Lower Fox River Basin Volunteer Monitoring Program

Lower Fox River Basin TMDL

2023 Annual Report

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Project Summary

Project Location

The Lower Fox River Basin (LFRB) volunteer monitoring program is in support of the Lower Fox River Basin Total Maximum Daily Load (TMDL). Specifically, the volunteer program includes 20 monitoring sites on 16 streams within the LFRB in Northeast Wisconsin. These tributaries and streams in the basin contribute nutrients and sediment directly to the Fox River, Lower Green Bay, and Fox River Area of Concern (AOC). The LFRB is approximately 640 sq. miles and extends from the outlet of Lake Winnebago to Green Bay and includes portions of four counties (Outagamie, Brown, Winnebago, and Calumet) and Oneida Nation (Figure 1).

The LFRB volunteer monitoring program relies on citizen volunteers to collect surface water samples from 20 monitoring sites throughout the LFRB. The streams and monitoring sites are displayed in Figure 1 and more detailed location information can be found in Appendix A.

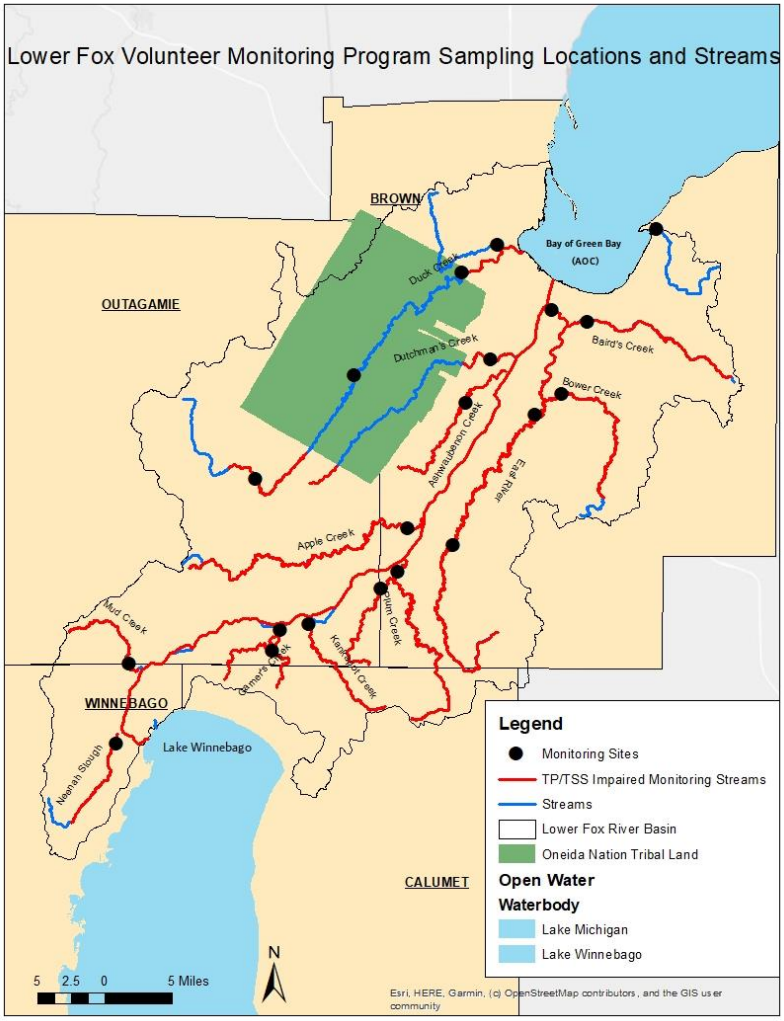


Figure 1: Lower Fox River Basin volunteer monitoring site locations.

Project Background

The Lower Fox River Basin TMDL was approved by the U.S. Environmental Protection Agency (EPA) in 2012. The goal of the TMDL is to improve water quality by reducing total phosphorus (TP) and total suspended solids (TSS) in the LFRB. The TMDL identifies and quantifies the sources and necessary phosphorus and sediment reductions to meet water quality goals. To facilitate TMDL implementation, smaller sub-basins were identified within the LFRB to help target high phosphorus and sediment loading watersheds. As TMDL implementation progresses, one objective is to evaluate long-term water quality trends within the entirety of the LFRB.

The LFRB volunteer monitoring program began in 2015 to achieve some of the monitoring objectives resulting from the TMDL. The program started with 14 monitoring sites across 13 tributary streams. Three new sites were added to the program in 2018 and an additional three new sites were added in 2020 to total 20 monitoring sites across 16 streams. Some monitoring sites were chosen because they represent the confluence of a tributary stream to the Lower Fox River and can therefore help represent the water quality of a TMDL sub-basin. Other monitoring sites were chosen due to implementation activities beginning in the watershed or where high phosphorus and sediment loading is occurring.

Given the time commitment and spatial location of the monitoring sites, the assistance of volunteers is vital to the success of the program. Volunteers serve the essential role of data collectors, as they collect monthly (May – October) surface water samples at 20 monitoring sites across the LFRB. Volunteers are trained on the proper sampling protocol before the sampling season by Wisconsin DNR staff to ensure reliable and accurate results are collected each month.

Problem Statement

The Lower Green Bay and waters within the LFRB are impaired due to excessive phosphorus and sediment loading. TMDL implementation focuses on restoring waters impaired by excessive sediment and/or high phosphorus concentrations. Phosphorus and sediment cause numerous impairments to waterways, including low dissolved oxygen concentrations, degraded habitat, and excessive turbidity. These impairments adversely impact fish and aquatic life, water quality, recreation, and potentially navigation.

Every two years, Sections 303(d) and 305(b) of the Clean Water Act (CWA) requires states to publish a list of all waters not meeting water quality standards and an overall report on surface water quality status of all waters in the state. Of the 16 monitoring streams, 14 are listed as impaired for TP and/or TSS on the 2022 303(d) Impaired Waters List. Appendix B includes more information about the impaired monitoring streams.

All but two of the monitored streams, Lancaster Creek, which is a reference stream, and Wequiock Creek, are impaired due to high levels of TP and/or TSS in the water. In addition, their downstream receiving waters, the Lower Green Bay and Fox River (LGBFR), are also impaired for TP and TSS and the AOC has a total of ten Beneficial Use Impairments, also known as BUIs (there were originally 13 BUIs in 1980 but three have been removed). The U.S. EPA

approved TMDL for the LFRB identifies the reductions needed to meet water quality goals. Since phosphorus and sediment loading impacts several of the BUIs in the LGBFR AOC, the goals of the AOC and TMDL (removal of the BUI's and meeting the TMDL reductions, respectively) are closely intertwined, and effective implementation of the TMDL is critical to the restoration of the Lower Fox River and Bay.

Project Goals

There are two main goals for this project: (1) increase public awareness and involvement in water quality issues by engaging the public in citizen science and (2) the collection of reliable surface water quality data to assess long-term water quality trends/successes. The LFRB volunteer monitoring program aims to increase community awareness on local water quality issues and the impact of land use decisions around them. The focus is to raise awareness through building a volunteer base and increasing community involvement and engagement.

Through citizen science the LFRB volunteer monitoring program's goal is to collect reliable data to characterize TP, dissolved reactive phosphorus (DRP), diatom phosphorus index (every 10 years if funding is available), TSS, total nitrogen (TN), and associated chemical and physical characteristics in the Lower Fox tributary streams during the primary algae and aquatic plant "growing season" of May through October. The sampling data brings focus to which streams are affected by elevated phosphorus and sediment concentrations.

It is important to note, however, that research is currently underway into the relationship between the reduction of TP, DRP, TN, and biological responses. The collection of TP, DRP, and TN will help strengthen the understanding of these relationships and effects they may have on biological responses in the Lower Fox River tributaries.

Additional goals of this project include:

1. Evaluate nutrient and sediment concentrations in the tributaries discharging to the Fox River
2. Monitor the health of the watershed overtime
3. Provide a basis for evaluation of the long-term effectiveness of implementation of the Lower Fox River TMDL; are there water quality improvements in watersheds with the implementation of best management practices?
4. Share water quality data broadly among stakeholders to collectively assess water quality

Proposed Work and Sampling Procedure

2023 is the nineth year the WDNR has led the LFRB volunteer monitoring program. Project structure remained the same in 2023 as implementation of volunteer monitoring efforts are coordinated by WDNR staff. Specifically, the WDNR:

- Continues to develop a well-trained volunteer base through various means of recruitment and community engagement:
    - Volunteers are trained to follow Water Action Volunteer (WAV) (https://wateractionvolunteers.org/) sampling protocol to ensure consistency is being met in each sample
    - Volunteers collect and ship surface water samples in iced coolers to the Wisconsin State Lab of Hygiene (WSLH) for analysis of TP, DRP, TSS, and TN
    - Volunteers collect streamflow and transparency data at the time of surface water sample collection (if able)
    - Duplicate samples are collected at randomly selected sites throughout the sampling season (Appendix J). Duplicates are collected on the same day and at the same time as the regular sample
- Continues to provide support to volunteers as needed
    - Ensures safe access and suitability at each monitoring site
    - Orders, prepares, and maintains supplies for volunteers to successfully carry out monitoring activities and shipment of samples
    - Fosters an open line of communication with volunteers to ensure that all sites are being monitored at the frequency outlined in the project QAPP
- Confirms that all 20 monitoring sites are monitored monthly from May to October for a total of six sampling events
- Compiles monthly sampling data results to share with volunteers and stakeholders
    - Records data into tables and graphs for analysis
    - Develops an annual report complete with data and figures to share with stakeholders to assess annual water quality

2023 Sampling Season

Summary

2023 was the ninth year for the LFRB volunteer monitoring program and water sampling began in May. The DNR Coordinator delivered sampling equipment and supplies to volunteers starting in April. Some sampling supplies such as sample bottles, coolers and liner bags, preservative acid, and DRP supplies were shipped to volunteers from the WSLH. Lab slips and shipping labels were created and shipped from DNR Central Office.

The sample collection completeness for the season was 99.15%, which is 4% more than 2022. This high percentage of sample completeness could be due to the increase of communication between the DNR coordinator and volunteers, the DNR coordinator was available to take a sample if the volunteer could not. The only missed sample was in July for Wequiock Creek, there was no flow in the creek due to lack of precipitation, which meant a sample could not be taken. A table with the percent completeness by monitoring site is provided in Appendix C.

Shipping changed from FedEx Priority Overnight to the US Postal Service (USPS) Priority Mail in 2021 and USPS has been used since. The switch allowed for more convenient package drop off for volunteers sampling in more remote areas. All shipping labels were printed and provided to volunteers at the start of the season.

A total of 57 DRP samples (including duplicate samples), or 48% of DRP samples collected, were flagged in 2023 due to samples exceeding the 48-hour hold time for DRP analysis. For reference, 34 DRP samples, or 27%, were flagged in 2022. There were multiple mailing issues this season, including coolers taking two weeks to be delivered or being delivered back to the volunteer; these issues could be a large factor as to why there were more DRP samples exceeding the hold time in 2023. We will monitor mailing issues in the future and decide if we need to change to a different shipping courier if problems persist. Although these samples are flagged by the lab for exceeding the analysis holding time, they are still able to be analyzed and the results are used. Volunteers are reminded each sampling season to ship samples immediately after collection or as early as possible the next day. The WSLH may also not have the capacity to analyze samples immediately after receiving them which also impacts sample analysis. Getting samples to the lab and analyzed within 48 hours continues to be an area for improvement as shipping times can vary by carrier and shipping origin.

A group of 16 volunteers monitored the 20 sites in 2023. Fourteen volunteers from the 2022 season returned for the 2023 season and the program gained two new volunteers. Prior to 2020 a large volunteer training event was held each year, but due to the large number of returning volunteers and COVID concerns there has not been a training event like this in recent seasons. Beginning in 2020, new volunteers have been trained individually at their site by the DNR coordinator. To train the two new volunteers in 2023, the DNR coordinator went to their site and they took the May sample together. This style of training will be used for future seasons due to the flexibility with volunteers' schedules and the assurance volunteers are taking their sample at the correct location.

Over the course of nine sampling seasons, over 40 volunteers have participated in the program. Many volunteers have returned to sample the same location for multiple years while new volunteers are recruited to sample vacant monitoring sites. Table 1 details volunteer participation in the program.

Volunteer Recruitment									
	2015	2016	2017	2018	2019	2020	2021	2022	2023
New	8	11	8	6	1	6	1	1	2
Returning		1	4	8	12	10	15	15	14

Table 1: Volunteer Recruitment for the LFRB volunteer monitoring program from 2015-2023.

Volunteer recruitment is one aspect of the program that consistently needs to be carried out. The coordinator should continue to recruit volunteers despite having a volunteer at every stream. It is better to have multiple volunteers at each monitoring site to learn with each other and help each other collect the samples. The more volunteers that are recruited, the more the message gets out in the community, which is a main goal of the LFRB volunteer monitoring program.

Outreach

- The LFRB Volunteer Monitoring Fact Sheet (Appendix L) was shared broadly to DNR staff and county land and water programs to help recruit volunteers
- The DNR Coordinator worked with the Fox Wolf Watershed Alliance Program Coordinator to further extend volunteer recruitment using their newsletter
- Information about the program is displayed on the Lower Fox TMDL webpage and the Water Action Volunteer website to further promote the program

Water Quality Data

Wisconsin Listing Methodology

To evaluate stream water quality and TP reductions, the WDNR follows a standard assessment procedure which accounts for sample methods, timing, variability, sample size and statistical confidence to more confidently determine whether a stream meets water quality criteria. The LFRB volunteer monitoring program TP sampling data is compared to Wisconsin's TP water quality criteria (WQC) for streams (0.075 mg/L) by calculating a 90% confidence limit around the Growing Season Median (GSM) of the TP sample dataset. A stream is considered impaired for TP if the lower confidence limit (LCL) of the GSM (May – October) TP concentration exceeds the stream WQC. The LCL is used to ensure a stream exceeds the criteria with a predetermined level of confidence before it is listed. A stream that is impaired for TP will be de-listed if the upper confidence limit (UCL) of the GSM TP subsequently drops below, or clearly attains, the criteria.[1] See Figure 2.

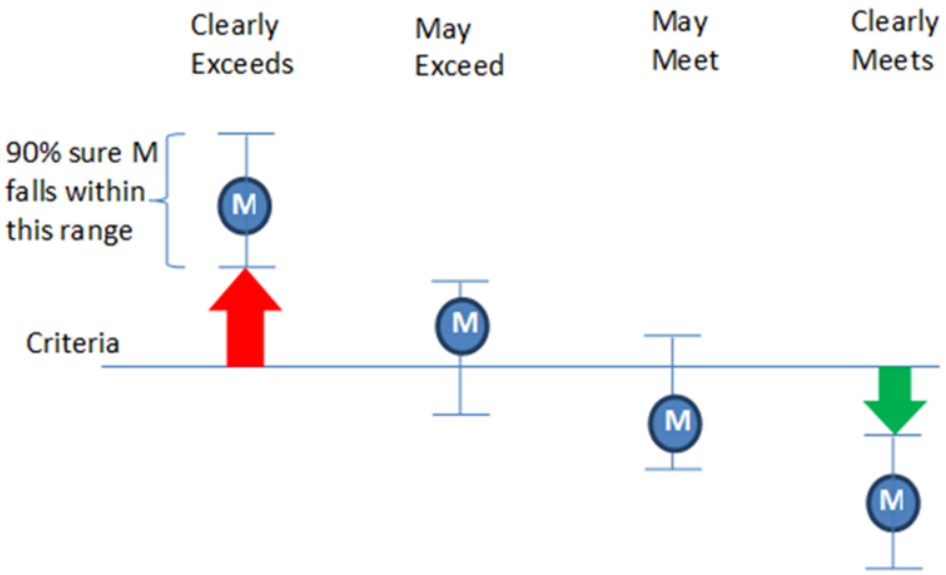


Figure 2: Wisconsin's TP criteria confidence table. Criteria line indicates the 0.075 mg/L WQC limit and M represents the Median value.

90% confidence limits were calculated for each monitoring site each year of data collection. A minimum of six samples, one per month from May – October, are needed to calculate the confidence limits. In years with less than six data points at a location, a data point from the same month from the most recent year of a full dataset was used instead. For example, in 2020 all monitoring sites had less than six data points collected. Data points from 2019 were used to fill in the months of May – July to calculate confidence limits. In 2023 only one site needed data from 2022 to calculate the confidence limit, Wequiock Creek. A confidence interval table is provided in Appendix G.

[1] WDNR 2020. Guidelines for Monitoring for Watershed Restoration Effectiveness. Wisconsin Department of Natural Resources, Bureau of Water Quality. Madison, Wisconsin. EGAD#3200-2020-26

From 2015-2022, Lancaster Creek was the only monitoring stream where water quality "May Meet" (2015, 2017, 2023) and "Clearly Meets" (2019, 2021, 2022) the State WQC. Currently, Lancaster Creek is not impaired. In 2023 Neenah Slough became the only other stream that "Clearly Meets" the TP WQC, in previous years its confidence limit "May Exceed" (2015, 2017, 2018, 2020, 2021, 2022) and "Clearly Exceeds" (2016 and 2019). The streams that "May Exceed" the WQC in 2023 are East River at Harold Lewis Trail and Wequiock Creek, all other sites (besides Lancaster and Neenah Slough) "Clearly Exceeds" the TP WQC.

Despite the monthly TP concentrations exceeding the WQC for most of the monitoring streams, the confidence limits and GSM TP values of 14 of the 20 monitoring sites show an overall decline and improvement towards the WQC since the start of sampling. These sites include Apple Creek, Ashwaubenon Creek, Baird Creek, Bower Creek, Dutchman Creek, East River at Harold Lewis Trail, East River at CTH G, Garner's Creek, Kankapot Creek, Lower Duck Creek, Neenah Slough, Plum Creek, Upper Duck Creek, and West Plum Creek. Confidence limit graphs can be found in Appendix H. In addition to decreasing UCL, LCL, and GSM values, some sites also show the UCL, LCL, and GSM value trends narrowing together indicating less sample variability and a truer median value.

Although the confidence limits calculated for some monitoring sites indicate a water quality improvement, TP continues to exceed the TP WQC across the monitoring sites each year. As implementation of the TMDL continues across the LFRB, this sampling will be useful for detecting changes in water quality and will provide insight into the proper timing for more rigorous watershed wide monitoring.

Total Phosphorus Analysis by Monitoring Site

The TP median value was calculated for all monitoring sites, the median is calculated instead of the mean in accordance with Wisconsin Consolidated Assessment and Listing Methodology (WisCALM) protocol for streams and rivers. Median is used for datasets with high variability to ensure results are not skewed by one extremely high or low value; streams and rivers tend to have higher variability in concentrations compared to lakes where the mean is used. The median values were calculated from only the samples collected during the sampling year compared to the GSM calculated for the TP assessment, which used data from previous years if a monthly sample was missed during the sample year; only one site had less than 100% sample collection in 2023. Appendix D breaks down the median TP value for each monitoring site, red values indicate years with less than 100% sample collection. The median value for years with missing data may not be a proper representation of the median TP value at that monitoring site for the specific year. All sampling data from 2015 – 2023 is provided in Appendix E.

Nearly all sites from 2015 - 2023 had yearly median TP values exceeding the State WQC except for Baird Creek (2020), Dutchman Creek (2020), Garner's Creek (2020), Lancaster Creek (2019, 2021, 2022), Neenah Slough (2021), and Wequiock Creek (2020). The lower median TP values in 2020 can be attributed to only 50% sample collection at each site. In 2023 the two monitoring sites with medians below the TP WQC were Lancaster Creek and Neenah Slough.

Total phosphorus is a key indicator of water quality. It is an essential nutrient for plant growth however, when excess amounts are introduced to a waterbody, water quality can decrease and

lead to excess algae growth and harmful algal blooms. In 2023, 19 of 119 (16%) TP samples met the WQC for streams, which is 0.075 mg/L. This percentage is the same as 2022 and only slightly more than 2021, which had 15% of samples meeting the 0.075 mg/L water quality target. This shows that even if GSM TP values are generally decreasing there is still the same number of samples meeting the TP WQC. The TP samples do not account for variations in temperature, precipitation, or implementation of best management practices.

Table 2 compares the number of TP samples each year meeting and not meeting the WQC. Monitoring sites have been added since the start of the program; with the increase of the number of samples collected each year, the number of samples meeting the WQC has also increased.

TP Samples Below 0.075 mg/L									
	2015	2016	2017	2018	2019	2020	2021	2022	2023
# Sites	14	14	14	17	17	20	20	20	20
# Samples Collected	62	72	84	101	101	60	110	115	119
# Above 0.075 mg/L	59	65	74	89	88	50	93	97	100
# Below 0.075 mg/L	3	7	10	12	13	10	17	18	19
% Below 0.075 mg/L	**5%**	**10%**	**12%**	**12%**	**13%**	**17%**	**15%**	**16%**	**16%**

Table 2: TP samples compared to TP WQC for the LFRB monitoring sites.

Dissolved Reactive Phosphorus Analysis by Monitoring Site

While phosphorus is a key indicator of water quality, DRP also plays an important role in water quality. DRP is the soluble form of phosphorus and is readily available for plant and algae growth. DRP concentrations can vary widely over short time periods due to plants taking it up and releasing it. Excessive amounts of DRP can also lead to harmful algal blooms and cause poor water quality. Since the start of the LFRB volunteer monitoring program, DRP concentrations continue to make up a large portion of TP concentrations across all monitoring sites. Appendix I compares each sampling event's TP and DRP concentrations.

Table 3 breaks down each DRP sample collected since 2015 into percentage ranges. Nearly half (318 of 820 or 46%) of TP samples collected since 2015 had 60 – 80% of their TP concentrations coming from DRP. Another 28% (231 of 821 samples) have had 40 – 60% of their concentrations coming from DRP. These numbers show that DRP makes up a large percentage of the TP during the sampling season, this can lead to excessive algal growth. As sampling continues, this data will be useful for evaluating implementation progress and effectiveness at reducing DRP.

DRP Percentage of TP Ranges								
Year	*# Sites*	*# Samples Collected*	*< 20% DRP*	*20 - 40% DRP*	*40 - 60% DRP*	*60 - 80% DRP*	*80 - 100% DRP*	*> 100% DRP*
2015	14	61	4	6	21	29	1	0
2016	14	72	3	13	29	24	3	0
2017	14	84	3	9	30	36	5	1
2018	17	101	3	10	27	53	8	0
2019	17	101	2	3	35	50	11	0
2020	20	60	1	8	14	25	9	3
2021	20	110	7	7	19	59	17	1
2022	20	112	5	12	20	57	18	0
2023	20	119	3	14	36	48	17	1
Total		820	31	82	231	381	89	6
Percent of Total			**4%**	**10%**	**28%**	**46%**	**11%**	**1%**

Table 3: DRP Percentage of TP (DRP >100% due to sample variance).

Total Suspended Solids and Total Phosphorus Analysis

Although no TSS WQC currently exist for the monitoring streams in the Lower Fox River basin, TSS concentrations in general closely align with TP concentrations. Figure 3 compares average TSS and average TP values for each sample month from 2015 – 2023. Total phosphorus includes particulate phosphorus which is attached to suspended sediments and other suspended materials in the water. Total phosphorus and total suspended solids data across all monitoring sites for each sample month from 2015 to 2023 were compared to evaluate the relationship between the two parameters. Figures 4-9 show each sample month of TP and TSS data. Each graph shows that generally, as TSS concentrations increase, TP concentrations also increase. This helps demonstrate that it is important to reduce the amount of TSS going into our waterbodies to help reduce TP concentrations.

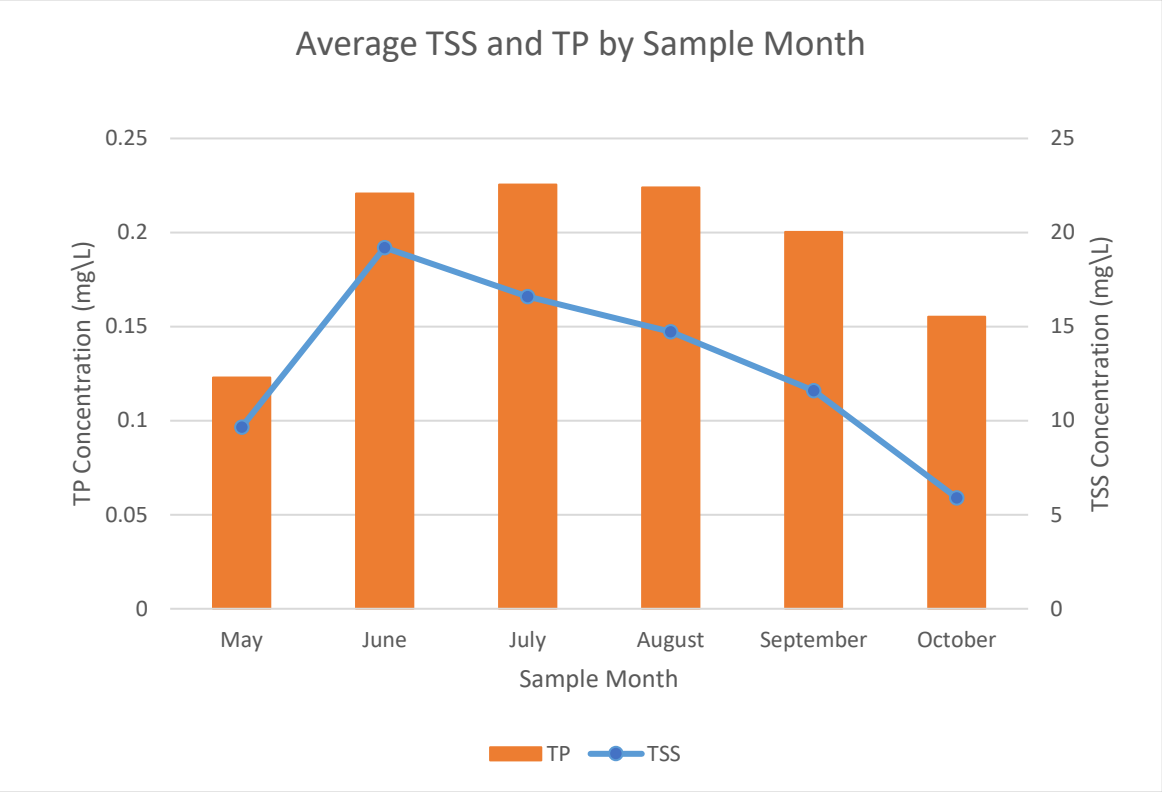


Figure 3: Average TSS and TP values compared by sample month.

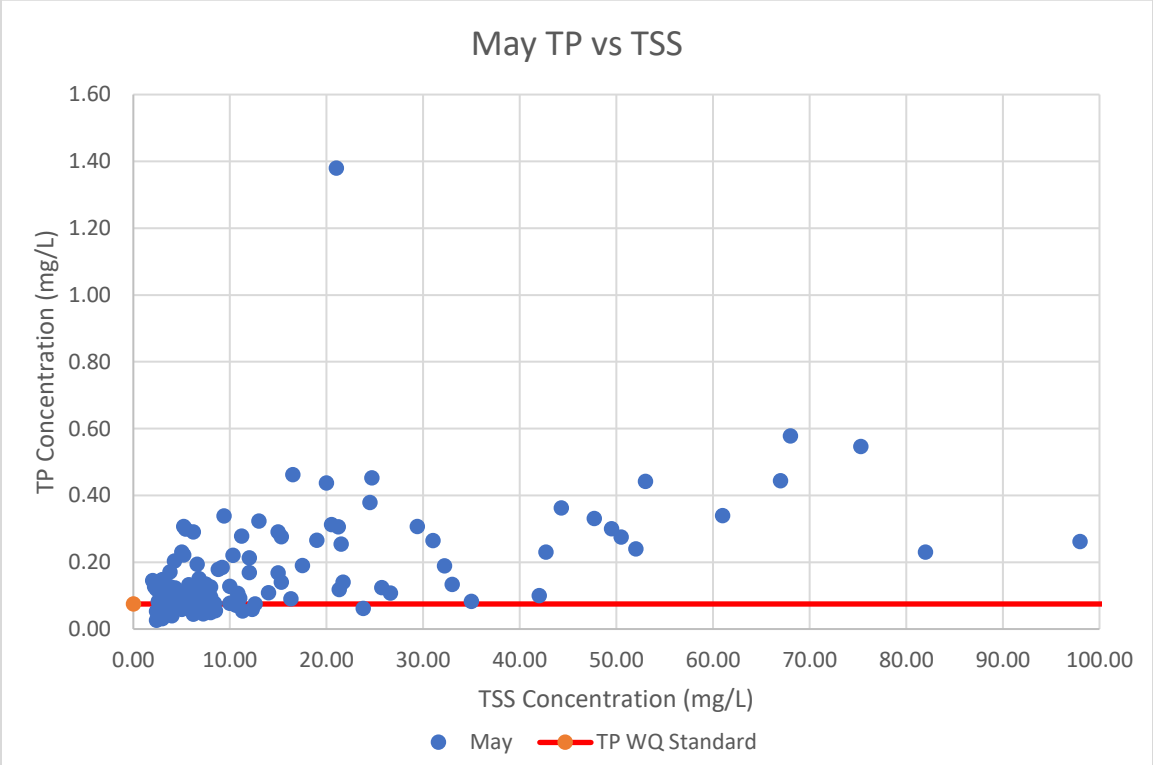


Figure 4: May TP and TSS sample concentrations.

