SECTION 319 NONPOINT SOURCE POLLUTION CONTROL PROGRAM
WATERSHED PROJECT FINAL REPORT

PARK RIVER WATERSHED
319 NONPOINT SOURCE POLLUTION PROGRAM

By

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This project was conducted in cooperation with the State of North Dakota and the United States Environmental Protection Agency, Region 8.

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EXECUTIVE SUMMARY

PROJECT TITLE: PARK RIVER WATERSHED

319 NONPOINT SOURCE POLLUTION PROGRAM

PROJECT START DATE: 8/1/2018 PROJECT COMPLETION DATE: 9/30/2022

FUNDING:

TOTAL BUDGET	$332,268.00
TOTAL EPA GRANT	$199,361.00
SECTION 319 BUDGET REVISIONS	($36,900.00)
REVISED SECTION 319 GRANT	$ 162,461.00
NON-FEDERAL MATCH USED	$ 108,307.00
TOTAL EXPENDITURES	$270,768.00

SUMMARY OF ACCOMPLISHMENTS

The Park River Watershed Project focused on program objectives intended to improve water quality of the Park River Watershed. The project provided technical, financial, and educational assistance to agricultural producers and landowners in the watershed for the purpose of best management practice (BMP) implementation to restore beneficial uses in recreation and fish/aquatic biota at the Homme Dam reservoir and to improve water quality and riparian areas in the South, Middle and North Branches of the Park River. Consultations were provided to 44 landowners. The adoption of strip till/no-till and cover crop practices increased due to the collaboration of the new Walsh County Soil Health Team that worked within the project location. The watershed coordinator facilitated a collaborative support network which resulted in a variety of local, state, and federal partners having provided assistance in workshops and field consultations to increase landowner understanding of best management practices and water quality issues. Other BMPs implemented included nutrient management on cropland, grade stabilization for erosion control, pasture/hayland planting, field windbreak establishment, filter strips, and forage harvest management. Routine water sampling to monitor water quality trends was achieved through implementation of the Quality Assurance Project Plan (QAPP).

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INTRODUCTION

Homme Dam was a high priority watershed for TMDL development in the early 2010's. In 2012, the EPA approved the TMDL for the reservoir. The first phase of BMP implementation in the Homme Dam watershed ran from 2014 until 2018 under agreement between the Walsh County Three Rivers Soil Conservation District (SCD) and the NDDH (now known as ND Department of Environmental Quality (NDDEQ). The SCD continued work from 2018 through 2022 in a watershed program phase called the Park River Watershed project, which not only included the Homme Dam portion of the Park River Watershed, but also portions of the South, Middle, and North branches of the Park River.

Background

Homme Dam (HUC 09020310-001) is located on the South Branch of the Park River located two miles west of Park River. The dam is operated by the US Army Corp of Engineers out of the Lake Ashtabula station, Valley City, N.D. Completed in 1950, Homme Dam is a 185- acre reservoir designed for flood control and water supply benefits (NDDH 2010). At full pool, Homme Dam covers a surface area of 185 acres, has a maximum depth of 34.5 feet and an average depth of 16.5 feet. The Homme Dam watershed is a 131,699 acre watershed in the Park River basin located in Cavalier and Walsh counties (Appendix 1)**.**

Homme Dam has been classified as a Class 3 warm-water fishery, "capable of supporting natural reproduction and growth of warm-water fishes (i.e. largemouth bass and bluegill) and associated aquatic biota and marginal growth. Some cool water species may also be present"**(**NDDH 2011). Homme Dam is an Army Corp of Engineers reservoir, which has undergone renovations to the spillway and reconditioning to the swim beach to better provide recreational opportunities to the public.

Topography and Land Use

The topography of the Park River Watershed varies from west to east due to glaciation. Elevation changes dramatically from Homme Dam in western Walsh County at 1,120 ft to 825ft at Grafton in eastern Walsh County. In western Walsh County, in what is referred to as the Glacial Till Plain, the landscape is comprised of undulating hills in addition to terminal moraines that are hilly. The area is categorized as Major Land Resource Area (MLRA) 55, the Northern Black Glaciated Plains. Within hilly areas, temporary or seasonal wetlands are not uncommon. Outcrops of shale bedrock from the Cretaceous age are exposed across the glacial till plain where the rivers and ravines drain into the lake bed. In general, the soils of the Glacial Till Plain largely consist of glacial till, sand and gravel deposits, and cobble substrate. These soils formed in calcareous loam and clay loam glacial till and the associated alluvium from the till process.

Several Lake Agassiz beach lines exist within the glacial till plain. Several more ancient beach lines lie in the elevation gradient experienced transitioning east until approximately five miles west of Highway 18 until it gradually flattens into level the glacial lake bed where little or no slope exists. This area is classified as MLRA 56- the Red River Valley of the North. The western lake bed consists of very fine sand, silt and silty clay loam. On the eastern lake bed, clay and silty clay were deposited. The climate supports a grassland transition between short grass prairie in the west and tallgrass prairie towards the east portion of the watershed. Agriculture has replaced most of the grassland areas. Riparian areas faced degradation and encroachment by agricultural practices, especially the utilization of narrow riparian areas for grazing livestock.

According to the 2016 National Agricultural Statistical Service (NASS) land survey, the 251,021

acres in the project area were classified as follows:

- 66% active cropland
- 15.25% pasture or grassland,
- 6.4% wetlands,
- 4.62% are riparian woodlands or shelterbelts,
- 5.3% barren or urban development,
- 1.12% tame grasses or planted grass,
- 0.50% alfalfa.

Crops commonly grown in the lower elevations of the watershed in fertile lake bed soils include spring wheat, soybeans, corn, potatoes, and sugar beets. The Homme Dam sub- watershed include spring wheat, edible beans, soybeans, canola and corn.

The climate of the Park River Watershed is characterized as sub humid with warm summers with frequent hot days and occasional cool days. Winters are very cold influenced by blasts of arctic air surging over the area. Average temperatures range from 20° F in the winter to 68° F in the summer. Precipitation occurs primarily during the warm period and is normally heavy in late spring and early summer. Total average annual precipitation nears 20 inches. An estimated rainfall total of 16 inches or 85 percent of rain falls between April and October. In 2016, this area received above average rainfall saturating soils in the watershed. In the summer months, 27 inches of rain was recorded by NDAWN in the east at Grafton and some areas west in the watershed received more rain than Grafton. With completely saturated soils, farmers were met with difficult crop losses. In stark contrast, 2017 resulted in 11 inches of rain during the summer months with 4 inches in June, and the remainder in erratic rainfall events.

Historical Water Quality Assessments

Historical water quality data was collected in 1996 and 2006 in Lake Quality Assessments (LWQA). Results indicated that nutrient levels in Homme Dam increased two-fold between 1996 and 2006 (NDDH 2012). Further water quality testing took place in 2010 and 2011 during the watershed assessment conducted by the Walsh County Three Rivers SCD. Water quality monitoring was conducted on one inlet site, one outlet site and the deepest area of the reservoir. In 2010, average growing season (April-November) total phosphorus concentrations were 0.338 mg/L and average chlorophyll-a concentrations was 13.3 µg/L (Table 1). Water quality data for 2011 indicated average growing season total phosphorus concentration was 0.233 mg/L and average chlorophyll-a concentration was 20.5 µg/L (Table 1).

Table 1. 2010 Homme Dam (Deepest Site) Water Quality Data Summary (NDDH 2012).

Parameter	N	Average	Minimum	Maximum	Median
Total Phosphorus (mg/L)	27	0.338	0.194	0.884	0.302
Dissolved Phosphorus (mg/L)	24	0.300	0.176	0.776	0.260
Total Nitrogen (mg/L)	27	1.600	1.020	2.290	1.490
Total Kjeldahl Nitrogen (mg/L)	27	1.000	0.839	1.175	0.975
Nitrate/Nitrite (mg/L)	27	0.270	0.015	0.870	0.180
Chlorophyll-a (µg/L)	9	13.300	0.750	36.700	12.200
Secchi Disk (meters)	9	1.300	0.600	2.700	1.200

Table 2. 2011 Homme Dam (Deepest Site) Water Quality Data Summary (NDDH 2012).

Parameter	N	Average	Minimum	Maximum	Median
Total Phosphorus (mg/L)	29	0.233	0.117	0.904	0.184
Dissolved Phosphorus (mg/L)	29	0.189	0.078	0.758	0.147
Total Nitrogen (mg/L)	29	1.615	0.936	2.750	1.350
Total Kjeldahl Nitrogen (mg/L)	29	0.987	0.321	1.534	0.975
Nitrate/Nitrite (mg/L)	29	0.422	0.015	1.240	0.086
Chlorophyll-a (µg/L)	10	20.50	0.750	61.40	17.90
Secchi Disk (meters)	9	1.300	0.400	2.100	1.300

The average growing season Secchi disk transparency in 2010 and 2011 was 1.3 meters. In 2010, the maximum Secchi disk transparency measurement recorded was 2.7 meters, while the maximum measurement in 2011 was 2.1 meters (Tables 1 & 2). Water quality data collected in Homme Dam in 2010 and 2011 showed an average chlorophyll-a concentration of 16.9 µg/L (TSI = 58.3) and average Secchi disk transparency depth of 1.3 meters (TSI = 56.4). Based on these data Homme Dam was generally assessed as a eutrophic lake. Total phosphorus data and corresponding TSI value of 83.4 characterized Homme Dam as hypereutrophic.

The TSI target of 58.3 for chlorophyll-a is the trophic state sufficient to maintain both aquatic life and recreation uses of Homme Dam (Table 3). The chlorophyll-a TSI target would have been achieved through the reduction of nutrient inputs into the lake by forty percent and maintenance a total phosphorous load capacity of 8,996.4 kg/yr or a daily load of 24.6 kg/day. Phosphorus loads into the reservoir required a reduction of forty percent through the treatment of AnnAGNPS identified “high priority areas” (NDDH 2012).

Table 3. Carlson’s Trophic State Indices for Homme Dam (NDDH 2012).

Parameter	Relationship	Units	TSI Value	Trophic Status
Total Phosphorus (TP)	TSI (Chl-a = 30.6 + 9.81[ln(Chl-a)]	µg/L	58.3	Eutrophic
Chlorophyll-a	TSI (TP) = 4.15 + 14.42[ln(TP)]	µg/L	83.4	Hypereutrophic
Secchi Disk (SD)	TSI (SD) = 60 – 14.41[ln(SD)]	µg/L	56.4	Eutrophic

TSI < 30 – Oligotrophic (least productive) TSI 30-50 Mesotrophic
TSI 50-65 Eutrophic TSI > 65 - Hypereutrophic (most productive)

Total Maximum Daily Load (TMDL)

The Homme Dam Nutrient Total Maximum Daily Load (TMDL) established an in-lake growing season average chlorophyll-a concentration target of 16.9 µg/L which corresponds to chlorophyll-a TSI of 58.3. This TSI target is a trophic state sufficient to maintain both aquatic life and recreation uses of Homme Dam. The chlorophyll-a TSI target is achieved by reducing nutrient inputs into the lake by forty percent which equates to a total phosphorous load capacity of 8,996.4 kg/yr or a daily load 24.6 kg/day.

Stream Visual Assessment Protocol (SVAP)

Several segments of the South Branch, Middle Branch, and North Branches of the Park River are listed on the 303(d) list with the following impairments:

- North Branch of the Park River has 27.63 miles of stream and tributaries were determined to be “not supporting” fish and aquatic biota in combination benthic and fishes bioassessments.
- Middle Branch of the Park River has 25.47 miles of stream and tributaries “Fully Supporting But Threatened” were determined to be “not supporting” fish and aquatic biota in combination benthic and fishes bioassessments.
- South Branch of the Park River was listed as “Fully Supporting But Threatened” fish and aquatic biota due to Selenium.
- Stream Visual Assessment Protocol (SVAP) scores on for riparian areas of the S. Branch of the Park River resulted in many of the sampled sites receiving a poor to fair ranking (Table 4)(NRCS 2008). The evaluation took into account hydrology, streambanks, soil, and riparian vegetation.

Table 4. South Branch Park River Stream Assessment Results

SVAP Rank	Number of Sites
Good	5
Fair (high)	27
Fair (medium)	5
Fair (low)	15
Poor	25
No Ranking	1

Harmful Algae Bloom (HABs) and Recreational Impairments

Recreation at Homme Dam has been impaired by harmful algae blooms (HAB’s) caused by eutrophication. Harmful algae blooms (HABs) occurred in the summer months of June- September, which hindered the ability of the public to safely enjoy water recreation activities. The local community was concerned about HABs and its impact to health, and the economy due to a loss of recreation that would have normally draw people to this very popular reservoir. The public became aware of harmful algae blooms in 2015, during the first summer of the Homme Dam Watershed Project. Algae toxin levels were over 800 ppb of microcystin toxin, or 80 times the maximum limit for safe recreational use during the bloom. The recreational limit for microcystin toxins in N.D. is 10 ppb.

Since that time, HABs testing and monitoring have been conducted in a successful collaboration between NDDEQ and the watershed coordinator. Advisories or warnings were posted for a total of 45 days in the summer of 2015. In 2017, advisories or warnings were posted for approximately 58 days, with a severe bloom (>400 ppb toxin) occurring in early September. This monitoring and outreach effort educated the public on the implications of exposure of people and pets to HABs at the swim beach and boat docks. They were notified of the presence of a harmful blooms through updates in signage onsite.

Prioritization of Target Areas Using AnnAGNPS

An Annualized Agricultural Nonpoint Source Pollution (AnnAGNPS) model was developed for Park River Watershed. The AnnAGNPS model uses soils, fertilization rates, cropping systems, elevation, land use, precipitation data, etc. to 1) characterize the size and shape of the watershed and 2) identify “high priority areas” that are potentially the most significant sources of nutrients (N & P) and sediment in the Homme Dam watershed (NDDH 2012). The results of the AnnAGNPS model will be used to target technical and financial assistance for the implementation of BMPs in the watershed (Appendix 1**).**

A PTMApp for the Park River Watershed was under development by the International Water Institute and the NDDEQ at the time the proposal for the watershed project was accepted. The model was complete in the spring of 2021. The PTMApp calculated total nitrogen, phosphorus and sediment for better prioritization at the watershed scale and field scale for use in identification of areas for nutrient and sediment reduction.

Nutrient loading into Homme Dam originates 100% from non-point source pollution (NDDH 2012). The vast majority of nutrient loads were transported with overland runoff from agricultural areas, riparian degradation, and over-utilization by livestock in the riparian corridor. Existing land use and Annualized Agricultural Non-Point Source pollution modeling (AnnAGNPS) within the watershed indicates that the majority of NPS loading is coming from cropland.

Implementation of best management practices by producers is necessary to address loading from NPS sources. A reduction in sediment loading upstream of Homme Dam was thought to be best accomplished through work with livestock producers who managed cool season riparian pastures often grazed for long periods of time. There was a need to find ways to rotate cattle to feeding areas other than the riparian zone and this work could be accomplished via collaboration with NDSU Extension specialists who promote methods such crop aftermath grazing, cover crop grazing, or temporary feeding in paddocks to reduce over-utilization of riparian pastures. Riparian areas in AnnAGNPS areas were expected to experience an increase in overall function if streambank erosion was reduced through riparian and cropland BMPs. Improvements in water quality were expected through the reduction of channel erosion and improvement of riparian function through riparian vegetation and buffer widths.

Watershed Project Development

The need for an implementation program in the Homme Dam watershed began in 2010, when the NDDEQ identified Homme Dam as an impaired water body and listed it on the 2010 Clean Water Act Section 303(d) list of impaired waters. Based on a Trophic State Index (TSI) score, "Fish and Other Aquatic Biota" and "Recreation" uses of Homme Dam were impaired due to excess nutrients, eutrophication, and biological indicators. As previously mentioned, the trophic status was determined to be eutrophic to hypereutrophic based on water quality data collected from 2010 to 2011.

In 2016, the Local Work Group reviewed top natural resource concerns for cropland and pastureland management in this watershed. While this meeting ultimately provided prioritization through development of ranking questions for USDA program assistance, it also formally identified top resource concerns. The top concerns for cropland were soil erosion, soil quality and water quality.

In September 2017, before the Park Watershed Project was proposed stakeholders were surveyed for feedback. A public watershed stakeholder meeting was held on September 15th, 2017 in a collaborative effort between the Red River Riparian Program and the SCD to gather feedback via discussion and written surveys. Surveys were made available to the public upon their request after advertising the opportunity in the local newspaper. A group of one-hundred twenty-five farmers, retired farmers, rural landowners, and local agencies were also sent direct mailings. There was a 27% return rate on surveys.

Resource concerns most frequently identified by stakeholders were soil erosion, streambank erosion, water quantity, and water quality— including sedimentation and algae blooms (Figure 1). When active farmers were asked to choose resource concerns that should be prioritized in conservation

programs in the watershed, they responded that soil erosion, streambank erosion, and water quality were a primary concern. Active farmers responded that funding for BMPs like shelterbelt establishment or renovation, riparian area practices, conservation easements in riparian areas, and salinity management should be high priorities for BMP funding in the watershed. Residue management practices such as strip till and no-till, along with workshops focused on farming and conservation received medium priority for watershed funding. When asked if assistance from a watershed coordinator or riparian specialist was needed 73% of active farmers, 50% of retired farmers, 50% of rural landowners, and 100% of local agency staff survey indicated "yes", with a majority selecting a preference for both technical and financial assistance being available as well.

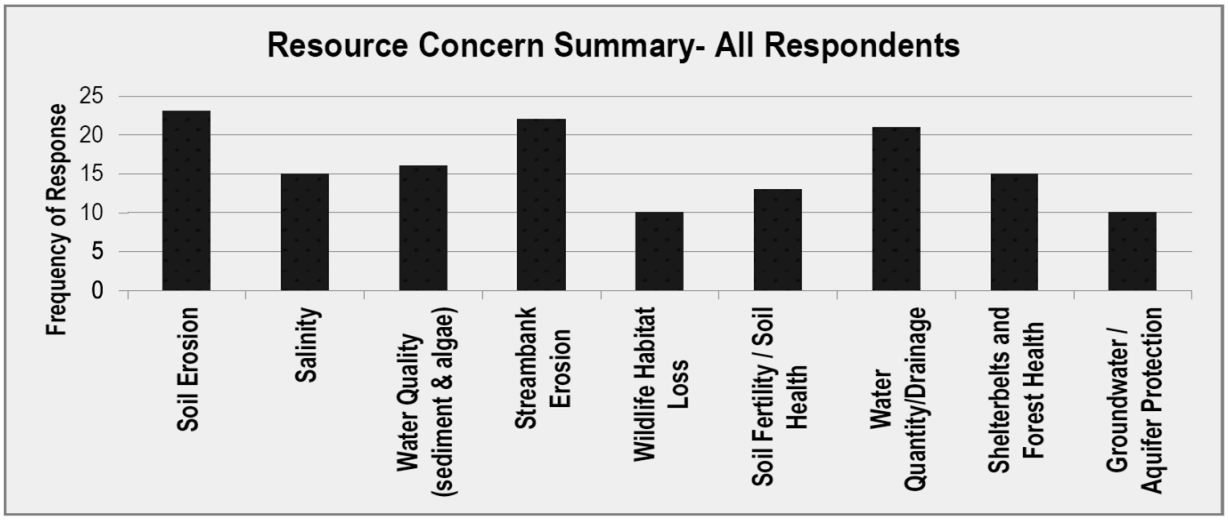

Figure 1. Park River Watershed stakeholder resource concerns.

