# Total Phosphorus (TP) and Nitrate (NO$_3$-N) Discrete Sampling at Continuous Instream Monitoring (CIM) Stations in Upper and Chemung Subbasins

The Susquehanna River Basin Commission (Commission) launched the Continuous Instream Monitoring (CIM) (formerly known as the Remote Water Quality Monitoring Network/RWQMN) in 2010 to measure water quality indicators across the Susquehanna River Basin. Over 65 historic and active CIM stations exist basinwide, with 23 in the Upper and Chemung Subbasins. Water quality parameter data are measured and transmitted every 15 minutes at these stations. **Trends** in water chemistry data (temperature, dissolved oxygen, pH, turbidity, and specific conductivity) at sites with more than 10 years of data can be explored on the CIM StoryMap and CIM Dashboard. Additional sampling occurs each year including **discrete water sampling for nutrients and metals**, **macroinvertebrate surveys, fish surveys**, and **streamflow measurements**. These data are available upon request (cim@srbc.gov).
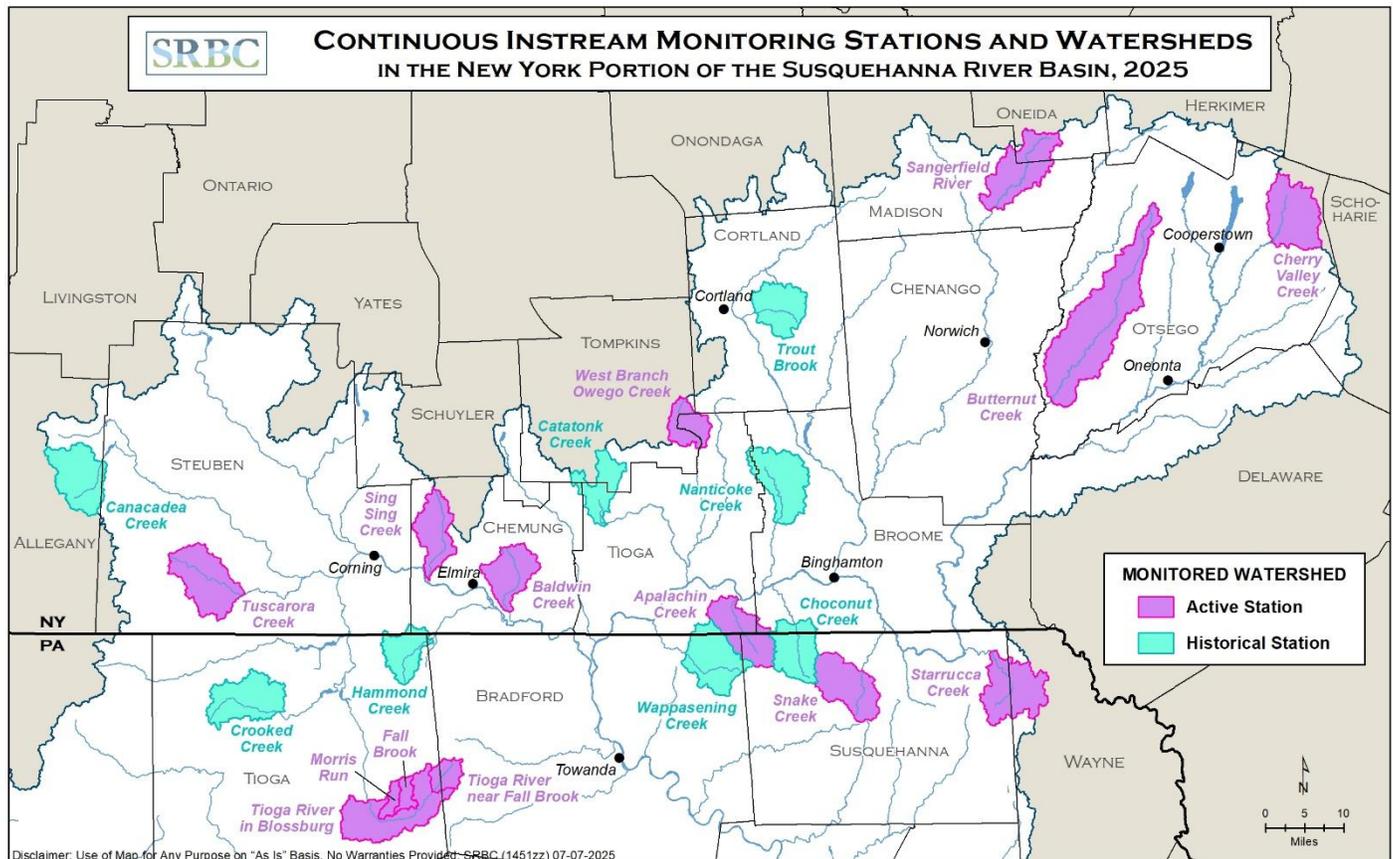
Location of Upper and Chemung Subbasin CIM sites and watersheds: historic (teal) and active (purple) (2010-2025)

Nutrient pollution has been linked to the declining health of the Chesapeake Bay. While the Chesapeake Bay is located far downstream, nutrient contribution from even small streams in New York plays a role. Discrete water quality samples at CIM sites are analyzed for many parameters, including the nutrients **total phosphorus (TP)** and **nitrate (NO$_3$-N).** The following pages show summaries of TP and NO$_3$-N results (2010-2024) from 19 of the 23 historic and active Chemung and Upper subbasins sites.*

These summaries include:

- Site overviews and map insets showing watershed locations in the basin,
- QR codes and hyperlinks to access individual watershed profiles,
- Annual average values of TP and NO$_3$-N, and
- Boxplots showing the ranges of total phosphorus (TP) and nitrate (NO$_3$-N) values.

*Three new active CIM stations (Tioga River in Blossburg, Morris Run, and Fall Brook) started collecting data in 2025 and are not included in this analysis. The Kirkwood, NY CIM station does not collect discrete data, only continuous, and is not shown on the map. All CIM sites have Watershed Profiles available online.

Boxplots (or box-and-whisker plots) are used to visualize the range and distribution of TP and NO_3-N data. Boxplots show a five-number summary of data: minimum value (bottom line), maximum value (upper line), and the Interquartile Range (IQR), made up of 3 segments in between.

The **"whiskers"** are the lines that connect the minimum and maximum values to the IQR. The first IQR **(Q1)** indicates where the lower 25% of data fall. The median (the middle value when numbers are sorted, or **Q2**) indicates where 50% of data fall above and 50% fall below. The upper quartile **(Q3)** indicates where the upper 25% of data fall. A boxplot with normal distribution is to the right **(a).**

(a)
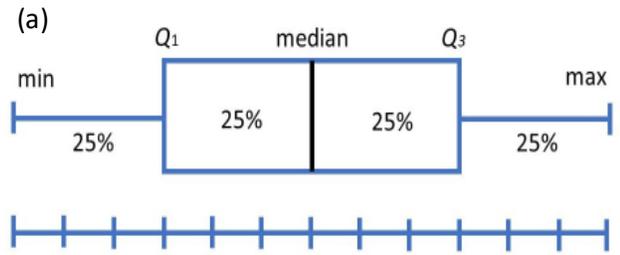
Boxplot with normal distribution. Image from
https://www.simplypsychology.org/boxplots.html

Sometimes the **median value (Q2)** falls above or below the middle of the box. When the median is closer to the minimum values, the boxplot has a **positive skew**, meaning most values are higher than the median. When the median is closer to the maximum value, the boxplot has a **negative skew (b)** meaning most values are lower than the median. When a value falls more than 1.5x the value of the IQR (or Q3-Q1), it is considered an **outlier**, and is represented by a dot above or below the minimum or maximum values **(c)**.

(b)

(c)
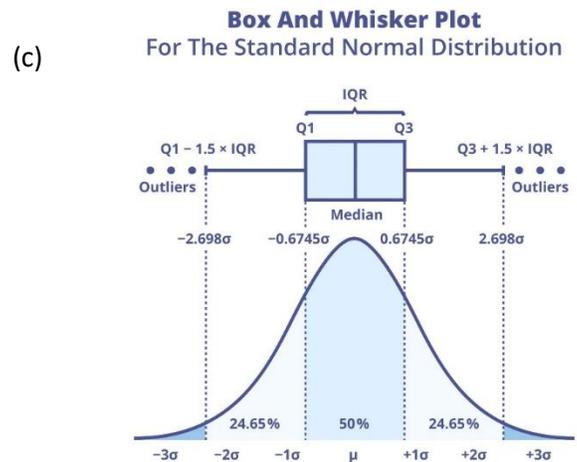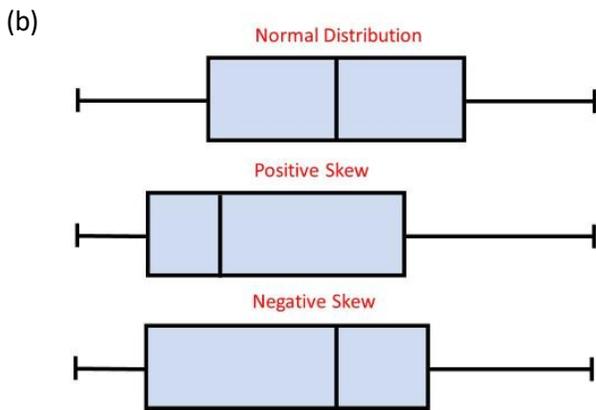
Possible boxplot distributions (b) and boxplot explanation in respect to the standard normal distribution (c). Images from
https://www.simplypsychology.org/boxplots.html

Using our **nitrate data** (below), you can see examples of differently skewed boxplots. **Apalachin Creek (left)** has a relatively even distribution for nitrate values, whereas **Canacadea Creek (center)** has a positive skew, and **Wappasening Creek (right)** has a slightly negative skew. In our boxplots, the X represents the mean, or average, value. The width of a boxplot reflects variability of the data. The wider a box, the more spread there is among the data points.
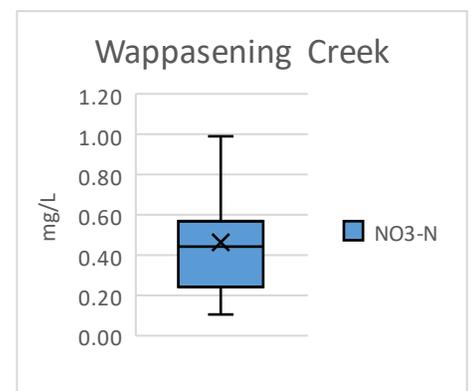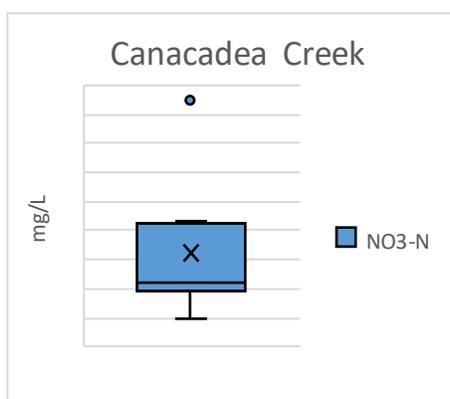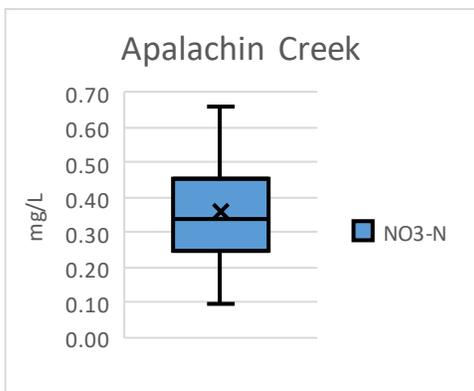
Boxplots for all sites for **NO₃-N data (a)** and **TP data (b)** are presented below. An outlier in the nitrate-N dataset was removed (Sangerfield River, 4.60 mg/L), and two outliers from the phosphorus dataset were removed (Baldwin Creek, 0.71 mg/L and Butternut Creek, 4.40 mg/L) to better visualize results at a smaller scale.
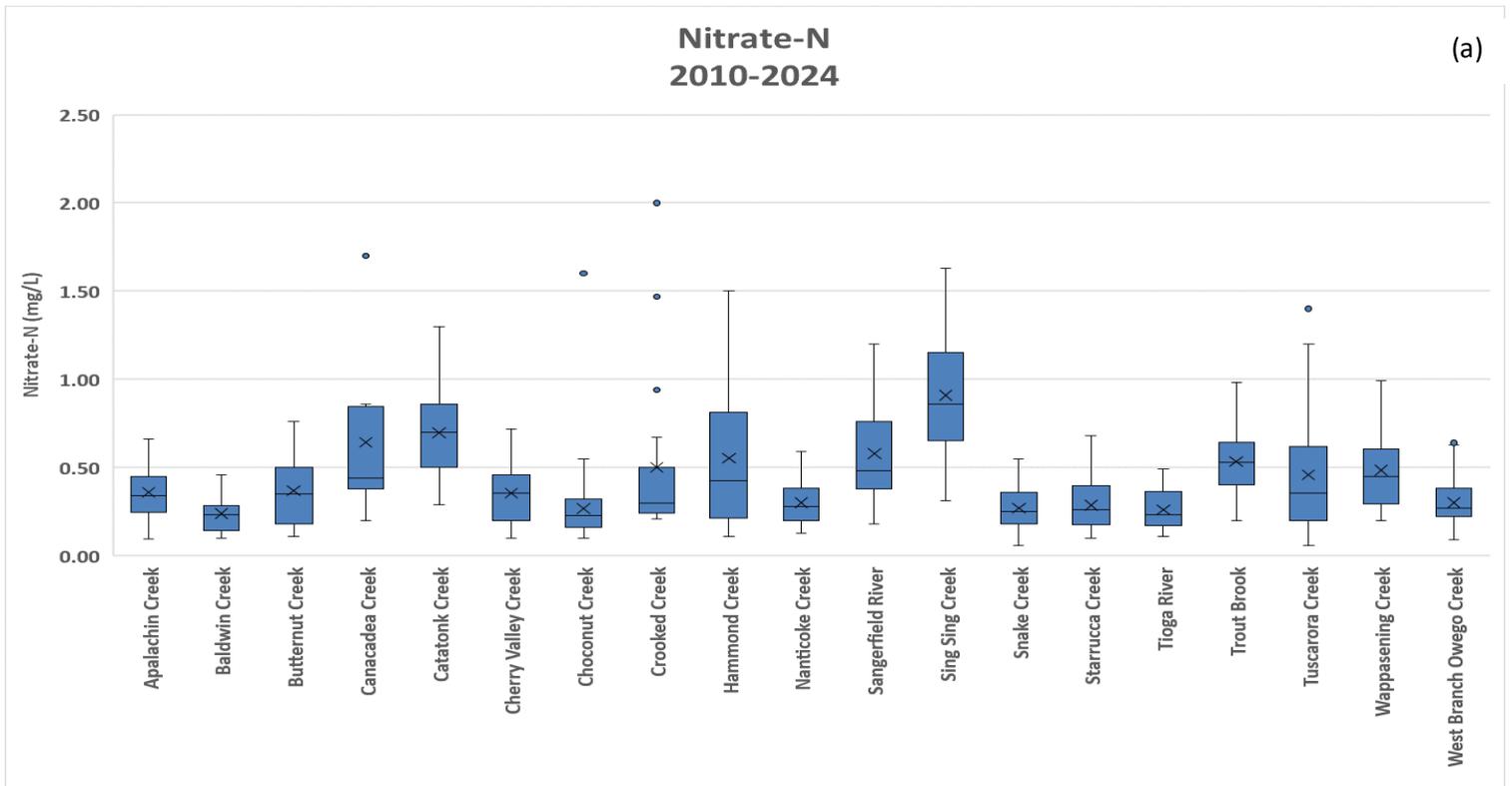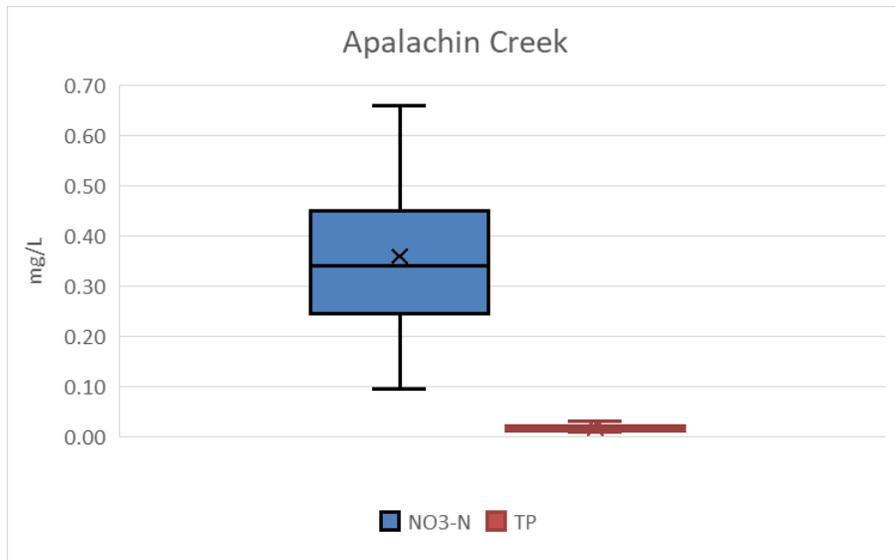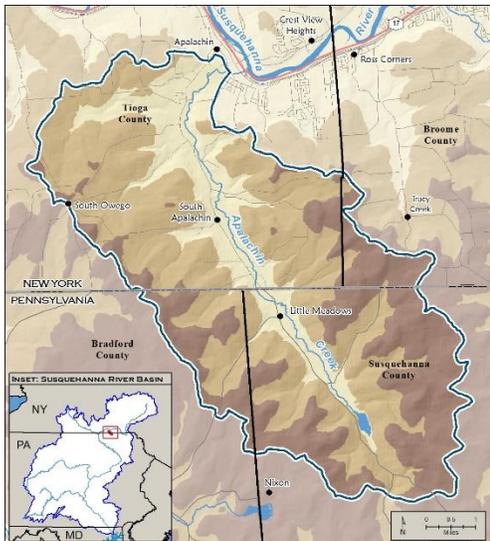