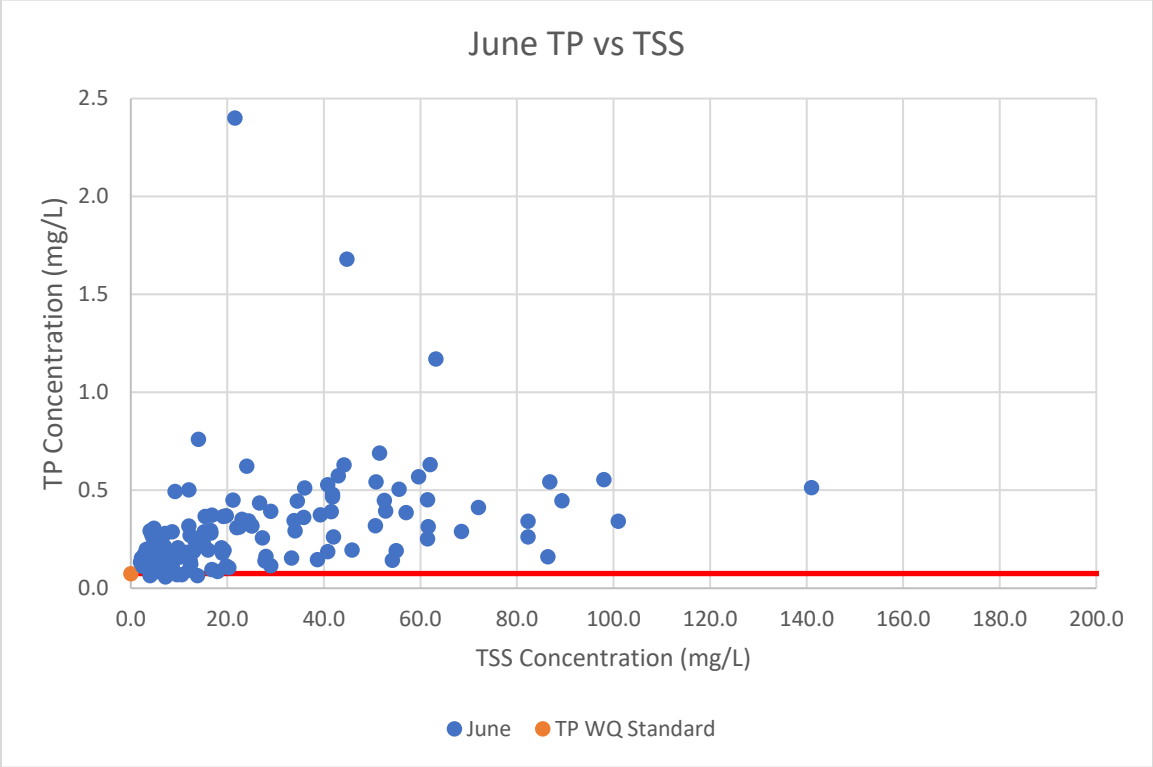


Figure 5: June TP and TSS sample concentrations.

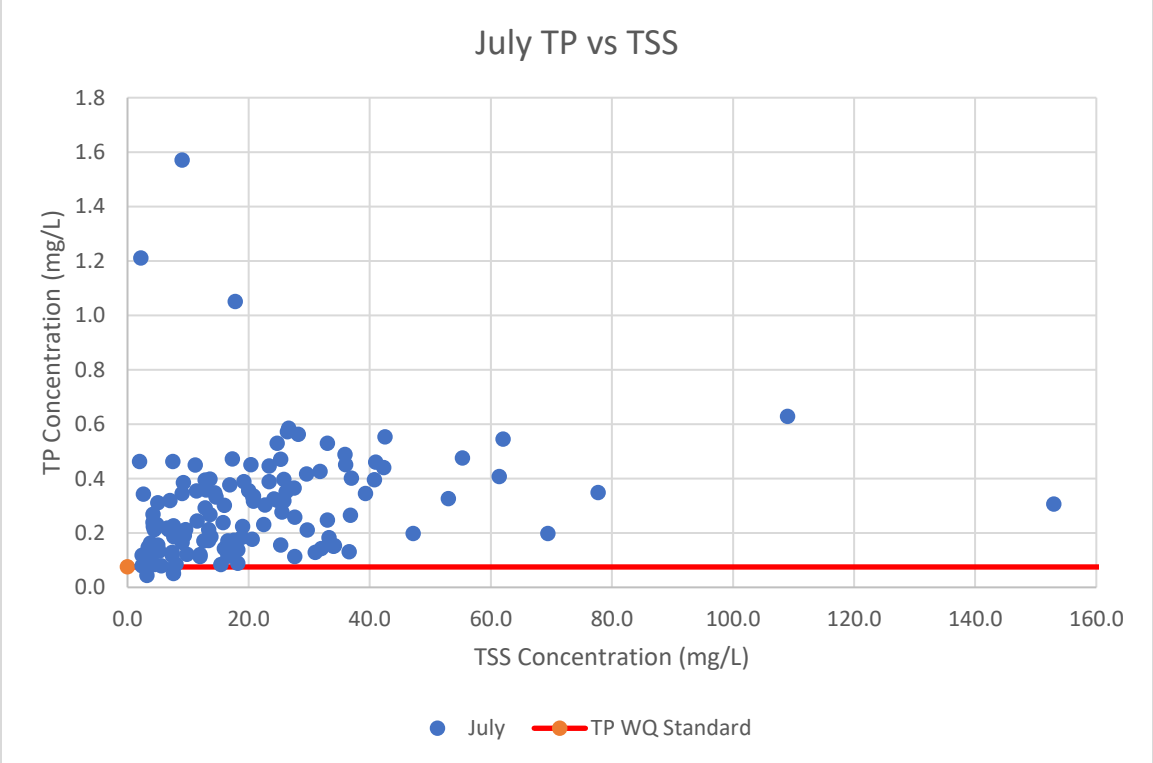


Figure 6: July TP and TSS concentrations.

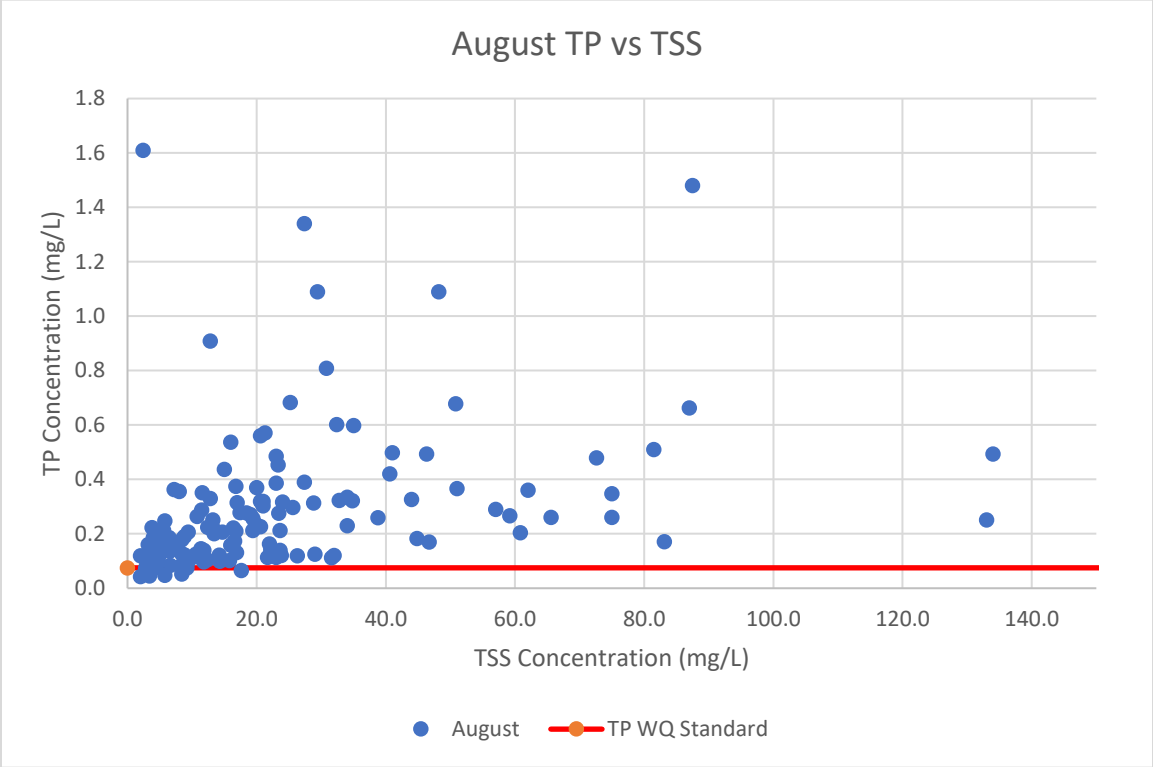


Figure 7: August TP and TSS concentrations.

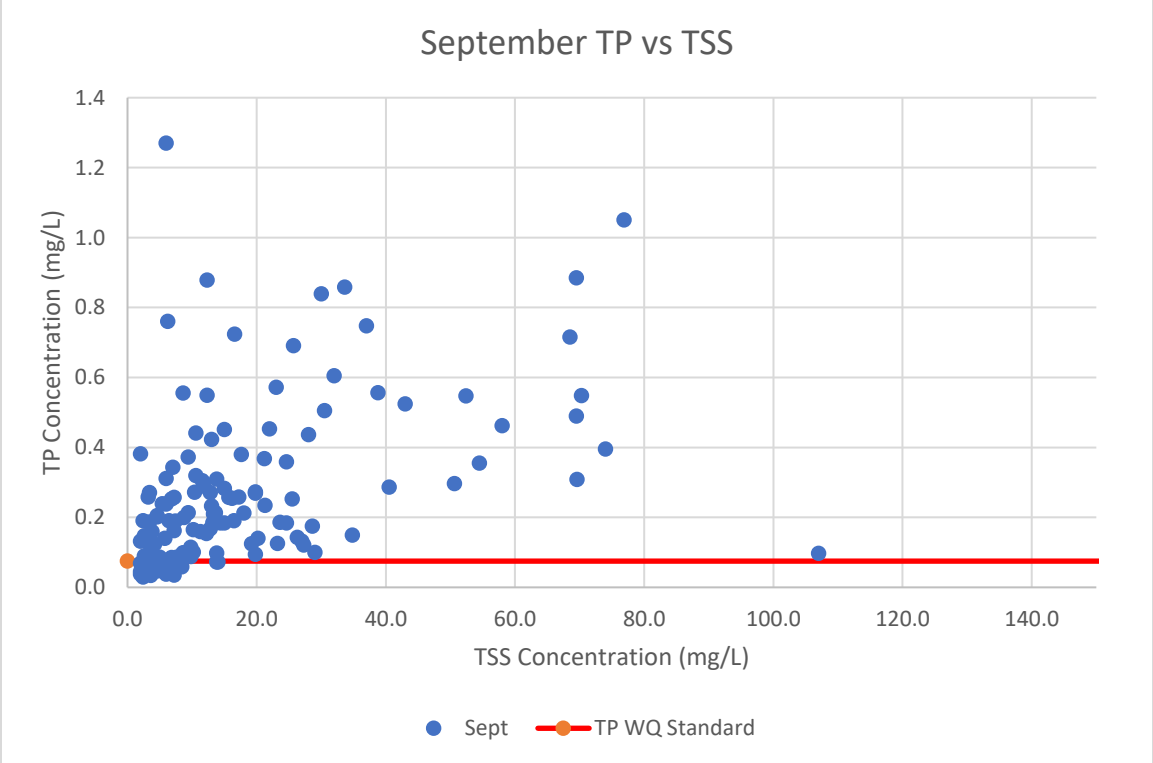


Figure 8: September TP and TSS concentrations.

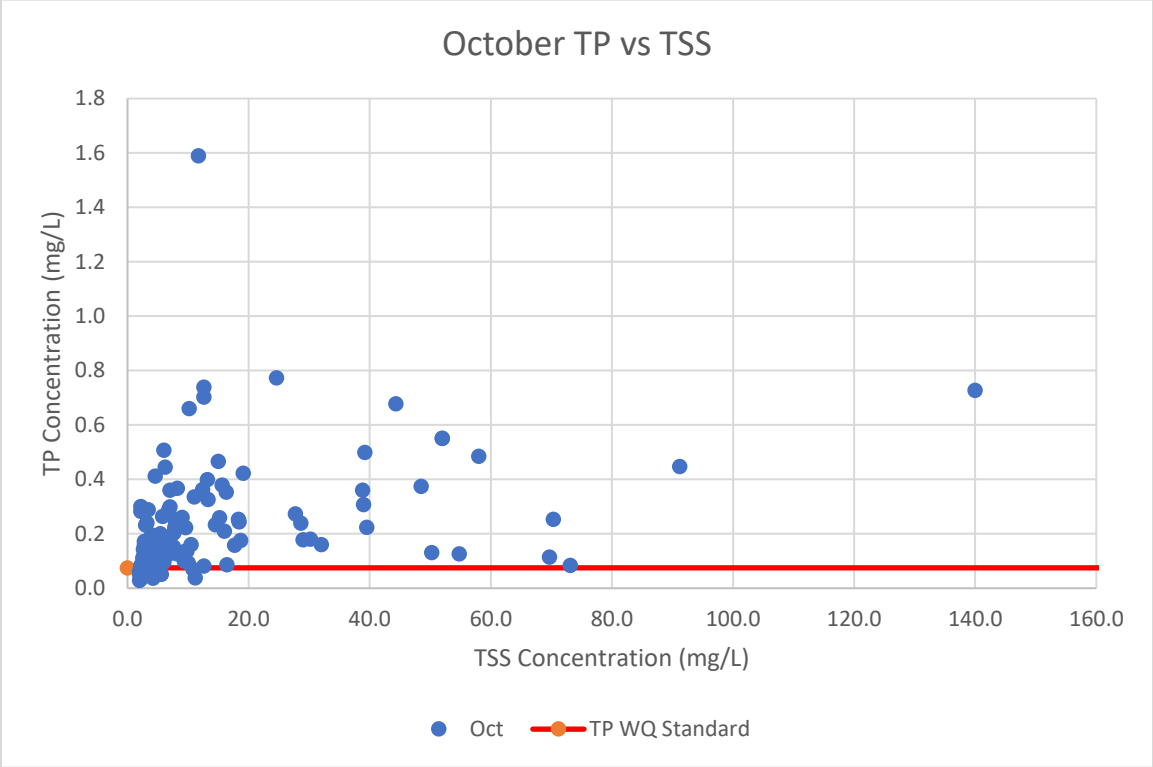


Figure 9: October TP and TSS concentrations.

Total Nitrogen Analysis by Monitoring Site

Total nitrogen has been sampled for in the LFRB volunteer monitoring program since 2020. There is no WQC for nitrogen in Wisconsin and the TMDL does not define a TN goal. A graph showing the TN medians for each site from 2020-2023 is in Appendix F. Medians vary by site with no clear trend of TN concentrations increasing or decreasing since 2020.

The TN and TP medians for each monitoring site are compared in Figure 10, there is no clear trend to note. The TP medians were calculated with data from 2020-2023 because that is when TN was sampled for. For about half the sites TN and TP median concentrations correlate with each other, when TP concentrations are higher/lower TN concentrations are also higher/lower. The relationship of TN and the other parameters will be compared in future seasons to find trends.

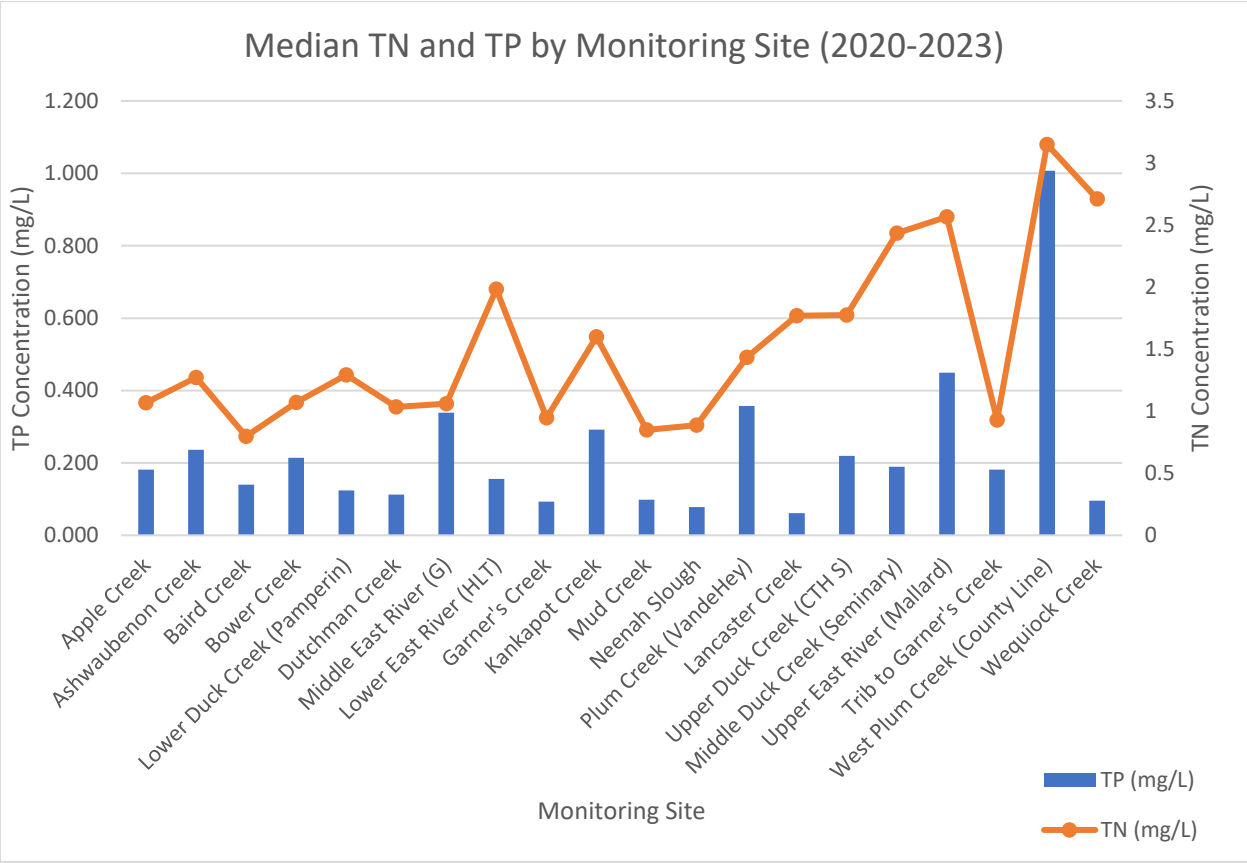


Figure 10: Median TN vs TP by monitoring site (2020-2023 Data).

Field Quality Assurance/Quality Control Duplicate Samples

To document the accuracy and precision of the field data collected by volunteers, two duplicate samples were taken as quality assurance/quality control (QA/QC) samples in 2023. In previous years 10% of the samples taken also had a duplicate sample, there were fewer duplicate samples in 2023 due to budget constraints. The duplicate sample locations were randomly selected from the list of sites that are monitored. These QA/QC tests document the accuracy and precision of the data collected and look at natural variability and sampling error.

Duplicate samples are collected on the same day and time as the regular samples, they are analyzed for the same parameters as the regular samples. Duplicate sample results were compared to the regular sample result and an absolute difference was calculated. The absolute difference between the two sets of samples is compared to each test's Level of Quantification (LOQ) and is considered good data quality if the value falls below the LOQ. The absolute difference for all parameters for the 2023 duplicate samples were below the LOQ, meaning it is good quality data. Relative percent difference between the regular and duplicate samples was also calculated, the results are flagged if the percentage is greater than 30% as this indicates a variance between the two sample results. The relative percent difference for each parameter was below 30% for both duplicate samples, indicating limited variance. Duplicate sample results are in Appendix J.

Stream Flow and Transparency

In addition to collecting water chemistry data each month, volunteers measure stream flow and water transparency. Stream flow is affected by the amount of water within a watershed and increases with rainstorms or snowmelt and decreases during dry periods. Flow defines the shape, size, and course of the stream. Streamflow and transparency data can be found in Appendix K.

Volunteers measure streamflow using a velocity-area approach, the stream needs to be wadable and two people are required. A 20 ft. length of stream is assessed followed by measuring the width and the water depth at numerous locations across the width. Water velocity is determined by measuring the time it takes for a tennis ball to float along the stream length.

Water transparency is collected each month with a 120cm transparency tube. Water clarity is affected by suspended sediment, dissolved material, and algae. Transparency readings range from 0-120cm, clear water with minimal dissolved material has a reading of 120cm. In 2023, 17 of the 106 (16%) transparency readings taken were 120cm, most of these results happened in September and October. Transparency readings will be analyzed in future seasons to determine if water clarity is increasing across the LFRB. Based on previous years data we see that as TSS concentrations increase, transparency readings decrease, and as TSS concentrations decrease, transparency readings increase.

Key Takeaways for 2015-2023

- Two sites had GSM TP concentrations below the Administrative Code NR 102 TP WQC of 0.075 mg/L in 2023, Lancaster Creek and Neenah Slough. From 2015-2023 Lancaster Creek is the only site to meet this criteria for multiple years (2015, 2019, 2021, 2022, 2023)

- GSM TP concentrations from 2015-2023 have decreased across many of the monitoring sites. In addition, some sites' LCL and/or UCL appear to be trending closer to the GSM value indicating less sample variability

- DRP concentrations across all monitoring sites continue to stay high. Samples are collected around the same time each month, meaning sample data does not reflect precipitation events. 46% of the DRP samples collected since 2015 make up 60 – 80% of the TP concentrations. There has also been an increase in the number of DRP samples in the 80 – 100% range. This data will be useful as implementation continues across the LFRB to help determine which conservation practices manage DRP runoff

- TP and TSS concentrations generally correlate across sampling months. As TP concentrations increase, TSS concentrations also increase. Monthly TSS concentrations tend to be more variable than TP concentrations

- Monthly TSS concentrations and transparency readings show that as TSS concentrations increase/decrease, transparency readings decrease/increase

- Weather conditions across the sampling season are important to note. 2023 was a particularly dry sampling season with rainfall amounts lower than average, from June 1st- August 30th the LFRB received 2 inches less rain than average

    - Less precipitation means less runoff entering the monitoring streams, this could cause nutrient results to be lower than average. One sampling stream dried up in July, Wequiock Creek, which can affect median results

Data Conclusions

2023 was the ninth year for the LFRB volunteer monitoring program, so we can see trends in water quality for some of the monitoring streams. It's important to remember the program is still young, and trends will change throughout its existence, especially when best management practices and implementation increase and improve the water quality in given watersheds. Raw data may suggest that variations in weather patterns, temperature, and time of year may have an impact on the TP, DRP, TSS, and TN concentrations. 2023 had less precipitation than average during the sampling season, which can affect median results for all parameters.

Since 2015, Lancaster Creek (our reference stream), is the only monitoring site with GSM concentrations below the TP WQC of 0.075 mg/L for multiple years (2015, 2019, 2021, 2022, 2023). In 2023 Neenah Slough was the only other monitoring site with a GSM below 0.075 mg/L. The amount of TP samples meeting the WQC has increased since 2015, the percentage of samples has remained between 15-17% since 2020.

Dissolved phosphorus continues to make up a large portion of total phosphorus concentrations across all monitoring sites. Appendix I provides a table of the percentage of DRP making up each TP sample and Table 3 categorizes the values into percentage categories. Since 2015 nearly half of the TP samples collected had 60-80% of concentrations coming from DRP while another 28% of TP samples have 40-60% of their concentrations coming from DRP.

The dissolved form of phosphorus is readily available for plant uptake and contributes to excessive algae growth and potentially harmful algal blooms. Excessive algal growth in the LFRB monitoring streams was noted by volunteers in 2023. Conservation efforts and BMPs have been installed in the LFRB TMDL area since the start of the volunteer program in 2015, yet DRP results remain high. The high DRP results may demonstrate that the BMPs installed are not effective at reducing DRP runoff. It will be important to think about if DRP is mainly coming from point or nonpoint sources and which BMP practices are most effective at reducing DRP.

Throughout the entirety of the project, there have been many TSS samples that reported no detects (ND) or less than 4 mg/L. Many low concentrations occur in the Autumn months of September and October in more urbanized watersheds of the LFRB. TSS and transparency readings are correlated, as most of the transparency readings of 120 cm also occur in September and October when TSS results are lower. TSS concentrations are also correlated with TP concentrations, TSS results appear to be more variable than TP results.

Total nitrogen was added to the list of parameters in 2020 and currently there is no WQC established for TN. TN trends vary by site, with some concentrations steadily going up over the four years while others are going down. Appendix F shows the median TN concentration by site from 2020-2023. The relationship between TN and other parameters was analyzed in 2023, and there is no clear correlation between TN and the other parameters. The medians for TN and TP were compared by site and about half the sites showed higher TN concentrations meant higher TP concentrations, while the other half of the sites showed no relationship between the two parameters. It is important to continue sampling for TN to determine its relationship with the other parameters and if concentrations decrease due to the installation of BMPs. Most of the

land use in the LFRB is agricultural and nitrogen is often found and used in this setting. Sampling for TN will be important for better understanding its impacts to surface water quality and helping develop a WQC for TN.

Given the consistently high levels of phosphorus and dissolved reactive phosphorus, it is recommended to continue this program at its current capacity.

Program Conclusions

One of the main goals of the LFRB volunteer monitoring program is the engagement of the public and increasing their awareness on water quality issues. In total, there have been over 40 volunteers that have collected samples for the program since it started in 2015. However, several of the 40 volunteers were/are part of larger organizations that are involved with the program, possibly making the volunteer contribution much higher. With the knowledge our past and present volunteers possess, they can teach others and be an extension of the program. Our volunteers can talk about their experiences and what they have seen with others, which allows the information to be carried out to even more individuals in the basin.

Volunteer recruitment has been carried out in several ways throughout the project. Two main contributions to volunteer recruitment have been newsletter articles and presenting for larger organizations. Newsletter articles allowed the DNR to recruit volunteers on a bigger platform, the articles reached a bigger audience and many contacts have been made to the DNR following the release of different articles. Presentations were also a key contributor to spreading awareness of water quality issues. PowerPoint presentations provided information to the public and individuals that may not realize the impact of water quality on everyday life. The presentations were very well received, and many people commented on how the information opened their eyes to the issue we are seeing in the LFRB.

The use of volunteers has proved important for success. Many volunteers are involved with the program which requires constant coordination and communication by the DNR coordinator to ensure success of the program. Communication proves to be the most important aspect of the DNR coordinators position. The coordinator is the liaison between the volunteers and other DNR staff that are involved within the program. Volunteers noted the communication from the DNR coordinator in 2023 was more than previous sampling seasons and was very helpful, particularly for the two new volunteers.

As funding and resources become available, additional sites may be added to the monitoring program. Most of the monitoring sites represent the confluence of tributary streams, these sites give good insight of the water quality of those basins. We can use the water quality data to determine where additional sampling should occur when additional resources become available.