The project sought to incorporate soil health principles into producers' farming practices across the watershed to reduce the amount of runoff, sediment transport, and NPS pollution from cropland. Dr. Dave Franzen, an NDSU Soil Extension specialist described Dr. David Hopkin's and Brandon Montgomery's work in comparing erosion rates on cropland in the Red River Valley. A study site that lost over 50% of its topsoil since 1960 is located in the South Branch of the Park River Watershed.

Soil erosion ranked high in the list of concerns landowners and conservationists had in the county. Prior to the project, conservationists in Walsh County educated producers about BMP practices for the conservation of their soils and protection of water quality. BMPs collaborators sought to include in future work included no-till farming coupled with cover crops for a reduction in soil erosion, increased infiltration, improved soil structure, increased soil water holding capacity, and overall health of their soils. These practices were expected to benefit water quality through the reduction in soil erosion, sediment loads, and phosphorus loads into Homme Dam and the three branches of the Park River.

The project was anticipated to have met its goals when Homme Dam could maintain the fully supporting status of the aquatic life and recreational uses. This restoration was expected to take place with the achievement of phosphorus load reduction goal in the amount of 40 percent of the annual phosphorus load. The maximum allowable load target was 8,996.4 kg/yr. The end target concentration maintained for chlorophyll-a was 16 µg/L, and corresponded to a chlorophyll-a TSI score of 58.3. If the load reduction and TSI score goals were met, the hypereutrophic status would

lower to a eutrophic status. A eutrophic status shift would better support aquatic life as well as increase water quality for recreational use.

2.0 PROJECT GOALS, OBJECTIVES, AND TASKS

Objective 1- Establish a network of collaborators to participate in the planning, prioritization, and implementation of watershed restoration activities to achieve water quality goals.

Task 1: Employ one full-time project coordinator to implement project tasks and develop plans for future priority initiatives addressing NPS pollution concerns.

Results: Evan Freeman served as the FT coordinator from June 2018-June 2019. Yari Villanueva served as the FT coordinator from June 2019-August 2021. Moriah Thompson served as coordinator FT from November-December 2021, then PT January-March 2022. The SCD District Manager provided support for existing watershed project participants from January-September 2022, due to challenges recruiting new staff to fill the role.

Task 2: Coordinate with other organizations, agencies, and stakeholders as needed to obtain additional technical and financial assistance to implement current and future projects addressing water quality and NPS pollution concerns. Partnerships are further discussed in section 5.0 Coordination Efforts.

Results:

- Collaborative relationships with agency partners provided additional conservation funding and technical assistance to the project. NRCS provided technical assistance to landowners with livestock and were members of the Soil Health Team. They also provided financial assistance for BMP's (Section 5.4). NDSU provided much needed technical support on cropland through the assistance of outreach specialists and the county agent.
- The Walsh County Soil Health Team was formed to provide producers with technical assistance on reducing soil erosion in the watershed and elsewhere in the county. This group will continue to work on NPS in this watershed and others. General Mills provided financial assistance on the no-till/strip-till demonstrations.
- Additional funding and/or technical assistance for landowners and producers was provided in coordination with the following organizations:
    - North Dakota Department of Health (presently North Dakota Department of Environmental Quality)
    - Natural Resource & Conservation Service (NRCS), Park River, ND
    - NDSU Walsh County Extension Agent (WCEXT)
    - North Dakota Game and Fish Department (NDG&F)
    - Walsh County Water Resource District (WCWRD)
    - North Dakota Forest Service (NDFS)
    - NDSU Extension Livestock Stewardship Specialist (NDSUEXT)
    - NDSU Extension Soil Health Specialists (NDSUSOIL)
    - General Mills
    - North Dakota Natural Resources Trust (NDNRT)
    - Walsh County Highway Department/ Homme Dam Park Board
    - K2S Engineering (319 BMP Team)

- Red River Riparian Program (RRRP)

Task 3: Organize a watershed stakeholder committee to include affiliated organizations, agencies and stakeholders involved in the Park River Watershed and Homme Dam. The committee will bring open dialog on prioritization of work areas, and help to further development of watershed goals, future conservation efforts, stakeholder awareness and education of landowners through conservation demonstration sites.

Results:

SCD Stakeholder Meeting

- In September 2019, the SCD Board and the watershed coordinator met with stakeholders including agency partners, local leaders and state legislators to form a strategic plan to address resource concerns. The result of this meeting was that local and state leaders and partners are aware of the watershed project and support its objectives. Resource concerns were discussed and BMP implementation goals were set for areas which included the Park River Watershed and other areas in the county.

Walsh County Soil Health Team

- The Walsh County Soil Health Team was established in 2020 to provide much needed technical assistance on cropland in the watershed. This group formed as a result of the watershed project's collaborative efforts with partnering agencies and stakeholders. The biggest contribution this collaborative accomplished was the relationship building with sugar beet producers that was needed and their adoption of strip tillage in their cropping system. Strip Tillage with sugar beets is not a practice that is common in the Red River Valley of N.D. and became a BMP that is now being implemented.

Task 4: Management of the watershed project to meet expectations of project implementation, task completion, and the appropriations of Section 319 funds and local match.

Results: The watershed project was managed by an involved district office and board:

- The SCD board reviewed monthly reports provided by the watershed coordinator on work activities, the status of BMP implementation, meeting and tour coordination and outreach to new contacts in the watershed.
- The SCD District Manager provided annual performance reviews with each coordinator, ongoing support to the project in administration and human resources, as well as serving as a technical resource for the coordinator.
- The SCD provided funds for the position, secured additional funds for the watershed project, and approved and processed cost share for 319 funds and other grants.

Objective 2- Maintain the chlorophyll-a concentrations in the reservoir at 16 µg/L by reducing the phosphorus loading to the reservoir by 40%, aimed to an annual phosphorus load capacity of 8,996.4 kg/yr.

Task 5: Work with livestock producers to develop improved grazing management systems as well as fencing systems and exclusion grazing. Coordinate with NDSU Extension Service livestock specialists and NRCS to address the need for additional grazing opportunities by incorporation rotations that include crop aftermath and/or cover crop incorporation into the grazing system. Work with the Red River Riparian Program and NRCS to plan and fund BMPs.

Results: In total, consultations were provided to three livestock operations:

- One livestock producer enrolled acres into a buffer program from NDG&F. NRCS provided field support to the watershed coordinator while evaluating rotational grazing systems with producers. In addition to one-on-one consultations, education was provided through several public events. No producers entered into rotational grazing systems or demonstration projects.
- Speaking engagements and annual presentations at the Walsh County Livestock Association provided networking opportunities with livestock producers and yielded site visits to producers alongside agency partners who provided technical support.
- A tour held in summer of 2020, in collaboration with NDSU Extension, provided a demonstration on an efficient temporary fencing strategy used by Justin Zahradka to successfully graze cattle on cropland acres.

Task 6: Work with crop producers to develop improved management practices, such as cover crop, no-till planting, grass buffers, and windbreaks in areas with soil erosion and runoff.

Results:

- Implementation of strip tillage in the Park River Watershed grew exponentially from one producer at the beginning of the project to over one dozen individuals in high erosion areas the Park River Watershed. It is estimated that total acres of strip tillage in the Park River Watershed grew from 160 acres to over 1,600 acres on year two of the demonstration project alone. Crops included in strip tillage acres include edible beans, soybeans, sugar beets and corn.
- While it is not known how many acres of cover crop were implemented during this project, areas within eight miles upstream of Homme Dam have seen the most conversion to strip tillage, no-till and cover crop implementation. A handful of producers in that zone have increased their cover crop acres to 1200+ acres per year/farm from the support received by collaborating agencies, both with and without financial incentives for BMPs. One of these producers estimates that between 10-20% of the acres in the Homme Dam watershed have at least one of these BMPs being utilized because the practices are "shown to work" and they are "no longer stigmatized and can be discussed openly".

Objective 3- Increase producers, landowners, and the general public's understanding of the impacts of NPS pollution and the potential solutions to prevent or reduce NPS pollution.

Task 7: Demonstrate the use of soil conservation and soil health BMPs on cropland areas to reduce NPS pollution. Examples used on demonstration sites include the use of cover crops, no-till planting, and nutrient management for improving soil health, and reducing erosion and excess nutrients. Work will be completed in cooperation with NRCS, NDSU Extension, Red River Riparian Program, and SCD Board of Supervisors.

Results: Approximately one dozen of the forty producers who followed the No-till/Strip Till demonstration project implemented strip tillage on sugar beets and other crops without any outside financial incentives.

- An extensive effort was made to demonstrate no-till and strip-till practices and the benefits to soil health, especially in the interest of preserving topsoil from wind erosion. The result was a collaboration between producers and agency personnel that was effective in introducing strip

tillage as a BMP that may be used with success in sugar beets and other row crops.

- Producers who had not used this BMP invested in it during the time of the demonstration. Details of this process of collaboration, the interest garnered from outside parties and research, and the contribution to strip tillage adoption are included in Appendix 2.

Collaborative efforts were made through meetings and tours to connect producers with a new equipment (strip tillage equipment) to demonstrate how the BMP could be used with a crop like sugar beets which is usually planted into fields that have been disked. Guest speakers, equipment representatives and feedback from producers involved in the demonstration sites were invaluable in getting this new BMP implemented.

Task 8: Coordinate with NDSU Extension, NRCS, and the Red River Riparian Program to conduct at least four workshops during the project period to discuss stream bank erosion, water quality issues, rotational and aftermath grazing, cover crops, riparian management, nutrient management, and no-till practices.

Results: One riparian tour and three soil health tours were held.

- A riparian tour was held in 2019 and included ND Game and Fish as well as the NDSU Extension Service environmental livestock specialist. The SCD and the ND Natural Resources Trust sponsored the tour in an effort to bring additional education to landowners and livestock producers.
- Walsh County Soil Health Tours mentioned elsewhere in this report and held in 2019, 2021, and 2022 with Walsh County Soil Health Team members educated producers on BMPs beneficial to cropland in the watershed. Topics discussed included cover crops, water quality, nutrient management, no-till and strip-till. Soil scientists Dr. Abbey Wick and Dr. David Franzen of NDSU Extension participated in these tours along side local extension agents and the other members of the Walsh County Soil Health Team.

Task 9: Utilize radio, newspaper articles, direct mailings, Soil Conservation District newsletter, one-on-one contacts, etc., to disseminate information on conservation and management options using BMP's that can be used to improve water quality in the watershed. We will provide direct mailings to landowners in the AnnAGNPS priority areas of the watershed at least twice per year.

Results: Project information was provided to landowners, producers and other stakeholders via newsletters, direct mail, newspaper articles, press released, talk radio, radio advertising, social media and at fifteen meetings over the course of the project. Forty-four producers or landowners in the watershed requested technical and/or financial assistance in response to the watershed coordinator's solicitations. Appendix 3 lists these project promotion efforts and the number of people reached.

Task 10: Work with Walsh County Schools to educate students about water quality issues and NPS. Continue to lead water quality seminars at the SCD's annual Eco-Ed Day and participate in other opportunities for outreach to students. Involvement in agricultural or science classes in local school districts, as well as the local land judging team meetings are two examples of opportunities to provide specialized learning to students (Table 5). Grafton, Park River or Edinburg school districts would be schools in the project area.

Results: The watershed project reached over 555 students during the course of 4 years, assisting them in understanding what kinds of pollution is taking place in their own backyards and how the way we farm is having impacts to our recreation and riparian areas in the watershed. The River

Watch group of students is led by the International Water Institute and those students became especially involved in the eutrophication issues at the Homme Dam Reservoir.

Table 5. Watershed Education and Outreach with Youth

Item	Month/Year	Topic	Location	# of Students
Outreach Presentation to River Watch Group	October 2018 -Students extended the invitation to the watershed project	Connecting the Dots: Water Quality, HABs, and BMPs to address NPS Pollution in the Homme Dam Reservoir	Edinburg, N.D.	15 students 9^{th}-12^{th} Grade
EcoEd	Held annually in September in 2019-2022	Water Quality, NPS, and Harmful Algae Blooms in Homme Dam	Park River, N.D.	~135 students in 6^{th} grade annually (540 total)

Objective 4-As BMP are applied, document trends in water quality and beneficial use conditions (i.e. chlorophyll-a concentrations, chlorophyll-a TSI score and phosphorus loadings) to evaluate progress toward established goals. Also, track the type, location, amount and costs of BMP applied with Section 319 cost share assistance.
Result: The NDDEQ water quality report for data collected during the project period in attached in Appendix 4.

Task 11: Coordinate with the NDDH to implement a Quality Assurance Project Plan (QAPP) to track in-lake trends in chlorophyll-a concentrations and annual phosphorous loading to the reservoir.

Result: Water sampling was performed as directed by the QAPP starting in the 2020 season and ended in 2021.

Task 12: Maintain the NPS Program BMP Tracker database to document the type, location, cost and amount of BMP applied with Section 319 financial assistance.

Result: Records of BMPs implemented with Section 319 financial support were maintained in the BMP Tracker and Funding Manager databases provided by NDDEQ.

2.1 PLANNED AND ACTUAL MILESTONES, PRODUCTS, AND COMPLETION DATES

The results and outputs of the project tasks are provided in the previous section, Section 2.0.

2.2 EVALUATION OF GOAL ACHIEVEMENT IN RELATIONSHIP TO THE STATE NPS MANAGEMENT PLAN

The work of the Homme Dam Watershed Program supports the North Dakota NPS Program mission to "… to implement a voluntary, incentive-based program that restores and protects the chemical, physical, and biological integrity of waters where the beneficial uses are threatened or impaired due to nonpoint sources of pollution." (NDDH 2016). The Homme Watershed project's accomplished outreach and technical assistance objectives by working through one-on-one consultations with forty-four landowners or producers. During this process, we utilized the best available technical

support from our partnering agencies, and determined the proper approach to achieving sound land management that would protect or improve water quality and beneficial uses of Homme Dam and the South, Middle, and North branches of the Park River.

Goal 3 of the 2016 NPS Program's management plan aims to "increase public awareness and understanding of water quality and beneficial use impairments associated with NPS pollution as well as the sources and causes of NPS pollution in the state." The dedication of the watershed project to this goal is shown not only through water quality monitoring and education outreach, but also through the increased efforts to address the causes of NPS through collaborative demonstration projects. The project began with a majority of residents knowing about the water quality issues that existed at the reservoir. At year four of the project, producers were more aware of practices that worked for other producers to help them address soil losses. Soil loss is major contributing factor to phosphorus loading into the reservoir and branches of the Park River.

2.3 SUPPLEMENTAL INFORMATION

By 2019, a group of concerned individuals working in soil health in Walsh County adopted an "enough is enough" mindset when it came to soil erosion. Just prior to that time in 2019, Jim Collins of NDDEQ announced at the January annual meeting of the SCD that the watershed had less than 40 years of topsoil remaining. The Walsh County Soil Health Team established in 2020, as a direct result of the watershed project wanting to form a collaboration to address this startling statistic. This team became the core group of individuals leading change in the watershed. The team included an agronomist who had extensive knowledge in sugar beet production and an interest in regenerative agriculture (Figure 2). All members on this demonstration project, from agency staff to those producers willing to try strip tillage, are credited with encouraging producers to undertake these implementation efforts with conservation BMPs.

Figure 2. Agronomist Dan Vagle shows tour attendees the roots of edible beans grown in a strip tilled field.

The participation level from farmers who observed the initial results of the novel concepts demonstrated to them with the no-till/strip-till sites was completely unexpected. Strip tillage was a new concept for nearly all producers in the watershed, certainly never tried here with sugar beets, nor many crops in general in the county. The demonstrations resulted in direct measurable growth in the number of strip-tilled acres in the county, with a gain of 1200% over the course of the first year alone. After the first tour was held in July 2021, two producers contacted our office within a week

to tell us that they made arrangements to purchase strip-till implements. Several producers who had been following the project either bought strip tillage equipment that same year or contracted with a producer for custom strip-tillage in their fields. Up until the time of these demonstrations, the use of strip-tillage with sugar beets was a conservation concept that was not being used in North Dakota or elsewhere in the Red River Valley. It had been tried in southwestern MN on a limited basis, and several members of the Walsh County Soil Health Team attended a conference where that southwestern MN example was provided.

When producers shared their experiences in a way others could learn from, a sizeable number of producers began using a BMP they had not used before. It is surprising that unsponsored producers following the project proceeded with the BMP with no additional financial incentives given their high level of investment into beet shares, and needing to deliver tonnage of beets on contracts with the sugar company in the fall. They moved ahead, willing to take a risk on their high value sugarbeet crop, which is a crop that leaves no residue after harvest, and directly impacts soil health in this watershed (Figure 3). This demonstration resulted in over a dozen producers using strip tillage with sugar beets on over 1,600 acres of sugar beet land in 2021. While not all of these acres are within the watershed, many are very close to the watershed as producers farm in multiple watersheds here.

Figure 3. Sugar beets grown in strip till residue of last year's wheat crop.

Producers with or without sugar beet acres are also incorporating cover crops and no-till into their rotations in numbers never seen in this watershed. It also resulted in an increase of cover crop acres, including acres seeded into rye, within the Homme Dam watershed. Several producers within the Homme Dam watershed have dramatically increased their cover crop, strip-till and no-till usage so that it is a normal part of their farm operations (Figure 4).

While it is not known the exact number of acres have been added to the watershed, in 2014 when projects here began, cover crop was not a widely practiced BMP, nor was no-till. In 2022, it is estimated that at least 10% of the fields have benefitted from cover crop and/or no-till, with as much as 20% of the fields within 5 miles of Homme Dam now incorporate these practices. Most farmers now discuss these practices openly with one another as it is now socially acceptable to use these practices here.

Figure 4. Edible beans strip till planted to allow for added residue on this low residue crop with high erosion post harvest.

3.0 BEST MANAGEMENT PRACTICES DEVELOPED AND/OR REVISED

The best management practices implemented in the Park River watershed largely consists of low-cost vegetative practices (Table 6). These practices primarily focused on reducing non-point source pollution from cropland. One windbreak and one riparian buffer were established. A large headcut was stopped in a deep and steep ravine along Homme Dam was stabilized using grade stabilization on the adjacent landowner's property.

Table 6. Best Management Practices Implemented in the Park River Watershed

Practice Code	Practice	Quantity	Unit
329A	No-Till and Strip Till	320	acres
410	Grade Stabilization	1	Number
512	Pasture/Hayland Planting	23.3	acres
380	Windbreak or Shelterbelt	25.15	Per 100 ft
393	Filter Strips	1.77	acres
340	Cover Crop	338.24	acres

4.0 MONITORING RESULTS

Best management practices along with water quality were monitored during the watershed project. The following information summarizes these efforts.

4.1 TMDL IMPLEMENTATION EFFECTIVENESS

TMDL implementation effectiveness is summarized in the Water Quality Report found in Appendix 4.

4.2 BMP EFFECTIVENESS EVALUATIONS

Best management practices were monitored for effectiveness in their potential to reduce NPS pollution. Twice or more per year, monitoring took place at the no-till/strip till demonstration sites (Figures 5 and 6). Soil erosion data was collected using boxes that collected blown soil during fall

2020- spring 2021 and fall 2021 to spring 2022. University of Minnesota analyzed the samples for nutrients and placed a value on lost soil. During 2020-2021, soil losses were significantly higher on fields where edible beans were grown the season prior to the sampling period. For this crop, it was estimated that 160 lbs of sediment was moving per day along a swath the width of a road, one foot off the ground. This is valued at $40 per one mile swath using December 2021 prices for N, P, and K.

