Diversion Approval Report for 2025

Prepared By:

Waukesha Water Utility and the Clean Water Plant on behalf of the City of Waukesha

Supported By:

SMITHGROUP

February 26, 2026

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Acronyms and Abbreviations

BPS	booster pumping station in Waukesha
CEM	conservation and efficiency measure
CWP	Clean Water Plant
gpd	gallons per day
MWW	Milwaukee Waterworks
REU	residential equivalency unit
USGS	U.S. Geological Survey
WBR	winter-based rate
WDNR	Wisconsin Department of Natural Resources
WPSC	Wisconsin Public Service Commission
WWU	Waukesha Water Utility

The June 21, 2016, Final Decision approving the Application by the City of Waukesha, Wisconsin (City), for a Diversion of Great Lakes Water from Lake Michigan and an Exception to Allow the Diversion sets forth various conditions of the approval.

Condition J of the Final Decision requires an annual report to be filed that "documents the daily, monthly, and annual amounts of water diverted and returned to the Lake Michigan watershed over the previous calendar year." The City of Waukesha continued its diversion for all of 2024, thereby requiring reporting as specified in the Final Decision and the Wisconsin Department of Natural Resources (WDNR) June 29, 2021, Diversion Approval. This report satisfies the requirements and mirrors the lettering format of the Diversion Approval, Section 12, *Reporting* (Diversion Approval, page 10).

A. Compact Principles

Requirement: The City shall summarize that the diversion was implemented consistent with the requirements of the Council Decision.

On October 9, 2023, the Waukesha Water Utility (WWU) completed its commissioning and testing of new equipment and began the initial transition to Milwaukee Waterworks (MWW) water. By November 2, 2023, the final transition was complete. Following the completion of the transition, and for all of 2025, WWU has continued to purchase water from MWW for distribution to its customers.

The WWU has an approved extended well abandonment agreement signed by all parties on November 28, 2023, for all previously active wells, thus changing their status from active to emergency use. The groundwater pumped in 2025 was minimal, only what was needed to complete the sampling required by WDNR, and it was pumped to waste.

B. City of Milwaukee Water Supply Volumes

Requirement: The total amount of water purchased daily, monthly, and annually from the City of Milwaukee, including the location(s) of the water meter used to determine the amount of water purchased.

The water purchased from MWW is measured by a meter in the pit near the Oklahoma Pump Station in Milwaukee. The annual total of purchased water from MWW for 2025 is 2,007,522,980 gallons. The daily water volume of purchased MWW water is included in Appendix A. The monthly water volume of purchased MWW water is summarized in Table B-1.

Table B-1. Monthly Water Purchased from Milwaukee Waterworks

Month	Pumpage from Groundwater (gallons)	Water Purchased from MWW for Drinking (gallons)
January 2025	0	159,730,509
February 2025	0	147,626,923
March 2025	0	162,011,890
April 2025	0	159,166,026
May 2025	0	172,457,849
June 2025	0	174,850,190
July 2025	0	181,048,593
August 2025	0	177,890,600
September 2025	0	174,575,900
October 2025	0	169,113,400
November 2025	0	160,954,300
December 2025	0	168,096,800
2025 Total	**0**	**2,007,522,980**

C. Water Sales Volumes

Requirement: The total amount of water sold monthly to each category of customer within the approved diversion area.

The City sold a total of 1,621,155,900 gallons of water in 2025 to its customers, all of which was ,purchased from MWW. The total sold volume is less than the total pumpage volume (2,007,522,980), where the difference includes water-using activities such as hydrant and main flushing, equipment,, maintenance, water main breaks, and water used for the various water quality analyzers.

Table C-1 summarizes the water sales volumes, by month and customer class, for 2025.

Table C-1. 2025 Monthly Water Sales Volumes in Gallons by Customer Class

Customer Class	# of Customers	Jan	Feb	Mar	Apr	May	Jun
RESIDENTIAL	17,292	53,307,800	57,941,200	55,624,600	49,286,100	51,146,700	59,605,900
RES-2 FAMILY	1,176	6,704,900	7,287,400	7,194,000	6,348,900	6,454,500	7,000,800
RES-3 FAMILY	75	456,800	506,300	538,200	440,600	442,800	483,600
MULTI-FAMILY	947	26,120,300	28,021,400	28,111,900	24,785,100	25,284,400	26,901,600
COMMERCIAL -REG	1,282	22,479,700	24,939,300	25,504,400	22,556,500	23,700,900	28,457,900
INDUSTRIAL	147	8,173,200	9,668,400	9,233,100	9,392,100	10,371,100	11,636,100
PUBLIC	116	3,498,600	4,119,000	3,653,400	3,197,500	3,682,200	6,685,200
IRRIGATION	183	2,400	800	1,600	1,500	32,400	556,900
TOTAL SALES	**21,218**	**120,743,700**	**132,483,800**	**129,861,200**	**116,008,300**	**121,115,000**	**141,328,000**

