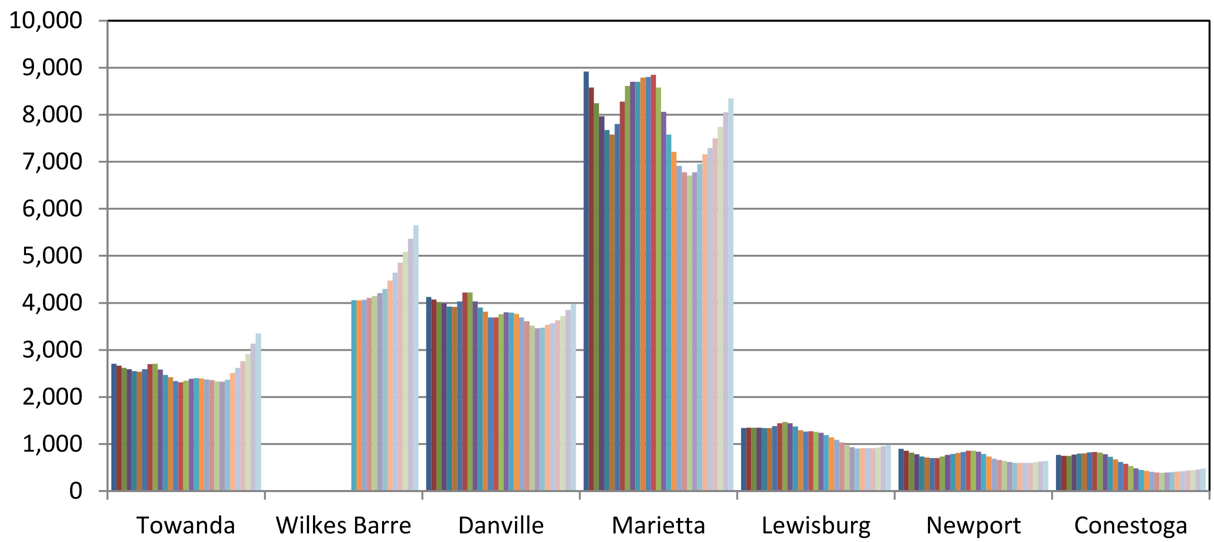

Figure A5. Annual Flow Normalized Loads of Total Phosphorus (1000's of Pounds)

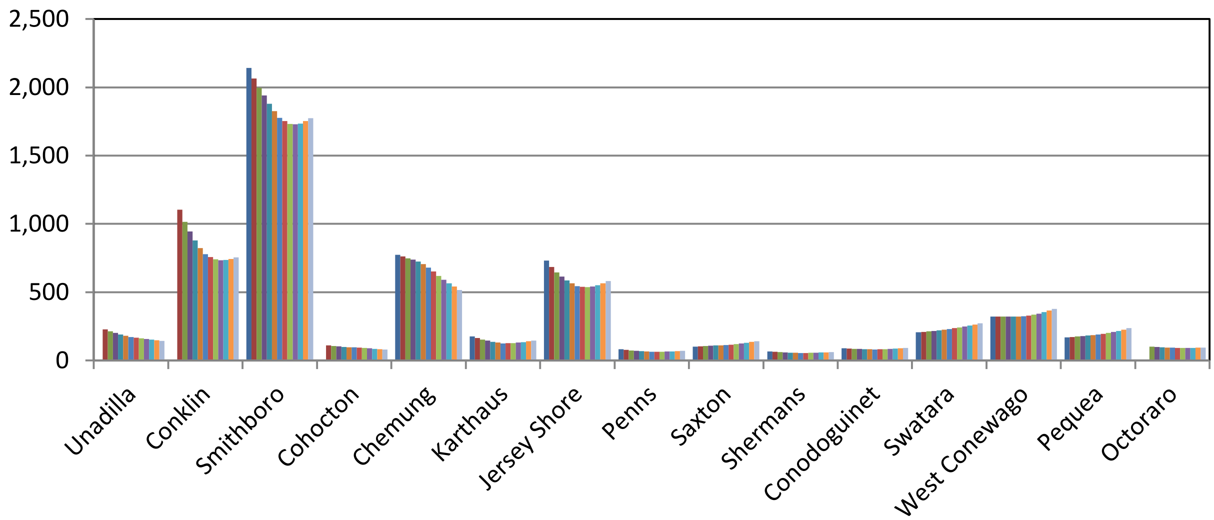

Figure A6. Annual Flow Normalized Loads of Total Phosphorus (1000's of Pounds)

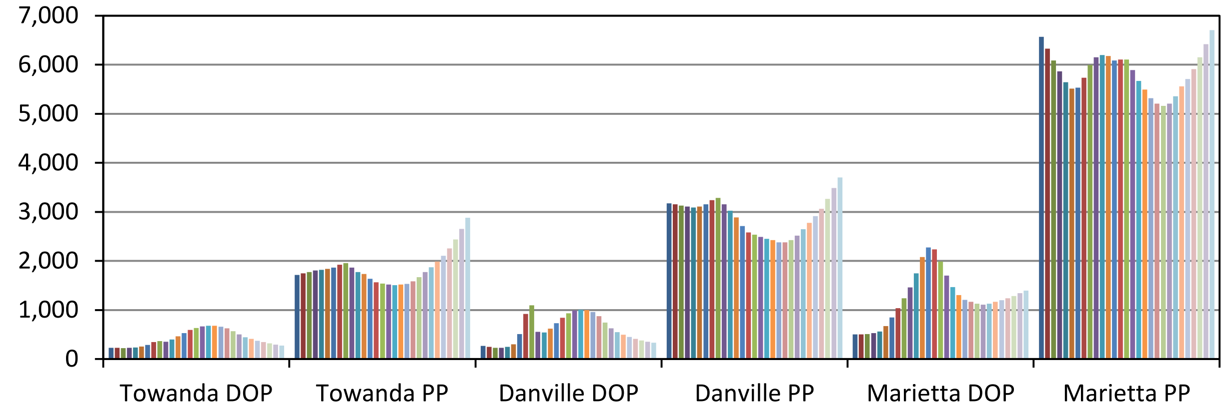

Figure A7. Annual Flow Normalized Loads of Dissolved Orthophosphate and Particulate Phosphorus (1000's of Pounds)

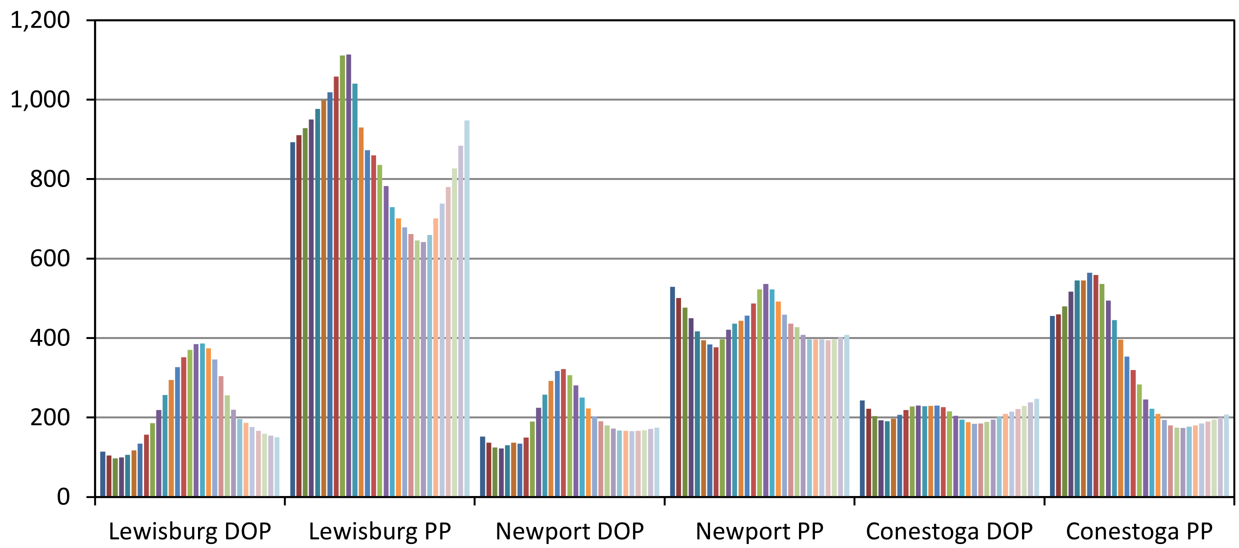

Figure A8. Annual Flow Normalized Loads of Dissolved Orthophosphate and Particulate Phosphorus (1000's of Pounds)

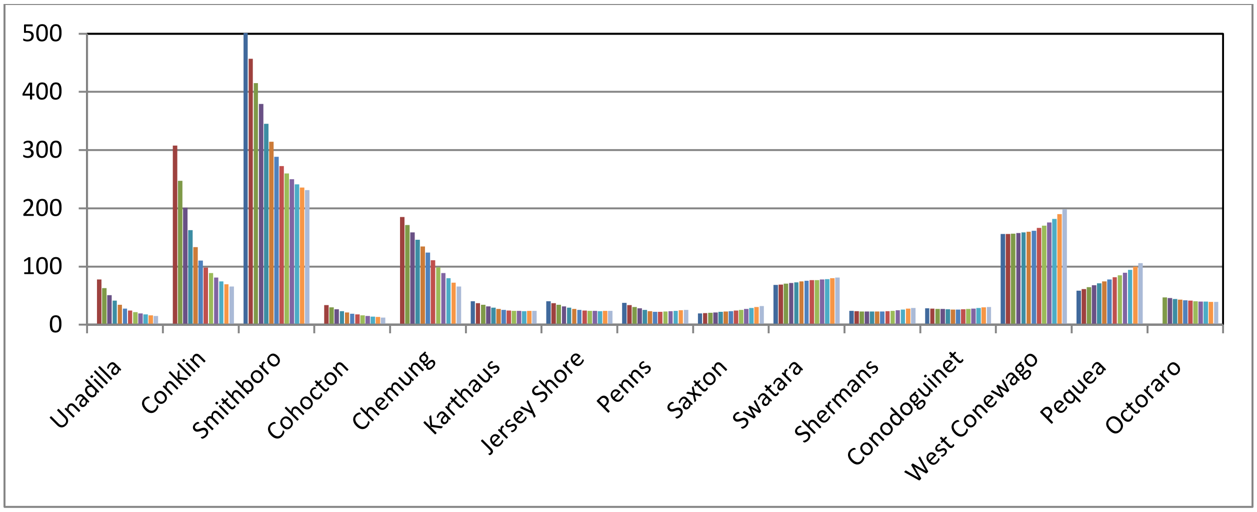

Figure A9. Annual Flow Normalized Loads of Dissolved Orthophosphate (1000's of Pounds)

