Walhonding Watershed Mass Balance

Final Technical Report - Version 2.0

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Prepared By:

Rural Action
Thriving Communities, Healthy Environments

With Support From:

MUSKINGUM WATERSHED CONSERVANCY DISTRICT

THE OHIO STATE UNIVERSITY

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1.0 INTRODUCTION

1.1 Background

Since 2018, Rural Action has been working with Muskingum Watershed Conservancy District and other partners in the Walhonding River Watershed to identify opportunities and plan water quality improvement projects. The Walhonding River Watershed drains 2,252 square miles in east-central Ohio, containing all or portions of nine counties. The Walhonding River Watershed has streams that are home to some of the most endangered animals in the United States; the purple cat's paw pearlymussel is not reproducing anywhere else in the world, but can be found breeding in Killbuck Creek. To preserve this biological gem it is imperative to introduce conservation practices for a wide range of land uses, including agricultural, forestry management, and urban stormwater management.

Current, accurate data is vital for a data-based approach to implementing conservation best management practices (BMPs), targeting the areas that will lead to the greatest water quality improvements. Unfortunately, much of the water quality data available throughout the region are ten or more years old. Updated chemical water quality information was needed to create the largest impact with conservation practices. Partner organizations, including Holmes SWCD, The Ohio State University at Mansfield, the Wilderness Center, and others, determined it was necessary to complete a watershed-wide mass-balance sampling event. This monitoring event, combined with a thorough review of existing data and literature, resulted in a comprehensive watershed water quality assessment, with recommendations for prioritized HUC12 watersheds for restoration and preservation projects that will have the most impact on the larger Walhonding River Watershed.

The watershed characterization sampling event was completed with the support of Greater Walhonding Conservation Alliance (GWCA) through contributions of their time, labor, and funding. The project was funded in large part by the Muskingum Watershed Conservancy District. The Ohio State University, Holmes Soil and Water Conservation Districts, AmeriCorps national service members, and community residents and volunteers all assisted with the collection of data during both high-flow and low-flow events.

1.2 Project Description

This watershed characterization survey collected chemical water quality data throughout the Walhonding River Watershed. Sample site location selection was made by utilizing the most recent data from the Ohio EPA, in order to increase consistency with existing water quality data. 124 sites were sampled during high flow in mid-May and low flow in late-August. Design of the monitoring plan was completed in partnership with GWCA organizations, and in consultation with The Ohio State University at Mansfield. Dr. Ozeas

Costa Jr. has been monitoring headwater streams in the Mohican River Watershed for over 10 years; his experiences and past research helped influence the final sample locations to achieve an accurate representation from multiple land uses and tributary sizes.

The data collected during these sampling events has been uploaded on a public platform—www.watersheddata.com - so that the data can be easily accessed. This website has been used by state agencies, research institutions, park districts, conservancy districts, and many nonprofit partners to safely and securely share water quality information. The distribution of the information collected will allow for actual implementation to be informed by the data collected by multiple partners simultaneously. Ohio University manages the platform and will be a partner in data collection, credibility, and quality assurance.

Looking downstream of Clear Creek

2.0 METHODS

2.1 Site Selection

Sites were selected primarily based on previously used Ohio EPA sample sites. The sites were selected to be bridge/road crossing sites so that samplers could minimize entering private property in order to access the sites. In HUC-12 watersheds where an OEPA site did not already exist at a bridge or easily accessible site, an alternative site was chosen as close to the confluence with the receiving stream. A minimum of one site was selected within each HUC-12 watershed. A list of the sites chosen is in Appendix 6.1. A map of the sites is in Appendix 6.2. For the low flow sampling event, a notification postcard was sent to landowners giving them the option to opt- out of sampling on their property. If a landowner opted out, the site was moved to a nearby bridge site. Three landowners opted out of sampling. The sites were split by location into four groups so that each of four sampling teams had approximately the same number of sites to sample.

2.2 Sampling Methods

Two, three-day sampling events took place—one when waterways would typically be at a high flow level and one when they would typically be at a low flow level. All field data was collected on standardized field data sheets. The date, time, samplers, weather conditions, and any observations were noted for each site. Field data was collected onsite using field monitors. Three of the teams used Myron meters and the fourth team used the Oakton PC450 meter. The field data collected included flow, water temperature, pH, conductivity, oxidation reduction potential, total dissolved solids (TDS), and dissolved oxygen. Three 20mL water samples were collected at each site as well as a blank at the end of each day of sampling. A standardized equipment cleanout method was utilized prior to filtering each sample. The sample bottles were labeled with sampler name, date, and site and placed into a small bag before being stored in a cooler with ice. Once the sampling was complete for each event, all of the sample bottles were moved to a refrigerator at the Ohio State University at Mansfield laboratory where they were later analyzed.

2.3 Data Analysis

Data analysis was conducted by Dr. Ozeas Costa from The Ohio State University. The samples were analyzed for NO_3, NO_2, NH_4, PO_4, dissolved silica, TN, TP, Ca, Mg, Na, K, HCO_3, Cl, SO_4, antimony, arsenic, barium, beryllium, cadmium, chromium, lead, selenium, aluminum, copper, iron, manganese, zinc, nickel, molybdenum, strontium, cobalt, thallium and vanadium. Raw data was used to create charts and maps identifying areas that have elevated levels of these chemicals, nutrients, and sediment.

White Heelsplitter *(Lasmigona complanata*) mussel found in Camel Creek

3.0 RESULTS

3.1 High Flow Sampling

A high flow sample collection was completed on May 10, 11, and 12, 2021. Because there had been significant rains in the week leading up to the sampling event, several of the sites were flooded and data could not be collected. After much discussion, sampling continued despite the high water because a vast majority of the sites were not in flood stage and waters were receding. Areas of extremely high flow were noted in the field sheet comments for each site. Due to a battery failure in the field meter, Repp Run and Little Killbuck did not have field data collected, but they did have laboratory data analyzed. No rain was noted at any of the sites during the sampling. Measures of central tendency and extrema from this sampling can be found in Appendix 6.3.

3.2 Low Flow Sampling

A low flow sample collection was completed on August 24, 25, and 26, 2021. During low flow sampling some of the teams experienced brief heavy rains on August 25. This rain was documented in the field data records. Due to a battery failure in one flow meter, stream flow volume could not be recorded at Black Creek, Wolf Creek, and Shrimplin Creek. The location WALH049 was noted at slightly different coordinates during the second sampling. Sites WALH011 and WALH048 were completely dry and samples and field data could not be collected during this sampling event. Measures of central tendency and extrema from this sampling can be found in Appendix 6.3.

3.3 Lab analysis

Dr. Ozeas Costa completed laboratory analysis of the samples and compiled a complete report which is attached as appendix 6.4 to this report. The samples were analyzed on the following dates:

- On May 24, 2021: May samples were analyzed for silicate (SiO_2) and nitrite (NO_2) plus nitrate (NO_3);
- On May 25, 2021: May samples were analyzed for orthophosphate (PO_4) and ammonium (NH_4);
- On June 2, 2021: May samples were analyzed for total nitrogen (TN) and total phosphorus (TP);
- On August 30, 2021: August samples were analyzed for orthophosphate (PO_4) and ammonium (NH_4);
- On August 31, 2021: August samples were analyzed for silicate (SiO_2) and nitrite (NO_2) plus nitrate (NO_3);
- On September 13, 2021: August samples were analyzed for total nitrogen (TN) and total phosphorus (TP);
- On September 14, 2021: August samples were re-analyzed for total nitrogen (TN) and total phosphorus (TP).

Vicki Irr, AmeriCorps volunteer with Rural Action, stands next to Little Killbuck Creek in Burbank, Ohio

4.0 DISCUSSION

4.1 Priority Watersheds

One of the goals of this project was to identify the HUC12 watersheds most in need of intensive nine-element nonpoint source implementation strategic plan (NPS-IS) development. A map is included as a visual representation of the impacted areas and can be found in Appendix 6.4. There were three areas of water quality concern along the Northern edge of the Walhonding Watershed due to high concentrations of nutrients during both sampling events.. There was one additional area of concern in the Southwest corner of the watershed. These watersheds should be targeted for restoration. Additionally, nine sites were noted during sampling as potential restoration project sites.

4.1 (a) Priority Watershed from Laboratory Analysis

The following watersheds were found to have extremely high concentrations of parameters known to limit aquatic life and use attainment status. See Appendix 6.6 for a listing of watersheds that display high concentrations of laboratory tested parameters.

The site that was found to have the highest concentration of Total Oxidized Nitrogen (TON) for both the high and low flow sampling events was WALH019, Spring Run. Spring Run is in the Apple Creek HUC-12 Watershed (05040030602). 55 watersheds contained extremely high concentrations of TON (>2.75mg/L) in the high flow sampling event, indicating that this is a parameter that should be a priority to address. In the low flow sampling event, only seven of the sites had concentrations of TON over 2.75mg/L.

The highest ammonium (NH_4) concentration during the low flow sampling event was found in Mile Run #4, at WALH108, which is in the Mile Run-Kokosing River HUC-12 (050400030202). The highest ammonium concentration during the high flow sampling event was found in Little Jelloway, WALH055. The HUC-12 number for the Little Jelloway Watershed is 050400030401. There were five sites with high concentrations of NH_4 (>.32 mg/L) during the low flow sampling event and three sites with high concentrations of NH_4 during the high flow sampling event. The sites with high concentrations were all different for high flow sampling and low flow sampling.

The Orthophosphate (PO_4) concentration was found to be highest during both high and low flow sampling in Sapps Run (WALH005), which is in the Shrimplin Creek-Killbuck HUC-12 (050400030705). During the high flow sampling event, two sites had concentrations of PO_4 over 120 µg/L (high levels). There were seven sites with high concentrations of PO_4 (over 120 µg/L) during the low flow sampling event.

Silicate (SiO_2) was highest during the high flow sampling event at the WALH036, Near Mouth Crooked Run, site. This site is located in the Crooked Creek-Walhonding Watershed (050400030908). During the low flow sampling event, SiO_2 was highest at WALH111, Trib to Kokosing #2. This site is located in the Headwaters Kokosing Watershed (050400030201). During the high flow sampling event 15 sites had concentrations of silicate above 4.5 mg/L, which is considered high. During low flow sampling 19 sites had high concentrations of silicate.

The Total Nitrogen (TN) was highest during the high flow sampling at Shipp Creek site. This site is in the Shipp Creek-Black Fork Mohican River Watershed (050400020102). TN was highest during the low flow sampling event in the Jerome Fork Mohican Watershed (WALH091), HUC 12 number 050400020605. There were 22 sites with TN concentrations considered high (over 4600 µg/L) during the high flow sampling event and there was one site considered high during the low flow sampling event.

Total Phosphorus (TP) was highest during the high flow sampling at the Headwaters Black Fork Mohican River (WALH124). The HUC 12 number for this watershed is 050400020102. During the low flow sampling TP was highest at the Sapps Run Site. High concentrations of TP were considered to be values over 330 µg/L. During the high flow sampling event 17 sites had high values of TP. During the low flow sampling event, two sites had high values of TP.

4.1 (b) Priority Watersheds from visual analysis/site visits

During sampling, sites that had potential for restoration or preservation were noted by samplers.

Sites that were noted for restoration were Paint Creek-WALH008 (050400030701), Killbuck Upstream Mowrer Lake-WALH027 (50400030504), Doughty Creek-WALH040 (050400030803), Big Run 2 - WALH063 (050400030303), Dowdy Creek-WALH069 (050400030402), Oldtown Run-WALH087 (050400020604), Trib to Rocky Fork-WALH114 (050400020204), and Headwaters Black Fork-WALH124 (050400020102). The most frequently cited reason for restoration potential was livestock presence in the waterway. Shade Creek-WALH 028 (050400030504) was noted as a site that had potential for preservation based on the excellent substrate present.

4.2 Next Steps

The data collected during this project is vital in the identification of future watershed preservation and restoration projects. HUC-12 watersheds identified as impacted watersheds should be prioritized for the development of nonpoint source implementation strategic plans. Notes taken by samplers in the field help to identify specific locations where conservation practices or restoration projects could be installed to improve water quality. Increased outreach to landowners should be undertaken by the different organizations working within the Greater Walhonding Conservation Alliance and other implementation organizations in order to have long-term adoption and maintenance of water quality BMPs. Additionally, because the data is now shared publicly and the report will be distributed to interested parties, other organizations have up-to-date information with which to make decisions on how and where they prioritize and implement projects.

Rural Action recommends the following HUC12 watersheds be prioritized for nine-element nonpoint source implementation strategy (NPS-IS) planning in the near future:

- **Jelloway Creek / 050400030402**

  The sites sampled in the Jelloway Creek Watershed were WALH054 (Jelloway Creek), WALH066 (East Branch Jelloway Creek at Humbert Rd), WALH067 (East Branch Jelloway Creek at Carey Rd), WALH068 (Sapps Run at Sapps Run Rd), WALH069 (Dowdy Creek), WALH070 (Jelloway Creek), WALH071 (Ireland Creek), and WALH072 (Trib to Jelloway). All of the sites except WALH072 tested high for Total Oxidized Nitrogen during the high flow sampling event. WALH054 measured high for Orthophosphate during the low flow sampling event. Silicate was measured as being a high level during the high flow sampling event for WALH066, WALH067, WALH068, WALH069, WALH070, and WALH071.. During the high flow sampling event, sites WALH069, WALH070, AND WALH071 were shown to have high values of Total Nitrogen (TN). Additionally, Site WALH069, Dowdy Creek, was identified by samplers as a site where there was livestock access to the stream.

- **Outlet Rocky Fork / 050400020204**

  The sites sampled in the Outlet Rocky Fork Watershed were WALH084 (Black Fork Mohican @ Wally Rd), WALH114 (Trib to Rocky Fork), WALH115 (Trib to Rocky Fork #2), and WALH116 (Trib to Rocky Fork #3). Site 114, Trib to Rocky Fork, was noted for restoration by samplers due to the presence of cattle in the waterway. Site 84 tested high for TON during both high and low flow event and high for orthophosphate during the low flow sampling event. Sites WALH115 AND WALH116 also contained high values for Total Phosphorus during the high flow sampling event.

- **Delano Run-Kokosing River / 050400030304**

  The site sampled in the Delano Run-Kokosing RIver Watershed were WALH058 (Wolf Run Kokosing), WALH093 (Cedar Run), WALH096 (Wolf Run), and WALH098 (Center Run). WALH098, Center Run, contained high concentrations of TON during the high flow sampling event and silicate during both high and low flow sampling events. Wolf Run-Kokosing (WALH058) contained high concentrations of NH_4 during the high flow sampling event. WALH096 was high for silicate during both high and low flow sampling events.

In addition to NPS-IS planning, we recommend continual communication between the stakeholders of the Greater Walhonding Conservation Alliance and relevant agencies such as Ohio EPA. Ohio EPA conducted water quality monitoring in the lower sections of the Walhonding River, up to river mile 16, in 2021 as part of the Large Rivers Survey project. They also completed monitoring at four sites in the Mohican River Watershed and three sites in the Killbuck Creek Watershed, all as part of the same Large Rivers Survey project. They will be releasing updated reports and TMDLs for the region within the next two years. Combined with the updated chemical information gathered during this characterization event, we hope local entities will continue to utilize all relevant data in making informed decisions about stream health and watershed projects.

Sarah Benton, AmeriCorps volunteer with Rural Action, measuring flow on Camel Creek

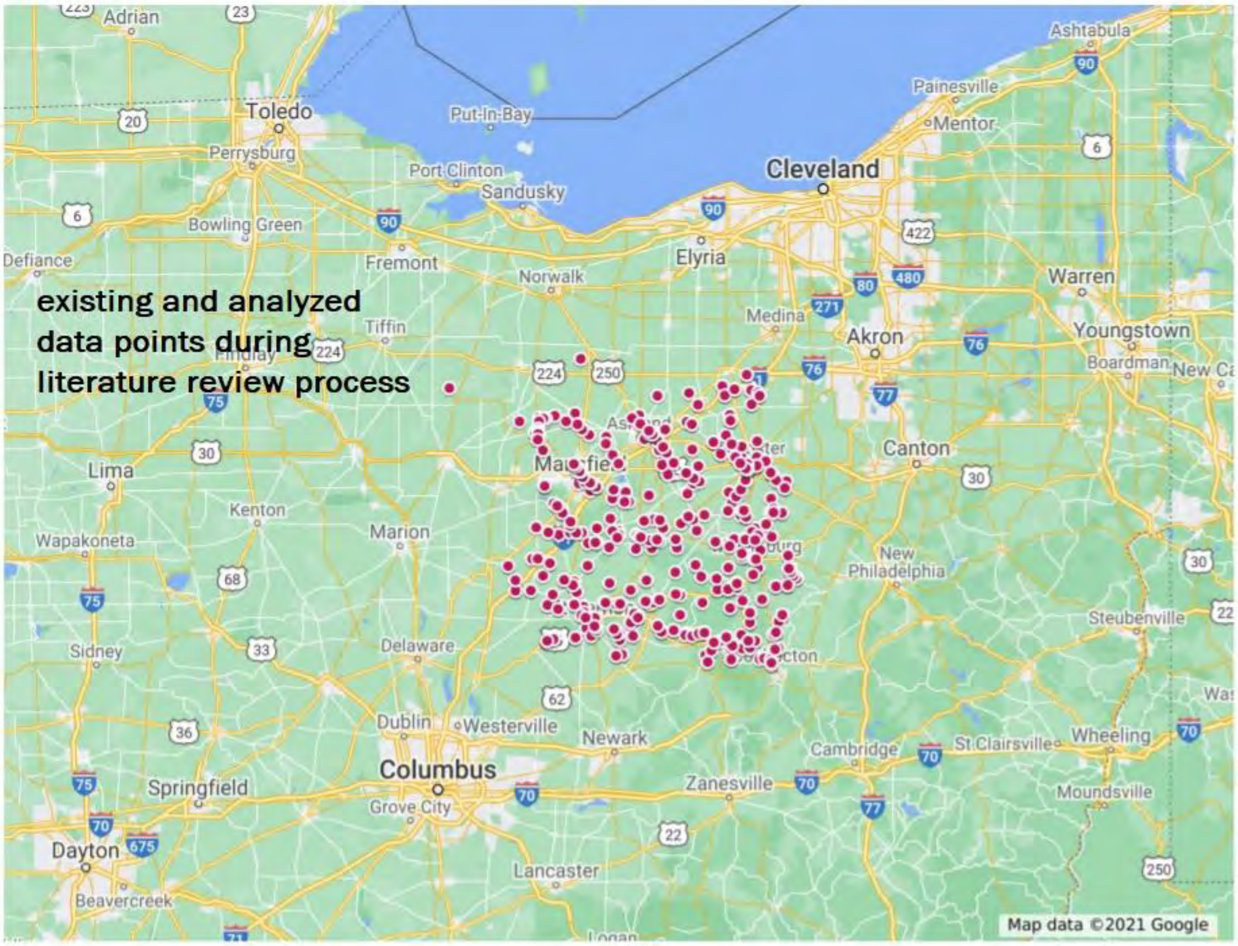
5.0 LITERATURE CITED

5.1 Literature Review Sources

Rural Action staff undertook a thorough literature review process starting on January 11th, 2021 and concluding February 28th, 2021. Data was selected and compiled from two sources, Ohio Environmental Protection Agency (Ohio EPA) and Holmes Soil and Water Conservation District (Holmes SWCD). Data collected was dated between 2007 and 2020. The most referenced and useful information came from EA3 HUC10 watershed assessments, attached in appendix 6.6, conducted by Ohio EPA between 2007 and 2010, because the detail of sample site location and attainment status directed us to possibly impaired watersheds.

In addition to reviewing water quality data from the above referenced sources, Rural Action also reviewed Ohio EPA-endorsed nine-element nonpoint source implementation strategy

(NPSIS) plans from the region and had verbal conversations with soil and water conservation district, natural resource conservation agencies, and state/federal environmental agency staff about known areas or types of impairments. The two completed and endorsed NPSIS plans included Tea Run-Killbuck Creek (HUC 50400030607) and Armstrong Run-Kokosing River (HUC 50400030302).



Looking downstream on Little Apple Creek, Wayne County, Ohio

6.0 Appendices

6.1 Site List

Site Name	HUC-12	Site Short Name
Black Creek	50400030704	WALH001
Wolf Creek	50400030801	WALH002
Shrimplin Creek	50400030705	WALH003
Sand Run	50400030705	WALH004
Sapps Run	50400030705	WALH005
Honey Run Killbuck	50400030703	WALH006
Martins Creek	50400030702	WALH007

Paint Creek	50400030701	WALH008
Salt Creek	50400030606	WALH009
North Branch Salt Creek	50400030605	WALH010
Tea Run	50400030607	WALH011
Rush Run @ Harrison Rd	50400030607	WALH012
Shreve Creek	50400030603	WALH013
Trib to Killbuck @ Willow Rd	50400030604	WALH014
Jennings Ditch	50400030604	WALH015
Apple Creek	50400030602	WALH016
Christmas Run	50400030505	WALH017
Little Apple Creek	50400030601	WALH018
Spring Run	50400030602	WALH019
Clear Creek	50400030505	WALH020
Little Killbuck @ Lattasburg Rd	50400030503	WALH021
Upper Muddy Fork Mohican	50400020501	WALH022
Middle Muddy Fork Mohican	50400020502	WALH023
Lower Muddy Fork Mohican	50400020503	WALH024
Rathburn Run	50400030503	WALH025
Cedar Run	50400030504	WALH026
Killbuck upst. Mowrer Lake	50400030504	WALH027
Shade Creek	50400030504	WALH028
Repp Run	50400030502	WALH029
Little Killbuck@ West Salem Rd.	50400030502	WALH030
Camel Creek	50400030502	WALH031
Killbuck Ditch	50400030501	WALH032
Near Mouth of Mill Creek	50400030907	WALH033
Spoon Creek	50400030907	WALH034
Turkey Run	50400030907	WALH035
Near Mouth Crooked Run	50400030908	WALH036
Near Mouth of Killbuck	50400030805	WALH037
Hoagland Run	50400030805	WALH038
Big Run	50400020804	WALH039

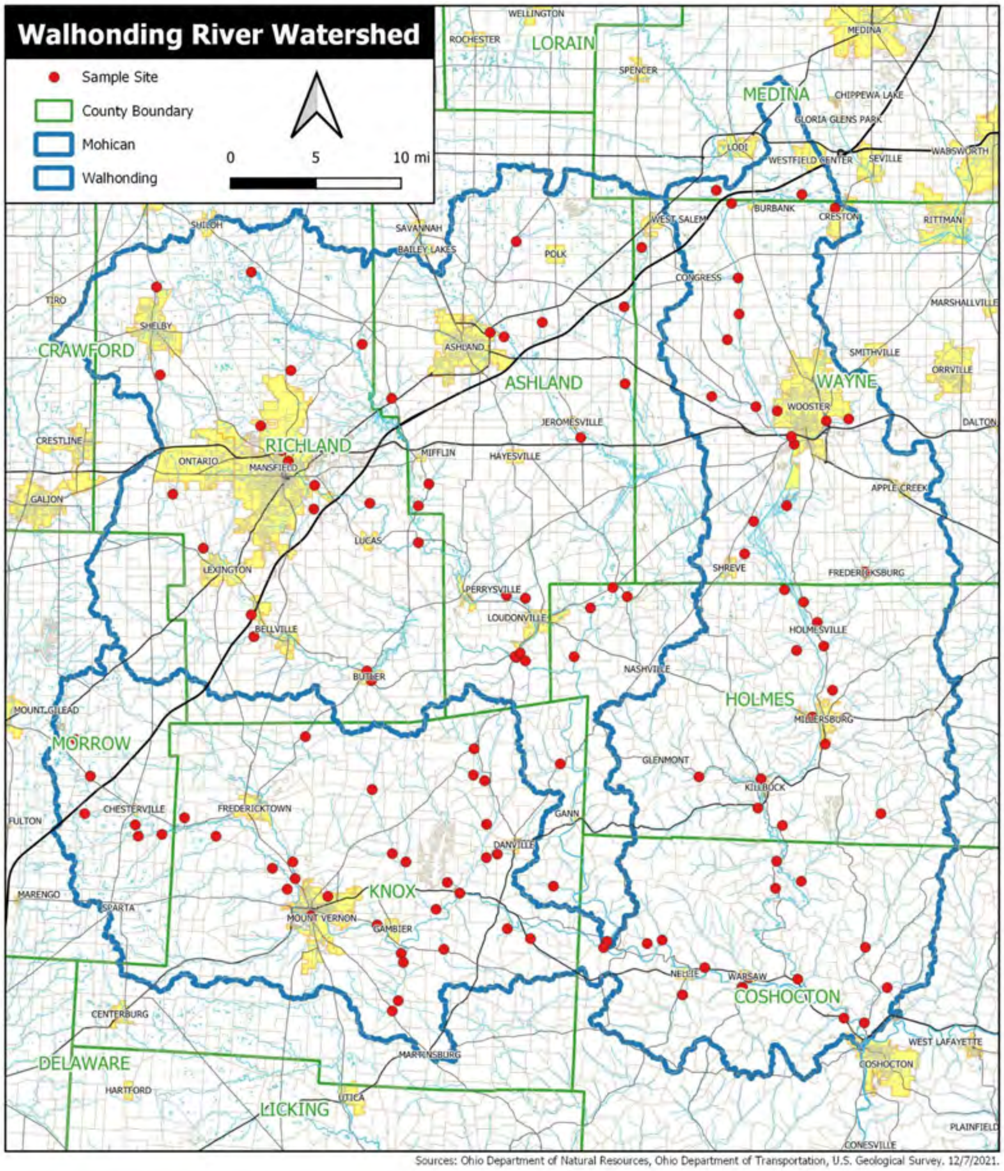
Doughty Creek	50400030803	WALH040
Headwaters Doughty Creek	50400030802	WALH041
Laurel Creek	50400030804	WALH042
Near Mouth of Beaver Run	50400030903	WALH043
Simmons Run	50400030904	WALH044
Darling Run	50400030905	WALH045
Mowhawk Creek	50400030901	WALH046
Dutch Run	50400030902	WALH047
Honey Run #1	50400030902	WALH048
Near Mouth of Mohican	50400020806	WALH049
Flat Run	50400020806	WALH050
Near Mouth of Lauren Run	50400020806	WALH051
Brush Run	50400030403	WALH052
Honey Run #2	50400020403	WALH053
Jelloway Creek	50400030402	WALH054
LIttle Jelloway Creek	50400030401	WALH055
Schenck Creek	50400030306	WALH056
LIttle Schenck Creek	50400030305	WALH057
Wolf Run Kokosing*	50400030304	WALH058
Indianfield Run	50400030307	WALH059
Trib to Big Run	50400030303	WALH060
Big Run 1	5040003000185	WALH061
Elliot Run	50400030303	WALH062
Big Run 2	50400030303	WALH063
LIttle Schenck Creek	50400030305	WALH064
Coleman Branch	50400030306	WALH065
East Branch Jelloway Creek at Humbert Rd	50400030402	WALH066
East Branch Jelloway Creek at Carey Rd	50400030402	WALH067
Sapps Run at Sapps Run Rd	50400030402	WALH068
Dowdy Creek	50400030402	WALH069
Jelloway Creek	50400030402	WALH070

Ireland Creek	50400030402	WALH071
Trib to Jelloway	50400030402	WALH072
Negro Run	50400020805	WALH073
Pine Run	50400020404	WALH074
Clear Fork Mohican	50400020405	WALH075
Black Fork Mohican	50400020803	WALH076
Sigafoos Run Mohican	50400020804	WALH077
Lake Fork Mohican	50400020703	WALH078
Big Run	50400020803	WALH079
Plum Run	50400020703	WALH080
Mohicanville Dam	50400020702	WALH081
Crab run	50400020701	WALH082
Honey Creek-Check huc 12	50400020801	WALH083
Black Fork Mohican @ Wally Rd	50400020204	WALH084
Charles Mill- Black Fork Mohican	50400020205	WALH085
Seymour Run	50400020202	WALH086
Oldtown Run	50400020604	WALH087
Village of Pavonia-Black Fork Mohican	50400020201	WALH088
Katotawa Creek	50400020603	WALH089
Lang Creek	50400020601	WALH090
Jerome Fork Mohican	50400020605	WALH091
Orange Creek	50400020602	WALH092
Cedar Run*	50400030304	WALH093
Clear Fork Upstr. WWTP	50400020403	WALH094
Slater Run	50400020403	WALH095
Wolf Run*	50400030304	WALH096
Dry Creek	50400030301	WALH097
Center Run	50400030304	WALH098
Armstrong Run	50400030302	WALH099
North Branch Kokosing	50400030103	WALH100
Granny Creek	50400030203	WALH101