This water quality monitoring data is also important in measuring implementation progress. There are ten active 9 Key Element Plans within the Lower Fox River TMDL area. These plans assess the causes and sources of pollution and prioritize restoration and protection strategies to address water quality problems. Watersheds with active 9 Key Element Plans include Plum Creek & Kankapot Creek (2015), Upper East River (2016), Upper Duck Creek (2016), Apple Creek

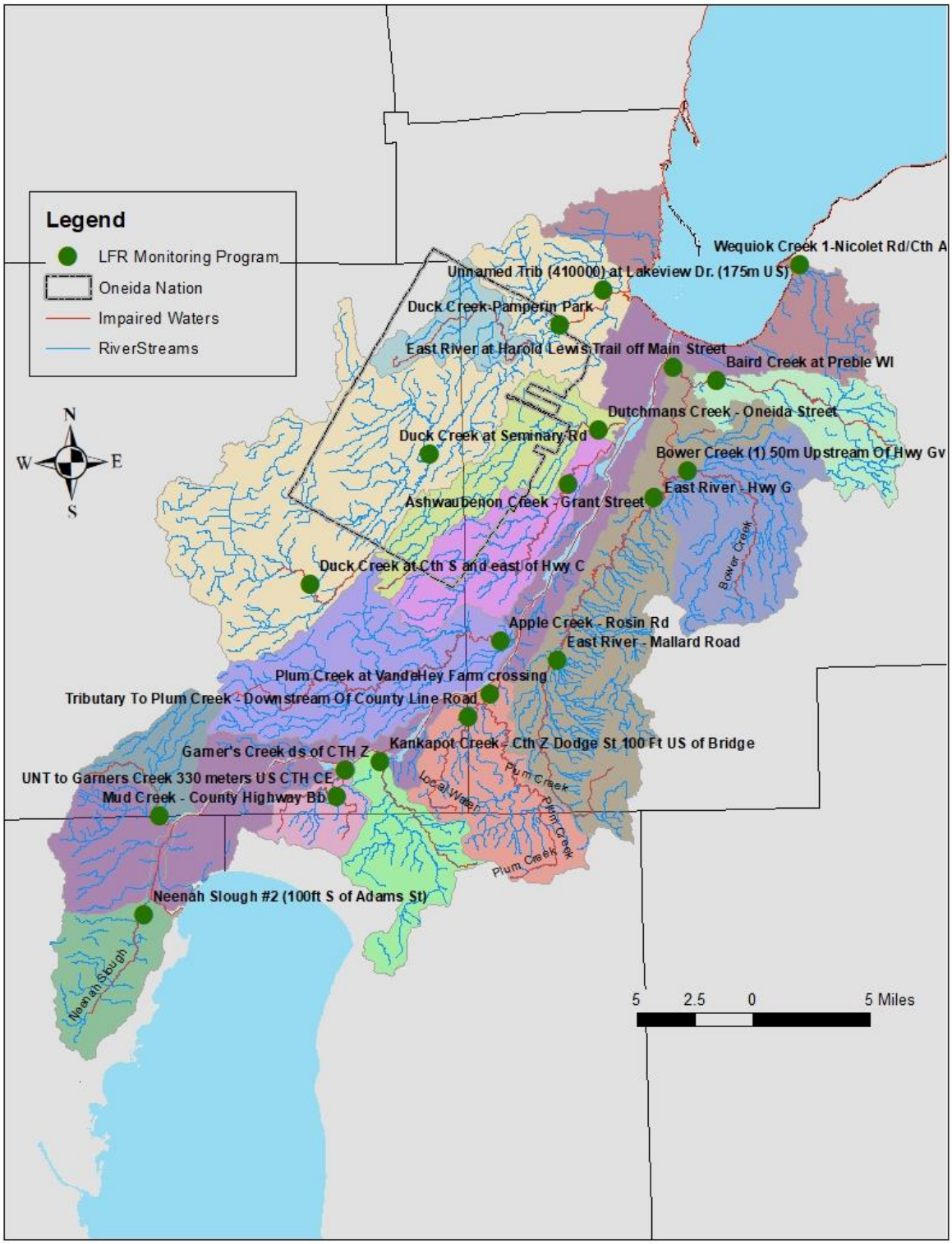
(2017), Lower East River (2018), Mainstem Lower Fox River (2019), Garner's Creek (2019), Bower Creek (2019), Ashwaubenon Creek & Dutchman Creek (2020), and Middle and Lower Duck Creek (2022). The Lower Fox River TMDL calls for a 59% overall TP reduction and 55% overall TSS reduction from all sources to meet water quality goals. The TMDL calls for a 78% TP reduction and 60% TSS reduction from agricultural sources in the watershed. The active 9 Key Element watershed plans focus on non-point source agricultural implementation. As implementation of these plans continue, sampling data can be utilized to help track implementation progress and assist in determining where additional data and information is needed to track progress.

Acknowledgements

Thank you to all the volunteers, present and past, that have made the Lower Fox River Basin volunteer monitoring program possible. Thank you to the Wisconsin DNR and the WAV program for funding and support. The WAV program manages a nutrient data database, where results can be viewed for monitoring sites across the state, including the LFRB volunteer monitoring sites (WAV Data Dashboard (wisc.edu)).

Appendices

Appendix A: Lower Fox River Basin Volunteer Monitoring Sites and TMDL Sub-basin Boundaries



Stream Name	SWIMS ID	SWIMS Station Name	X	Y
Ashwaubenon Creek	10016502	Ashwaubenon Creek - Grant Street	-88.101373	44.445027
Duck Creek	10038644	Duck Creek - Pamperin Park	-88.102972	44.543283
Wequiock Creek	10010769	Nicolet Rd/Cty A	-87.890966	44.576114
Bower Creek	10009445	Bower Creek (1) 50m Upstream of Hwy Gv	-87.99585	44.453503
East River	53508	East River at Mallard Rd	-88.111276	44.335537
West Plum Creek	10016494	Downstream of County Line Rd	-88.191967	44.29915
Duck Creek	453255	Duck Creek at Seminary Rd	-88.215525	44.466286
Baird Creek	53683	Baird Creek at Preble WI	-87.970044	44.507873
East River	10043279	East River @ Harold Lewis Trail off Main Street	-88.0065	44.515369
Plum Creek	10046999	Plum Creek - VandeHey Farm Crossing	-88.17243	44.313688
Trib to Garners Cr	10047157	US CTH CE	-88.30943	44.251832
Dutchman Creek	10015851	Dutchmans Creek - Oneida Street	-88.073155	44.478821
Duck Creek	10029975	Duck Creek at CTH S	-88.31982	44.389055
Garner's Creek	10043028	Garner's Creek - DS of Cty Z	-88.296227	44.26877
Kankapot Creek	453261	Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	-88.264213	44.276284
Lancaster Creek	10034510	Unnamed Trib. (410000) - Lakeview Dr	-88.063943	44.56433
Mud Creek	453258	Mud Creek - County Highway BB	-88459029	44.243669
East River	53675	East River - Hwy G	-88.026784	44.434625
Apple Creek	53684	Apple Creek - Rosin Rd	-88.160301	44.345476
Neenah Slough	10032175	Neenah Slough #2 (100ft S of Adams St)	-88.473302	44.18332

Appendix B: Impaired Monitoring Streams

Local Waterbody Name	Waters ID	WBIC	County	Start Mile	End Mile	Total Size (mi)	Date Listed	Source Category	Pollutant	Impairment	Listing Condition Category
Apple Creek	313933	124100	Brown	0	3.99	3.99	4/1/1998	NPS	Total Phosphorus	Low DO	TMDL approved by EPA in 2012 (4A)
									Sediment/Total Suspended Solids	Elevated Water Temperature, Degraded Habitat	
	10839		Brown, Outagamie	3.99	23.88	19.89			Total Phosphorus	Low DO	
									Sediment/Total Suspended Solids	Elevated Water Temperature, Degraded Habitat	
Ashwaubenon Creek	10834	122200	Brown	0	14.15	14.15	4/1/2008	PS/NPS	Total Phosphorus	Low DO	TMDL approved by EPA in 2012 (4A)
									Sediment/Total Suspended Solids	Degraded Habitat	

Baird Creek	10681	118100	Brown	0	3.5	3.5	4/1/2006	NPS	Total Phosphorus	Low DO	TMDL approved by EPA in 2012 (4A)
									Sediment/Total Suspended Solids	Degraded Habitat	
	10682			3.5	13.1	9.6	4/1/2008	PS/NPS	Total Phosphorus	Low DO	
									Sediment/Total Suspended Solids	Degraded Habitat	
Bower Creek	10683	118400	Brown	0	3	3	4/1/2008	NPS	Total Phosphorus	Low DO, Degraded Biological Community	TMDL approved by EPA in 2012 (4A)
									Sediment/Total Suspended Solids	Degraded Habitat	
	10684			3	13	10			Total Phosphorus	Low DO	
									Sediment/Total Suspended Solids	Degraded Habitat	
Duck Creek	10850	409700	Brown	0	4.96	4.96	4/1/1998	NPS	Total Phosphorus	Low DO	TMDL approved by EPA in 2012 (4A)
									Sediment/Total Suspended Solids	Degraded Habitat	
	10851		Outagamie	25.69	32.9	7.21	4/1/1998	PS/NPS	Total Phosphorus	Low DO	

									Sediment/Total Suspended Solids	Degraded Habitat	
Dutchman Creek	10832	121600	Brown	0	4.04	4.04	4/1/1998	NPS	Total Phosphorus	Low DO, Degraded Biological Community	TMDL approved by EPA in 2012 (4A)
	1854741		Outagamie	16.05	17.97	1.91			Total Phosphorus	Low DO	
East River	10679	118000	Brown	0	14.15	14.15	4/1/1998	PS/NPS	Total Phosphorus	Low DO, Degraded Biological Community, High Phosphorus Levels	TMDL approved by EPA in 2012 (4A)
								NPS	Sediment/Total Suspended Solids	Degraded Habitat	
	10680	118000	Brown, Calumet	14.15	42.25	28.1	4/1/1998	NPS	Total Phosphorus	Low DO, Degraded Biological Community	
									Sediment/Total Suspended Solids	Degraded Habitat	

Garner's Creek	10845	127700	Calumet, Outagamie	0	6.99	6.99	4/1/2008	PS/NPS	Total Phosphorus	Degraded Biological Community, Degraded Habitat	TMDL approved by EPA in 2012 (4A)
									Sediment/Total Suspended Solids	Degraded Habitat	
Kankapot Creek	10844	126800	Outagamie	0	2.66	2.66	4/1/2008	PS/NPS	Total Phosphorus	Degraded Biological Community, Degraded Habitat	TMDL approved by EPA in 2012 (4A)
	357763		Calumet, Outagamie	2.66	9.57	6.91			Sediment/Total Suspended Solids	Degraded Habitat	
Mud Creek	10846	129500	Outagamie, Winnebago	0	3.71	3.71	4/1/2008	PS/NPS	Total Phosphorus	Degraded Habitat	TMDL approved by EPA in 2012 (4A)
									Sediment/Total Suspended Solids		
	10847	129500	Outagamie	3.71	6.87	3.16	4/1/1998	PS/NPS	Sediment/Total Suspended Solids		
Neenah Slough	10848	130800	Winnebago	0	2.77	2.77	4/1/1998	PS/NPS	Total Phosphorus	Low DO	TMDL approved by EPA in 2012 (4A)
	357915			2.77	3.54	0.77				Low DO	
	357955			3.55	6.12	2.57				Low DO, Degraded Biological Community	

Plum Creek	10841	125100	Brown	0	13.86	13.86	4/1/2008	PS/NPS	Total Phosphorus	Degraded Biological Community, Degraded Habitat	TMDL approved by EPA in 2012 (4A)
							4/1/1998		Sediment/Total Suspended Solids	Elevated Water Temperature, Degraded Habitat	
	357670	125100	Brown, Calumet	13.87	16.42	2.55	4/1/1998	PS/NPS	Sediment/Total Suspended Solids	Elevated Water Temperature, Degraded Habitat	
Local Water (Trib to Garner's Creek)	3993962	5022162	Calumet, Outagamie	0	4.71	4.71	4/1/2016	PS/NPS	Total Phosphorus	Degraded Biological Community	Watershed Plan (5W)

Appendix C: Percent Completeness by Monitoring Site

Sample Collection Completeness (%) - Out of 6 samples per year									
Monitoring Site	2015	2016	2017	2018	2019	2020	2021	2022	2023
Apple Creek	100%	100%	100%	83.3%	100%	50%	83%	100%	100%
Ashwaubenon Creek	100%	100%	100%	100%	83.3%	50%	83%	100%	100%
Baird Creek	100%	83.3%	100%	100%	100%	50%	83%	100%	100%
Bower Creek	100%	66.67%	100.0%	100%	100%	50%	83%	100%	100%
Lower Duck Creek (Pamperin Park)	100%	100%	100%	100%	100%	50%	100%	100%	100%
Dutchman Creek	50.0%	33.3%	100.0%	100%	100%	50%	83%	50%	100%
Middle East River (CTH G)	100%	100%	100%	100%	100%	50%	83%	100%	100%
Lower East River (Harold Lewis Trail)	0%	100%	100%	100%	100%	50%	100%	100%	100%
Garner's Creek	100%	83.3%	100%	100%	100%	50%	100%	100%	100%
Kankapot Creek	100%	83.3%	100%	100%	100%	50%	100%	100%	100%
Mud Creek	50.0%	100%	100%	100%	100%	50%	100%	100%	100%
Neenah Slough	100%	100%	100%	100%	100%	50%	83%	100%	100%
Plum Creek (VandeHey)		50%	100%	100%	100%	50%	83%	100%	100%
Lancaster Creek	50%	100%	100%	100%	100%	50%	100%	67%	100%
Upper Duck Creek (CTH S)				100%	100%	50%	100%	100%	100%
Middle Duck Creek (Seminary Rd)				100%	100%	50%	100%	100%	100%
Upper East River (Mallard Rd)				100%	100%	50%	83%	100%	100%
Trib to Garner's Creek						50%	100%	100%	100%
West Plum Creek (County Line)						50%	100%	100%	100%
Wequiock Creek						50%	83%	100%	83%
Combined Percentage	80.77%	85.71%	100.00%	99.02%	99.02%	50.00%	91.52%	95.85%	99.15%

Appendix D: Median Total Phosphorus Concentration by Monitoring Site

Median TP (mg/L)									
Monitoring Site	2015	2016	2017	2018	2019	2020	2021	2022	2023
Apple Creek	0.273	0.297	0.318	0.168	0.265	0.126	0.176	0.270	0.187
Ashwaubenon Creek	0.347	0.316	0.321	0.301	0.485	0.119	0.319	0.252	0.222
Baird Creek	0.288	0.172	0.317	0.289	0.506	0.075	0.170	0.143	0.136
Bower Creek	0.199	0.229	0.310	0.323	0.328	0.232	0.230	0.168	0.198
Lower Duck Creek (Pamperin Park)	0.141	0.173	0.192	0.134	0.148	0.121	0.156	0.113	0.128
Dutchman Creek	0.306	0.117	0.157	0.141	0.280	0.069	0.098	0.127	0.184
Middle East River (CTH G)	0.526	0.472	0.460	0.321	0.421	0.303	0.276	0.379	0.374
Lower East River (HLT)		0.252	0.143	0.321	0.170	0.253	0.128	0.182	0.129
Garner's Creek	0.139	0.131	0.129	0.100	0.128	0.072	0.087	0.099	0.111
Kankapot Creek	0.365	0.292	0.498	0.402	0.355	0.277	0.307	0.360	0.266
Mud Creek	0.108	0.098	0.088	0.097	0.092	0.096	0.094	0.151	0.100
Neenah Slough	0.078	0.112	0.091	0.076	0.110	0.080	0.075	0.098	0.043
Plum Creek (VandeHey)		0.839	0.532	0.442	0.401	0.423	0.283	0.339	0.376
Lancaster Creek	0.086	0.085	0.076	0.091	0.061	0.097	0.049	0.060	0.062
Upper Duck Creek (CTH S)				0.247	0.154	0.282	0.172	0.180	0.260
Middle Duck Creek (Seminary Rd)				0.158	0.210	0.154	0.237	0.180	0.199
Upper East River (Mallard Rd)				0.529	0.503	0.399	0.319	0.500	0.552
Trib to Garner's Creek						0.160	0.249	0.193	0.170
West Plum Creek (County Line)						1.710	0.915	1.099	0.767
Wequiock Creek						0.065	0.114	0.129	0.077

Red values indicate years with at least one missed sample.

Appendix E: 2015-2023 Sampling Data

TP (mg/L)										
Monitoring Site	Month	2015	2016	2017	2018	2019	2020	2021	2022	2023
Apple Creek	May	0.34	0.0714	0.331	0.168	0.23	-	-	0.0308	0.0716
	June	0.268	0.342	1.67	0.244	0.262	-	0.514	0.184	0.103
	July	0.354	0.407	0.345	0.319	0.267	-	0.176	0.376	0.462
	August	0.278	0.251	0.207	-	0.288	0.267	0.186	0.888	0.277
	September	0.199	0.954	0.305	0.147	0.273	0.126	0.0942	0.355	0.185
	October	0.224	0.141	0.254	0.0691	0.224	0.122	0.0673	0.0762	0.189
Ashwaubenon Creek	May	0.513	0.3	0.254	0.291	-	-	-	0.291	0.221
	June	0.435	0.295	0.529	0.293	0.313	-	0.512	0.309	0.373
	July	0.472	0.332	0.388	0.332	0.544	-	0.264	0.335	0.23
	August	0.226	0.259	0.204	0.313	0.317	0.223	0.323	0.212	0.222
	September	0.258	0.489	0.239	0.309	0.715	0.0989	0.232	0.159	0.165
	October	0.259	0.678	0.466	0.289	0.485	0.119	0.319	0.0986	0.111
Baird Creek	May	0.477	0.123	0.204	0.23	0.578	-	-	0.127	0.148
	June	0.317	0.179	0.393	0.191	0.502	-	0.281	0.2	0.124
	July	0.319	0.212	0.45	0.348	0.201	-	0.17	0.155	0.173
	August	0.181	-	0.363	0.187	0.51	0.16	0.479	0.264	0.178
	September	0.258	0.252	0.271	0.555	0.572	0.0691	0.167	0.131	0.101
	October	0.127	0.133	0.137	0.499	0.253	0.0753	0.115	0.0691	0.0843
Bower Creek	May	0.179	0.126	0.135	0.0927	0.262	-	-	0.127	0.105
	June	0.187	0.257	0.318	0.344	0.289	-	0.63	0.37	0.233
	July	0.401	0.388	0.302	0.384	0.395	-	0.197	0.301	0.243
	August	0.21	0.2	0.224	0.326	0.367	0.319	0.23	0.174	0.206
	September	0.213	-	0.451	0.319	0.436	0.154	0.175	0.162	0.19
	October	0.152	-	0.36	0.152	0.233	0.232	0.244	0.137	0.148
Lower Duck Creek (Pamperin Park)	May	0.094	0.0666	0.0694	0.0589	0.0742	-	0.194	0.0939	0.0627
	June	0.314	0.142	0.193	0.319	0.192	-	0.343	0.133	0.262

	July	0.172	0.183	0.276	0.186	0.237	-	0.118	0.223	0.128
	August	0.122	0.163	0.145	0.0975	0.104	0.121	0.361	0.142	0.139
	September	0.159	0.257	0.19	0.114	0.269	0.0344	0.045	0.0865	0.0552
	October	0.0967	0.203	0.308	0.153	0.0867	0.2	0.0405	0.0561	0.127
Dutchman Creek	May	0.547	0.107	0.0977	0.104	0.363	-	-	0.0535	0.442
	June	0.231	-	0.271	0.569	0.196	-	0.159	0.173	0.199
	July	0.306	-	0.212	0.165	0.396	-	0.113	-	0.133
	August	-	0.126	0.102	0.116	0.113	0.126	0.098	-	0.184
	September	-	-	0.187	0.201	0.423	0.0538	0.0907	0.14	0.184
	October	-	-	0.127	0.106	0.128	0.0692	0.0836	-	0.0988
Middle East River (CTH G)	May	0.307	0.275	0.444	0.276	0.23	-	-	0.307	0.265
	June	0.631	0.449	0.554	0.366	0.447	-	0.386	0.543	0.479
	July	1.05	0.585	0.475	0.471	0.394	-	0.316	0.45	0.449
	August	0.598	0.494	0.494	0.261	0.37	0.303	0.276	0.56	0.571
	September	0.453	0.885	0.289	0.368	0.605	0.209	0.213	0.272	0.184
	October	0.361	0.368	0.336	0.159	0.551	0.363	0.239	0.264	0.299
Lower East River (HLT)	May	-	0.0923	0.0589	0.14	0.0827	-	0.109	0.108	0.0776
	June	-	0.189	0.624	0.294	0.0954	-	0.691	0.206	0.0779
	July	-	0.347	0.211	0.155	0.182	-	0.137	0.628	0.416
	August	-	0.314	0.12	0.348	0.29	0.121	0.131	0.158	0.551
	September	-	0.524	0.124	0.623	0.381	0.548	0.125	0.296	0.0721
	October	-	0.178	0.161	0.375	0.158	0.253	0.0821	0.1	0.181
Garner's Creek	May	0.124	0.0769	0.118	0.0457	0.075	-	0.0896	0.0568	0.0394
	June	0.14	-	0.147	0.155	0.143	-	0.162	0.161	0.124
	July	0.326	0.131	0.14	0.142	0.151	-	0.0843	0.142	0.198
	August	0.099	0.183	0.139	0.122	0.113	0.125	0.17	0.12	0.125
	September	0.395	0.132	0.114	0.0779	0.143	0.0722	0.0599	0.0778	0.0981
	October	0.137	0.0883	0.0873	0.0375	0.07	0.0594	0.0511	0.0567	0.0862
Kankapot Creek	May	0.379	0.169	0.313	0.437	0.222	-	0.278	0.0556	0.133
	June	0.321	0.392	0.412	0.366	0.345	-	0.45	0.362	0.289

	July	0.351	0.292	0.488	0.462	0.364	-	0.325	0.357	0.446
	August	0.315	0.257	0.663	0.678	0.386	0.351	0.39	0.498	0.261
	September	0.38	-	0.747	0.311	0.462	0.277	0.212	0.547	0.271
	October	0.812	0.353	0.507	0.208	0.327	0.21	0.288	0.192	0.176
Mud Creek	May	0.108	0.0819	0.071	0.0829	0.0441	-	0.119	0.0619	0.0589
	June	0.119	0.108	0.102	0.112	0.0836	-	0.113	0.154	0.116
	July	-	0.147	0.186	0.142	0.138	-	0.114	0.212	0.084
	August	0.0746	0.0959	0.114	0.119	0.101	0.122	0.0752	0.152	0.122
	September	-	0.0996	0.0688	0.0744	0.121	0.0294	0.0331	0.149	0.0603
	October	-	0.093	0.0745	0.0498	0.0585	0.096	0.0724	0.0618	0.126
Neenah Slough	May	0.134	0.0746	0.1	0.19	0.0962	-	-	0.0673	0.0748
	June	-	0.352	0.159	0.167	0.102	-	0.0885	0.147	0.0641
	July	0.0784	0.231	0.0813	0.0614	0.118	-	0.0749	0.162	0.0435
	August	0.0935	0.0614	0.0606	0.0379	0.0525	0.0804	0.084	0.0449	0.0433
	September	0.0571	0.086	0.0451	0.088	0.234	0.0376	0.0463	0.0847	0.0339
	October	0.0761	0.138	0.115	0.0649	0.131	0.223	0.0509	0.111	0.0382
Plum Creek (VandeHey)	May	-	-	0.462	0.266	0.184	-	-	0.189	0.14
	June	-	-	0.395	0.446	0.375	-	0.467	1.17	0.184
	July	-	-	0.46	0.529	0.426	-	0.257	0.318	0.397
	August	-	1.34	0.602	0.437	0.335	0.375	0.297	0.212	0.485
	September	-	0.839	0.878	1.05	0.505	0.549	0.283	0.359	0.372
	October	-	0.661	1.59	0.283	0.727	0.423	0.261	0.703	0.379
Lancaster Creek	May	0.0538	0.0493	0.0549	0.0908	0.0621	-	0.0708	-	0.0262
	June	0.086	0.106	0.115	0.0918	0.0576	-	0.0642	0.0687	0.0688
	July	0.128	0.113	0.0836	0.12	0.072	-	0.0504	0.0791	0.0883
	August	-	0.251	0.0746	0.171	0.0656	0.112	0.0478	0.0519	0.0813
	September	-	0.0647	0.077	0.0582	0.059	0.0969	0.0372	-	0.0542
	October	-	0.0557	0.0579	0.0278	0.0284	0.0836	0.027	0.0378	0.0285
Upper Duck Creek (CTH S)	May	-	-	-	0.24	0.073	-	0.171	0.104	0.0674
	June	-	-	-	0.253	0.109	-	0.495	0.112	0.12

	July	-	-	-	0.355	0.171	-	0.121	0.226	0.212
	August	-	-	-	0.537	0.136	0.322	0.144	0.147	0.356
	September	-	-	-	0.238	0.254	0.189	0.184	0.123	0.308
	October	-	-	-	0.071	0.273	0.282	0.172	0.0567	0.448
Middle Duck Creek (Seminary Rd)	May	-	-	-	0.107	0.128	-	0.299	0.145	0.119
	June	-	-	-	0.172	0.29	-	0.282	0.214	0.207
	July	-	-	-	0.224	0.247	-	0.191	0.268	0.311
	August	-	-	-	0.214	0.173	0.154	0.33	0.248	0.223
	September	-	-	-	0.144	0.286	0.0859	0.109	0.132	0.19
	October	-	-	-	0.143	0.0941	0.162	0.104	0.0723	0.19
Upper East River (Mallard Rd)	May	-	-	-	0.453	0.213	-	-	0.339	0.323
	June	-	-	-	0.505	0.452	-	1.68	0.543	0.575
	July	-	-	-	0.553	0.562	-	0.44	0.571	0.529
	August	-	-	-	0.683	0.454	0.421	0.319	0.909	0.809
	September	-	-	-	0.556	0.691	0.252	0.257	0.441	1.27
	October	-	-	-	0.196	0.551	0.399	0.301	0.457	0.445
Trib to Garner's Creek	May	-	-	-	-	-	-	0.226	0.119	0.0936
	June	-	-	-	-	-	-	0.306	0.196	0.157
	July	-	-	-	-	-	-	0.218	0.239	0.342
	August	-	-	-	-	-	0.183	0.271	0.19	0.182
	September	-	-	-	-	-	0.0897	0.205	0.186	0.343
	October	-	-	-	-	-	0.16	0.292	0.241	0.137
West Plum Creek (County Line)	May	-	-	-	-	-	-	1.38	0.151	0.306
	June	-	-	-	-	-	-	2.4	1.34	0.761
	July	-	-	-	-	-	-	0.344	1.57	1.21
	August	-	-	-	-	-	1.09	1.09	1.48	1.61
	September	-	-	-	-	-	1.71	0.724	0.858	0.76
	October	-	-	-	-	-	3.3	0.739	0.412	0.773
Wequiock Creek	May	-	-	-	-	-	-	-	0.0479	0.0718
	June	-	-	-	-	-	-	0.211	0.117	0.133

	July	-	-	-	-	-	-	0.114	0.153	-
	August	-	-	-	-	-	0.123	0.166	0.201	0.237
	September	-	-	-	-	-	0.0651	0.0668	0.14	0.0855
	October	-	-	-	-	-	0.0369	0.101	0.0611	0.0771