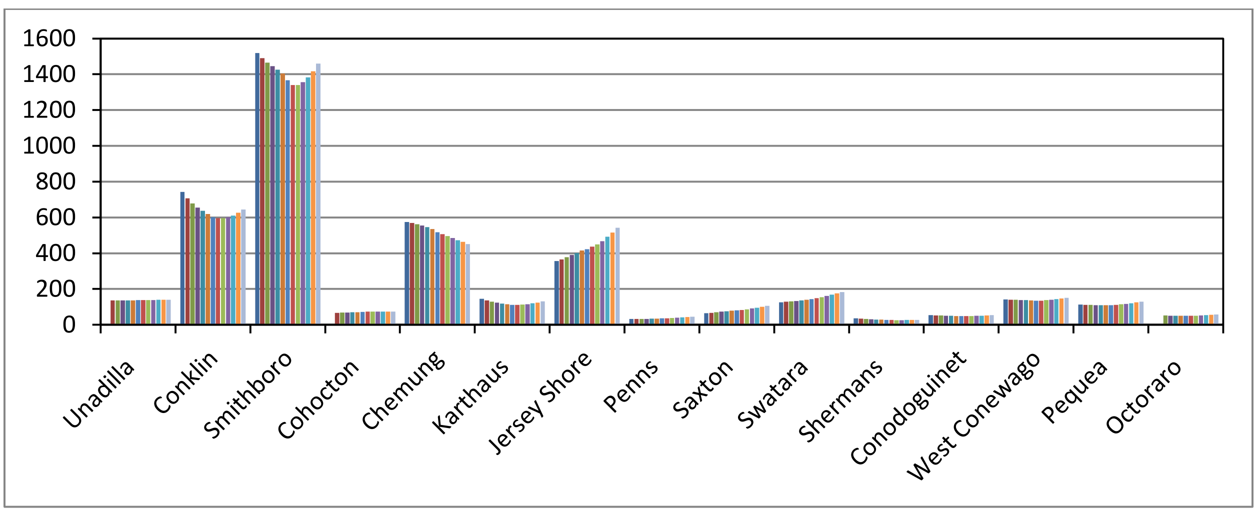

Figure A10. Annual Flow Normalized Loads of Particulate Phosphorus (1000's of Pounds)

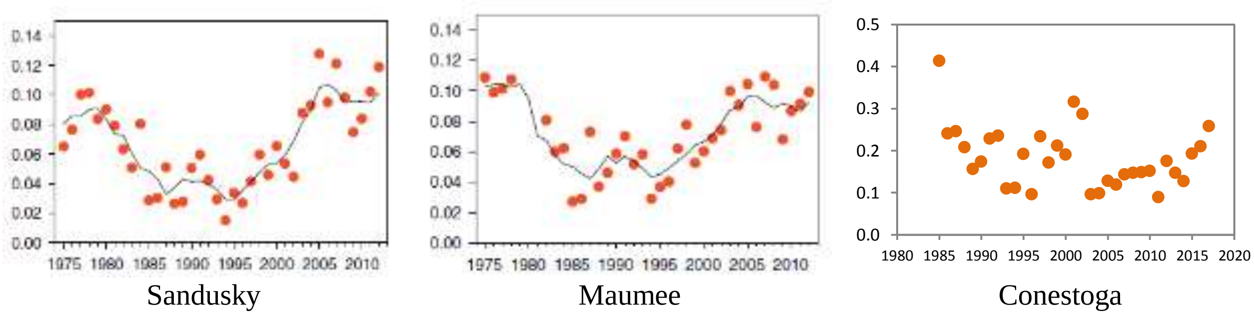

Figure A11. Erie and Conestoga Flow Weighted Mean Concentrations Dissolved Orthophosphorus at Sandusky, Maumee, and Conestoga

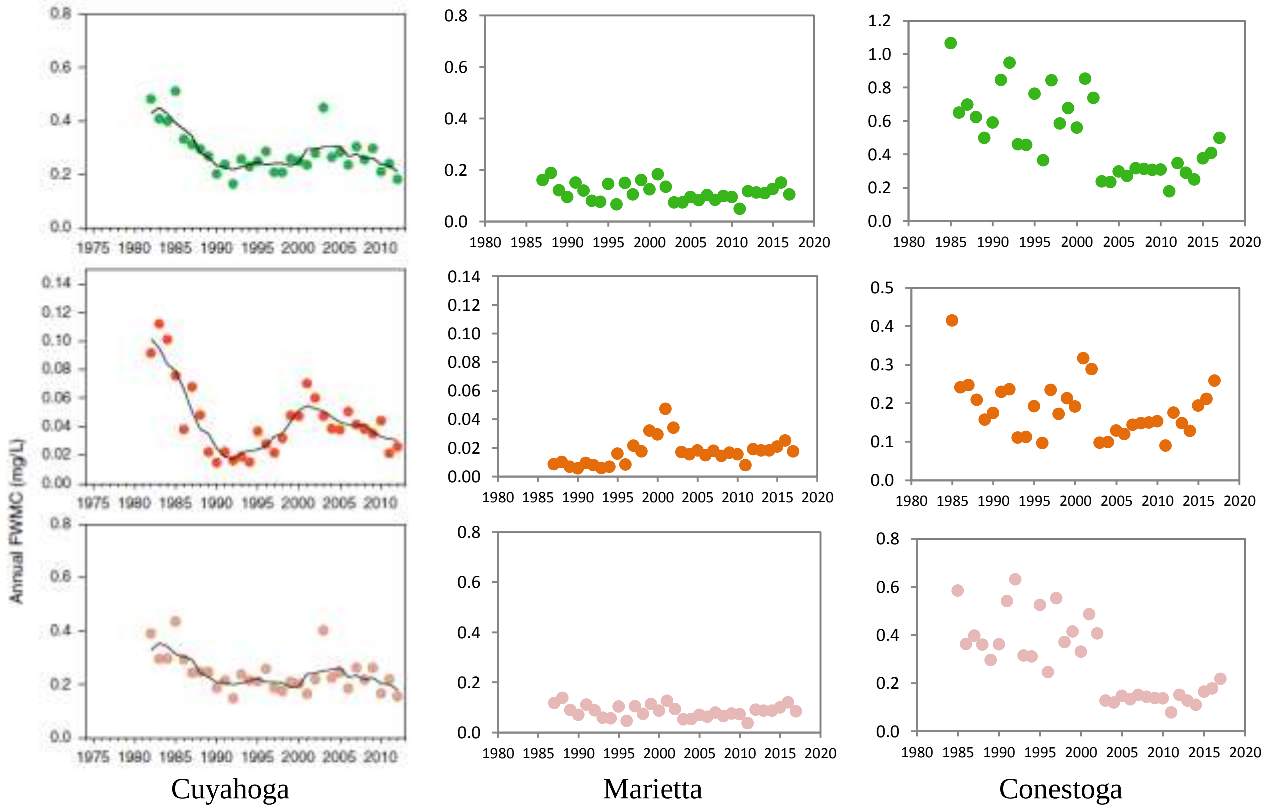

Figure A12. Total Phosphorus (TOP), Dissolved Orthophosphorus (MIDDLE), and Total Particulate Phosphorus (BOTTOM) at Cuyahoga, Marietta, and Conestoga

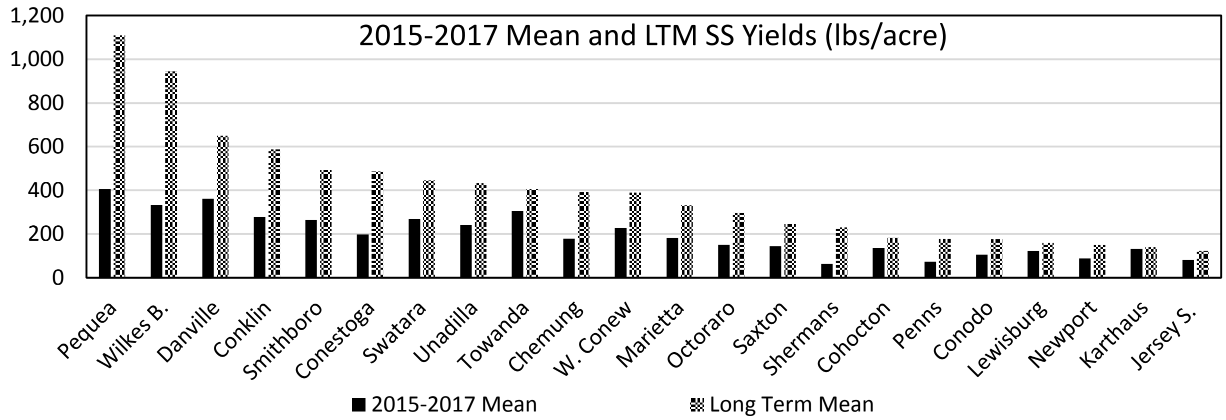

Figure A13. Suspended Sediment Yields Sorted by Decreasing Long-Term Mean Suspended Sediment

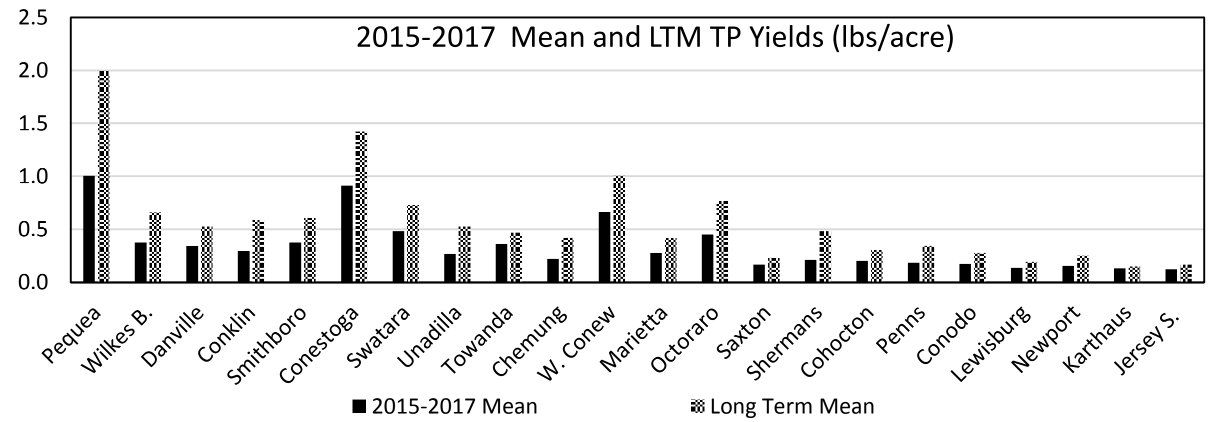

Figure A14. Total Phosphorus Yields Sorted by Decreasing Long-Term Mean Suspended Sediment