Job Run	50400030103	WALH102
East Branch Kokosing	50400030102	WALH103
Mile Run	50400030202	WALH104
Trib to Mile RUn	50400030202	WALH105
Trib to Mile RUn 2	50400030202	WALH106
Trib to Mile RUn 3	50400030202	WALH107
Trib to Mile RUn 4	50400030202	WALH108
South Branch Kokosing	50400030201	WALH109
Trib to Kokosing @ center corners-Chesterville Rd	50400030201	WALH110
Trib to Kokosing #2	50400030201	WALH111
Cedar Fork Mohican*	50400020302	WALH112
Clear Fork Downstream of Golf Club	50400020301	WALH113
Trib to Rocky Fork	50400020204	WALH114
Trib to Rocky Fork #2	50400020204	WALH115
Trib to Rocky Fork #3	50400020204	WALH116
Touby Run	50400020203	WALH117
Trib to Rocky Fork #4	50400020203	WALH118
Rocky Fork	50400020203	WALH119
Brubaker Creek	50400020103	WALH120
Whetstone Creek	50400020104	WALH121
Shipp Creek	50400020105	WALH122
Marsh Run	50400020101	WALH123
Headwaters Black Fork	50400020102	WALH124
Headwaters Clear Fork	50400020301	WALH125
Clear Creek at Reservoir Discharge	50400020303	WALH126

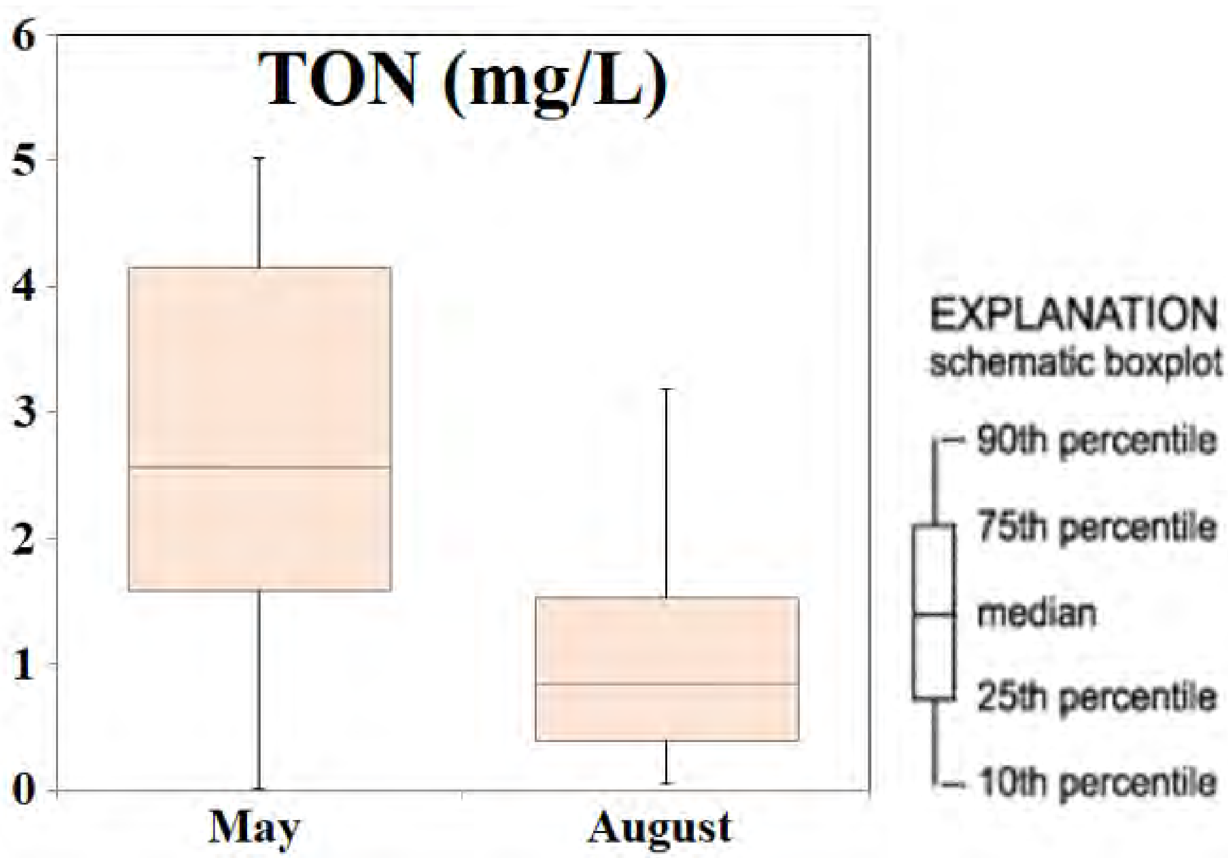
*Denotes a site that is a duplicate

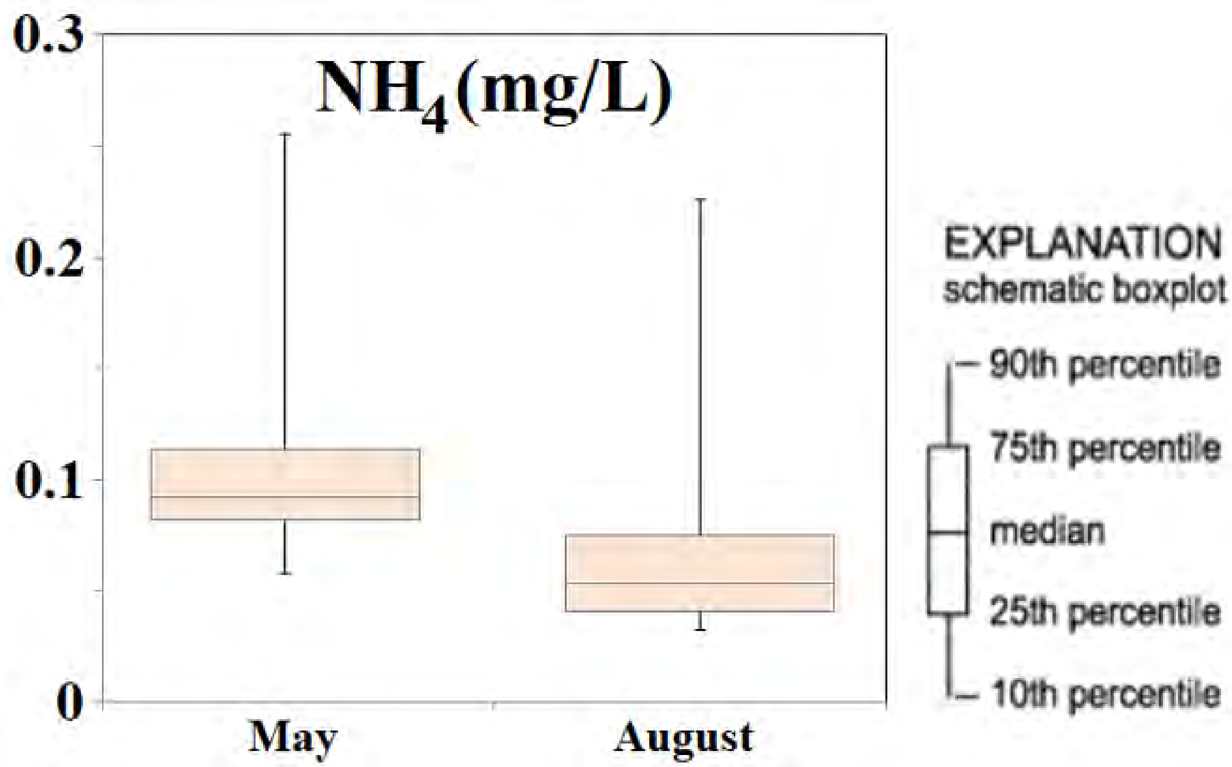
6.2 Site map

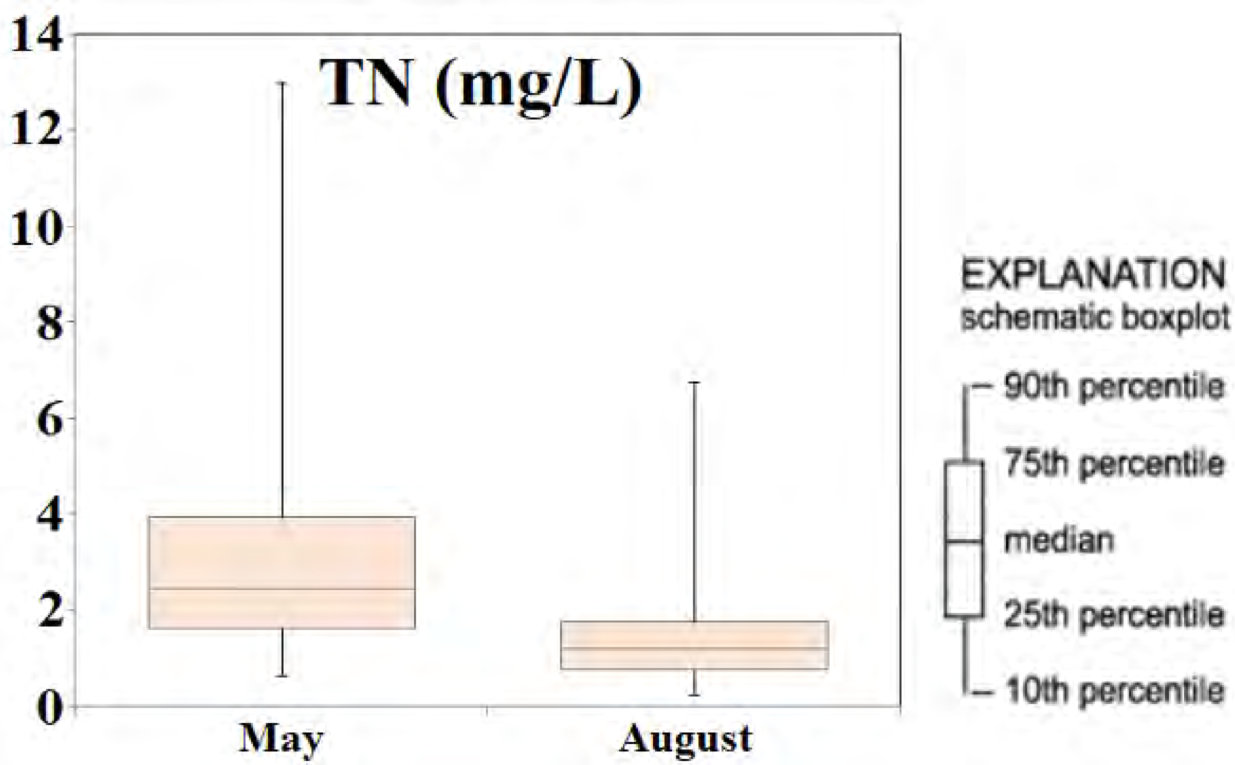

Walhonding River Watershed
Sample Site
County Boundary
Mohican
Walhonding
0
5
10 mi
LORAIN
MEDINA
CRAWFORD
RICHLAND
ASHLAND
WAYNE
HOLMES
MORROW
KNOX
COSHOCTON
DELAWARE
LICKING
Sources: Ohio Department of Natural Resources, Ohio Department of Transportation, U.S. Geological Survey. 12/7/2021.

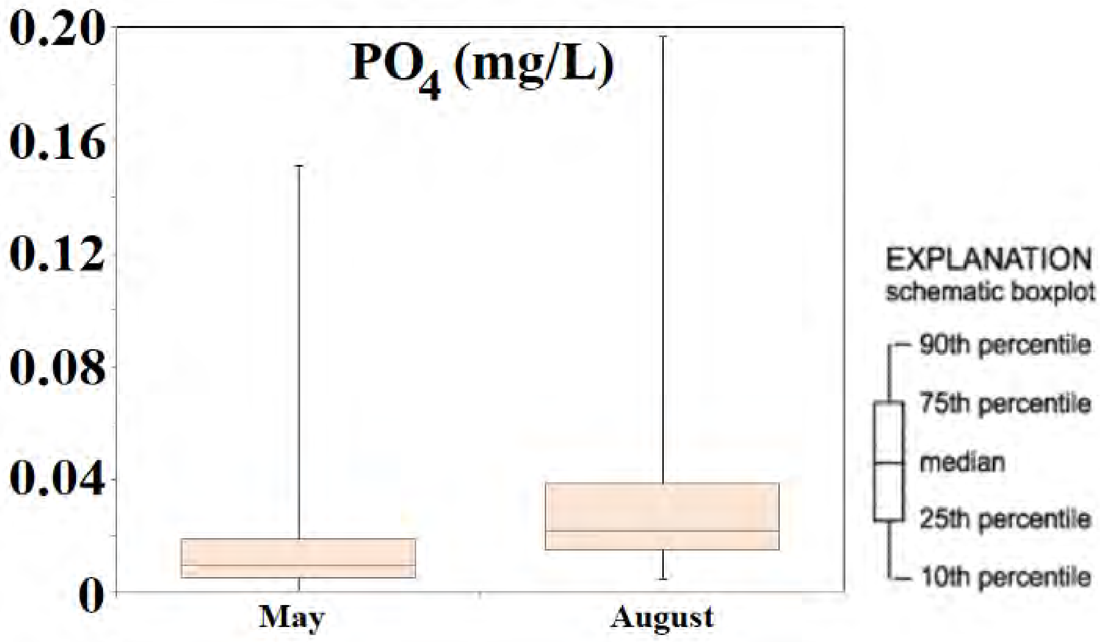
6.3 Field Data

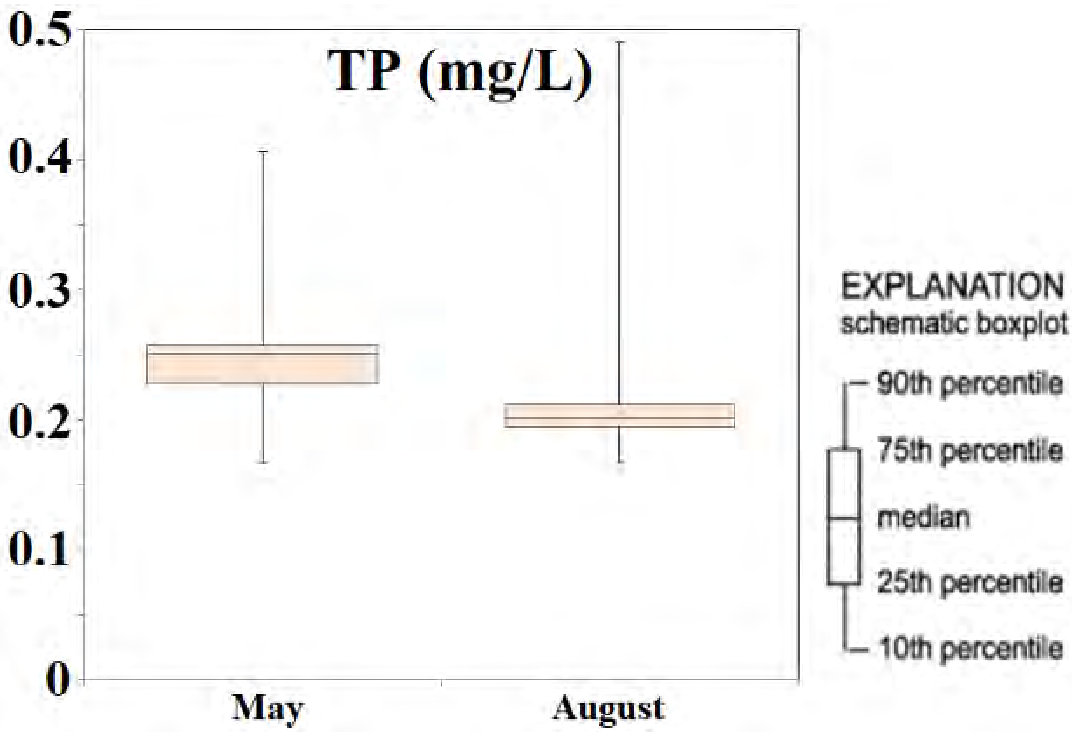
	May 2021				Aug 2021			
	Mean	StDev	Min	Max	Mean	StDev	Min	Max
TON	2717.3	1416.8	14.6	5017.3	1047.4	797.0	50.8	3183.5
NH_4	115.9	68.9	58.4	551.5	91.6	118.4	32.3	734.6
TN	2952.9	1978.1	641.2	12958.9	1432.7	973.0	252.4	6765.1
PO_4	16.8	32.8	0.01	319.6	44.0	104.2	4.43	1100.3
TP	256.8	56.4	167.2	406.6	215.6	80.2	167.2	1040.4
SiO_2	3729.9	812.1	301.5	5194.4	3663.3	827.4	1279.1	6228.9

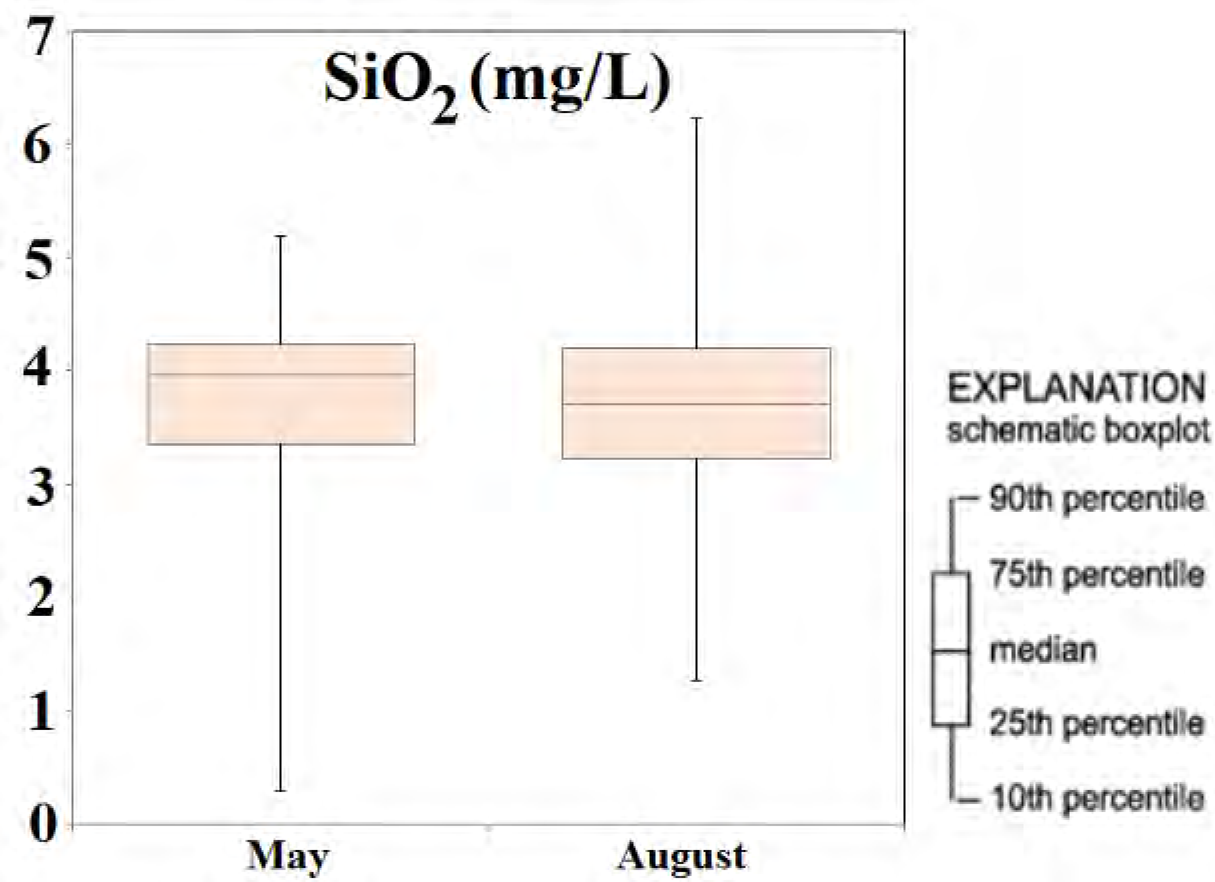



0.3
NH4(mg/L)
0.2
0.1
0
May
August
EXPLANATION
schematic boxplot
90th percentile
75th percentile
median
25th percentile
10th percentile

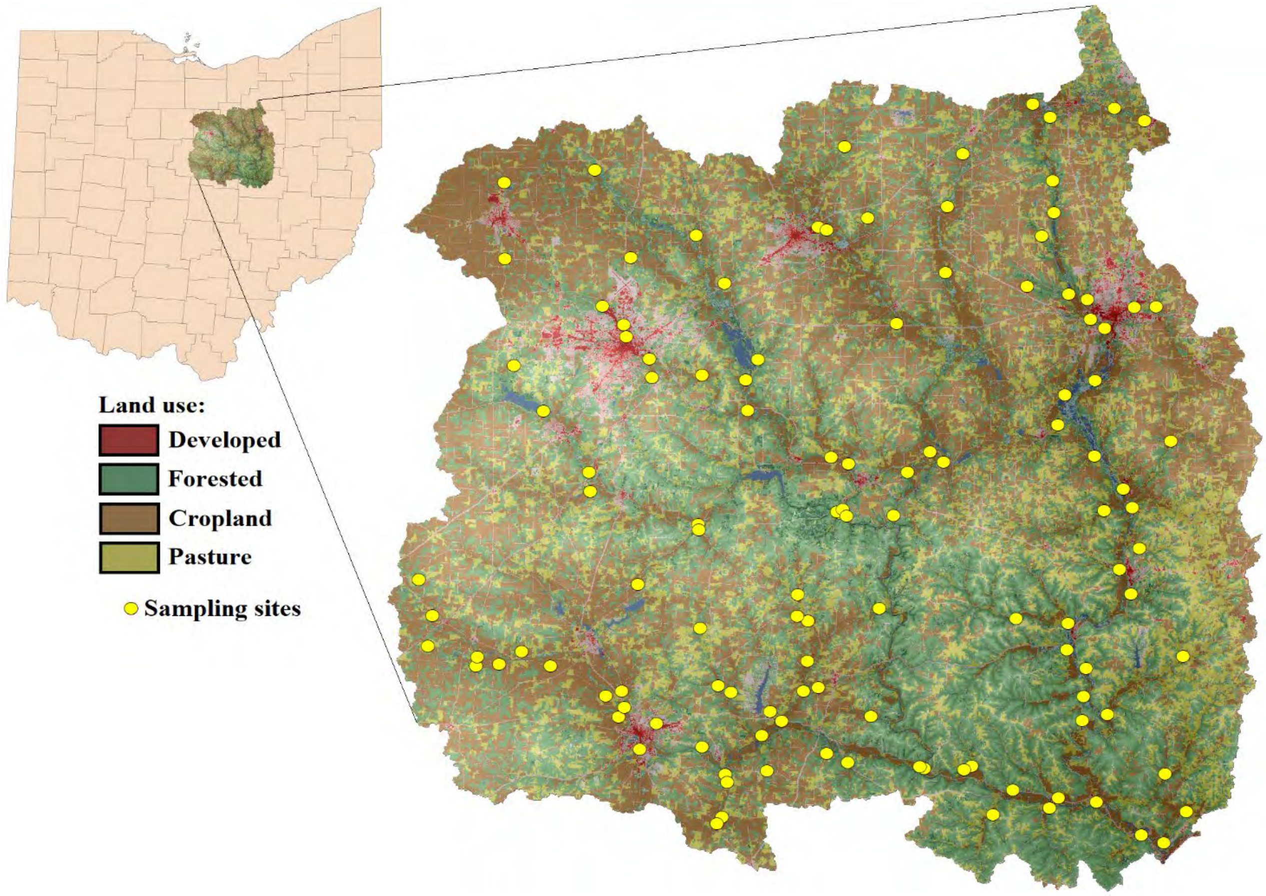

14
TN (mg/L)
12
10
8
6
4
2
0
May
August
EXPLANATION
schematic boxplot
90th percentile
75th percentile
median
25th percentile
10th percentile


PO4 (mg/L)
0.20
0.16
0.12
0.08
0.04
0
May
August
EXPLANATION
schematic boxplot
90th percentile
75th percentile
median
25th percentile
10th percentile


TP (mg/L)
0.5
0.4
0.3
0.2
0.1
0
May
August
EXPLANATION
schematic boxplot
90th percentile
75th percentile
median
25th percentile
10th percentile


SiO2 (mg/L)
7
6
5
4
3
2
1
0
May
August
EXPLANATION
schematic boxplot
90th percentile
75th percentile
median
25th percentile
10th percentile

The Walhonding Watershed



Characteristics of the Study Area

The Walhonding River watershed drains an area of about 2,252 square miles (5,833 km^2) over nine counties in north-central Ohio: Knox, Morrow, Crawford, Richland, Ashland, Medina, Wayne, Holmes, and Coshocton. The Walhonding River is formed by the confluence of three major tributaries: the Kokosing River, which flows from the west for approximately 57 miles, draining about 21% of the watershed; the Killbuck River, which flows from the northeast for approximately 82 miles, draining about 27% of the watershed; and the Mohican River, its larger tributary, which flows from the north for about 40 miles in Ashland County, after collecting waters from the Clear Fork, the Black Fork, and the Lake Fork, draining about 1,000 square miles (or 44%) of the Walhonding watershed.

The Walhonding is a mixed-use watershed. About 36.7% of the area is forested, with most of this forested land occupying the southeastern portion of the watershed. Another 33.2% of the land is used for cultivated crops, while 17.0% is used for pasture. Only 10.5% of the watershed is considered residential, with intensive development covering about 1% of the total area, encompassing the towns of Mansfield (population: 46,576), Wooster (population: 26,673), Ashland (population: 20,390), Mount Vernon (population: 16,667) and Shelby (population: 8,866). The figure above shows the location of 126 stream sites sampled in the watershed during spring (May 11-13, 2021) and summer (August 24-26, 2021). This report summarizes the geochemical dataset produced from the analysis of the samples.

The Geochemical Dataset

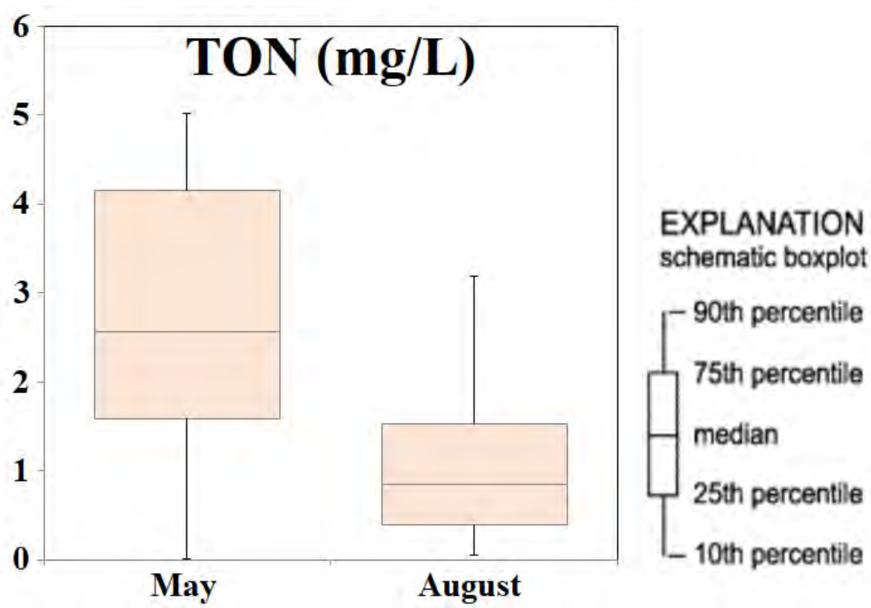
Stream water samples were analyzed for major nutrients (nitrate plus nitrate, ammonium, orthophosphate, reactive silica, total nitrogen, and total phosphorus) using a Skalar San^{++} continuous flow analyzer at the Water Isotope and Nutrient Laboratory (WINL) at the Ohio State University. Elemental analyses were also performed for detection of 76 major and trace elements, using a Perkin Elmer Elan ICP-MS at the Trace Element Research Laboratory (TERL) at the Ohio State University.