DRP (mg/L)										
Monitoring Site	Month	2015	2016	2017	2018	2019	2020	2021	2022	2023
Apple Creek	May	0.16	0.0266	0.141	0.0861	0.109	-	-	ND	0.0293
	June	0.18	0.187	0.323	0.167	0.123	-	0.26	0.132	0.0767
	July	0.27	0.259	0.251	0.264	0.219	-	0.082	0.306	0.386
	August	0.201	0.173	0.126	-	0.136	0.095	0.143	0.348	0.146
	September	0.139	0.341	0.238	0.0724	0.188	0.0623	0.0605	-	0.102
	October	0.182	0.106	0.15	0.0341	0.16	0.0861	0.0452	0.0463	0.125
Ashwaubenon Creek	May	-	0.17	0.156	0.207	-	-	-	0.199	0.163
	June	0.221	0.19	0.383	0.102	0.242	-	0.409	0.253	0.303
	July	0.306	0.247	0.288	0.256	0.352	-	0.17	0.279	0.146
	August	0.128	0.103	0.071	0.0869	0.259	0.159	0.254	0.153	0.119
	September	0.126	0.288	0.191	0.199	0.498	0.07	0.155	0.126	0.0779
	October	0.203	0.486	0.375	0.259	0.346	0.0938	0.301	0.0713	0.0776
Baird Creek	May	0.345	0.0573	0.142	0.158	0.278	-	-	0.0747	0.0917
	June	0.216	0.0994	0.243	0.106	0.337	-	0.208	0.122	0.0744
	July	0.183	0.1335	0.276	0.152	0.145	-	0.106	0.106	0.0942
	August	0.12	-	0.29	0.134	0.274	0.109	0.293	0.193	0.12
	September	0.188	0.154	0.216	0.476	0.439	0.0746	0.0914	0.0899	0.058
	October	0.0983	0.0963	0.101	0.326	0.158	0.0711	0.0839	0.042	0.0568
Bower Creek	May	0.112	0.0661	0.0471	0.0444	0.142	-	-	0.0736	0.052
	June	0.0969	0.154	0.229	0.232	0.192	-	0.363	0.271	0.163
	July	0.118	0.293	0.21	0.265	0.251	-	0.0933	0.17	0.175
	August	0.108	0.119	0.13	0.174	0.178	0.14	0.145	0.105	0.129

	September	0.145	-	0.295	0.244	0.306	0.0468	0.117	0.098	0.113
	October	0.12	-	0.0296	0.0946	0.113	0.118	0.181	0.0803	0.0725
Lower Duck Creek (Pamperin Park)	May	0.0433	0.0189	0.0248	0.0182	0.0333	-	0.137	0.0557	0.0154
	June	0.141	0.0802	0.121	0.193	0.0928	-	0.134	0.108	0.177
	July	0.0914	0.131	0.18	0.113	0.19	-	0.0792	0.161	0.0738
	August	0.0735	0.0773	0.0953	0.0302	0.0594	0.0405	0.227	0.0836	0.0826
	September	0.111	0.179	0.124	0.0814	0.196	0.0127	0.0167	0.0561	0.0161
	October	0.0466	0.156	0.177	0.12	0.0631	0.167	0.0212	0.0183	0.0767
Dutchman Creek	May	0.0839	0.0318	0.0406	0.0462	0.246	-	-	0.0144	0.306
	June	0.176	-	0.198	0.378	0.136	-	0.104	0.118	0.143
	July	0.193	-	0.164	0.115	0.286	-	0.0516	-	0.103
	August	-	0.0495	0.0454	0.0669	0.0558	0.108	0.073	-	0.145
	September	-	-	0.146	0.163	0.343	0.0319	0.0533	0.103	0.113
	October	-	-	0.103	0.0796	0.0874	0.0429	0.0679	-	0.0627
Middle East River (CTH G)	May	0.205	0.146	0.199	0.184	0.12	-	-	0.207	0.168
	June	0.396	0.294	0.302	0.282	0.265	-	0.243	0.413	0.333
	July	0.831	0.488	0.195	0.375	0.349	-	0.234	0.4	0.361
	August	0.455	0.288	0.314	0.171	0.274	0.206	0.22	0.45	0.459
	September	0.341	0.526	0.232	0.311	0.467	0.169	0.162	0.205	0.122
	October	0.256	0.312	0.293	0.107	0.338	0.291	0.161	0.199	0.246
Lower East River (HLT)	May	-	0.0186	0.022	0.0837	0.0525	-	0.0301	0.0424	0.0336
	June	-	0.104	0.296	0.165	0.0435	-	0.114	0.0814	0.00862
	July	-	0.257	0.122	0.0454	0.105	-	0.0622	0.0886	0.0969
	August	-	0.0931	0.147	0.0175	0.0365	0.0246	0.0499	0.0533	0.151
	September	-	0.336	0.038	0.194	0.194	0.0623	0.0249	0.0946	0.00807
	October	-	0.0775	0.056	0.171	0.0954	0.124	0.0948	0.0659	0.0414
Garner's Creek	May	0.0424	0.031	0.0316	0.0109	0.0089	-	0.0488	0.0105	ND
	June	0.0562	0.0589	0.0531	0.0604	0.0391	-	0.088	0.0481	0.0635
	July	0.0212	0.0591	0.0809	0.0645	0.0673	-	0.056	0.0799	0.0631
	August	0.019	0.0491	0.0675	0.0768	0.0264	0.0445	0.0896	0.0485	0.0504

	September	0.0181	0.0031	0.0637	0.0489	0.0607	0.0395	0.0362	0.0478	0.0412
	October	0.0398	0.0311	0.0518	0.0232	0.0326	0.0374	0.0266	0.0276	0.0207
Kankapot Creek	May	0.171	0.0769	0.182	0.306	0.149	-	0.157	0.00991	0.0673
	June	0.186	0.224	0.218	0.221	0.149	-	0.351	0.219	0.165
	July	0.236	0.179	0.282	0.335	0.255	-	0.236	0.26	0.279
	August	0.197	0.113	0.424	0.448	0.246	0.229	0.302	0.317	0.128
	September	0.235	-	0.564	0.213	0.304	0.161	0.15	0.373	0.173
	October	0.471	0.206	0.384	0.122	0.194	0.146	0.23	0.0941	0.0698
Mud Creek	May	0.0326	0.027	0.0299	0.0232	0.01	-	0.053	0.0224	0.0227
	June	0.0569	0.0587	0.066	0.0662	0.0196	-	0.0857	0.104	0.0658
	July	-	0.0959	0.0962	0.0956	0.0886	-	0.0791	0.168	0.0475
	August	0.0376	0.049	0.0551	0.0712	0.0646	0.0892	0.054	0.104	0.0831
	September	-	0.0324	0.0394	0.0474	0.0454	0.0264	0.0134	0.0674	0.0265
	October	-	0.0602	0.0433	0.0235	0.0363	0.0565	0.0392	0.037	0.0316
Neenah Slough	May	0.0399	0.0305	0.0155	0.119	0.0464	-	-	0.024	0.0211
	June	-	0.223	0.0998	0.115	0.0549	-	0.057	0.112	0.0291
	July	0.0332	0.163	0.0489	0.0359	0.102	-	0.0476	0.128	0.0114
	August	0.0706	0.0376	0.0284	0.007	0.0362	0.0399	0.0455	0.0289	0.0262
	September	0.0313	0.0498	0.0193	0.0548	0.146	0.0182	0.0135	0.0479	0.00711
	October	0.05	0.094	0.0541	0.0417	0.0848	0.164	0.0144	0.0548	0.0203
Plum Creek (VandeHey)	May	-	-	0.321	0.159	0.108	-	-	0.101	0.0657
	June	-	-	0.26	0.311	0.284	-	0.367	0.858	0.116
	July	-	-	0.354	0.319	0.331	-	0.177	0.191	0.209
	August	-	0.197	0.29	0.326	0.227	0.222	0.196	0.0717	0.381
	September	-	0.633	0.726	0.877	0.393	0.326	0.187	0.254	0.228
	October	-	0.571	1.21	0.203	0.399	0.318	0.2	0.466	0.266
Lancaster Creek	May	0.0181	0.0106	0.0339	0.043	0.0207	-	0.0356	-	0.0108
	June	0.0429	0.0515	0.0459	0.051	0.0434	-	0.0299	0.0377	0.0302
	July	0.0635	0.0513	0.0388	0.0767	0.049	-	0.0336	0.0554	0.0495
	August	-	0.0369	0.0449	0.0339	0.0325	0.0743	0.0354	0.0332	0.0499

	September	-	0.0342	0.0408	0.0284	0.0346	0.0385	0.0262	-	0.0339
	October	-	0.0234	0.0309	0.0164	0.0233	0.0306	0.0194	0.00645	0.017
Upper Duck Creek (CTH S)	May	-	-	-	0.124	0.04	-	0.0966	0.0593	0.025
	June	-	-	-	0.0895	0.064	-	0.378	0.0707	0.0721
	July	-	-	-	0.225	0.138	-	0.0814	0.18	0.15
	August	-	-	-	0.37	0.105	0.198	0.101	0.106	0.27
	September	-	-	-	0.158	0.169	0.115	0.113	0.0847	0.186
	October	-	-	-	0.046	0.151	0.217	0.126	0.0402	0.259
Middle Duck Creek (Seminary Rd)	May	-	-	-	0.0598	0.0707	-	0.0966	0.106	0.0633
	June	-	-	-	0.128	0.122	-	0.184	0.176	0.159
	July	-	-	-	0.174	0.18	-	0.152	0.234	0.262
	August	-	-	-	0.169	0.156	0.112	0.249	0.195	0.177
	September	-	-	-	0.111	0.213	0.0513	0.0799	0.101	0.142
	October	-	-	-	0.113	0.0731	0.141	0.0871	0.0438	0.138
Upper East River (Mallard Rd)	May	-	-	-	0.345	0.139	-	-	0.277	0.252
	June	-	-	-	0.17	0.313	-	1.53	0.358	0.482
	July	-	-	-	0.153	0.491	-	0.31	0.522	0.595
	August	-	-	-	0.578	0.353	0.33	0.271	0.853	0.712
	September	-	-	-	0.414	0.492	0.195	0.216	0.371	1.04
	October	-	-	-	0.139	0.338	0.346	0.271	0.396	0.372
Trib to Garner's Creek	May	-	-	-	-	-	-	0.189	0.0824	0.0537
	June	-	-	-	-	-	-	0.261	0.0503	0.128
	July	-	-	-	-	-	-	0.17	0.209	0.302
	August	-	-	-	-	-	0.134	0.184	0.114	0.142
	September	-	-	-	-	-	0.0615	0.18	0.0809	0.279
	October	-	-	-	-	-	0.0683	0.26	0.194	0.0922
West Plum Creek (County Line)	May	-	-	-	-	-	-	1.22	0.0909	0.164
	June	-	-	-	-	-	-	2.13	1.12	0.618
	July	-	-	-	-	-	-	0.28	1.4	1.07
	August	-	-	-	-	-	0.845	0.897	0.905	1.47

	September	-	-	-	-	-	1.23	0.653	-	0.621
	October	-	-	-	-	-	2.86	0.618	0.338	0.541
Wequiock Creek	May	-	-	-	-	-	-	-	0.00822	0.0371
	June	-	-	-	-	-	-	0.137	0.0734	0.0915
	July	-	-	-	-	-	-	0.0892	0.114	-
	August	-	-	-	-	-	0.0968	0.138	0.143	0.151
	September	-	-	-	-	-	0.0734	0.0477	0.0938	0.0583
	October	-	-	-	-	-	0.0422	0.0738	0.0273	0.0481

TSS (mg/L)										
Monitoring Site	Month	2015	2016	2017	2018	2019	2020	2021	2022	2023
Apple Creek	May	61	3.2	47.7	15	82	-	-	3	3
	June	4.4	82.3	1010	13.3	82.3	-	141	698	ND
	July	11.4	61.4	39.3	7	13.6	-	20.6	16.9	2
	August	17.4	13.2	14.7	-	11.5	59.2	4	378	18.4
	September	8.75	420	11.6	2.6	19.8	NA	19.8	54.5	13.2
	October	7.8	3.2	7.8	ND	39.5	NA	ND	2.2	7
Ashwaubenon Creek	May	-	49.5	21.5	15	-	-	-	6.2	10.3
	June	26.7	16.5	40.8	34	22.5	-	36	22	16.8
	July	17.3	14.6	19.2	20.7	62	-	36.8	20.8	22.5
	August	20.6	38.8	60.8	670	24	13.2	32.8	19.4	16.4
	September	17.2	69.5	5.4	13.8	68.5	8.6	13	3.8	10.2
	October	15.2	44.3	15	3.4	58	ND	ND	ND	2.5
Baird Creek	May	ND	4.33	4.25	5	68	-	-	2.2	3
	June	12	19	29	5.5	12	-	7.2	4.4	3.8
	July	24.8	13.4	36	77.7	8.2	-	12.6	5	17.6
	August	ND	-	7.2	6.4	81.5	3.2	72.6	10.8	8.4
	September	3.2	6.8	3.4	8.6	23	2.8	12.8	ND	10.2
	October	2.8	3.2	ND	39.2	18.3	2.4	ND	ND	3

Bower Creek	May	8.8	8	7.5	3.6	98	-	-	3.8	5.25
	June	40.8	27.3	25.1	24.4	8.6	-	44.2	19.8	6.4
	July	37	23.4	22.7	9.25	40.8	-	69.4	16	11.5
	August	16.8	13.4	12.4	44	51	21	34	16.6	9.4
	September	9.4	-	15	10.6	28	12.2	28.6	7.2	6.4
	October	7.6	-	7	ND	14.5	3	18.4	9.8	4.8
Lower Duck Creek (Pamperin Park)	May	7.2	ND	4.75	5	6.3	-	6.6	ND	5
	June	61.6	12.3	19.3	50.7	55	-	101	ND	42
	July	13.4	18.9	25.5	13.8	15.8	-	7.4	19	7.4
	August	11.7	22	11.4	11.8	12.3	23.8	62	22.2	11.8
	September	11.3	15.7	16.5	3.6	19.8	7.2	2	3	7.4
	October	4.75	7.67	39	3.8	4.2	5.4	ND	2.6	8.2
Dutchman Creek	May	75.3	10.8	10.8	6	44.3	-	-	2.4	53
	June	15	-	12.3	59.6	16	-	10.2	2.8	3.2
	July	153	-	9.6	9	25.8	-	27.6	-	5.2
	August	-	8.4	15.8	10.8	21.7	5	9.4	-	5
	September	-	-	3.4	4.6	13	6.6	8.6	5.8	15
	October	-	-	3.5	ND	7	3.2	2.2	-	ND
Middle East River (CTH G)	May	5.2	50.5	67	15.3	42.7	-	-	29.4	31
	June	62	52.5	98	19.2	89.3	-	57	50.8	41.8
	July	17.8	26.6	55.3	25.3	12.8	-	20.8	20.4	11.2
	August	35	134	46.3	75	20	21	23.4	20.6	21.3
	September	22	69.5	11.8	21.2	32	13.3	13.6	10.4	14.4
	October	38.8	8.2	11	2.8	52	12.4	28.6	5.8	7
Lower East River (HLT)	May	-	11	12.3	15.3	35	-	14	26.6	10
	June	-	13	24	4	16.8	-	51.5	18.8	6.75
	July	-	14.4	29.7	25.3	33.3	-	18.2	109	29.6
	August	-	28.8	26.3	75	57	32	16.9	16	198
	September	-	43	19.2	201	2	70.3	23.2	50.6	14
	October	-	29	32	48.5	17.7	70.3	12.6	9.4	30.2

Garner's Creek	May	25.7	8.4	21.3	7.25	12.6	-	6.8	6.2	4
	June	27.8	40	38.7	33.3	54.2	-	28	86.4	12.4
	July	53	36.6	16.5	16	34	-	8	32	47.2
	August	14.3	44.8	23.6	14.2	23	10.6	46.7	23.1	29
	September	74	27	9.8	4.6	26.3	13.8	3.4	6.2	13.8
	October	9.6	5.4	3.67	4.2	10.8	4.4	2	2.2	16.4
Kankapot Creek	May	24.5	12	20.5	20	5.2	-	11.2	3.8	5.75
	June	25	41.5	72	15.4	33.8	-	21.2	35.8	15.2
	July	26.2	12.8	35.9	7.5	27.5	-	24.2	13	23.4
	August	17	19.4	87	50.8	23	11.6	27.4	41	65.6
	September	17.6	-	37	6	58	NA	18	52.4	12.8
	October	ND	16.3	6	ND	13.3	16	6.8	4.4	18.7
Mud Creek	May	7.4	2.6	ND	2.6	6.2	-	6.4	ND	3.2
	June	4.25	7.25	ND	2.5	5.2	-	19.8	2.2	ND
	July	-	3.4	7.65	ND	4.5	-	3.2	4.4	4.4
	August	2.8	4.4	4.8	2	ND	3.2	4.2	ND	ND
	September	-	29	2	2.6	27.3	2.4	2.4	34.8	4.4
	October	-	10	3	2.4	4.6	6	4.4	2	54.8
Neenah Slough	May	33	4.2	42	17.5	8	-	-	5.4	10.8
	June	-	23	9.5	8.33	4.8	-	6.2	2.6	4
	July	2.4	4.86	ND	ND	2.4	-	2.8	3.8	3.2
	August	3	ND	ND	ND	ND	4.4	6.6	3.4	2
	September	ND	ND	ND	9.8	21.3	6	4.6	6.8	3.6
	October	2.8	3.8	69.7	2.6	50.23	9.6	5.6	5.2	11.2
Plum Creek (VandeHey)	May	-	-	16.5	19	9.2	-	-	32.2	21.7
	June	-	-	52.8	34.5	39.3	-	41.8	63.2	11.7
	July	-	-	41	24.7	31.8	-	27.6	25.8	13.6
	August	-	27.4	32.4	15	34	16.8	25.6	23.6	23
	September	-	30	12.3	76.9	30.5	12.3	15	24.6	9.4
	October	-	10.2	11.7	2.2	140	19.1	9	12.6	15.6

Lancaster Creek	May	11.3	8	8.5	16.3	23.8	-	7	-	2.4
	June	18	20.3	29	12	7.2	-	13.8	9.6	10.6
	July	31	12	15.4	12	7.6	-	7.6	5.6	18.2
	August	-	133	9.2	83.1	17.6	31.6	5.8	8.4	8.2
	September	-	3.2	4	8.4	5.6	107	2	-	6.6
	October	-	ND	ND	ND	2	73.1	ND	2.4	ND
Upper Duck Creek (CTH S)	May	-	-	-	52	5	-	3.8	3.4	2.8
	June	-	-	-	61.5	7	-	9.2	8.6	7
	July	-	-	-	20	16.6	-	9.8	7.6	6.8
	August	-	-	-	16	6.5	34.8	7.8	5.4	8
	September	-	-	-	6	16.2	7.4	24.6	4.2	69.6
	October	-	-	-	ND	27.7	ND	2.8	ND	91.2
Middle Duck Creek (Seminary Rd)	May	-	-	-	5.33	10	-	5.4	2	2.75
	June	-	-	-	5	68.5	-	16.6	7	9.8
	July	-	-	-	4.25	33	-	9.4	4.2	5
	August	-	-	-	5.6	6.67	4.4	12.8	5.8	3.8
	September	-	-	-	ND	40.5	5	ND	2	2.4
	October	-	-	-	2.6	2.75	6	ND	ND	-
Upper East River (Mallard Rd)	May	-	-	-	24.7	12	-	-	9.4	13
	June	-	-	-	55.6	61.5	-	44.8	86.8	43
	July	-	-	-	42.5	28.2	-	42.3	26.4	33
	August	-	-	-	25.2	23.3	40.6	20.6	12.8	30.8
	September	-	-	-	38.8	25.7	25.5	7.2	10.6	6
	October	-	-	-	4	52	13.2	2.2	ND	6.2
Trib to Garner's Creek	May	-	-	-	-	-	-	ND	2.4	4.75
	June	-	-	-	-	-	-	4.8	45.8	7
	July	-	-	-	-	-	-	6.6	4.2	2.6
	August	-	-	-	-	-	5	19	8.8	5.6
	September	-	-	-	-	-	2.6	4.6	23.6	7
	October	-	-	-	-	-	10.5	ND	3.2	3.6

West Plum Creek (County Line)	May	-	-	-	-	-	-	21	6.8	21.2
	June	-	-	-	-	-	-	21.6	852	14
	July	-	-	-	-	-	-	9	9	2.2
	August	-	-	-	-	-	29.4	48.2	87.5	2.4
	September	-	-	-	-	-	NA	16.6	33.6	6.2
	October	-	-	-	-	-	NA	12.6	4.6	24.6
Wequiock Creek	May	-	-	-	-	-	-	-	3	10.6
	June	-	-	-	-	-	-	4.25	3.2	2
	July	-	-	-	-	-	-	16.6	34.2	-
	August	-	-	-	-	-	8.8	4.6	5.6	19.8
	September	-	-	-	-	-	3.2	3.4	20.2	7.6
	October	-	-	-	-	-	ND	3	4.2	ND

TN (mg/L)					
Monitoring Site	Month	2020	2021	2022	2023
Apple Creek	May	-	-	1.14	2.01
	June	-	23.1	2.22	0.746
	July	-	1.18	1.89	1.08
	August	1.16	0.976	3.99	1.06
	September	1.44	0.858	3.27	0.758
	October	0.122	0.594	0.555	0.829
Ashwaubenon Creek	May	-	-	1.16	2.23
	June	-	1.56	4.32	1.27
	July	-	1.93	1.4	1.24
	August	1.71	2.18	1.33	1.02
	September	1.3	1.25	1.03	1.14
	October	0.823	0.826	0.643	0.702
Baird Creek	May	-	-	1.27	1.04
	June	-	0.957	1.17	0.653

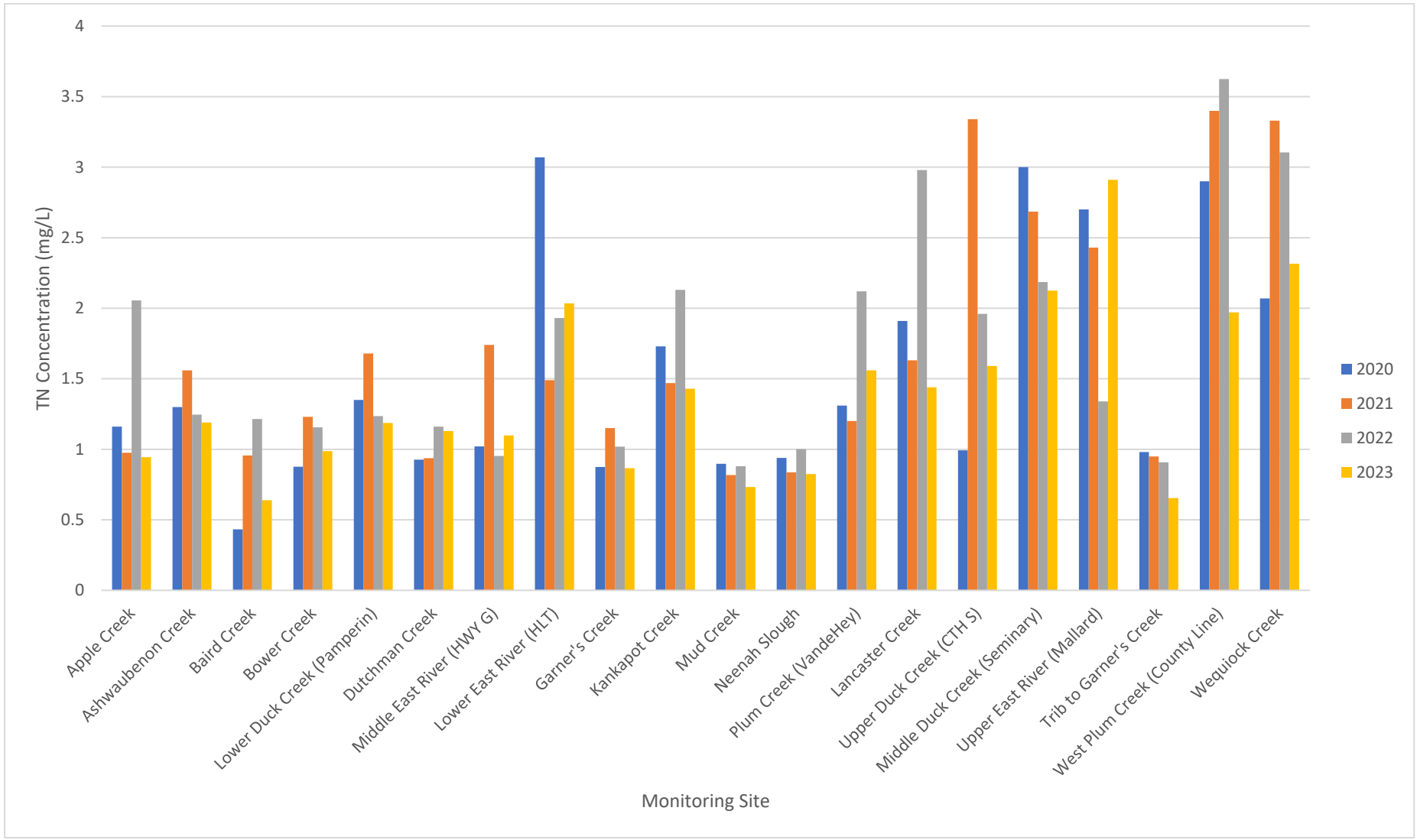
	July	-	1.61	0.698	0.624
	August	0.734	1.63	4.59	0.933
	September	0.433	0.919	1.26	0.612
	October	0.389	0.938	0.578	0.328
Bower Creek	May	-	-	1.12	1.08
	June	-	1.35	1.19	0.963
	July	-	1.1	1.33	1.01
	August	1.11	1.34	1.08	1.07
	September	0.856	0.908	1.19	0.611
	October	0.876	1.23	0.548	0.53
Lower Duck Creek (Pamperin Park)	May	-	1.43	1.88	1.55
	June	-	10.6	1.31	6.02
	July	-	2.02	1.07	0.919
	August	1.26	1.92	1.16	0.933
	September	1.35	1.22	1.62	0.632
	October	3.87	1.44	0.925	1.44
Dutchman Creek	May	-	-	1.16	5.73
	June	-	1.14	0.92	1.27
	July	-	0.857	-	0.989
	August	0.944	1.47	-	0.852
	September	0.926	0.937	1.3	1.42
	October	0.879	0.784	-	0.692
Middle East River (CTH G)	May	-	-	1.52	1.5
	June	-	13.8	1.32	17.3
	July	-	1.74	0.969	0.907
	August	1.02	1.93	0.938	1.29
	September	0.751	1.07	0.867	0.612
	October	7.05	1.21	0.793	0.476
Lower East River (HLT)	May	-	1.51	1.76	1.92
	June	-	13.1	2.1	1.36

	July	-	1.27	4.63	2.57
	August	1.39	1.24	1.25	2.56
	September	3.79	1.47	2.59	1.18
	October	3.07	1.77	1.56	2.15
Garner's Creek	May	-	1.14	0.894	0.819
	June	-	1.17	1.4	0.956
	July	-	1.16	1.05	1.2
	August	0.938	1.23	1.22	0.888
	September	0.875	0.502	0.988	0.624
	October	0.493	0.711	0.49	0.845
Kankapot Creek	May	-	1.47	0.827	1
	June	-	1.47	4.7	1.39
	July	-	2.05	1.14	1.47
	August	1.73	2.32	2.61	1.56
	September	1.23	1.11	4	0.954
	October	4.39	0.985	1.65	2.04
Mud Creek	May	-	1.38	0.636	0.861
	June	-	0.632	1.03	0.654
	July	-	0.953	0.731	0.766
	August	0.897	0.522	1.18	0.698
	September	0.366	0.706	1.16	0.453
	October	1.07	0.93	0.426	1.06
Neenah Slough	May	-	-	1.12	1.44
	June	-	0.746	1.24	0.924
	July	-	0.988	0.883	0.748
	August	0.938	0.767	0.801	0.689
	September	0.582	0.837	1.15	0.538
	October	1.48	0.905	0.782	0.899
Plum Creek (VandeHey)	May	-	-	4.19	1.57
	June	-	1.2	3.02	1.07

	July	-	1.37	1.18	2.76
	August	1.31	1.51	2.16	1.55
	September	1.21	0.931	2.08	0.898
	October	11.9	1.09	1.58	4.51
Lancaster Creek	May	-	1.94	-	1.42
	June	-	1.48	1.34	1.56
	July	-	1.49	1.34	1.27
	August	1.4	2.04	1.48	1.15
	September	1.91	1.77	-	1.88
	October	2.15	1.46	0.857	1.46
Upper Duck Creek (CTH S)	May	-	2.08	2.6	3.18
	June	-	1.8	4.8	1.98
	July	-	4.6	1.87	1.49
	August	1.68	3.22	1.86	1.61
	September	0.992	3.46	3.51	1.57
	October	0.217	3.95	3.36	0.983
Middle Duck Creek (Seminary Rd)	May	-	1.84	2.35	2.51
	June	-	13.6	1.87	16.6
	July	-	2.79	1.82	1.74
	August	2.26	1.89	1.96	1.73
	September	3	2.92	3.02	1.49
	October	4.33	2.58	1.96	3.08
Upper East River (Mallard Rd)	May	-	-	2.47	2.77
	June	-	2.57	3.72	3.05
	July	-	2.53	1.9	4.54
	August	2.7	2.43	1.44	2.32
	September	2.15	2.28	2.48	1.3
	October	5.85	2.01	0.978	8.3
Trib to Garner's Creek	May	-	0.932	0.599	0.678
	June	-	0.968	2.3	0.625