When comparing two boxplots, a **good rule of thumb** is if the median line (Q2) falls outside of the other box, the datasets are likely significantly different. For example, using our nitrate-N data (below), **Tioga River** and **Starrucca Creek** appear to have similar distributions. If we imagine their median lines extended, they would be close to overlapping. However, if we imagine the **Trout Brook** median and the **Tioga River** median extended, the lines would not overlap, indicating they may be significantly different.
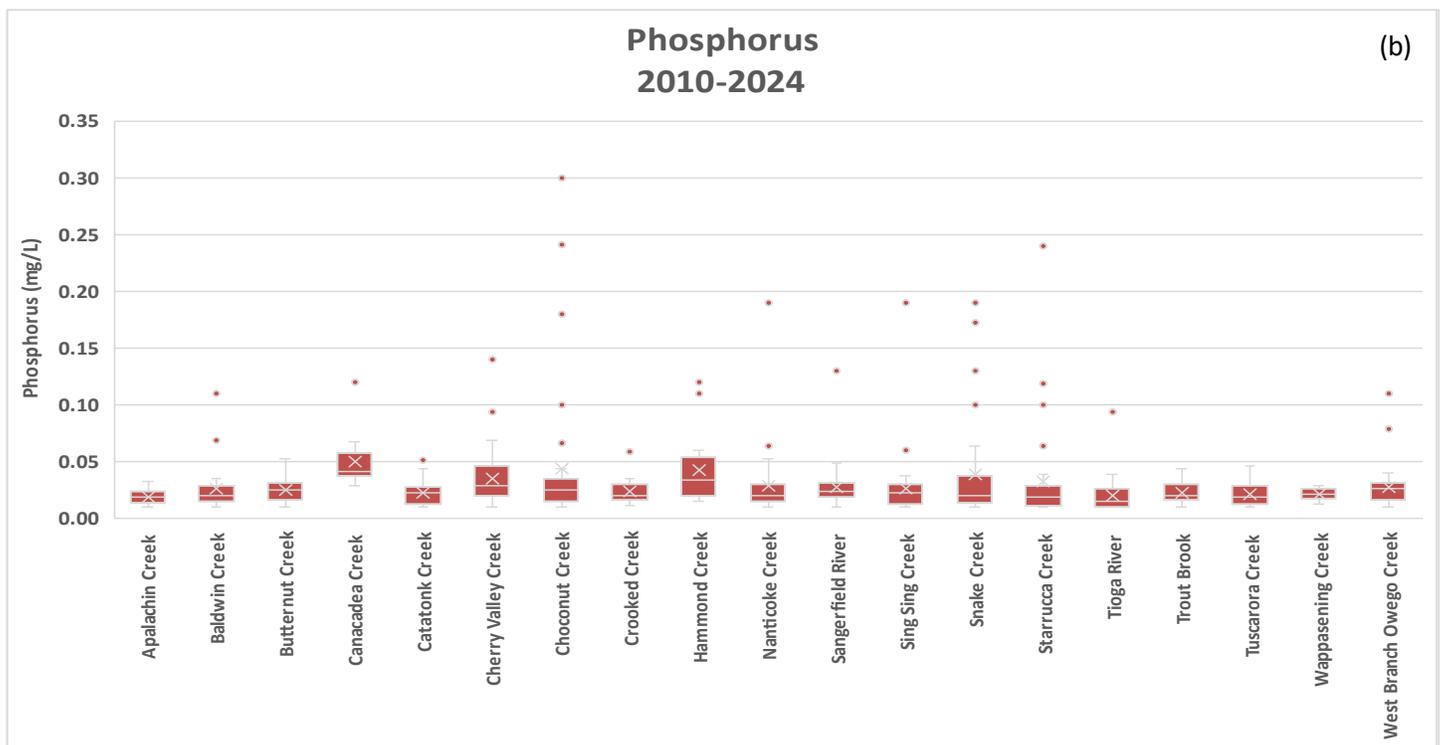
Apalachin Creek near Apalachin, NY

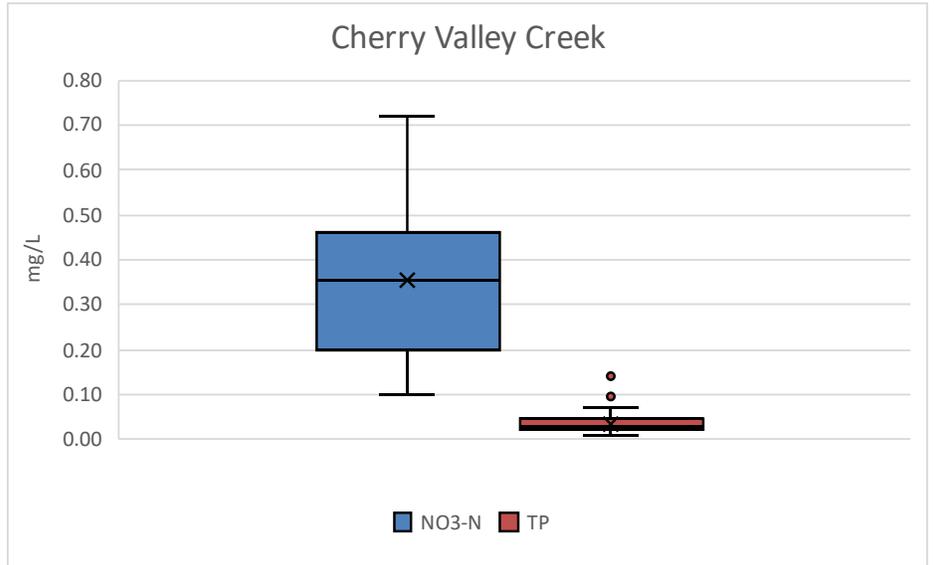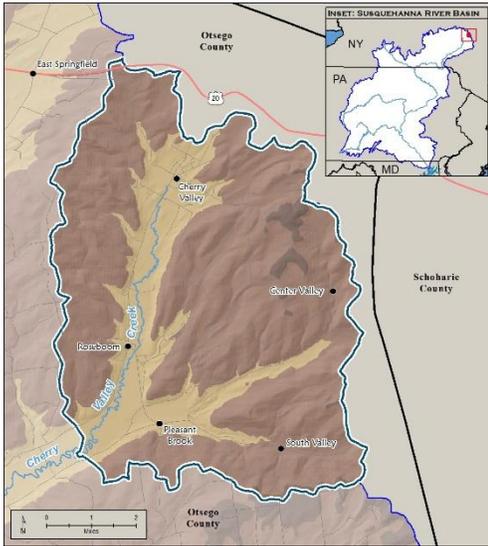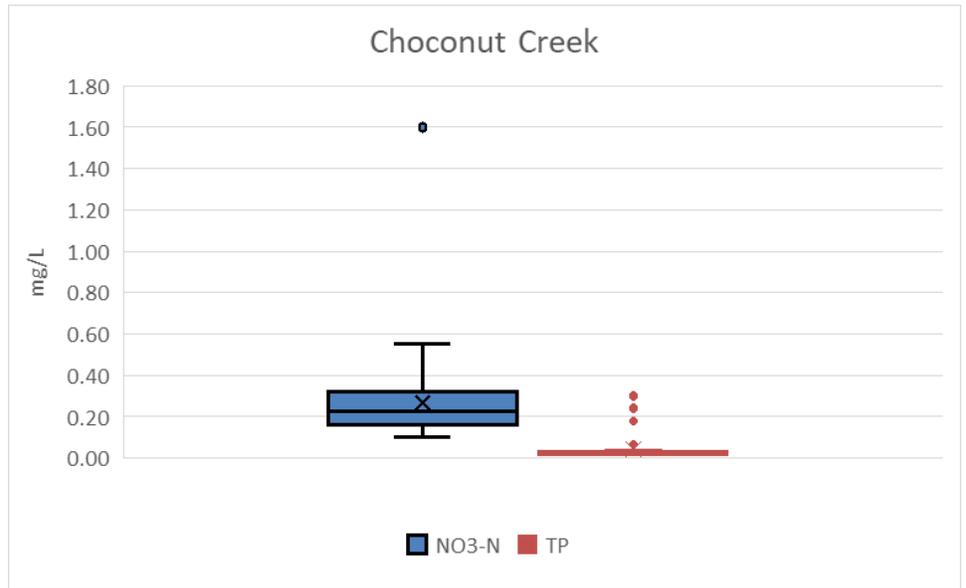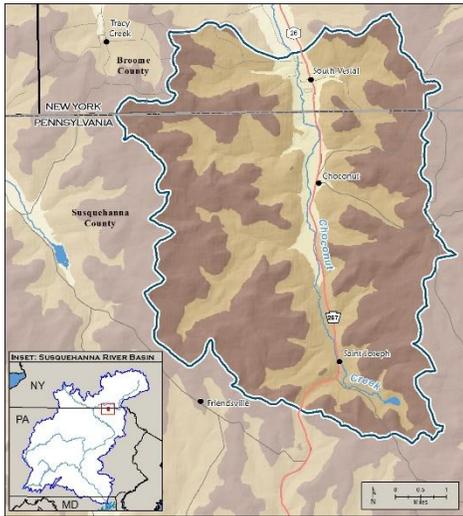https://www.srbc.gov/continuous-instream-monitoring/watershedProfile?cimSystemsId=2&monitoringStationsId=56

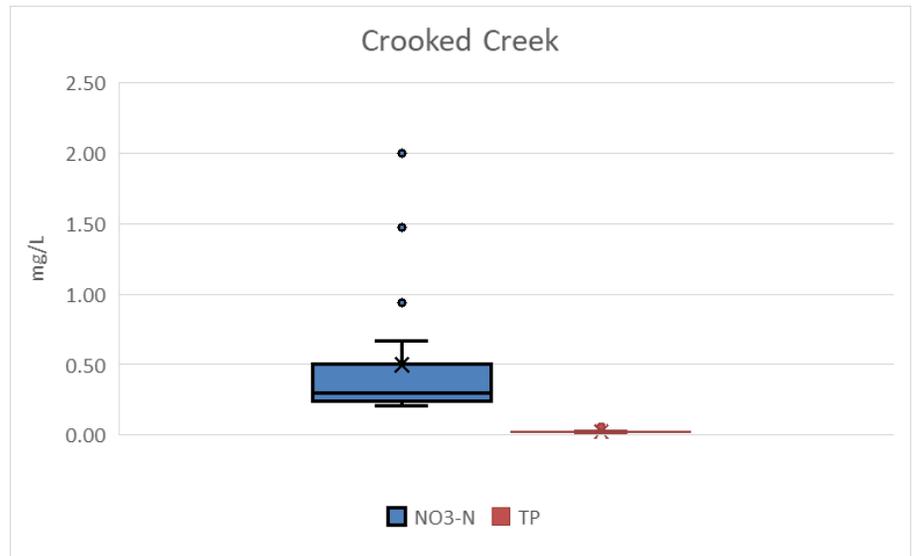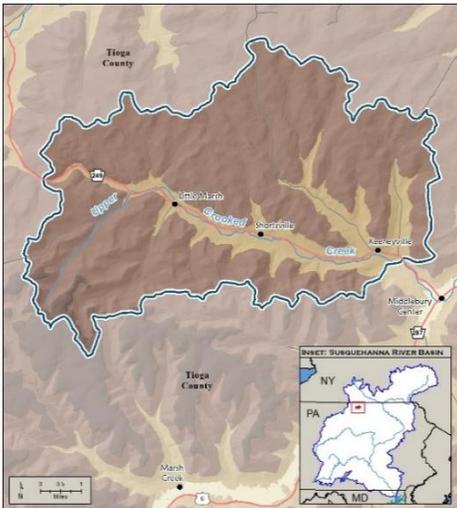| County:	Tioga (NY)
Latitude:	42.063124
Longitude:	-76.15029
Drainage Area (mi²)	42.81
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(34) (25)
Data collected:	2010-2024
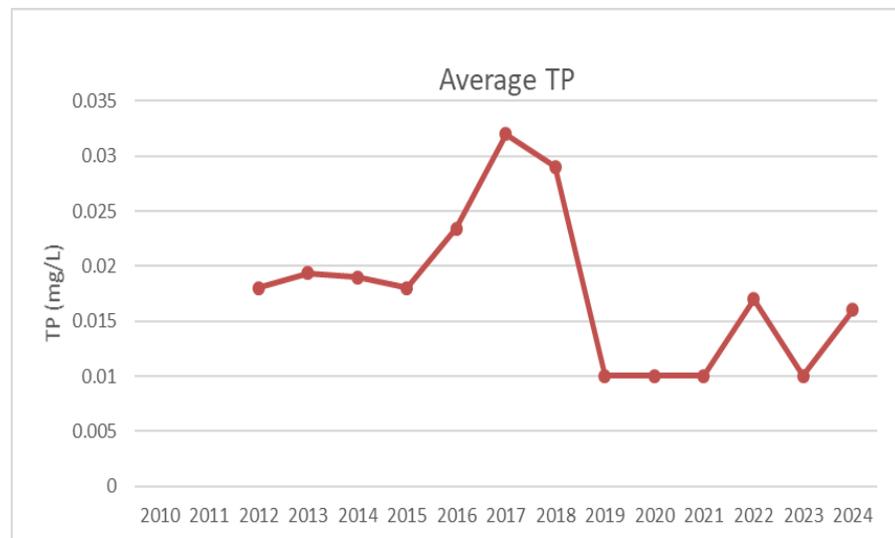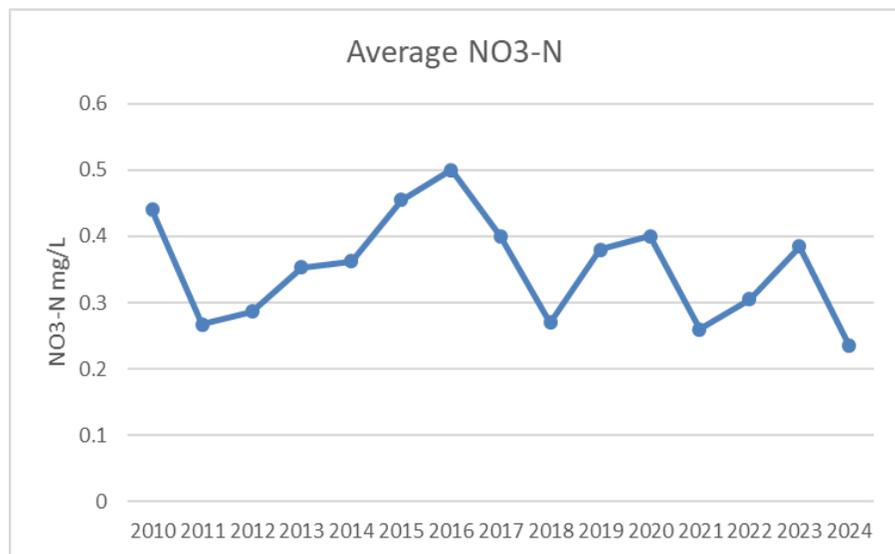
Baldwin Creek near Lowman, NY