1. Major plant nutrients

The range of nutrient concentrations in the study area is very large, reflecting the extreme variations in local conditions, from the wide array of land use and vegetation cover to great extremes in stream discharge and hydrology. Precipitation also plays a significant role, since many of the sites sampled in the spring were still in flood stage. In general, mean concentrations were higher in the spring, compared to the summer, for all parameters except orthophosphate (PO_4). The table below summarizes this nutrient dataset (concentrations are provided in µg/L):

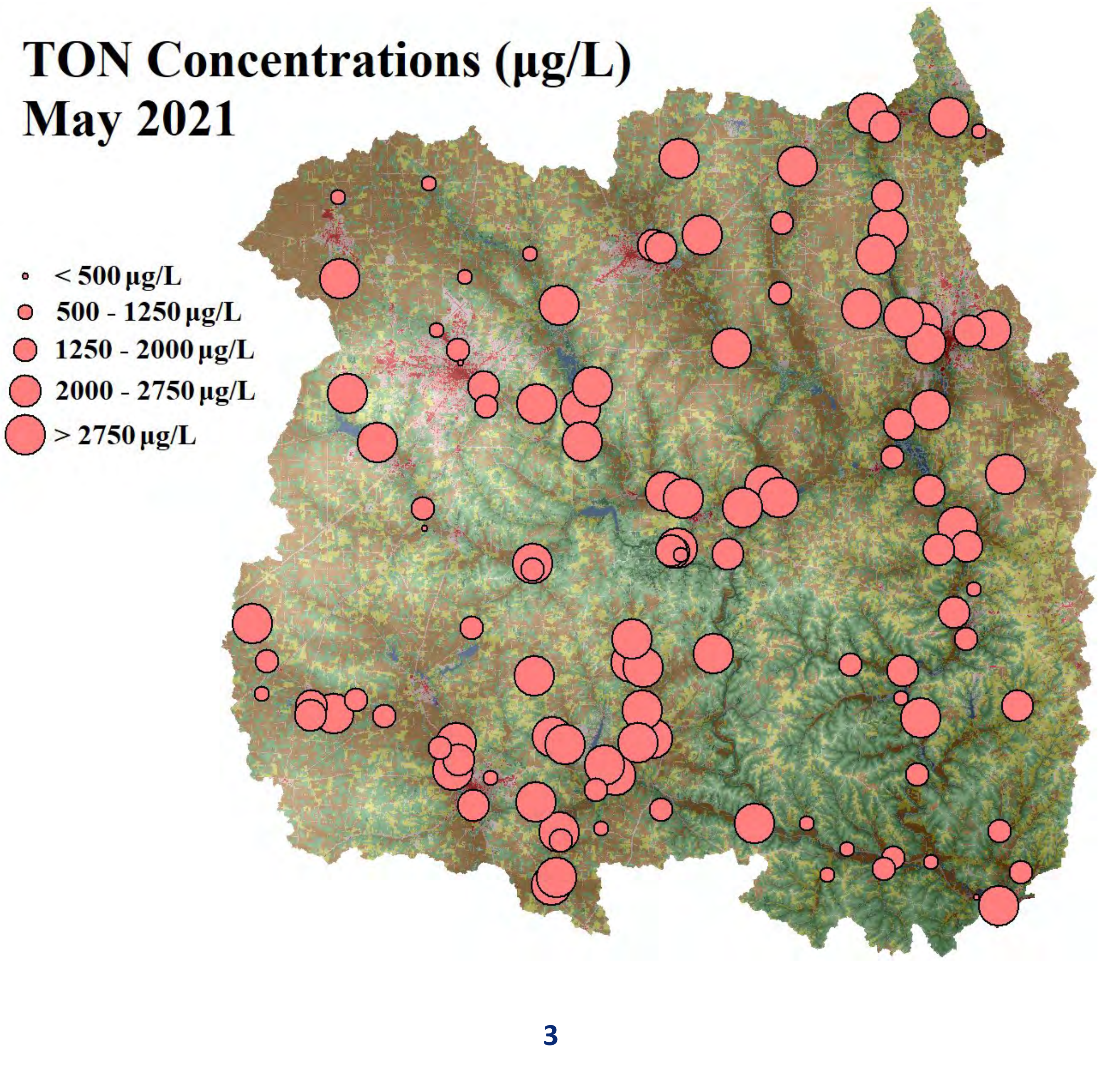
	May 2021				Aug 2021			
	Mean	StDev	Min	Max	Mean	StDev	Min	Max
TON	2717.3	1416.8	14.6	5017.3	1047.4	797.0	50.8	3183.5
NH_4	115.9	68.9	58.4	551.5	91.6	118.4	32.3	734.6
TN	2952.9	1978.1	641.2	12958.9	1432.7	973.0	252.4	6765.1
PO_4	16.8	32.8	0.01	319.6	44.0	104.2	4.43	1100.3
TP	256.8	56.4	167.2	406.6	215.6	80.2	167.2	1040.4
SiO_2	3729.9	812.1	301.5	5194.4	3663.3	827.4	1279.1	6228.9

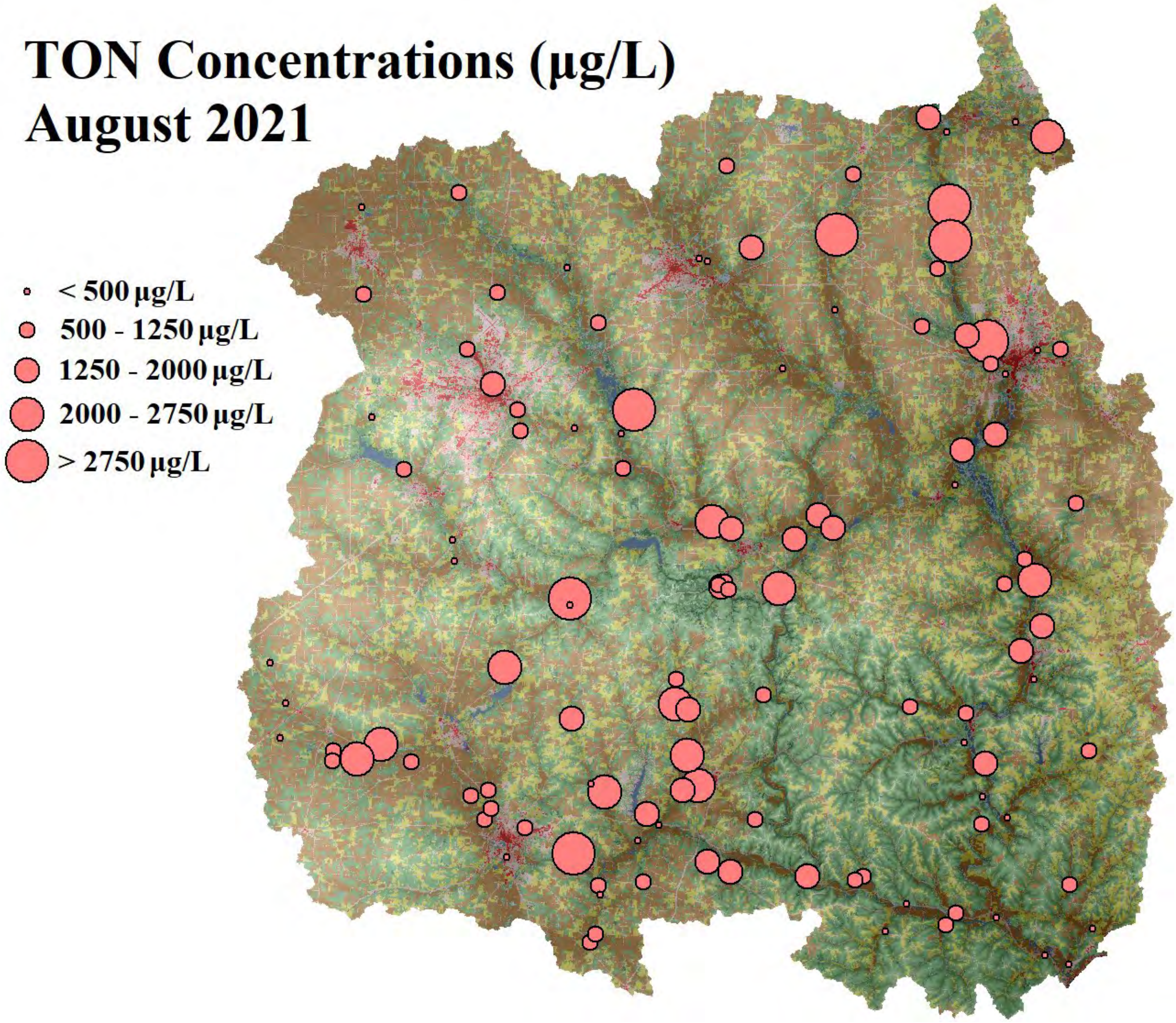
1.1. Total Oxidized Nitrogen (NO_2+NO_3)



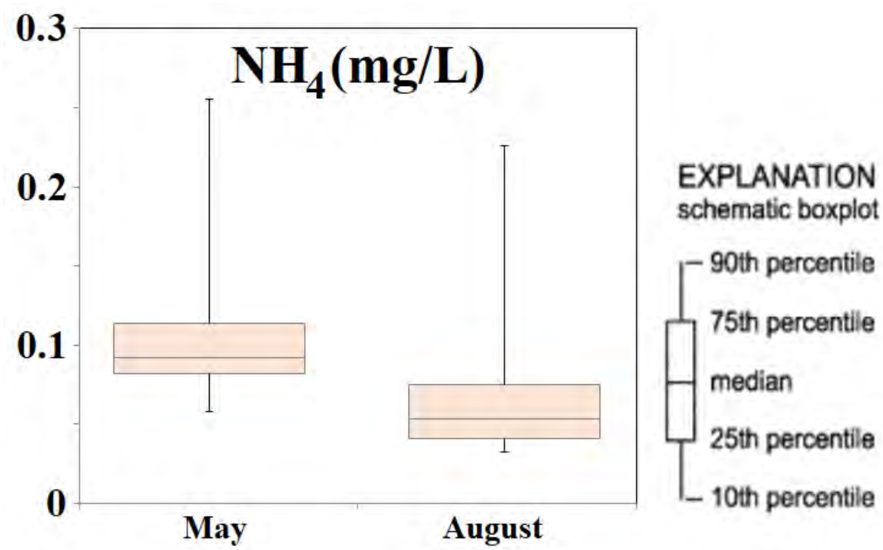
Total Oxidized Nitrogen or TON is a measure of two inorganic forms of nitrogen in a sample: nitrite-nitrogen plus nitrate-nitrogen. These soluble compounds are in a form that can be readily used by plants and algae. Nitrite levels are often much lower than nitrate since, in most cases, nitrites are oxidized to nitrates, unless the dissolved oxygen present in the water is too low (a condition called hypoxia). Too much TON can contribute to excessive algal growth in waterways. Nitrate enters water and soil through runoff from fields treated with nitrogen fertilizer, animal manure, septic tank wastes, and sewage sludge.

Concentrations of total oxidized nitrogen (NO_2+NO_3) in the study sites varied from a low of 14.6 µg/L (in May 2021) to a maximum of 5017.3 µg/L (also in May). TON concentrations in spring are, on average, about 4.8 times higher than summer concentrations. Some of the lowest TON values were found in stream reaches on the southeast corner of the watershed, the section most heavily forested in the study area (figure below).



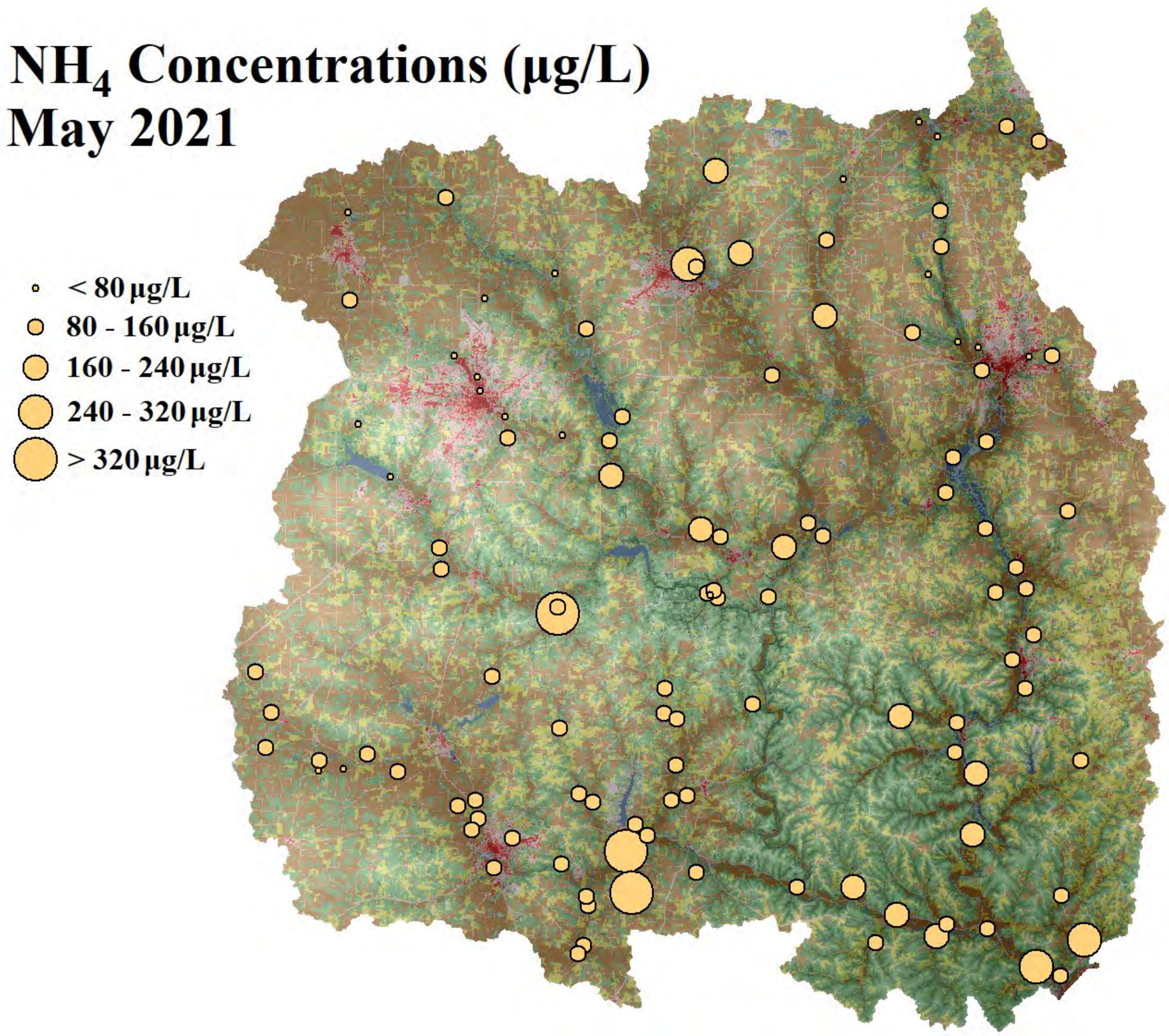


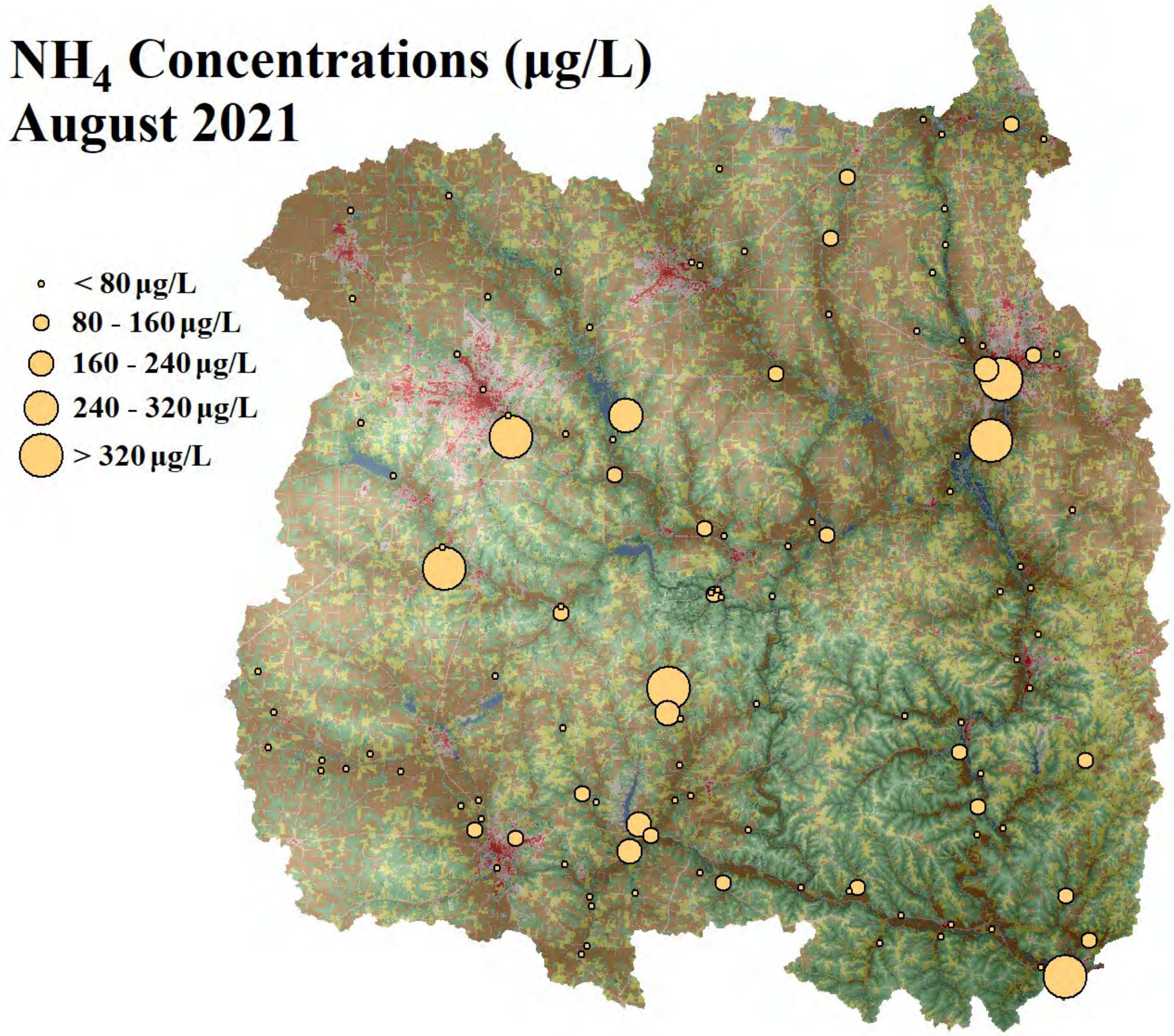
1.2. Ammonium Nitrogen (NH_4)



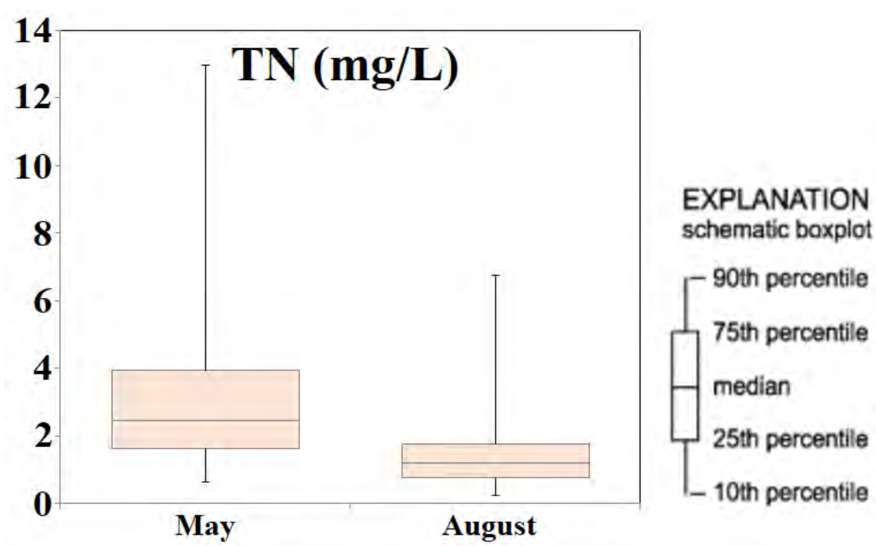
Ammonia is produced for commercial fertilizers and other industrial applications. Natural sources of ammonia include the decomposition or breakdown of organic waste matter, gas exchange with the atmosphere, forest fires, animal and human waste, and nitrogen fixation processes. Ammonia can enter the aquatic environment via direct means such as municipal effluent discharges and the excretion of nitrogenous wastes from animals, and indirect means such as nitrogen fixation, air deposition, and runoff from agricultural lands. When ammonia is present in water at high enough levels, it is difficult for aquatic organisms to sufficiently excrete the toxicant, leading to toxic buildup in internal tissues and blood, and potentially death. Environmental factors, such as pH and temperature, can affect ammonia toxicity to aquatic animals. Ammonia in the presence of dissolved oxygen is converted into nitrate by nitrifying bacteria in the water. This causes depletion of the dissolved oxygen (hypoxia).

Ammonium (NH_4) concentrations in the study sites varied from a low of 32.3 µg/L (in August 2021) to a maximum of 734.6 µg/L (also in August). NH_4 concentrations in the spring are, on average, about 1.9 times higher than summer concentrations.

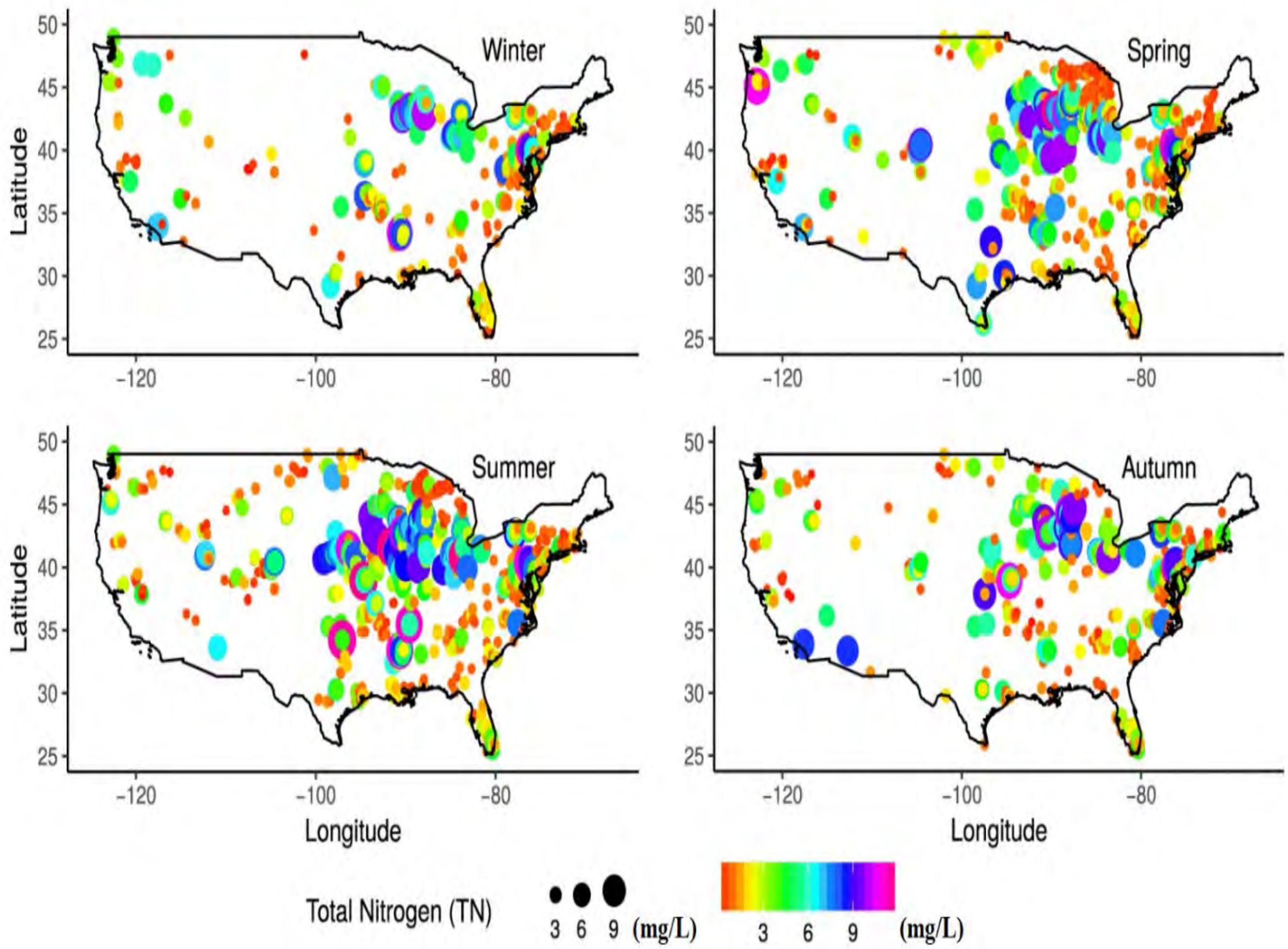




1.3. Total Nitrogen (TN)

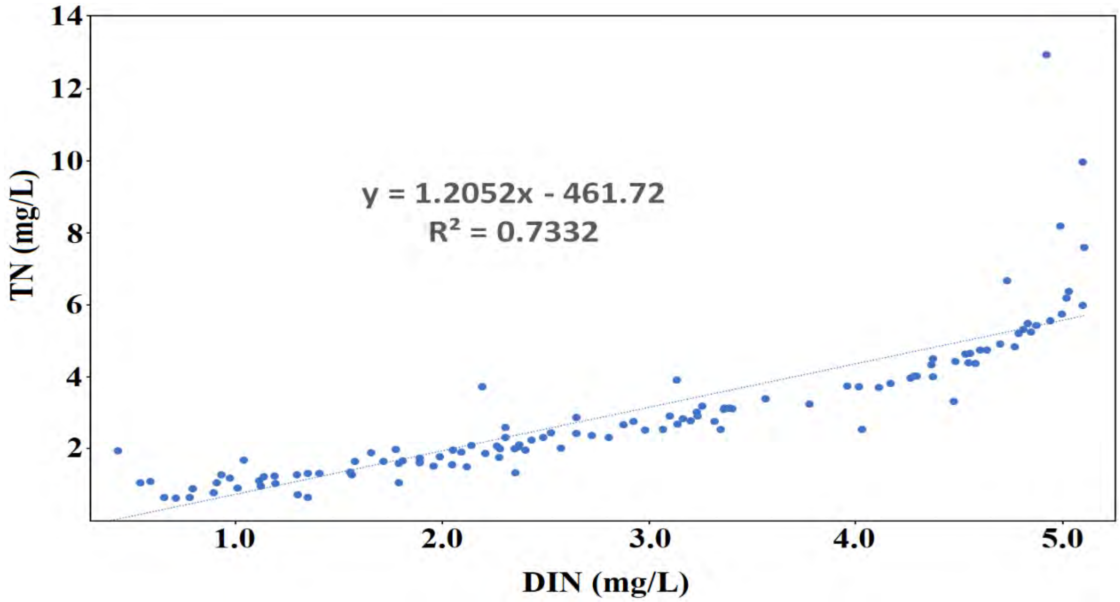


Total Nitrogen (TN) is the sum of nitrate (NO_3), nitrite (NO_2), ammonium (NH_4) and organic nitrogen (such as amino acids, plant tissue, and detritus). Naturally occurring levels of total nitrogen vary substantially across the country, although TN concentrations are usually highest in the northeast and Midwest (figure below) with peak concentrations occurring in the summer and lowest in the winter.

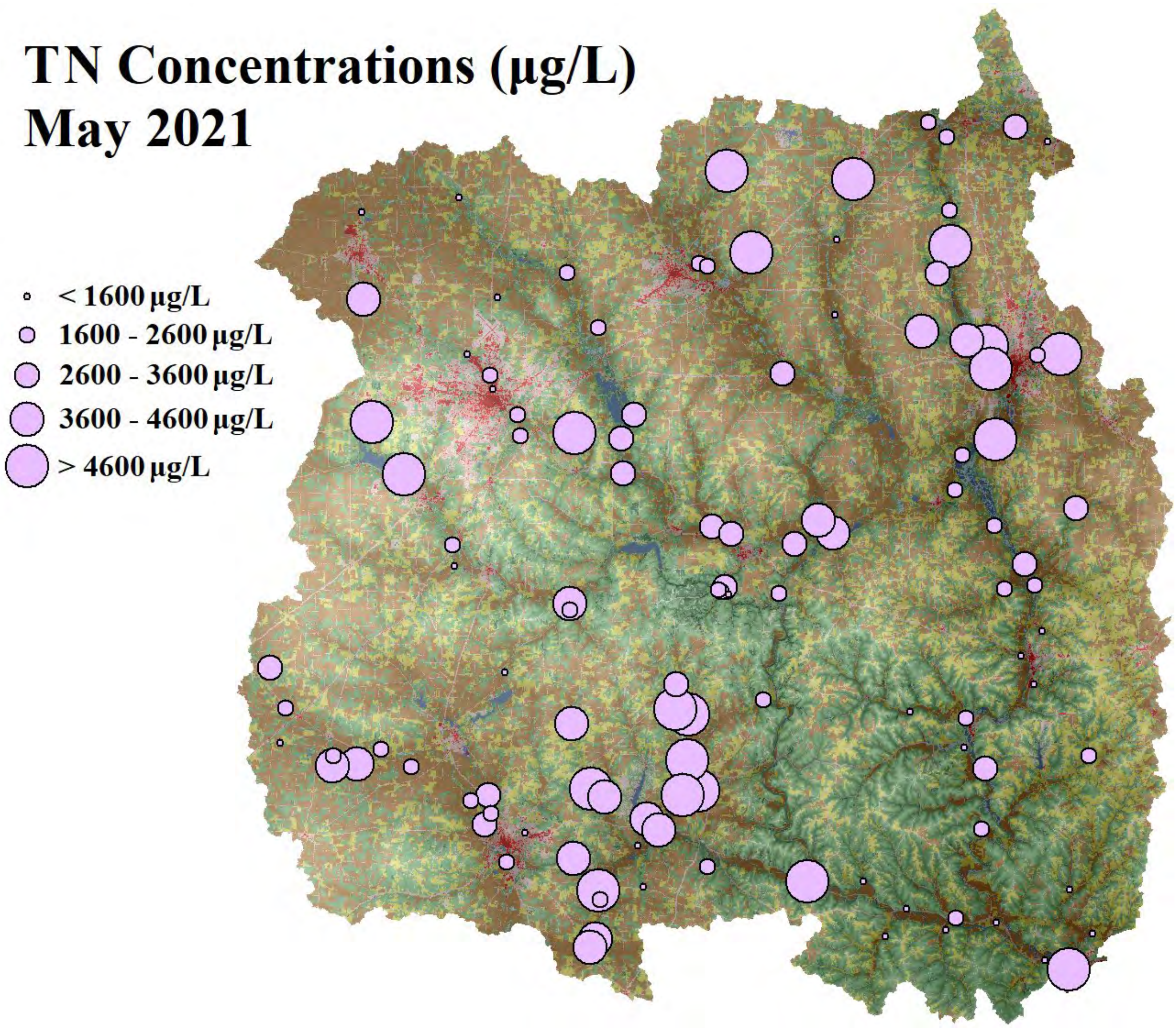


Total nitrogen concentrations in the study sites varied from a low of 0.25 mg/L (in August 2021) to a maximum of 12.96 mg/L (in May 2021). The EPA reference levels for total nitrogen in streams range from 0.12 to 2.2 mg/L. As such, most of the streams in this study exceed the recommended water quality criteria, especially during the spring. TN concentrations in the spring are, on average, about 2.5 times higher than summer concentrations.