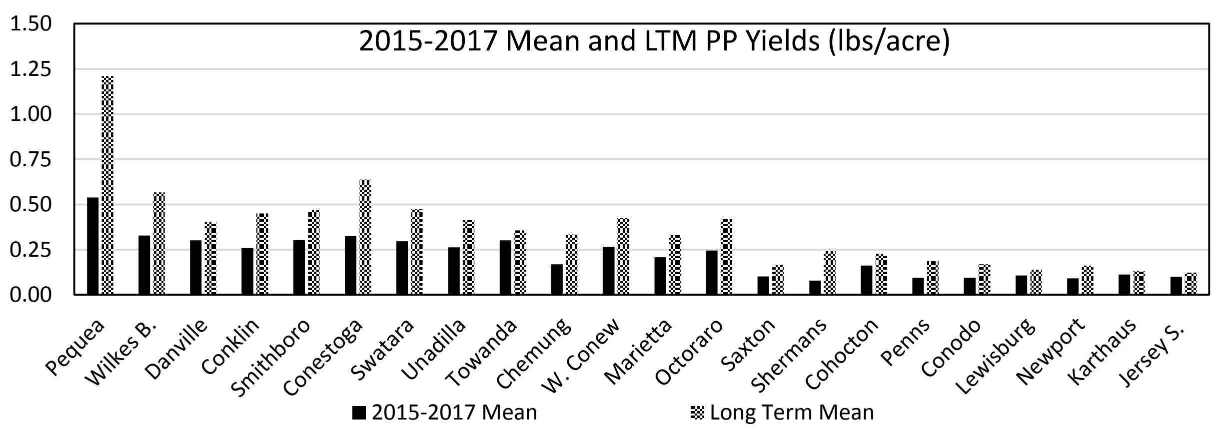

Figure A15. Particulate Phosphorus Yields Sorted by Decreasing Long-Term Mean Suspended Sediment

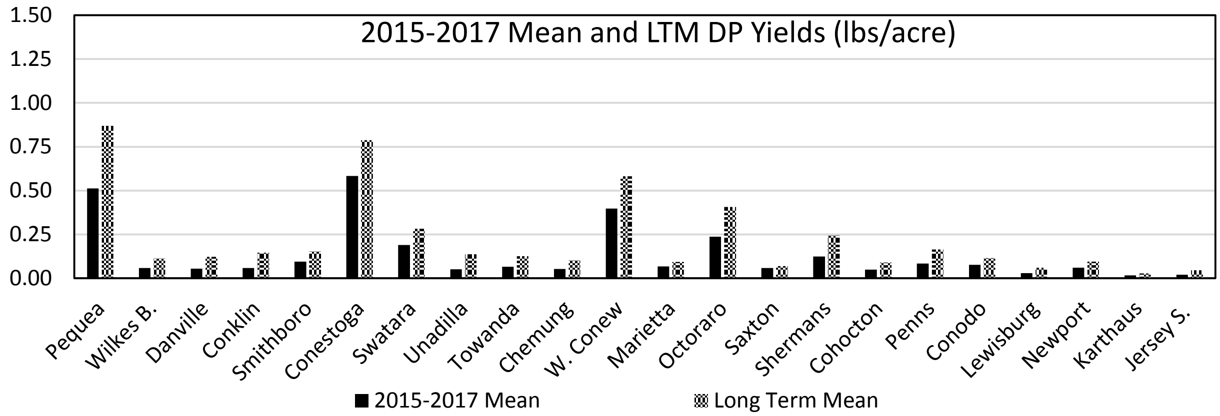

Figure A16. Dissolved Phosphorus Yields Sorted by Decreasing Long-Term Mean Suspended Sediment

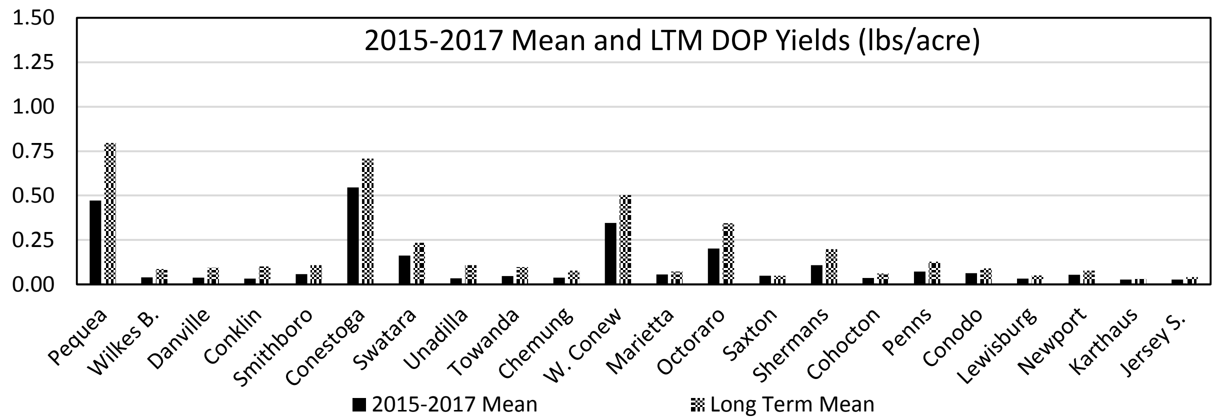

Figure A17. Dissolve Orthophosphate Yields Sorted by Decreasing Long-Term Mean Suspended Sediment

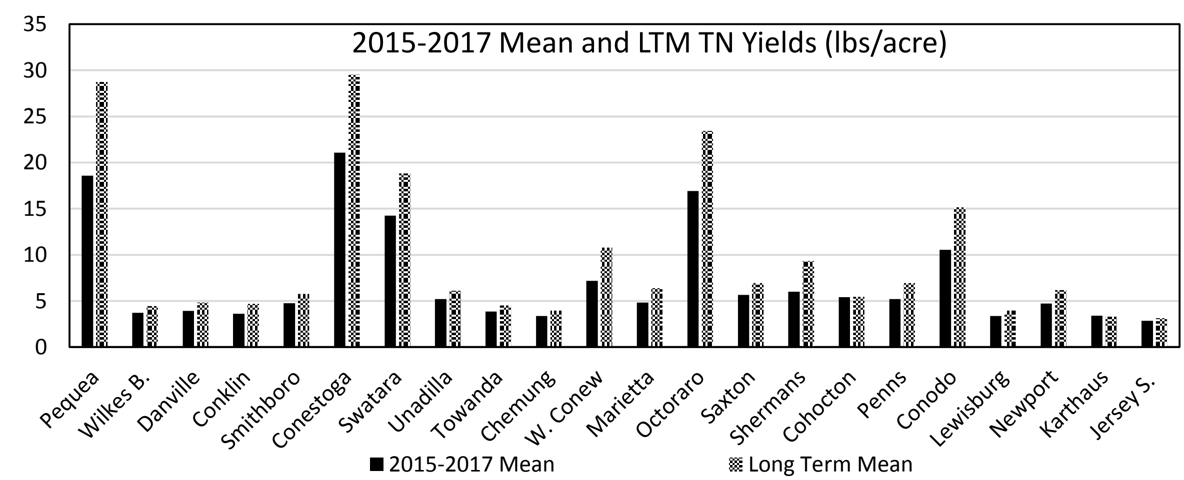

Figure A18. Total Nitrogen Yields Sorted by Decreasing Long-Term Mean Suspended Sediment

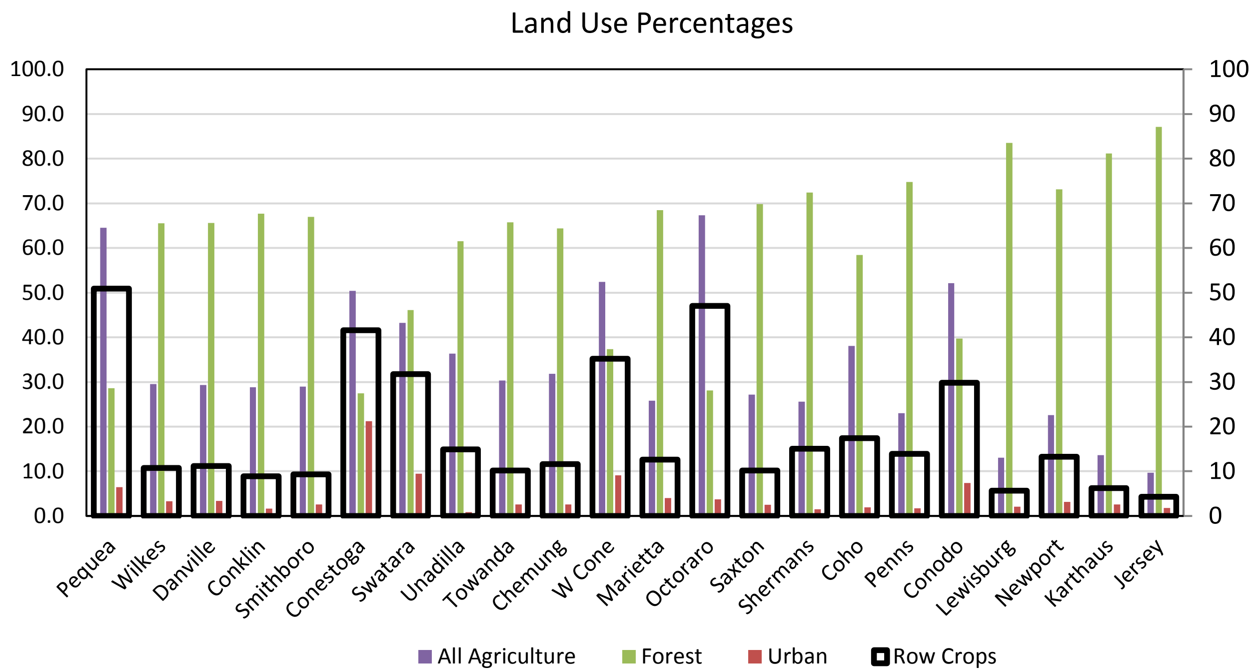

Figure A19. 2011 Land Use Percentages Sorted By Decreasing Long-Term Mean Suspended Sediment (Row crops percent is from 2006 data)