	July	-	1.13	0.656	0.632
	August	0.981	1.73	1.16	0.698
	September	0.509	0.743	1.3	0.967
	October	1.49	0.606	0.623	0.441
West Plum Creek (County Line)	May	-	2.68	1.35	2.79
	June	-	4.24	14.6	1.8
	July	-	5.74	2.52	1.45
	August	1.91	1.79	5.1	1.97
	September	2.9	2.09	4.73	1.97
	October	4.54	4.12	0.933	2.14
Wequiock Creek	May	-	-	1.61	3.14
	June	-	18.9	2.71	1.49
	July	-	4.26	3.5	-
	August	2.91	3.33	6.03	4.76
	September	2.07	2.25	4.84	-
	October	1.26	1.53	1.76	0.721

Appendix F: Median Total Nitrogen Concentration by Monitoring Site



Appendix G: Confidence Interval Table

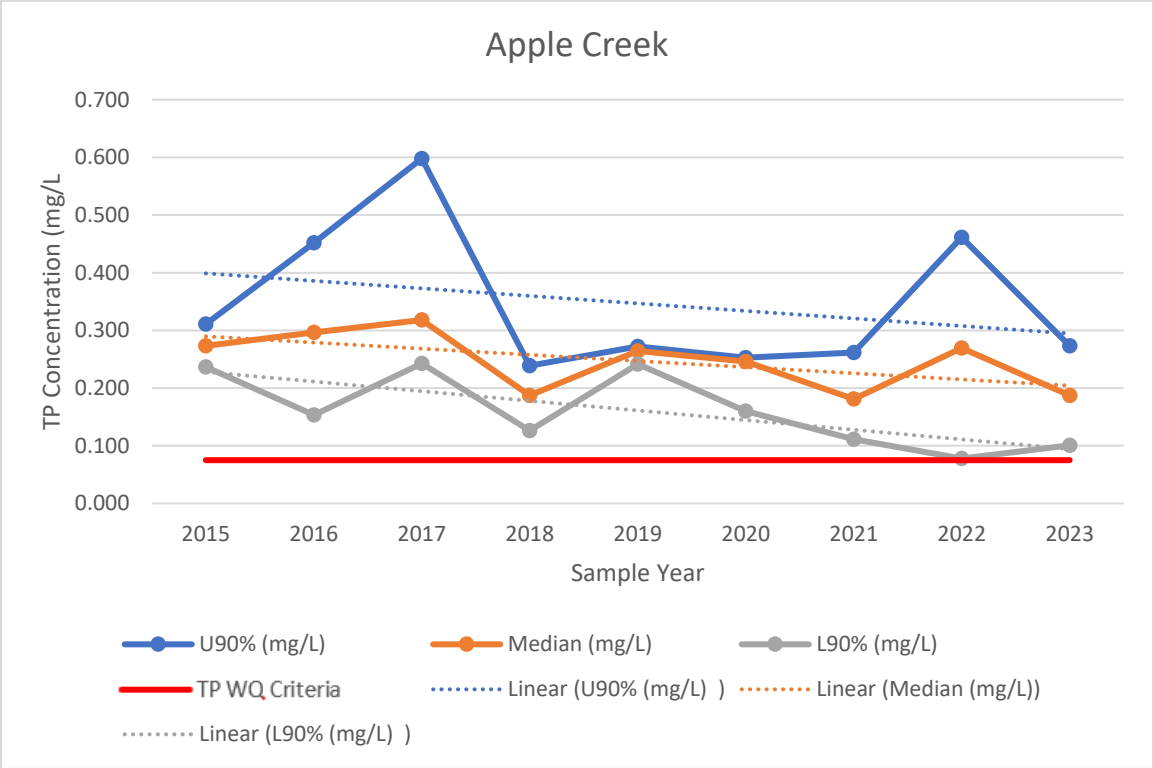
Monitoring Site	TP Calculation	2015	2016	2017	2018	2019	2020	2021	2022	2023
Apple Creek	**U90% (mg/L)**	0.311	0.452	0.598	0.239	0.272	0.253	0.262	0.462	0.273
	Median (mg/L)	0.273	0.297	0.318	0.188	0.265	0.246	0.181	0.270	0.187
	L90% (mg/L)	0.237	0.154	0.243	0.126	0.241	0.160	0.111	0.077	0.101
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Ashwaubenon Creek	**U90% (mg/L)**	0.425	0.461	0.412	0.314	0.523	0.279	0.369	0.309	0.275
	Median (mg/L)	0.347	0.316	0.321	0.301	0.401	0.257	0.305	0.252	0.222
	L90% (mg/L)	0.275	0.296	0.257	0.294	0.336	0.150	0.266	0.194	0.168
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Baird Creek	**U90% (mg/L)**	0.340	0.197	0.368	0.406	0.532	0.329	0.370	0.184	0.159
	Median (mg/L)	0.288	0.176	0.317	0.289	0.506	0.181	0.226	0.143	0.136
	L90% (mg/L)	0.194	0.145	0.214	0.228	0.306	0.111	0.171	0.102	0.113
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Bower Creek	**U90% (mg/L)**	0.260	0.264	0.360	0.340	0.374	0.321	0.344	0.229	0.230
	Median (mg/L)	0.199	0.207	0.310	0.323	0.328	0.276	0.237	0.168	0.198
	L90% (mg/L)	0.174	0.164	0.216	0.170	0.277	0.218	0.199	0.107	0.166
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Lower Duck Creek (Pamperin Park)	**U90% (mg/L)**	0.191	0.207	0.245	0.191	0.198	0.186	0.235	0.149	0.173
	Median (mg/L)	0.141	0.173	0.192	0.134	0.148	0.157	0.156	0.113	0.128
	L90% (mg/L)	0.111	0.118	0.129	0.095	0.102	0.076	0.074	0.077	0.082
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	May Exceed	Clearly Exceeds	Clearly Exceeds

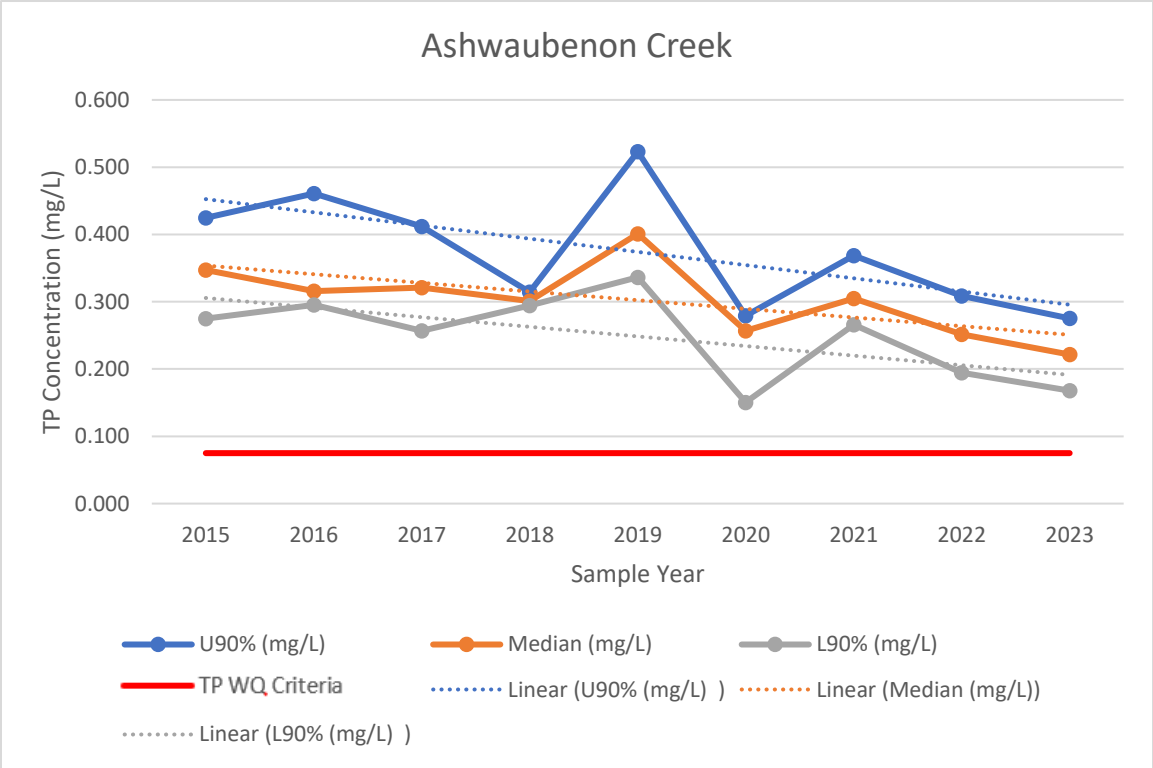
Dutchman Creek	**U90% (mg/L)**	0.308	0.202	0.199	0.251	0.337	0.254	0.181	0.161	0.258
	Median (mg/L)	0.209	0.157	0.157	0.141	0.280	0.161	0.106	0.127	0.184
	L90% (mg/L)	0.148	0.131	0.120	0.115	0.165	0.093	0.093	0.093	0.110
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Middle East River (CTH G)	**U90% (mg/L)**	0.680	0.606	0.490	0.377	0.509	0.375	0.310	0.462	0.465
	Median (mg/L)	0.526	0.472	0.460	0.321	0.421	0.333	0.258	0.379	0.374
	L90% (mg/L)	0.399	0.374	0.363	0.239	0.336	0.260	0.237	0.295	0.283
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Lower East River (HLT)	**U90% (mg/L)**		0.343	0.261	0.399	0.246	0.260	0.244	0.304	0.255
	Median (mg/L)		0.252	0.143	0.321	0.170	0.152	0.128	0.182	0.129
	L90% (mg/L)		0.164	0.101	0.201	0.119	0.111	0.098	0.060	0.003
	Relation to Criteria		Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	May Exceed	May Exceed
Garner's Creek	**U90% (mg/L)**	0.248	0.146	0.138	0.121	0.136	0.124	0.125	0.127	0.143
	Median (mg/L)	0.139	0.132	0.129	0.100	0.128	0.100	0.087	0.099	0.111
	L90% (mg/L)	0.126	0.099	0.109	0.059	0.090	0.077	0.069	0.071	0.079
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	May Exceed	Clearly Exceeds	Clearly Exceeds	May Exceed	May Exceed	Clearly Exceeds
Kankapot Creek	**U90% (mg/L)**	0.497	0.358	0.606	0.489	0.397	0.333	0.369	0.473	0.332
	Median (mg/L)	0.365	0.323	0.498	0.402	0.355	0.311	0.307	0.360	0.266
	L90% (mg/L)	0.324	0.244	0.414	0.302	0.296	0.249	0.268	0.246	0.200
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Mud Creek	**U90% (mg/L)**	0.120	0.115	0.121	0.115	0.110	0.108	0.108	0.187	0.119
	Median (mg/L)	0.104	0.098	0.088	0.097	0.092	0.090	0.094	0.151	0.100
	L90% (mg/L)	0.091	0.091	0.076	0.073	0.065	0.052	0.060	0.114	0.081
	Relation to Criteria	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	May Exceed	May Exceed	May Exceed	May Exceed	Clearly Exceeds	Clearly Exceeds

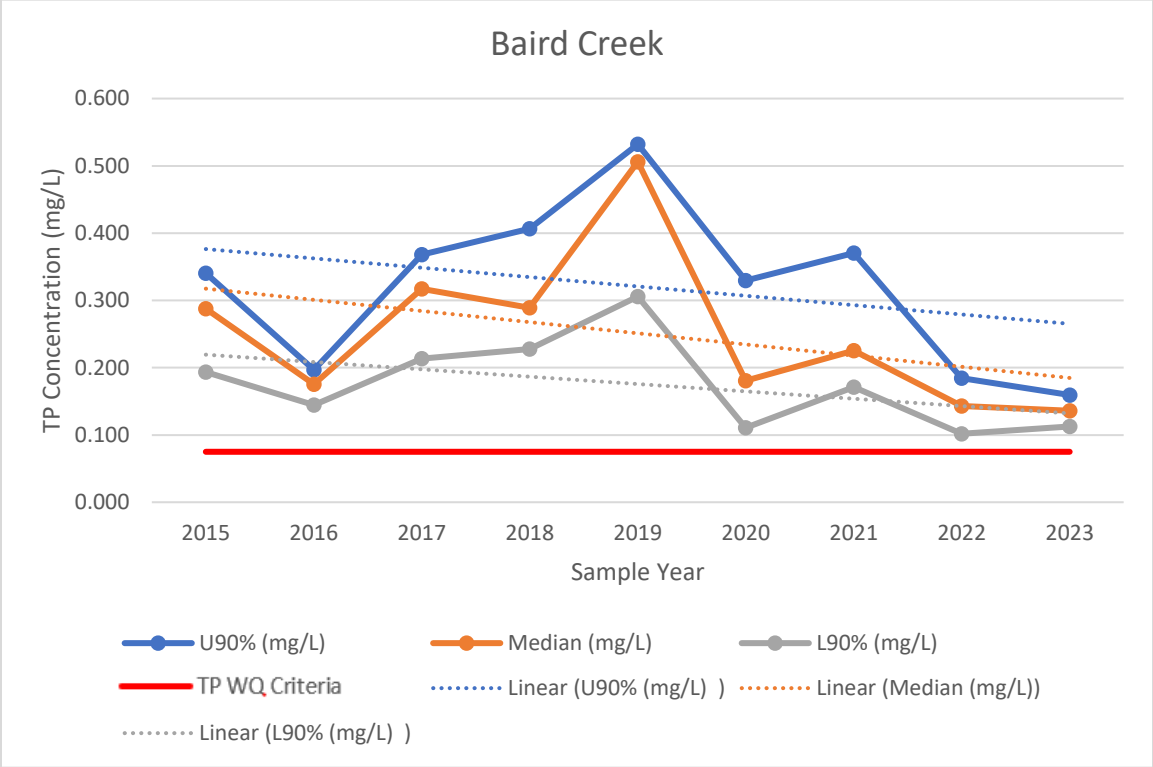
Neenah Slough	**U90% (mg/L)**	0.158	0.194	0.113	0.126	0.149	0.136	0.085	0.126	0.053
	Median (mg/L)	0.086	0.112	0.091	0.076	0.110	0.099	0.079	0.098	0.043
	L90% (mg/L)	0.072	0.085	0.065	0.060	0.083	0.068	0.059	0.070	0.034
	Relation to Criteria	May Exceed	Clearly Exceeds	May Exceed	May Exceed	Clearly Exceeds	May Exceed	May Exceed	May Exceed	Clearly Meets
Plum Creek (VandeHey)	**U90% (mg/L)**			0.781	0.605	0.516	0.462	0.336	0.572	0.458
	Median (mg/L)			0.562	0.442	0.401	0.399	0.272	0.339	0.376
	L90% (mg/L)			0.508	0.332	0.297	0.296	0.234	0.105	0.293
	Relation to Criteria			Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Lancaster Creek	**U90% (mg/L)**	0.129	0.130	0.088	0.118	0.068	0.092	0.058	0.069	0.078
	Median (mg/L)	0.075	0.085	0.076	0.091	0.061	0.078	0.049	0.060	0.062
	L90% (mg/L)	0.063	0.063	0.064	0.055	0.045	0.067	0.038	0.051	0.045
	Relation to Criteria	May Meet	May Exceed	May Meet	May Exceed	Clearly Meets	May Exceed	Clearly Meets	Clearly Meets	May Meet
Upper Duck Creek (CTH S)	**U90% (mg/L)**				0.362	0.208	0.237	0.256	0.152	0.349
	Median (mg/L)				0.247	0.154	0.180	0.172	0.118	0.260
	L90% (mg/L)				0.160	0.113	0.120	0.141	0.083	0.171
	Relation to Criteria				Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Middle Duck Creek (Seminary Rd)	**U90% (mg/L)**				0.192	0.247	0.214	0.270	0.226	0.237
	Median (mg/L)				0.158	0.210	0.158	0.237	0.180	0.199
	L90% (mg/L)				0.137	0.141	0.126	0.145	0.133	0.160
	Relation to Criteria				Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Upper East River (Mallard Rd)	**U90% (mg/L)**				0.599	0.587	0.454	0.622	0.621	0.761
	Median (mg/L)				0.529	0.503	0.410	0.310	0.500	0.552
	L90% (mg/L)				0.353	0.359	0.290	0.253	0.379	0.343
	Relation to Criteria				Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds	Clearly Exceeds

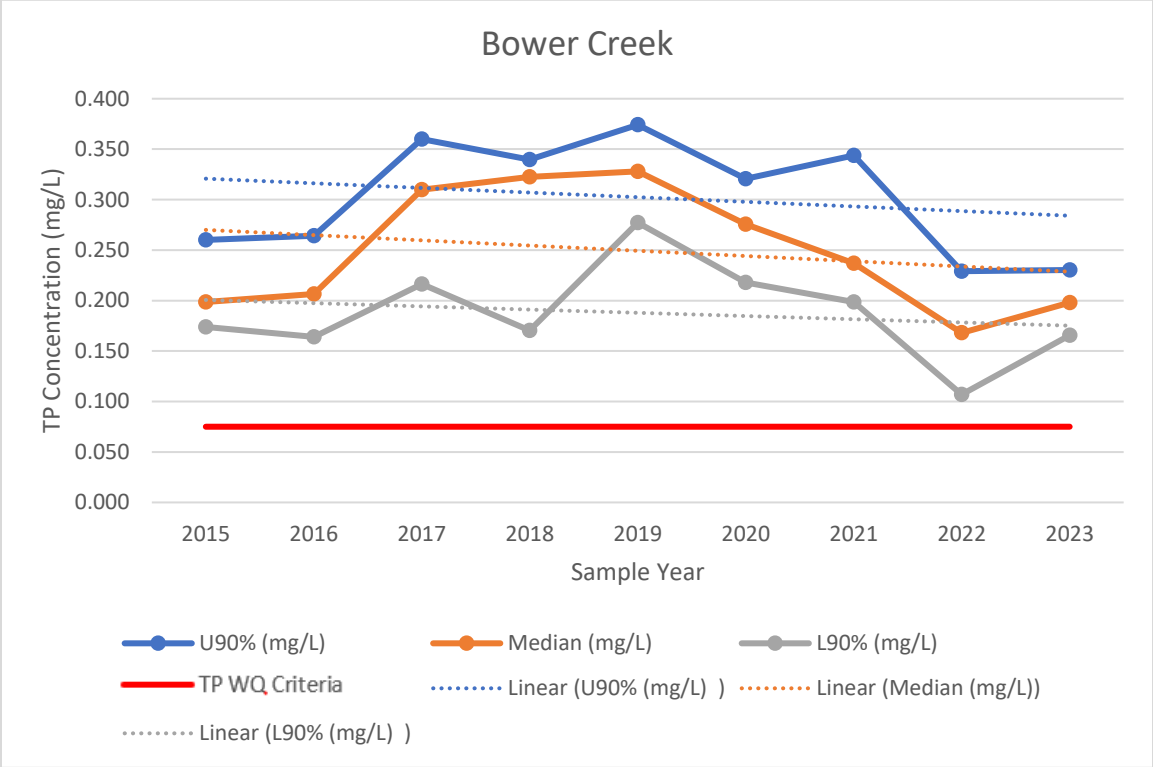
Trib to Garner's Creek	**U90% (mg/L)**							0.1925	0.2204	0.2353
	Median (mg/L)							0.1865	0.193	0.1695
	L90% (mg/L)							0.1184	0.1656	0.1037
	Relation to Criteria							Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
West Plum Creek (County Line)	**U90% (mg/L)**							1.3429	1.4630	1.0423
	Median (mg/L)							0.897	1.099	0.767
	L90% (mg/L)							0.7053	0.7350	0.4917
	Relation to Criteria							Clearly Exceeds	Clearly Exceeds	Clearly Exceeds
Wequiock Creek	**U90% (mg/L)**							0.10019	0.16407	0.15087
	Median (mg/L)							0.082	0.1285	0.10925
	L90% (mg/L)							0.06483	0.09293	0.06763
	Relation to Criteria							May Exceed	Clearly Exceeds	May Exceed

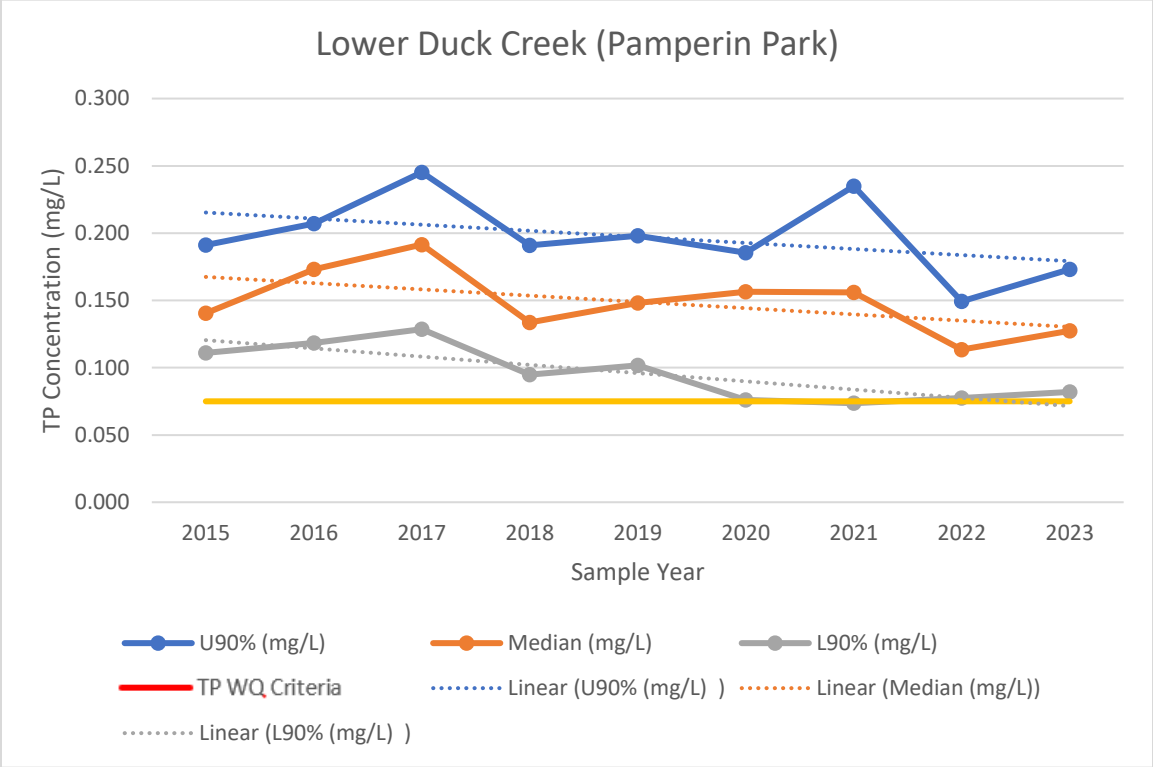
Appendix H: Confidence Interval Graphs

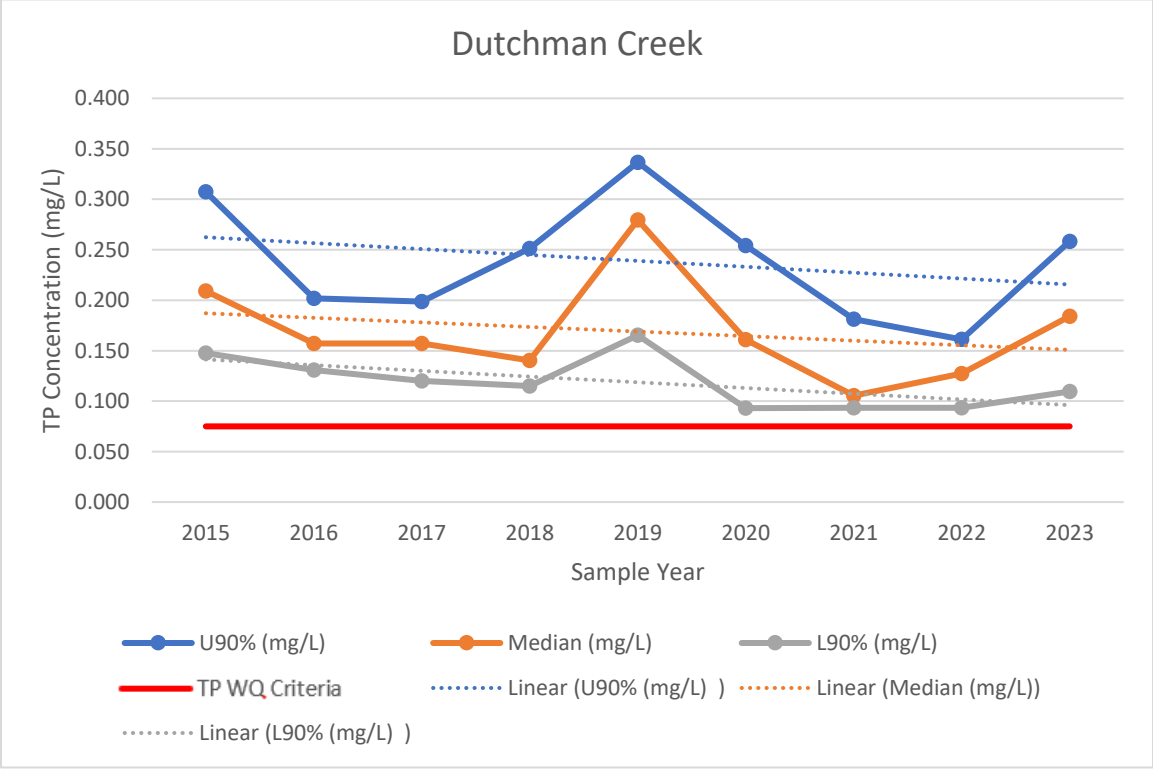


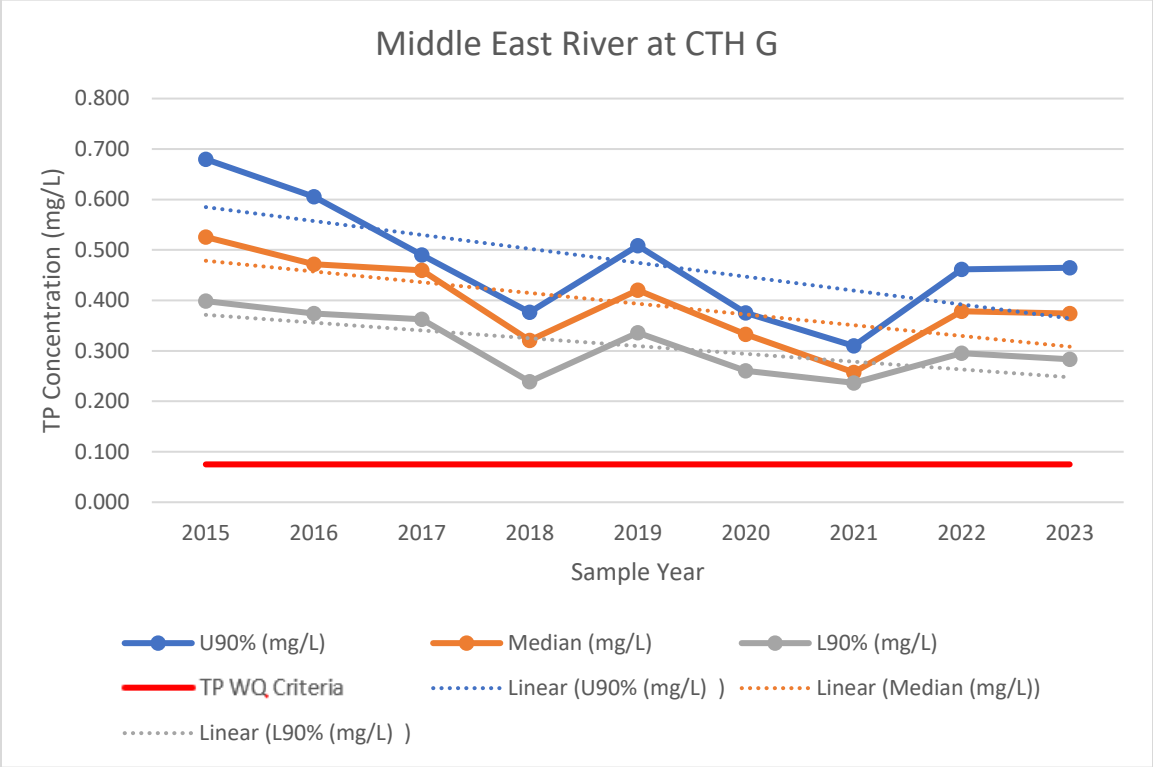


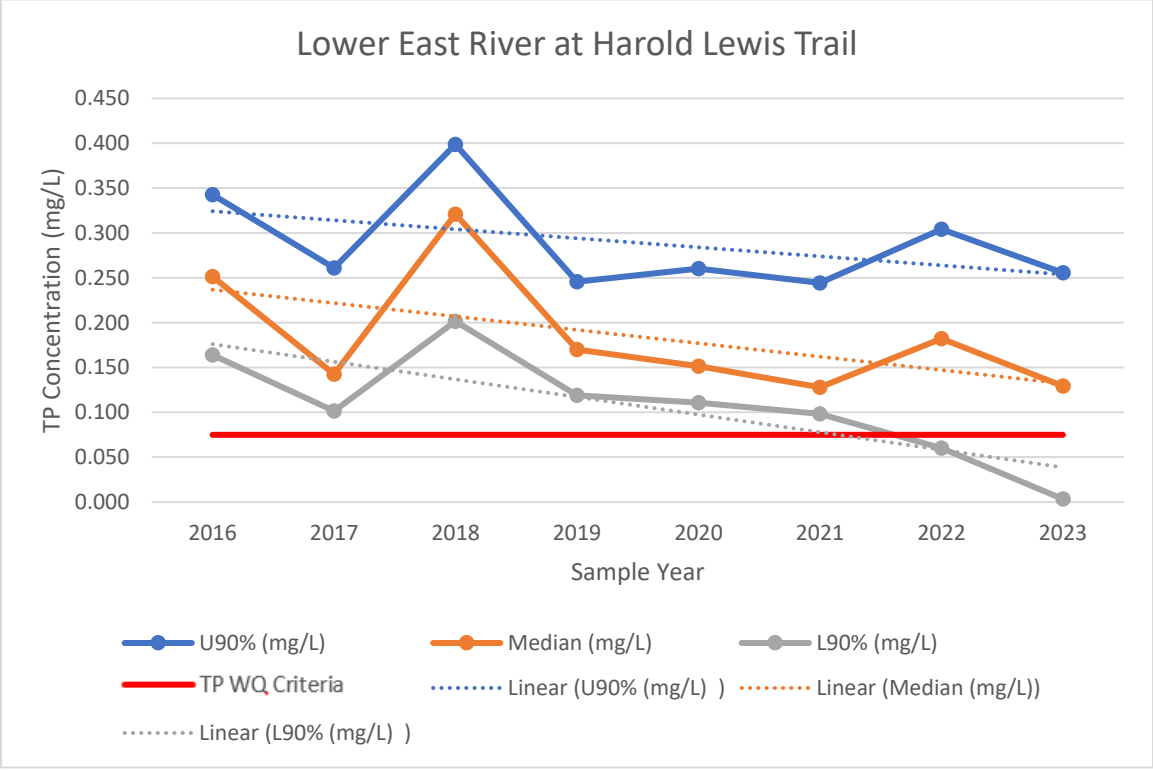

Baird Creek
TP Concentration (mg/L)
0.600
0.500
0.400
0.300
0.200
0.100
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