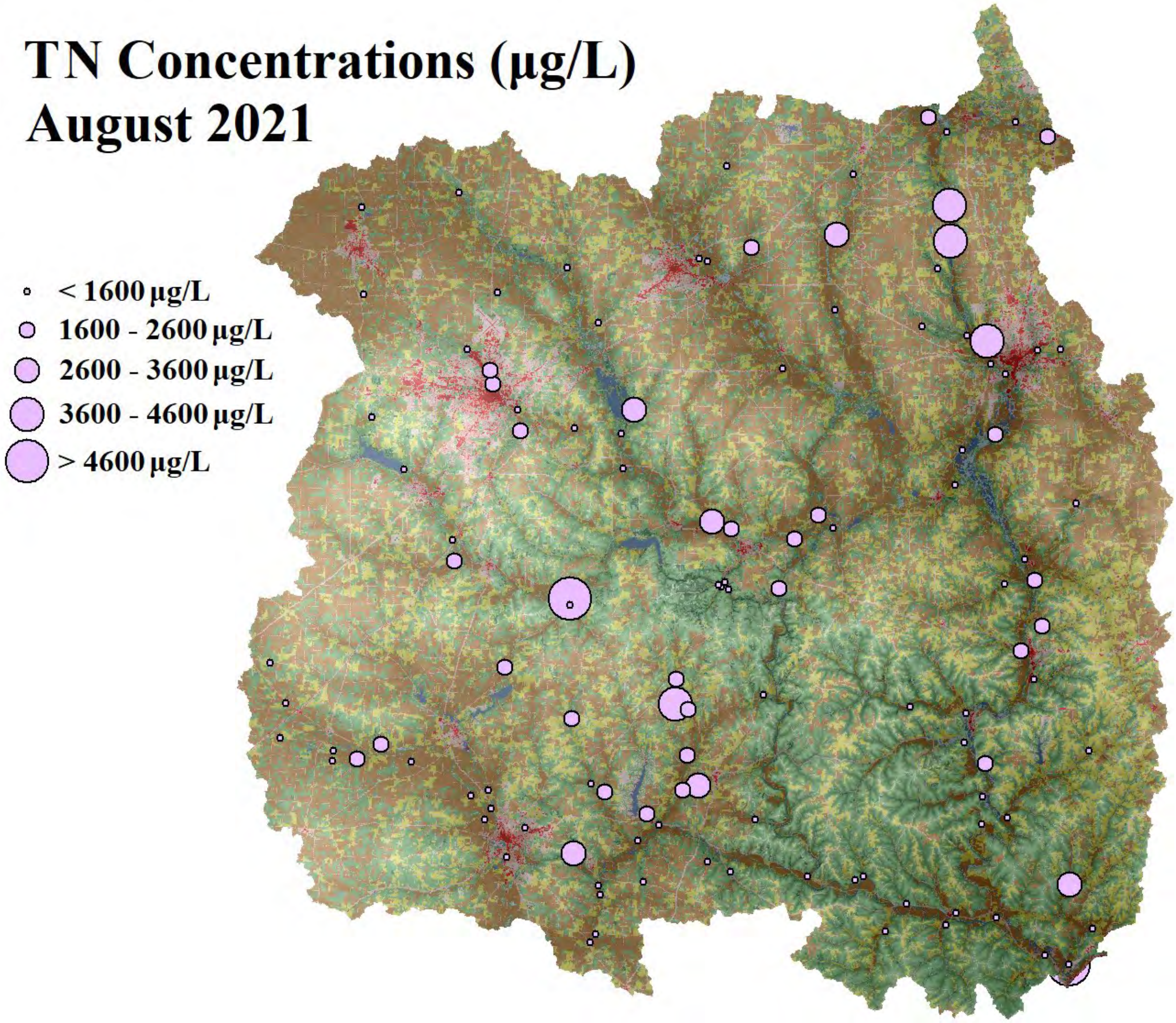
By subtracting the inorganic N forms from the TN value, we can identify the amount of organic nitrogen in the water sample. Results from this study show that most of the nitrogen in streams of the Walhonding Watershed are in inorganic forms, particularly as oxidized nitrogen (nitrate, NO_3). The inorganic forms (Dissolved Inorganic Nitrogen: NO_2, NO_3, NH_4) contribute about 73% of the total nitrogen concentrations (figure below).



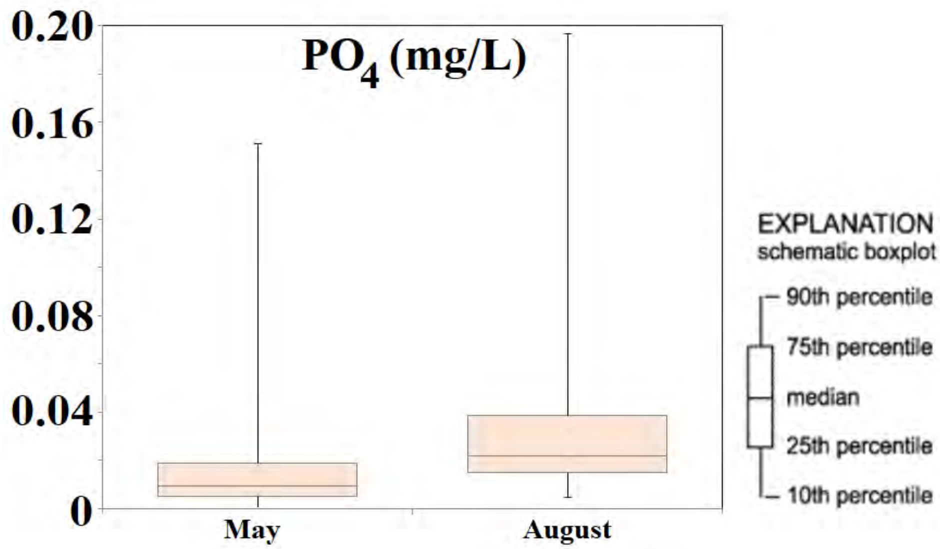
y = 1.2052x - 461.72
R^2 = 0.7332
TN (mg/L)
DIN (mg/L)
14
12
10
8
6
4
2
1.0
2.0
3.0
4.0
5.0



TN Concentrations (µg/L)
May 2021
< 1600 µg/L
1600 - 2600 µg/L
2600 - 3600 µg/L
3600 - 4600 µg/L
> 4600 µg/L

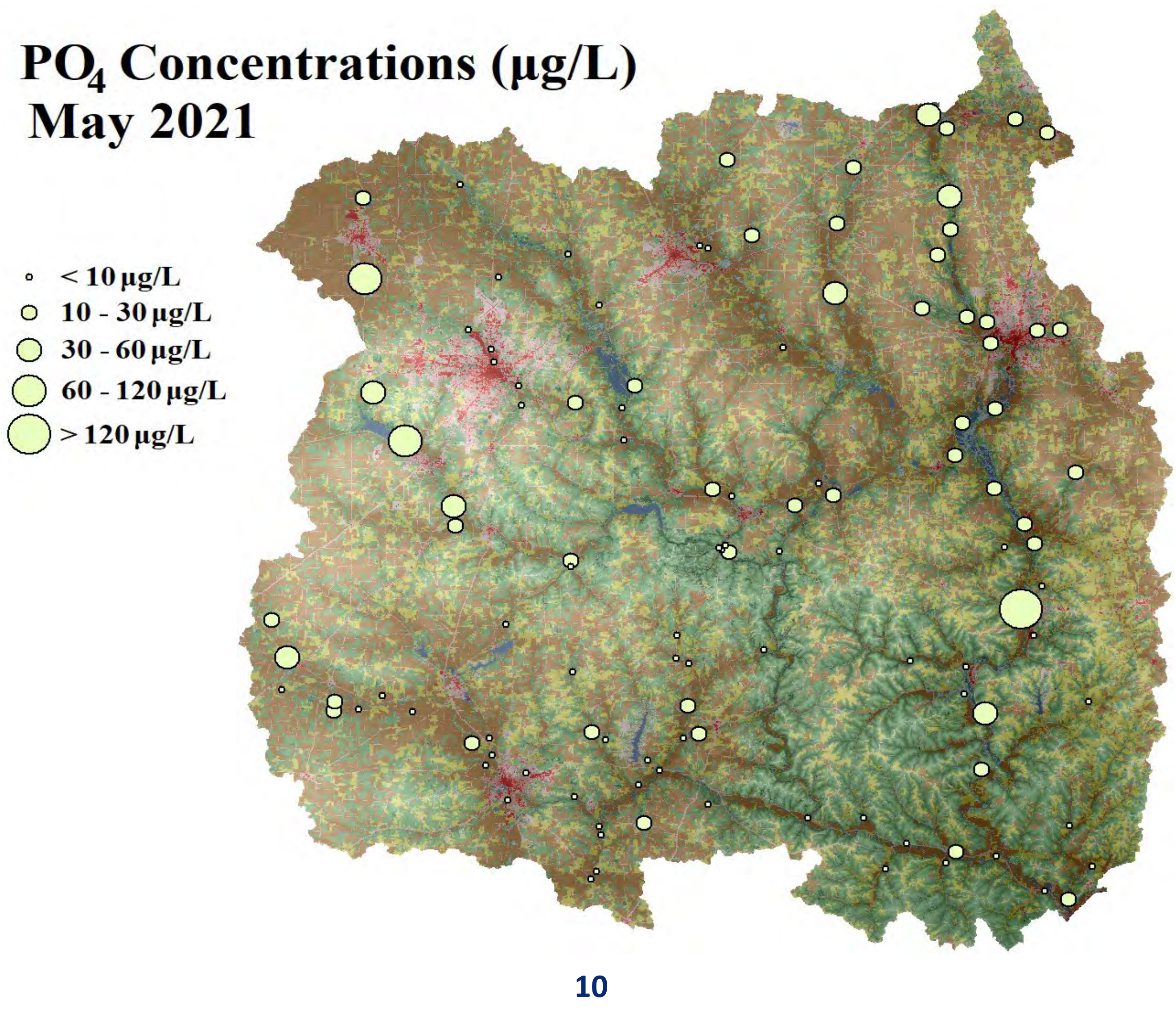


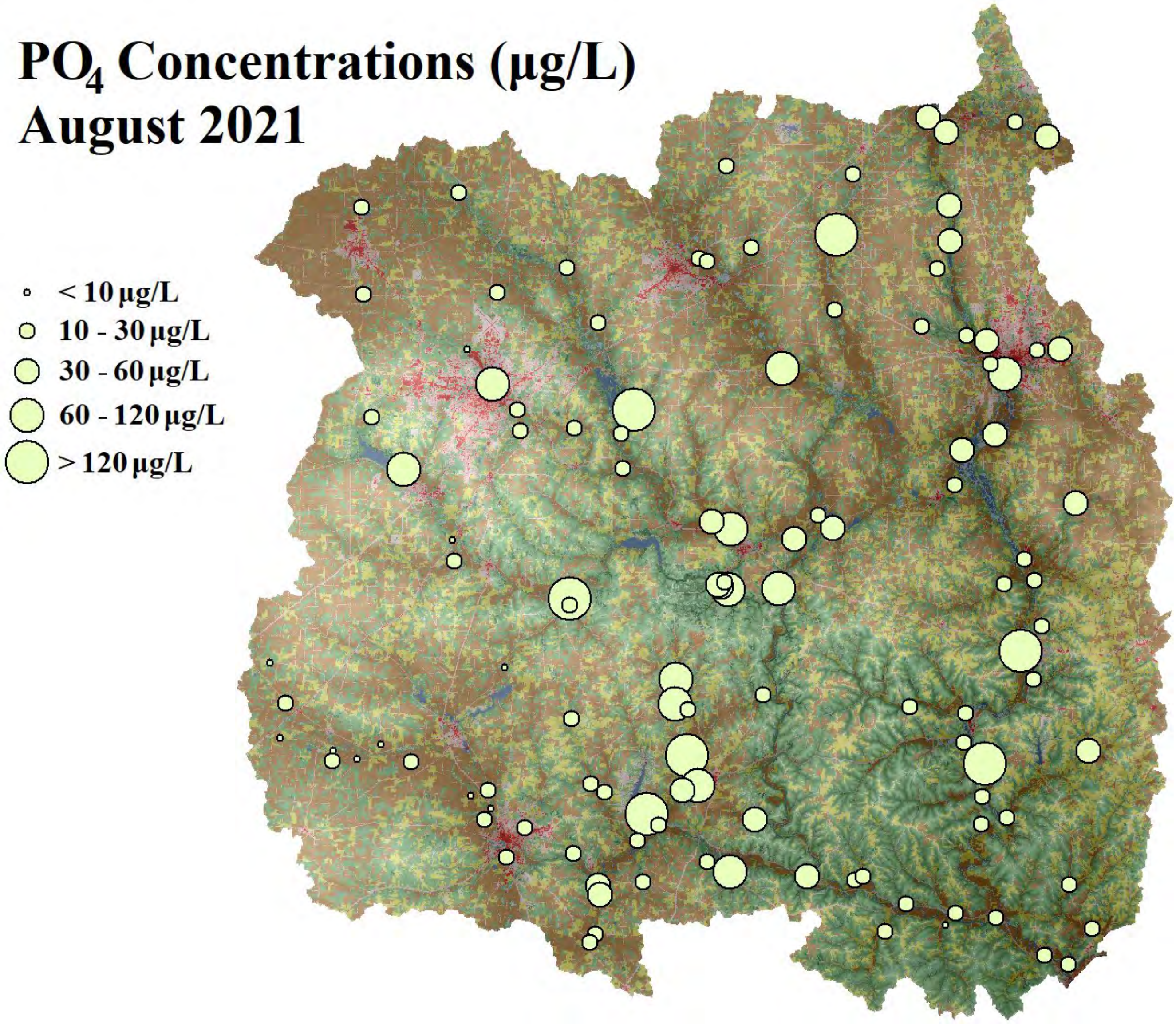
1.4. Orthophosphate (PO_4)



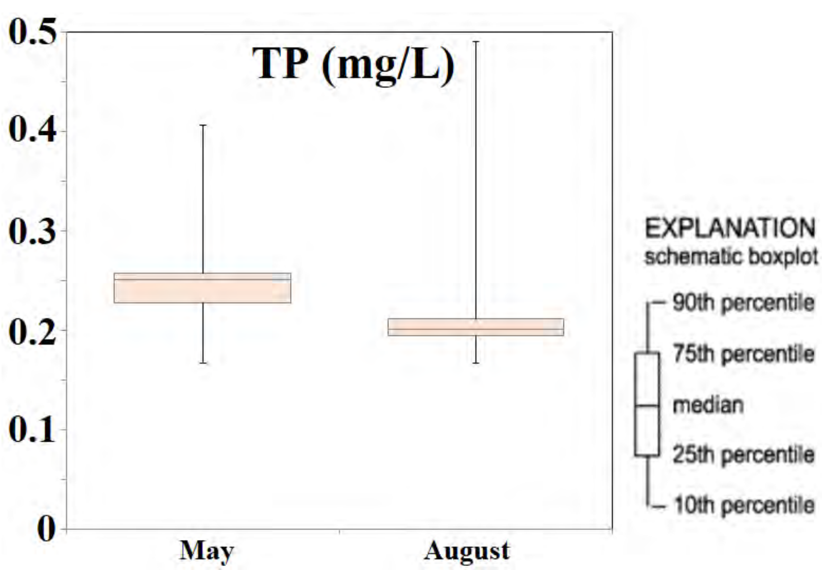
Phosphorus is an essential element for plant life and a common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent. Soil erosion is a major contributor of phosphorus to streams and lakes, and bank erosion during floods can transport large amounts of phosphorous. The dissolved reactive form of phosphorus, which is most directly taken up by plants, is orthophosphate (PO_4). The other type of inorganic phosphate includes polyphosphates (also known as metaphosphates or condensed phosphates). In water, polyphosphates are unstable and will eventually convert to orthophosphate. In freshwater lakes and rivers, phosphorus is often found to be the growth-limiting nutrient, because it occurs in the least amount relative to the needs of plants. If excessive amounts of phosphorus and nitrogen are added to the water, algae and aquatic plants can be produced in large quantities. When these algae die, bacteria decompose them, and use up oxygen. This process is called eutrophication. The loss of oxygen in bottom waters can free up phosphorus previously trapped in the sediments, further increasing the available phosphorus.

Orthophosphate (PO_4) concentrations in the study sites varied from a low of 0.01 µg/L (in May 2021) to a maximum of 1100.3 µg/L (in August). PO_4 concentrations in the summer are, on average, about 5.1 times higher than spring concentrations.

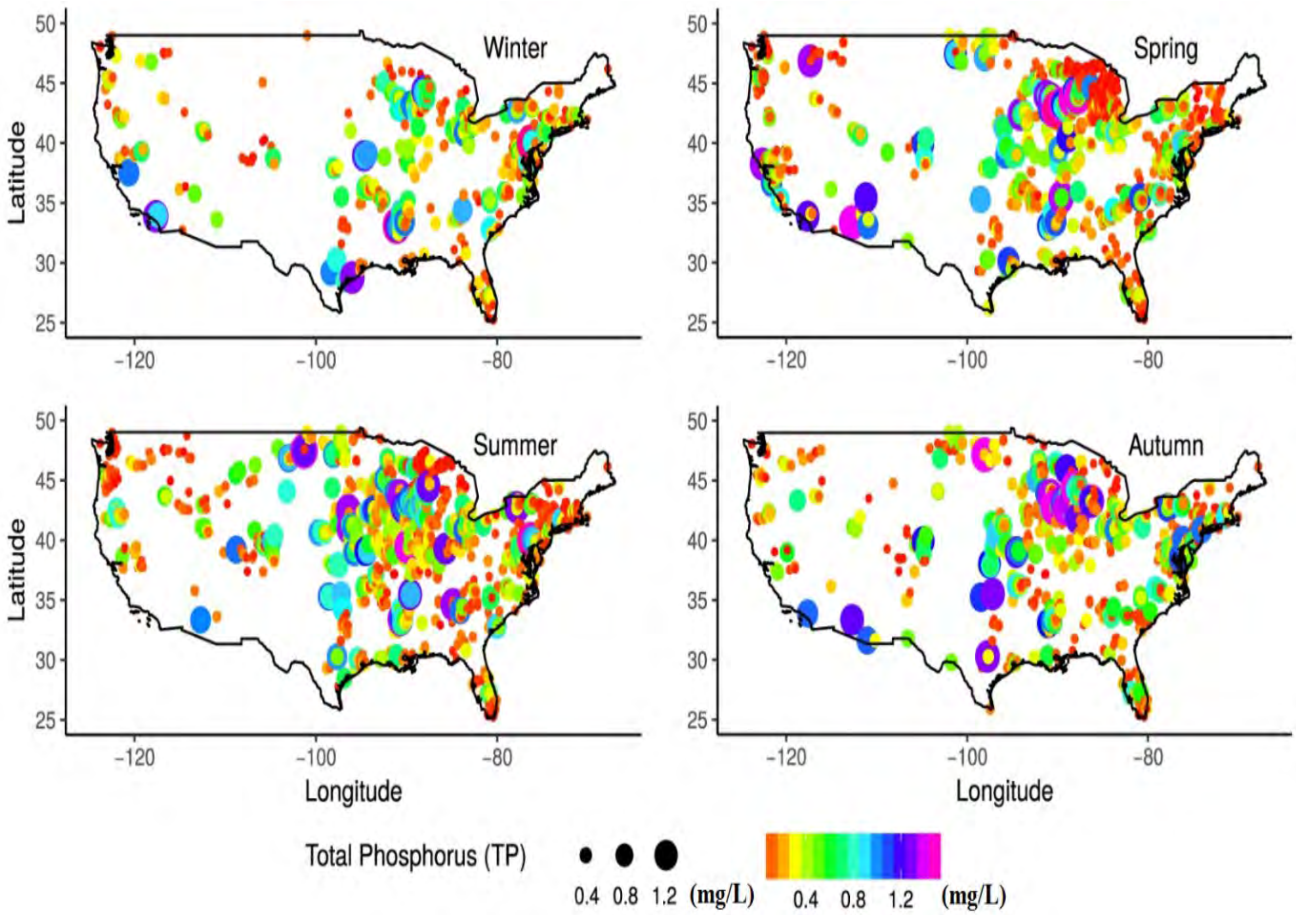


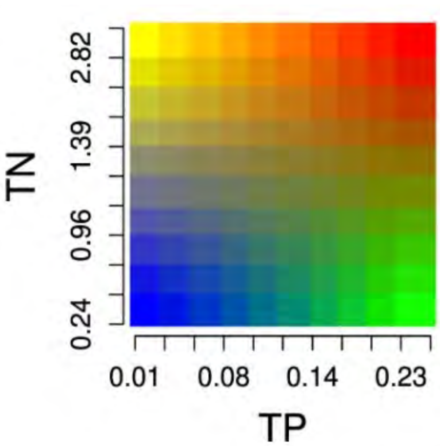


1.5. Total Phosphorus (TP)

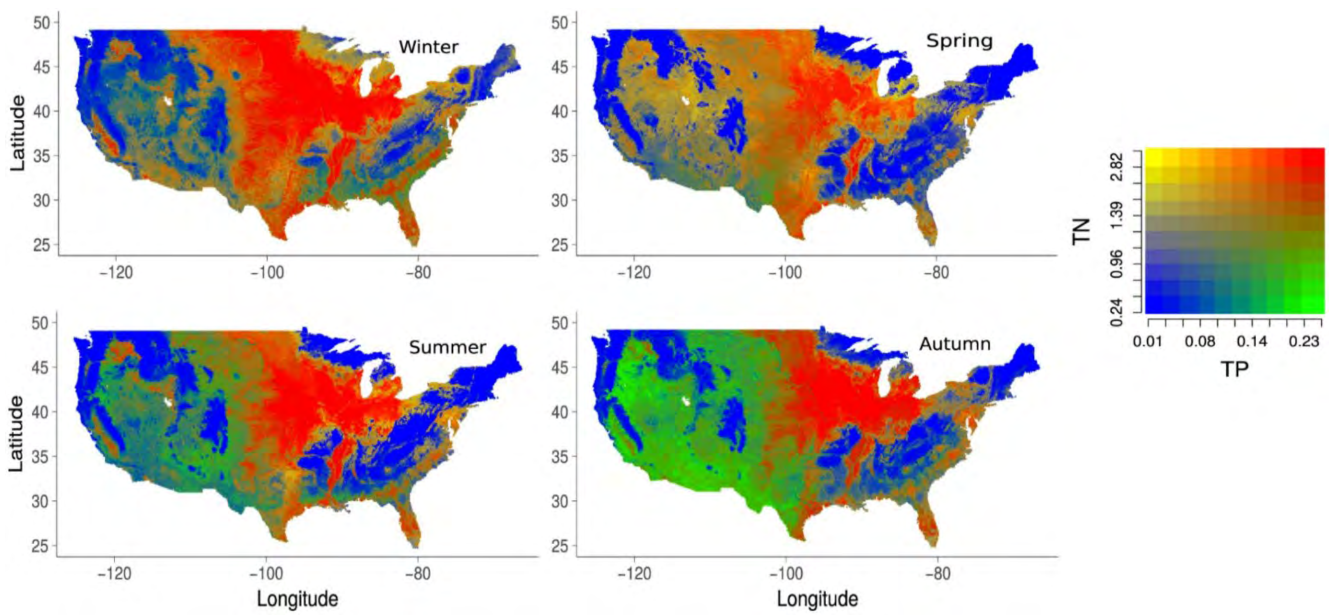


Total Phosphorus (TP) is the sum of orthophosphates, polyphosphates, and organic bound phosphates (such as esters of phosphoric acid, H_3PO_4). Major sources of TP include human and animal wastes, soil erosion, detergents, septic systems and runoff from farmland or fertilized lawns. Naturally occurring levels of total phosphorus vary substantially across the country, although TP concentrations are usually highest in the northeast and Midwest (figure below) with peak concentrations occurring in the summer and lowest in the winter.

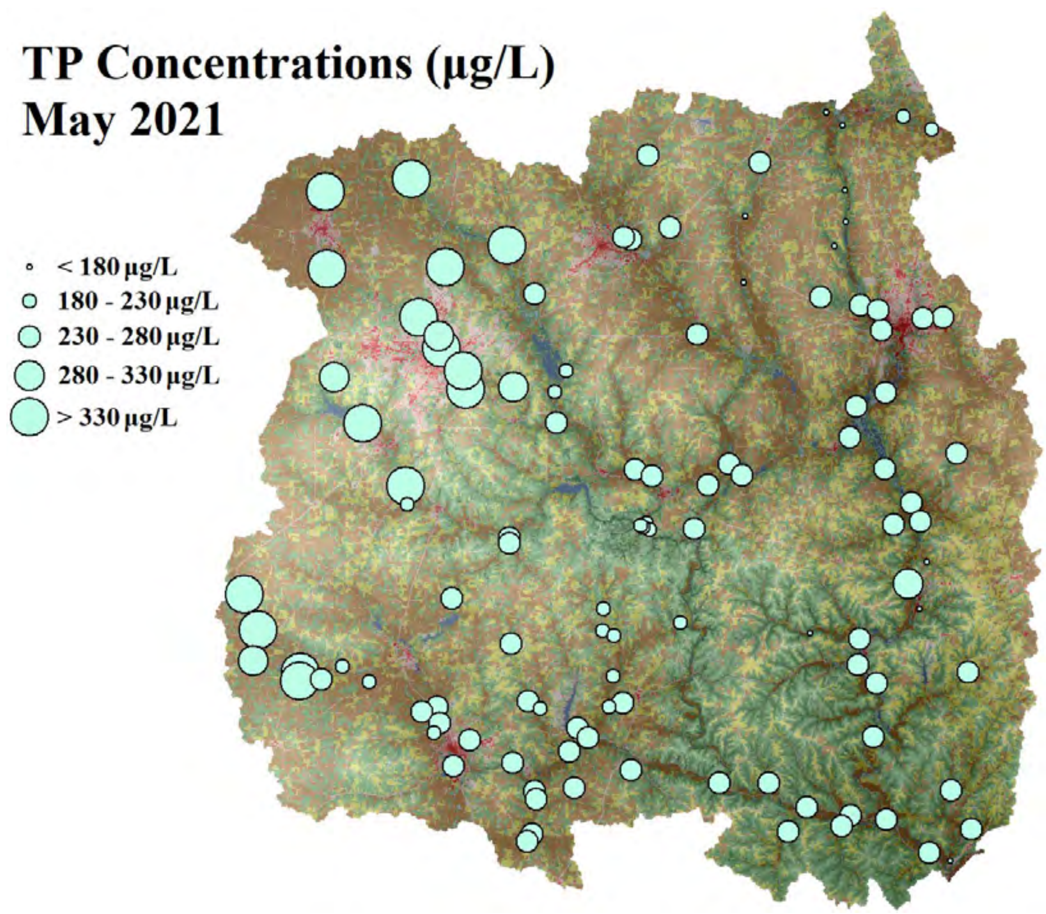


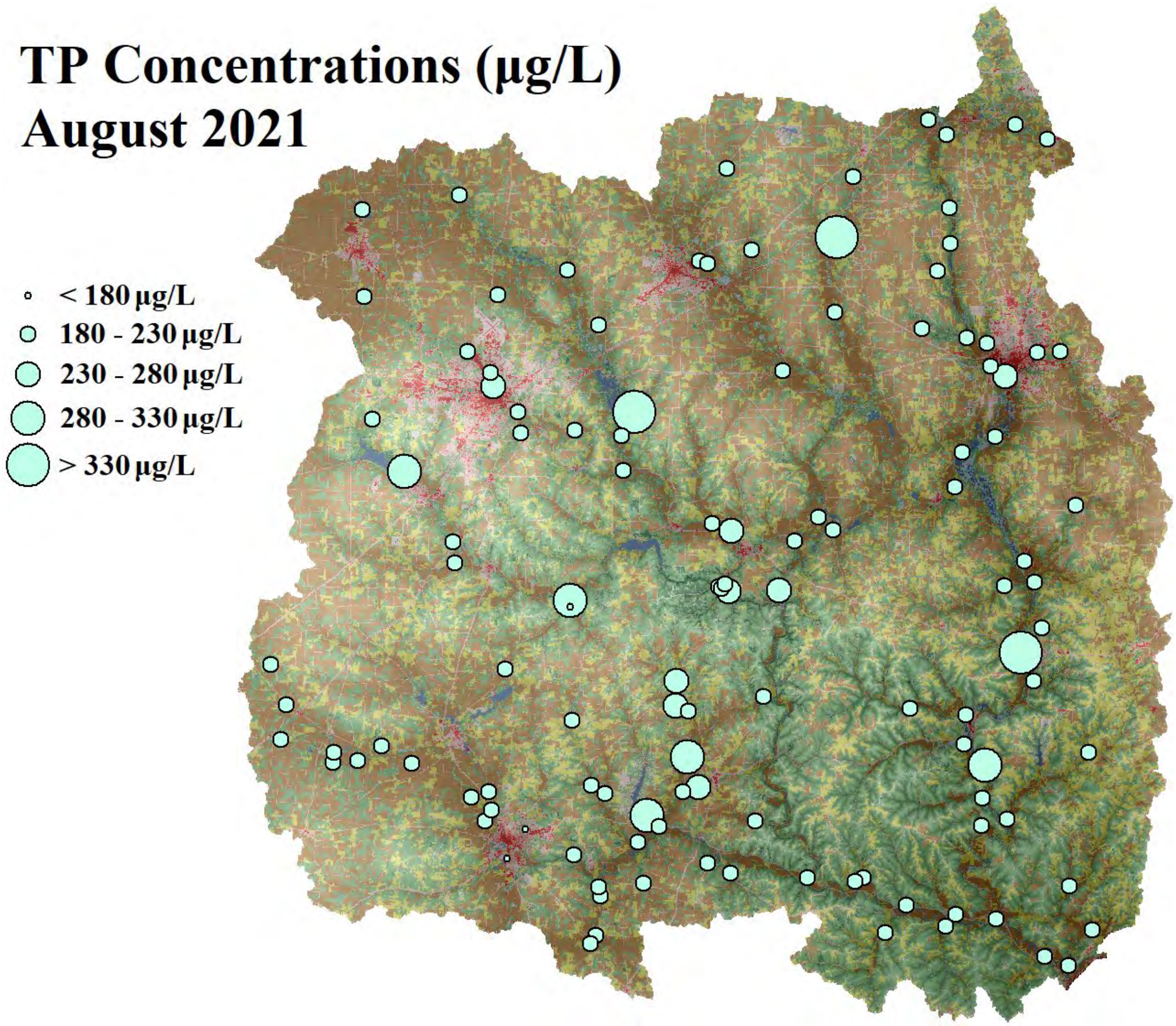


A bivariate plot using both TN and TP show the spatial patterns of these essential nutrients across the four seasons in the United States. The resulting bivariate plot (next page) shows that high concentrations of TN and TP (red color) occurs in intensive agriculture/grazing areas (across the Midwest and Great plains) and close to large urban areas. Conversely, low concentrations of TN and TP (blue color) are located in forested and mountainous areas (e.g., Rocky Mountains, Appalachian Mountains, and the Great Basin).