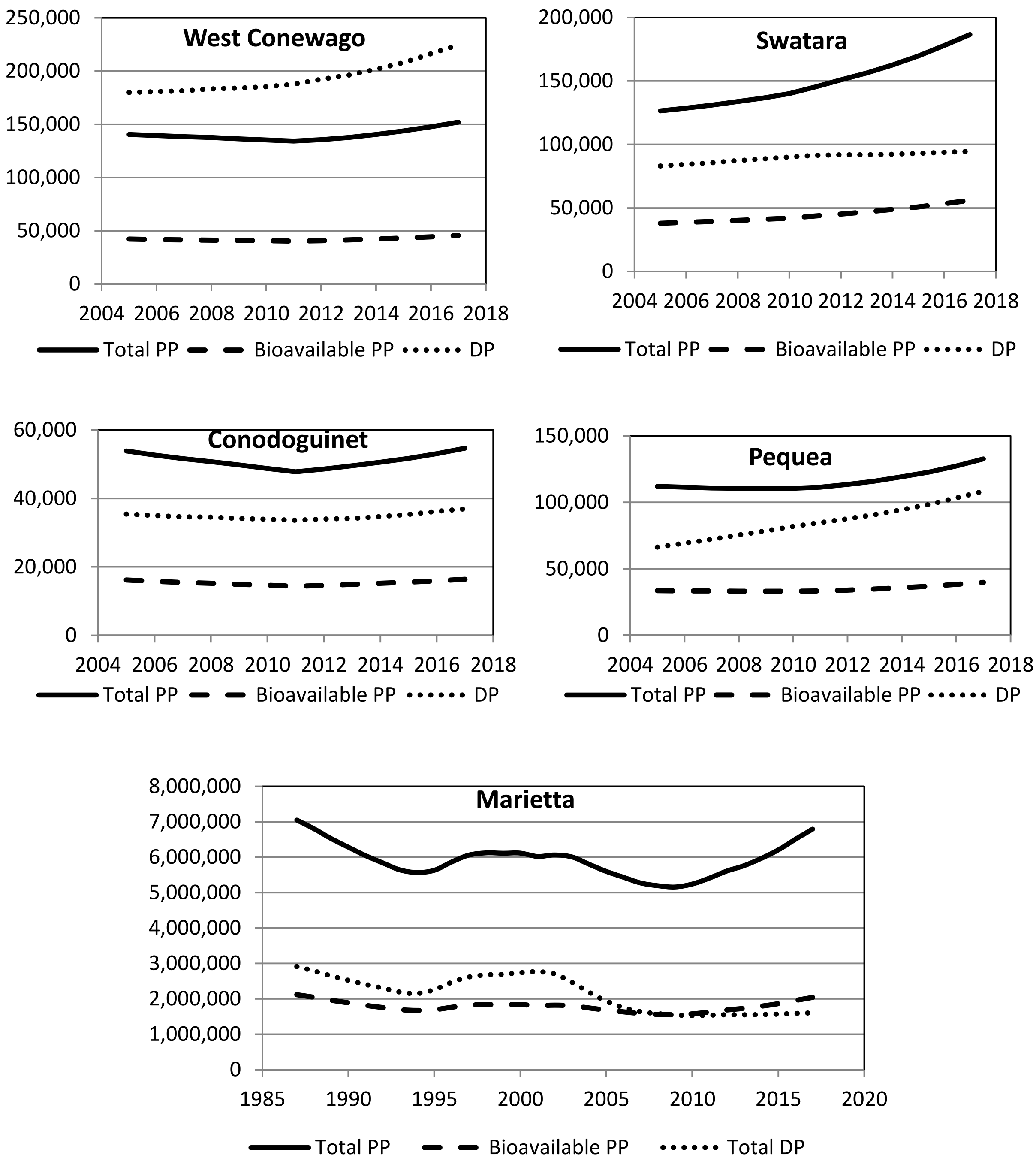

Figure A20. Bioavailable Phosphorus Loads in Pounds (Bioavailable PP calculated as 30% of total particulate phosphorus.)

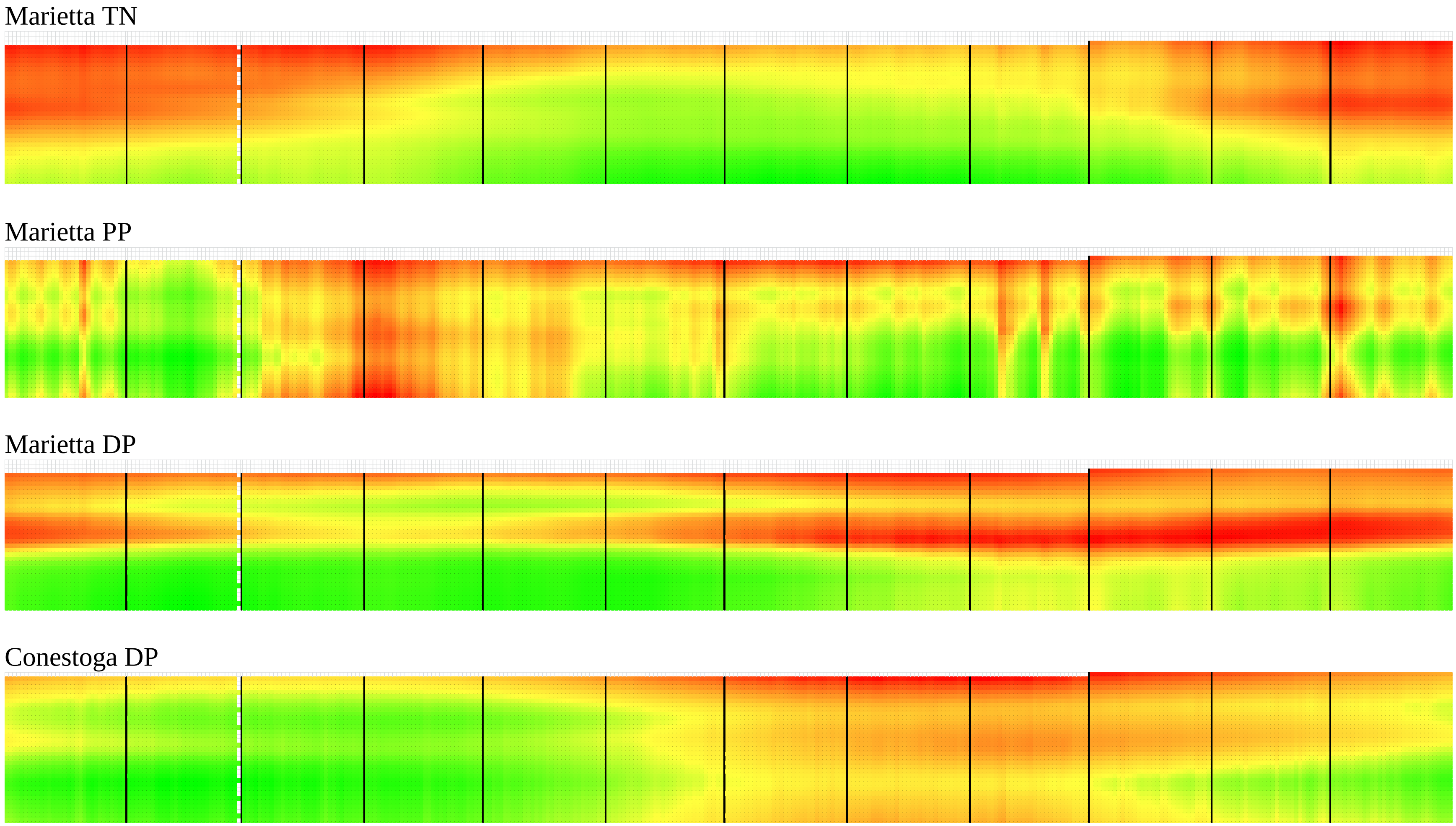

Figure A21. Marietta Daily Flow Normalized Concentration, Total Nitrogen, Particulate Phosphorus, Dissolved Phosphorus, and Conestoga Dissolved Phosphorus

APPENDIX B

Individual Site Data

Table B1. 2017 Annual and Seasonal Precipitation and Discharge at Towanda

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	10.25	7.73	2.52	19,875	15,846	1.25
April-June (Spring)	15.68	11.44	4.24	21,892	15,458	1.42
July-September (Summer)	11.39	11.84	-0.45	5,630	4,875	1.15
October-December (Fall)	8.67	9.75	-1.08	5,516	10,167	0.54
Annual Total	45.99	40.76	5.23	13,228	11,586	1.14

Table B2. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Towanda

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	26,171	99%	5.26	0.920	0.919
TNO_x	15,156	101%	3.04	0.558	0.561
TNH_3	1,105	88%	0.22	0.035	0.035
DN	21,114	94%	4.24	0.777	0.780
DNO_x	15,157	102%	3.04	0.559	0.561
DNH_3	1,013	97%	0.20	0.034	0.034
TP	2,831	116%	0.57	0.064	0.063
DP	428	58%	0.09	0.015	0.015
DOP	305	72%	0.06	0.010	0.010
TOC	94,613	113%	19.00	3.185	3.095
TSS	2,574,778	105%	517.04	44.159	41.013
SS	1,533,033	92%	307.85	30.308	29.917

Table B3. Flow Normalized Trends at Towanda

Towanda Flow Normalized Trends	1989-2017				2005-2017			
	Concentration		Load		Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼	VL	▼	ALAN	-
Nitrate/Nitrite	HL	▼	HL	▼	L	▼	HL	▼
Ammonia	HL	▼	HL	▼	L	▼	L	▼
Dissolved Nitrogen	HL	▼	HL	▼	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼	ALAN	-	L	▼
Ammonia	HL	▼	VL	▼	L	▼	ALAN	-
Total Phosphorus	HL	▼	L	△	L	▼	L	△
Particulate Phosphorus	ALAN	-	L	△	VL	△	L	△
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	L	▼	L	△	HL	▼	HL	▼
Total Organic Carbon	HL	▼	ALAN	-	L	▼	L	△
Total Suspended Solids	L	△	L	△	L	△	ALAN	-
Suspended Sediment	ALAN	-	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 B4. 2017 Annual and Seasonal Precipitation and Discharge at Danville