Figure 5: Summer 2021 strip tilled beets on 2020 no-till wheat stubble.

Figure 6: Fall 2021, November 3rd rye cover crop growing after sugar beet harvest from strip tilled beets into 2020 no-till wheat

4.3 SURFACE WATER IMPROVEMENTS

Surface water improvements will be summarized in the Water Quality Report found in Appendix V.

4.4 QUALITY ASSURANCE REPORTING

The Quality Assurance Project Plan (QAPP) was implemented starting in May 2019 and commenced until September 2020. The QAPP project ended early due to lake levels being too low to safely launch a boat. Water quality results are detailed in Appendix 3.

4.5 RESULTS OF BMP OPERATION AND MAINTENANCE REVIEWS

Inspections of BMPs were completed annually by the watershed coordinator. Adherence to Operation and Maintenance (O&M) terms was ensured for all BMPs implemented during the watershed project. No deficiencies were found during site visits. Feedback was solicited from landowners as to their satisfaction with the BMPs implemented and other measures that they could benefit from on their property.

5.0 COORDINATION EFFORTS

The watershed project developed relationships with non-governmental organizations in addition to an array of local, state and federal agencies. This cooperation is mentioned throughout this report. In regards to NGO's, General Mills is a corporate sponsor that provided financial support to sugar beet producers participating in the watershed project's Soil Health Demonstration site (payments for no-till, strip tillage, and cover crops).

Local government collaboration included the Walsh County Highway Department along with the Homme Dam park manager who continued with discussion on ways to best manage the riparian areas along the beach and dock.

5.1 COORDINATION FROM OTHER STATE AGENCIES

North Dakota Department of Environmental Quality (Formerly NDDH)

The watershed coordinator worked closely with the State NPS Coordinator, Greg Sandness, to strategize ways to increase outreach and further implementation of best management practices in the watershed. Mr. Sandness provided through his collaboration with NDG&F, a new program for the watershed coordinator to utilize called the Red River Wildlife and Water Quality Enhancement Program. Mr. Sandness also provided support to the Walsh County Soil Health Team during and after its creation of the no-till/strip till demonstration sites. The watershed coordinator also received feedback on reporting, including financial reimbursements, grant management, and procurement.

5.2 OTHER STATE ENVIRONMENTAL PROGRAM COORDINATION

North Dakota Game & Fish Department

NDG&F Private Lands director, Kevin Kading, provided funding and promotion of the Red River Wildlife and Water Quality program for the establishment of riparian practices beneficial for water quality. Mr. Kading provided the watershed project radio promotion opportunities and facilitated in collaboration with Mr. Sandness additional funding for a riparian buffer program designed to be implemented on areas of the S. Branch of the Park River, and elsewhere in other reaches of the Park River basin.

North Dakota Forest Service

The NDFS has played an active role in reaching out to landowners in the watershed with windbreak and forestry plans. Their department has developed a windbreak renovation program which provided landowners with additional options for restoration of windbreaks.

North Dakota Natural Resources Trust (NDNRT)

The trust provided a Riparian Education Grant for tours and educational materials. The watershed project created a riparian booklet used to education landowners on BMP practices. The grant also purchased two stream tables for use by the project.

5.3 FEDERAL COORDINATION

Natural Resource Conservation Service

The Walsh County Three Rivers Soil Conservation District routinely partners with the NRCS office in Park River, N.D. District staff invite NRCS staff to monthly SCD board meetings and have a dedicated time slot to present any updates. SCD staff also attends monthly staff meeting at the NRCS building to discuss recent past, current, and upcoming projects within Walsh County and the project boundary.

Environmental Protection Agency

The watershed coordinator was included on monthly HABs meetings with EPA Region 8 staff and affiliates. The technical support and involvement allowed the watershed project to have technical information that was up to date on this evolving topic.

National Oceanic and Atmospheric Administration

The watershed coordinator with guidance and support from the National Oceanic and Atmospheric Administration (NOAA) and NDDEQ, continued the identification and documentation of algae species and blooms in the Homme Dam Reservoir. The NOAA continued to provide the watershed

coordinator with a microscope and other equipment to submit algae reports to the Plankton Monitoring Network.

5.4 USDA PROGRAMS The watershed project's main USDA partner for the Park River Watershed Project is the NRCS staff in Park River, N.D. NRCS provided the watershed project assistant with education and outreach, along with financial assistance to watershed landowners. Environmental Quality Incentives Program (EQIP) cover crop and no-till practices were installed and totaled 3,300 acres and $131,820.00 (Table 7).

Table 7. EQIP Practices in the Park River Watershed 2018 through 2022

Practice	Unit	Cost
Cover Crop	1,720 acres	$86,000.00
No-Till	1,580 acres	$45,820.00
Total	3,300 acres	$131,820.00

Conservation Stewardship Program practices implemented in the Park River Watershed included no-till, cover crop, integrated pest management, nutrient management and forage harvest management practices on 5,206 acres (Table 8).

Table 8. CSP Practices in the Park River Watershed August 2018-September 2022

Practice	Unit	Cost
Cover Crop	340 acres	$5,440.00
No-Till	786 acres	$4,760.00
Integrated Pest Management	1,770 acres	$26,550.00
Forage Harvest Management	20 acres	$360.00
Nutrient Management	2,290 acres	$45,800.00
Total	5,206 acres	$82,910.00

5.5 ACCOMPLISHMENTS OF AGENCY COORDINATION MEETINGS

Walsh County Soil Health Team

The formation of collaborative relationships with agency partners allowed a higher level of coordination of efforts to combat the causes of NPS pollution, especially those originating from cropland sources. The Walsh County Soil Health Team was established in 2020 as a result of this watershed project's collaborative efforts with partnering agencies. The team provided BMP implementation suggestions and began the important process of acting upon the hurdles that landowners face implementing BMPs to reduce wind erosion on cropland that ultimately was contributing to NPS pollution. The team began an aggressive approach towards soil erosion and demonstration sites on cropland with four producers using no-till and strip tillage were created. Meetings were held up to four times per year to manage the demonstration site goals and tasks. Further technical and outreach participation was provided by the team members and advisory support members during outreach events, such as the annual soil health tour and additional workshops. State NPS Coordinator, Greg Sandness and State NRCS Agronomist, Ted Alme were state and federal contacts that provided much needed feedback to the Walsh County Soil Health Team.

Walsh County Soil Health Team Members:

-SCD Board members who are also producers
-Local agronomist specialized in sugar beet production
-NDSU Walsh County Extension Agent (WCEXT)
-Natural Resource & Conservation Service (NRCS), Park River, ND

Advisory support provided by:

-NDSU Extension Soil Health Specialists (NDSUSOIL)
-State NPS Coordinator
-NRCS State Agronomist

5.6 OTHER SOURCES OF FUNDS

North Dakota Natural Resources Trust to provide additional riparian education for landowners through a grant of $1,300. A portion of this funding was utilized to conduct a riparian tour and purchase stream tables for riparian demonstrations.

ND G&F provided cash match in the amount of $792.95to two producers who either established riparian buffers or expanded existing riparian buffers. Later, NDG&F in collaboration with NDDEQ awarded the SCD funds in the amount of $39,285 for riparian management BMPs. Projects are in the planning stages to utilize this funding within and outside of the project area until 2025.

General Mills awarded the watershed project $101,300 in funding to provide compensation to producers enrolled in the No-Till/Strip Till demonstration projects. A small portion of that funding also paid for soil samples, meetings, tours and site signage. At the end of the watershed phase $38,200 were spent on the demonstration site. The remaining funds will go to continue the demonstrations into 2023.

6.0 SUMMARY OF PUBLIC PARTICIPATION

Public participation was cultivated through meetings and workshops held to promote the watershed program and conservation principles to reduce NPS pollution and benefit water quality (Table 11). Public outreach for the program increased as Walsh County Soil Health Team members utilized existing connections in the communities. Collaborative outreach messaging brought people closer to the project. Soil health team members were instrumental in helping the watershed coordinator entertain dialog with the public at tours and other events.

7.0 ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

Outreach to livestock producers and landowners with pasture acres was not as successful as cropland outreach efforts, even though these producers had cropland that could be utilized for additional grazing acres via crop aftermath grazing. Three producers received consultations for livestock rotational grazing systems through collaborative outreach. The lack of rotation out of riparian areas remained a longstanding issue in this watershed and dates back decades when farms were established. Solutions were brought to producers once more. The riparian area management tour included livestock grazing systems and was attended by only one producer. Cattle are the main livestock and most producers have less than 125 cow calf pairs. It is not known why there are issues with getting these producers to our tours, but many do attend our cropland tours instead.

When working with cattle producers to set up a demonstration site involving aftermath grazing on cropland that could help expand grazing possibilities, producers brought their issues to the table with

more transparency than what was experienced in the past. Producers stated they did not have the capacity to make changes due to farm succession transition entanglements, such as children wanting to move home to farm and decisions not yet being able to be made, or death of elderly landowners and issues with leases, etc. In addition to these unsettled issues, producers themselves questioned their ability to rotate stock, especially making time for transporting stock several times per season, or other farm management factors.

After outreach was completed with cattle producers, one year of severe drought (2020) and one year of extreme drought (2021) brought issues with forage availability to the forefront. Several producers were left to overgrazing situations due to that fact alternatives to pasture grazing were left unexplored, for the reasons already named. In addition, commodity prices were high and much effort was focused on maximizing cropland strategies. For example, one cattle producer converted 80 acres of forage production into cropland that had a lower CPI than other acres. It is unknown when progress can be made with these livestock operations and a few years from now they may settle into their new arrangements with their farm managers.

Sampling efforts required by the QAPP were also hindered by the drought years. Low water level during the later portion of the summer and early fall prevented boat launch. In addition, USACE drawdowns in September and October each year. Downstream sampling prematurely ended during the season due to low water in the stream channel.

8.0 FUTURE ACTIVITY RECOMMENDATIONS

Serving producers through collaborations and partnerships was the overarching theme of the entire Park River Watershed Project. The Walsh County Soil Health Team began officially during this time as a true collaboration not yet experienced here by team member or producers. Producers found that all team members were on the same page in regard to BMPs and issues in the watershed. There was hardly an end to the team's ability to network, to seek out answers if the answers were not already found within the team.

Financially speaking, the team was an amplified version of technical resources already paid for through existing federal, state, local and private company budgets. The watershed coordinator position was needed to coordinate items and provide follow through on the ideas of the team, conducting the additional work that collaborators were not able to add to their mounting workloads. The watershed project provided an avenue for the team members to get creative in how they worked on issues in the watershed and how they funded BMPs using different programs.

The collaboration in some ways brought new ways for producers to work with these agencies. Producers embraced the idea of an official soil health team working in the watershed and many more producers from outside of the watershed called on us. Producers who hadn't been working with an agency or program now found themselves hearing about options that agency or program had from any one of the members of the soil health team. The watershed coordinator was in the fortunate position to be able to draw any form of assistance needed from the depths of the other team members without needing to be convincing towards the team member or the producer who may not ordinarily work with an agency on said issue.

Programs used to address the BMP implementation were rather irrelevant to the team members because the goal was to get the resource concern addressed through any program available to address

it. As a result, funding for implementation was not heavily utilized by any program specifically and was spread across different funding sources. In addition, many producers adopted practices entirely without the use of cost share. Some commented about how cost share contracts tie them down and don't allow the flexibility they like. They implemented practices on their own because they found value enough in what was demonstrated to them. To sum it all up, the dedication to this collaboration brought about a more robust set of resources for producers to lean on, not only for technical advice, but also problem-solving capabilities.

At the end of four years, the early evidence points to this project's outreach success helping cropland producers make meaningful changes in the way they farm. Livestock producers may also greatly benefit from the collaboration's abilities to troubleshoot hurdles that exist for them implementing rotational grazing systems upstream of the Homme Dam reservoir, or possibly another reservoir of similar characteristics. Looking ahead, a county-wide outreach initiative directed towards outreach and education is a strategy that is worth exploring to reduce non-point source pollution not only within the Park River Watershed, but in the other watersheds within the county.

9.0 LITERATURE CITED

NDDoH. 2010. Quality Assurance Project Plan for the Homme Dam Water Quality and Watershed Assessment Project. North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NDDoH. 2011. Water Quality Assessment Methodology for North Dakota's Surface Waters (Revised December 2011). North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NDDoH 2012. Homme Dam Nutrient Total Maximum Daily Load (TMDL). North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

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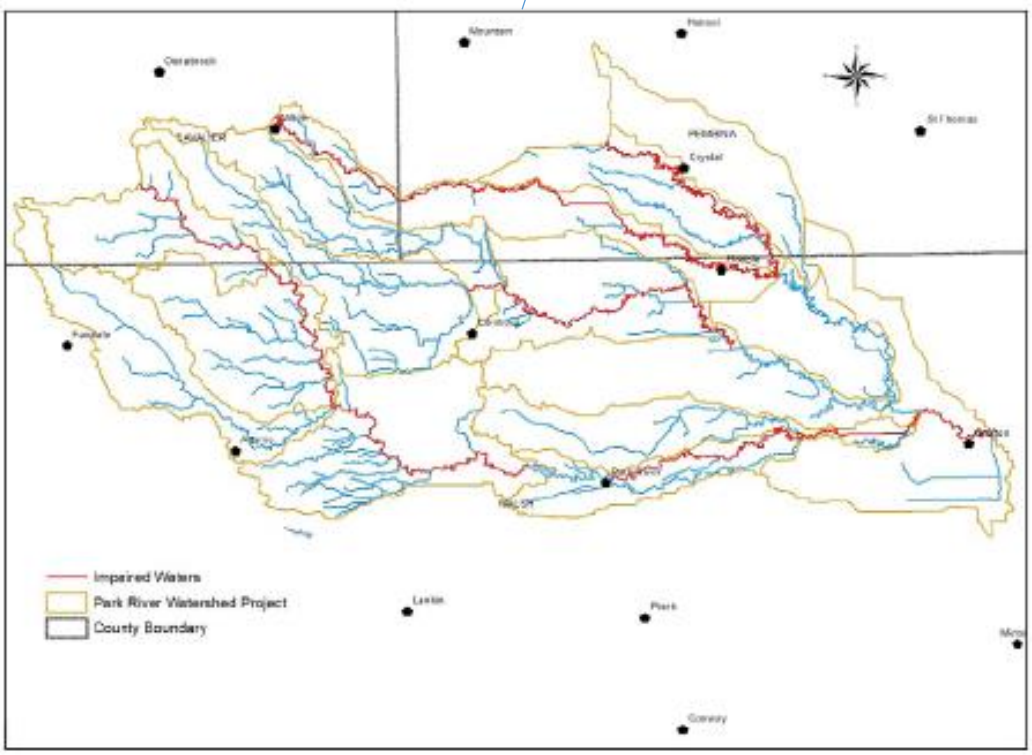
APPENDIX V. Water Quality Report

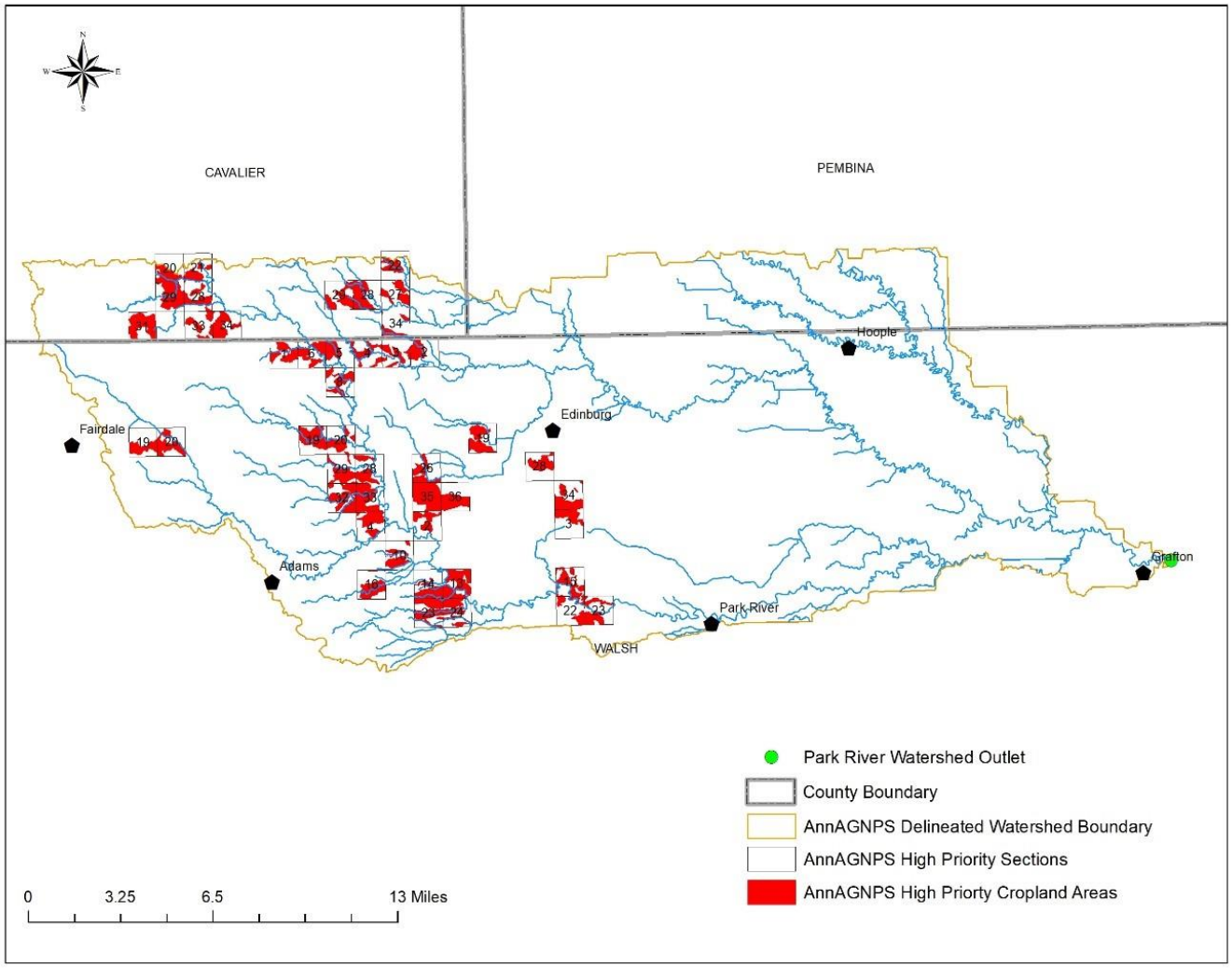
APPENDIX I.