Baldwin Creek
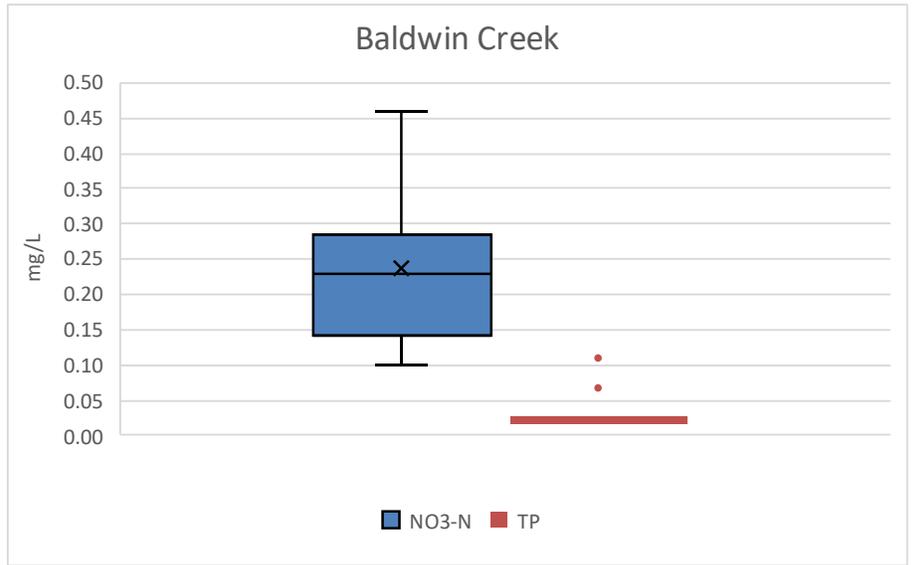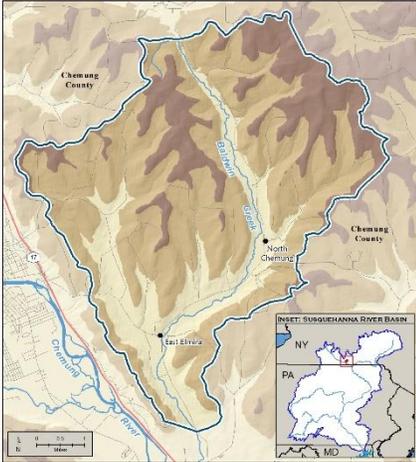
County:	Chemung (NY)
Latitude:	42.04209
Longitude:	-76.72019
Drainage Area (mi²)	35.38
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(25) (30)
Data collected	2010-2024

Average NO3-N

Average TP
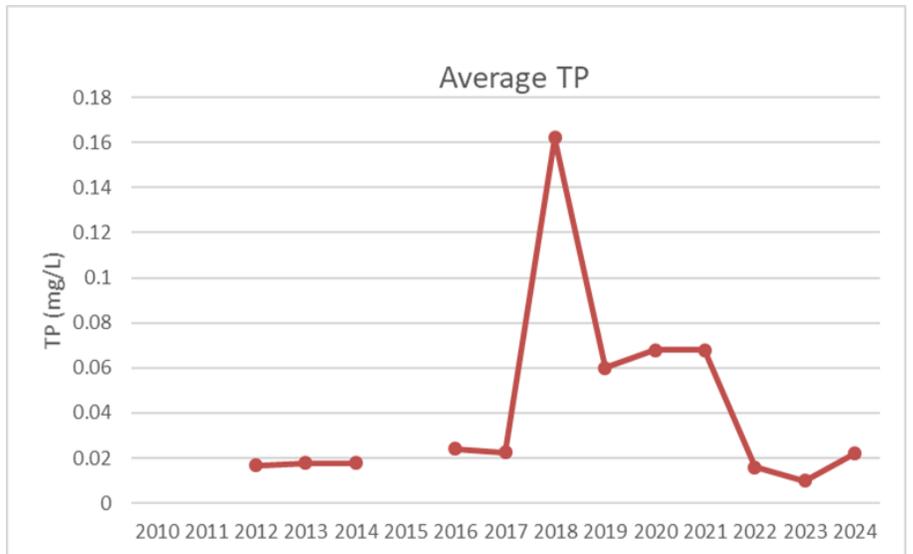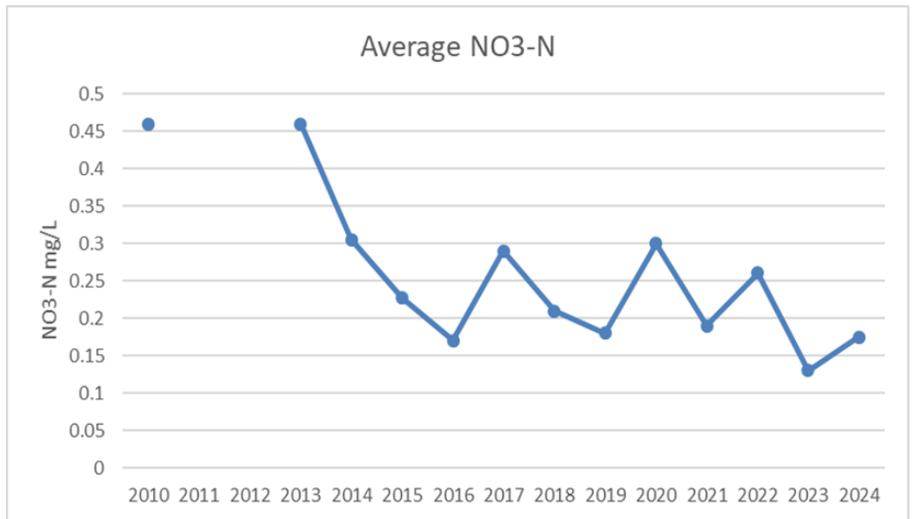
Butternut Creek near Mt. Upton, NY
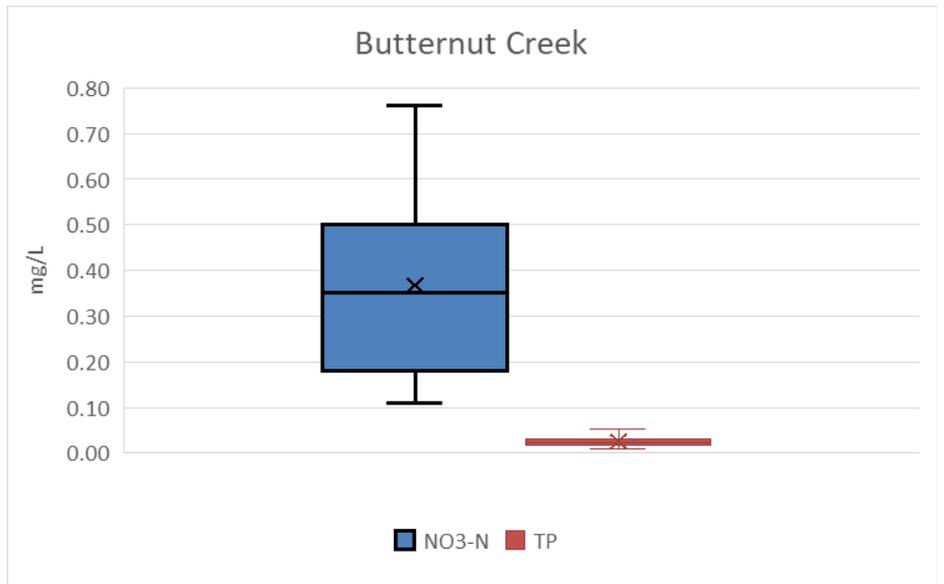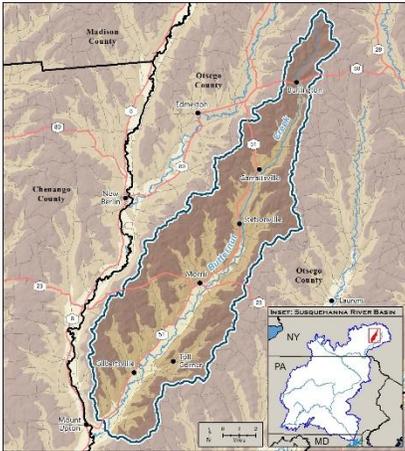
County:	Otsego (NY)
Latitude:	42.42092
Longitude:	-75.36012
Drainage Area (mi²)	128.85
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(23) (22)
Data collected	2019-2024
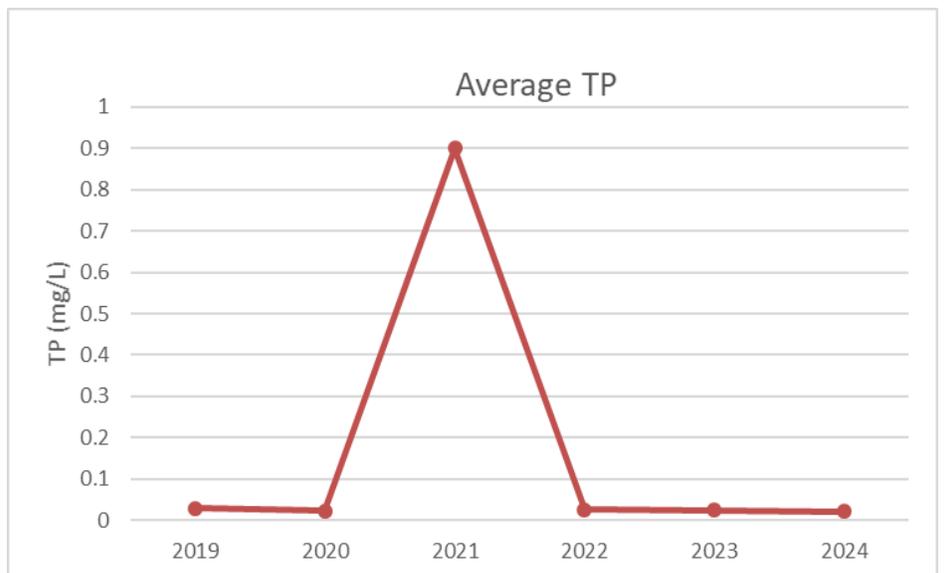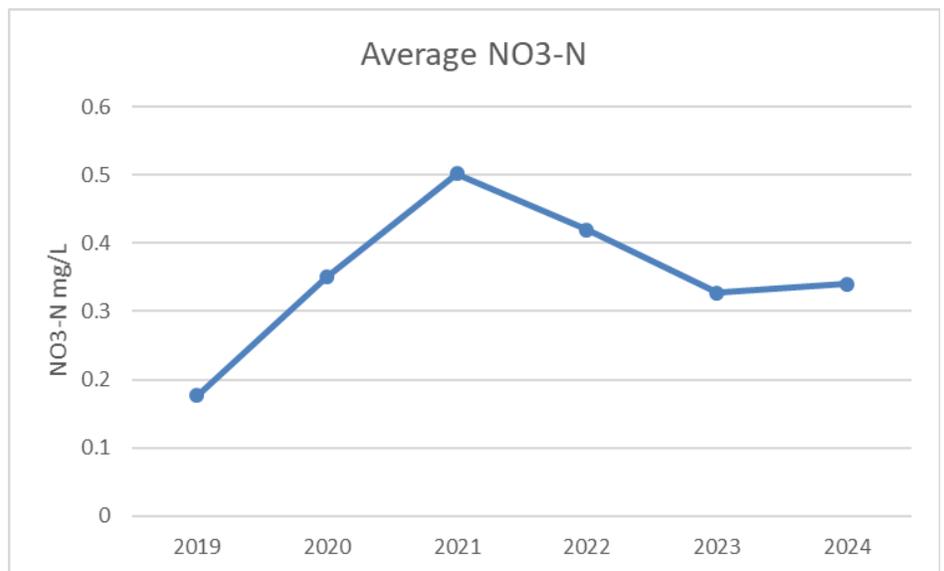
Canacadea Creek near Almond, NY
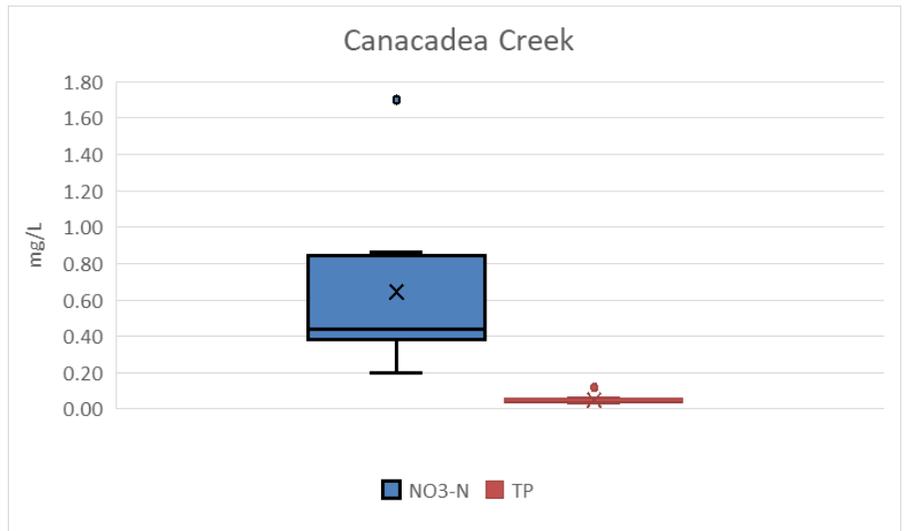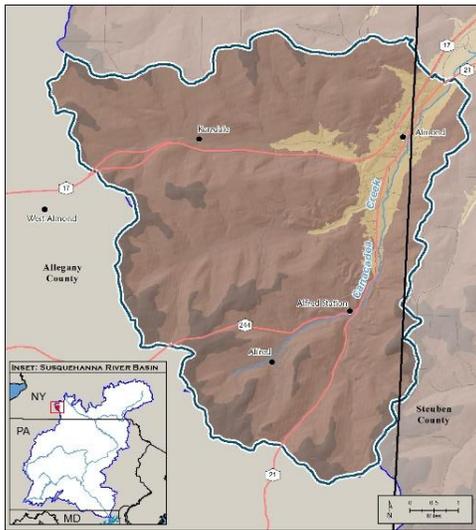
County:	Steuben (NY)
Latitude:	42.319034
Longitude:	-77.736702
Drainage Area (mi²)	46.66
Site Status:	Historic
Number of Samples: (NO3-N) (TP)	(10) (10)
Data collected	2010-2014
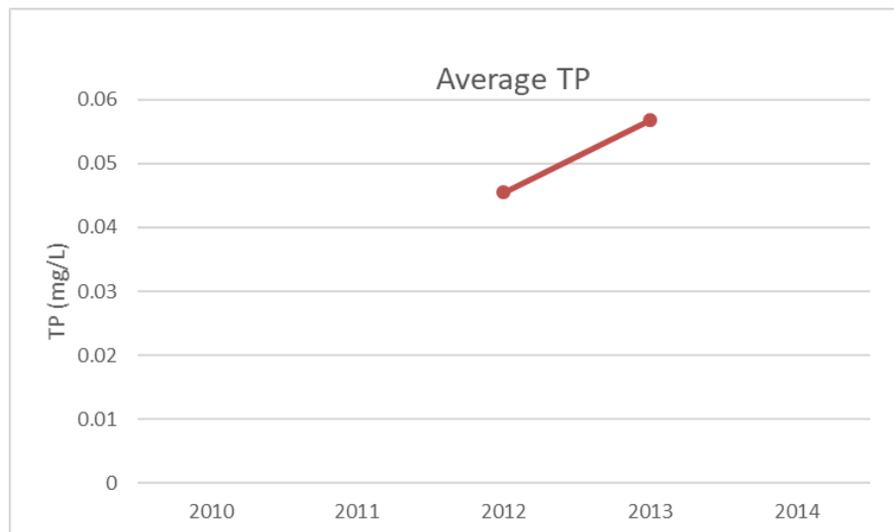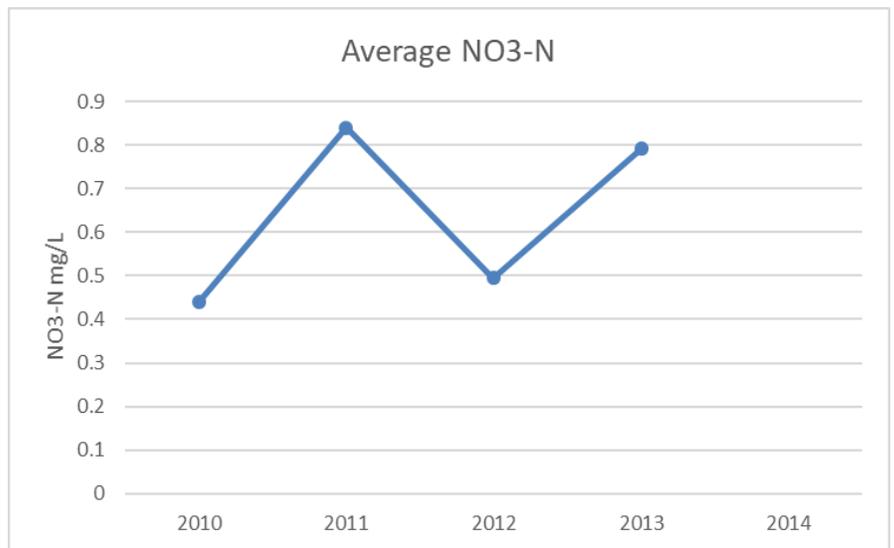
Catatonk Creek near Spencer, NY
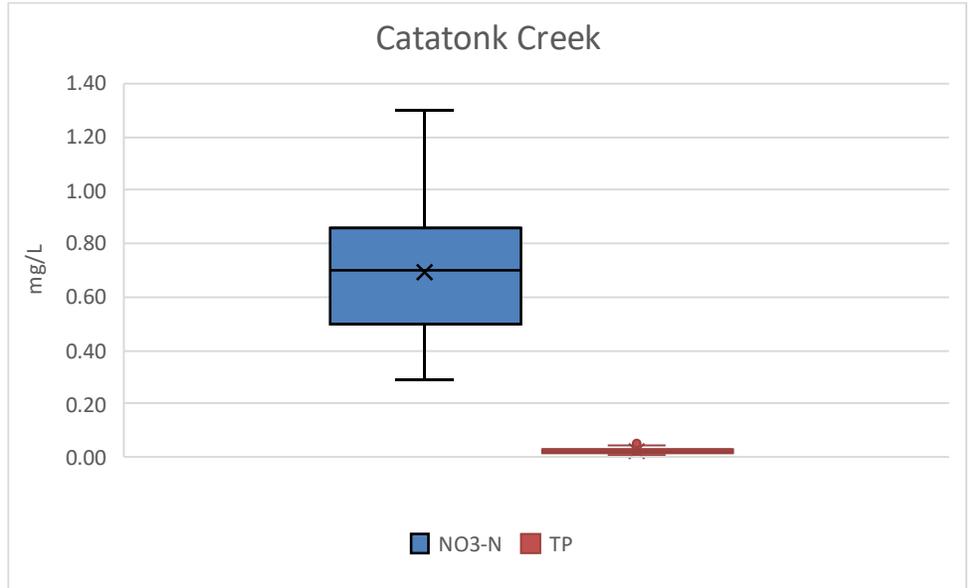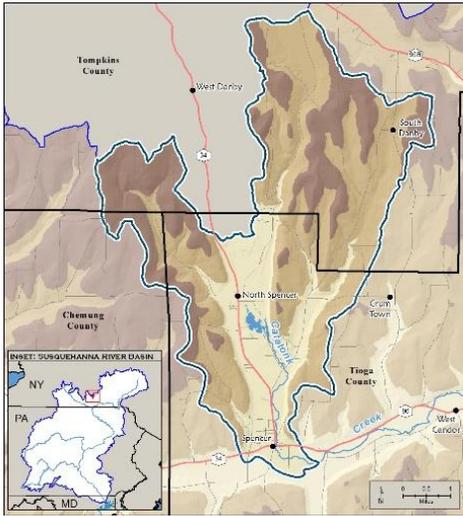
County:	Tioga (NY)
Latitude:	42.204719
Longitude:	-76.475079
Drainage Area (mi²)	30.36
Site Status:	Historic
Number of Samples: (NO3-N) (TP)	(45) (47)
Data collected	2010-2024
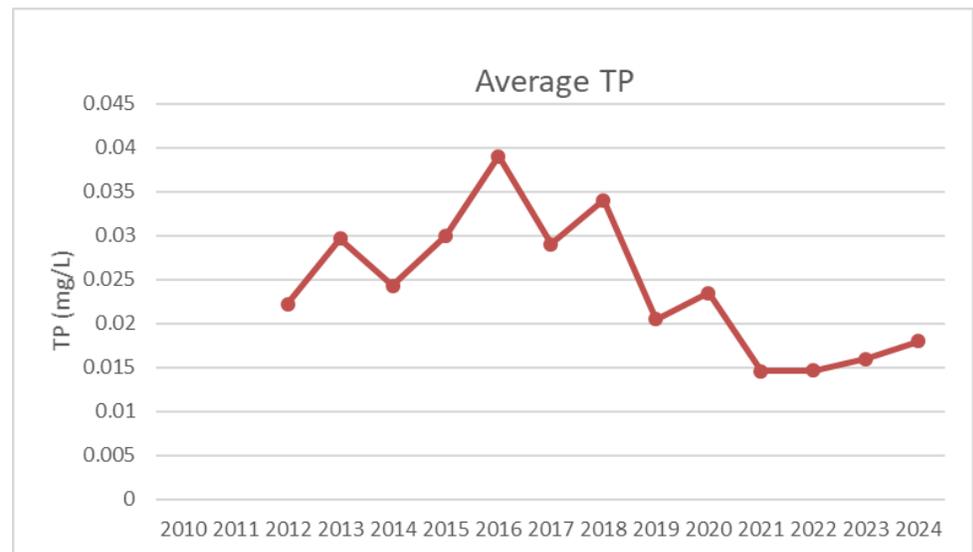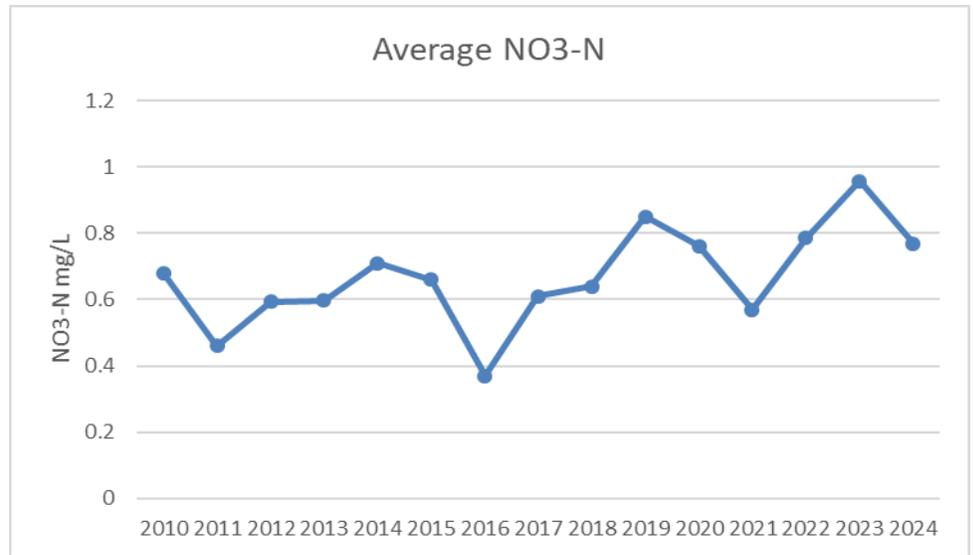
Cherry Valley Creek near Middlefield, NY