Customer Class	Jul	Aug	Sep	Oct	Nov	Dec	Total
RESIDENTIAL	64,131,400	64,220,100	60,855,400	54,744,000	56,447,500	56,621,400	683,932,100
RES-2 FAMILY	7,550,200	7,451,500	7,501,700	6,881,400	7,030,300	7,300,500	84,706,100
RES-3 FAMILY	494,800	487,400	503,100	477,800	510,800	531,800	5,874,000
MULTI-FAMILY	28,215,000	28,129,700	28,572,400	26,961,200	27,943,600	28,892,500	327,939,100
COMMERCIAL -REG	32,540,300	32,962,600	31,383,100	29,893,500	27,334,900	24,971,300	326,724,400
INDUSTRIAL	11,659,600	12,898,400	11,395,500	12,864,800	12,021,700	10,434,800	129,748,800
PUBLIC	5,245,100	5,496,200	4,982,400	4,797,000	3,823,600	3,282,300	52,462,500
IRRIGATION	1,836,800	2,327,700	2,268,600	1,626,700	834,100	279,400	9,768,900
TOTAL SALES	**151,673,200**	**153,973,600**	**147,462,200**	**138,246,400**	**135,946,500**	**132,314,000**	**1,621,155,900**

D. Return Flow Volumes

Requirement: The daily, monthly, and annual volume of treated wastewater discharge returned to the Root River and the daily, monthly, and annual volume of treated wastewater discharge returned to the Fox River.

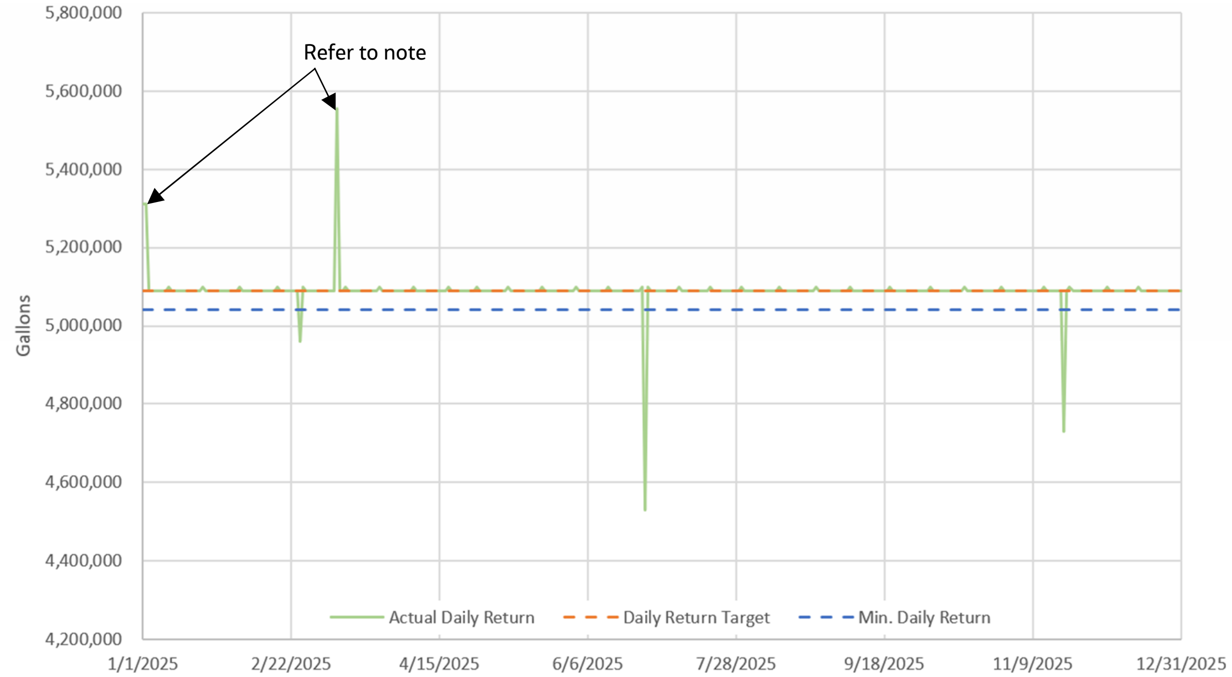
The City continued normal operation of the return flow pump station throughout 2025, with the majority of treatment plant flow to the Root River and the balance of the total plant flow to the Fox River (Table D-1). The 2024 average daily water demand was 5.04 million gallons, which was the daily return flow requirement in 2025. Similar to return flow in 2023 and 2024, an additional 0.05 million gallons of daily return flow was set in the pump station controls to provide a margin of safety to meet daily return flow volumes. This resulted in a daily return flow target of 5.09 million gallons. Following the same pump station control logic as 2024, after 5.09 million gallons were measured by the Clean Water Plant (CWP) magmeter, the pumps shut down until midnight. When midnight arrived, the pumps restarted to return 5.09 million gallons and this cycle repeated each day. The additional 0.05 million gallons greater than the requirement may be changed in the future as the plant staff become more familiar with the pump station operation and are confident about meeting the daily return flow volume requirement.