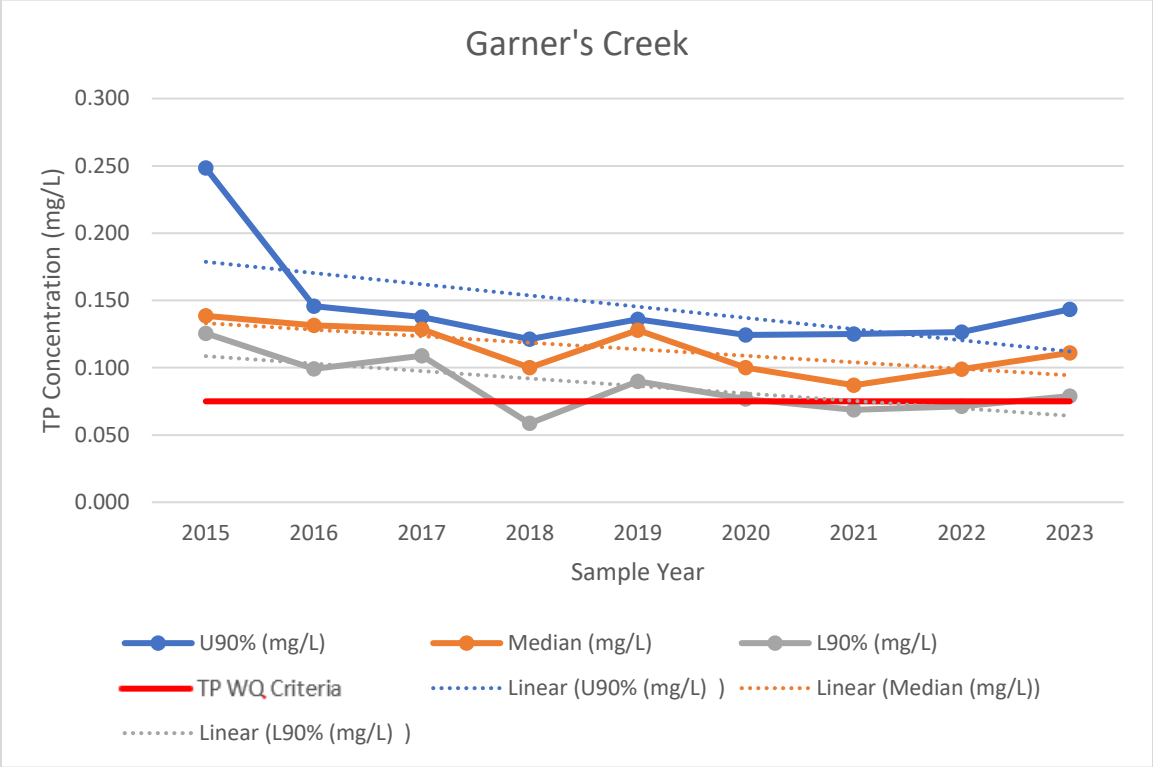

Bower Creek
TP Concentration (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

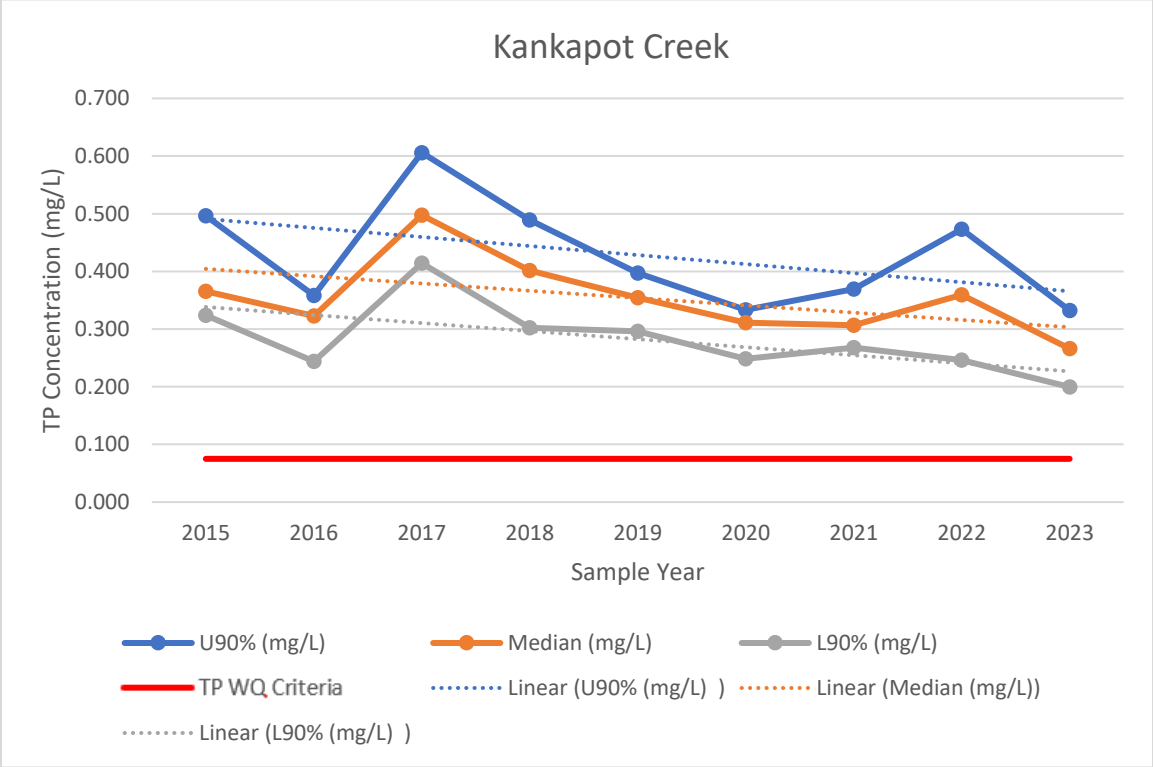

Lower Duck Creek (Pamperin Park)
TP Concentration (mg/L)
0.300
0.250
0.200
0.150
0.100
0.050
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

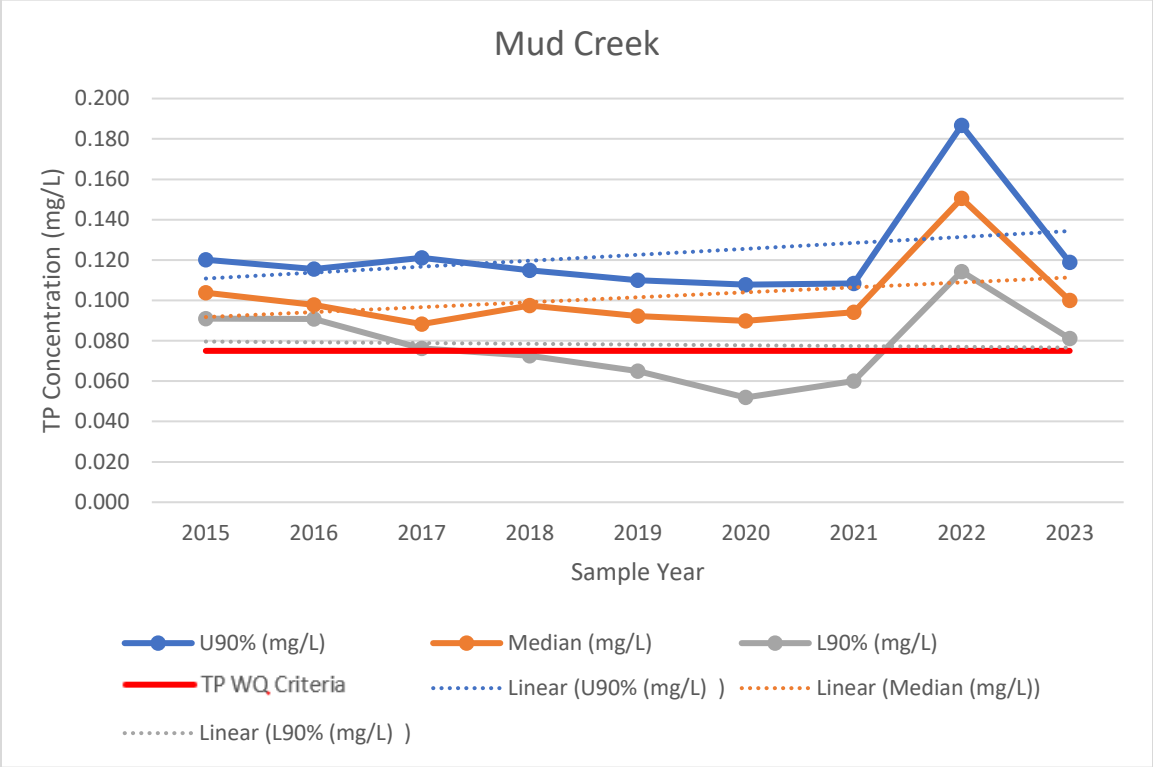

Dutchman Creek
TP Concentration (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

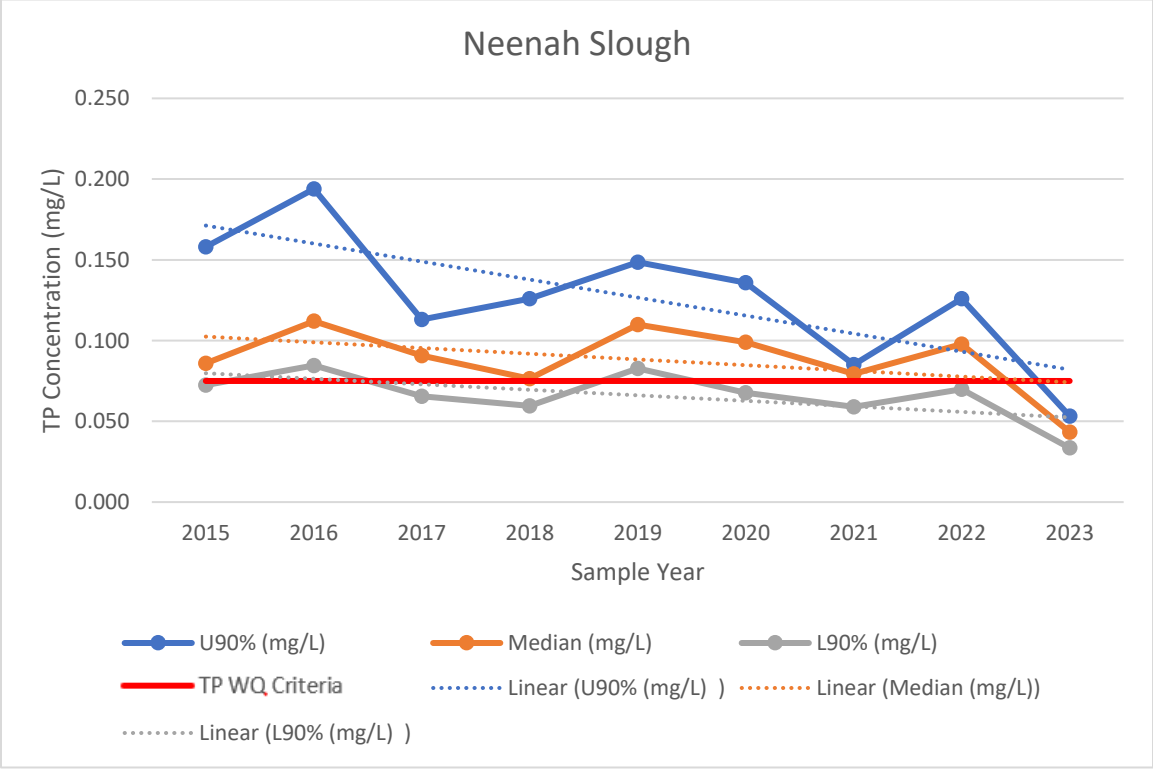

Middle East River at CTH G
TP Concentration (mg/L)
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

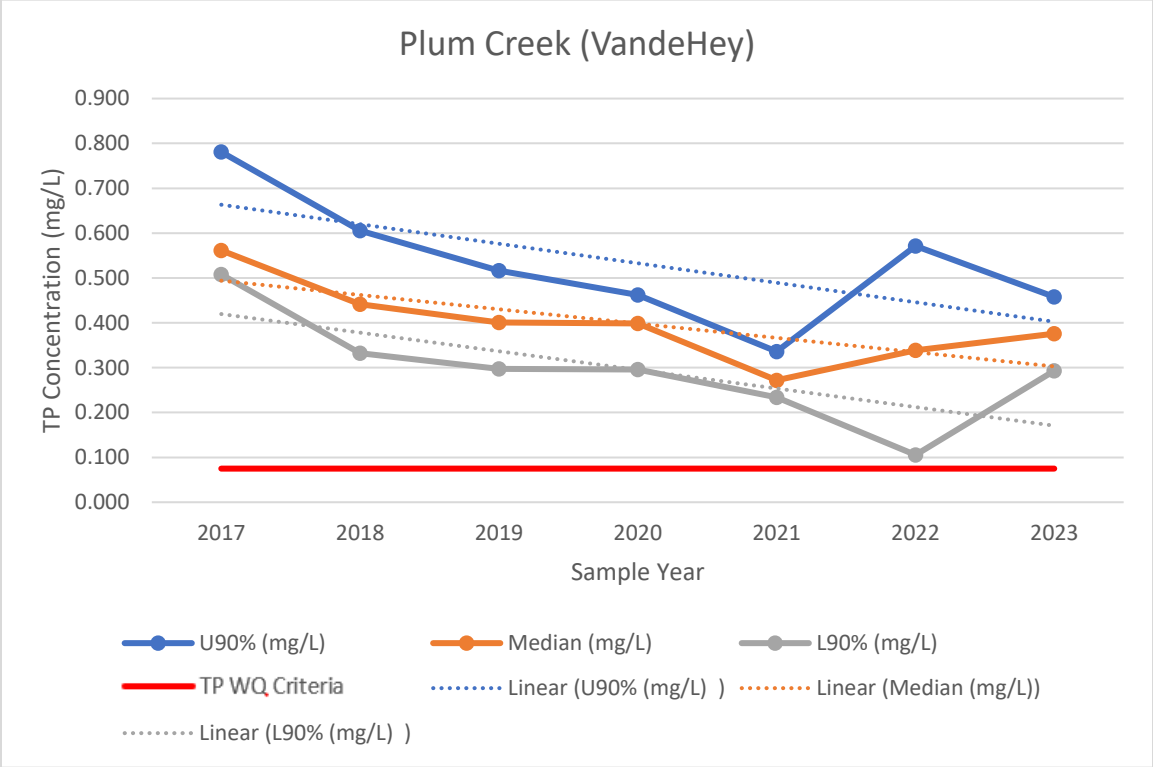

Lower East River at Harold Lewis Trail
TP Concentration (mg/L)
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

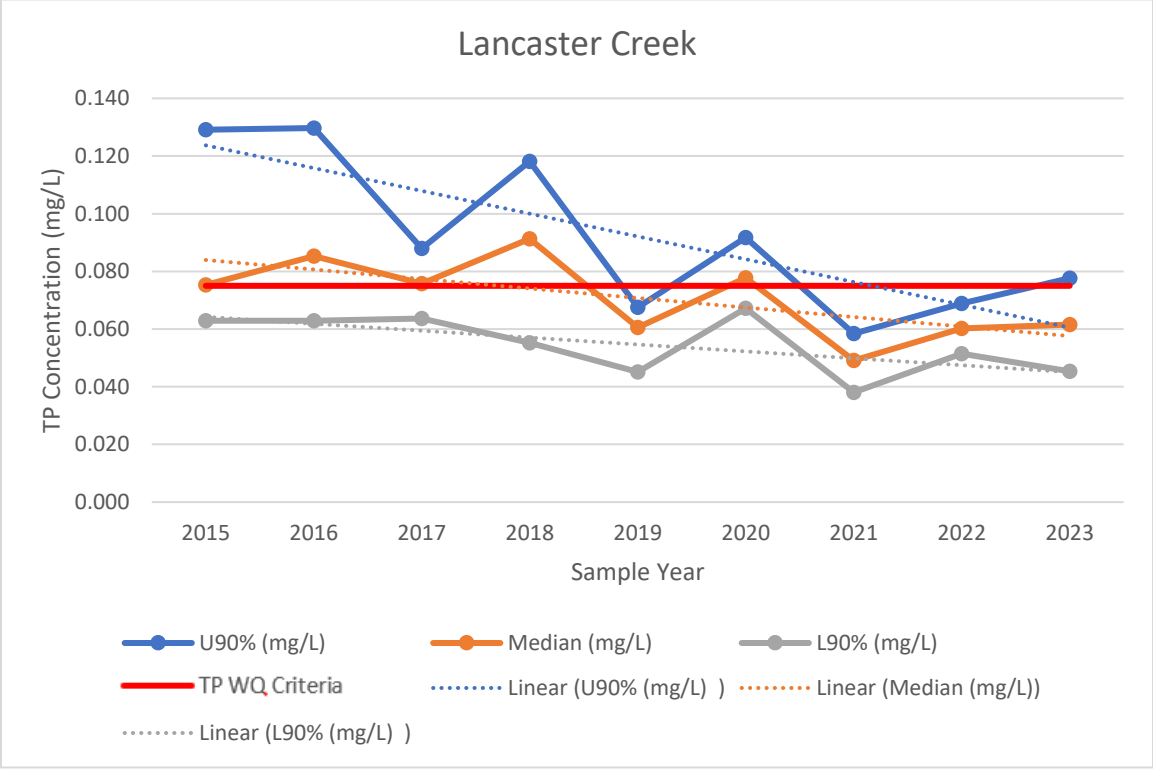

Garner's Creek
TP Concentration (mg/L)
0.300
0.250
0.200
0.150
0.100
0.050
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

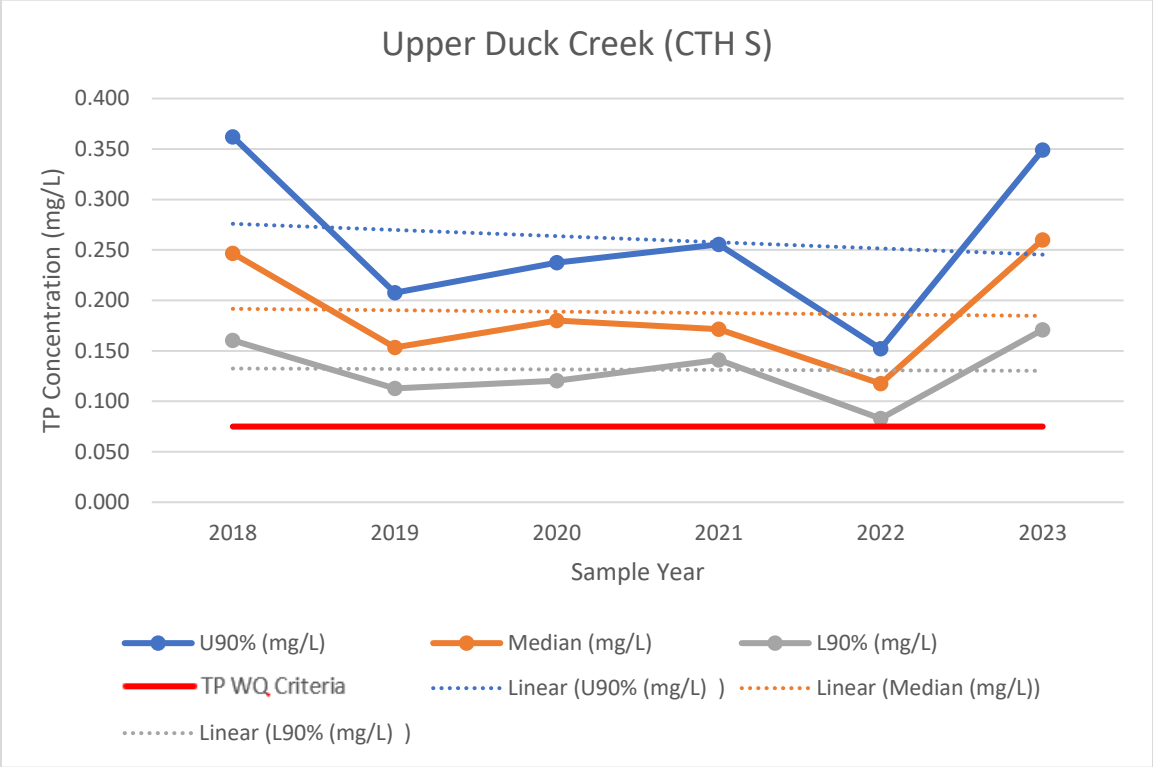

Kankapot Creek
TP Concentration (mg/L)
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

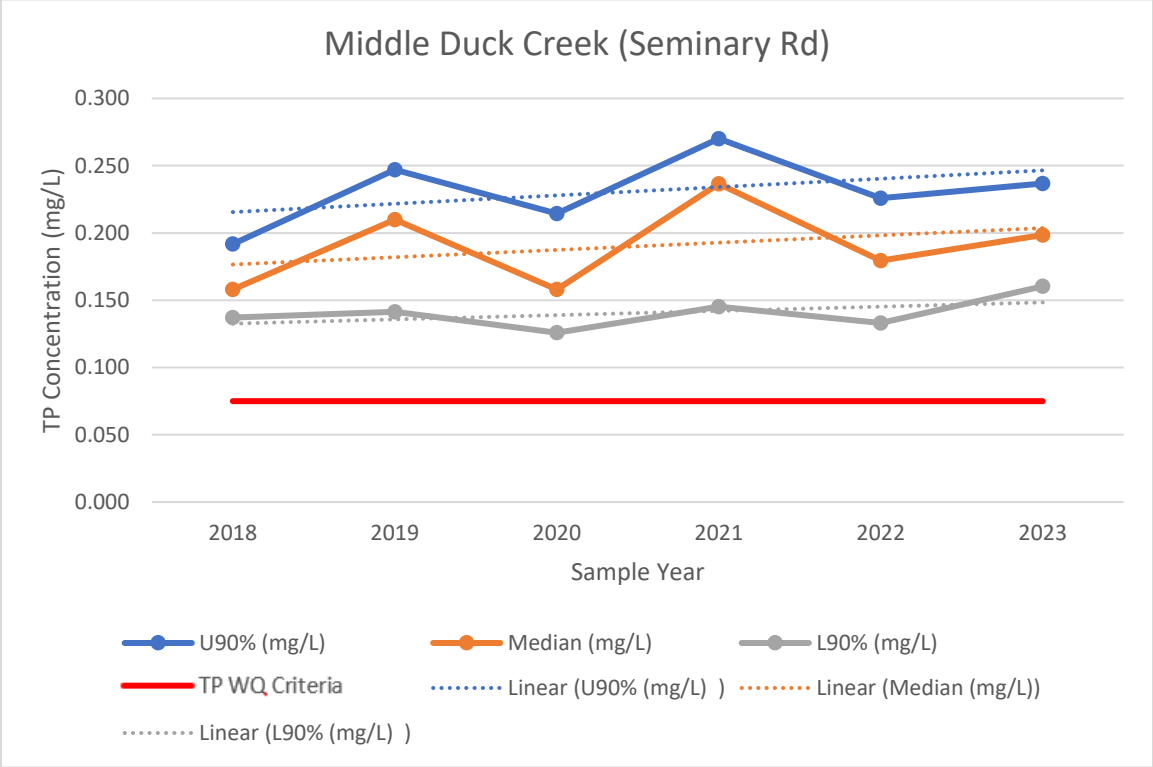

Mud Creek
TP Concentration (mg/L)
0.200
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