Cherry Valley Creek

County:	Otsego (NY)
Latitude:	42.706392
Longitude:	-74.799213
Drainage Area (mi²)	50.77
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(39) (46)
Data collected	2010-2024

Average NO3-N

Average TP
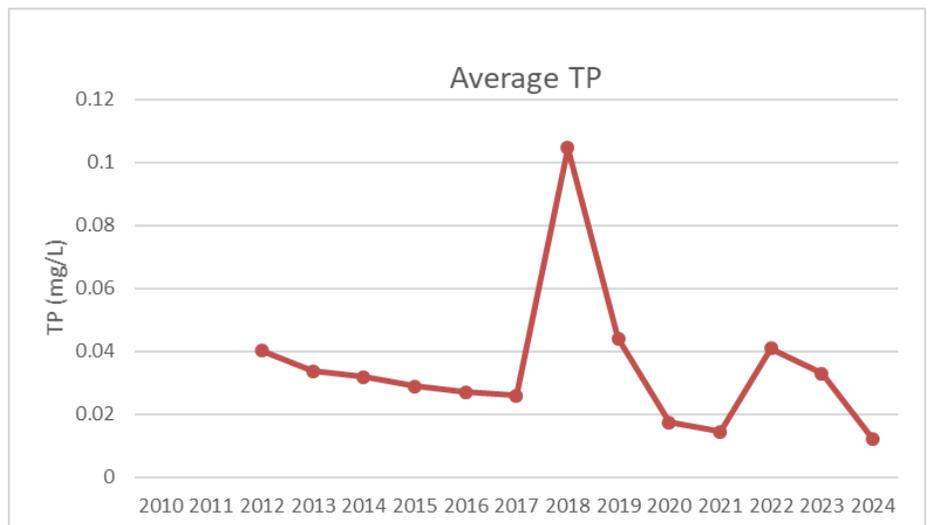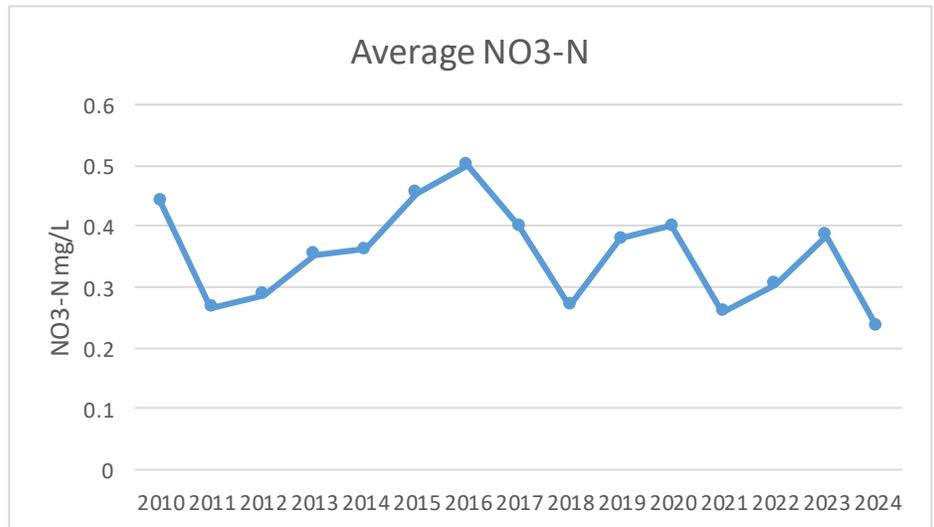
Choconut Creek near Vestal Center, NY

County:	Broome (NY)
Latitude:	42.015819
Longitude:	-76.009313
Drainage Area (mi²)	38.03
Site Status:	Historic
Number of Samples: (NO3-N) (TP)	(39) (46)
Data collected	2012-2024
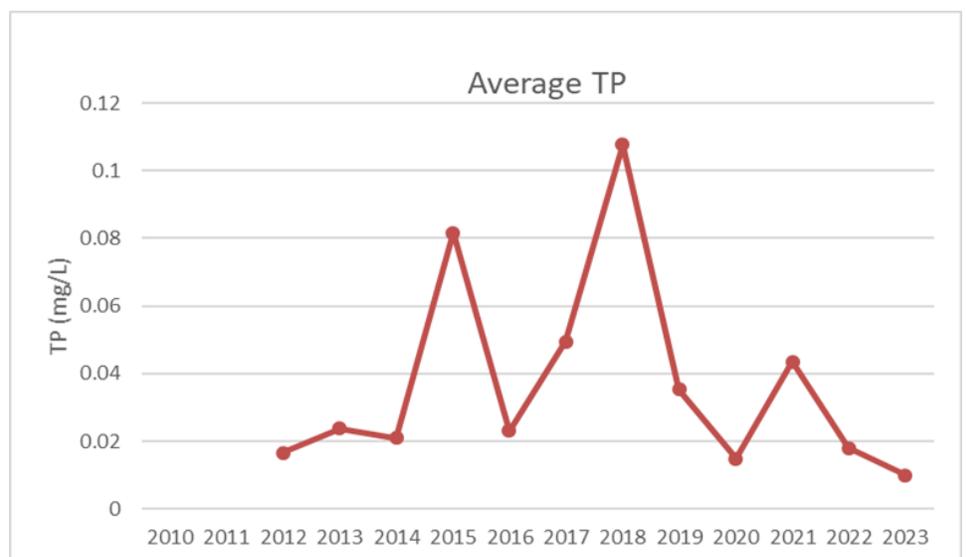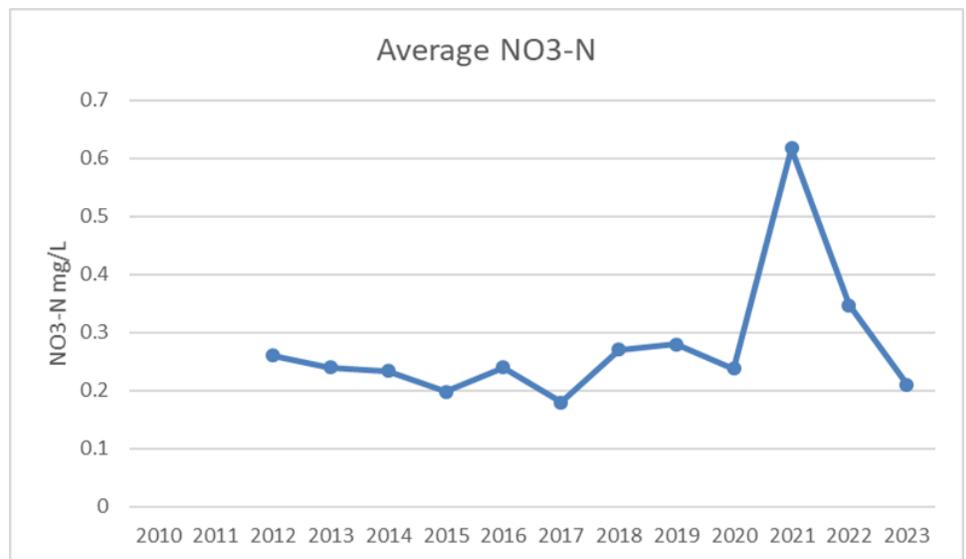
Crooked Creek near Keeneyville, PA