Watershed location in North Dakota
Maps Showing Targeted acres for BMP Implementation
Areas of BMP Implementation

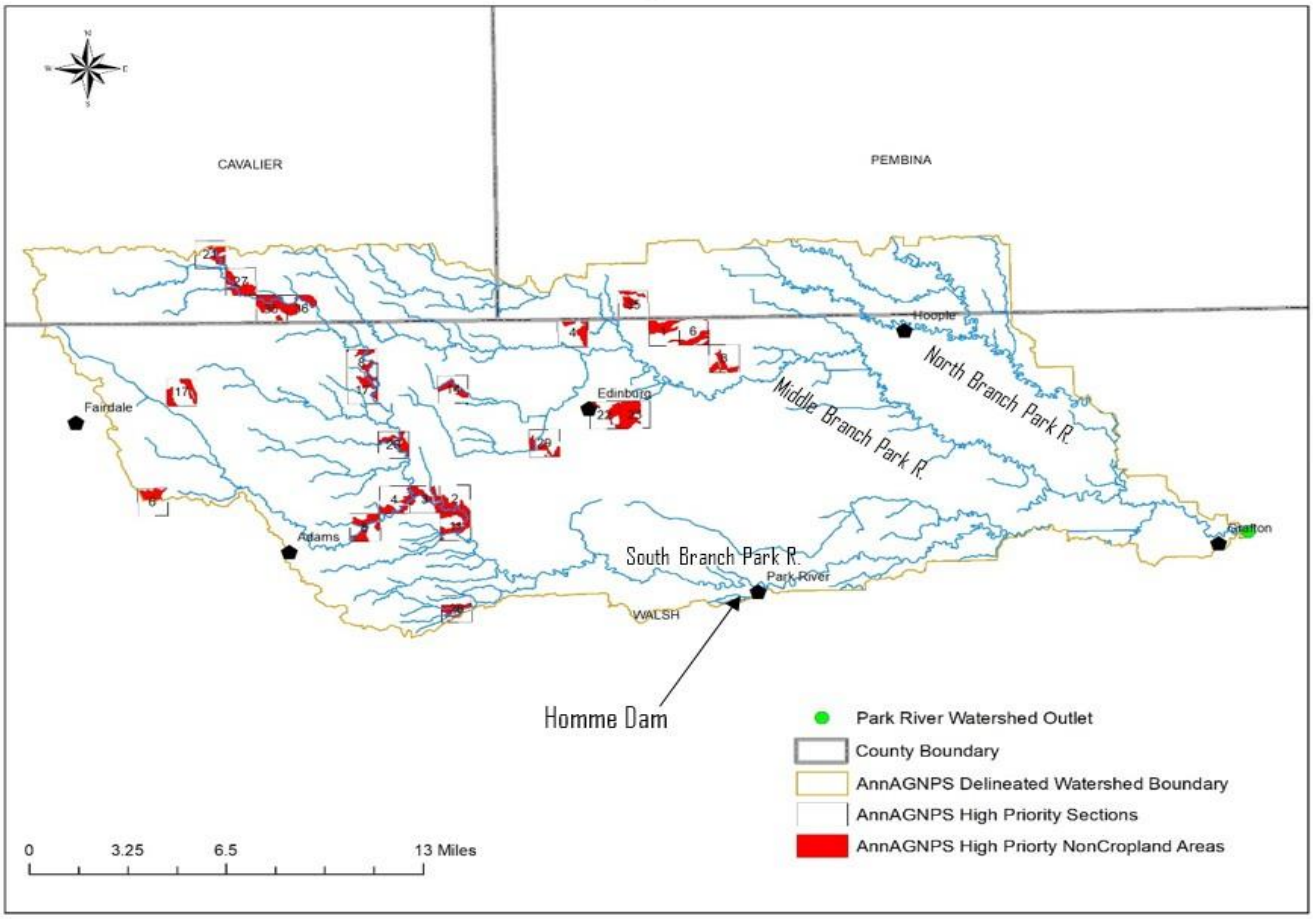

DIVIDE
BURKE
RENVILLE
BOTTINEAU
ROLETTE
TOWNER
CAVALIER
PEMBINA
WILLIAMS
MOUNTRAIL
WARD
MCHENRY
PIERCE
RAMSEY
BENSON
NELSON
GRAND FORKS
MCKENZIE
MCLEAN
SHERIDAN
WELLS
EDDY
FOSTER
GRIGGS
STEELE
TRAILL
DUNN
MERCER
OLIVER
BILLINGS
GOLDEN VALLEY
BURLEIGH
KIDDER
STUTSMAN
BARNES
CASS
STARK
MORTON
SLOPE
HETTINGER
GRANT
EMMONS
LOGAN
LAMOURE
RANSOM
RICHLAND
BOWMAN
ADAMS
SIOUX
MCINTOSH
DICKEY
SARGENT
Legend
Park River Watershed
Homme Dam Watershed


Impaired Waters
Park River Watershed Project
County Boundary

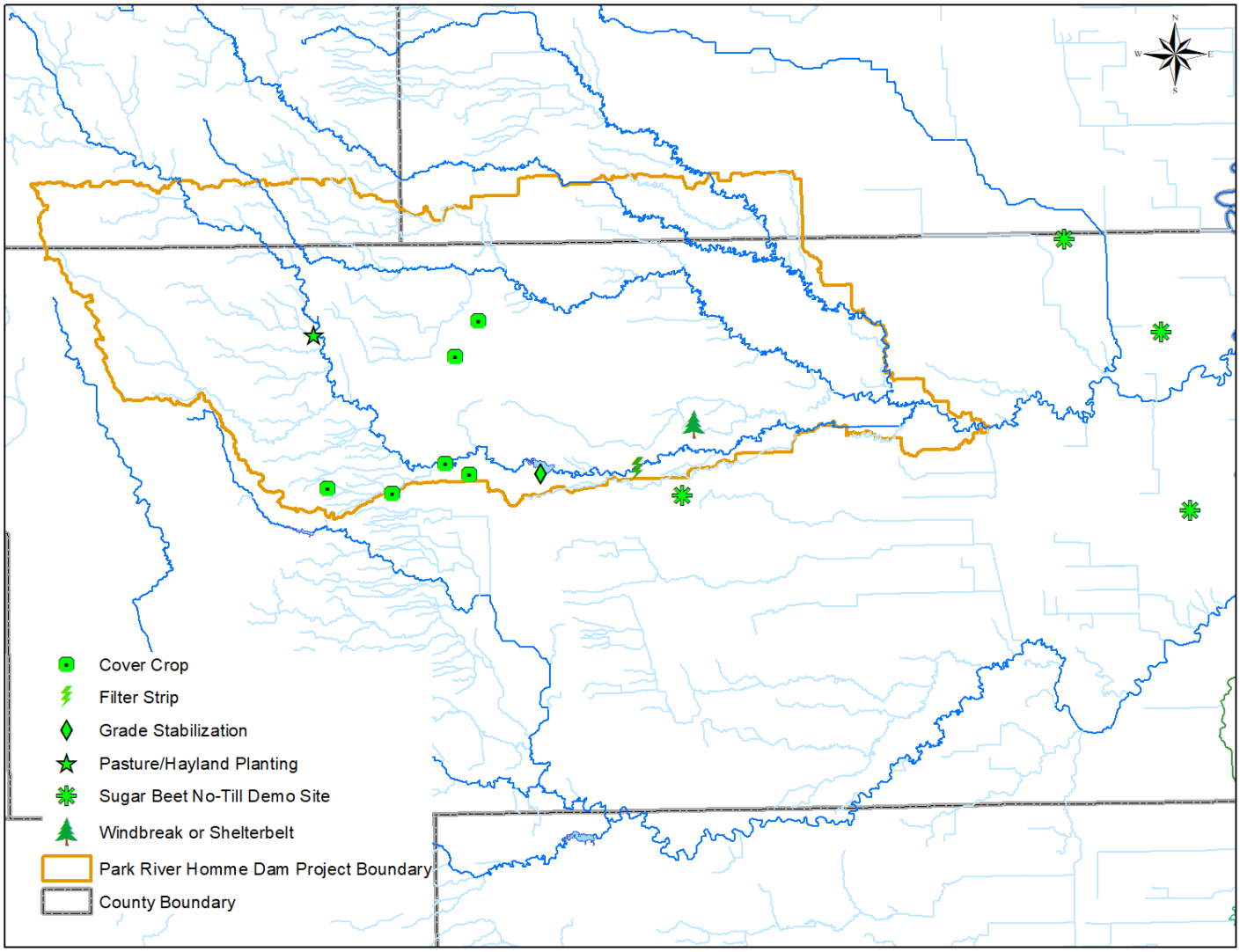
High Priority Cropland Areas as determined by AnnAGNPS



High Priority Non-Cropland Areas as determined by AnnAGNPS



Areas of BMP Implementation



APPENDIX II

The No-Till/Strip Till Collaboration of the Walsh County Soil Health Team

No-Till/Strip Till Demonstration Collaboration of the Walsh County Soil Health Team

Team formation & Resource goals	The Walsh County Soil Health Team formed during the beginning of this watershed project. The team was especially motivated by soil erosion issues and the questions surrounding whether no-till or strip till would be a beneficial BMP in the watershed. Little adoption of these practices were occurring in the watershed, even though nationally, many areas consider these practices as being widely adopted. Considering the extensive soil losses over the decades, hurdles in adoption needed to be identified and addressed, and the team worked hard to identify those obstacles.
Demonstration site planning and funding	The Park River Watershed coordinator aided in the planning efforts and acquisition of funds for four demonstrations sites as part of the team's effort. To date, four demonstration sites of eighty acres have been utilized over a three year span. Funding was secured from General Mills to pay four participants in the demonstration project for four years. The risk of trying strip tillage on a high value crop like sugar beets meant buying down some of the risk for the producer.
Immediate attention from producers	As a direct result of this demonstration effort, strip tillage was demonstrated in the short term as a potential BMP for use to reduce erosion on sugar beet acres in the Red River Valley (RRV). Producers with sugar beets took immediate interest in the demonstrations. Twelve producers participated in strip tillage on their own in year two of the project without any external financial incentives. It is estimated that acres of strip till grew by 1000% (160 acres to 1600 acres).
Researchers and other outside interests contact the project	The University of Minnesota's (U of M) Soil Health Extension Specialist offered to participate in the project, and guided the watershed coordinator technical support and equipment to collect and submit wind blown eroded soil from these demonstration sites to the university lab for analysis. The results were published on the U of M Extension Minnesota Crop News in an article discussing the volume of soil loss and the cost to farmers: https://blog-crop-news.extension.umn.edu/2022/04/wind-erosion-and-nutrient-loss-how-much.html.
	The demonstration prompted researchers working with sugar cooperatives in the RRV to undertake new research projects directly related to the demonstrations, beginning with NDSU in 2021. In addition, researchers not affiliated with academic institutions, but rather NGO's, also contacted the project in an effort to collaborate with producers in the watershed. Their interests were related to producers adopting strip tillage with sugar beets. Others inquired on our collaboration process. NDSU included Walsh County Soil Health Team members Brad Brummond (Extension) and Sarah Johnston (SCD) in a communication workshop to discuss this new collaboration and the success of this demonstration project.
Dissemination beyond the watershed	In 2022, General Mills presented the demonstration project at the Red River Basin Commission's *Red River Basin Land and Water International Summit & Conference.* In 2021, the watershed coordinator and SCD district manager introduced the project at this conference and received much interest from online attendees. The demonstration resulted in the Kittson County Soil and Water Conservation District's recent development of a strip tillage demonstration project with General Mills and producers growing sugar beets on the Minnesota side of the Red River.
Importance of a coordinator position	Collaboration efforts by the Walsh County Soil Health Team and the partners and stakeholders listed above would not have been possible to this extent without facilitation and coordination provided by the watershed coordinator. The coordinator acted as a point of contact for producers and team members, and served in multiple capacities, including meeting facilitation, outreach planning, demonstration project management and the securing of demonstration project funding.

APPENDIX III.

Public Meeting Involvement by the Park River Watershed Project

Public Meeting Involvement by the Park River Watershed Project (those with an * were coordinated by the watershed coordinator)

Meeting Name	Month/Year	Purpose	Location	Attendees
Walsh County SCD Annual Meeting	March 2019	Presentation on Park River Watershed Project	Grafton, N.D.	35 attendees
Walsh County Soil Health Tour	July 2019	Presentations educated participants on no-till/strip till practices, rainfall simulator, and demonstration on portable fencing/grazing cover crops.	Park River, N.D.	19 attendees
Riverbank Tour for Landowners*	July 2019	Riparian site visits, riparian management, streambank restoration; ND Game and Fish buffer grant program.	Park River, N.D.	12 attendees
Producer Shop Talk	December 2019	Met with local producers in N. Branch of Park R. to review one farm's soil results. Held in collaboration with NDSU Extension. The producer extended invites to other producers.	Hoople, N.D.	10 attendees
Strip Tillage Roundtable*	February 2020	Presentation by producer regarding strip tillage equipment and BMPs. Sign up demonstration producers.	Grafton, N.D.	45 attendees
Walsh County Township Officer Meetings	2019 2021 2022	Presentations to landowners on dust storms and soil erosion rates, watershed program cost share. Held annually in March.	Park River, N.D.	~50 attendees each year
Walsh County Livestock Association	2019 2020 2021	Provided short presentations and handout about the program at each annual meeting.	Park River, N.D.	~35 attendees each year
Communication Workshop-NDSU Extension Soil Science/SARE	December 2020	Online workshop hosted by Dr. Abbey Wick with a 30 minute segment on collaborations of Walsh County Soil Health Team members/ Park R. Watershed demos w/Strip Till/No-Till.	Online Conference, Fargo, N.D.	National attendees online 300+
Red River Basin Commission, Land & Water Summit International Conference	January 2021	Conference presentation regarding Park River Watershed project's collaboration of new Walsh Co. Soil Health Team and upcoming demonstration sites involving no-till/strip-till.	Online Conference Fargo, N.D.	150+ online attendees
Walsh County Soil Health Tour	July 2021	Full day tour of presentations by NDSU Extension and Walsh County Soil Health Team. Featured cover crop, no-till/strip tillage sites and equipment.	Park River, N.D.	64 attendees
Walsh County Soil Health Tour	July 2022	Full day tour of presentations by NDSU Extension and Walsh County Soil Health Team. Featured cover crop, no-till/strip tillage sites and equipment, including watershed demonstrations.	Minto, N.D.	45 attendees

APPENDIX IV.

Media and Outreach

Media and Outreach

Park River Watershed Project Promotion Efforts

Item	***Month/Year***	***Item/Purpose***	***Location***	***# of People Reached***
Newsletters	April 2020 April 2021	Full page educational summary on the program in SCD newsletter	Park River Watershed and county residents	4,500+ property owners
Newspaper articles -Conservation Corner Column	2018 2019 2021 No articles in '20 or '22	10/18 *Coord. Intro.* 12/18 *Soils* 2/19 *Need for Trees* 4/19 *Water Quality* 8/19 *Project C/S* 10/19 *Nutrient Mgmt* 12/19 *No-Till Conversion* 3/21 *Septic Systems* 4/21 *Spring Soil Erosion* 9/21 *TMDL's*	Walsh County Record (county's official newspaper)	Area subscribers 1,000+
Press Releases	2019	8/19 *319 Cost Share* 12/19 *No-Till/Strip Till Demonstration L.O. Application/ Solicitation*	Walsh County Record WC Press	Area subscribers 1000+
Radio (Talk Radio)	January 2022 February 2022	ND G&F Cost Share discussion on stream buffers 30 mins KNOX. News Update soundbite KNDK.	Grand Forks, ND, KNOX AM and Langdon, ND KNDK FM/AM	Regional listening area 20,000+
Radio advertising	March 2019	Coordinator recorded watershed program advertisement, ran 80 times	Grafton, ND KXPO AM	Local listening area
Direct Mailings to Landowners	2018	Letters to landowners 2018: 146 letters 319 c/s 2019: 90 letters 319 c/s 2020: 90 Strip Till Roundtable invites 2021: 42 letters 319 c/s, 80 letters Soil Health Tour	Park River Watershed	448 contact opportunities, included absentee landowners in priority areas
Social Media/ Webpage	2019-2022	Promoted program on SCD's webpage and Facebook account	www.walshcounty1938.com	

APPENDIX V.

Water Quality Report

Summary of Water Quality Data for the Park River Watershed Project

The following is a summary report of the water quality data collected under the Park River Watershed project in 2020 and 2021. Water quality monitoring was conducted on the Park River, the South Branch of the Park River, and on Homme Dam (Figure 1, Table 1). Stream site samples were analyzed for nutrients (complete) and total suspended solids. Homme Dam lake site samples were analyzed for nutrients (complete), total suspended solids, and nutrients (dissolved). No temperature, dissolved oxygen, or Secchi disk data was collected from the Homme Dam lake site.

Water quality trends are a reflection of many variables, including sample size and number of monitoring years. Due to sampling constraints within and across monitoring years, water quality trend interpretations for this project are limited.

Nutrients (Total Nitrogen, Total Phosphorus)

In 2020, median nitrogen levels (measured in milligrams per liter, mg/L), were similar across upstream and downstream sites: 1.09 mg/L (381260), 1.15 mg/L (386032), and 1.06 mg/L (386031) (no data was collected from upstream site 380121 in 2020) (Tables 3, 5, 7; Figures 7, 8, 13, 15, 18, 20). Median nitrogen levels decreased from 2020 to 2021 measurements, and increased overall between upstream and downstream sites in 2021: 0.39 mg/L (380121), 0.64 mg/L (381260), 0.88 mg/L (386032), and 0.76 mg/L (386031) (Tables 2, 4, 6, 8; Figures 2, 4, 7, 8, 13, 15, 18, 20).

In 2020, median phosphorus levels increased from upstream to downstream sites (excluding site 380121 where no 2020 data was collected): 0.188 mg/L (381260), 0.28 mg/L (386032), and 0.348 mg/L (386031) (Tables 3, 5, 7; Figures 7, 9, 13, 16, 18, 21). Median phosphorus levels decreased from 2020 to 2021 measurements, and increased from upstream to downstream sites in 2021: 0.090 mg/L (380121), 0.109 mg/L (381260), 0.12 mg/L (386032), and 0.259 mg/L (386031) (Tables 2, 4, 6, 8; Figures 2, 5, 7, 9, 13, 16, 18, 21).

Total Suspended Solids

In 2020, median total suspended solids (TSS) varied between upstream and downstream sites: 4 mg/L (381260), 17 mg/L (386032), 15 mg/L (386031) (no data was collected from upstream site 380121 in 2020) (Tables 3, 5, 7; Figures 12, 14, 17, 19, 22). Median TSS from 2020 to 2021 decreased at the Homme Dam site and increased at stream sites: 2.5 mg/L (380121), 2.5 mg/L (381260), 25 mg/L (386032), and 17 mg/L (386031). TSS measurements of 2.5 mg/L reflect samples returned as non-detect; where 2.5 mg/L is equal to half of the laboratory detection level.