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	10.20	7.89	2.31	27,518	22,218	1.24
April-June (Spring)	15.51	11.63	3.88	32,130	21,532	1.49
July-September (Summer)	11.53	12.07	-0.53	8,491	7,252	1.17
October-December (Fall)	8.21	9.91	-1.70	7,189	14,989	0.48
Annual Total	45.45	41.48	3.96	18,832	16,498	1.14

Table B5. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Danville

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	37,941	93%	5.28	0.870	0.852
TNO_x	21,328	92%	2.97	0.509	0.502
TNH_3	1,418	74%	0.20	0.032	0.030
DN	29,489	87%	4.11	0.721	0.712
DNO_x	21,342	92%	2.97	0.511	0.504
DNH_3	1,232	74%	0.17	0.027	0.026
TP	3,804	100%	0.53	0.062	0.059
DP	507	52%	0.07	0.012	0.012
DOP	354	66%	0.05	0.008	0.008
TOC	128,670	109%	17.92	3.025	2.953
TSS	4,407,317	118%	613.65	49.704	53.447
SS	2,547,355	93%	354.68	32.342	35.329

Table B6. Flow Normalized Trends at Danville

Danville Flow Normalized Trends	1985-2017				2005-2017			
	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	▼	VL	▼	HL	▼	ALAN	-
Particulate Phosphorus	HL	▼	ALAN	-	L	△	L	△
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	L	▼	ALAN	-	HL	▼	HL	▼
Total Organic Carbon	HL	▼	HL	▼	HL	▼	ALAN	-
Total Suspended Solids	ALAN	-	ALAN	-	ALAN	-	ALAN	-
Suspended Sediment	L	▼	ALAN	-	VL	△	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 B7. 2017 Annual and Seasonal Precipitation and Discharge at Marietta

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	9.43	8.22	1.21	53,277	53,131	1.00
April-June (Spring)	14.74	11.54	3.20	67,235	50,038	1.34
July-September (Summer)	11.82	11.93	-0.11	21,251	18,269	1.16
October-December (Fall)	8.84	9.92	-1.07	20,726	34,268	0.60
Annual Total	44.84	41.60	3.23	40,622	38,927	1.04

Table B8. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Marietta

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	99,875	82%	6.00	1.115	1.080
TNO_x	67,977	81%	4.09	0.775	0.749
TNH_3	2,822	68%	0.17	0.032	0.032
DN	83,167	80%	5.00	0.976	0.946
DNO_x	67,799	81%	4.08	0.773	0.747
DNH_3	2,446	67%	0.15	0.028	0.028
TP	6,514	83%	0.39	0.056	0.056
DP	1,479	70%	0.09	0.018	0.018
DOP	1,240	104%	0.07	0.015	0.014
TOC	285,880	112%	17.18	3.287	3.164
TSS	4,539,398	76%	272.84	29.322	31.689
SS	3,763,531	75%	226.21	26.161	29.355

Table B9. Flow Normalized Trends at Marietta

Marietta Flow Normalized Trends	1987-2017				2005-2017			
	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	▼	L	▼	VL	▼	ALAN	-
Particulate Phosphorus	HL	▼	L	▼	L	▼	L	△
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	HL	△	HL	△	HL	▼	L	▼
Total Organic Carbon	HL	▼	ALAN	-	L	△	L	△
Total Suspended Solids	L	▼	L	▼	ALAN	-	L	▼
Suspended Sediment	HL	▼	L	▼	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 B10. 2017 Annual and Seasonal Precipitation and Discharge at Lewisburg

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	9.40	8.42	0.98	16,876	14,987	1.13
April-June (Spring)	15.67	11.62	4.05	19,780	13,274	1.49
July-September (Summer)	10.54	12.17	-1.63	4,377	4,976	0.88
October-December (Fall)	9.92	10.02	-0.10	7,137	9,843	0.73
Annual Total	45.53	42.23	3.30	12,043	10,770	1.12

Table B11. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Lewisburg

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	17,635	81%	4.04	0.676	0.672
TNO_x	11,741	84%	2.69	0.476	0.479
TNH_3	438	48%	0.10	0.018	0.018
DN	14,629	77%	3.35	0.596	0.599
DNO_x	11,723	84%	2.68	0.476	0.480
DNH_3	400	50%	0.09	0.017	0.017
TP	790	65%	0.18	0.022	0.022
DP	147	35%	0.03	0.006	0.006
DOP	167	79%	0.04	0.007	0.006
TOC	49,434	106%	11.32	1.794	1.753
TSS	775,593	65%	177.56	15.200	16.334
SS	555,147	83%	127.09	12.643	13.552

Table B12. Flow Normalized Trends at Lewisburg

Lewisburg Flow Normalized Trends	1985-2017				2005-2017			
	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	△	L	▼	L	△
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	HL	▼	L	▼	HL	▼	HL	▼
Total Organic Carbon	HL	▼	ALAN	-	HL	▼	L	△
Total Suspended Solids	L	▼	L	▼	ALAN	-	L	△
Suspended Sediment	L	▼	ALAN	-	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 B13. 2017 Annual and Seasonal Precipitation and Discharge at Newport

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	8.99	8.30	0.68	4,322	6,227	0.69
April-June (Spring)	14.23	11.28	2.95	6,530	5,495	1.19
July-September (Summer)	11.90	10.76	1.13	2,382	1,990	1.20
October-December (Fall)	9.67	9.58	0.10	2,956	3,597	0.82
Annual Total	44.79	39.92	4.87	4,048	4,327	0.94

Table B14. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Newport

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	12,713	84%	5.93	1.465	1.397
TNO_x	9,464	85%	4.41	1.126	1.055
TNH_3	250	69%	0.12	0.028	0.027
DN	11,318	83%	5.28	1.362	1.292
DNO_x	9,435	86%	4.40	1.122	1.052
DNH_3	235	75%	0.11	0.027	0.027
TP	454	60%	0.21	0.039	0.039
DP	171	53%	0.08	0.018	0.017
DOP	152	76%	0.07	0.016	0.015
TOC	25,600	87%	11.93	2.848	2.819
TSS	262,794	56%	122.50	15.294	17.611
SS	156,447	44%	72.93	10.926	11.444

Table B15. Flow Normalized Trends at Newport

Newport Flow Normalized Trends	1985-2017				2005-2017			
	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	L	▼	HL	▼	HL	▼	HL	▼
Ammonia	HL	▼	HL	▼	L	▼	L	▼
Total Phosphorus	HL	▼	HL	▼	HL	▼	VL	▼
Particulate Phosphorus	HL	▼	L	▼	HL	▼	HL	▼
Dissolved Phosphorus	HL	▼	HL	▼	HL	▼	HL	▼
Orthophosphorus	HL	▼	L	▼	HL	▼	HL	▼
Total Organic Carbon	HL	▼	HL	▼	VL	▼	ALAN	-
Total Suspended Solids	VL	▼	L	▼	HL	▼	HL	▼
Suspended Sediment	HL	▼	VL	▼	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 B16. 2017 Annual and Seasonal Precipitation and Discharge at Conestoga

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	7.80	9.11	-1.31	456	895	0.51
April-June (Spring)	12.73	11.63	1.09	645	732	0.88
July-September (Summer)	16.15	13.10	3.05	545	484	1.13
October-December (Fall)	7.09	10.77	-3.68	293	627	0.47
Annual Total	43.77	44.61	-0.84	485	685	0.71

Table B17. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Conestoga

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	5,461	56%	18.16	5.899	5.744
TNO_x	4,821	61%	16.03	5.351	5.105
TNH_3	77	35%	0.26	0.063	0.078
DN	5,269	59%	17.52	5.779	5.563
DNO_x	4,839	62%	16.09	5.373	5.120
DNH_3	74	36%	0.25	0.060	0.074
TP	218	37%	0.73	0.196	0.235
DP	155	60%	0.52	0.157	0.177
DOP	146	66%	0.49	0.148	0.169
TOC	3,136	44%	10.43	2.970	3.236
TSS	30,543	12%	101.54	15.412	28.171
SS	27,950	13%	92.92	13.649	32.255

Table B18. Flow Normalized Trends at Conestoga

Conestoga Flow Normalized Trends	1985-2017				2005-2017			
	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	▼	ALAN	-
Particulate Phosphorus	HL	▼	L	▼	VL	▼	L	▼
Dissolved Phosphorus	HL	▼	HL	▼	ALAN	-	L	△
Orthophosphorus	HL	▼	HL	▼	L	U	VL	△
Total Organic Carbon	HL	▼	HL	▼	HL	▼	L	▼
Total Suspended Solids	HL	▼	L	▼	HL	▼	L	△
Suspended Sediment	HL	▼	VL	▼	VL	▼	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 B19. 2017 Annual and Seasonal Precipitation and Discharge at Unadilla

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	11.21	8.63	2.57	1,657	1,293	1.28
April-June (Spring)	17.42	12.19	5.23	1,980	1,245	1.59
July-September (Summer)	11.64	12.60	-0.95	489	543	0.90
October-December (Fall)	8.58	10.80	-2.22	434	975	0.44
Annual Total	48.84	44.22	4.63	1,140	1,014	1.12

Table B20. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Unadilla

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	2,498	123%	7.51	0.984	0.984
TNO_x	1,465	125%	4.40	0.631	0.640
TNH_3	51	73%	0.15	0.020	0.020
DN	2,181	125%	6.55	0.946	0.960
DNO_x	1,503	129%	4.52	0.642	0.649
DNH_3	53	82%	0.16	0.021	0.021
TP	155	88%	0.47	0.033	0.031
DP	25	54%	0.07	0.009	0.009
DOP	17	47%	0.05	0.006	0.006
TOC	7,242	107%	21.76	2.876	2.874
TSS	152,011	105%	456.76	25.215	24.402
SS	138,315	109%	415.61	22.929	22.298