County:	Tioga (PA)
Latitude:	41.857518
Longitude:	-77.293131
Drainage Area (mi²)	47.43
Site Status:	Historic
Number of Samples: (NO3-N) (TP)	(16) (20)
Data collected	2012-2017

Crooked Creek

Average NO3-N

Average TP
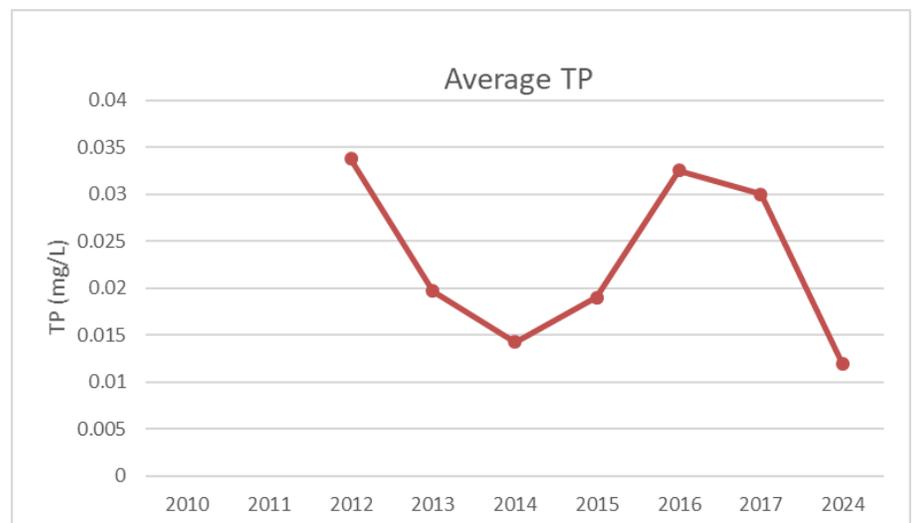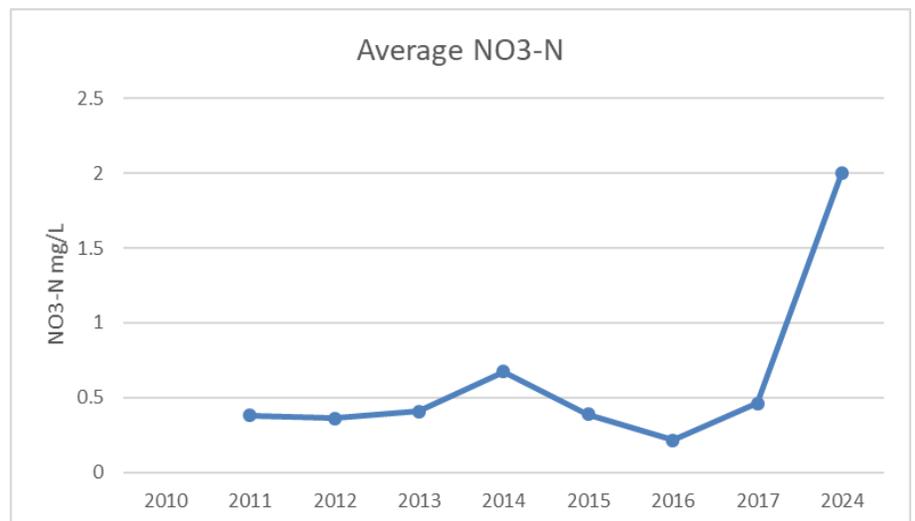
Hammond Creek near Millerton, PA

Hammond Creek
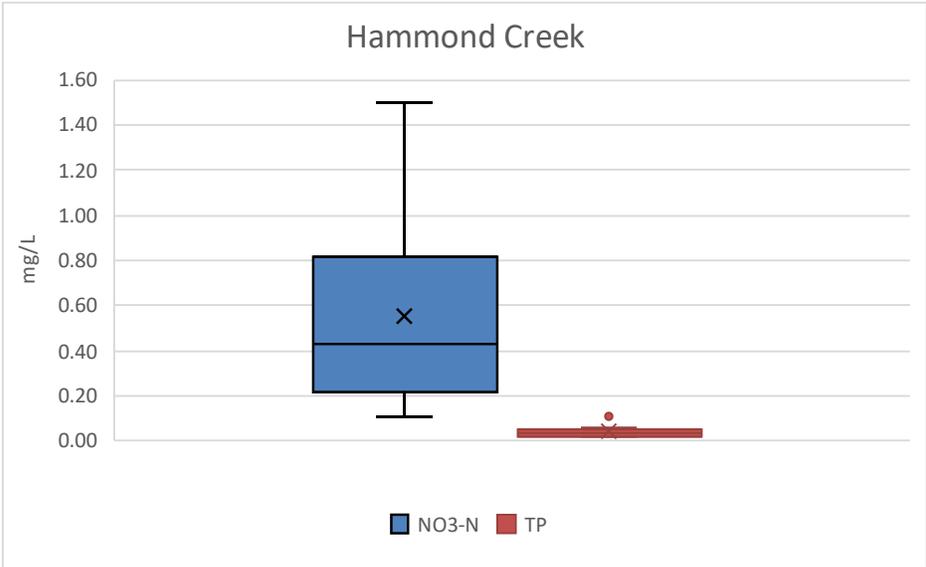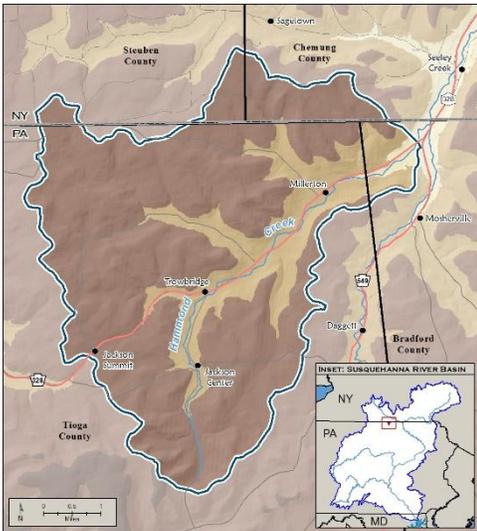
County:	Tioga (PA)
Latitude:	41.991638
Longitude:	-76.912327
Drainage Area (mi²)	28.63
Site Status:	Historic
Number of Samples: (NO3-N) (TP)	(15) (14)
Data collected	2011-2016

Average NO3-N

Average TP
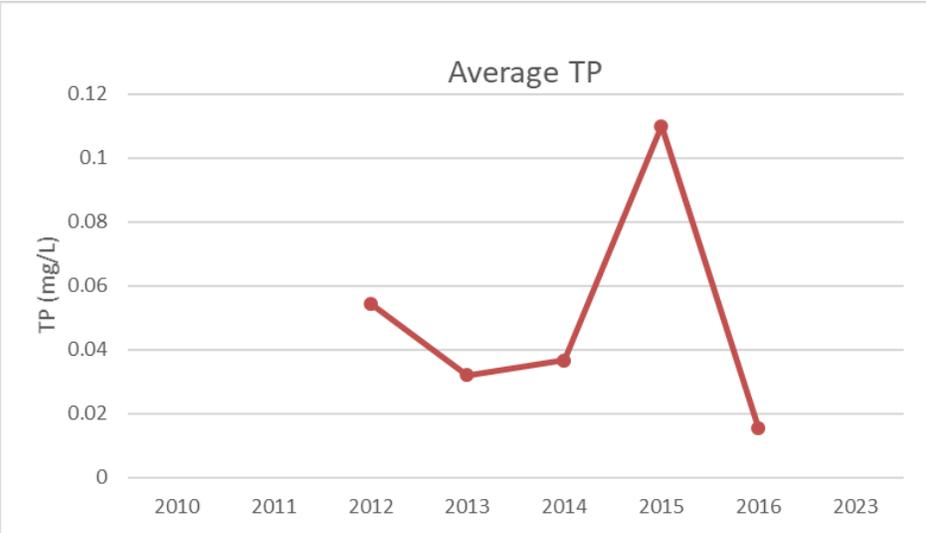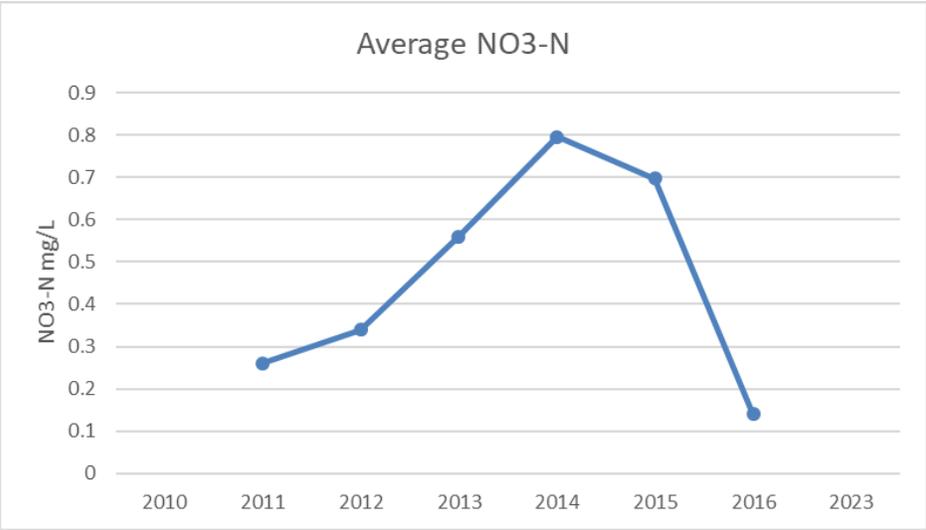
Nanticoke Creek near Maine, NY
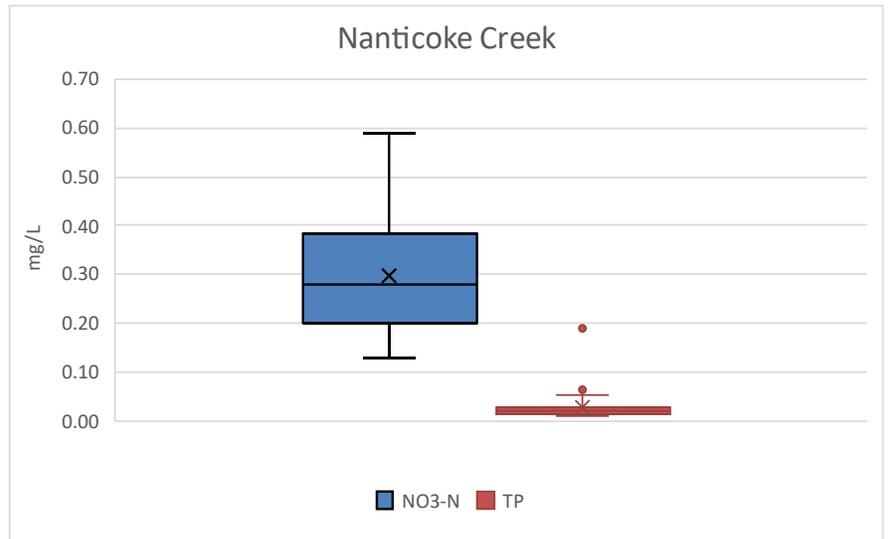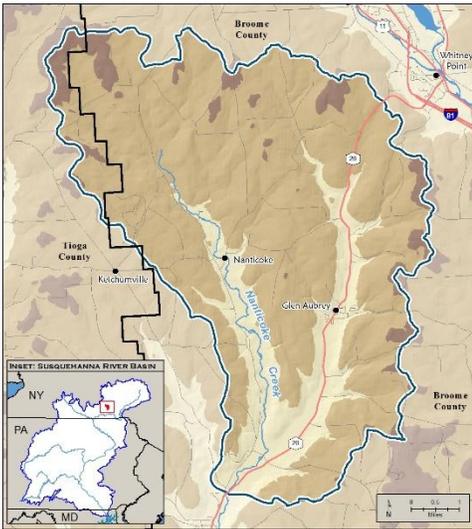
County:	Broome (NY)
Latitude:	42.204258
Longitude:	-76.053565
Drainage Area (mi²)	47.99
Site Status:	Historic
Number of Samples: (NO3-N) (TP)	(34) (38)
Data collected	2010-2024
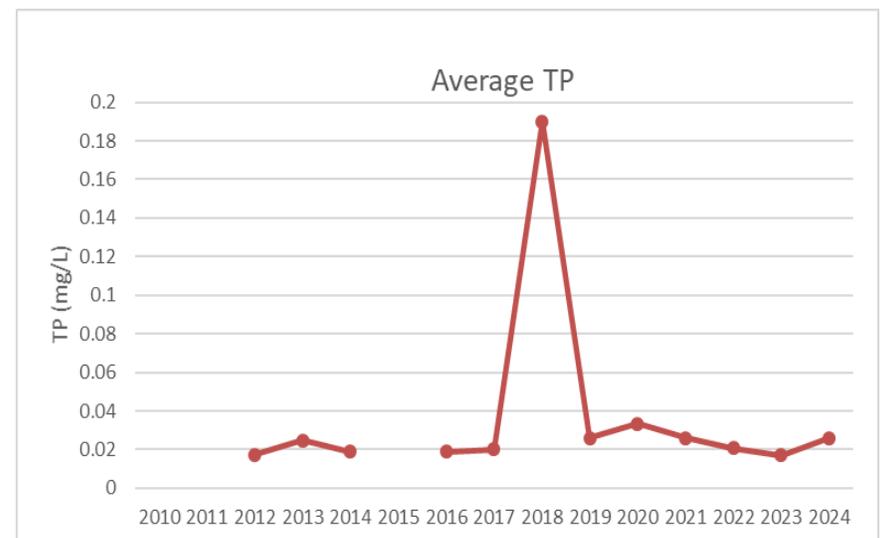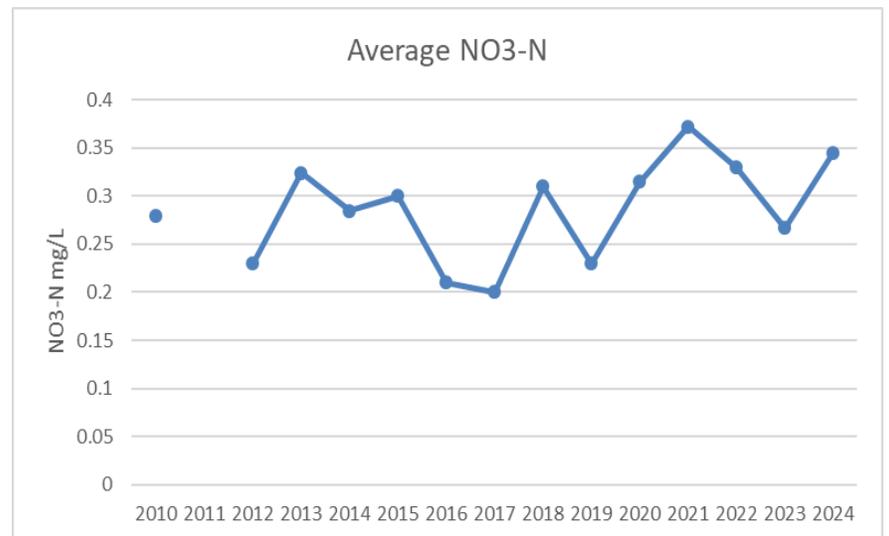
Sangerfield River near Poolville, NY