Chlorophyll A & B

Chlorophyll A & B (measured in micrograms per liter, µg/L) were measured from Homme Dam (381260) samples in 2020 and 2021. From 2020 to 2021, median chlorophyll A measurements decreased from 10.2 µg/L to 2.25 µg/L. Median values of Chlorophyll B remained the same from 2020 to 2021, at 0.25 µg/L. Chlorophyll B measurements of 0.25 µg/L reflect samples returned as non-detect, where 0.25 µg/L is equal to half of the laboratory detection level. (Tables 3, 4; Figures 10, 11)

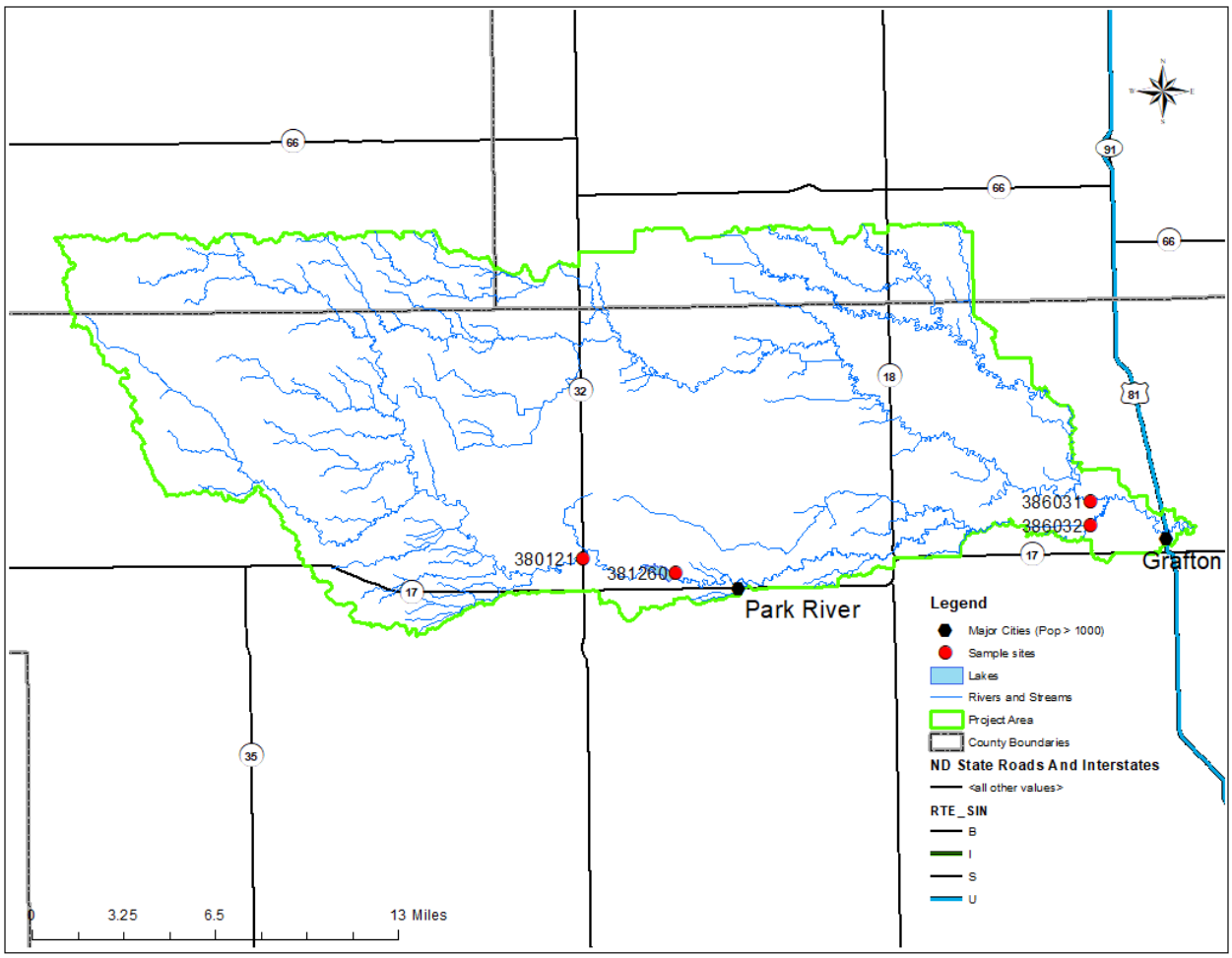


Figure 1. Location overview and sampling sites for Park River and Homme Dam.

Table 1. Water quality sampling locations in the Park River Watershed.

STORET Site ID	Site Description
380121	South Branch Park River (5 miles West, 1 mile North of Park River) Latitude: 48.41447 Longitude: -97.86189
381260	Homme Dam (Deepest area) Latitude: 48.40628 Longitude: -97.79094
386032	South Branch Park River (1 mile West, 2 miles North of Grafton) Latitude: 48.427225 Longitude: -97.470086
386031	Park River (2 miles West, 2 miles North of Grafton) Latitude: 48.439314 Longitude: -97.436758

Station 380121 – South Branch Park River

Water quality data was collected from monitoring site 380121 weekly from April – September (and once in November) in 2021; no data was collected from this site in 2020. Laboratory results reported as non-detect were updated to half of the detection level value.

Table 2. Summary statistics of water quality results from site 380121 on South Branch Park River in 2021.

Parameter	Unit	Maximum	Minimum	Average	Median	No. of Samples
Ammonia	mg/L	0.073	0.015*	0.020	0.015	25
Nitrate + Nitrite	mg/L	0.117	0.015	0.019	0.015	25
Total Kjeldahl Nitrogen	mg/L	0.74	0.26	0.40	0.36	25
Total Nitrogen	mg/L	0.77	0.29	0.44	0.39	25
Total Phosphorus	mg/L	0.370	0.025	0.097	0.090	25
Total Suspended Solids	mg/L	28	2.5*	5	2.5*	25
*Half of minimum detection level for associated parameter						

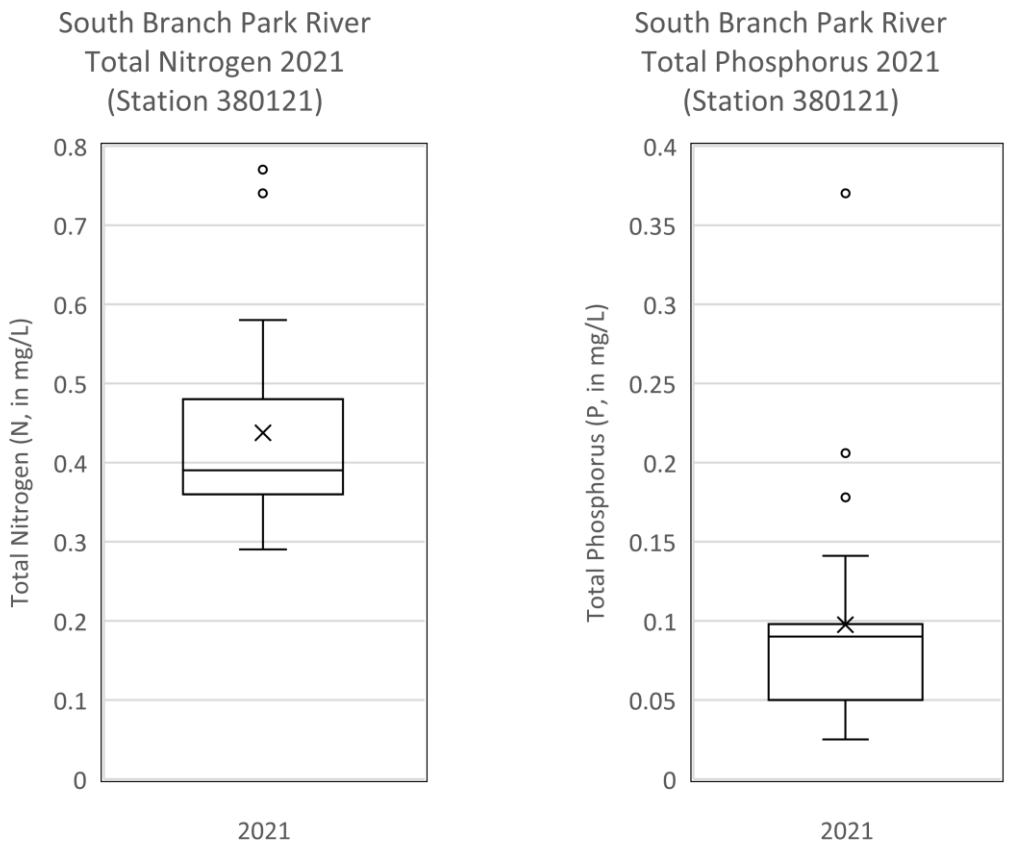


Figure 2. Summary statistics of Total Nitrogen (left) and Total Phosphorus (right) at water quality monitoring site 380121 on South Branch Park River in 2021.

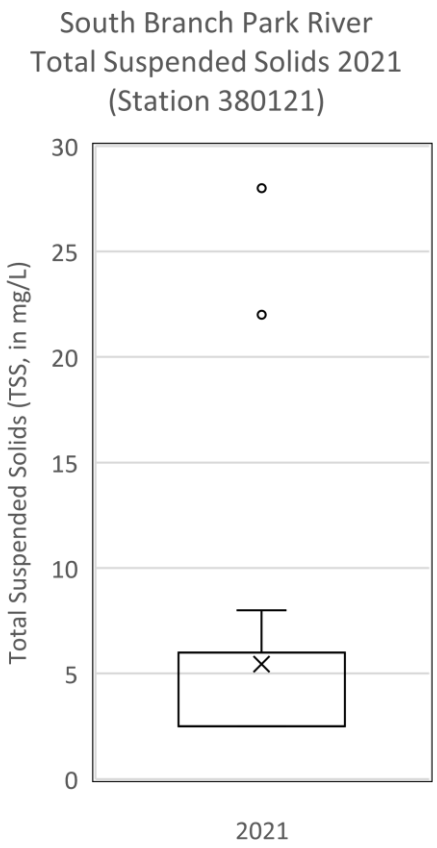


Figure 3. Summary statistics of Total Suspended Solids at water quality monitoring site 380121 on South Branch Park River in 2021.

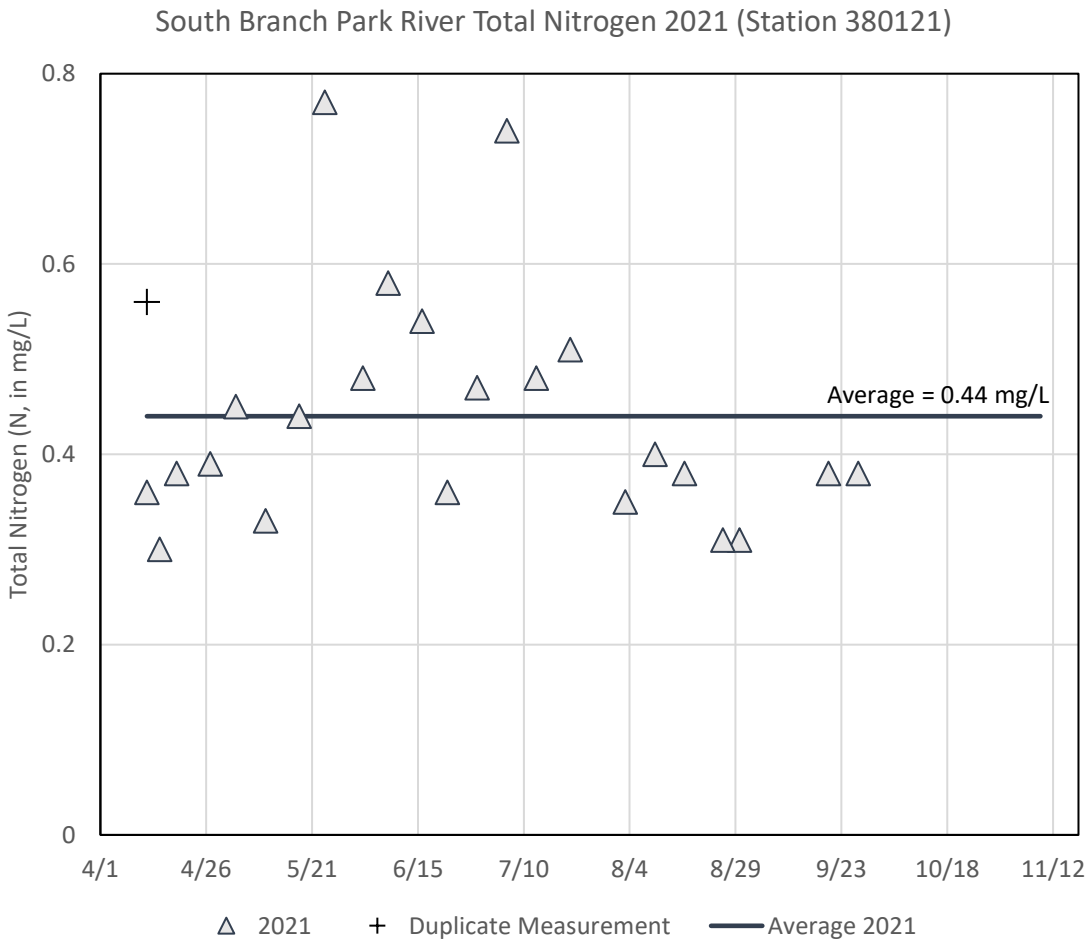


Figure 4. Total Nitrogen (N) at water quality monitoring site 380121 on South Branch Park River in 2021.

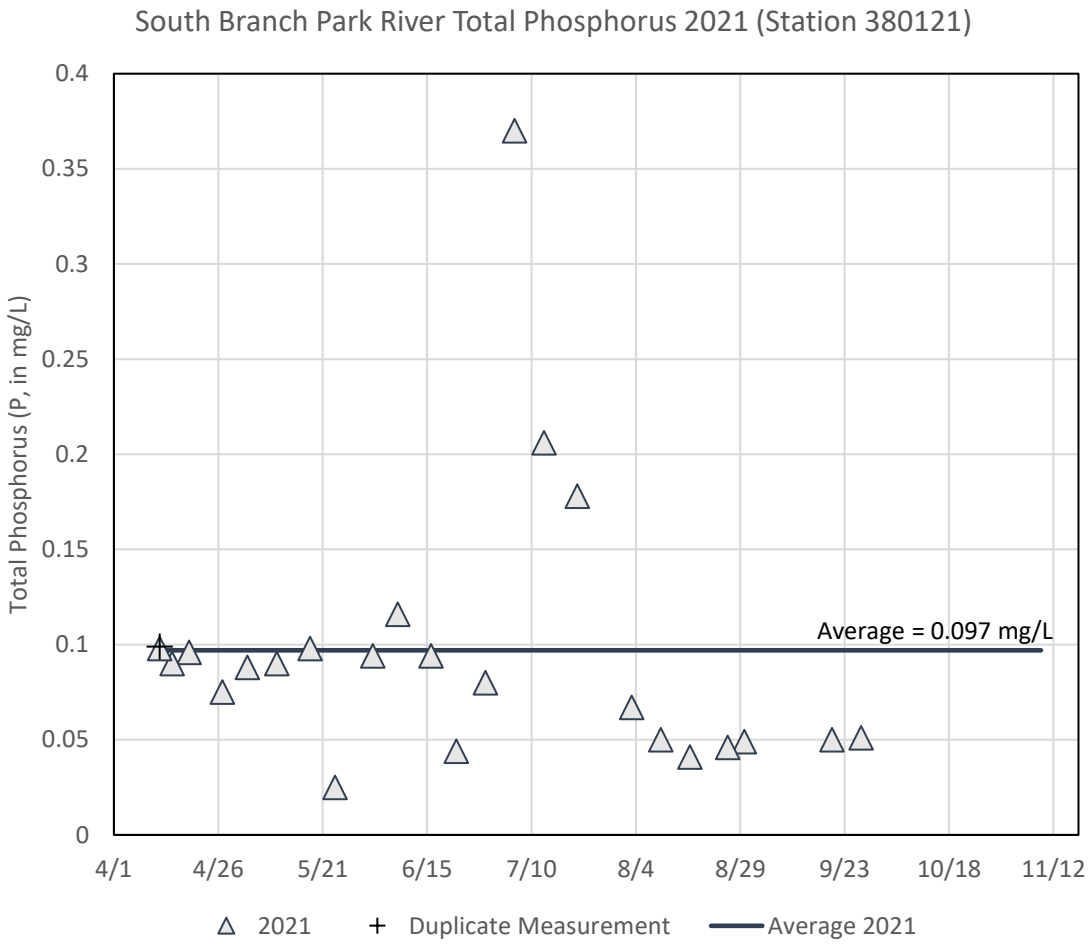


Figure 5. Total Phosphorus (P) at water quality monitoring site 380121 on South Branch Park River in 2021.

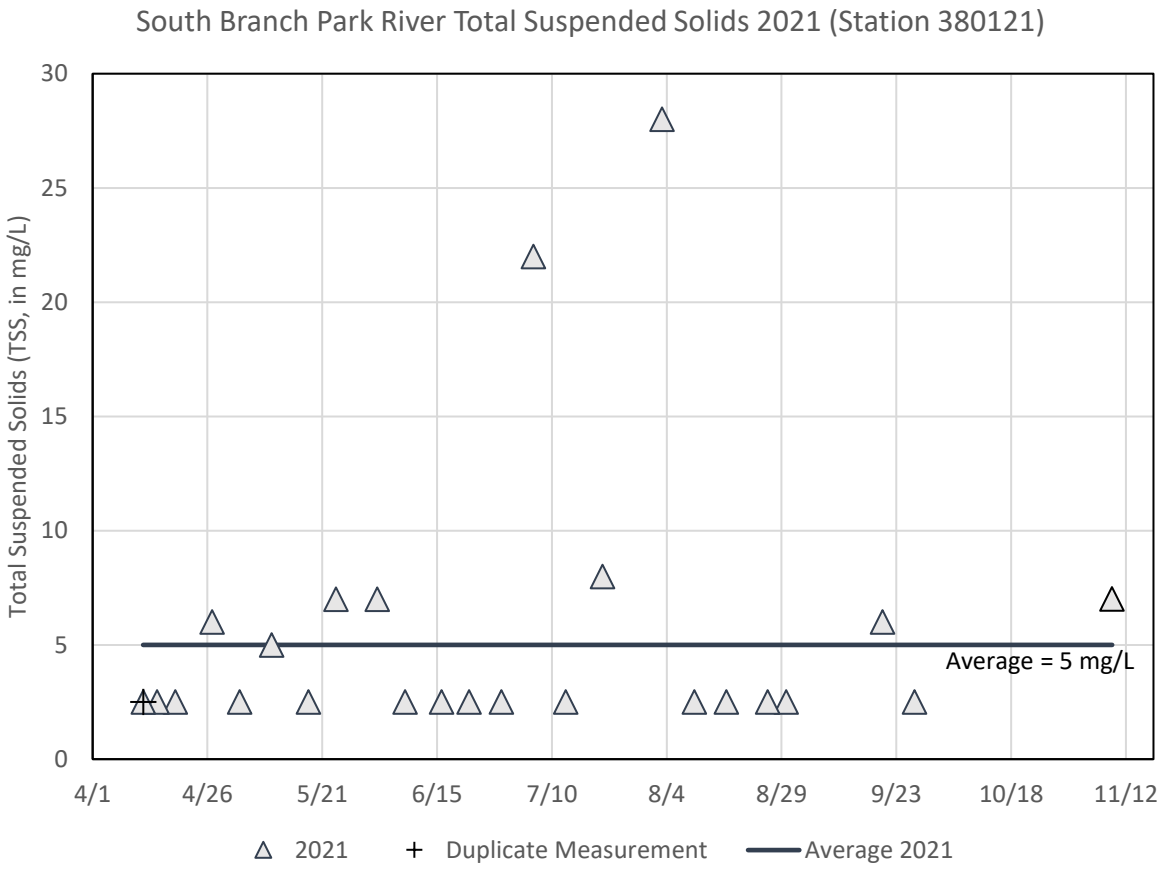


Figure 6. Total Suspended Solids (TSS) at water quality monitoring site 380121 on South Branch Park River in 2021.