Table B21. Flow Normalized Trends at Unadilla

Unadilla Flow Normalized Trends	2006-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	△	L	△
Nitrate/Nitrite	L	△	L	△
Ammonia	HL	▼	HL	▼
Dissolved Nitrogen	HL	△	L	△
Nitrate/Nitrite	HL	△	L	△
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	L	△	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 B22. 2017 Annual and Seasonal Precipitation and Discharge at Conklin

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	12.17	8.77	3.40	6,608	5,296	1.25
April-June (Spring)	17.61	12.33	5.28	7,640	5,044	1.51
July-September (Summer)	11.75	12.67	-0.92	1,899	2,184	0.87
October-December (Fall)	8.21	10.74	-2.53	1,474	3,801	0.39
Annual Total	49.75	44.52	5.23	4,405	4,081	1.08

Table B23. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Conklin

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	7,221	108%	5.06	0.712	0.707
TNO_x	3,590	106%	2.52	0.383	0.381
TNH_3	200	70%	0.14	0.019	0.019
DN	6,019	110%	4.22	0.660	0.662
DNO_x	3,709	109%	2.60	0.394	0.392
DNH_3	192	72%	0.13	0.019	0.018
TP	689	82%	0.48	0.039	0.039
DP	112	54%	0.08	0.010	0.011
DOP	62	43%	0.04	0.006	0.006
TOC	27,345	107%	19.16	2.745	2.809
TSS	722,021	86%	505.90	30.583	30.394
SS	714,068	116%	500.33	30.465	29.758

Table B24. Flow Normalized Trends at Conklin

Conklin Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	HL	▼	HL	▼
Dissolved Nitrogen	L	▼	L	▼
Nitrate/Nitrite	L	▼	L	▼
Ammonia	HL	▼	HL	▼
Total Phosphorus	HL	▼	HL	▼
Particulate Phosphorus	L	▼	L	▼
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	L	▼	L	△
Total Suspended Solids	L	△	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 B25. 2017 Annual and Seasonal Precipitation and Discharge at Smithboro

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2016	LTM	% LTM
January-March (Winter)	11.67	8.53	3.15	14,360	11,852	1.21
April-June (Spring)	17.30	12.07	5.22	16,294	10,761	1.51
July-September (Summer)	12.23	12.45	-0.22	4,804	4,475	1.07
October-December (Fall)	8.70	10.59	-1.90	3,939	8,701	0.45
Annual Total	49.89	43.64	6.25	9,849	8,947	1.10

Table B26. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Smithboro

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	19,918	114%	6.57	0.967	0.966
TNO_x	10,459	113%	3.45	0.575	0.572
TNH_3	900	112%	0.30	0.048	0.048
DN	16,931	114%	5.59	0.873	0.883
DNO_x	10,520	113%	3.47	0.554	0.565
DNH_3	887	116%	0.29	0.046	0.046
TP	1,771	96%	0.58	0.057	0.056
DP	396	85%	0.13	0.019	0.019
DOP	235	72%	0.08	0.012	0.012
TOC	67,542	113%	22.29	3.180	3.228
TSS	1,337,342	89%	441.40	32.496	32.174
SS	1,547,410	126%	510.74	35.852	33.619

Table B27. Flow Normalized Trends at Smithboro

Smithboro Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	▼	L	▼
Nitrate/Nitrite	ALAN	-	L	▼
Ammonia	L	△	L	▼
Dissolved Nitrogen	ALAN	-	L	▼
Nitrate/Nitrite	ALAN	-	L	▼
Ammonia	ALAN	-	ALAN	-
Total Phosphorus	HL	▼	VL	▼
Particulate Phosphorus	HL	▼	L	▼
Dissolved Phosphorus	VL	▼	VL	▼
Orthophosphorus	VL	▼	VL	▼
Total Organic Carbon	ALAN	-	L	△
Total Suspended Solids	VL	△	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 B28. 2017 Annual and Seasonal Precipitation and Discharge at Cohocton

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	7.95	6.21	1.74	1,014	778	1.30
April-June (Spring)	13.88	10.60	3.27	1,011	641	1.58
July-September (Summer)	11.13	11.59	-0.46	158	184	0.86
October-December (Fall)	9.36	8.71	0.65	280	418	0.67
Annual Total	42.31	37.03	5.28	616	505	1.22

Table B29. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Cohocton

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	2,118	129%	7.04	1.585	1.598
TNO_x	1,432	138%	4.76	1.131	1.156
TNH_3	30	75%	0.10	0.021	0.020
DN	1,942	135%	6.46	1.539	1.558
DNO_x	1,464	140%	4.87	1.151	1.177
DNH_3	36	89%	0.12	0.025	0.024
TP	82	90%	0.27	0.036	0.033
DP	18	66%	0.06	0.012	0.012
DOP	13	66%	0.04	0.008	0.008
TOC	5,326	117%	17.71	3.865	3.747
TSS	55,367	101%	184.07	18.107	16.347
SS	54,960	109%	182.71	17.780	15.799

Table B30. Flow Normalized Trends at Cohocton

Cohocton Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	△	HL	△
Nitrate/Nitrite	VL	△	HL	△
Ammonia	HL	▼	HL	▼
Dissolved Nitrogen	HL	△	HL	△
Nitrate/Nitrite	HL	△	HL	△
Ammonia	HL	▼	HL	▼
Total Phosphorus	HL	▼	VL	▼
Particulate Phosphorus	L	▼	ALAN	-
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	ALAN	-	L	△
Total Suspended Solids	L	△	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 B31. 2017 Annual and Seasonal Precipitation and Discharge at Chemung

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	7.91	6.37	1.54	5,086	4,320	1.18
April-June (Spring)	13.08	10.40	2.68	4,902	3,431	1.43
July-September (Summer)	10.17	10.88	-0.71	627	865	0.72
October-December (Fall)	8.57	8.37	0.20	1,416	2,358	0.60
Annual Total	39.73	36.01	3.72	3,008	2,744	1.10

Table B32. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Chemung

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	7,182	111%	4.37	1.116	1.104
TNO_x	4,207	122%	2.56	0.725	0.712
TNH_3	252	107%	0.15	0.034	0.033
DN	6,153	115%	3.75	1.027	1.034
DNO_x	4,040	118%	2.46	0.686	0.695
DNH_3	233	104%	0.14	0.034	0.033
TP	498	72%	0.30	0.049	0.047
DP	101	60%	0.06	0.018	0.018
DOP	68	53%	0.04	0.012	0.012
TOC	22,498	104%	13.69	3.280	3.255
TSS	430,863	67%	262.26	27.300	28.534
SS	411,057	83%	250.21	25.690	26.586

Table B33. Flow Normalized Trends at Chemung

Chemung Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	ALAN	-	ALAN	-
Nitrate/Nitrite	L	△	L	△
Ammonia	ALAN	-	L	▼
Dissolved Nitrogen	ALAN	-	ALAN	-
Nitrate/Nitrite	ALAN	-	ALAN	-
Ammonia	ALAN	-	ALAN	-
Total Phosphorus	HL	▼	VL	▼
Particulate Phosphorus	HL	▼	L	▼
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	ALAN	-	L	△
Total Suspended Solids	ALAN	-	L	△
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 B34.   2017 Annual and Seasonal Precipitation and Discharge at Wilkes-Barre

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	10.25	7.82	2.44	24,520	20,770	1.18
April-June (Spring)	15.58	11.52	4.06	28,329	18,164	1.56
July-September (Summer)	11.40	11.92	-0.52	7,266	6,964	1.04
October-December (Fall)	8.29	9.82	-1.53	6,571	13,856	0.47
Annual Total	45.52	41.08	4.44	16,672	14,938	1.12

Table B35. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Wilkes-Barre

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	33,140	115%	5.10	0.881	0.879
TNO_x	17,953	115%	2.76	0.510	0.510
TNH_3	1,312	99%	0.20	0.038	0.038
DN	25,449	110%	3.92	0.723	0.722
DNO_x	17,888	115%	2.75	0.509	0.508
DNH_3	1,199	100%	0.18	0.036	0.036
TP	3,922	92%	0.60	0.071	0.073
DP	527	71%	0.08	0.014	0.014
DOP	353	63%	0.05	0.009	0.009
TOC	118,872	104%	18.30	3.161	3.135
TSS	3,790,296	62%	583.65	48.095	70.669
SS	2,846,439	58%	438.31	38.072	52.223

Table B36.   Flow Normalized Trends at Wilkes-Barre

Wilkes-Barre Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	▼	L	△
Nitrate/Nitrite	ALAN	-	ALAN	-
Ammonia	HL	▼	L	▼
Dissolved Nitrogen	L	▼	L	▼
Nitrate/Nitrite	ALAN	-	ALAN	-
Ammonia	L	▼	VL	▼
Total Phosphorus	L	▼	L	△
Particulate Phosphorus	L	△	L	△
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	L	▼	ALAN	-
Total Suspended Solids	L	△	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 B37. 2017 Annual and Seasonal Precipitation and Discharge at Karthaus

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2016	LTM	% LTM
January-March (Winter)	9.92	8.90	1.01	3,881	3,555	1.09
April-June (Spring)	16.09	11.89	4.20	3,758	2,554	1.47
July-September (Summer)	9.75	11.88	-2.14	948	908	1.04
October-December (Fall)	10.20	10.13	0.07	1,459	1,973	0.74
Annual Total	45.96	42.80	3.15	2,511	2,248	1.12

Table B38. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Karthaus

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	3,362	114%	3.78	0.570	0.555
TNO_x	2,185	116%	2.45	0.378	0.369
TNH_3	163	87%	0.18	0.030	0.031
DN	2,773	109%	3.11	0.492	0.482
DNO_x	2,198	117%	2.47	0.382	0.373
DNH_3	144	86%	0.16	0.027	0.027
TP	127	95%	0.14	0.016	0.015
DP	15	60%	0.02	0.003	0.003
DOP	28	101%	0.03	0.005	0.005
TOC	10,749	111%	12.07	1.855	1.772
TSS	121,159	98%	136.10	13.695	13.940
SS	90,544	93%	101.71	11.080	11.261

Table B39. Flow Normalized Trends at Karthaus

Karthaus Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	ALAN	-	L	△
Nitrate/Nitrite	ALAN	-	L	△
Ammonia	HL	▼	HL	▼
Dissolved Nitrogen	L	▼	ALAN	-
Nitrate/Nitrite	ALAN	-	L	△
Ammonia	HL	▼	HL	▼
Total Phosphorus	HL	▼	L	▼
Particulate Phosphorus	HL	▼	L	▼
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	N/A	N/A	N/A	N/A
Total Organic Carbon	ALAN	-	VL	△
Total Suspended Solids	ALAN	-	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 B40. 2017 Annual and Seasonal Precipitation and Discharge at Jersey Shore