Sangerfield Creek
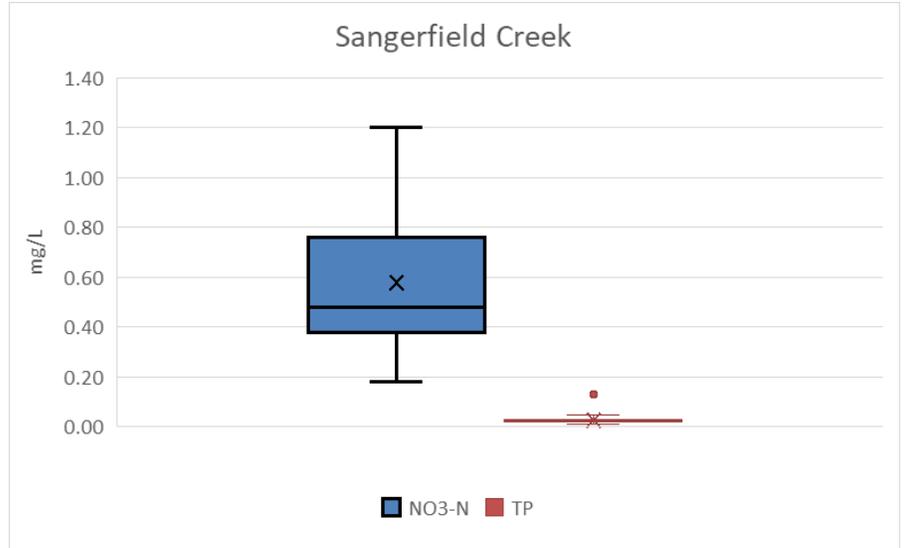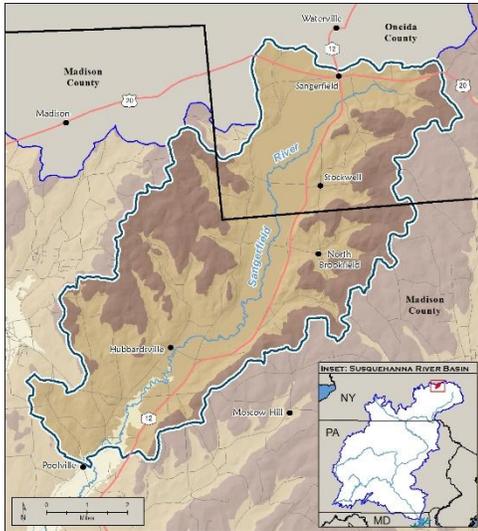
NO3-N ▢   TP ▢

County:	Madison (NY)
Latitude:	42.77596
Longitude:	-75.502199
Drainage Area (mi²)	52.49
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(41) (48)
Data collected	2010-2024

Average NO3-N

Average TP
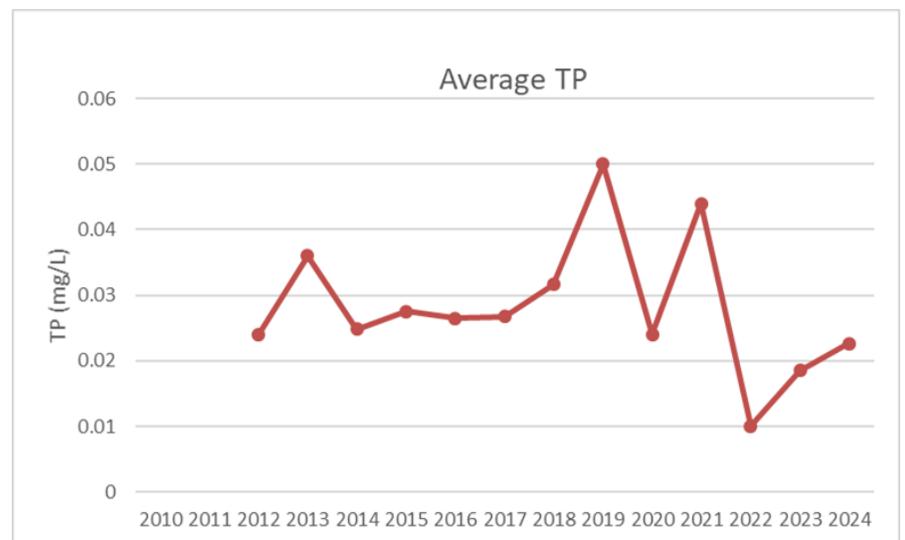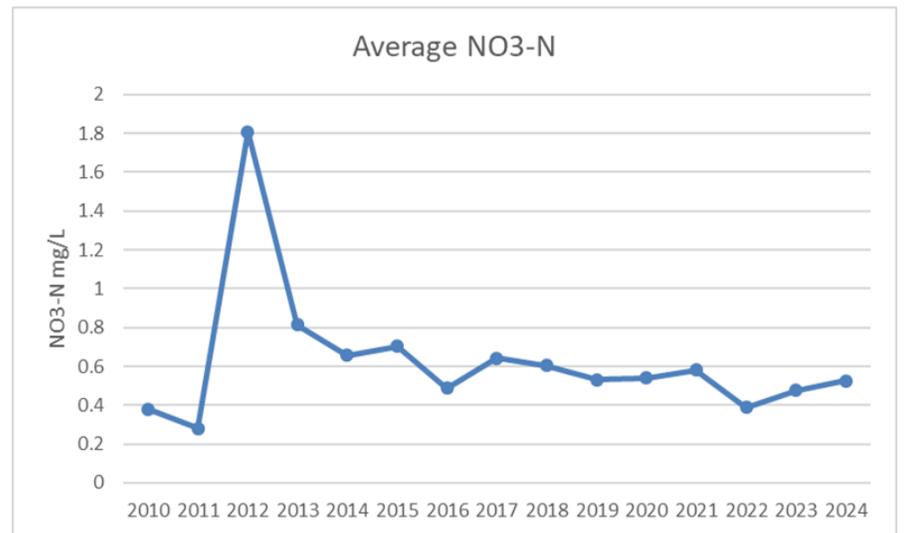
Sing Sing Creek near Big Flats, NY

Sing Sing Creek
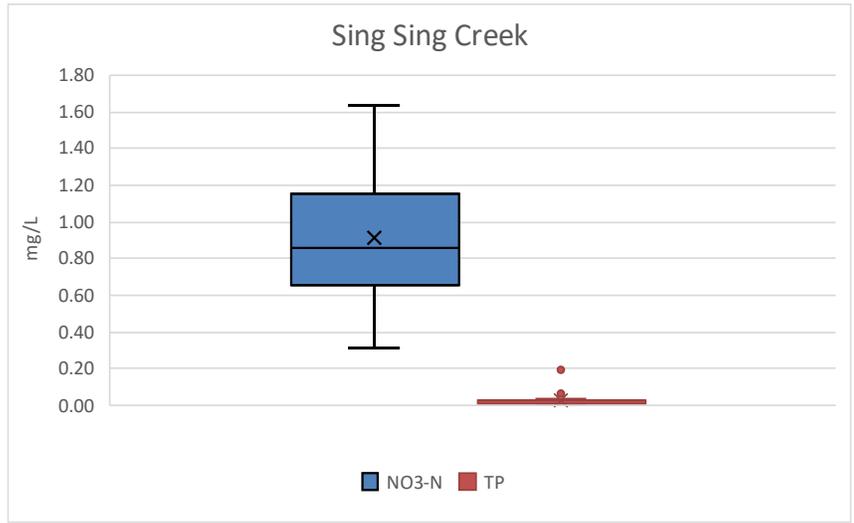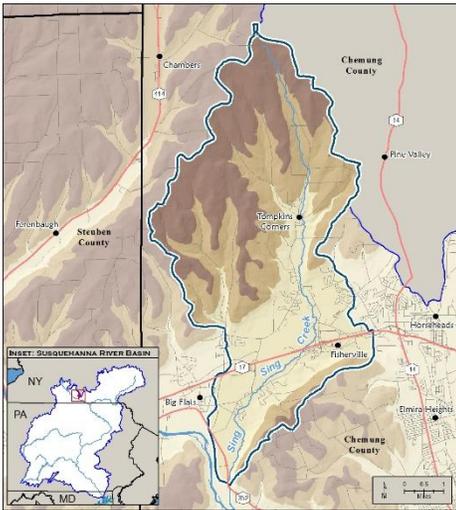
NO3-N ■   TP ■

County:	Chemung (NY)
Latitude:	42.10277778
Longitude:	-76.92222222
Drainage Area (mi²)	35.16
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(42) (51)
Data collected	2010-2024

Average NO3-N

Average TP
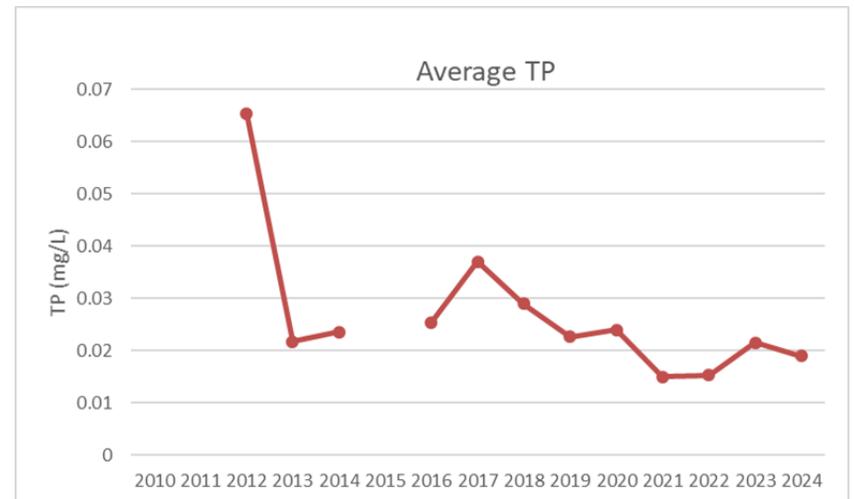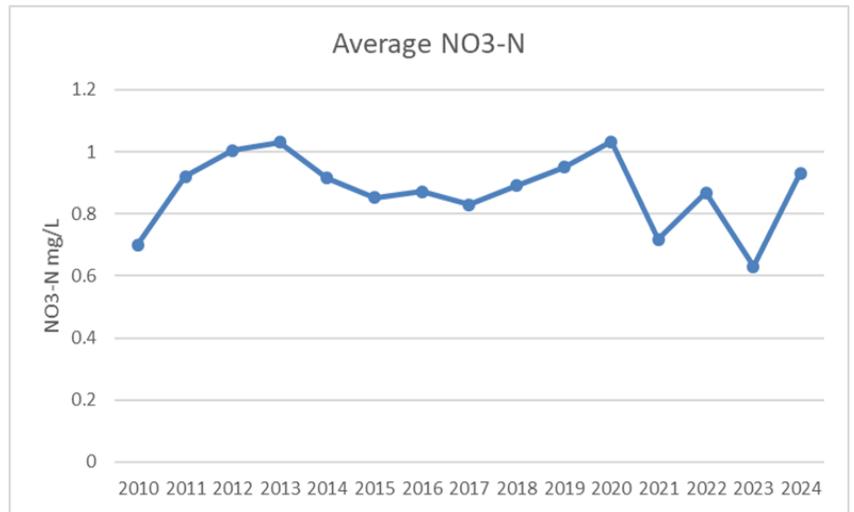
Snake Creek near Lawsville Center, PA

Snake Creek
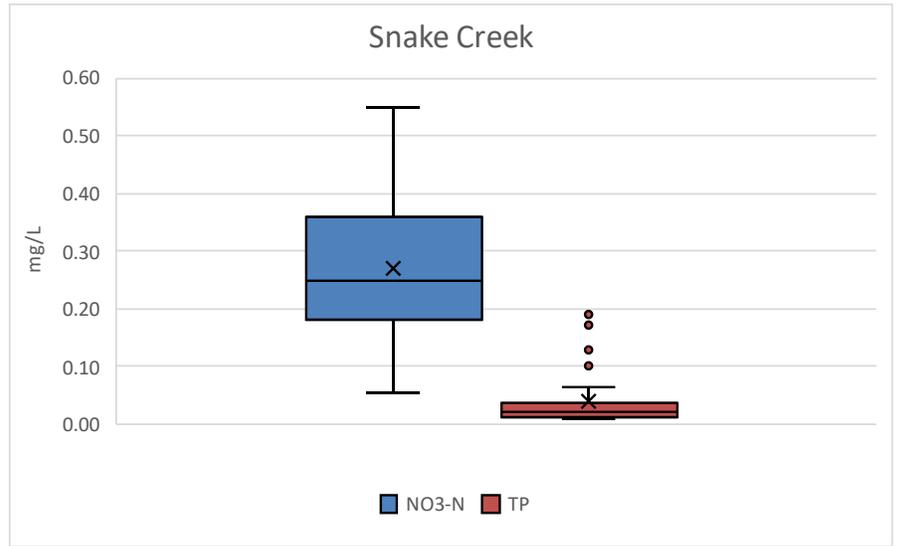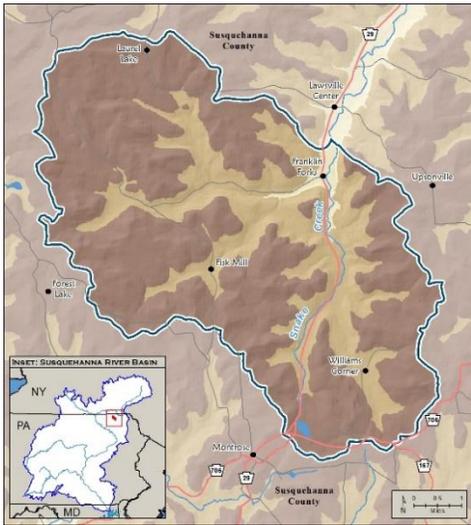
County:	Susquehanna (PA)
Latitude:	41.92994
Longitude:	-75.84137
Drainage Area (mi²)	45.08
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(50) (47)
Data collected	2010-2024

Average NO3-N

Average TP
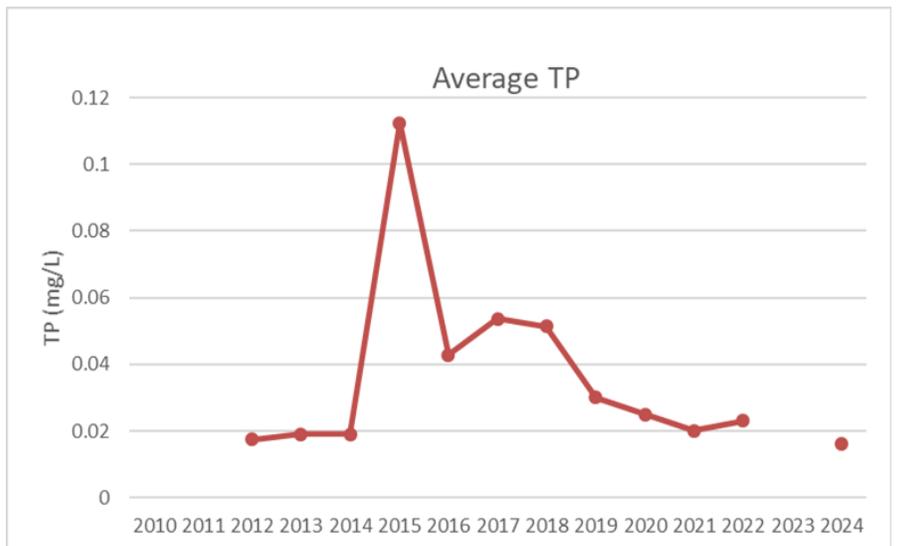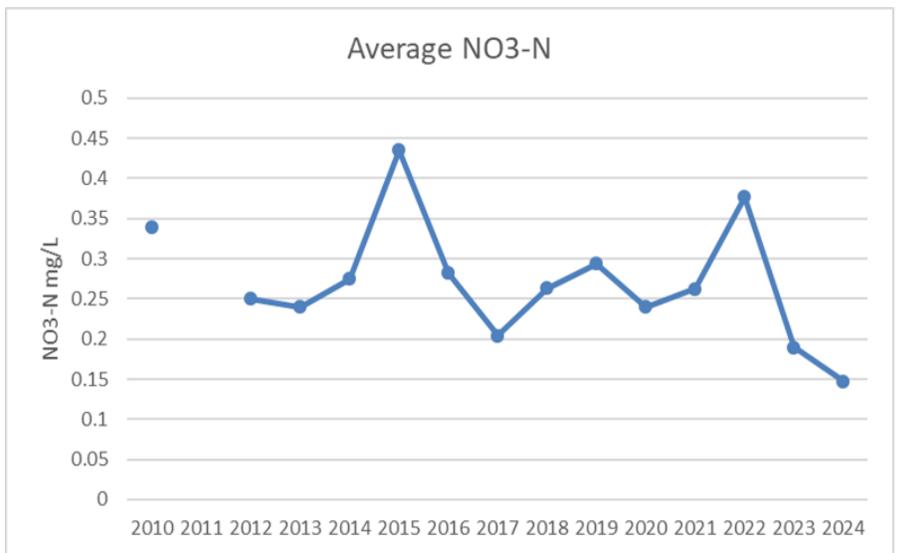
Starrucca Creek near Stevens Point, PA