Station 381260 – Homme Dam

Water quality data was collected from monitoring site 381260 one to two times per month from May – September in 2020 and 2021 (no samples collected August of 2020). Laboratory results reported as non-detect were updated to half of the detection level value. Samples were collected from a depth of 0.923 meters.

Table 3. Summary statistics of water quality results from site 381260 on Homme Dam in 2020.

Parameter	Unit	Maximum	Minimum	Average	Median	No. of Samples
Ammonia	mg/L	0.18	0.015*	0.056	0.015*	4
Ammonia (dissolved)	mg/L	0.14	0.015*	0.046	0.015*	4
Nitrate + Nitrite	mg/L	0.181	0.015*	0.057	0.015*	4
Nitrate + Nitrite (dissolved)	mg/L	0.188	0.015*	0.058	0.015*	4
Total Kjeldahl Nitrogen	mg/L	1.34	0.58	0.97	0.99	4
Total Kjeldahl Nitrogen (dissolved)	mg/L	1.05	0.67	0.89	0.91	4
Total Nitrogen	mg/L	1.37	0.61	1.04	1.09	4
Total Nitrogen (dissolved)	mg/L	1.22	0.70	0.96	0.95	4
Total Phosphorus	mg/L	0.411	0.129	0.229	0.188	4
Phosphorus (dissolved)	mg/L	0.352	0.102	0.192	0.157	4
Chlorophyll A	µg/L	26.2	2.67	13.0	10.2	3
Chlorophyll B	µg/L	2.21	0.25*	0.90	0.25*	3
Total Suspended Solids	mg/L	7	2.5*	5	4	4
Total Dissolved Solids**	mg/L	561				1
Bicarbonate**	mg/L	271				1
Calcium (dissolved)**	mg/L	70.7				1
Carbonate**	mg/L	4				1
Chloride**	mg/L	17.3				1
Fluoride**	mg/L	0.249				1
Hardness (total $CaCO_3$)**	mg/L	302				1
Hardness (non-carbonate)**	mg/L	74				1
Hydroxide**	mg/L	0.5*				1
Iron (dissolved)**	mg/L	0.025*				1

Magnesium (dissolved)**	mg/L	30.5	1
Manganese (dissolved)**	mg/L	0.336	1
Potassium (dissolved)**	mg/L	9.29	1
Silica (dissolved)**	mg/L	18.4	1
Sodium (dissolved**)	mg/L	70.4	1
Sulfate**	mg/L	234	1
*Half of minimum detection level for associated parameter **Sampled 05/30/2020			

Table 4. Summary statistics of water quality results from site 381260 on Homme Dam in 2021.

Parameter	Unit	Maximum	Minimum	Average	Median	No. of Samples
Ammonia	mg/L	0.121	0.015*	0.045	0.015*	10
Ammonia (dissolved)	mg/L	0.107	0.015*	0.042	0.015*	10
Nitrate + Nitrite	mg/L	0.181	0.015*	0.027	0.015*	10
Nitrate + Nitrite (dissolved)	mg/L	0.188	0.015*	0.015*	0.015*	10
Total Kjeldahl Nitrogen	mg/L	0.82	0.46	0.62	0.61	10
Total Kjeldahl Nitrogen (dissolved)	mg/L	0.71	0.40	0.59	0.59	10
Total Nitrogen	mg/L	0.85	0.49	0.65	0.64	10
Total Nitrogen (dissolved)	mg/L	0.74	0.43	0.62	0.62	10
Total Phosphorus	mg/L	0.282	0.038	0.124	0.109	10
Phosphorus (dissolved)	mg/L	0.260	0.033	0.110	0.091	10
Chlorophyll A	µg/L	13.4	0.25*	5.29	2.23	10
Chlorophyll B	µg/L	0.70	0.25*	0.295	0.25*	10
Total Suspended Solids	mg/L	8	2.5*	3.3	2.5*	10
*Half of minimum detection level for associated parameter						

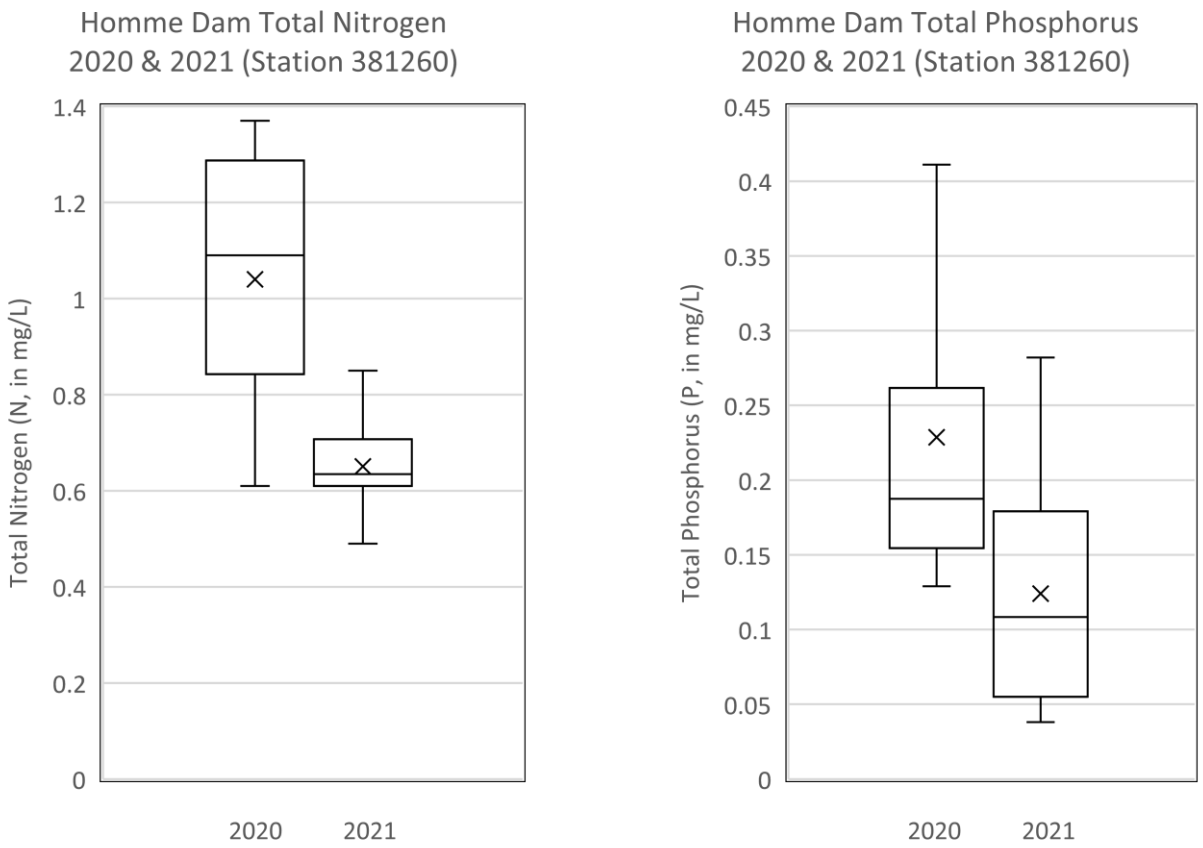


Figure 7. Summary statistics of Total Nitrogen (left) and Total Phosphorus (right) at water quality monitoring site 381260 on Homme Dam in 2020 and 2021.

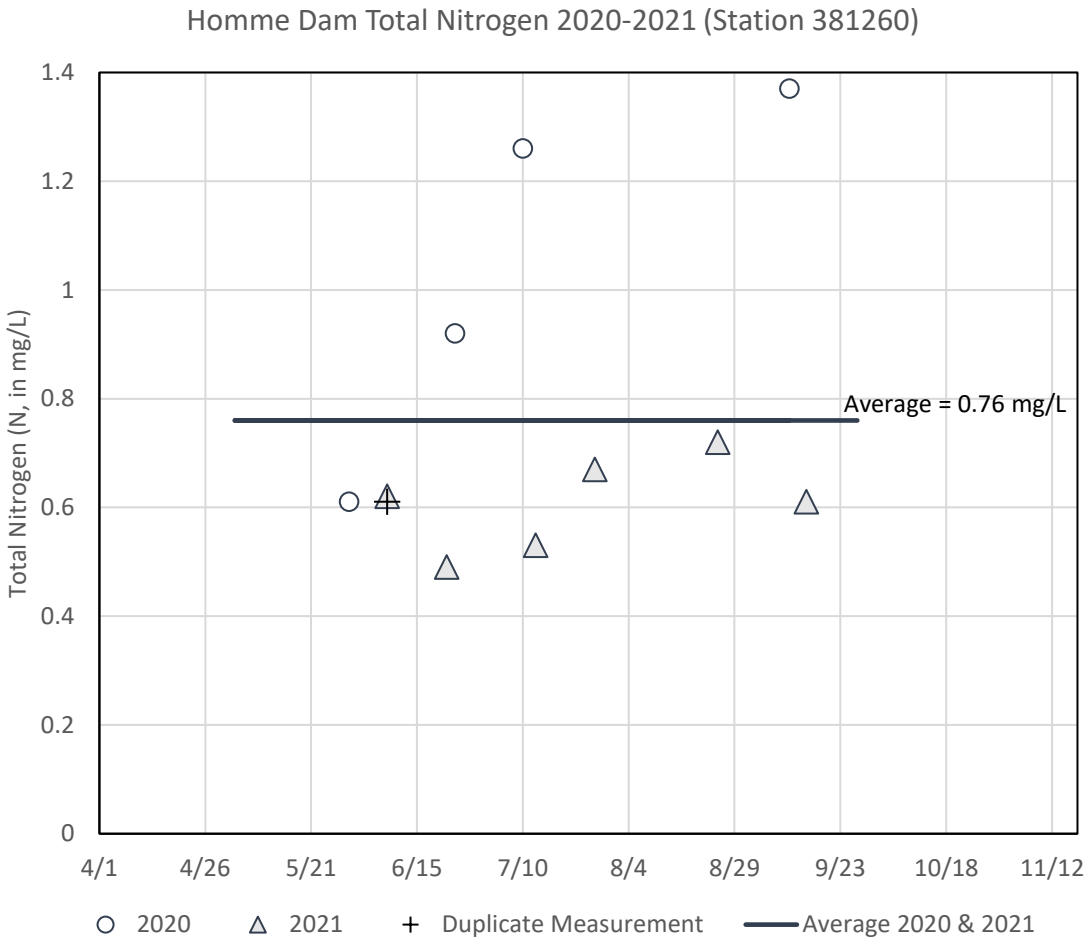


Figure 8. Total Nitrogen (N) at water quality monitoring site 381260 on Homme Dam in 2020 and 2021. Sample depth = 0.923 meters.

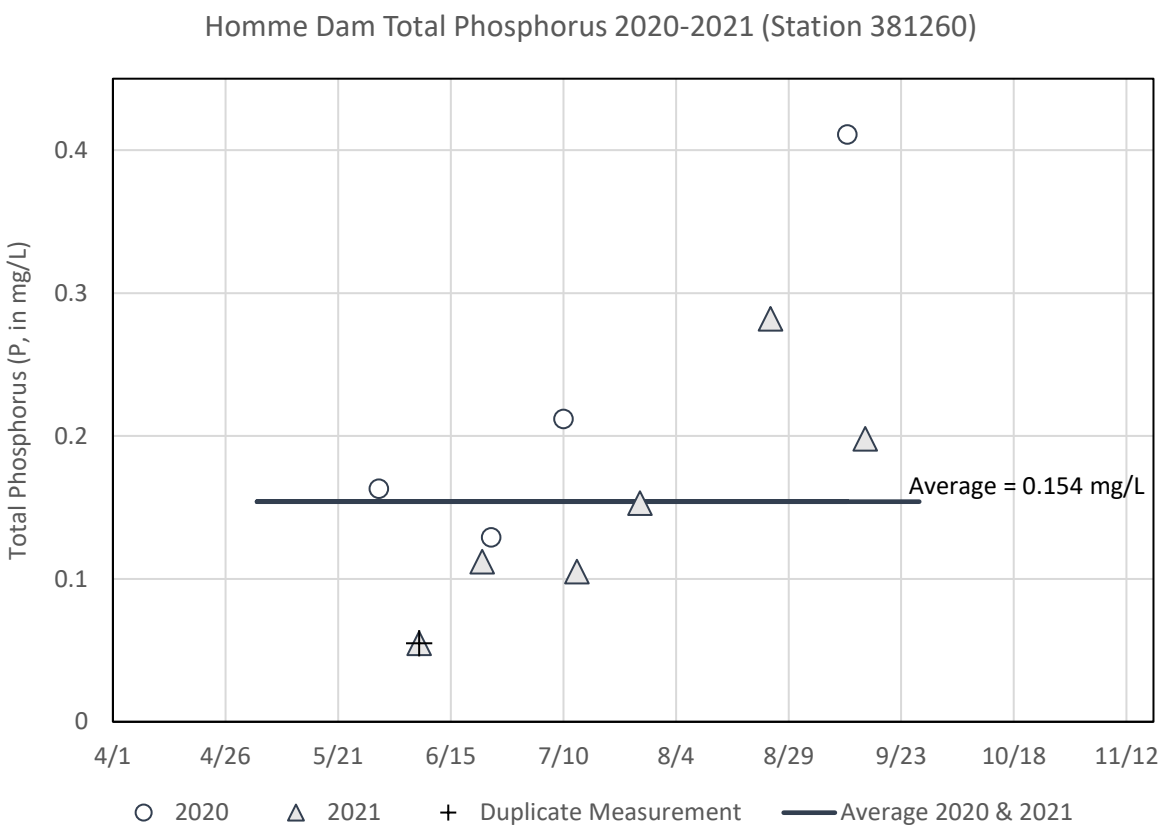


Figure 9. Total Phosphorus (P) at water quality monitoring site 381260 on Homme Dam in 2020 and 2021. Sample depth = 0.923 meters.

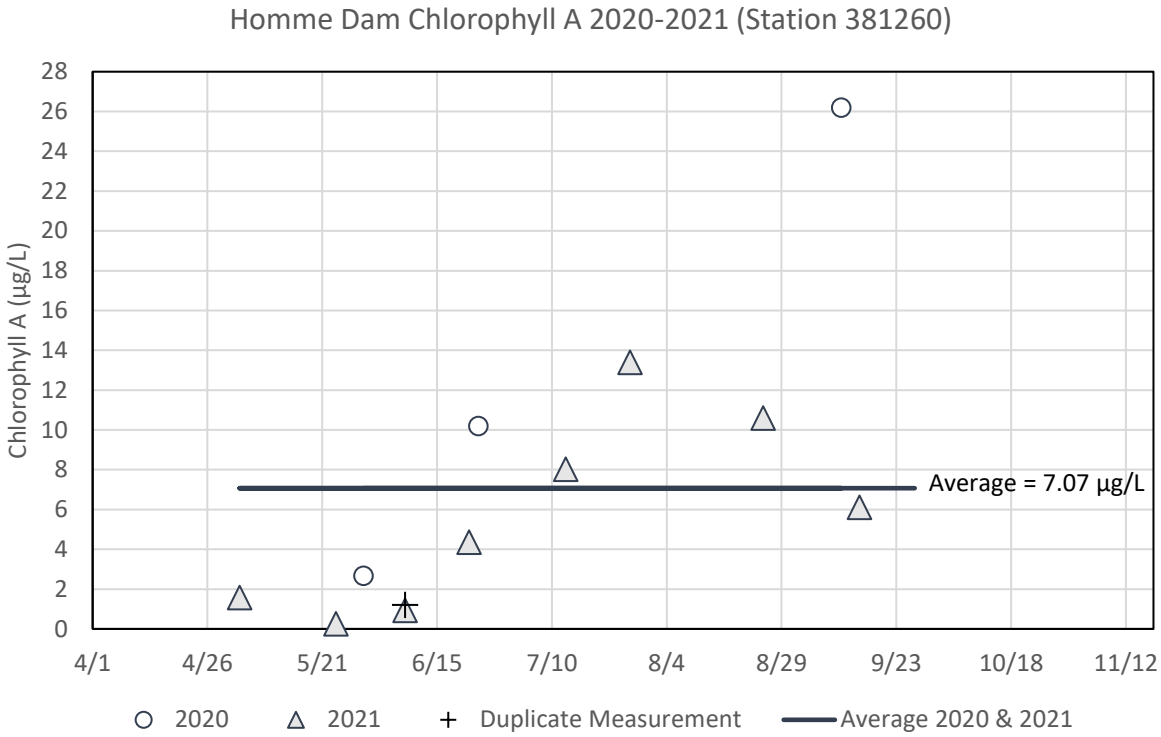


Figure 10. Chlorophyll A at water quality monitoring site 381260 on Homme Dam in 2020 and 2021. Sample depth = 0.923 meters.

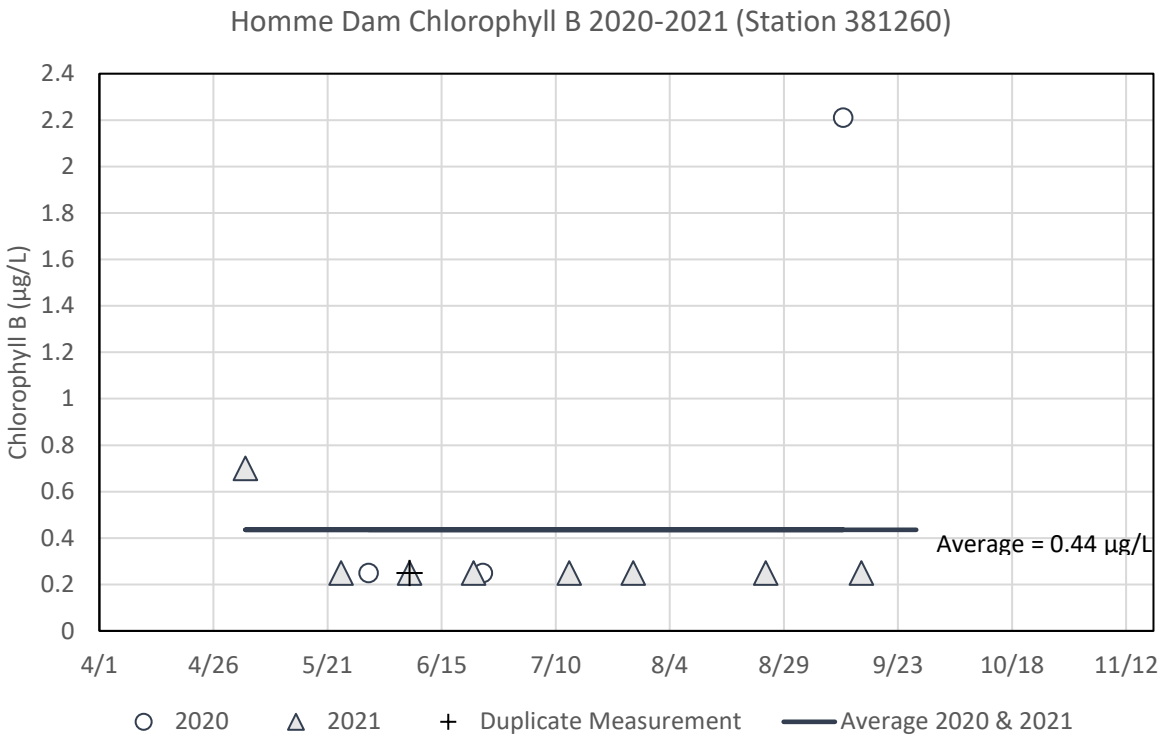


Figure 11. Chlorophyll B at water quality monitoring site 381260 on Homme Dam in 2020 and 2021. Sample depth = 0.923 meters.