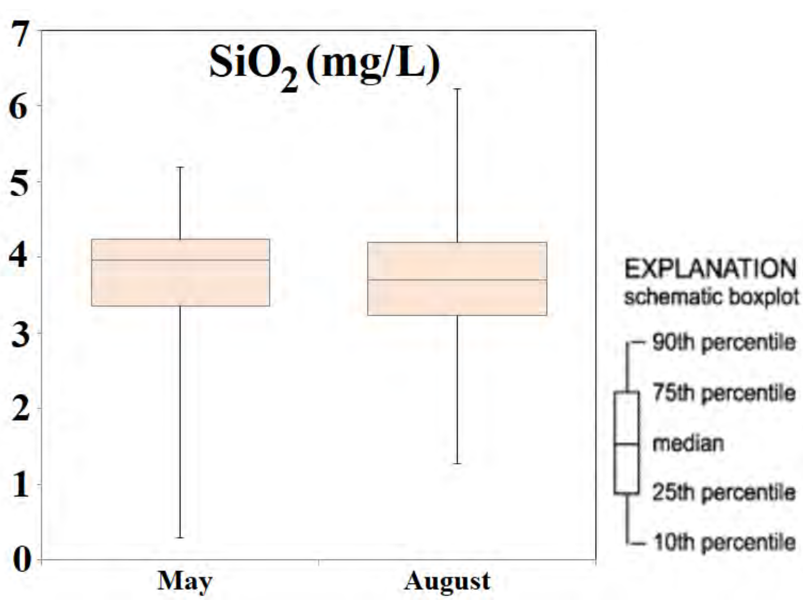


Total phosphorus (TP) concentrations in the study area varied from a low of 167.2 µg/L (in May 2021) to a maximum of 1040.4 µg/L (in August). To control eutrophication, the USEPA has established a recommended limit of 50 µg/L for total phosphates in streams that enter lakes and 100 µg/L for total phosphorus in flowing waters. As such, most of the streams in this study exceed the recommended water quality criteria.



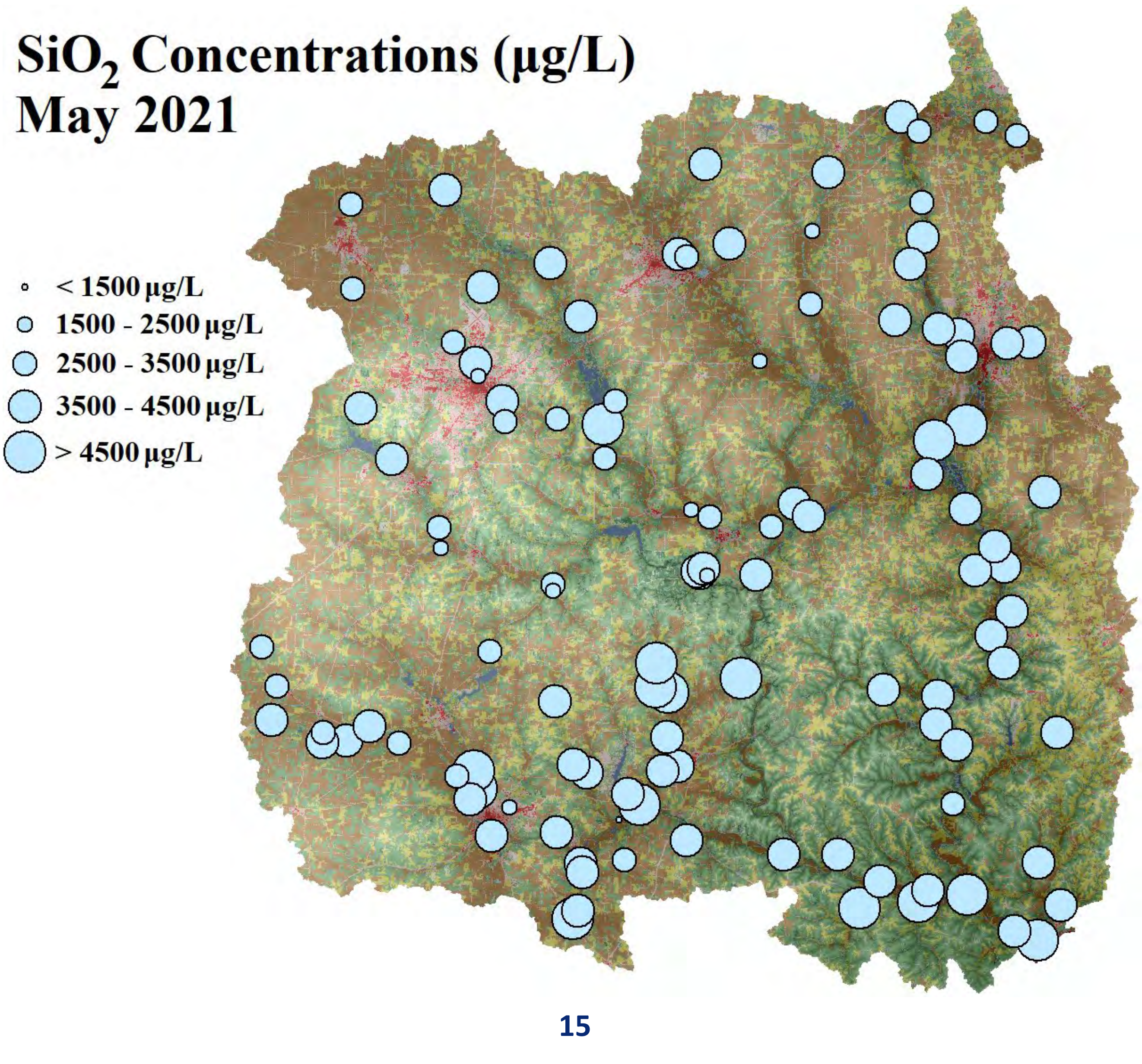


1.6. Dissolved Reactive Silica (SiO_2)



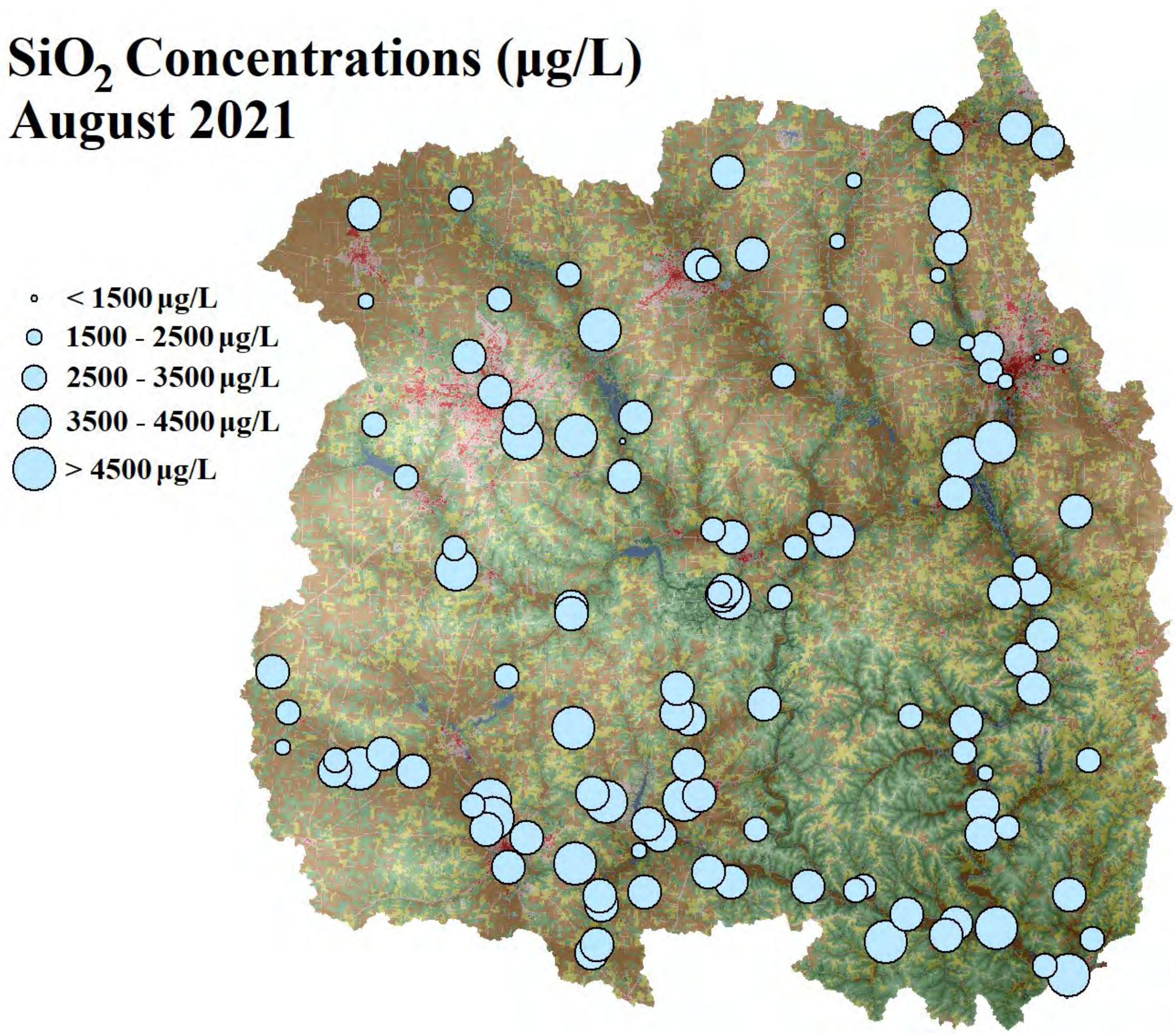
Silica is a mineral compound with the formula SiO_2 . This very common mineral has many different forms and is most easily recognized in nature as the mineral quartz. Although the solubility of silica in water is low, and the dissolution rate of silicate minerals is very low, its sheer abundance in rocks means that, through weathering processes, it is also abundant in water and groundwater. Silica can exist in water supplies in two main forms. The first of these is “Reactive Silica”. Reactive silica is dissolved in water as the bisilicate ion making it a very weak acid. The other form of silica in the water is known as “Colloidal Silica”. This form is a polymeric silica where the particles are ultra-fine and cannot be filtered out of the water using normal filtration techniques.

Dissolved reactive silica (dissolved silicate, DSi) is also an important nutrient used by planktonic diatoms for cell division and growth. Diatoms are used to monitor past and present environmental conditions and are commonly used in studies of water quality. Because of its stability, SiO_2 has also been used as a conservative tracer of manure spreading, as it does not undergo biogeochemical processes that significantly alter its concentrations, as is the case with inorganic nitrogen compounds.



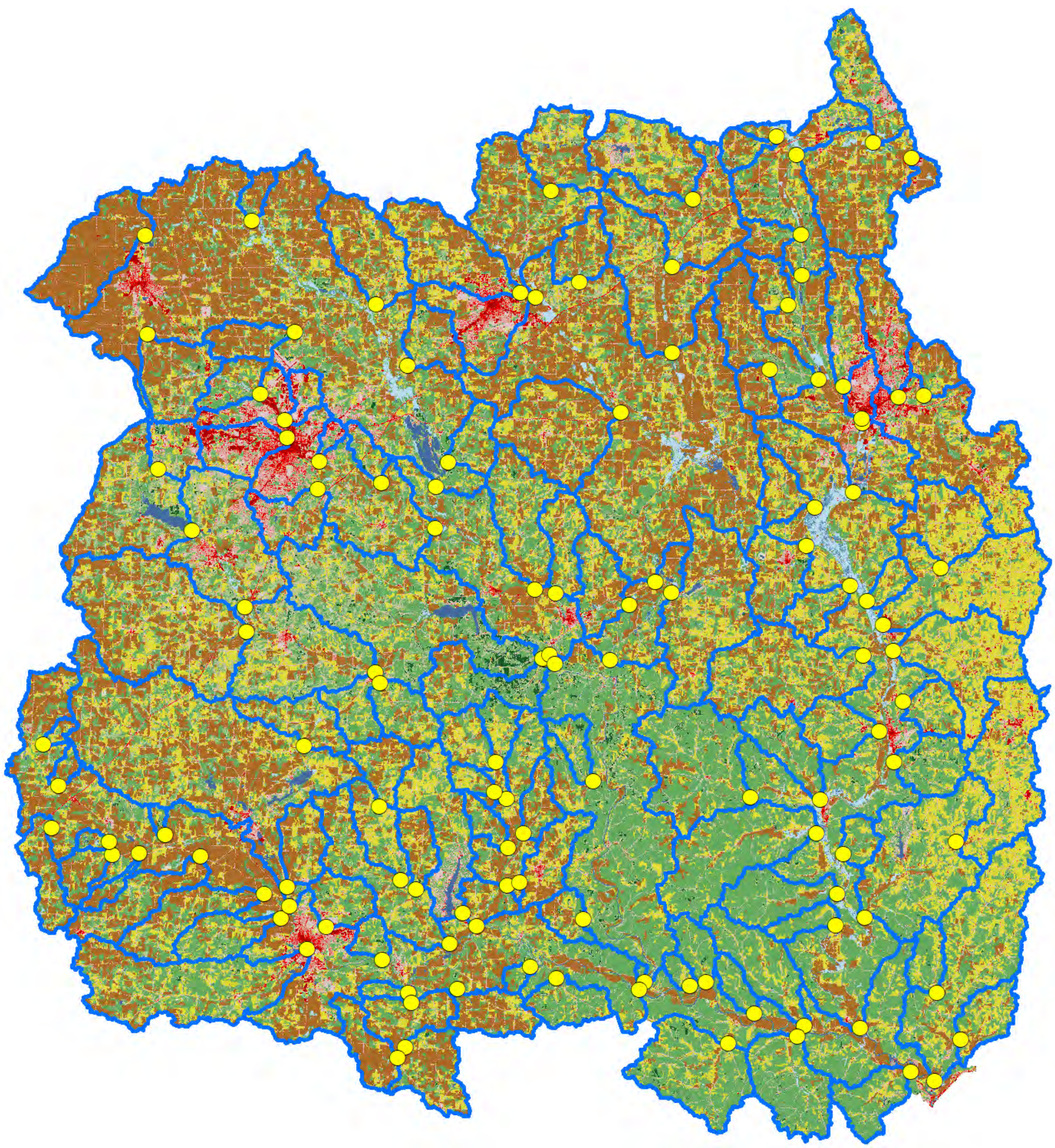
Dissolved silica observed in natural waters results primarily from the chemical breakdown of silicate minerals, such as kaolinite and montmorillonite, in the processes of weathering. The rate at which dissolved silica is supplied from these minerals varies with the climate, the topography, the vegetation, and the nature of the original mineral. As such, rock type is the principal factor controlling the silica content of natural waters. Conversely, the use of dissolved silica by planktonic species (diatoms) is the principal mode of silica removal from the environment. This uptake of silica by microorganisms has been shown to occasionally reduce dissolved silica concentrations to near-zero levels.

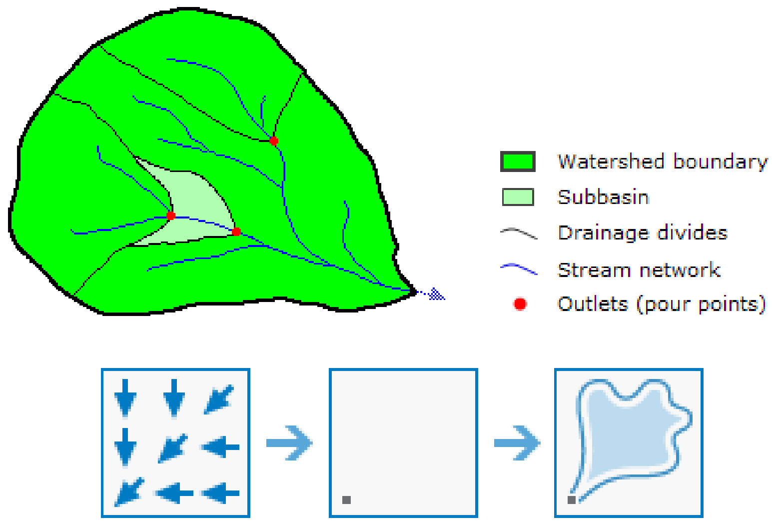
Natural concentrations of dissolved silica are usually high. The median value of silica is 17 mg/L for ground water, 14 mg/L for streams, and 3 mg/L for lake and ocean waters, as well as water recently derived from rain or snow. Dissolved silica concentrations in the study area varied from a low of 0.3 mg/L (in May 2021) to a maximum of 6.3 mg/L (in August), although mean concentrations are very similar on both seasons (3.9 mg/L in May and 3.7 mg/L in August).



2. Water quality by sub-basin

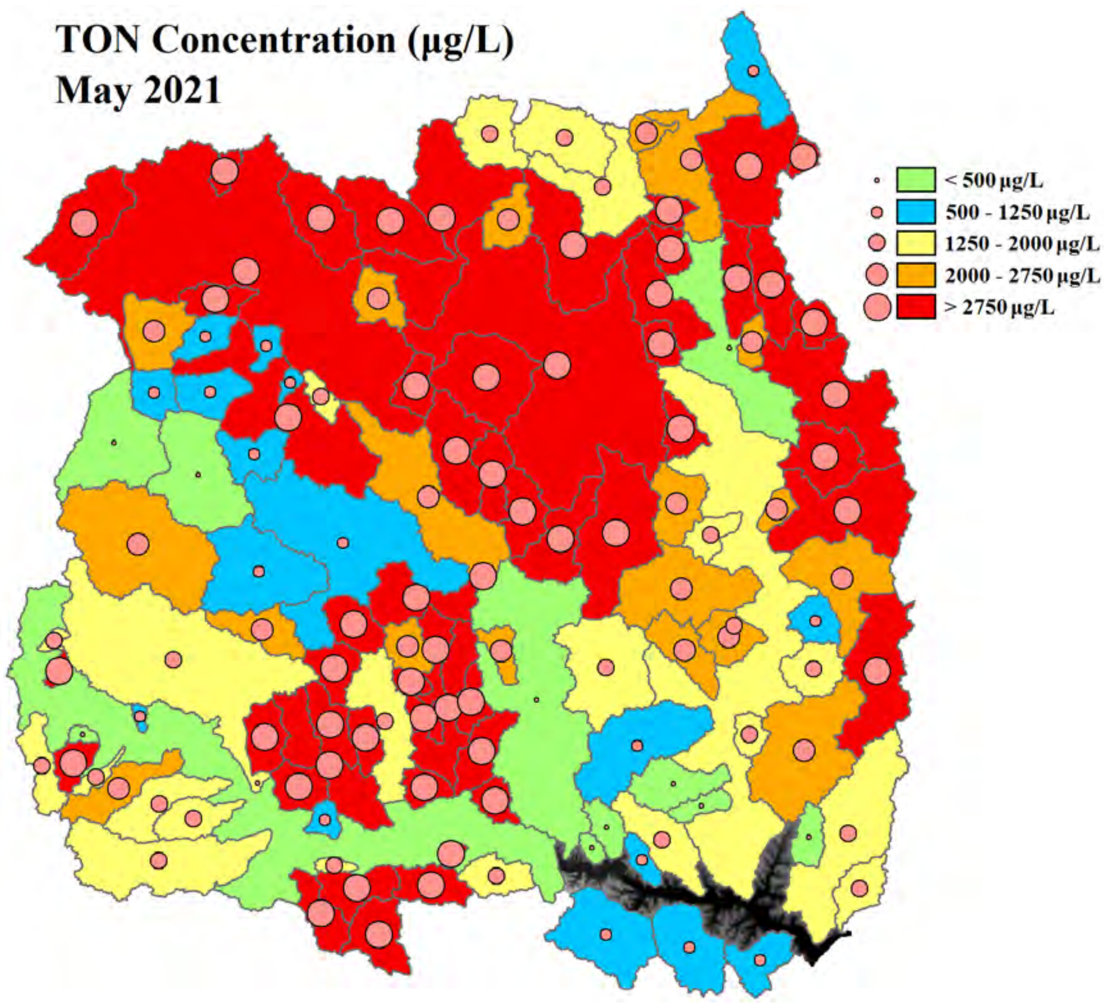
In order to identify low-water quality targets for intervention within the watershed, a sub-basin analysis was performed. First, we used the ArcGIS spatial analyst toolbox to generate the upslope area that contributes water flow (concentrated drainage) to each of the sampling points in this study. The boundaries between each sub-basins (drainage divides) were calculated using a corrected digital elevation model (DEM) of the Walhonding Watershed. The resulting map of sub-basins for each sampling point is shown in the figure below.

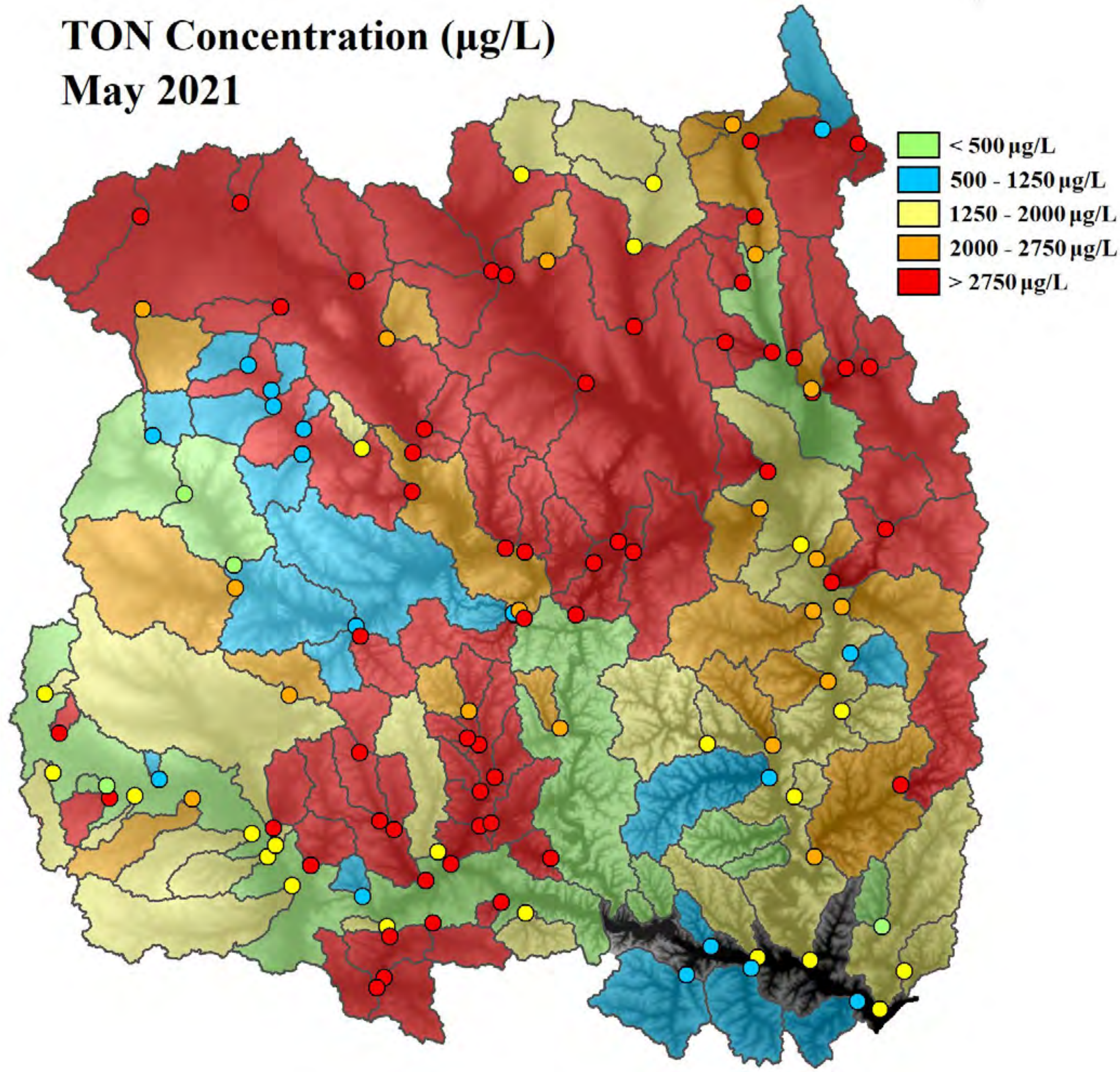




The figure above shows the workflow for delineating the sub-basins by computing the flow direction from the DEM using the “Watershed” tool in the ArcGIS spatial analyst.