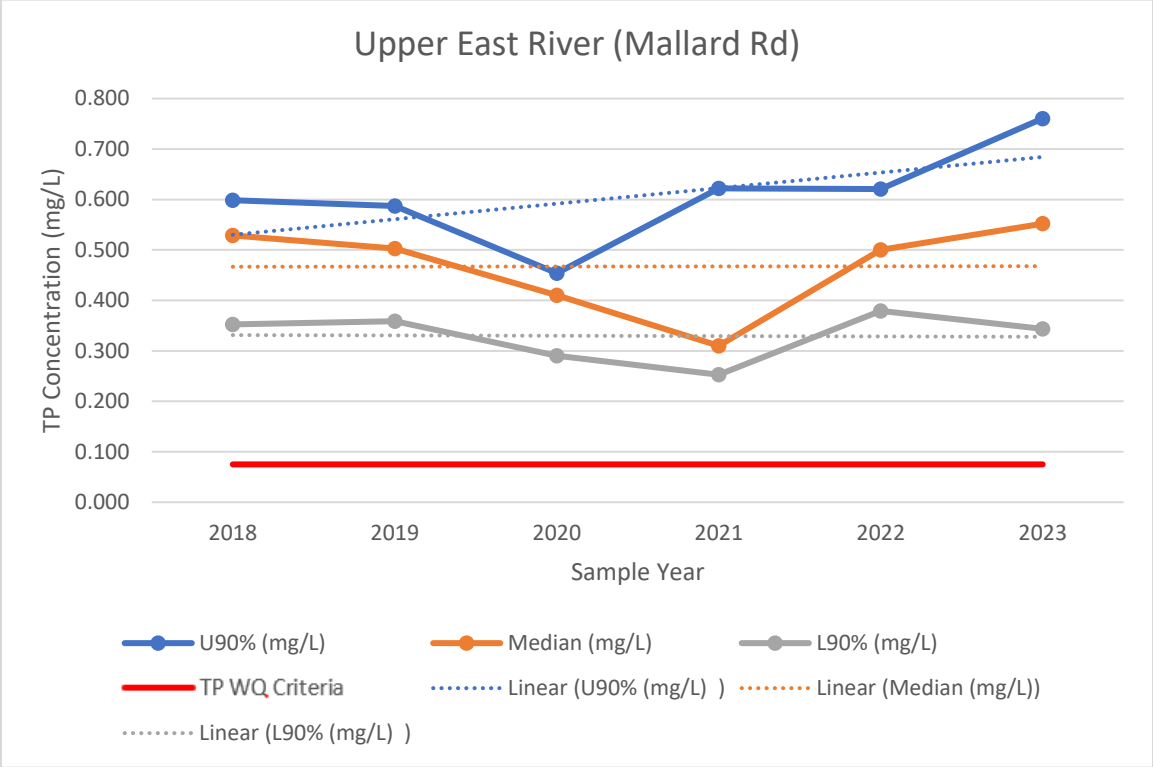

Neenah Slough
TP Concentration (mg/L)
0.250
0.200
0.150
0.100
0.050
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

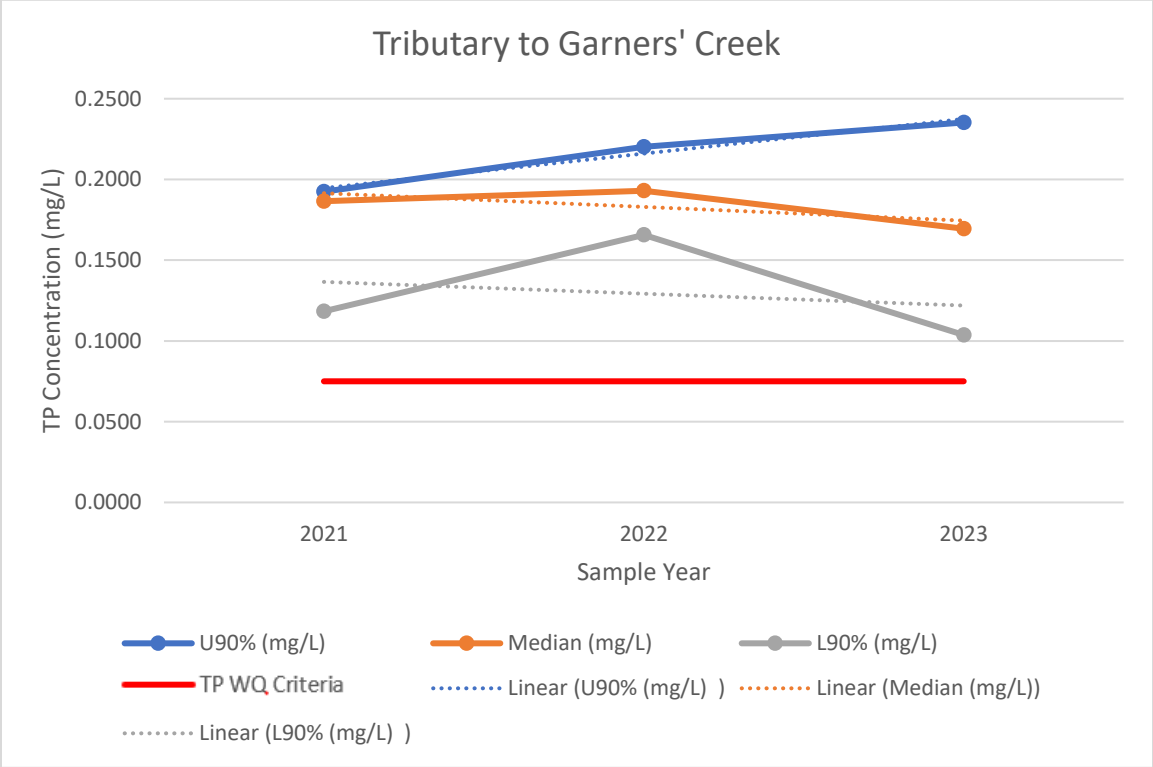

Plum Creek (VandeHey)
TP Concentration (mg/L)
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

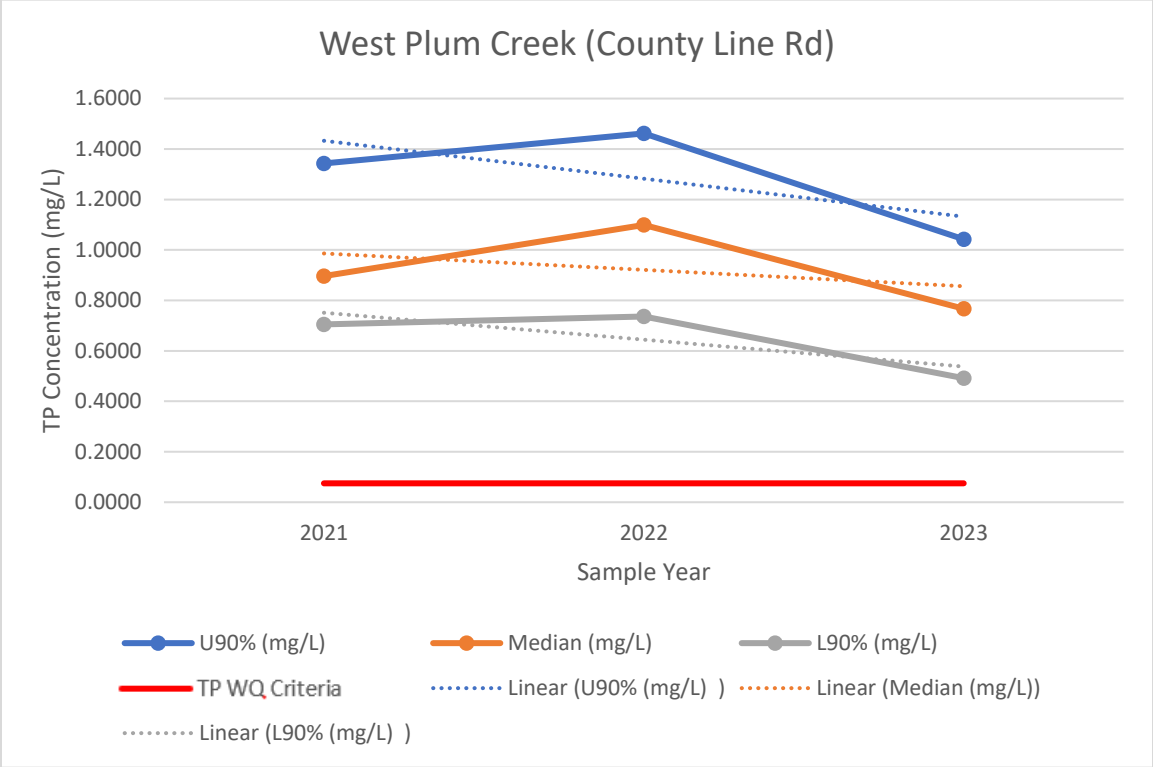

Lancaster Creek
TP Concentration (mg/L)
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
2015
2016
2017
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

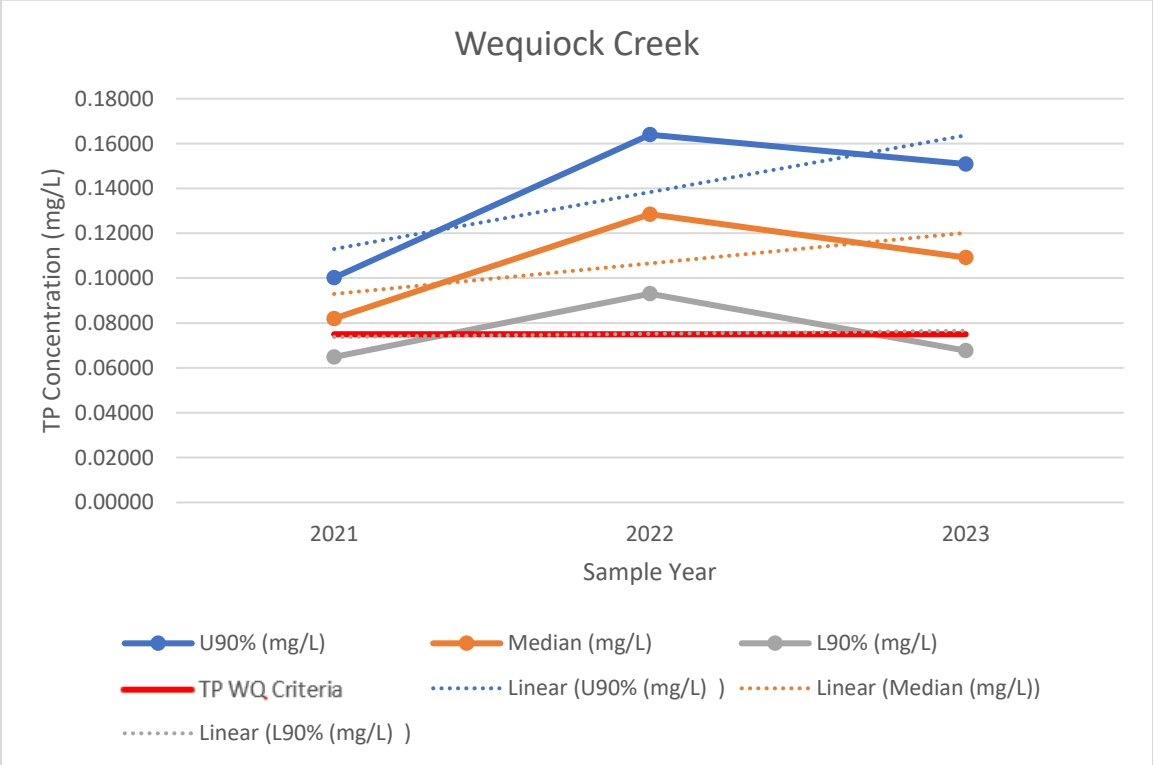

Upper Duck Creek (CTH S)
TP Concentration (mg/L)
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))


Middle Duck Creek (Seminary Rd)
TP Concentration (mg/L)
0.300
0.250
0.200
0.150
0.100
0.050
0.000
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))


Upper East River (Mallard Rd)
TP Concentration (mg/L)
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
2018
2019
2020
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))


Tributary to Garners' Creek
TP Concentration (mg/L)
0.2500
0.2000
0.1500
0.1000
0.0500
0.0000
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))


West Plum Creek (County Line Rd)
TP Concentration (mg/L)
1.6000
1.4000
1.2000
1.0000
0.8000
0.6000
0.4000
0.2000
0.0000
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))


Wequiock Creek
TP Concentration (mg/L)
0.18000
0.16000
0.14000
0.12000
0.10000
0.08000
0.06000
0.04000
0.02000
0.00000
2021
2022
2023
Sample Year
U90% (mg/L)
Median (mg/L)
L90% (mg/L)
TP WQ Criteria
Linear (U90% (mg/L))
Linear (Median (mg/L))
Linear (L90% (mg/L))

Lower Fox River Basin Volunteer Monitoring Program

2023 Annual Report

Appendix I: Percentage of Total Phosphorus Concentrations from Dissolved Reactive Phosphorus

DRP % of TP																			
	Apple Creek	Ashwaubenon Creek	Baird Creek	Bower Creek	Lower Duck Creek (Pamperin Park)	Dutchman's Creek	Middle East River (CTH G)	Lower East River (HLT)	Garner's Creek	Kankapot Creek	Mud Creek	Neenah Slough	Plum Creek (VandeHey)	Lancaster Creek	Upper Duck Creek (CTH S)	Middle Duck Creek (Seminary Rd)	Upper East River (Mallard Rd)	Trib to Garner's Creek	West Plum Creek (County Line)	Wequiock Creek
May-15	47%	NA	72%	63%	***46%***	15%	67%	-	***34%***	45%	***30%***	***30%***	-	***34%***	-	-	-	-	-	-
Jun-15	67%	51%	68%	52%	45%	76%	63%	-	***40%***	58%	***48%***		-	***50%***	-	-	-	-	-	-
Jul-15	76%	65%	57%	29%	53%	63%	79%	-	***7%***	67%	-	***42%***	-	***50%***	-	-	-	-	-	-
Aug-15	72%	57%	66%	51%	***60%***	-	76%	-	***19%***	63%	***50%***	***76%***	-	-	-	-	-	-	-	-
Sep-15	70%	49%	73%	68%	70%	-	75%	-	***5%***	62%	-	***55%***	-	-	-	-	-	-	-	-
Oct-15	81%	78%	77%	79%	***48%***	-	71%	-	***29%***	58%	-	***66%***	-	-	-	-	-	-	-	-
May-16	***37%***	57%	***47%***	***52%***	28%	***30%***	53%	***20%***	***40%***	46%	***33%***	***41%***	-	***22%***	-	-	-	-	-	-
Jun-16	55%	64%	56%	60%	56%	-	65%	55%	-	57%	***54%***	63%	-	***49%***	-	-	-	-	-	-
Jul-16	64%	74%	63%	76%	72%	-	83%	74%	***45%***	61%	65%	71%	-	***45%***	-	-	-	-	-	-
Aug-16	69%	40%	-	60%	47%	***39%***	58%	30%	***27%***	44%	***51%***	***61%***	15%	***15%***	-	-	-	-	-	-
Sep-16	36%	59%	61%	-	70%	-	59%	64%	***2%***	-	***33%***	***58%***	75%	***53%***	-	-	-	-	-	-
Oct-16	75%	72%	72%	-	77%	-	85%	44%	***35%***	58%	***65%***	68%	86%	***42%***	-	-	-	-	-	-
May-17	43%	61%	***70%***	***35%***	***36%***	***42%***	45%	***37%***	***27%***	58%	***42%***	***16%***	69%	***62%***	-	-	-	-	-	-
Jun-17	19%	72%	62%	72%	63%	73%	55%	47%	***36%***	53%	***65%***	63%	66%	***40%***	-	-	-	-	-	-
Jul-17	73%	74%	61%	70%	65%	77%	41%	58%	58%	58%	52%	***60%***	77%	***46%***	-	-	-	-	-	-
Aug-17	61%	***35%***	80%	58%	66%	***45%***	64%	**123%**	***49%***	64%	***48%***	***47%***	48%	***60%***	-	-	-	-	-	-
Sep-17	78%	80%	80%	65%	65%	78%	80%	***31%***	***56%***	76%	***57%***	***43%***	83%	***53%***	-	-	-	-	-	-
Oct-17	59%	80%	***74%***	***8%***	57%	81%	87%	***35%***	***59%***	76%	***58%***	***47%***	76%	***53%***	-	-	-	-	-	-

May-18	51%	71%	69%	48%	***44%***	***44%***	67%	60%	***24%***	70%	***28%***	63%	60%	***47%***	52%	***56%***	76%	-	-	-
Jun-18	68%	35%	55%	67%	66%	66%	77%	56%	***39%***	60%	***59%***	69%	70%	***56%***	35%	74%	34%	-	-	-
Jul-18	83%	77%	44%	69%	70%	70%	80%	***29%***	***45%***	73%	***67%***	***58%***	60%	64%	63%	78%	28%	-	-	-
Aug-18	-	28%	72%	53%	***58%***	***58%***	66%	***5%***	**63%**	66%	60%	***18%***	75%	***20%***	69%	79%	85%	-	-	-
Sep-18	***49%***	64%	86%	76%	81%	81%	85%	31%	***63%***	68%	***64%***	***62%***	84%	***49%***	66%	77%	74%	-	-	-
Oct-18	***49%***	90%	65%	62%	75%	75%	67%	46%	***62%***	59%	***47%***	***64%***	72%	***59%***	*65%*	79%	71%	-	-	-
May-19	47%	-	48%	54%	45%	68%	52%	***63%***	***12%***	67%	***48%***	***48%***	59%	***33%***	***55%***	***55%***	65%	-	-	-
Jun-19	47%	77%	67%	66%	48%	69%	59%	***46%***	***27%***	43%	***54%***	***54%***	76%	***75%***	***59%***	42%	69%	-	-	-
Jul-19	82%	65%	72%	64%	80%	72%	89%	58%	***45%***	70%	86%	86%	78%	***68%***	81%	73%	87%	-	-	-
Aug-19	47%	82%	54%	49%	57%	*49%*	74%	***13%***	***23%***	64%	***69%***	***69%***	68%	***50%***	77%	90%	78%	-	-	-
Sep-19	69%	70%	77%	70%	73%	81%	77%	**51%**	***42%***	66%	***62%***	62%	78%	***59%***	67%	74%	71%	-	-	-
Oct-19	71%	71%	62%	48%	73%	68%	61%	**60%**	***47%***	59%	***65%***	65%	55%	***82%***	55%	***78%***	61%	-	-	-
May-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jun-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jul-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug-20	36%	71%	68%	44%	***33%***	86%	68%	***20%***	***36%***	65%	***73%***	***50%***	59%	***66%***	61%	73%	78%	73%	78%	79%
Sep-20	***49%***	***71%***	***108%***	***30%***	***37%***	***59%***	81%	***11%***	***55%***	58%	***90%***	***48%***	59%	***40%***	61%	60%	77%	***69%***	72%	***113%***
Oct-20	***71%***	***79%***	***94%***	51%	84%	***62%***	80%	49%	***63%***	70%	**59%**	74%	75%	***37%***	77%	87%	87%	***43%***	87%	***114%***
May-21	-	-	-	-	71%	-	-	***28%***	***54%***	56%	***45%***	-	-	***50%***	56%	32%	-	84%	88%	-
Jun-21	51%	80%	74%	58%	39%	16%	63%	16%	54%	78%	76%	***64%***	79%	***47%***	76%	65%	91%	85%	89%	65%
Jul-21	47%	64%	62%	47%	67%	11%	74%	***45%***	***66%***	73%	69%	***64%***	69%	***67%***	67%	80%	70%	78%	81%	78%
Aug-21	77%	79%	61%	63%	63%	***10%***	80%	***38%***	53%	77%	***72%***	***54%***	66%	***74%***	70%	75%	85%	68%	82%	83%
Sep-21	***64%***	67%	55%	67%	***37%***	***9%***	76%	***20%***	***60%***	71%	***40%***	***29%***	66%	***70%***	61%	73%	84%	88%	90%	***71%***
Oct-21	***67%***	94%	73%	74%	***52%***	***8%***	67%	**115%**	***52%***	80%	***54%***	***28%***	77%	***72%***	73%	84%	90%	89%	84%	***73%***

May-22	-	68%	***59%***	***58%***	***59%***	***27%***	67%	***39%***	***18%***	***18%***	***36%***	***36%***	53%	-	***57%***	73%	82%	69%	60%	***17%***
Jun-22	72%	82%	61%	73%	81%	68%	76%	40%	***30%***	60%	68%	76%	73%	***55%***	***63%***	82%	66%	***26%***	84%	***63%***
Jul-22	81%	83%	68%	56%	72%	-	89%	14%	56%	73%	79%	79%	60%	***70%***	80%	87%	91%	87%	89%	75%
Aug-22	39%	72%	73%	60%	59%	-	80%	***34%***	***40%***	64%	68%	***64%***	***34%***	***64%***	72%	79%	94%	60%	61%	71%
Sep-22	-	79%	69%	60%	***65%***	74%	75%	32%	***61%***	68%	***45%***	***57%***	71%	-	69%	77%	84%	43%	-	67%
Oct-22	***61%***	***72%***	***61%***	59%	***33%***	-	75%	***66%***	***49%***	49%	***60%***	***49%***	66%	***17%***	***71%***	***61%***	87%	80%	82%	***45%***
May-23	***41%***	74%	62%	***50%***	***25%***	69%	63%	***43%***	***0%***	***51%***	***39%***	***28%***	***47%***	***41%***	***37%***	***53%***	78%	***57%***	54%	***52%***
Jun-23	74%	81%	***60%***	70%	68%	72%	70%	***11%***	***51%***	57%	***57%***	***45%***	63%	***44%***	***60%***	77%	84%	82%	81%	69%
Jul-23	84%	63%	54%	72%	***58%***	77%	80%	23%	***32%***	63%	***57%***	***26%***	53%	***56%***	71%	84%	112%	88%	88%	-
Aug-23	53%	54%	67%	63%	59%	79%	80%	27%	***40%***	49%	68%	***61%***	79%	***61%***	76%	79%	88%	78%	91%	64%
Sep-23	55%	47%	***57%***	59%	***29%***	61%	66%	***11%***	***42%***	64%	***44%***	***21%***	61%	***63%***	60%	75%	82%	81%	82%	***68%***
Oct-23	66%	70%	***67%***	***49%***	60%	***63%***	82%	***23%***	***24%***	***40%***	***25%***	***53%***	70%	***60%***	58%	73%	84%	67%	70%	***62%***

Red percentages indicate the DRP concentration exceeded the TP concentration (DRP >100%)

Italicized and bold percentages indicate the DRP sample concentration was <u>below</u> the 0.075 mg/L criteria

Appendix J: Duplicate Sample Data

Monitoring Site	Date	Parameter	Duplicate Sample	Regular Sample	Absolute Difference		Relative Percent Difference
Duck Creek-Pamperin Park	8/14/2018	PHOSPHATE ORTHO DISS	0.0301	0.0302	0.0001	MG/L	0.33
	8/14/2018	PHOSPHORUS TOTAL	0.103	0.0975	0.0055	MG/L	5.49
	8/14/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	18.8	11.8	7	MG/L	45.75
Neenah Slough #2 (100ft S of Adams St)	9/25/2018	PHOSPHATE ORTHO DISS	0.04944	0.0548	0.00536	MG/L	10.28
	9/25/2018	PHOSPHORUS TOTAL	0.078	0.088	0.01	MG/L	12.05
	9/25/2018	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	31.4	9.8	21.6	MG/L	104.85
Apple Creek - Rosin Rd	9/15/2020	PHOSPHATE ORTHO DISS	0.063	0.0623	0.0007	MG/L	1.12
	9/15/2020	PHOSPHORUS TOTAL	0.125	0.126	0.001	MG/L	0.80
	9/15/2020	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	22.3	NA	NA	MG/L	
	9/15/2020	NITROGEN TOTAL	1.43	1.44	0.01	MG/L	0.70
West Plum Creek - DS of County Line Rd	9/14/2020	PHOSPHORUS TOTAL	1.7	1.71	0.01	MG/L	0.59
	9/14/2020	PHOSPHATE ORTHO DISS	1.21	1.23	0.02	MG/L	1.64
	9/14/2020	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	33.8	NA	NA	MG/L	
	9/14/2020	NITROGEN TOTAL	2.92	2.9	0.02	MG/L	0.69
Upper East River - Mallard Rd	6/16/2021	PHOSPHORUS TOTAL	1.67	1.68	0.01	MG/L	0.60
	6/16/2021	PHOSPHATE ORTHO DISS	1.49	1.53	0.04	MG/L	2.65
	6/16/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	33	44.8	11.8	MG/L	30.33
	6/16/2021	NITROGEN TOTAL	2.59	2.57	0.02	MG/L	0.78
Trib to Garner's	6/23/2021	PHOSPHORUS TOTAL	0.311	0.306	0.005	MG/L	1.62
	6/23/2021	PHOSPHATE ORTHO DISS	0.262	0.261	0.001	MG/L	0.38
	6/23/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	6.2	4.8	1.4	MG/L	25.45
	6/23/2021	NITROGEN TOTAL	0.993	0.968	0.025	MG/L	2.55
Duck Creek-Pamperin Park	6/28/2021	PHOSPHORUS TOTAL	0.367	0.343	0.024	MG/L	6.76
	6/28/2021	PHOSPHATE ORTHO DISS	0.134	0.134	0	MG/L	0.00
	6/28/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	108	101	7	MG/L	6.70
	6/28/2021	NITROGEN TOTAL	10.6	10.6	0	MG/L	0.00
Baird Creek at Preble WI	7/6/2021	PHOSPHORUS TOTAL	0.17	0.17	0	MG/L	0.00
	7/6/2021	PHOSPHATE ORTHO DISS	0.107	0.106	0.001	MG/L	0.94
	7/6/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	13.4	12.6	0.8	MG/L	6.15
	7/6/2021	NITROGEN TOTAL	1.65	1.61	0.04	MG/L	2.45
Wequiock Creek - Nicolet Rd/CTY A	7/19/2021	PHOSPHORUS TOTAL	0.113	0.114	0.001	MG/L	0.88
	7/19/2021	PHOSPHATE ORTHO DISS	0.0885	0.0892	0.0007	MG/L	0.79
	7/19/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	10	16.6	6.6	MG/L	49.62
	7/19/2021	NITROGEN TOTAL	4.26	4.29	0.03	MG/L	0.70
Ashwaubenon Creek - Grant Street	7/21/2021	PHOSPHORUS TOTAL	0.265	0.264	0.001	MG/L	0.38
	7/21/2021	PHOSPHATE ORTHO DISS	0.165	0.17	0.005	MG/L	2.99
	7/21/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	34.6	36.8	2.2	MG/L	6.16
	7/21/2021	NITROGEN TOTAL	1.93	1.93	0	MG/L	0.00
Plum Creek at VandeHey Farm crossing	8/24/2021	PHOSPHORUS TOTAL	0.293	0.297	0.004	MG/L	1.36
	8/24/2021	PHOSPHATE ORTHO DISS	0.195	0.196	0.001	MG/L	0.51
	8/24/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	22.6	27.6	5	MG/L	19.92
	8/24/2021	NITROGEN TOTAL	1.49	1.51	0.02	MG/L	1.33