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2016	LTM	% LTM
January-March (Winter)	9.70	8.43	1.27	12,996	12,162	1.07
April-June (Spring)	15.98	11.62	4.36	14,155	9,449	1.50
July-September (Summer)	9.99	11.93	-1.93	2,822	2,785	1.01
October-December (Fall)	10.09	9.96	0.13	5,234	7,225	0.72
Annual Total	45.77	41.94	3.83	8,802	7,905	1.11

Table B41. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Jersey Shore

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	11,012	106%	3.29	0.594	0.601
TNO_x	7,059	100%	2.11	0.400	0.409
TNH_3	418	93%	0.12	0.023	0.023
DN	9,172	101%	2.74	0.528	0.539
DNO_x	7,086	101%	2.12	0.401	0.410
DNH_3	303	79%	0.09	0.018	0.018
TP	513	92%	0.15	0.019	0.019
DP	77	50%	0.02	0.005	0.005
DOP	110	80%	0.03	0.006	0.005
TOC	35,080	113%	10.48	1.764	1.718
TSS	348,473	85%	104.13	9.447	9.184
SS	248,291	79%	74.19	7.222	7.109

Table B42. Flow Normalized Trends at Jersey Shore

Jersey Shore Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	ALAN	-
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	HL	▼	L	▼
Dissolved Nitrogen	HL	▼	VL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	HL	▼	VL	▼
Total Phosphorus	HL	▼	HL	▼
Particulate Phosphorus	ALAN	-	L	△
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	ALAN	-	L	△
Total Suspended Solids	L	▼	L	▼
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 B43. 2017 Annual and Seasonal Precipitation and Discharge at Penns Creek

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	8.42	8.73	-0.31	296	638	0.46
April-June (Spring)	14.33	11.91	2.42	673	577	1.17
July-September (Summer)	11.59	12.56	-0.97	211	207	1.02
October-December (Fall)	10.51	10.34	0.16	341	406	0.84
Annual Total	44.84	43.55	1.29	380	457	0.83

Table B44. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Penns Creek

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	1,161	86%	5.95	1.393	1.396
TNO_x	868	86%	4.45	1.109	1.096
TNH_3	21	68%	0.11	0.025	0.026
DN	1,049	85%	5.38	1.323	1.319
DNO_x	872	86%	4.47	1.112	1.099
DNH_3	19	69%	0.10	0.024	0.024
TP	53	78%	0.27	0.036	0.040
DP	22	70%	0.11	0.018	0.020
DOP	19	77%	0.10	0.015	0.017
TOC	2,720	90%	13.93	2.664	2.779
TSS	22,956	66%	117.60	10.491	12.179
SS	14,819	58%	75.92	7.906	9.410

Table B45. Flow Normalized Trends at Penns Creek

Penns Creek Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	VL	△	HL	△
Nitrate/Nitrite	HL	△	VL	△
Ammonia	VL	▼	L	▼
Dissolved Nitrogen	VL	△	HL	U
Nitrate/Nitrite	VL	△	L	△
Ammonia	L	▼	VL	▼
Total Phosphorus	HL	▼	L	▼
Particulate Phosphorus	L	△	L	△
Dissolved Phosphorus	HL	▼	HL	▼
Orthophosphorus	HL	▼	HL	▼
Total Organic Carbon	ALAN	-	L	△
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 B46. 2017 Annual and Seasonal Precipitation and Discharge at East Mahantango

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	9.06	8.98	0.08	215	104	2.06
April-June (Spring)	12.49	12.37	0.12	220	98	2.23
July-September (Summer)	16.70	13.37	3.33	284	48	5.94
October-December (Fall)	7.91	10.83	-2.92	92	58	1.60
Annual Total	46.16	45.56	0.60	203	77	2.63

Table B47. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at East Mahantango

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	2,221	121%	21.42	4.361	4.187
TNO_x	1,934	118%	18.65	3.995	3.842
TNH_3	18	99%	0.17	0.034	0.035
DN	2,103	120%	20.28	4.294	4.130
DNO_x	1,937	118%	18.69	3.993	3.839
DNH_3	15	91%	0.14	0.027	0.029
TP	58	146%	0.56	0.072	0.074
DP	19	123%	0.18	0.038	0.041
DOP	16	120%	0.16	0.034	0.038
TOC	1,465	125%	14.13	2.334	2.260
TSS	72,946	200%	703.56	25.492	18.310
SS	35,869	154%	345.96	15.696	12.315

Table B48. Flow Normalized Trends at East Mahantango

East Mahantango Flow Normalized Trends	2012-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	△	HL	△
Nitrate/Nitrite	HL	△	HL	△
Ammonia	ALAN	-	L	▼
Dissolved Nitrogen	HL	△	HL	△
Nitrate/Nitrite	HL	△	HL	△
Ammonia	L	▼	L	▼
Total Phosphorus	ALAN	-	ALAN	-
Particulate Phosphorus	ALAN	-	ALAN	-
Dissolved Phosphorus	L	▼	L	▼
Orthophosphorus	L	▼	L	▼
Total Organic Carbon	ALAN	-	ALAN	-
Total Suspended Solids	N/A	N/A	N/A	N/A
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 B49. 2017 Annual and Seasonal Precipitation and Discharge at Saxton

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	10.29	8.08	2.21	1,254	1,347	0.93
April-June (Spring)	15.26	11.13	4.14	1,511	1,151	1.31
July-September (Summer)	12.01	10.12	1.89	455	270	1.69
October-December (Fall)	9.14	9.06	0.08	520	664	0.78
Annual Total	46.71	38.39	8.32	935	858	1.09

Table B50. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Saxton

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	3,706	111%	7.68	1.966	1.976
TNO_x	2,763	108%	5.73	1.587	1.614
TNH_3	65	102%	0.14	0.030	0.029
DN	3,243	108%	6.72	1.832	1.853
DNO_x	2,753	108%	5.71	1.587	1.616
DNH_3	62	106%	0.13	0.030	0.030
TP	120	106%	0.25	0.043	0.040
DP	40	120%	0.08	0.019	0.017
DOP	34	143%	0.07	0.016	0.014
TOC	6,599	112%	13.67	2.847	2.630
TSS	103,426	88%	214.33	21.852	20.657
SS	89,414	75%	185.29	18.972	18.034

Table B51. Flow Normalized Trends at Saxton

Saxton Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	▼	ALAN	-
Nitrate/Nitrite	L	▼	L	▼
Ammonia	L	▼	L	▼
Dissolved Nitrogen	L	▼	L	▼
Nitrate/Nitrite	L	▼	L	▼
Ammonia	L	△	ALAN	-
Total Phosphorus	HL	△	HL	△
Particulate Phosphorus	HL	△	HL	△
Dissolved Phosphorus	VL	△	L	△
Orthophosphorus	HL	△	HL	△
Total Organic Carbon	L	▼	L	△
Total Suspended Solids	ALAN	-	L	▼
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 B52. 2017 Annual and Seasonal Precipitation and Discharge at Kishacoquillas

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	8.40	8.46	-0.06	131	91	1.45
April-June (Spring)	14.71	11.37	3.34	348	105	3.30
July-September (Summer)	12.12	11.00	1.12	128	42	3.07
October-December (Fall)	10.64	9.71	0.93	215	55	3.93
Annual Total	45.86	40.53	5.33	206	73	2.81

Table B53. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Kishacoquillas

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	1,163	113%	11.15	3.116	3.164
TNO_x	955	106%	9.16	2.727	2.793
TNH_3	10	104%	0.09	0.023	0.022
DN	1,082	110%	10.37	3.030	3.093
DNO_x	958	107%	9.18	2.738	2.806
DNH_3	8	88%	0.08	0.021	0.021
TP	29	122%	0.28	0.054	0.054
DP	14	100%	0.14	0.032	0.033
DOP	13	107%	0.13	0.030	0.032
TOC	1,393	138%	13.35	2.274	2.081
TSS	15,677	166%	150.27	12.751	11.276
SS	15,677	166%	150.27	12.751	11.276

Table B54. Flow Normalized Trends at Kishacoquillas

Kishacoquillas Flow Normalized Trends	2012-2017			
	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	HL	▼	L	▼
Total Phosphorus	L	▼	L	▼
Particulate Phosphorus	L	△	L	△
Dissolved Phosphorus	HL	▼	VL	▼
Orthophosphorus	HL	▼	L	▼
Total Organic Carbon	L	▼	ALAN	-
Total Suspended Solids	N/A	N/A	N/A	N/A
Suspended Sediment	N/A	N/A	N/A	N/A

- 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 B55. 2017 Annual and Seasonal Precipitation and Discharge at Shermans

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	7.93	8.79	-0.86	227	411	0.55
April-June (Spring)	12.70	11.61	1.09	325	364	0.89
July-September (Summer)	13.54	11.57	1.97	187	124	1.50
October-December (Fall)	9.89	10.02	-0.13	255	298	0.86
Annual Total	44.06	41.99	2.07	248	299	0.83

Table B56. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Shermans

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	890	79%	7.40	1.603	1.558
TNO_x	699	81%	5.81	1.317	1.260
TNH_3	17	63%	0.14	0.028	0.030
DN	834	81%	6.93	1.545	1.492
DNO_x	698	81%	5.80	1.315	1.259
DNH_3	16	60%	0.13	0.027	0.029
TP	36	63%	0.30	0.042	0.044
DP	22	75%	0.18	0.027	0.028
DOP	19	81%	0.16	0.024	0.025
TOC	1,823	79%	15.15	2.629	2.605
TSS	10,167	37%	84.50	8.380	9.434
SS	7,199	39%	59.83	6.551	6.984

Table B57. Flow Normalized Trends at Shermans

Shermans Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	L	▼
Nitrate/Nitrite	VL	▼	L	▼
Ammonia	L	▼	L	▼
Dissolved Nitrogen	HL	▼	L	▼
Nitrate/Nitrite	HL	▼	ALAN	-
Ammonia	L	▼	ALAN	-
Total Phosphorus	ALAN	-	L	▼
Particulate Phosphorus	ALAN	-	L	▼
Dissolved Phosphorus	L	△	ALAN	-
Orthophosphorus	HL	△	L	△
Total Organic Carbon	ALAN	-	ALAN	-
Total Suspended Solids	L	▼	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 B58. 2017 Annual and Seasonal Precipitation and Discharge at Conodoguinet