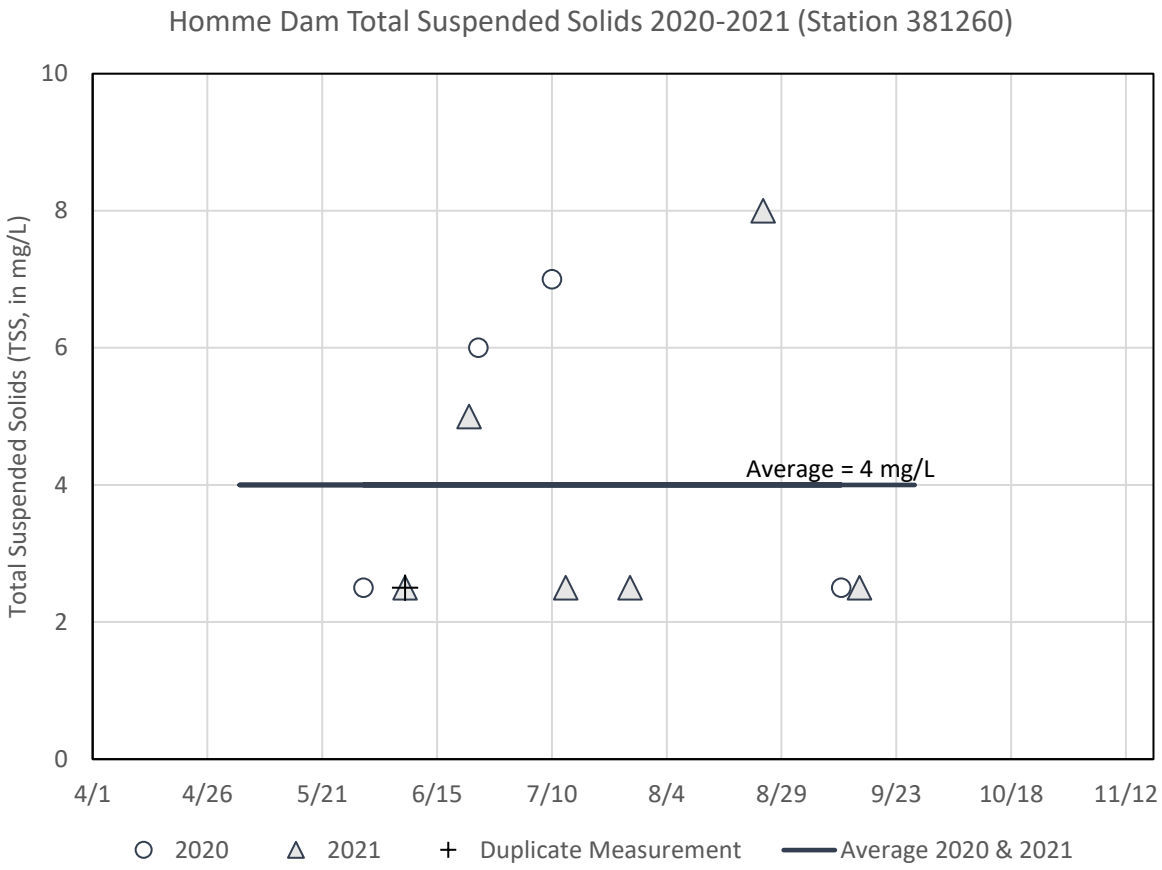


Figure 12. Total Suspended Solids (TSS) at water quality monitoring site 381260 on Homme Dam in 2020 and 2021. Sample depth = 0.923 meters.

Station 386032 – South Branch Park River

Water quality data was collected from monitoring site 386032 weekly as conditions permitted, between April and September (once in November 2021). Laboratory results reported as non-detect were updated to half of the detection level value.

Table 5. Summary statistics of water quality results from site 386032 on South Branch Park River in 2020.

Parameter	Unit	Maximum	Minimum	Average	Median	No. of Samples
Ammonia	mg/L	0.140	0.015*	0.029	0.015*	9
Nitrate + Nitrite	mg/L	0.855	0.015*	0.333	0.316	9
Total Kjeldahl Nitrogen	mg/L	1.03	0.66	0.81	0.78	9
Total Nitrogen	mg/L	1.77	0.70	1.14	1.15	9
Total Phosphorus	mg/L	0.35	0.11	0.25	0.28	9
Total Suspended Solids	mg/L	103	2.5*	27	17	9
Alkalinity**	mg/L	252				1
Bicarbonate**	mg/L	293				1
Calcium**	mg/L	94.5				1
Carbonate**	mg/L	7				1
Chloride**	mg/L	26.2				1
Fluoride**	mg/L	0.280				1
Hardness (Total $CaCO_3$)**	mg/L	413				1
Hydroxide**	mg/L	0.5*				1
Iron**	mg/L	0.085				1
Magnesium**	mg/L	42.9				1
Manganese**	mg/L	0.087				1
Potassium**	mg/L	10.1				1
Silica**	mg/L	13.7				1
Sodium**	mg/L	75.8				1
Sulfate**	mg/L	308				1
Total Dissolved Solids**	mg/L	710				1

*Half of minimum detection level for associated parameter
**Sampled 06/01/2020

Table 6. Summary statistics of water quality results from site 386032 on South Branch Park River in 2021.

Parameter	Unit	Maximum	Minimum	Average	Median	No. of Samples
Ammonia	mg/L	0.440	0.015*	0.076	0.015*	26
Nitrate + Nitrite	mg/L	0.185	0.015*	0.026	0.015*	26
Total Kjeldahl Nitrogen	mg/L	1.59	0.40	0.85	0.85	26
Total Nitrogen	mg/L	1.62	0.51	0.89	0.88	26
Total Phosphorus	mg/L	1.11	0.01*	0.24	0.12	26
Total Suspended Solids	mg/L	102	2.5*	30	25	26
*Half of minimum detection level for associated parameter						

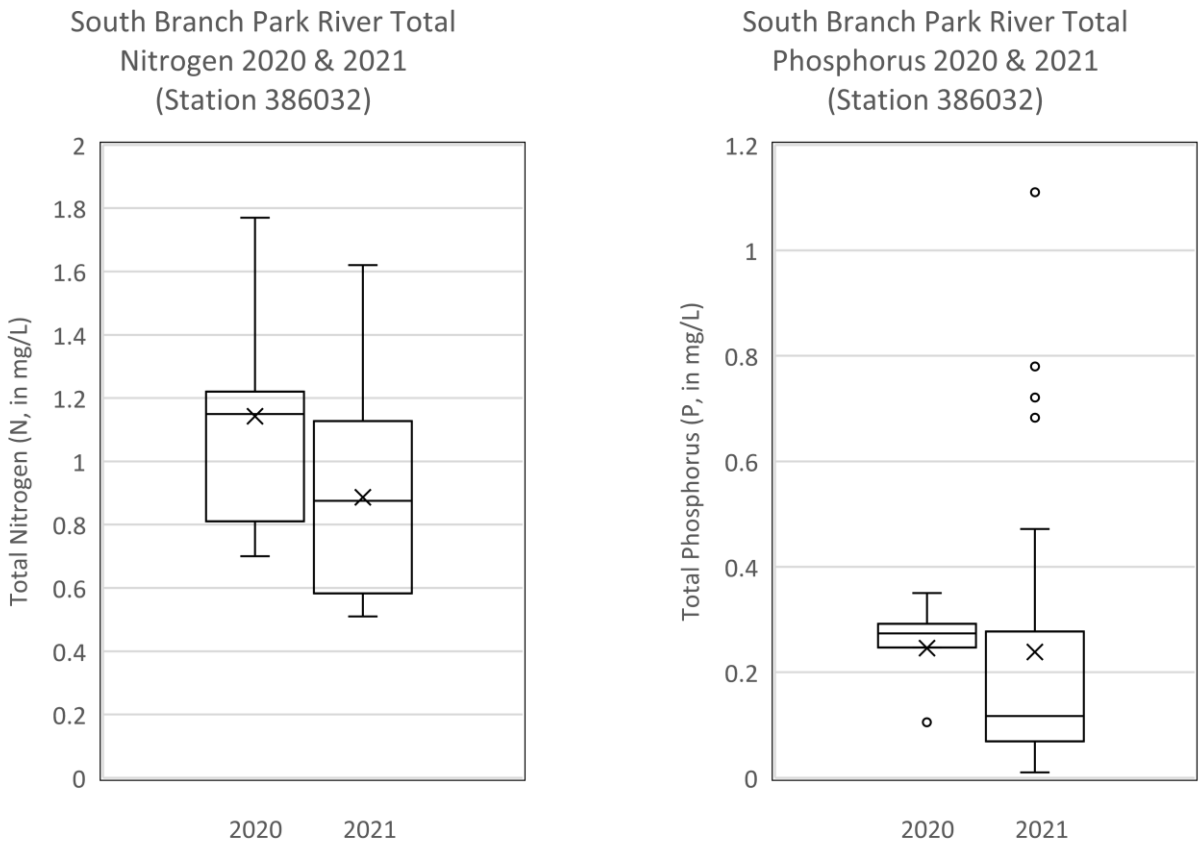


Figure 13. Summary statistics of Total Nitrogen (left) and Total Phosphorus (right) at water quality monitoring site 386032 on South Branch Park River in 2020 and 2021.

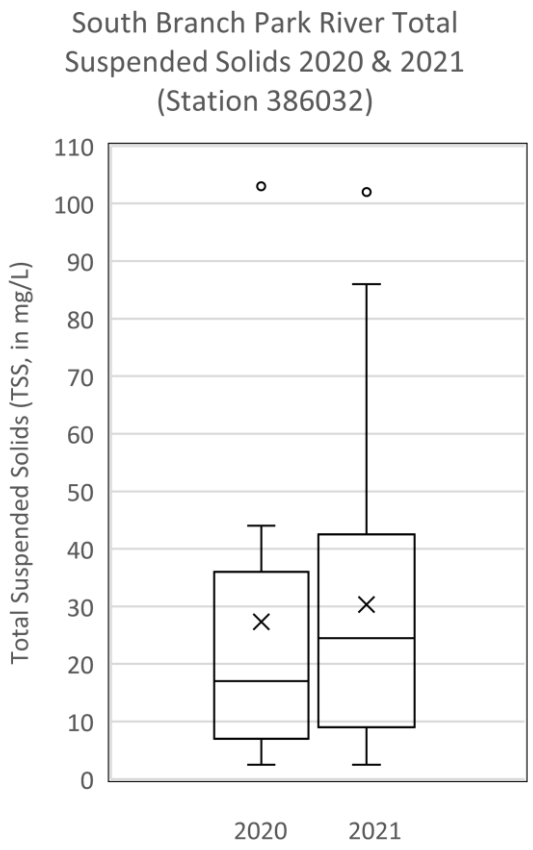


Figure 14. Summary statistics of Total Suspended Solids at water quality monitoring site 386032 on South Branch Park River in 2020 and 2021.

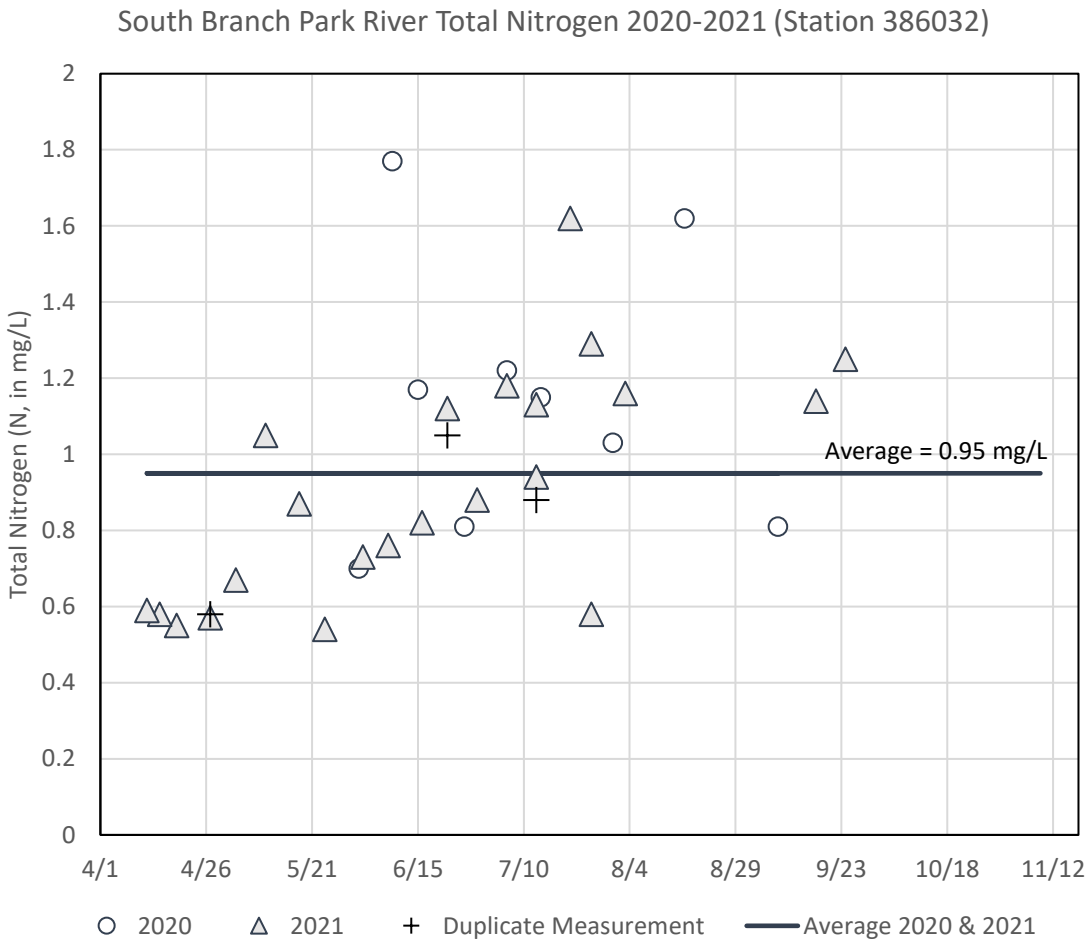


Figure 15. Total Nitrogen (N) at water quality monitoring site 386032 on South Branch Park River in 2020 and 2021.

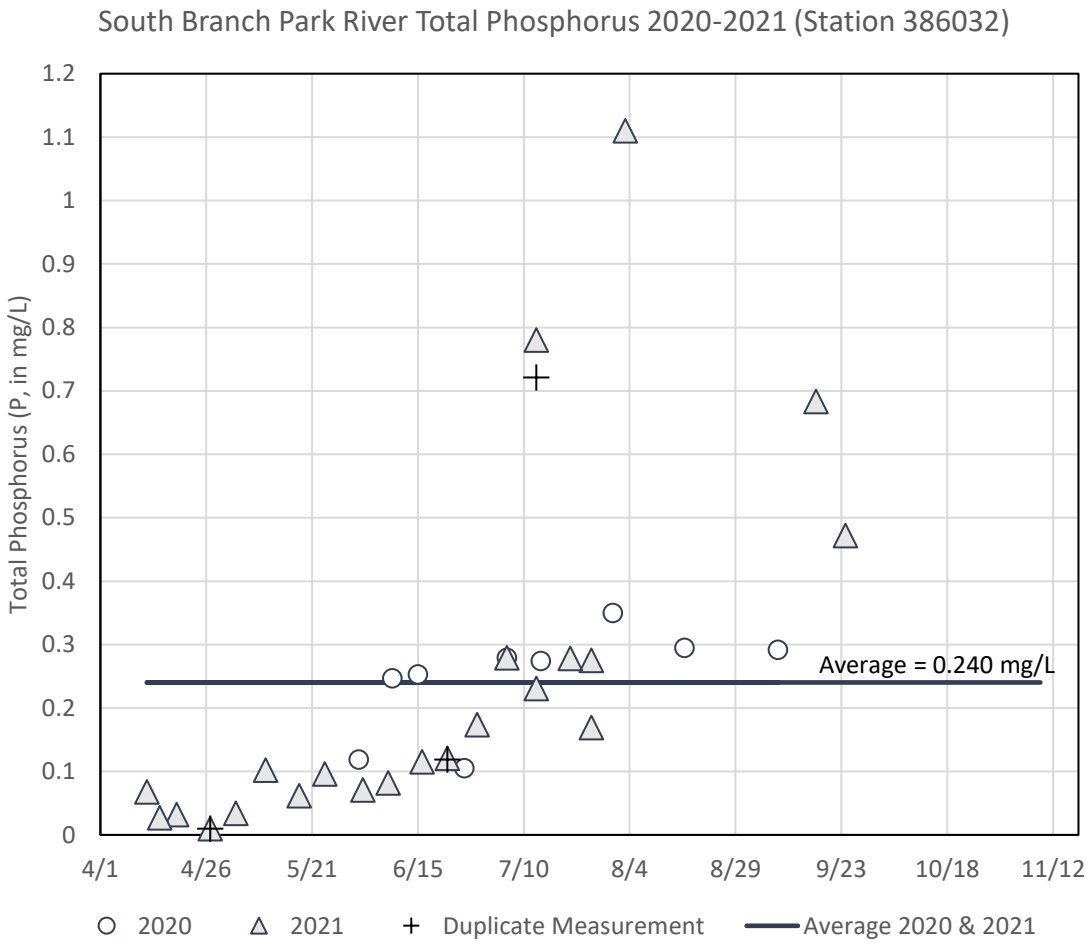


Figure 16. Total Phosphorus (P) at water quality monitoring site 386032 on South Branch Park River in 2020 and 2021.