Unnamed Trib. (410000)-Lakeview Dr.	8/25/2021	PHOSPHORUS TOTAL	0.0445	0.0478	0.0033	MG/L	7.15
	8/25/2021	PHOSPHATE ORTHO DISS	0.0342	0.0354	0.0012	MG/L	3.45
	8/25/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	4.8	5.8	1	MG/L	18.87
	8/25/2021	NITROGEN TOTAL	1.95	2.04	0.09	MG/L	4.51
Mud Creek - County Highway BB	9/16/2021	PHOSPHORUS TOTAL	0.0329	0.0331	0.0002	MG/L	0.61
	9/16/2021	PHOSPHATE ORTHO DISS	0.0132	0.0134	0.0002	MG/L	1.50
	9/16/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	2	2.4	0.4	MG/L	18.18
	9/16/2021	NITROGEN TOTAL	0.712	0.706	0.006	MG/L	0.85
East River at Harold Lewis Trail off Main Street	9/27/2021	PHOSPHATE ORTHO DISS	0.0273	0.0249	0.0024	MG/L	9.20
	9/27/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	28.8	23.2	5.6	MG/L	21.54
	9/27/2021	NITROGEN TOTAL	1.73	1.47	0.26	MG/L	16.25
	9/27/2021	PHOSPHORUS TOTAL	0.178	0.125	0.053	MG/L	34.98
Upper Duck Creek - CTH S	10/13/2021	PHOSPHORUS TOTAL	0.171	0.172	0.001	MG/L	0.58
	10/13/2021	PHOSPHATE ORTHO DISS	0.126	0.126	0	MG/L	0.00
	10/13/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	2.4	2.8	0.4	MG/L	15.38
	10/13/2021	NITROGEN TOTAL	3.9	3.46	0.44	MG/L	11.96
Bower Creek (1) 50m Upstream Of Hwy GV	8/24/2021	PHOSPHORUS TOTAL	0.243	0.23	0.013	MG/L	5.50
	8/24/2021	PHOSPHATE ORTHO DISS	0.147	0.145	0.002	MG/L	1.37
	8/24/2021	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	38.6	34	4.6	MG/L	12.67
	8/24/2021	NITROGEN TOTAL	1.36	1.34	0.02	MG/L	1.48
East River - HWY G	9/28/2022	PHOSPHORUS TOTAL	0.272	0.272	0	MG/L	0.00
	9/28/2022	PHOSPHATE ORTHO DISS	0.203	0.205	-0.002	MG/L	-0.98
	9/28/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	15	10.4	4.6	MG/L	36.22
	9/28/2022	NITROGEN TOTAL	0.899	0.867	0.032	MG/L	3.62
Baird Creek at Preble WI	9/24/2022	PHOSPHORUS TOTAL	0.131	0.131	0	MG/L	0.00
	9/24/2022	PHOSPHATE ORTHO DISS	0.0907	0.0899	0.0008	MG/L	0.89
	9/24/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	2	0	2	MG/L	200.00
	9/24/2022	NITROGEN TOTAL	1.26	1.26	0	MG/L	0.00
Kankapot Creek - CTH Z Dodge St 100 ft US of Bridge	9/14/2022	PHOSPHORUS TOTAL	0.544	0.547	-0.003	MG/L	-0.55
	9/14/2022	PHOSPHATE ORTHO DISS	0.379	0.373	0.006	MG/L	1.60
	9/14/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	51	52.4	-1.4	MG/L	-2.71
	9/14/2022	NITROGEN TOTAL	4.01	4	0.01	MG/L	0.25
Mud Creek - County Highway BB	8/16/2022	PHOSPHORUS TOTAL	0.15	0.152	-0.002	MG/L	-1.32
	8/16/2022	PHOSPHATE ORTHO DISS	0.106	0.104	0.002	MG/L	1.90
	8/16/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	0	0	0	MG/L	
	8/16/2022	NITROGEN TOTAL	1.19	1.18	0.01	MG/L	0.84
Garner's Creek DS of CTH Z	8/15/2022	PHOSPHORUS TOTAL	0.117	0.12	-0.003	MG/L	-2.53
	8/15/2022	PHOSPHATE ORTHO DISS	0.0484	0.0485	-0.0001	MG/L	-0.21
	8/15/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	21.6	23.1	-1.5	MG/L	-6.71
	8/15/2022	NITROGEN TOTAL	1.23	1.22	0.01	MG/L	0.82
Tributary to Plum Creek - Downstream of County Line Road	8/7/2022	PHOSPHORUS TOTAL	1.47	1.48	-0.01	MG/L	-0.68
	8/7/2022	PHOSPHATE ORTHO DISS	0.925	0.905	0.02	MG/L	2.19
	8/7/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	89	87.5	1.5	MG/L	1.70
	8/7/2022	NITROGEN TOTAL	5.08	5.1	-0.02	MG/L	-0.39

Duck Creek at Seminary Rd	7/27/2022	PHOSPHORUS TOTAL		0.268	0.001	MG/L	0.37
	7/27/2022	PHOSPHATE ORTHO DISS	0.235	0.234	0.001	MG/L	0.43
	7/27/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	4.6	4.2	0.4	MG/L	9.09
	7/27/2022	NITROGEN TOTAL	1.82	1.82	0	MG/L	0.00
Duck Creek - Pamperin Park	7/27/2022	PHOSPHORUS TOTAL	0.227	0.223	0.004	MG/L	1.78
	7/27/2022	PHOSPHATE ORTHO DISS	0.167	0.161	0.006	MG/L	3.66
	7/27/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	18	19	-1	MG/L	-5.41
	7/27/2022	NITROGEN TOTAL	1.08	1.07	0.01	MG/L	0.93
Apple Creek - Rosin Rd	7/5/2022	PHOSPHORUS TOTAL	0.381	0.376	0.005	MG/L	1.32
	7/5/2022	PHOSPHATE ORTHO DISS	0.304	0.306	-0.002	MG/L	-0.66
	7/5/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	14	16.9	-2.9	MG/L	-18.77
	7/5/2022	NITROGEN TOTAL	1.9	1.89	0.01	MG/L	0.53
Dutchman Creek - Oneida Street	6/30/2022	PHOSPHORUS TOTAL	0.172	0.173	-0.001	MG/L	-0.58
	6/30/2022	PHOSPHATE ORTHO DISS	0.123	0.118	0.005	MG/L	4.15
	6/30/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	2.8	2.8	0	MG/L	0.00
	6/30/2022	NITROGEN TOTAL	0.924	0.92	0.004	MG/L	0.43
Bower Creek (1) 50m Upstream Of Hwy GV	6/26/2022	PHOSPHORUS TOTAL	0.421	0.37	0.051	MG/L	12.90
	6/26/2022	PHOSPHATE ORTHO DISS	0.272	0.271	0.001	MG/L	0.37
	6/26/2022	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	21	19.8	1.2	MG/L	5.88
	6/26/2022	NITROGEN TOTAL	1.23	1.19	0.04	MG/L	3.31
Plum Creek at VandeHey Farm crossing	6/19/2023	PHOSPHORUS TOTAL	0.185	0.184	0.001	MG/L	0.54
	6/19/2023	PHOSPHATE ORTHO DISS	0.119	0.116	0.003	MG/L	2.55
	6/19/2023	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	13.3	11.7	1.6	MG/L	12.80
	6/19/2023	NITROGEN TOTAL	1.07	1.07	0	MG/L	0.00
Ashwaubenon Creek - Grant Street	8/21/2023	PHOSPHORUS TOTAL	0.215	0.222	0.007	MG/L	3.20
	8/21/2023	PHOSPHATE ORTHO DISS	0.118	0.119	0.001	MG/L	0.84
	8/21/2023	RESIDUE TOTAL NFLT (TOTAL SUSPENDED SOLIDS)	16.8	16.4	0.4	MG/L	2.41
	8/21/2023	NITROGEN TOTAL	1.02	1.02	0	MG/L	0.00

	Level of Detection (LOD) mg/L	Level of Quantification (LOQ) mg/L
TP	0.00900	0.0300
DRP	0.00400	0.0130
TSS	2.0	2.0
TN	0.058	0.192

Highlighted cells indicate variance (relative percent difference >30%) between regular and duplicate sample results

Lower Fox River Basin Volunteer Monitoring Program
2023 Annual Report
Appendix K: Stream Flow and Transparency Data

Stream Flow (CFS)										
Monitoring Site	Month	2015	2016	2017	2018	2019	2020	2021	2022	2023
Apple Creek	May	-	-	40.1	-	-	-	-	-	-
	June	-	-	55.7	-	-	-	-	-	-
	July	-	-	-	-	-	-	-	-	-
	August	-	-	-	-	-	-	-	-	-
	September	-	-	6.2	-	-	-	-	-	-
	October	-	-	-	-	-	-	-	-	-
Ashwaubenon Creek	May	-	0.818	-	-	-	-	-	42.3	3.5
	June	-	-	-	-	-	-	NA	2.2	100
	July	-	14.6	-	-	27.1	-	13	0	0.9
	August	-	0	46.4	0	0	-	1.2	0.9	0
	September	-	16.8	13.9	0	-	-	0.61	0	0
	October	-	54	36.6	0	-	0	-	0	0
Baird Creek	May	-	2.5	11.2	4.94	-	-	-	60.2	4.9
	June	-	0.56	12.6	74.69	18.44	-	20.2	29.6	1.5
	July	-	-	10	6.1	2.57	-	-	-	217.6
	August	-	-	4.5	47.23	38.25	1.02	-	16.8	2.2
	September	-	-	-	59.9	-	18.4	59.9	67.13	0.01
	October	-	4.5	4.1	-	-	-	56.1	0.19	1.7
Bower Creek	May	-	1.178	8.6	19.2	-	-	-	-	-
	June	-	1	2.2	-	84.47	-	-	-	-
	July	-	-	2.3	1.3	-	-	-	-	-
	August	-	-	3.5	0	-	-	-	-	-
	September	-	-		12.8	-	-	-	-	-
	October	-	-	4.2	23.5	-	-	-	-	-
Lower Duck Creek (Pamperin Park)	May	-	10.95	49.5	74.1	-	-	36.1	31.7	306
	June	-	14.9	42.2	510.3	54.7	-	316.8	16.2	77.7
	July	-	7.1	40.5	16.5	97.2	-	31.7	20.4	13.7

	August	-	3.8	52.9	7.2	102	20.3	431.2	34.7	12.1
	September	-	27.2	40.1	49.3	240	10.2	15.2	32.2	10
	October	-	34.1	98.3	-	154.9	82.1	19.7	16.2	32.2
Dutchman Creek	May	-	7.713	38.54	19.5	-	-	-	-	-
	June	-	-	-	-	-	-	-	-	-
	July	-	-	7.1	1.3	-	-	-	-	-
	August	-	-	-	1.3	-	-	-	-	-
	September	-	-	-		-	-	-	-	-
	October	-	-	-	0.5	-	-	-	-	-
Middle East River (CTH G)	May	-	10.7	26.3	6.5	0	-	-	-	-
	June	-	-	33.1	6	-	-	-	-	-
	July	-	-	31	-	-	-	-	-	-
	August	-	-	42.4	16.8	-	-	-	-	-
	September	-	-	9.5	8	-	-	-	-	-
	October	-	-	4.9	-	-	-	-	-	-
Lower East River (HLT)	May	-	-	-	-	-	-	-	-	-
	June	-	-	-	-	-	-	-	-	-
	July	-	-	-	-	-	-	-	-	-
	August	-	-	-	-	-	-	-	-	-
	September	-	-	-	-	-	-	-	-	-
	October	-	-	-	-	-	-	-	-	-
Garner's Creek	May	-	8.24	8.24	8.35	16.97	-	-	-	-
	June	3.52	13.85	13.85	14.6	9.55	-	7.3	-	-
	July	-	2.31	2.31	1.83	5.74	-	4.02	-	-
	August	-	3.77	0	1.93	3.79	-	27	-	-
	September	-	5.3	-	6.83	26.66	-	0	-	-
	October	-	0	3.22	8.08	25.53	-	-	-	-
Kankapot Creek	May	-	0.0015	-	-	25.6	-	0.559	1.127	-
	June	-	10.6	16.6	-	0.8	-	0.125	1.9	-
	July	-	0	2.1	0	139	-	0.497	0.36	-

	August	-	0.17	1.5	0	0.17	-	0.628	0.95	-
	September	-	-	0.269	0	-	0.097	-	0.59	-
	October	-	0.3	1.868	0	1.33	1	0.26	0.118	-
Mud Creek	May	-	12.9	14.7	3.2	0	-	0.8	1.3	-
	June	-	-	7.4	6.4	-	-	1.2	-	-
	July	-	-	24.7	2.6	-	-	7.2	-	-
	August	-	3740	24.6	0.6	-	1.18	2.6	-	-
	September	-	223.51	0.2	7.5	-	0.9	9.6	-	-
	October	-	4.2	45.7	-	-	18.7	6.9	-	-
Neenah Slough	May	-	12.4	-	4.59	0	-	-	-	-
	June	-	-	-	20.87	-	-	-	-	-
	July	-	15.41	7	5.3	-	-	-	-	-
	August	-	13.2	9.7	-	-	-	-	-	-
	September	-		26	-	-	0	-	-	-
	October	-	7.7	13.4	-	-	-	-	-	-
Plum Creek (VandeHey)	May	-	-	3.7	2.3	13.2	-	-	-	-
	June	-	-	16	36.3	4.9	-	1.2	-	-
	July	-	-	4.7	3.3	3.3	-	10	-	-
	August	-	2.6	0.9	0.8	7	0.7	6.73	-	-
	September	-	2.7	-	9.1	-	0.8	2	-	-
	October	-	2.6	1.3	7	66.3	13	1.9	-	-
Lancaster Creek	May	-	-	24.9	4.9	-	-	-	-	-
	June	-	0	-	6.4	-	-	-	-	-
	July	-	0	8.64	2.49	-	-	-	-	-
	August	-	0	8.99		-	0	-	-	-
	September	-	0	2.98	23.4	-	-	-	-	-
	October	-	0	5.07	6.12	-	-	-	-	-
Upper Duck Creek (CTH S)	May	-	-	-	-	55.6	-	-	6.3	4.1
	June	-	-	-	-	9.2	-	-	-	0
	July	-	-	-	-	28.7	-	30	0	1.5

	August	-	-	-	-	2.9	-	0.7	2.2	0
	September	-	-	-	-	-	0	36.2	1.9	0
	October	-	-	-	-	-	0	10.3	7.5	-
Middle Duck Creek (Seminary Rd)	May	-	-	-	-	-	-	16.4	22.4	18.7
	June	-	-	-	-	232	-	191.5	13.1	35.1
	July	-	-	-	-	46	-	20.8	-	8.3
	August	-	-	-	-	20.2	6.1	229.6	24.3	8.2
	September	-	-	-	-	127.3	3.9	9.4	15.1	8.1
	October	-	-	-	-	63.7	34.7	12.3	12.1	21.1
Upper East River (Mallard Rd)	May	-	-	-	5.6	32	-	-	-	-
	June	-	-	-	49.6	8.7	-	-	-	-
	July	-	-	-	3.4	6.2	-	15	-	-
	August	-	-	-	0.7	15.7	1.4	4.65	-	-
	September	-	-	-	23.5	-	1.5	3.9	-	-
	October	-	-	-	13.7	-	23.5	5.1	-	-
Trib to Garner's Creek	May	-	-	-	-	-	-	-	-	-
	June	-	-	-	-	-	-	1.2	-	-
	July	-	-	-	-	-	-	-	-	-
	August	-	-	-	-	-	-	-	-	-
	September	-	-	-	-	-	-	-	-	-
	October	-	-	-	-	-	-	-	-	-
West Plum Creek (County Line)	May	-	-	-	-	-	-	3.1075	-	-
	June	-	-	-	-	-	-	0	-	-
	July	-	-	-	-	-	-	0.978	-	-
	August	-	-	-	-	-	0	0.732	-	-
	September	-	-	-	-	-	-	-	-	-
	October	-	-	-	-	-	-	3.34	-	-
Wequiock Creek	May	-	-	-	-	-	-	-	-	12.5
	June	-	-	-	-	-	-	8.21	-	-
	July	-	-	-	-	-	-	8.2	-	-

	August	-	-	-	-	-	-	7.68	-	-
	September	-	-	-	-	-	0.192	-	-	-
	October	-	-	-	-	-	0.05	11.3	-	-

Transparency (CM)										
Monitoring Site	Month	2015	2016	2017	2018	2019	2020	2021	2022	2023
Apple Creek	May	-	-	10.48	41.4	-	-	-	120	120
	June	-	-	5	59	12	-	-	60	120
	July	-	-	5.11	46.5	-	-	-	46	120
	August	-	-	-	-	-	25	-	4	34
	September	38.5	-	7.4	0.5	32	26	81	16.5	35
	October	-	-	-	70	-	-	-	109	83
Ashwaubenon Creek	May	-	18	-	42.3	-	-	-	49.93	46.8
	June	-	31.1	-	17.33	-	-	18	23.9	24.5
	July	-	40.4	-	12.33	27.3	-	16	21.73	24
	August	-	15.2	15.5	32	25.7	28.49	31	29.53	47.13
	September	17.9	11.5	68	21	9.2	51.4	39.27	77.9	48.8
	October	-	17.6	21	35	13	101	115	110	92.7
Baird Creek	May	-	120	110.3	79.2	17	-	-	105	120
	June	-	55.2	23.5	54	-	-	60	97	120
	July	-	-	18.35	10	36	-	40	-	66
	August	-	-		76	7.5	120	12	63	53
	September	82.5	-	102.35	55	39.5	115	-	120	51
	October	-	81.2	120	26	29.3	20.32	120	120	120
Bower Creek	May	-	97	84.7	62	15	-	-	60	83
	June	-	34.6	-	21	55	-	35	36	83
	July	-	-	10.7	64	21	-	10	-	45
	August	-	-	80	78	15	37	33	39	58
	September	36.2	-	56.15	38	17	27	42	-	67

	October	-	-	56	113	58	-	102	-	50
Lower Duck Creek (Pamperin Park)	May	-	55	99.1	105	120	-	85.1	100	91.7
	June	-	21.7	45.4	32.5	15.1	-	27.2	100	41.3
	July	-	28.3	25.1	46.3	31	-	92	40.1	80.1
	August	-	31.5	55.25	52.5	44.85	25.1	23.5	-	60.2
	September	-	55	52.5	93	29	83.5	100	92.6	66.1
	October	-	78	22.7	-	95.5	68.5	100	97.2	100
Dutchman Creek	May	-	72	55.1	83	17	-	-	85	15
	June	-	-	47	14	37	-	83	120	120
	July	-	-	58	45	24	-	19	-	99
	August	-	55.01	35	62	26	35	61.5	-	81
	September	-	-	105	62.8	29	108.5	50	88	32
	October	-	-	2	120	34	-	103	-	115
Middle East River (CTH G)	May	-	23	16	16	29	-	-	28	26
	June	-	-	9.6	24	12	-	18	-	28
	July	-	-	14.5	15	36.5	-	33	31	45
	August	-	-	9.55	27	28	39	26	28	45
	September	-	1.5	44.45	16.1	-	50.5	55	43	36
	October	-			74	21	27	85	70	65
Lower East River (HLT)	May	-	40	50	32	0.31	-	34	29	38
	June	-	-	30	15	0.5	-	0.18	30	45
	July	-	-	16	21	32		7	11	24
	August	-	-	29	-	11	0.25	24	29	7
	September	-	-	32	4	6	-	20	15	-
	October	-	-	29	14	33	15	0.41	40	28
Garner's Creek	May	-	23	23	45	53.3	-	-	-	-
	June	22	9	9	16	13	-	67	-	-
	July	-	25	25	26.5	21.5	-	52	-	-
	August	-	13	19	29.5	22.25	41	11.5	-	-
	September	-	22.5	35	63.5	20.5	34	114	-	-

	October	-	32	80	120	43	96	120	-	-
Kankapot Creek	May	-	56	16.2	-	78.2	-	44	78	78
	June	-	10.23	7.46	28	22	-	24.2	25	21.8
	July	-	5.3	12	54	27	-	24	34.6	21.4
	August	-	18	44	9	26	55	15.08	12	13.2
	September	-	-	7.5	0.09	13.4	32	43.1	15	31
	October	-	44.1	42.5	90	30.2	40	45	58	29.5
Mud Creek	May	-	120	100.2	84.1	67	-	45	120	120
	June	-	53	114.2	93.1	81.2	-	120	120	120
	July	-	120	76	101.5	-	-	120	120	58
	August	-	94	78.8	108	-	-	113	120	120
	September	-	47.9	71.2	88.95	-	120	120	25	111
	October	-	120	79.65	120	-	56	80	120	17
Neenah Slough	May	18	120	41.8	117.4	45.8	-	-	-	50
	June	-	19.1	42.7	114	87.4	-	50.61	86.3	106
	July	-	93.2	120	120	120	-	120	91.5	102
	August	-	120	118	120	115	81.1	106	92.5	1.098
	September	-	-	120	120	26	65.5	111	57.78	112.5
	October	-	116	45.5	120	50.23	31.3	86.7	79.52	36.5
Plum Creek (VandeHey)	May	-		34	26	51.5	-	-	21.5	25
	June	-		12	13.8	20	-	22.2	11	36
	July	-		15	20.5	21.5	-	22	22.5	39
	August	-	19	15	29.5	18	29.5	27	25	25
	September	-	6.5	46.3	8	20.5	41.5	30.5	-	-
	October	-	32	29.8	75	6	22	51	35	-
Lancaster Creek	May	-	89	104.33	65	43.6	-	104.1	-	120
	June	-	0	-	61.3	101.3	-	-	104	69
	July	-	54.3	65.2	64.6	-	-	-	107	41
	August	-	12.3	77.47	22.9	84.6	120	120	120	67
	September	-	117	120	95.2	120	120	-	-	91

	October	-	117.2	120	120	120	105.5	-	120	120
Upper Duck Creek (CTH S)	May	-	-	-	82	56	-	15.5	71.2	84.3
	June	-	-	-	65	69.9	-	54.2	35.55	59.3
	July	-	-	-	33	47.6	-	57	41.5	61
	August	-	-	-	35	54.6	34.26	21	59.7	47
	September	-	-	-	58	34.2	31	33.4	71.4	39.5
	October	-	-	-	69	25	67	76.66	115	-
Middle Duck Creek (Seminary Rd)	May	-	-	-	120	51	-	92	100	97.2
	June	-	-	-	83	13.75	-	30.1	71.2	72
	July	-	-	-	75	45.5	-	58.7	-	89.6
	August	-	-	-	67	75.1	90	19.7	-	91
	September	-	-	-	1.5	40.5	95	100	96	100
	October	-	-	-	-	100	83	100	94.7	100
Upper East River (Mallard Rd)	May	-	-	-	24.5	50.5	-	-	53	47
	June	-	-	-	14.5	12.25	-	-	10	15
	July	-	-	-	12.75	24	-	19.5	24	22
	August	-	-	-	32.5	27	16	28	30	22
	September	-	-	-	15	20	27	58	32	-
	October	-	-	-	66.5	10.5	30	100	-	-
Trib to Garner's Creek	May	-	-	-	-	-	-	120	120	76
	June	-	-	-	-	-	-	120	20	55
	July	-	-	-	-	-	-	65	66	90
	August	-	-	-	-	-	48.5	23	60	65
	September	-	-	-	-	-	120	37	33	65
	October	-	-	-	-	-	26	80	53	95
West Plum Creek (County Line)	May	-	-	-	-	-	-	18	73.5	35
	June	-	-	-	-	-	-	23.50	26	43
	July	-	-	-	-	-	-	44.92	45	110
	August	-	-	-	-	-	23	18.50	9	99
	September	-	-	-	-	-	16	32.33	17	120

	October	-	-	-	-	-	15	38.23	30.5	120
Wequiock Creek	May	-	-	-	-	-	-	-	-	120
	June	-	-	-	-	-	-	68.00	-	-
	July	-	-	-	-	-	-	63.00	-	-
	August	-	-	-	-	-	69	48.00	-	41.5
	September	-	-	-	-	-	120	-	-	120
	October	-	-	-	-	-	115	82.00	-	120

Appendix L: Lower Fox River Basin Volunteer Monitoring Fact Sheet

Lower Fox River Basin Monitoring Fact Sheet

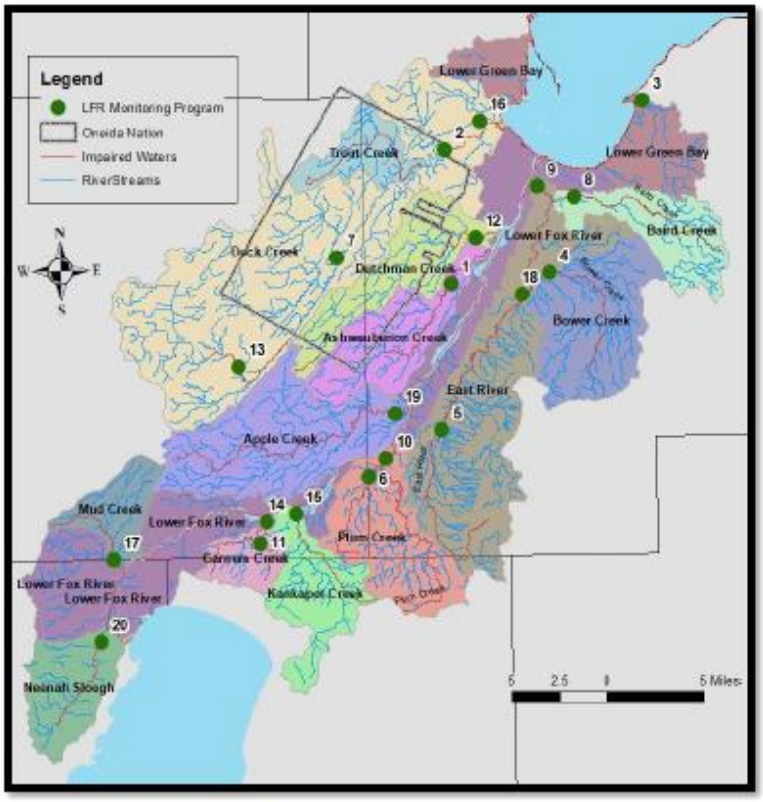
In 2012, the EPA approved the Lower Fox River Total Maximum Daily Load (TMDL). The TMDL identifies the need for pollutant reductions in waterbodies throughout the basin to meet water quality standards. There are 27 stream segments in the Lower Fox basin listed as impaired due to excess phosphorus and/or sediment loading.

Phosphorus is an essential nutrient for plant growth, but can have detrimental effects on lakes, rivers, and streams when excessive amounts are introduced to these systems. Common forms of pollutant delivery in these systems include surface runoff from urban and agricultural areas and discharges from wastewater treatment facilities, industrial businesses, and farms. Excess phosphorus in a river system can create harmful algal blooms during the summer months which impact human, plant, and animal life.

In 2015, the Lower Fox River Volunteer Monitoring program began to help achieve the monitoring goals outlined in the TMDL. There are 20 stream monitoring locations total across 16 tributary streams which are monitored by citizen volunteers. Volunteers are relied upon to collect surface water samples following WDNR protocol on a monthly basis between the months of May and October. Water samples are shipped to the State Lab of Hygiene in Madison and are analyzed for Total Phosphorus, Total Suspended Solids, and Total Nitrogen

Basin facts

- Watershed area: 641 square miles (403,657 acres)
- Includes 4 counties (Brown, Outagamie, Calumet, Winnebago) and Oneida Tribal Land
- 27 impaired waterbody segments
- Approx. 300 farms
- 29 MS4s*
- 32 Dischargers
  - 14 municipal
  - 18 industrial



Want to get involved or have questions? Contact:

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*MS4s - municipal separate storm sewer system; municipalities with WPDES permits for stormwater management.

More information can be found at: https://dnr.wisconsin.gov/topic/TMDLs/LowerFox/index.html

See backside for exact sample locations

	Stream Name	WBIC	SWIMS ID	SWIMS Station Name	Latitude	Longitude	Impairment
1	Ashwaubenon Creek	122200	10016502	Ashwaubenon Creek - Grant Street	44.44508	-88.09875	TP and TSS
2	Lower Duck Creek	409700	10038644	Duck Creek - Pamperin Park	44.54773	-88.10285	TP and TSS
3	Wequiock Creek	3000022	10010769	Nicolet Rd/CTY A	44.57651	-87.89083	
4	Bower Creek	118400	10009445	Bower Creek (1) 50m Upstream of Hwy Gv	44.45179	-87.99543	TP and TSS
5	Upper East River	118000	53508	East River at Mallard Rd	44.33542	-88.11198	TP and TSS
6	West Plum Creek	125200	10016494	Downstream of County Line Rd	44.30296	-88.18901	TP
7	Mid Duck Creek	409700	453255	Duck Creek at Seminary Rd	44.46608	-88.21892	TP and TSS
8	Baird's Creek	118100	53683	Baird Creek at Preble WI	44.50741	-87.96754	TP and TSS
9	East River	118000	10043279	East River @ Harold Lewis Trail off Main Street	44.51633	-88.00587	TP and TSS
10	Plum Creek	125100	10046999	Plum Creek - VandeHey Farm Crossing	44.31540	-88.17154	TP and TSS
11	Tributary to Garners Creek	5022162	10047157	US CTH CE	44.25392	-88.30658	TP
12	Dutchman's Creek	121600	10015851	Dutchmans Creek - Oneida Street	44.47859	-88.0723	TP
13	Upper Duck Creek	409700	10029975	Duck Creek at CTH S	44.38665	-88.32509	TP and TSS
14	Garner's Creek	127700	10043028	Garner's Creek - DS of Cty Z	44.2701	-88.29816	TP and TSS
15	Kankapot Creek	126800	453261	Kankapot Creek - Cth Z Dodge St 100 Ft US of Bridge	44.27504	-88.26778	TP and TSS
16	Lancaster Creek	410000	10034510	Unnamed Trib. (410000) - Lakeview Dr	44.56583	-88.06471	
17	Mud Creek	129500	453258	Mud Creek - County Highway BB	44.24417	-88.46037	TP and TSS
18	East River (G)	118000	53675	East River - Hwy G	44.43550	-88.02457	TP and TSS
19	Apple Creek	124100	53684	Apple Creek - Rosin Rd	44.34861	-88.16119	TP and TSS
20	Neenah Slough	130800	10032175	Neenah Slough #2 (100ft S of Adams St)	44.18274	-88.47481	TP

*SWIMS – Surface Water Integrated Monitoring System; a Wisconsin DNR information system that holds chemistry (water, sediment), physical, and biological (macroinvertebrate, aquatic invasive species) surface water data.