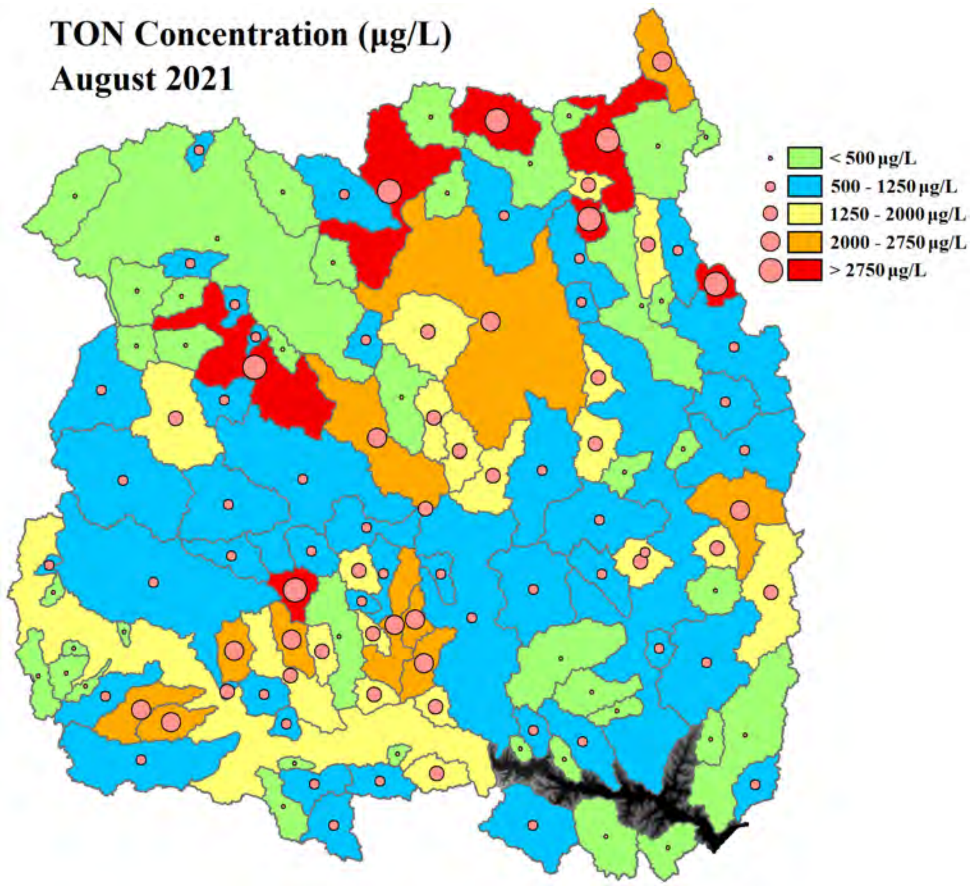
2.1. Total Oxidized Nitrogen (NO_2+NO_3) by sub-basin

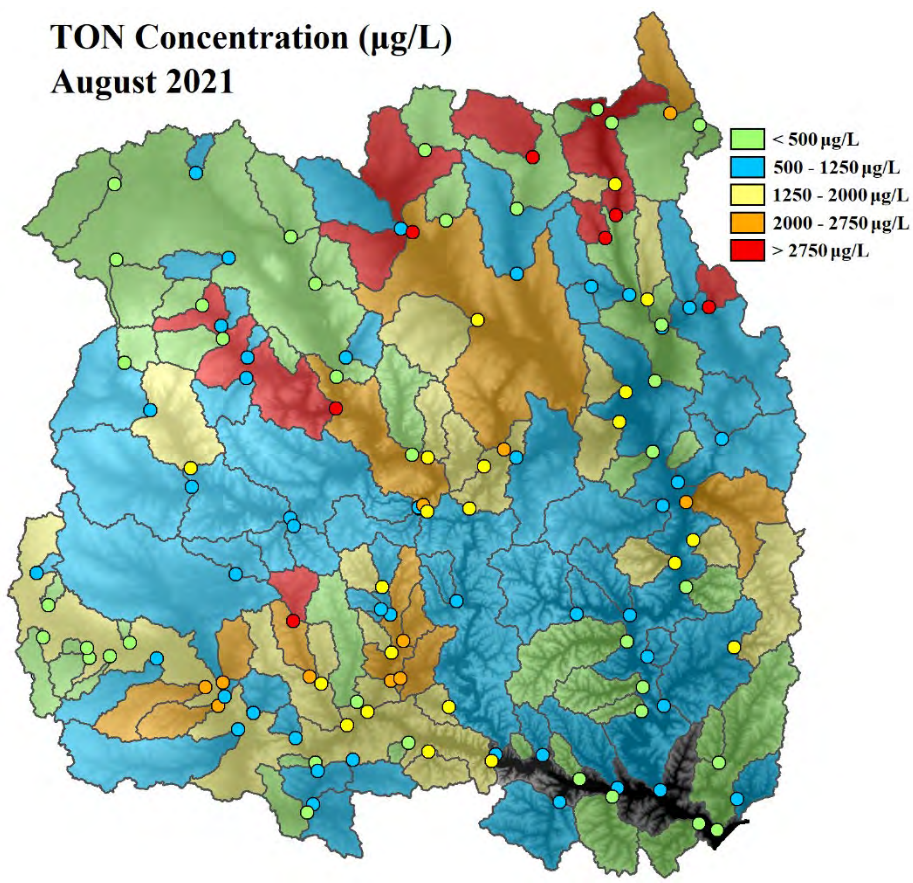




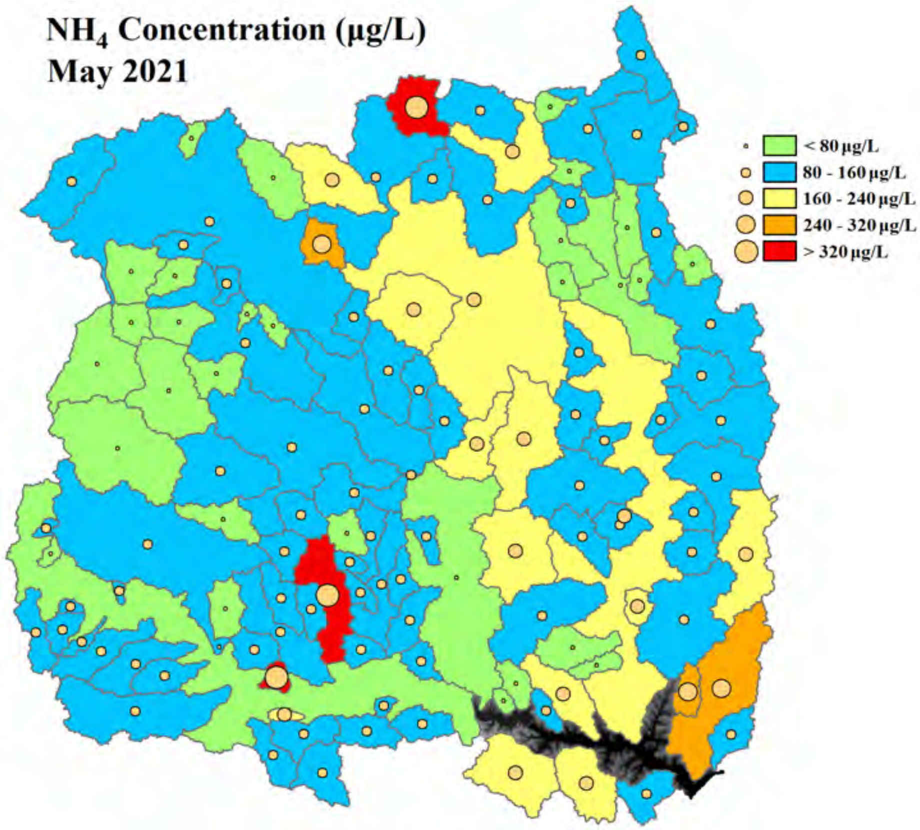
The U.S. EPA has established an enforceable level of 10 mg/L total nitrate plus nitrite (measured as nitrogen) as the Maximum Contaminant Level (MCL) in drinking water. Concentrations above this level can be fatal to infants and livestock. The natural level of oxidized nitrogen (nitrates and nitrites) in surface water is typically lower than that MCL (usually less than 1 mg/L), although it can reach up to 30 mg/L in the effluent of wastewater treatment plants.

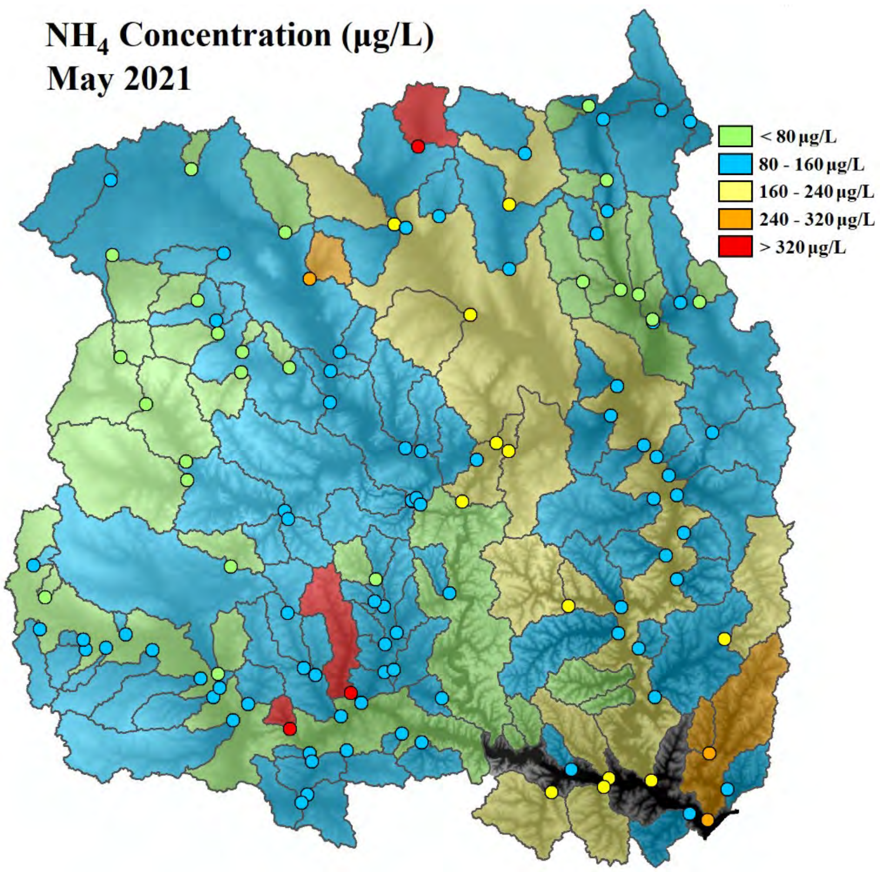
For this study, we considered TON concentrations below 1.25 mg/L to be **low**, while concentrations above 2.75 mg/L to be **high**. In the spring (May sampling – figure in previous page), only **21** of the 126 sampling sites had TON concentrations below 1.25 mg/L, while **55** sites showed concentrations above 2.75 mg/L. For the summer (August sampling – figure below), **84** of the 126 sampling sites had TON concentrations below 1.25 mg/L, while only **7** sites showed concentrations above 2.75 mg/L.


TON Concentration (µg/L)
August 2021
< 500 µg/L
500 - 1250 µg/L
1250 - 2000 µg/L
2000 - 2750 µg/L
> 2750 µg/L

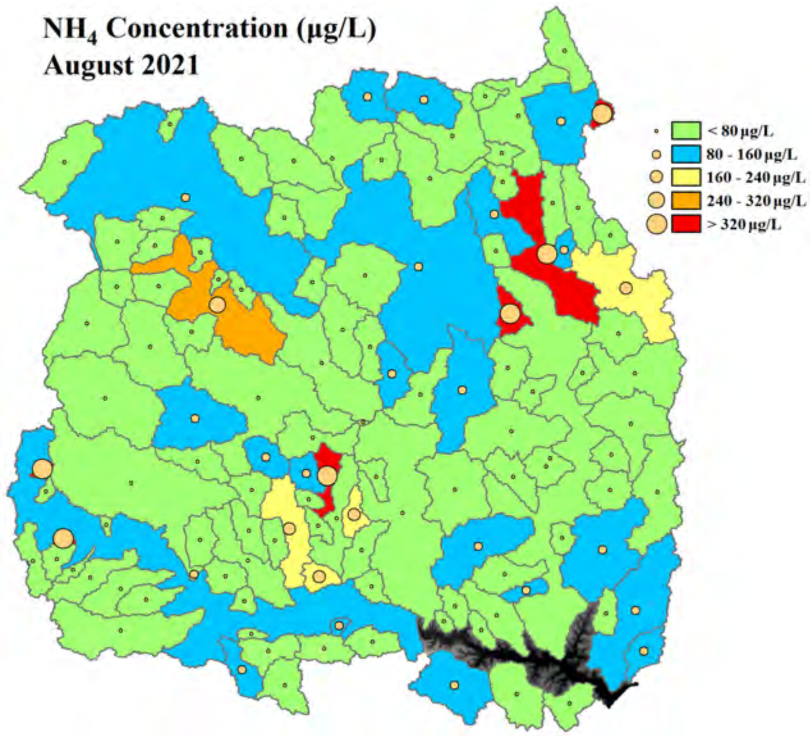

TON Concentration (µg/L)
August 2021
< 500 µg/L
500 - 1250 µg/L
1250 - 2000 µg/L
2000 - 2750 µg/L
> 2750 µg/L

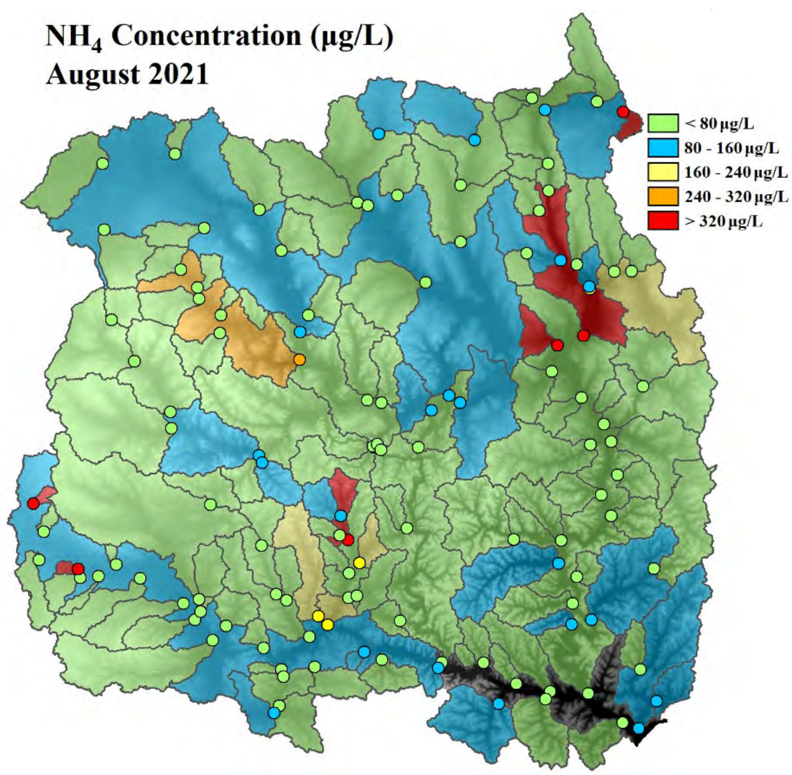
2.2. Ammonium Nitrogen (NH_4) by sub-basin





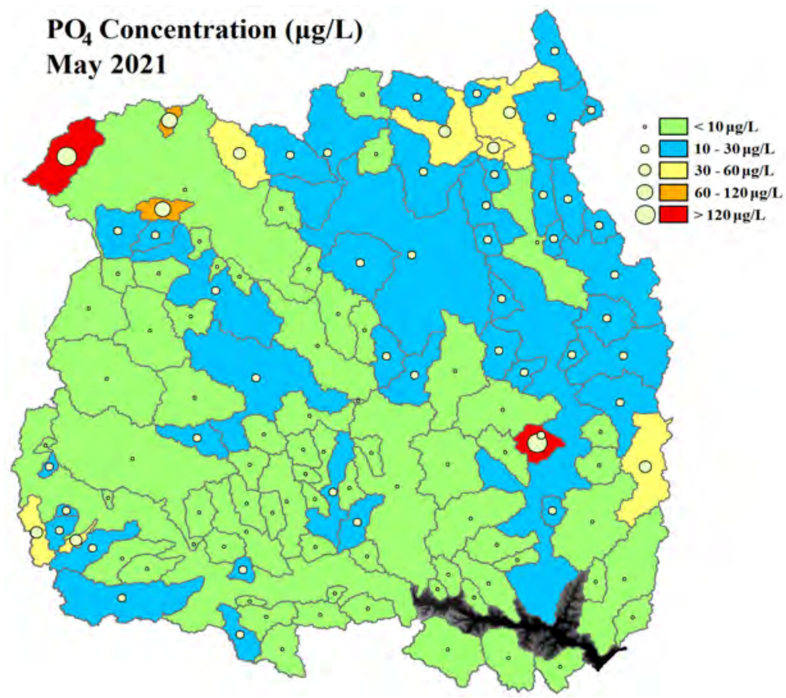
For this study, NH_4 concentrations below 0.16 mg/L were considered **low**, while concentrations above 0.32 mg/L were considered **high**. In the spring (May sampling – figure above), **101** sub-basins had NH_4 concentrations below 0.16 mg/L, while only **3** sites showed concentrations above 0.32 mg/L. For the summer (August sampling – figure below), **112** sub-basins had NH_4 concentrations below 0.16 mg/L, with **5** sites showing concentrations above 0.32 mg/L.

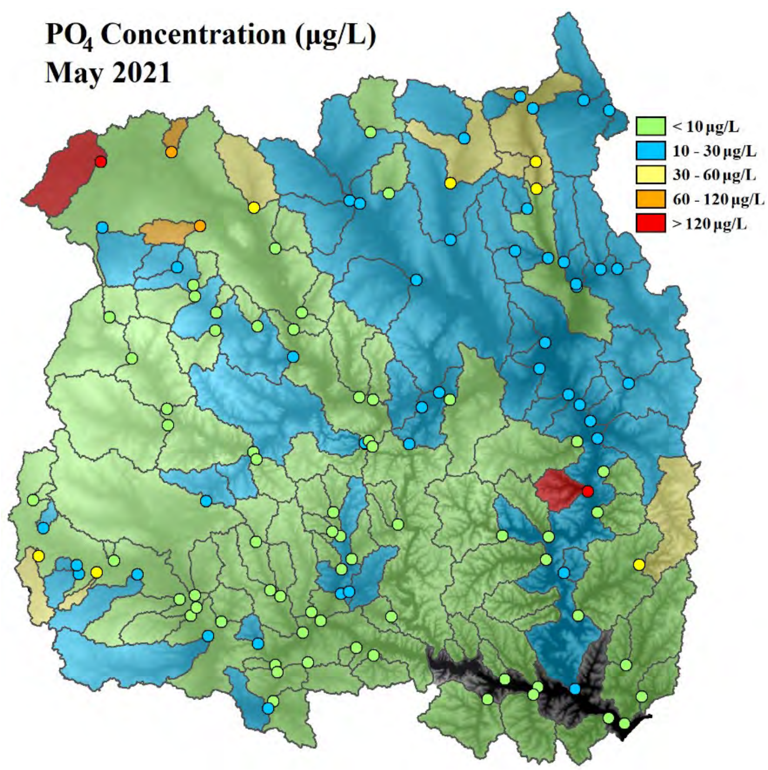


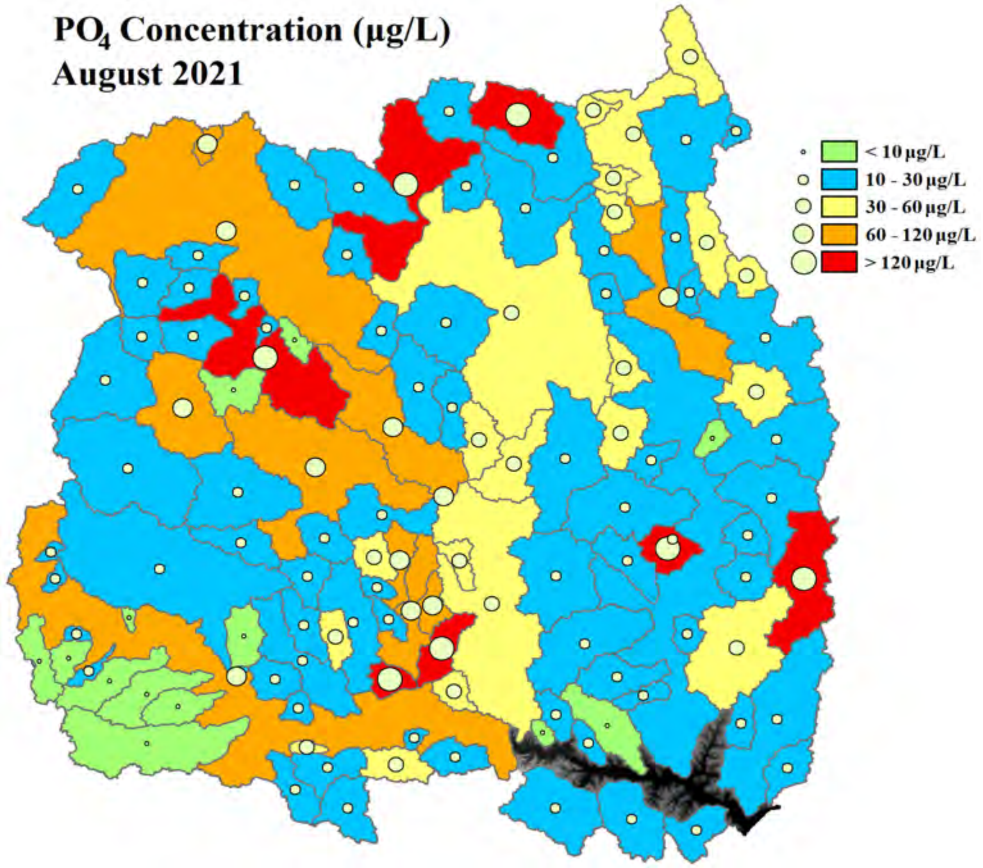


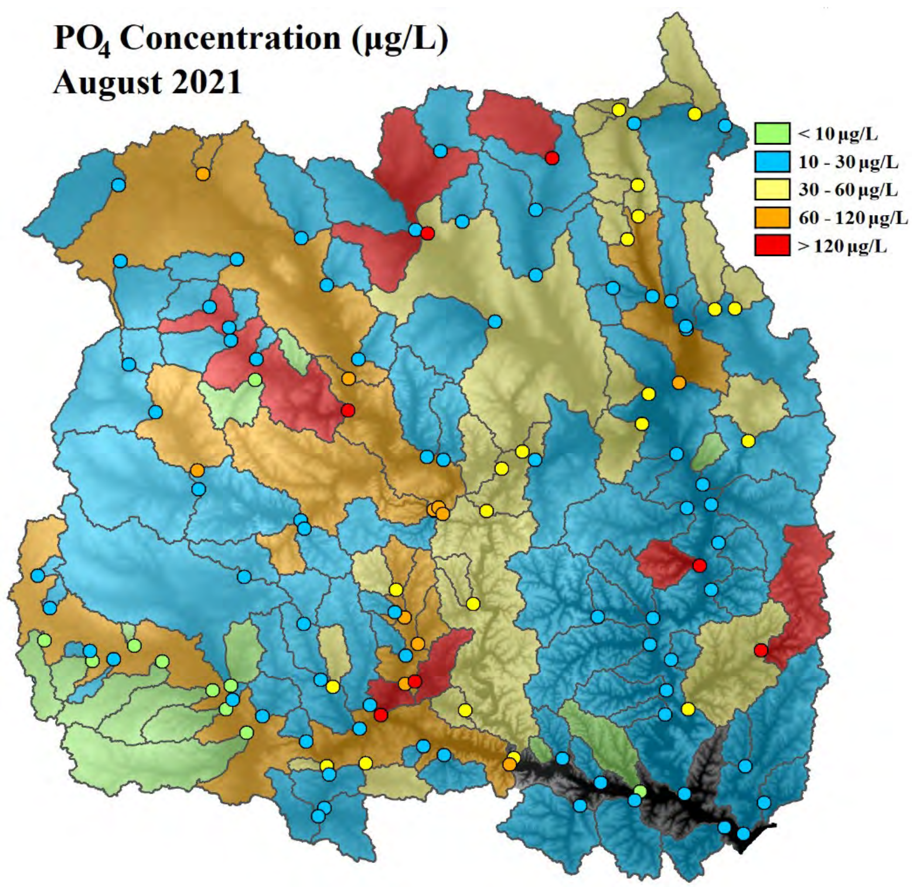
2.3. Orthophosphate (PO_4) by sub-basin

For this study, PO_4 concentrations below 30 µg/L were considered **low**, while concentrations above 120 µg/L were considered **high**. In the spring (May sampling – figure next page), **108** sub-basins had PO_4 concentrations below 30 µg/L, while only **2** sites showed concentrations above 120 µg/L. For the summer (August sampling – figure next page), **84** sub-basins had PO_4 concentrations below 30 µg/L, with **7** sites showing concentrations above 120 µg/L.



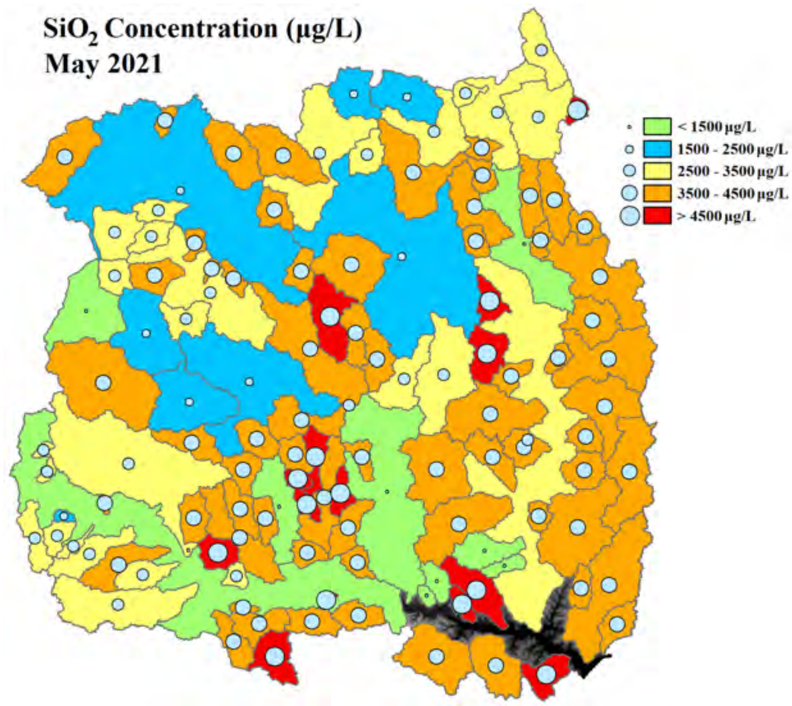


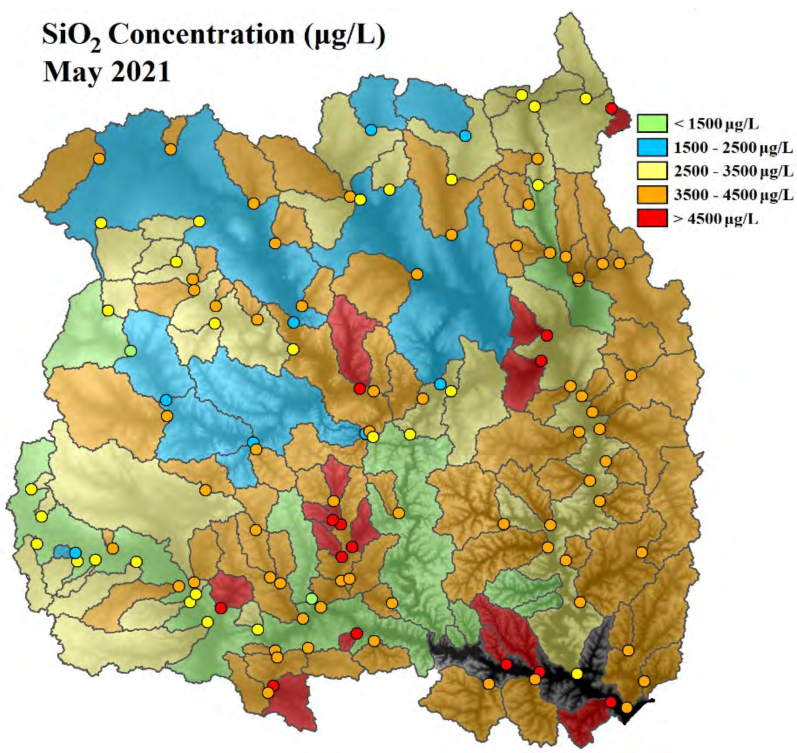

PO$_4$ Concentration (µg/L)
August 2021
< 10 µg/L
10 - 30 µg/L
30 - 60 µg/L
60 - 120 µg/L
> 120 µg/L

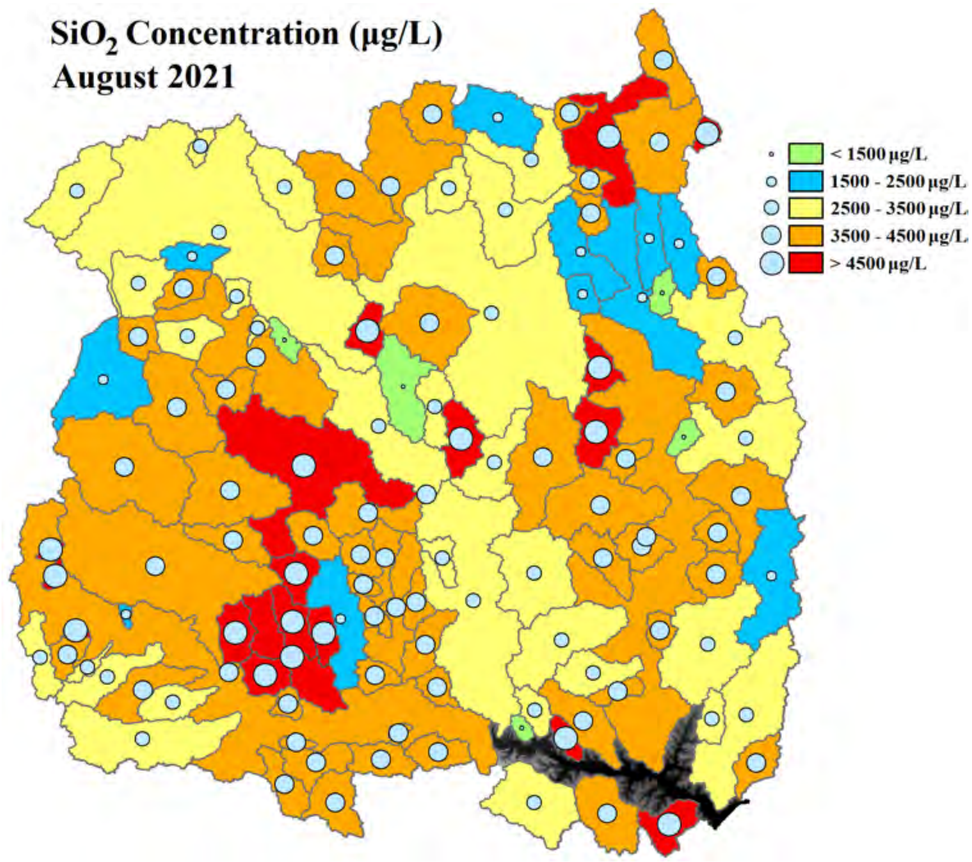

PO$_4$ Concentration (µg/L)
August 2021
< 10 µg/L
10 - 30 µg/L
30 - 60 µg/L
60 - 120 µg/L
> 120 µg/L

2.4. Dissolved Reactive Silica (SiO_2) by sub-basin

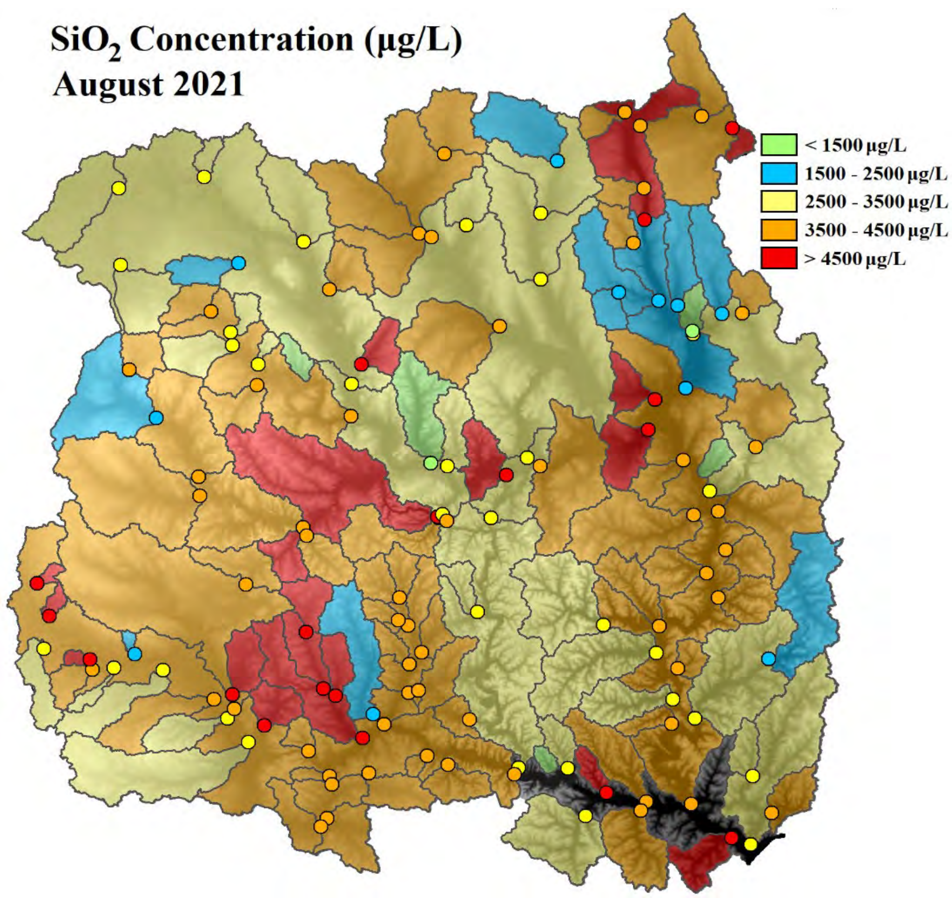
For this study, SiO_2 concentrations below 2.5 mg/L were considered **low**, while concentrations above 4.5 mg/L were considered **high**. In the spring (May sampling – figure below), only **10** sub-basins had SiO_2 concentrations below 2.5 mg/L, while **15** sites showed concentrations above 4.5 mg/L. For the summer (August sampling – figure next page), **13** sub-basins had SiO_2 concentrations below 2.5 mg/L, with **19** sites showing concentrations above 4.5 mg/L.