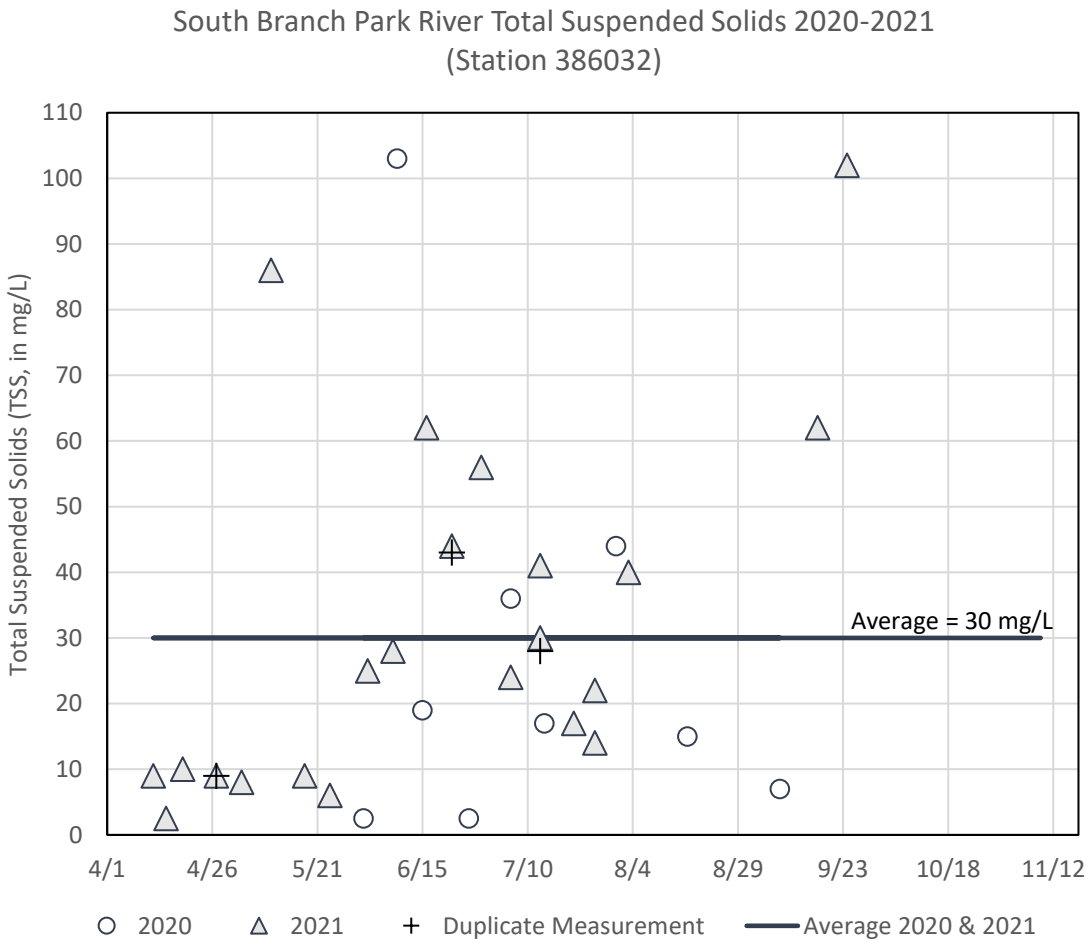


Figure 17. Total Suspended Solids (TSS) at water quality monitoring site 386032 on South Branch Park River in 2020 and 2021.

Station 386031 – Park River

Water quality data was collected from monitoring site 386031 weekly as conditions permitted, between April and September (once in November 2021). Laboratory results reported as non-detect were updated to half of the detection level value.

Table 7. Summary statistics of water quality results from site 386031 on Park River in 2020.

Parameter	Unit	Maximum	Minimum	Average	Median	No. of Samples
Ammonia	mg/L	0.550	0.015*	0.088	0.060	11
Nitrate + Nitrite	mg/L	2.15	0.015*	0.319	0.123	11
Total Kjeldahl Nitrogen	mg/L	1.4	0.67	0.91	0.89	11
Total Nitrogen	mg/L	3.55	0.70	1.24	1.06	11
Total Phosphorus	mg/L	0.443	0.200	0.334	0.348	11
Total Suspended Solids	mg/L	45	7	19	15	11
Alkalinity**	mg/L	327	324	-	-	2**
Bicarbonate**	mg/L	387	387	-	-	2**
Calcium**	mg/L	117	112	-	-	2**
Carbonate**	mg/L	6	4	-	-	2**
Chloride**	mg/L	80	79	-	-	2**
Fluoride**	mg/L	0.439	0.436	-	-	2**
Hardness (Total $CaCO_3$)**	mg/L	510	487	-	-	2**
Hydroxide**	mg/L	0.5*	0.5*	-	-	2**
Iron**	mg/L	0.258	0.158	-	-	2**
Magnesium**	mg/L	52.9	50.4	-	-	2**
Manganese**	mg/L	0.203	0.170	-	-	2**
Potassium**	mg/L	8.19	7.74	-	-	2**
Silica**	mg/L	14.3	13.8	-	-	2**
Sodium**	mg/L	96.7	91.0	-	-	2**
Sulfate**	mg/L	293	290	-	-	2**
Total Dissolved Solids**	mg/L	840	832	-	-	2**

*Half of minimum detection level for associated parameter

**Sampled 06/01/2020; No. of Samples includes duplicate sample collected same day/time

Table 8. Summary statistics of water quality results from site 386031 on Park River in 2021.

Parameter	Unit	Maximum	Minimum	Average	Median	No. of Samples
Ammonia	mg/L	0.073	0.015*	0.018	0.015*	26
Nitrate + Nitrite	mg/L	0.057	0.015*	0.017	0.015*	26
Total Kjeldahl Nitrogen	mg/L	1.33	0.49	0.83	0.76	26
Total Nitrogen	mg/L	1.36	0.53	0.86	0.76	26
Total Phosphorus	mg/L	1.18	0.056	0.523	0.259	26
Total Suspended Solids	mg/L	286	2.5*	36	17	26
*Half of minimum detection level for associated parameter						

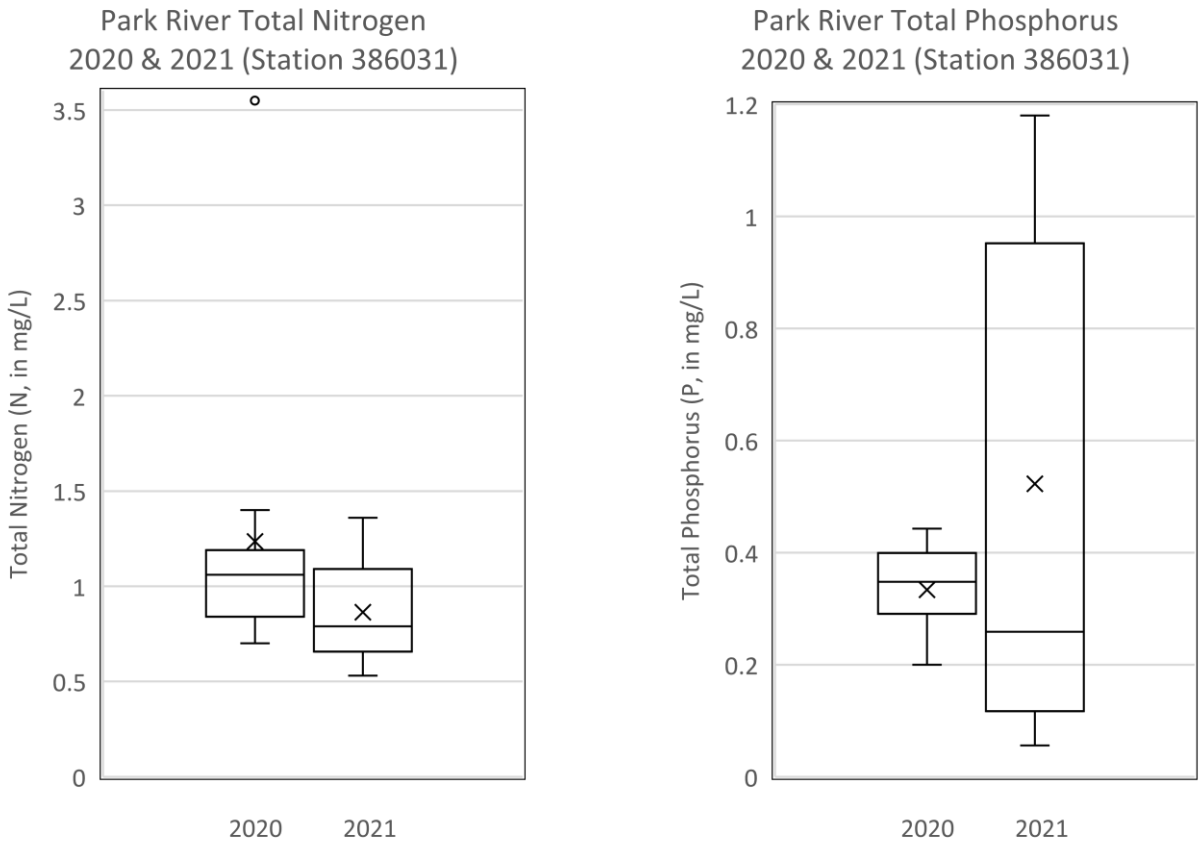


Figure 18. Summary statistics of Total Nitrogen (left) and Total Phosphorus (right) at water quality monitoring site 386031 on Park River in 2020 and 2021.

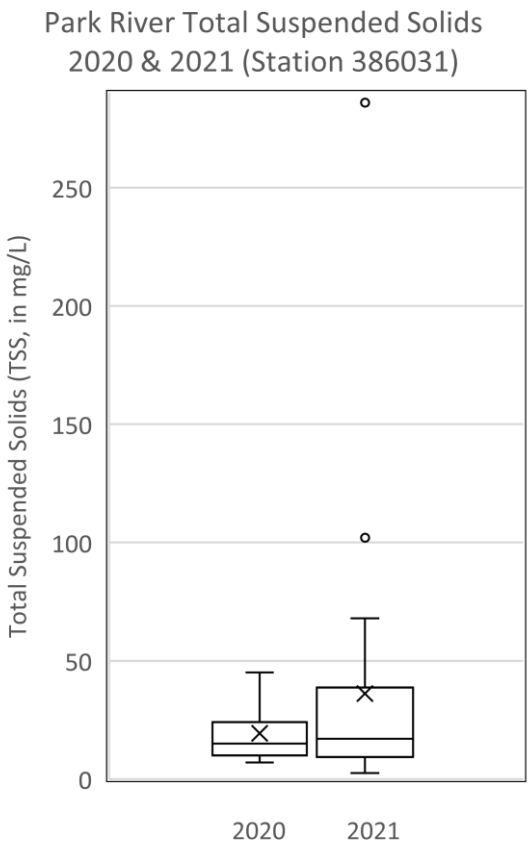


Figure 19. Summary statistics of Total Suspended Solids (TSS) at water quality monitoring site 386031 on Park River in 2020 and 2021.

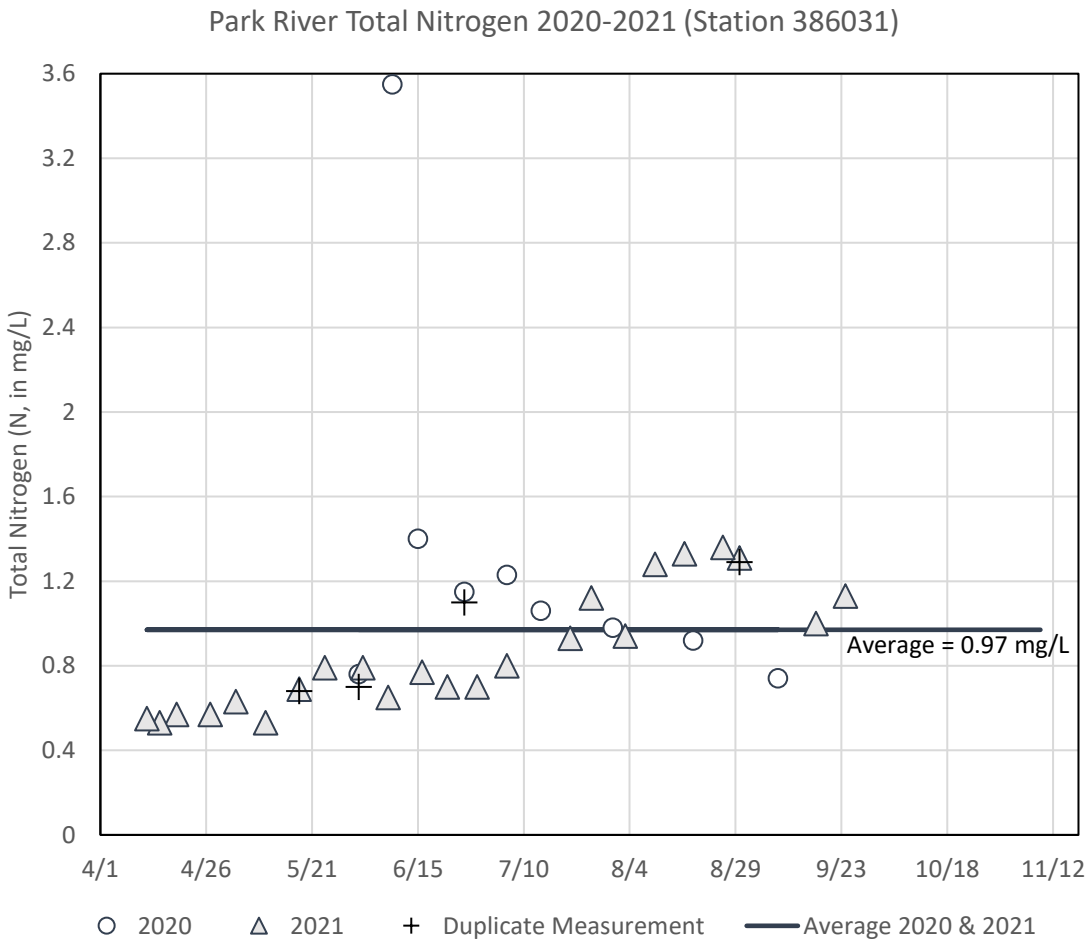


Figure 20. Total Nitrogen (N) at water quality monitoring site 386031 on Park River in 2020 and 2021.

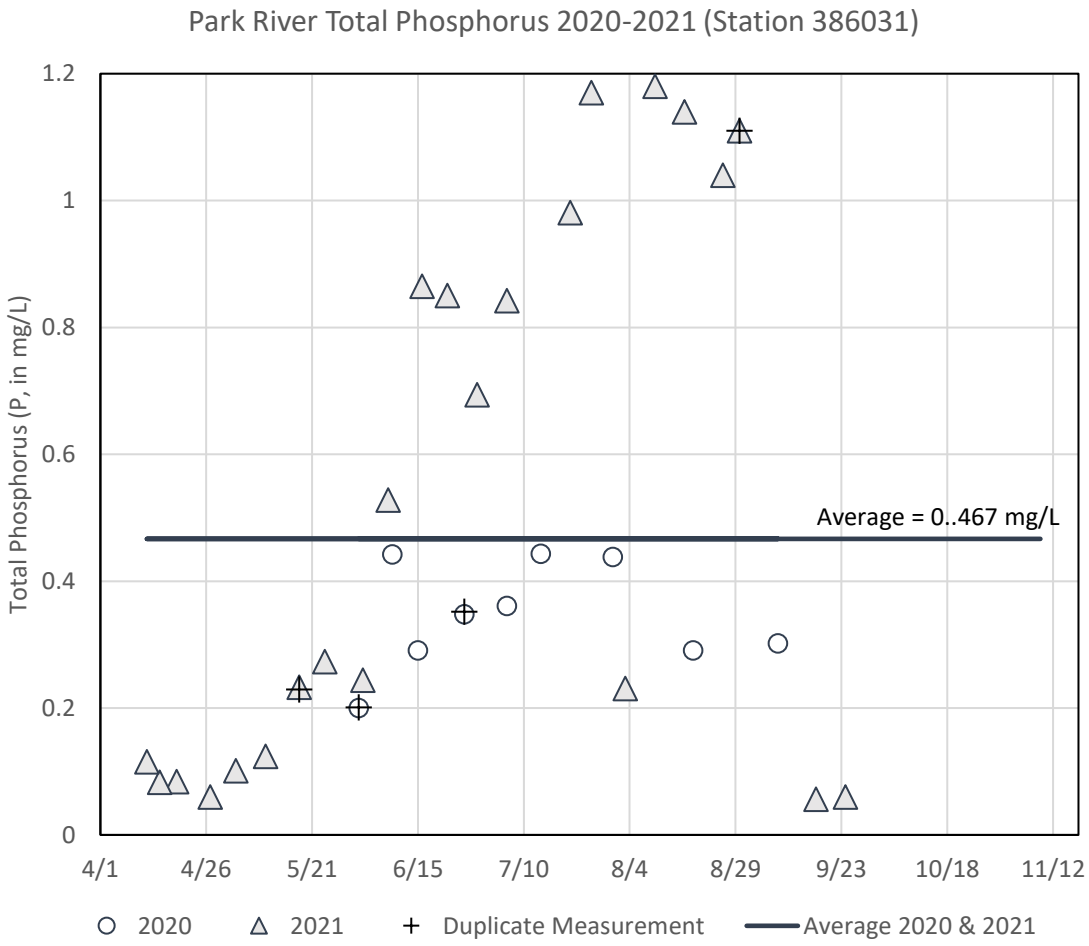


Figure 21. Total Phosphorus (P) at water quality monitoring site 386031 on Park River in 2020 and 2021.

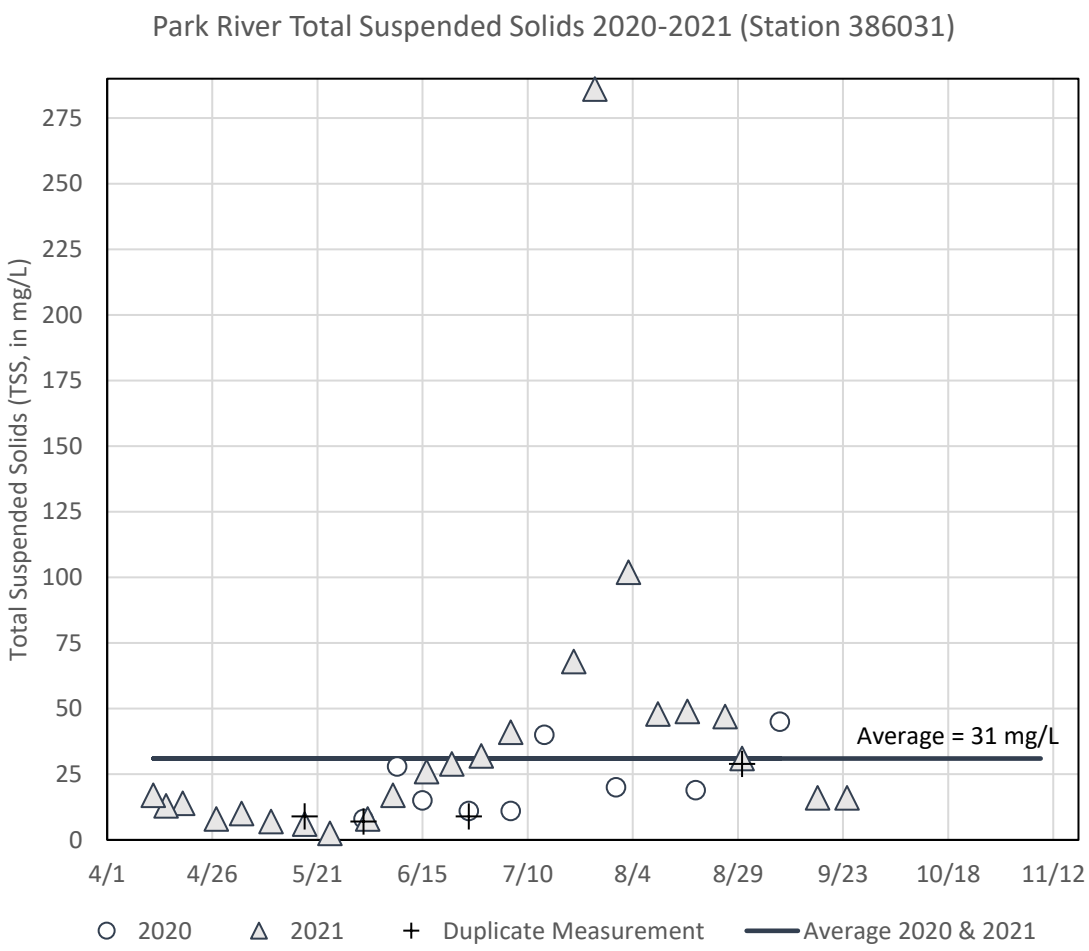


Figure 22. Total Suspended Solids (TSS) at water quality monitoring site 386031 on Park River in 2020 and 2021.