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	8.08	8.90	-0.82	468	813	0.58
April-June (Spring)	12.03	11.74	0.29	544	740	0.73
July-September (Summer)	14.56	11.52	3.04	496	338	1.47
October-December (Fall)	9.59	9.93	-0.34	441	591	0.75
Annual Total	44.26	42.10	2.16	487	621	0.79

Table B59. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Conodoguinet

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	3,373	74%	11.29	3.505	3.491
TNO_x	2,893	73%	9.68	3.096	3.059
TNH_3	42	72%	0.14	0.035	0.038
DN	3,239	74%	10.84	3.419	3.386
DNO_x	2,897	73%	9.69	3.102	3.062
DNH_3	41	76%	0.14	0.035	0.038
TP	57	67%	0.19	0.037	0.041
DP	28	82%	0.09	0.021	0.021
DOP	24	88%	0.08	0.017	0.018
TOC	3,267	77%	10.93	2.650	2.748
TSS	29,782	57%	99.64	13.394	17.676
SS	26,100	55%	87.32	11.691	15.265

Table B60. Flow Normalized Trends at Conodoguinet

Conodoguinet Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	ALAN	-	ALAN	-
Dissolved Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	ALAN	-	L	△
Total Phosphorus	ALAN	-	ALAN	-
Particulate Phosphorus	ALAN	-	ALAN	-
Dissolved Phosphorus	L	△	ALAN	-
Orthophosphorus	L	△	L	△
Total Organic Carbon	ALAN	-	ALAN	-
Total Suspended Solids	L	△	L	△
Suspended Sediment	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 B61. 2017 Annual and Seasonal Precipitation and Discharge at Paxton

Season	Discharge (cfs)		
	2017	LTM	% LTM
January-March (Winter)	13	7	1.82
April-June (Spring)	16	7	2.26
July-September (Summer)	20	4	4.70
October-December (Fall)	9	6	1.53
Annual Total	14	6	2.38

Table B62. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Paxton

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	44.34	91%	5.77	1.354	1.379
TNO_x	30.61	84%	3.99	1.065	1.083
TNH_3	1.13	110%	0.15	0.024	0.024
DN	38.73	88%	5.04	1.291	1.314
DNO_x	30.13	84%	3.92	1.058	1.076
DNH_3	1.01	101%	0.13	0.022	0.022
TP	2.20	112%	0.29	0.033	0.032
DP	0.91	114%	0.12	0.017	0.016
DOP	0.84	113%	0.11	0.016	0.016
TOC	121.14	101%	15.77	2.660	2.668
TSS	1,931.51	90%	251.50	13.622	15.241
SS	1,931.51	90%	251.50	13.622	15.241

Table B63. Flow Normalized Trends at Paxton

Paxton Flow Normalized Trends	2012-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	L	△	ALAN	-
Nitrate/Nitrite	ALAN	-	L	▼
Ammonia	ALAN	-	L	△
Dissolved Nitrogen	ALAN	-	L	▼
Nitrate/Nitrite	ALAN	-	VL	▼
Ammonia	N/A	N/A	N/A	N/A
Total Phosphorus	VL	△	ALAN	-
Particulate Phosphorus	VL	△	ALAN	-
Dissolved Phosphorus	L	△	VL	△
Orthophosphorus	L	△	L	△
Total Organic Carbon	ALAN	-	L	△
Total Suspended Solids	N/A	N/A	N/A	N/A
Suspended Sediment	N/A	N/A	N/A	N/A

- 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 B64. 2017 Annual and Seasonal Precipitation and Discharge at Swatara

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	8.24	9.35	-1.10	747	1,063	0.70
April-June (Spring)	13.17	12.44	0.73	1,032	905	1.14
July-September (Summer)	15.18	13.78	1.40	1,253	623	2.01
October-December (Fall)	8.30	11.31	-3.02	466	813	0.57
Annual Total	49.08	46.88	2.20	874	851	1.03

Table B65. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Swatara

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	5,395	93%	17.42	3.214	3.236
TNO_x	4,357	88%	14.07	2.776	2.819
TNH_3	106	84%	0.34	0.045	0.047
DN	5,016	91%	16.19	3.104	3.137
DNO_x	4,328	88%	13.97	2.759	2.803
DNH_3	101	85%	0.33	0.043	0.046
TP	221	98%	0.71	0.072	0.068
DP	83	95%	0.27	0.035	0.035
DOP	71	97%	0.23	0.030	0.030
TOC	6,993	103%	22.58	2.896	2.709
TSS	131,916	96%	425.87	26.897	22.305
SS	108,200	94%	349.30	23.348	17.044

Table B66. Flow Normalized Trends at Swatara

Swatara Flow Normalized Trends	2005-2017			
	Concentration		Load	
Parameter/code	Likeliness	Trend	Likeliness	Trend
Total Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	VL	▼	ALAN	-
Dissolved Nitrogen	HL	▼	HL	▼
Nitrate/Nitrite	HL	▼	HL	▼
Ammonia	L	▼	ALAN	-
Total Phosphorus	ALAN	-	L	△
Particulate Phosphorus	L	△	L	△
Dissolved Phosphorus	L	▼	L	△
Orthophosphorus	L	▼	L	△
Total Organic Carbon	ALAN	-	ALAN	-
Total Suspended Solids	VL	△	VL	△
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 B67. 2017 Annual and Seasonal Precipitation and Discharge at West Conewago

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	8.40	9.47	-1.07	569	1,010	0.56
April-June (Spring)	11.78	11.76	0.02	604	715	0.85
July-September (Summer)	13.43	12.39	1.04	217	338	0.64
October-December (Fall)	8.65	10.43	-1.78	297	719	0.41
Annual Total	42.26	44.06	-1.80	422	695	0.61

Table B68. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at West Conewago

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	1,826	52%	5.57	1.832	1.894
TNO_x	1,260	51%	3.85	1.322	1.332
TNH_3	67	59%	0.20	0.054	0.062
DN	1,663	53%	5.08	1.733	1.763
DNO_x	1,260	52%	3.84	1.322	1.332
DNH_3	63	58%	0.19	0.051	0.058
TP	143	43%	0.44	0.127	0.151
DP	95	50%	0.29	0.101	0.114
DOP	82	50%	0.25	0.087	0.099
TOC	4,376	51%	13.35	4.418	4.736
TSS	35,421	28%	108.10	14.523	22.976
SS	27,104	25%	82.72	12.312	18.284

Table B69. Flow Normalized Trends at West Conewago

West Conewago Flow Normalized Trends	2005-2017			
	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	△	VL	△
Total Phosphorus	L	△	L	△
Particulate Phosphorus	ALAN	-	ALAN	-
Dissolved Phosphorus	L	△	L	△
Orthophosphorus	L	△	VL	△
Total Organic Carbon	ALAN	-	L	▼
Total Suspended Solids	ALAN	-	L	▼
Suspended Sediment	ALAN	-	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 B70. 2017 Annual and Seasonal Precipitation and Discharge at Pequea

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	8.00	9.37	-1.38	103	254	0.40
April-June (Spring)	11.91	11.47	0.45	133	216	0.61
July-September (Summer)	13.81	12.69	1.13	95	127	0.75
October-December (Fall)	7.42	10.89	-3.47	72	187	0.38
Annual Total	41.15	44.42	-3.28	101	196	0.51

Table B71. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Pequea

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	1,288	47%	13.50	6.519	6.300
TNO_x	1,191	52%	12.49	6.152	5.558
TNH_3	12	23%	0.12	0.046	0.094
DN	1,259	49%	13.20	6.430	6.028
DNO_x	1,189	52%	12.47	6.142	5.551
DNH_3	12	25%	0.13	0.046	0.096
TP	38	20%	0.40	0.152	0.299
DP	25	30%	0.26	0.109	0.183
DOP	23	30%	0.24	0.098	0.169
TOC	536	28%	5.62	2.357	3.481
TSS	6,966	7%	73.05	20.100	71.837
SS	6,280	7%	65.86	18.190	56.101

Table B72. Flow Normalized Trends at Pequea

Pequea Flow Normalized Trends	2005-2017			
	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	L	△	L	△
Total Phosphorus	HL	△	VL	△
Particulate Phosphorus	HL	△	L	△
Dissolved Phosphorus	HL	△	VL	△
Orthophosphorus	HL	△	HL	△
Total Organic Carbon	L	△	L	△
Total Suspended Solids	L	△	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 B73. 2017 Annual and Seasonal Precipitation and Discharge at Octoraro

Season	Precipitation (inches)			Discharge (cfs)		
	2017	LTM	LTM Departure	2017	LTM	% LTM
January-March (Winter)	7.82	10.15	-2.33	128	300	0.43
April-June (Spring)	12.44	11.78	0.66	161	237	0.68
July-September (Summer)	14.97	13.50	1.47	136	171	0.79
October-December (Fall)	7.51	11.27	-3.76	73	189	0.38
Annual Total	42.73	46.69	-3.95	124	225	0.55

Table B74. 2017 Annual Loads (1000's lbs), Yields (lbs/acre), and Concentrations (mg/L) at Octoraro

Parameter	Load	Load % of LTM	Yield	Conc	FNC
TN	1,388	49%	11.48	5.564	5.570
TNO_x	1,239	50%	10.24	5.062	4.932
TNH_3	12	21%	0.10	0.038	0.060
DN	1,351	50%	11.17	5.465	5.410
DNO_x	1,241	51%	10.26	5.074	4.940
DNH_3	13	21%	0.10	0.039	0.060
TP	22	24%	0.18	0.067	0.103
DP	13	27%	0.11	0.045	0.066
DOP	10	25%	0.09	0.035	0.054
TOC	781	40%	6.46	2.880	3.297
TSS	3,920	11%	32.41	8.615	20.171
SS	3,550	14%	29.35	8.042	15.710

Table B75. Flow Normalized Trends at Octoraro

Octoraro Flow Normalized Trends	2007-2017			
	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	▼	VL	▼
Ammonia	L	▼	L	▼
Total Phosphorus	VL	▼	ALAN	-
Particulate Phosphorus	ALAN	-	ALAN	-
Dissolved Phosphorus	HL	▼	L	▼
Orthophosphorus	HL	▼	L	▼
Total Organic Carbon	L	▼	L	▼
Total Suspended Solids	L	△	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