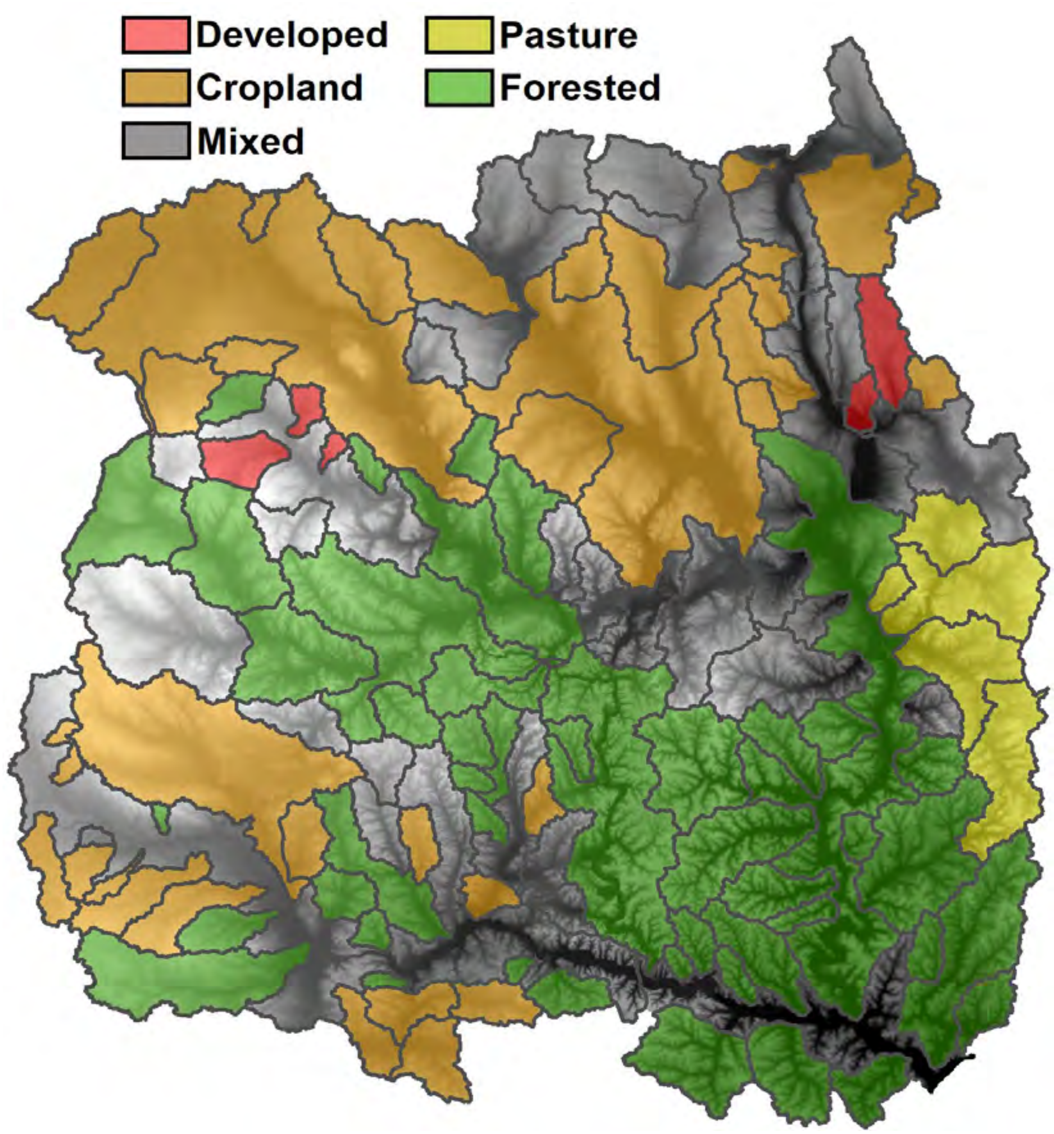
SiO$_2$ Concentration (µg/L)
August 2021
< 1500 µg/L
1500 - 2500 µg/L
2500 - 3500 µg/L
3500 - 4500 µg/L
> 4500 µg/L



SiO$_2$ Concentration (µg/L)
August 2021
< 1500 µg/L
1500 - 2500 µg/L
2500 - 3500 µg/L
3500 - 4500 µg/L
> 4500 µg/L

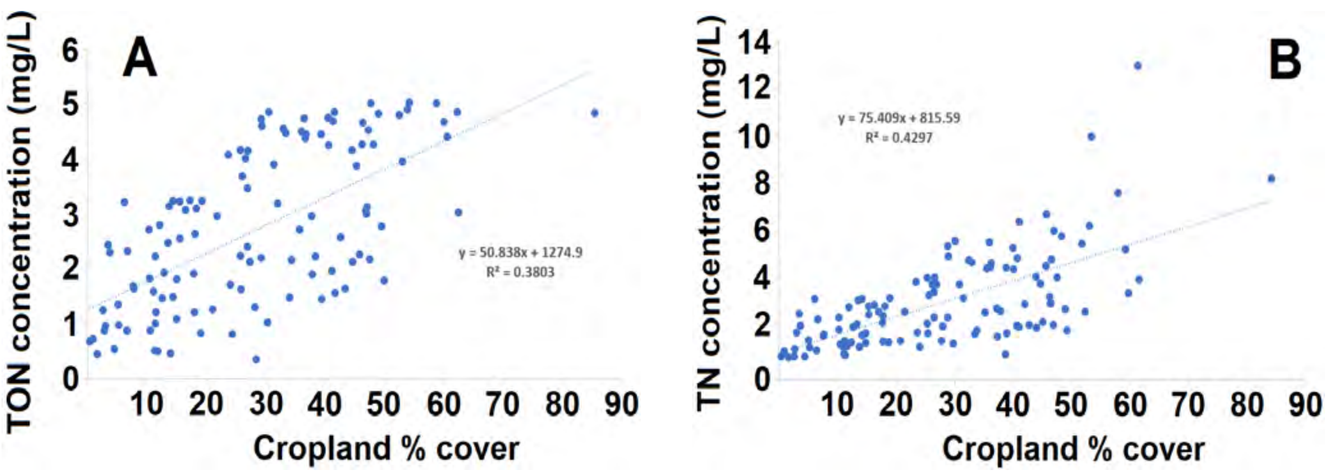
3. Land use effects

In order to identify the effects of land use on the geochemistry of streams in the Walhonding watershed, an analysis of the water quality data was performed using the land use of each sub-basin as a defining criterion. The map below shows the dominant (>40%) land use for all sampled sub-basins in the study area: developed (urban, roads), cropland, pastureland, and forested. Sub-basins where none of the four land-use types had over 40% land cover are indicated as "mixed" land use.

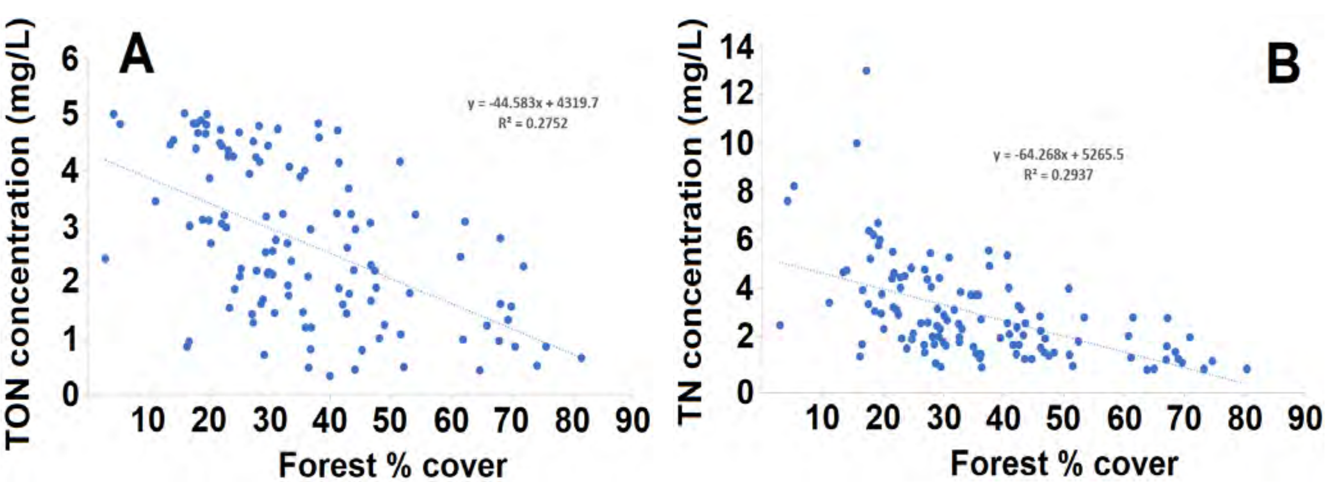


There are five sub-basins where the "DEVELOPED" land use is dominant, with percent cover ranging from a low of 40.2% (site WALH018) to a high of 87.4% (site WALH017). Thirty-five sub-basins have "CROPLAND" land use as dominant, with percent cover ranging from a low of 40.5% (site WALH100) to a high of 85.4% (site WALH123). Five sub-basins have "PASTURE" land use as dominant, with percent cover ranging from a low of 44.3% (site WALH011) to a high of 59.5% (site WALH007). Forty-seven sub-basins have "FORESTED" land use as dominant, with percent cover ranging from a low of 40.0% (site WALH126) to a high of 81.5% (site WALH045). The remaining 32 sub-basins had no dominant land use.

The percent cover of DEVELOPED and PASTURE land has no significant effect on nutrient concentrations in the sampled streams. However, the percent cover of CROPLAND does affect the concentrations of TON and TN in these streams. Figure A below shows a scatter plot comparing the percent of cropland cover for each sub-basin with the TON concentration at each corresponding sampling site. This plot shows that as the cropland cover of the sub-basin increases, so does the TON concentrations in the streams draining the sub-basin. An even stronger relationship was observed between cropland percent cover and total nitrogen (TN) concentrations (figure B below).



Similarly strong relationships were observed between the TON/TN parameters and the FORESTED land cover percentage, as indicated in the plots below. This time, however, the correlation is negative, meaning an inverse relationship exists. These plots show that as the forest cover percent of the sub-basins **increase**, the TON and TN concentrations in the streams draining these sub-basins **decrease**.



It is important to note that the strong relationships showed in all four scatter plots were only observed for the spring dataset (May sampling). There was no significant correlation observed between these variables during the summer (August sampling).

6.5 Literature Review

Known Issues, NPS-IS, and Proposed Projects

These HUC 12s are listed as unassessed or unknown use attainment

- o 50400020806 - Flat Run- Mohican River
- o 50400020301 - Headwaters Clear Fork Mohican River
- o 50400030702 - Martin's Creek
- o 50400020202 - Seymour Run- Black Fork
- o 50400020804 - Sigafoos Run- Mohican River
- o 50400030607 - Tea Run- Killbuck Creek

Approved NPS-IS plans exist for:

- o Kokosing River-Armstrong Run
- o Tea Run-Killbuck Creek.

  - 401 permit submitted in Oct 2020 for streambank stabilization work at two locations along the southern streambank of the Kokosing River in Mount Vernon, Ohio.

  - The Kokosing River is a state-designated Water Trail

  - Kelly Capuzzi with OEPA supplied her knowledge of known issues. Her thoughts are below:

“Simmons Run enters the Walhonding at river mile 10.66 and looks impacted due to sedimentation. The fish community is exceptional so that looks like a good candidate for some type of stream restoration project.”
“Beaver Run is listed as partial attainment of EWH due to sedimentation so that also might be a good one to look at. The report says there’s a lot of unrestricted livestock access in the watershed so that could also be addressed.”
“There are state endangered lake chubsuckers in the wetlands of Killbuck so any wetlands in the watershed that can be protected would be great. I know there’s some land preservation going on in Killbuck with the Killbuck Watershed land trust so that might be a good group to work with.”

  - Taylor Gilmore with the Wayne SWCD supplied her knowledge of known issues. Her thoughts are below:

“Within the Killbuck there’s a lot of agricultural land. A couple years back we had a pollution complaint that had manure entering straight into the Killbuck Creek (this was also in Chester Township). A landowner over applied to one of his fields and didn’t have the 30 foot setback from the creek.”
“There might be some erosion in Chester Township (nothing has been brought to our office but it’s steep and has a lot of riverines).”

USGS station locations

- Black Fork Mohican River at Shelby OH
- Black Fork below Charles Mill Dam near Mifflin OH
- Rocky Fork at Lucas OH
- Black Fork at Melco OH
- Black Fork at Loudonville OH
- Clear Fork Mohican River at Bellville OH
- Clear Fork bl Pleasant Hill Dam nr Perrysville OH
- Lake Fork bl Mohicanville Dam near Mohicanville OH
- Kokosing River at Mount Vernon OH
- Walhonding River below Mohawk Dam at Nellie OH
- Killbuck Creek at Killbuck OH
- Walhonding River below Randle OH
- Mill Creek near Coshocton OH

EA3 Assessments by HUC 10 Units

R02S01	MUDDY FK. MOHICAN R. E OF REDHAW @ MARTIN RD.	05040002	05	02	13.40	39.00	55	38	8.61	Good
300261	KISER DITCH @ SR 95	05040002	05	03	0.38	19.40	32.5	24		Very Poor
300159	MUDDY FK. MOHICAN R. @ FUNK RD.	05040002	05	03	4.30	74.00	44	40	7.66	N/A
300255	MUDDY FK. MOHICAN R. @ HINER RD. (PERRY TWP. RD. 1550)	05040002	05	03	8.20	66.60	70.5	49	10.06	N/A
R02P09	JAMISON CREEK 0.75 MI E OF ASHLAND @ CR 1302	05040002	06	01	0.28	13.20	65	54		Good
R02S10	LANG CREEK UPST. ASHLAND @ TWP. RD. 1104	05040002	06	01	3.15	17.30	51.5	48		Very Good
300251	LANG CREEK @ TWP. RD. 1006	05040002	06	01	5.26	7.70	63	48		Marginally Good
300250	LEIDIGH MILL CREEK ADJ. SR 511	05040002	06	02	1.91	8.60	66.5	46		Good
300248	ORANGE CREEK @ SR 58	05040002	06	02	4.85	15.90	81	48		Marginally Good
300249	ORANGE CREEK @ ASHLAND CR 620	05040002	06	02	6.32	9.20	69.5	50		Good
300247	KATOTAWA CREEK @ MONTGOMERY TWP. RD. 1275	05040002	06	03	3.49	9.10	83	48		Exceptional
300253	QUAKER SPRINGS RUN @ ASHLAND CR 2000	05040002	06	04	1.97	7.60	67.5	54		Exceptional
300254	OLDTOWN RUN @ ASHLAND CR 1802	05040002	06	04	4.31	7.60	53.5	52		Exceptional
300252	NEWELL RUN @ MONTGOMERY TWP. RD. 655	05040002	06	05	1.00	8.40	80.5	54		Exceptional
R02W17	JEROME FORK NW OF JEROMESVILLE @ TWP. RD. 1600	05040002	06	05	7.90	114.00	56.5	33	7.42	Good
611870	JEROME FORK AT ASHLAND @ CR 1302	05040002	06	05	12.08	73.40	52.5	42	9.01	Good
611860	JEROME FORK AT ASHLAND @ US RT 42	05040002	06	05	12.98	38.60	50	47	9.97	N/A
R02P03	JEROME FORK SE OF JEROMESVILLE @ CR 175	05040002	06	06	2.56	147.00	50	41	7.71	N/A
300278	ODELL LAKE OUTLET @ SR 179	05040002	07	01	0.59	31.60	68.5	50	8.95	N/A
300273	CRAB RUN @ WASHINGTON TWP. RD. 473	05040002	07	01	2.17	8.00	74.5	52		Exceptional
300276	ODELL LAKE OUTLET @ SR 226	05040002	07	01	3.03	11.30	44	42		Good
300270	LAKE FORK MOHICAN R. @ SR 3	05040002	07	02	7.33	290.00	69	50	8.90	N/A
300272	LAKE FORK MOHICAN R. @ SR 95	05040002	07	02	14.04	271.00	47.5	30	5.84	N/A
300275	PLUM RUN @ HOLMES CR 22	05040002	07	03	0.13	7.40	75.5	50		Good
300160	LAKE FORK MOHICAN R. @ WASHINGTON TWP. RD. 451	05040002	07	03	0.95	346.00	87	51	9.59	N/A
300282	HONEY CREEK NW OF LOUDONVILLE @ CR 775	05040002	08	01	0.11	17.30	61	46		Good
300283	HONEY CREEK @ CR 2175	05040002	08	01	5.19	7.80	64	46		Exceptional

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EA3 Assessments by HUC 10 Units

R01W16	ROCKY FK. MOHICAN R. N OF MANSFIELD @ BOWMAN RD (CR 215)	05040002	02	03	16.43	11.20	66.5	32		Good
R01W32	ROCKY FK. MOHICAN R. E OF LUCAS @ APPLEGATE RD.	05040002	02	04	0.57	77.00	88	46	9.75	Good
300237	TRIB. TO ROCKY FORK (10.70) @ MANSFIELD LUCAS RD. (CR 300)	05040002	02	04	1.33	8.80	68.5	44		N/A
R99Q11	ROCKY FK. MOHICAN R. UPST. LUCAS @ SMART RD. (S. CROSSING)	05040002	02	04	4.38	66.00	91.5	37	7.42	N/A
601800	ROCKY FK. MOHICAN R. DST MANSFIELD @ SR 39	05040002	02	04	10.13	51.00	88.5	33	7.04	Poor
611900	ROCKY FK. MOHICAN R. AT MANSFIELD @ SR 39 (PARK AVE. E)	05040002	02	04	12.49	30.30	50.5	28	5.03	Poor
R01P29	BLACK FK. MOHICAN R. NW OF PERRYSVILLE @ SR 39	05040002	02	05	14.65	224.00	60.5	35	7.61	N/A
R01P19	BLACK FK. MOHICAN R. @ TWP. RD. 1265	05040002	02	05	17.81	218.00	68	40	9.99	N/A
R99Q21	CEDAR FORK W OF BELLVILLE @ SR 546	05040002	03	02	3.25	36.00	81.5	48	8.79	N/A
300239	CEDAR FORK @ WIRICK RD.	05040002	03	02	5.60	17.20	78.5	44		Very Good
R99Q23	CEDAR FORK W OF BELLVILLE @ WEST POINT RD.	05040002	03	02	8.25	10.30	81	48		Exceptional
R99Q16	CLEAR FK. MOHICAN R. @ RITTER RD., DST. I-71	05040002	03	03	23.35	63.00	86.5	44	8.92	N/A
300246	HONEY CREEK @ DURBIN RD. (JEFFERSON TWP. RD. 404)	05040002	04	01	0.80	8.80	75	50		Exceptional
R01W07	CLEAR FK. MOHICAN R. NEAR BUTLER @ CUTNAW RD.	05040002	04	01	16.17	131.00	82	39	8.43	N/A
R01G03	CLEAR FK. MOHICAN R.@ SR 13	05040002	04	01	19.83	114.00	78	41	9.51	Good
300243	OPOSSUM RUN @ SR 95	05040002	04	02	0.35	15.60	77	40		Good
300244	OPOSSUM RUN @ RHINEHART RD. (RICHLAND CR 398)	05040002	04	02	4.57	7.80	76.5	48		Exceptional
300245	SLATER RUN @ ST. RT. 97 (CLEVELAND ST.)	05040002	04	03	0.82	8.10	73	52		Exceptional
300240	CLEAR FK. MOHICAN R. @ BUNKER HILL RD. (RICHLAND CR 350)	05040002	04	03	10.55	160.00	76.5	45	8.96	N/A
300241	PINE RUN @ McCURDY RD. (ASHLAND CR 3275)	05040002	04	04	5.71	7.80	85	48		Exceptional
300242	SWITZER CREEK ADJ. PLEASANT VALLEY RD. (RICHLAND CR 303)	05040002	04	05	2.83	9.20	73	48		Very Good
R01S26	CLEAR FK. MOHICAN R. @ ST PK COVERED BRIDGE (FOREST RD 58)	05040002	04	05	4.03	199.00	83	53	10.43	N/A
R02S03	MUDDY FK. MOHICAN R. S OF WEST SALEM @ FLEMMING RD.	05040002	05	01	18.40	18.50	73	50		Good
300256	MUDDY FK. MOHICAN R. @ JACKSON TWP. RD. 101	05040002	05	01	23.29	9.30	73.5	34		Good
300264	REDHAW CREEK AT JACKSON TWP. RD. 133	05040002	05	02	2.54	8.00	66.5	54		Very Good

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EA3 Assessments by HUC 10 Units

R01W34	MARSH RUN N OF SHELBY @ SR 61	05040002	01	01	0.17	20.80	27	32	7.59	Good
300221	MARSH RUN @ LONDON WEST RD. (CR 58)	05040002	01	01	4.55	8.50	35	42		Good
R01P10	TRIB TO BLACK FK. MOHICAN R (54.46) S OF SHELBY @ SR 61	05040002	01	02	0.08	4.80	54	44		Good
R01S24	TUBY RUN AT SHELBY @ FOOTBRIDGE NEAR MOUTH	05040002	01	02	0.10	4.50	53.5	56		Very Poor
300220	BEAR RUN @ LONDON WEST RD. (CR 58)	05040002	01	02	0.48	8.60	26	40		Poor
R01W33	BLACK FK. MOHICAN R. N OF SHELBY @ LONDON WEST RD.	05040002	01	02	51.32	30.80	64.5	38	6.90	Good
300219	BLACK FK. MOHICAN R. ADJ PARK ST. (SHELBY RESERV. #2 INTAKE)	05040002	01	02	53.88	21.50	72	40	8.00	Very Good
300218	BLACK FK. MOHICAN R. AT STIVING RD.	05040002	01	02	57.72	7.40	55.5	42		Good
300224	BRUBAKER CREEK @ EBY RD. (TWP. RD. 230)	05040002	01	03	0.30	22.70	66	36	6.55	Good
300225	WHETSTONE CREEK @ VANTILBURG RD. (TWP. RD. 86)	05040002	01	04	0.69	16.50	67.5	46		Good
300228	WHETSTONE CREEK ADJ OLIVESBURG FITCHVILLE RD.	05040002	01	04	3.88	10.20	63	52		N/A
300222	SHIPP CREEK @ SR 603	05040002	01	05	0.95	6.80	62.5	52		Marginally Good
200657	BLACK FK. MOHICAN R. SE OF GANGES @ SR 13	05040002	01	05	36.60	108.00	35.5	20	4.58	N/A
R01S02	BLACK FK. MOHICAN R. AT GANGES @ GANGES-FIVE POINTS RD.	05040002	01	05	43.18	85.00	72.5	36	8.14	N/A
300233	TRIB. TO BLACK FK. MOHICAN R. (25.16) @ SR 603	05040002	02	01	1.68	7.80	74.5	48		N/A
300231	BLACK FK. MOHICAN R. AT CRIDER RD. (RICHLAND CR 92)	05040002	02	01	23.31	190.00	56	21	5.22	N/A
R01G01	BLACK FK. MOHICAN R. @ CHARLES RD. (WELLER TWP. RD. 89)	05040002	02	01	29.67	166.00	57.5	19	5.26	Good
300782	TRIB. TO ROCKY FORK (14.43) NEAR MOUTH, ADJ PEABODY BARNES	05040002	02	03	0.10	3.40	69.5	48		Marginally Good
R01W18	TRIB. TO ROCKY FK MOHICAN R (14.43) N OF MANSFIELD @ SR 13	05040002	02	03	0.36	3.30	51	40		Marginally Good
300238	TOUBY RUN AT MANSFIELD @ BOWMAN ST.	05040002	02	03	1.00	9.20	48.5	36		Fair
R01P26	ROCKY FK. MOHICAN R. AT MANSFIELD @ MAIN ST.	05040002	02	03	14.05	19.60	55	33		N/A
R01P22	ROCKY FK. MOHICAN R. AT MANSFIELD @ LONGVIEW AVE.	05040002	02	03	14.23	19.30	45	36		Fair
R01P01	ROCKY FK. MOHICAN R. AT MANSFIELD @ US RT 30	05040002	02	03	14.32	19.30	62.5	38		N/A
R99Q15	ROCKY FK. MOHICAN R. AT MANSFIELD UPST. EDS	05040002	02	03	14.60	15.80	49.5	38		N/A

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EA3 Assessments by HUC 10 Units