Starrucca Creek
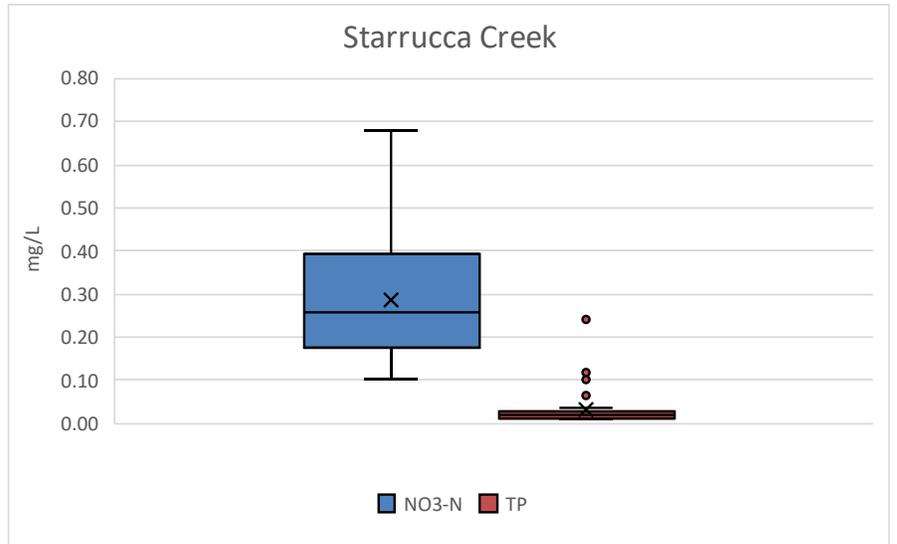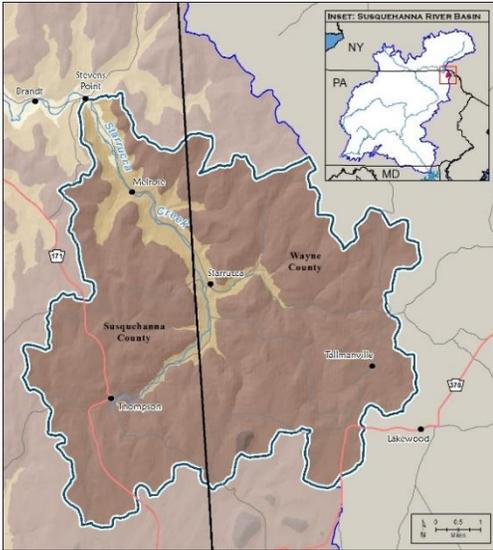
NO3-N TP

County:	Susquehanna (PA)
Latitude:	41.959458
Longitude:	-75.523512
Drainage Area (mi²)	51.87
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(44) (49)
Data collected	2010-2024

Average NO3-N

Average TP
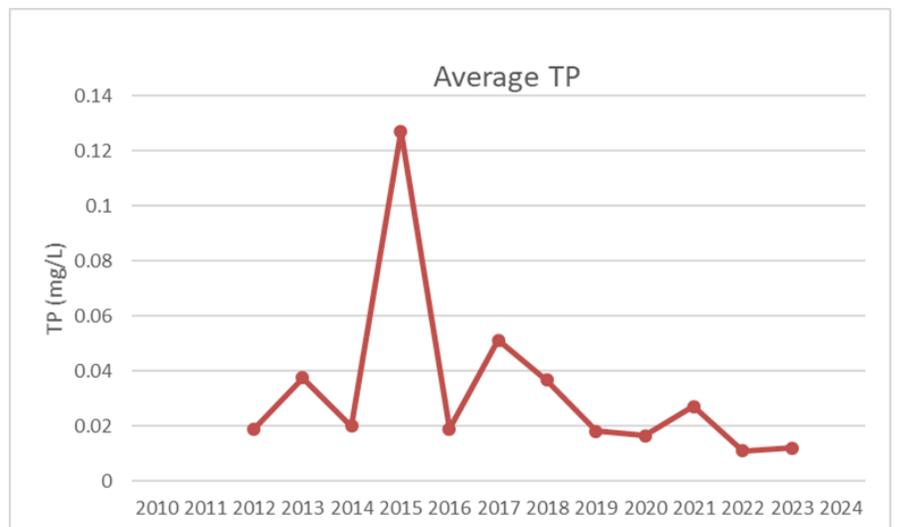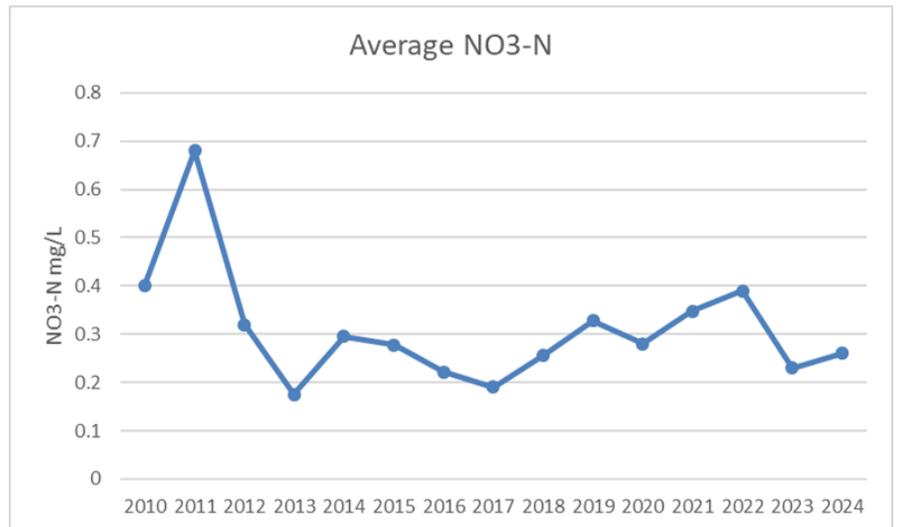
Tioga River near Fall Brook, PA

Tioga River
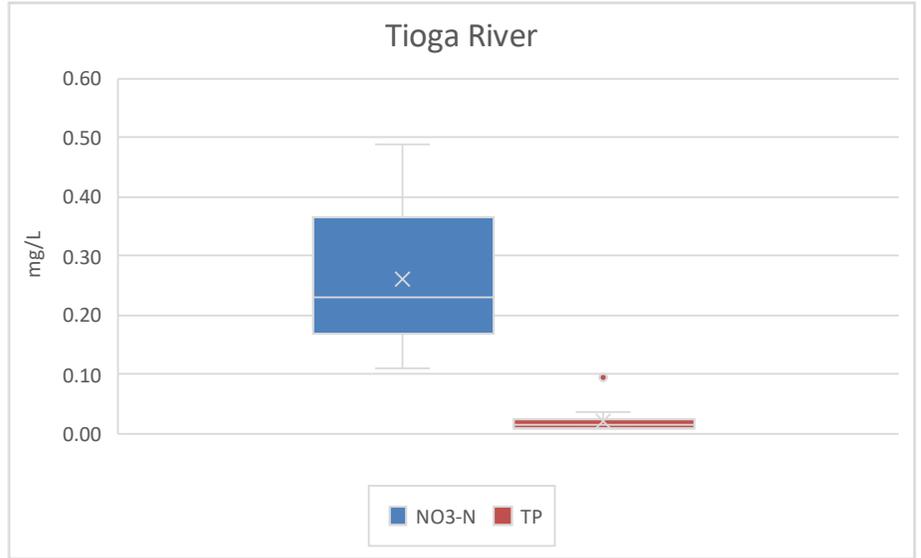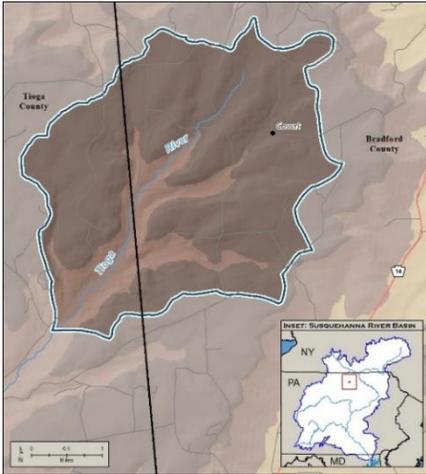
County:	Tioga (PA)
Latitude:	41.709307
Longitude:	-76.914157
Drainage Area (mi²)	13.50
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(29) (37)
Data collected	2012-2024

Average NO3-N

Average TP
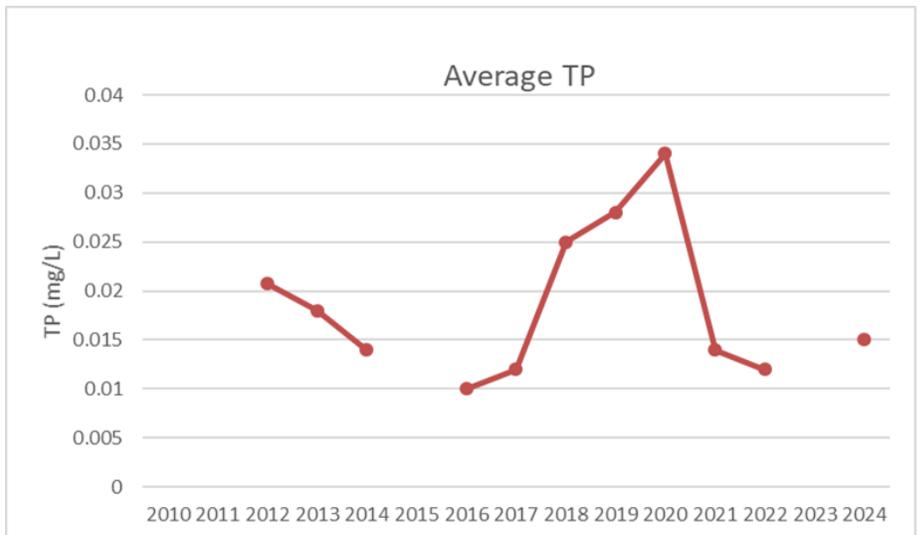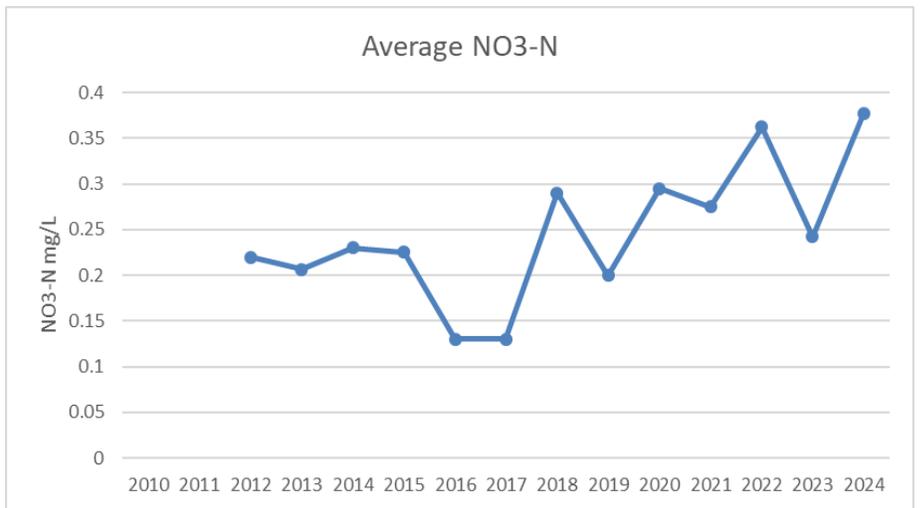
Trout Brook near McGraw, NY

Trout Brook
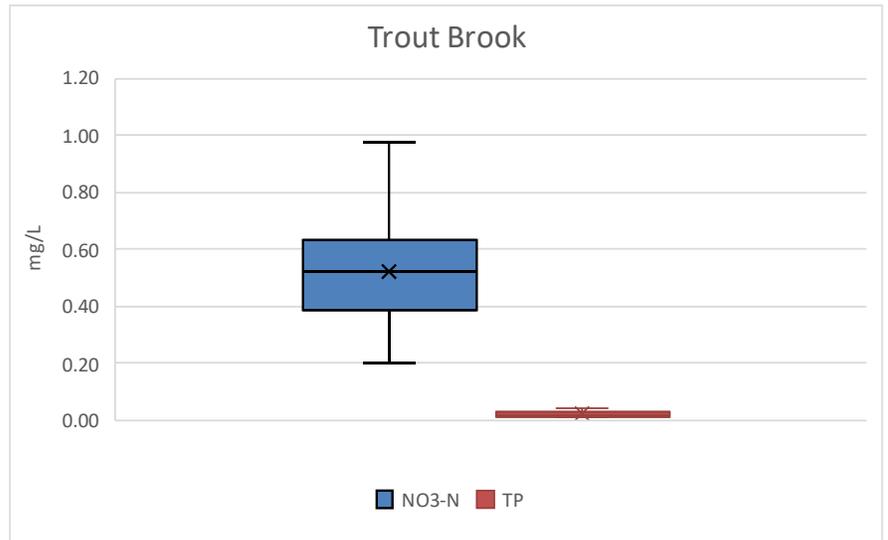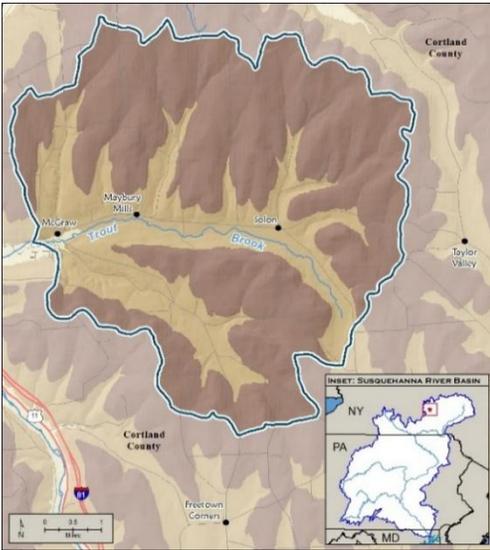
County:	Cortland (NY)
Latitude:	42.592774
Longitude:	-76.105889
Drainage Area (mi²)	35.65
Site Status:	Historic
Number of Samples: (NO3-N) (TP)	(30) (39)
Data collected	2012-2024