203603	KILLBUCK CREEK AT HELMICK @ COVERED BRIDGE (TWP. RD. 25)	05040003	08	05	13.28	581.00	67	47	9.24	N/A
301012	TRIB. TO MOHAWK CREEK (2.93) @ TWP. RD. 373	05040003	09	01	0.60	6.40	74.3	52		Exceptional
300887	MOHAWK CREEK @ CR 82	05040003	09	01	1.48	22.60	57.8	51	9.50	N/A
301011	MOHAWK CREEK @ TWP. RD. 409	05040003	09	01	4.10	9.50	66.3	52		Very Good
301013	DUTCH RUN @ TWP. RD. 344/TWP. RD. 338	05040003	09	02	0.15	5.40	63.3	42		Exceptional
301014	HONEY RUN @ TWP. RD. 359	05040003	09	02	0.60	1.90	50.5			Very Good
601910	WALHONDING R. AT NELLIE @ US RT 36	05040003	09	02	15.73	1505.00	83	55	10.88	Exceptional
300321	WALHONDING R. NEAR WALHONDING @ SR 715	05040003	09	02	21.80	1490.00	81.5	56	10.64	N/A
200633	BEAVER RUN AT WARSAW, UPST. US RT 36, ADJ. LANE	05040003	09	03	0.30	14.10	60.3	54		Good
301015	BEAVER RUN @ CR 22	05040003	09	03	2.60	8.40	53.5	46		Very Good
301018	FLINT RUN @ SR 60	05040003	09	04	0.40	2.30	56.5	50		Fair
301016	SIMMONS RUN @ TWP. RD. 41B	05040003	09	04	0.60	16.30	78	52		Good
301017	SIMMONS RUN @ TWP. RD. 78	05040003	09	04	2.97	6.90	64.5	52		Fair
301019	DARLING RUN @ LANE OFF TWP. RD. 340 AT NELLIE CEMETERY	05040003	09	05	0.10	3.30	59.8	44		Fair
R04S35	WALHONDING R. UPST. KILLBUCK CREEK @ US RT 36	05040003	09	05	7.54	1575.00	92	54	11.54	N/A
300288	WALHONDING R. UPST. SIXMILE DAM	05040003	09	05	8.81	1572.00	64	45	8.53	Fair
200632	L. MILL CREEK N OF COSHOCTON @ ADJ. TWP. RD. 206	05040003	09	06	0.10	8.40	63.8	54		Good
R04S29	MILL CREEK N OF COSHOCTON @ TWP. RD. 206	05040003	09	06	8.51	18.50	64.3	44		Very Good
301020	MILL CREEK @ TWP. RD. 215	05040003	09	06	12.50	8.80	68	52		Good
R04S31	TURKEY RUN N OF COSHOCTON @ CR 12	05040003	09	07	0.19	5.50	70.5	58		Exceptional
R04S28	MILL CREEK N OF COSHOCTON @ CR 24	05040003	09	07	0.43	51.10	59.8	46	9.33	N/A
300888	MILL CREEK @ TWP. RD. 322	05040003	09	07	3.54	39.90	59.8	44	8.67	N/A
300978	MILL CREEK @ USGS GAGE STATION	05040003	09	07	7.90	27.10	58	47	9.24	Very Good
301023	CROOKED RUN @ END OF TWP. RD 495, DST US RT 36	05040003	09	08	0.06	9.00	42.8	36		Fair
R04W27	WALHONDING R. AT COSHOCTON @ US RT 36	05040003	09	08	0.76	2255.00	94	52	10.66	N/A
R04W27	WALHONDING R. AT COSHOCTON @ US RT 36	05040003	09	08	0.76	2255.00		53	10.43	N/A
301024	CROOKED RUN UPST. EDGEWOOD MHP @ LANE OFF CR 23	05040003	09	08	0.98	8.00	53.3	44		Marginally Good

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EA3 Assessments by HUC 10 Units

203626	BLACK CREEK W OF KILLBUCK @ TWP. RD. 31	05040003	07	04	4.58	26.50	69	40	7.66	Exceptional
R04K11	BLACK CREEK NW OF GLENMONT @ TWP. RD. 225	05040003	07	04	9.75	3.80	73	54		Exceptional
203631	CORNS RUN W OF MILLERSBURG @ CO. RD. 400	05040003	07	05	0.60	5.00	61	42		Fair
R04K15	SAPPS RUN W OF MILLERSBURG @ CO. RD. 349	05040003	07	05	0.63	8.50	47	28		Fair
203630	BEAR RUN W OF MILLERSBURG @ CO. RD. 400	05040003	07	05	0.80	2.60	55.5	36		Very Good
R04K13	SHRIMPLIN CREEK NW OF KILLBUCK @ TWP. RD. 252	05040003	07	05	2.86	5.70	76	54		Exceptional
R04S06	KILLBUCK CREEK DST. MILLERSBURG @ TWP. RD. 92	05040003	07	05	28.93	407.00	65	50	9.50	N/A
R04K03	KILLBUCK CREEK AT MILLERSBURG @ CLINTON AVE.	05040003	07	05	31.76	380.00	65	56	10.07	N/A
R04K10	TRIB. TO WOLF CREEK (6.49) S OF STILLWELL @ CO. RD. 452	05040003	08	01	1.36	4.70	62	58		Exceptional
R04S24	WOLF CREEK SW OF KILLBUCK @ TWP. RD. 78	05040003	08	01	2.08	23.60	62	44		Very Good
203625	WOLF CREEK @ TWP. RD. 31	05040003	08	01	4.07	18.10	61.5	52		Exceptional
R04S23	TRIB. TO DOUGHTY CREEK (14.34) NW OF CHARM @ ST. RT. 557	05040003	08	02	0.60	2.50	51.5	26		Marginally Good
203623	MILITARY RUN @ TWP. RD. 128	05040003	08	02	0.90	4.90	55.5	50		Good
R04S09	DOUGHTY CREEK NEAR BECKS MILLS @ CO. RD. 19	05040003	08	02	11.70	19.70	53.5	42		Good
R04W30	DOUGHTY CREEK DST. GUGGISBURG CHEESE CO. @ TWP. RD. 123	05040003	08	02	14.29	18.40	55.5	46		Marginally Good
R04S10	DOUGHTY CREEK DST. GUGGISBURG CHEESE CO. @ CO. RD. 355	05040003	08	02	14.64	15.10	63	48		Good
R04K05	DOUGHTY CREEK S OF BERLIN @ CO. RD. 120	05040003	08	02	15.90	13.00	68	50		N/A
R04K06	DOUGHTY CREEK W OF BERLIN @ TWP. RD. 359	05040003	08	02	18.74	5.50	48.5	26		Marginally Good
R04P04	DOUGHTY CREEK SE OF LAYLAND, NEAR MOUTH @ TWP. RD. 343	05040003	08	03	0.63	60.70	58	48	9.28	N/A
300589	DOUGHTY CREEK @ ST. RT. 83	05040003	08	03	4.89	42.10	63	50	9.42	N/A
R04K09	BIG RUN W OF LAYLAND @ TWP. RD. 330	05040003	08	04	3.55	8.30	53.5	50		Exceptional
203606	KILLBUCK CREEK 0.1 MI. DST. HOLMES/COSHOCTON CO. LINE	05040003	08	04	20.70	501.00	58	41	8.37	N/A
R04S03	KILLBUCK CREEK DST. KILLBUCK WWTP @ U.S. RT. 62	05040003	08	04	23.91	464.00	60	41	8.69	N/A
R04S05	KILLBUCK CREEK AT KILLBUCK @ OLD CO. RD. 28	05040003	08	04	24.90	462.00	59	44	9.03	N/A
R04K04	BUCKLEW RUN N OF RANDLE @ TWP. RD. 413	05040003	08	05	1.45	6.00	65.5	48		Good
203602	KILLBUCK CREEK 1.5 MI UPST. CO. RD. 28, ADJ CO. RD. 24	05040003	08	05	2.10	599.00	75	50	9.61	N/A

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R03W50	APPLE CREEK AT WOOSTER @ SPRUCE ST.	05040003	06	02	0.60	51.40	65.5	43	8.50	N/A
R03K10	L. APPLE CREEK (9.79) NE OF TOWN OF APPLE CREEK @ HACKETT RD	05040003	06	02	1.10	3.80	59	42		Good
R03W48	APPLE CREEK @ END OF SYLVAN RD, DST PITTSBURGH AVE.	05040003	06	02	1.88	49.00	77.5	45	8.33	N/A
R03S31	APPLE CREEK AT WOOSTER @ PITTSBURGH AVE.	05040003	06	02	1.95	49.00				N/A
R03W38	APPLE CREEK DST. APPLE CREEK WWTP @ ELY RD.	05040003	06	02	6.28	23.00	75.5	47	8.56	N/A
R03P01	APPLE CREEK UPST. APPLE CREEK WWTP @ ST. RT. 250	05040003	06	02	8.70	13.70	74	38		Good
R03P05	SHREVE CREEK DST. SHREVE WWTP @ SHREVE EASTERN RD.	05040003	06	03	3.06	10.00	53	36		Fair
R03K07	TRIB. TO KILLBUCK CREEK (43.60) AT MILLBROOK @ KISTER RD.	05040003	06	04	2.68	5.00	61.5	32		Good
R03W11	KILLBUCK CREEK S OF WOOSTER @ VALLEY RD.	05040003	06	04	46.02	194.00	54.5	29	8.26	N/A
R03W06	KILLBUCK CREEK NEAR WESTWOOD, DST. APPLE CREEK	05040003	06	04	49.40	190.00	59	42	8.98	N/A
R04K23	N. BR. SALT CREEK N OF FREDERICKSBURG @ MORELAND RD.	05040003	06	05	3.29	6.90	42	37		Fair
R04P06	SALT CREEK N OF HOLMESVILLE @ ST. RT. 83	05040003	06	06	0.80	42.60	53.5	38	7.98	N/A
300590	SALT CREEK @ CO. RD. 192, E OF TWP. RD. 566	05040003	06	06	3.02	39.30	64	38	8.76	N/A
R04K21	SALT CREEK AT FREDERICKSBURG @ HOLMESVILLE RD.	05040003	06	06	5.07	34.50	75	42	8.55	N/A
R04K22	SALT CREEK E OF FREDERICKSBURG, UPST. SALT CREEK RD.	05040003	06	06	8.50	13.20	61.5	42		Good
R04K20	TRIB TO PAINT CREEK (3.01) NW OF MILLERSBURG @ TWP. RD. 525	05040003	07	01	1.50	4.20	71.5	50		Exceptional
R04S25	PAINT CREEK SW OF HOLMESVILLE @ TWP. 556	05040003	07	01	1.84	26.20	70.5	40	8.85	Exceptional
R04K18	PAINT CREEK NW OF MILLERSBURG @ TWP. RD. 262	05040003	07	01	5.27	14.30	67	48		Exceptional
R04K19	PAINT CREEK E OF NASHVILLE @ CO. RD. 51	05040003	07	01	8.68	4.80	68.5	40		Exceptional
R04K17	MARTINS CREEK AT MARTINSVILLE @ TWP. RD. 601	05040003	07	02	3.50	12.50	59.5	40		Good
R04K01	HONEY RUN N OF MILLERSBURG @ TWP. RD. 332	05040003	07	03	1.03	6.20	60.5	46		Good
R04S08	KILLBUCK CREEK DST. HOLMESVILLE @ TWP. RD. 346	05040003	07	03	35.57	367.00	67	42	8.58	N/A
R04W01	KILLBUCK CREEK AT HOLMESVILLE @ CO. RD. 320	05040003	07	03	37.13	313.00	62.5	46	8.68	N/A
R04K12	TRIB. TO BLACK CREEK (7.35) NEAR GLENMONT @ TWP. RD. 14	05040003	07	04	0.66	4.60	70.5	48		Exceptional

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300279	BRUSH RUN @ RUTLEDGE RD. (CR 36)	05040003	04	03	0.91	7.80	65.5	48		Good
R12K21	KOKOSING R. @ RILEY CHAPEL RD.	05040003	04	03	2.69	478.00	88	52	9.30	N/A
R12S04	KOKOSING R. DST. MILLWOOD @ US RT 36	05040003	04	03	6.12	463.00	87	48	9.37	N/A
203615	KILLBUCK CREEK W OF CRESTON @ CANAAN CENTER RD.	05040003	05	01	70.82	20.40	57.5	40	7.51	Very Good
R03S29	KILLBUCK CREEK SW OF CRESTON @ BRITTON RD.	05040003	05	01	72.81	15.80	59	44		Exceptional
R03K06	KILLBUCK CREEK N OF CANAAN @ CANAAN CENTER RD.	05040003	05	01	75.74	5.10	75.5	58		Exceptional
R03W59	CAMEL CREEK W OF CRESTON @ WESTFIELD RD.	05040003	05	02	0.52	12.50	58	34		Good
203638	REPP RUN SW OF LODI @ CO. RD. 34	05040003	05	02	0.70	3.40	71	46		Very Good
R03S36	CAMEL CREEK W OF WESTFIELD CENTER @ GREENWICH RD.	05040003	05	02	3.76	8.70	72.5	48		N/A
300592	KILLBUCK CREEK AT BURBANK @ ST. RT. 83	05040003	05	02	66.85	42.30	59	42	7.04	Good
R03S33	L. KILLBUCK CREEK NEAR WOOSTER @ ST. RT. 302	05040003	05	03	0.55	20.80	54.5	43	8.39	N/A
R03K14	RATHBURN RUN NW OF JEFFERSON, ADJ. LEHR RD.	05040003	05	03	2.50	5.10	63.5	54		Marginally Good
R03S34	L. KILLBUCK CREEK NE OF NEW PITTSBURG @ ST. RT. 302	05040003	05	03	6.55	7.00	70.5	48		Good
R03K15	CEDAR RUN AT CEDAR VALLEY @ RICE HILL	05040003	05	04	1.45	5.90	65	44		Exceptional
R03S16	KILLBUCK CREEK UPST. WOOSTER @ MCAFEE RD.	05040003	05	04	55.35	92.00	62	44	8.70	N/A
R03S27	KILLBUCK CREEK AT ARMSTRONG @ PLEASANT HOME RD.	05040003	05	04	59.66	76.00	71.5	39	8.86	N/A
203613	KILLBUCK CREEK SW OF BURBANK @ BRITTON RD.	05040003	05	04	64.40	56.00				N/A
R03K12	CLEAR CREEK W OF WOOSTER @ SILVER RD.	05040003	05	05	1.08	11.40	71.5	58		Exceptional
R03K13	CLEAR CREEK NW OF WOOSTER @ MECHANICSBURG RD.	05040003	05	05	3.71	7.20	68.5	50		Exceptional
R03W01	KILLBUCK CREEK UPST. WOOSTER WWTP	05040003	05	05	49.95	136.00	50	38	8.91	N/A
R03W47	L. APPLE CREEK JUST E OF WOOSTER @ MOUTH	05040003	06	01	0.01	12.90	67	34		Good
R03K11	L. APPLE CREEK AT WOOSTER @ PORTAGE RD.	05040003	06	01	1.70	11.10	49	28		Good
R03S23	L. APPLE CREEK N OF WOOSTER @ SMITHVILLE-WESTERN RD.	05040003	06	01	4.45	5.70	67.5	28		Good
R03S24	L. APPLE CREEK N OF WOOSTER @ SCHELLIN RD.	05040003	06	01	5.05	4.70	75	30		N/A
R03P02	APPLE CREEK AT WOOSTER @ OLD COLUMBUS AVE.	05040003	06	02	0.10	51.60	62.5	43	8.44	N/A
R03K08	SPRING RUN E OF WOOSTER @ CANAL RD.	05040003	06	02	0.36	5.10	64.5	48		Good

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EA3 Assessments by HUC 10 Units

300357	ELLIOT RUN @ TWP. RD. 415 (SYCAMORE RD.)	05040003	03	03	0.13	10.70	47.5	54		Very Good
R12K24	BIG RUN @ BIG RUN RD.	05040003	03	03	0.68	29.20	70.5	44	8.63	N/A
300265	ELLIOT RUN @ CURTIS RD. (TWP. RD. 415)	05040003	03	03	1.05	8.00	32	44		Marginally Good
300263	BIG RUN @ SR 586	05040003	03	03	4.40	9.10	65	50		Marginally Good
300262	DELANO RUN ADJ. MEADOWBROOK DRIVE	05040003	03	04	1.55	7.10	53.5	30		Good
300260	CENTER RUN @ BEECH ST.	05040003	03	04	1.72	7.80	60.5	48		Exceptional
300366	KOKOSING R. NEAR GAMBIER @ SR 229, UPST. BIG RUN	05040003	03	04	18.90	281.00	82	53	9.96	N/A
R12S08	KOKOSING R. AT GAMBIER @ LAYMON RD.	05040003	03	04	20.90	280.00	82.5	49	9.02	N/A
611890	KOKOSING R. AT MT. VERNON @ TWP. RD. 257	05040003	03	04	24.30	272.00	87.5	54	8.89	N/A
R12K14	KOKOSING R. UPST. MT. VERNON WWTP	05040003	03	04	25.30	251.00	82.5	56	9.89	N/A
300269	L. SCHENCK CREEK @ GILCREST RD. (CR 8)	05040003	03	05	0.15	16.30	72	46		Exceptional
300268	L. SCHENCK CREEK @ FREDERICKTOWN-AMITY RD. (CR 66)	05040003	03	05	4.45	8.20	91.5	50		Exceptional
R12K25	SCHENCK CREEK SW OF HOWARD @ SCHENCK CREEK RD.	05040003	03	06	0.55	41.20	76	50	9.26	Exceptional
R12S25	SCHENCK CREEK W OF HOWARD @ US RT 36	05040003	03	06	2.64	37.30	83.5	47	9.31	Exceptional
300266	SCHENCK CREEK ADJ. PROPER RD. (TWP. RD. 274)	05040003	03	06	8.75	8.90	80.5	46		Exceptional
200671	INDIANFIELD RUN SE OF GAMBIER @ LANE DST. ST. RT. 229	05040003	03	07	2.50	8.90	73	54		Very Good
R12S06	KOKOSING R. AT HOWARD @ CR 35	05040003	03	07	11.55	379.00	81	53	9.15	Exceptional
300352	L. JELLOWAY CREEK @ MOUTH	05040003	04	01	0.01	19.50	71	44	8.80	Low Fair
R12K12	L. JELLOWAY CREEK NW OF HOWARD @ MAGERS RD.	05040003	04	01	1.01	19.00	71	36		N/A
300277	L. JELLOWAY CREEK @ BEAVER RD. (TWP. RD. 318)	05040003	04	01	6.97	10.50	67	54		Very Good
R12K26	JELLOWAY CREEK @ US RT 36	05040003	04	02	0.08	74.00	81.5	53	9.25	Good
200670	E. BR. JELLOWAY CREEK DST DANVILLE @ TWP. RD. 438	05040003	04	02	1.10	9.20	46	24		N/A
R99Q02	E. BR. JELLOWAY CREEK AT DANVILLE @ U.S. 62 (UPPER CROSSING)	05040003	04	02	3.33	4.50	61.5	40		N/A
R12K11	JELLOWAY CREEK UPST E. BR. JELLOWAY CREEK	05040003	04	02	4.40	36.50	73.5	49	9.14	N/A
300271	JELLOWAY CREEK @ ORANGE HILL RD. (TWP. RD. 325)	05040003	04	02	8.85	16.50	74	52		Exceptional
R12S03	KOKOSING R. AT MOUTH @ TWP. RD. 423	05040003	04	03	0.07	485.00	81	55	9.09	Exceptional

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EA3 Assessments by HUC 10 Units

Station	Station Name	HUC 8	10	12	RM	Drain Area	QHEI	IBI	MIWBI	Narrative Score
300227	TRIB. TO N. BR. KOKOSING R. (9.99) @ RUGGLES RD. (T.R. 178)	05040003	01	01	4.04	8.40	57	32		Marginally Good
200676	N. BR. KOKOSING R. JUST W OF WATERFORD, UPST TRIB	05040003	01	01	14.10	14.10	82.5	54		Exceptional
300223	N. BR. KOKOSING R. @ DRIVE OFF MT. VERNON-TIFFIN RD. (CR 22)	05040003	01	01	17.77	8.00	71	50		Exceptional
300232	E. BR. N. BR. KOKOSING R. @ MOUTH	05040003	01	02	0.15	31.80	87.5	51	9.72	Very Good
300230	E. BR. N. BR. KOKOSING R. @ TOMS RD. (TWP. RD. 288)	05040003	01	02	6.04	9.90	23	42		Good
R12K22	N. BR. KOKOSING R. @ SR 13	05040003	01	03	0.02	97.90	85	52	9.98	N/A
300234	JOB RUN @ UPPER FREDERICKTOWN RD. (CR 6)	05040003	01	03	0.06	8.50	46.5	48		Exceptional
R99Q03	N. BR. KOKOSING R. DST. FREDRICKTOWN WWTP @ MONTGOMERY RD.	05040003	01	03	5.37	85.00	65	54	9.84	Exceptional
R12S21	N. BR. KOKOSING R. AT FREDERICKTOWN @ MILL ST.	05040003	01	03	6.18	84.00	82.5	55	9.89	N/A
300226	N. BR. KOKOSING R. @ OVERLY RD. (TWP. RD. 377)	05040003	01	03	9.15	45.50	66	40	7.53	N/A
300215	S. BR. KOKOSING R. @ CARDINGTON-CHESTERVILLE RD. (CR 23)	05040003	02	01	2.96	8.40	57.5	38		Fair
R12S17	KOKOSING R. @ CHIPPS RD., UPST I-71	05040003	02	01	49.73	15.20	57.5	44		N/A
300211	KOKOSING R.@ PULASKIVILLE RD.	05040003	02	01	54.69	8.30	65.5	50		Very Good
300216	MILE RUN @ TRACK OFF OF SPARTA RD. (CR 11)	05040003	02	02	4.75	9.00	57.5	50		Marginally Good
300212	KOKOSING R. @ VAIL RD.	05040003	02	02	39.27	60.00	55.5	39	9.19	N/A
R12S14	KOKOSING R. AT CHESTERVILLE @ SR 314	05040003	02	02	45.44	38.00	46	46	9.20	N/A
300217	GRANNY CREEK @ GRANNY CREEK RD. (TWP. RD. 402)	05040003	02	03	4.29	9.10	79	52		Very Good
300213	KOKOSING R. @ BECKLEY RD. (TWP. RD. 401)	05040003	02	03	32.56	79.90	75	47	9.36	N/A
R12K23	DRY CREEK @ PARROTT ST.	05040003	03	01	1.04	33.70	61	46	8.95	N/A
200673	DRY CREEK SW OF MT. VERNON @ TWP. RD. 127 (THAYER RD.)	05040003	03	01	4.50	25.10	69.5	42	7.49	N/A
300259	DRY CREEK @ TUCKER RD. (TWP. RD. 121)	05040003	03	01	9.22	16.00	81.5	54		Very Good
300258	DRY CREEK @ SIMMONS CHURCH RD. (CR 25)	05040003	03	01	10.72	7.60	78	56		Exceptional
300235	ARMSTRONG RUN @ LOWER GREEN VALLEY RD. (TWP. RD. 389)	05040003	03	02	1.06	8.30	71.5	48		Exceptional
R12P02	KOKOSING R. AT MT. VERNON @ TILDEN AVE. GAGE	05040003	03	02	28.61	202.00	82	48	9.31	N/A

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6.6 Priority Watersheds List

*yellow cell indicates watersheds with high concentrations during both flow events

Sites with Nitrate Concentrations Over .32 mg/L

NH4	
May	*August*
WALH055-LIttle Jelloway Creek	WALH014- Trib to Killbuck @Willow Rd.
WALH058-Wolf Run Kokosing	WALH015- Jennings Ditch
WALH092-Orange Creek	WALH070-Jelloway Creek
	WALH108-Trib to Mile

	Run 4
	WALH111-Trib to Kokosing #2

Sites with TON Concentrations over 2.75 mg/L

TON	
May	*August*
WALH009- Salt Creek	WALH019-Spring Run
WALH010-North Branch Salt Creek	WALH022-Upper Muddy Fork Mohican
WALH014- Trib to Killbuck @Willow Rd.	WALH026-Cedar Run
WALH016-Apple Creek	WALH027-Killbuck Upstr. Mowrer Lake
WALH018- Little Apple Creek	WALH057-Little Schenck Creek
WALH019-Spring Run	WALH084-Black Fork Mohican @ Wally Rd.
WALH020-Clear Creek	WALH091-Jerome Fork Mohican
WALH021-Little Killbuck at Lattasburg Rd	
WALH024-Lower Muddy Fork Mohican	
WALH025-Rathburn Run	
WALH026-Cedar Run	
WALH028-Shade Creek	
WALH030-Little Killbuck @ West Salem Rd.	
WALH032-Killbuck Ditch	
WALH041-Headwaters	

Doughty Creek	
WALH050-Flat Run	
WALH053-Honey Run #2	
WALH054-Jelloway Creek	
WALH056-Schenck Creek	
WALH057-Little Schenck Creek	
WALH059-Indianfield Run	
WALH061-Big Run #1	
WALH062-Elliot Run	
WALH063- Big Run #2	
WALH064-Little Schenck Creek	
WALH065-Coleman Branch	
WALH066-East Branch Jelloway Creek @ Humbert Rd.	
WALH067- East Branch Jelloway Creek @ Carey Rd.	
WALH068-Sapps Run @ Sapps Run Rd.	
WALH069-Dowdy Creek	
WALH070-Jelloway Creek	
WALH071-Ireland Creek	
WALH074-Pine Run	
WALH077-Sigafoos Run Mohican	
WALH078-Lake Fork Mohican	
WALH079-Big Run	
WALH080- Plum Run	
WALH081-Mohicanville Dam	

WALH082-Crab Run	
WALH083-Honey Creek	
WALH084-Black Fork Mohican @ Wally Rd.	
WALH085-Charles Mill Black Fork Mohican	
WALH086-Seymour Run	
WALH087-Oldtown Run	
WALH090-Lang Creek	
WALH091-Jerome Fork Mohican	
WALH095-Slater Run	
WALH098-Center Run	
WALH102-Job Run	
WALH107-Trib to Mile Run 3	
WALH110-Trib to Kokosing @ center corners-Chesterville Rd	
WALH120-Brubaker Creek	

Sites with Phosphate Concentrations over 120 µg/L

PO4	
May	*August*
WALH005- Sapps Run	WALH005-Sapps Run
WALH123- Marsh Run	WALH022-Upper Muddy Fork Mohican
	WALH041-Headwaters Doughty Creek

	WALH054-Jelloway Creek
	WALH067- East Branch Jelloway Creek @ Carey Rd.
	WALH084-Black Fork Mohican @ Wally Rd.
	WALH091-Jerome Fork Mohican

Sites with Silicate Concentrations over 4.5 mg/L

SiO2	
May	*August*
WALH013-Shreve Creek	WALH013-Shreve Creek
WALH014- Trib to Killbuck @ Willow Rd	WALH014- Trib to Killbuck @ Willow Rd
WALH032-Killbuck Ditch	WALH027-Killbuck Upstr. Mowrer Lake
WALH36-Near Mouth Crooked Run	WALH032-Killbuck Ditch
WALH043-Near Mouth Beaver Run	WALH36-Near Mouth Crooked Run
WALH045-Darling Run	WALH045-Darling Run
WALH053-Honey Run #2	WALH56-Schenck Creek
WALH062-Elliot Run	WALH057-Little Schenck Creek
WALH068-Sapps Run @ Sapps Run Rd.	WALH064-Little Schenck Creek
WALH069-Dowdy Creek	WALH065-Coleman Branch
WALH070-Jelloway Creek	WALH075- Clear Fork Mohican

WALH071-Ireland Creek	WALH080- Plum Run
WALH083-Honey Creek	WALH086-Seymour Run
WALH096-Wolf Run	WALH096-Wolf Run
WALH098-Center Run	WALH098-Center Run
	WALH102-Job Run
	WALH108-Trib to Mile Run 4
	WALH110-Trib to Kokosing @ center corners-Chesterville Rd
	WALH111-Trib to Kokosing #2

TN	
May	*August*
WALH014- Trib to Killbuck @Willow Rd.	WALH091-Jerome Fork Mohican
WALH016-Apple Creek	
WALH018- Little Apple Creek	
WALH019-Spring Run	
WALH021-Little Killbuck at Lattasburg Rd	
WALH026-Cedar Run	
WALH032-Killbuck Ditch	
WALH050-Flat Run	
WALH059-Indianfield Run	
WALH063- Big Run #2	
WALH065-Coleman Branch	
WALH067- East Branch Jelloway Creek @ Carey Rd.	

WALH068-Sapps Run @ Sapps Run Rd.	
WALH069-Dowdy Creek	
WALH070-Jelloway Creek	
WALH087-Oldtown Run	
WALH090-Lang Creek	
WALH110-Trib to Kokosing @ center corners-Chesterville Rd	
WALH121-Whetstone Creek	

TP	
May	*August*
WALH103-East Branch Kokosing	WALH005- Sapps Run
WALH104-Mile Run	WALH022- Upper Muddy Fork Mohican
WALH106-Trib to Mile Run #2	
WALH107- Trib to Mile Run #3	
WALH109-South Branch Kokosing	
WALH111-Trib to Kokosing #2	
WALH113- Clear Fork Downstream of Golf Club	
WALH115- Trib to Rocky Fork #2	
WALH116- Trib to Rocky Fork #3	
WALH117- Touby Run	
WALH118-Trib to Rocky Fork #4	
WALH119-Rocky Fork	

WALH120- Brubaker Creek	
WALH123- Marsh Run	
WALH124- Headwaters Black Fork	
WALH125- Headwaters Clear Fork	