Average NO3-N

Average TP
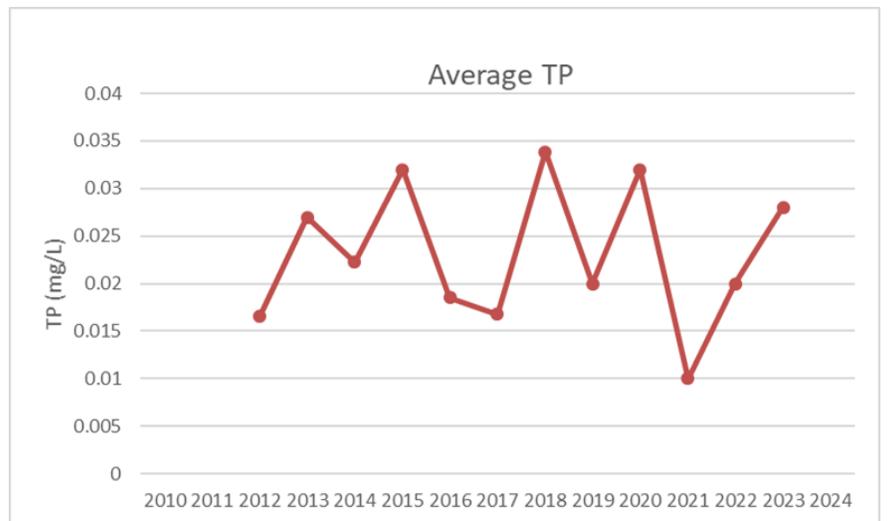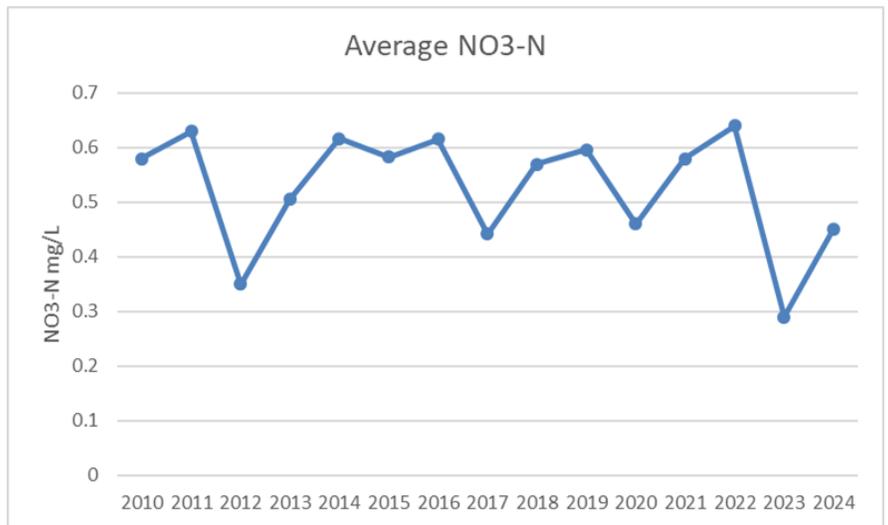
Tuscarora Creek near Woodhull, NY
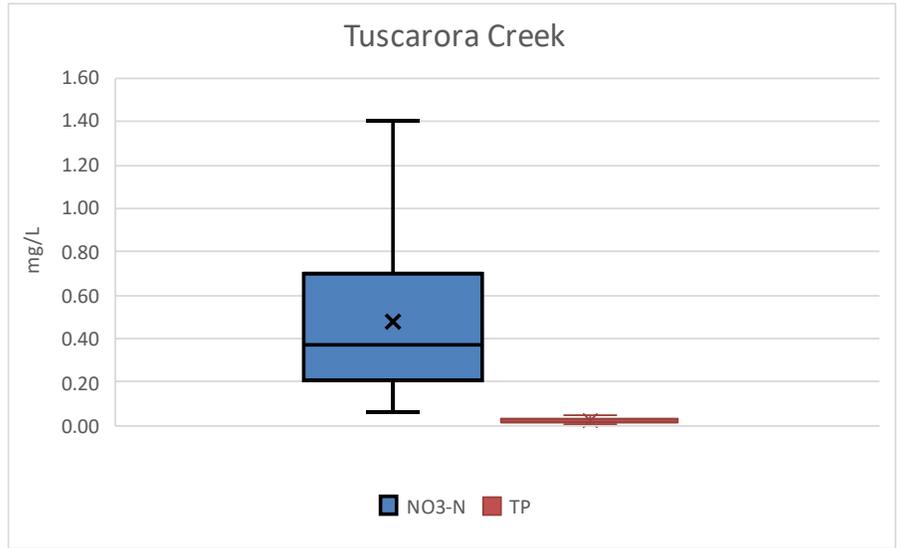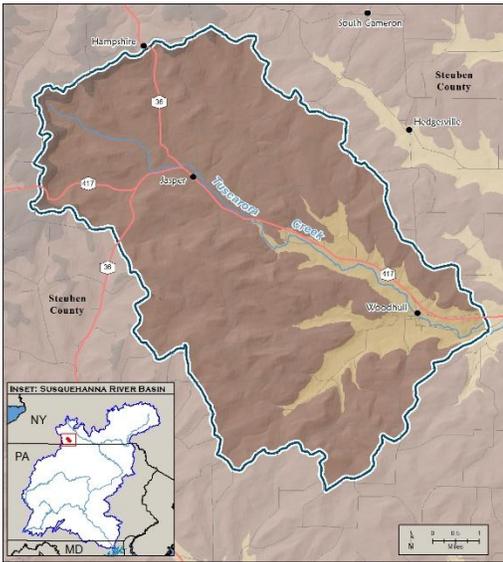
County:	Steuben (NY)
Latitude:	42.075196
Longitude:	-77.379177
Drainage Area (mi²)	52.69
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(24) (22)
Data collected	2010-2024
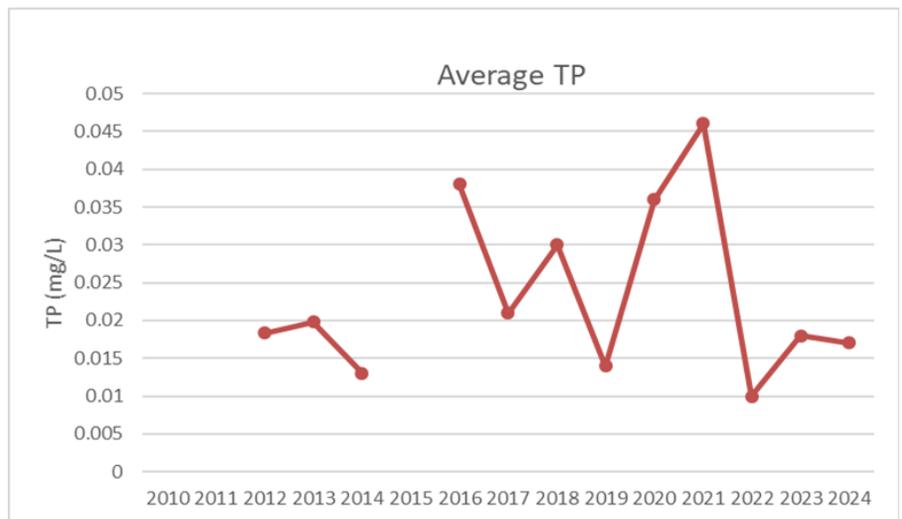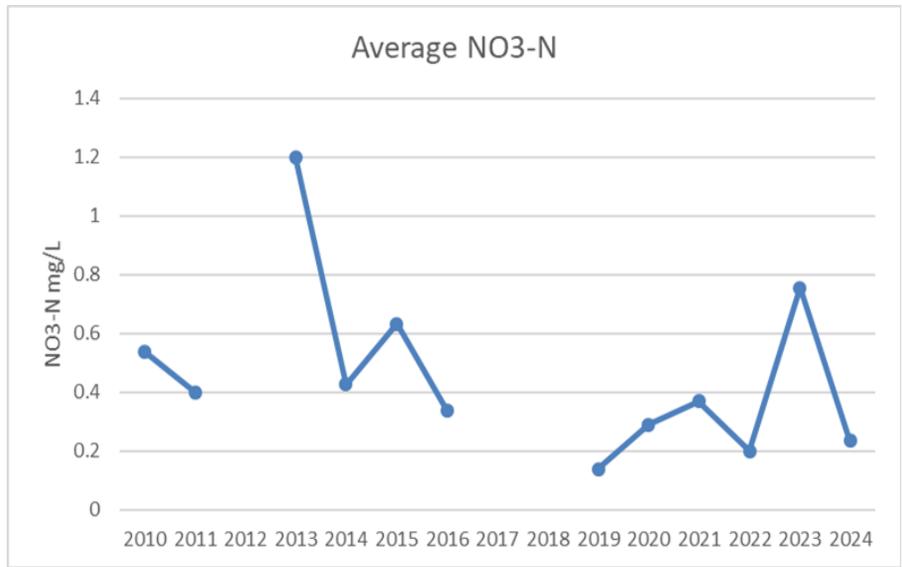
Wappasening Creek near Windham Center, PA
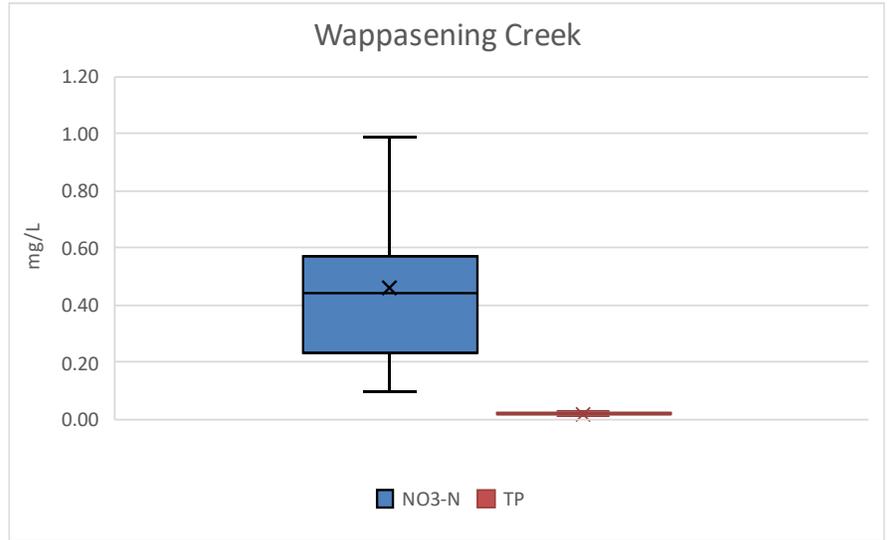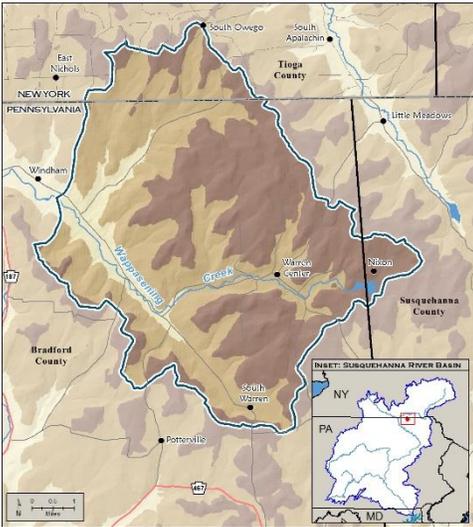
County:	Bradford (PA)
Latitude:	41.966614
Longitude:	-76.280828
Drainage Area (mi²)	47.14
Site Status:	Historic
Number of Samples: (NO3-N) (TP)	(12) (17)
Data collected	2010-2016
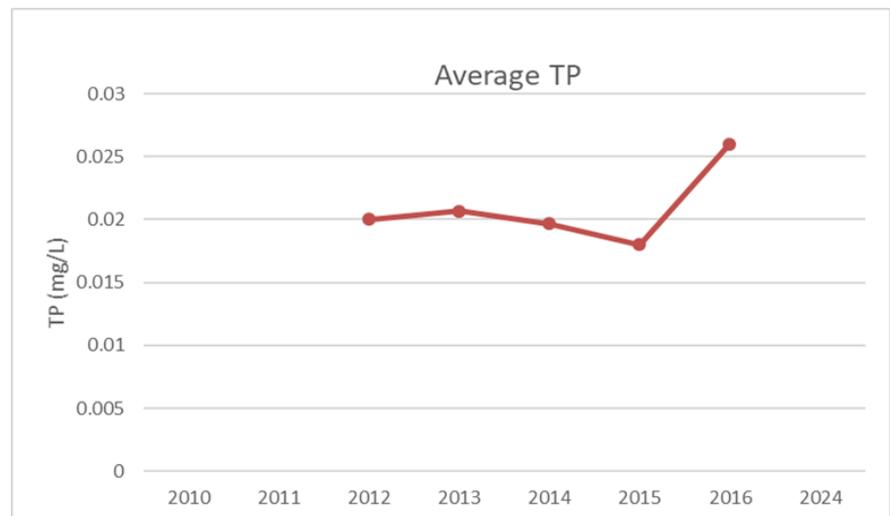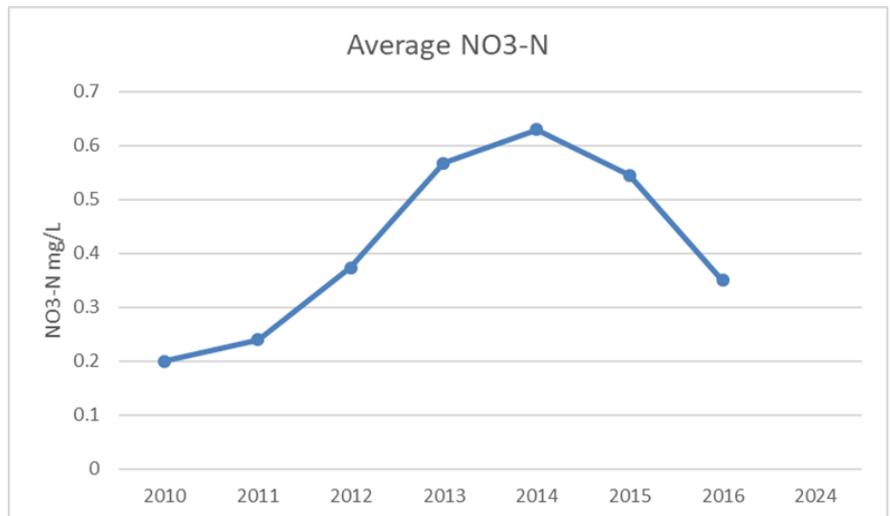
West Branch Owego Creek near Speedsville, NY

West Branch Owego Creek
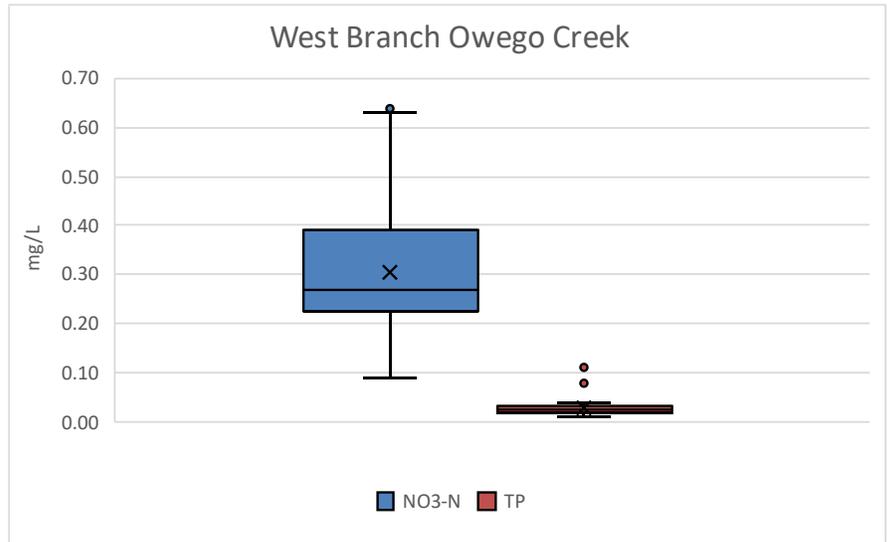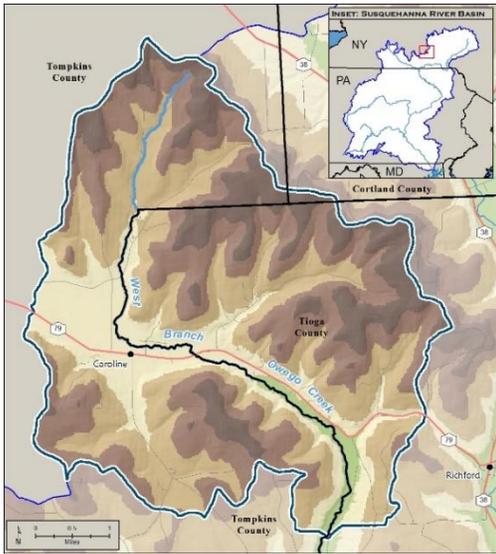
County:	Tioga(NY)
Latitude:	42.3424
Longitude:	-76.2444
Drainage Area (mi²)	24.39
Site Status:	Active
Number of Samples: (NO3-N) (TP)	(41) (46)
Data collected	2013-2024

Average NO3-N

Average TP