Table D-1. Monthly Volumes Discharged to the Root and Fox Rivers

Month	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)
January	44,616,000	158,250,000	202,866,000
February	32,962,000	42,420,000	175,382,000
March	65,213,000	58,275,000	223,488,000
April	122,591,000	152,730,000	275,321,000
May	97,577,000	157,810,000	255,387,000
June	112,943,000	152,180,000	265,123,000
July	90,165,000	157,820,000	247,985,000
August	255,539,000	157,810,000	413,349,000
September	94,065,000	152,720,000	246,785,000
October	73,213,000	157,820,000	231,033,000
November	55,434,000	152,360,000	207,794,000
December	58,463,000	157,810,000	216,273,000
Annual Total	**1,102,781,000**	**1,858,005,000**	**2,960,786,000**

The daily return flow requirement was achieved on 362 of the 365 days (99.2% of days). A summary of the daily return flow and the three days when daily flow was less than the requirement is summarized on Figure D-1 and in Table D-2. The daily return flow volumes are included in Appendix B.

Figure D-1. 2025 Daily Return Flow and Targets



Note: For the first two days of the year, the return flow pump station operated at the prior year's set points until updated return volume requirements could be calculated and the set points updated. On March 10, 2025, the return flow program was interrupted and the pumps ran manually resulting in a daily surplus.

Table D-2. 2025 Days Less Than Return Flow Target

Date	Return Volume Deficit to Requirement (gallons)	Comment
2/25/2025	-80,000	Return flow pumps did not restart at midnight due to a programming issue. This was corrected and confirmed with visual observation of pumps restarting the following day.
6/26/2025	-510,000	Pumps shut off to troubleshoot potential pipeline leak; determined leak was not associated with the return flow pipe.
11/20/2025	-310,000	Pumps paused for USGS flow meter equipment removal at reaeration building.

E. Consumptive Use

Requirement: The total consumptive use as defined in Wis. Stat. §281.346(1)(e).

In 2025, the WWU had 12 customers who measured consumptive use or water volume used during production. The total water usage associated with production was 30,209,600 gallons.

When the City began the Lake Michigan diversion, the WDNR requested that consumptive use be calculated using both the winter-based rate (WBR) method and a separate calculation that includes the water loss reported to the Wisconsin Public Service Commission (WPSC) and water used by industry that is incorporated into food and beverage products.

The WBR method primarily focuses on outdoor water use (lawn and landscape watering, car washing, pools) and assumes most of the consumptive use in municipal water supply systems is from evapotranspiration. Given that the City's water use peaks in summer months, the WDNR accepts this method to calculate domestic consumptive use. Annual and summer consumptive use are calculated as follows:

- The WBR method calculates annual consumptive use according to the following equation:

  Annual consumptive-use coefficient (%) = [(Sum of all monthly withdrawals ÷ 12) – (Sum of winter-month withdrawals ÷ 3)] ÷ (Sum of all monthly withdrawals ÷ 12) × 100

  Note: "All months" are January through December and "winter months" are January, February, and December.

- The WBR method calculates summer consumptive use according to the following equation:

  Summer consumptive-use coefficient (%) = [(Sum of summer monthly withdrawals – Sum of winter monthly withdrawals) ÷ Sum of summer monthly withdrawals] × 100

  Note: "Summer months" are June, July, and August. This basic equation also is used to estimate coefficients for spring (March, April, and May) and fall (September, October, and November).

The annual and summer consumptive-use coefficient calculations following the WBR method are summarized in Table E-1. The City's annual coefficient and summer coefficient are both much lower than that calculated by the USGS for other midwestern states (5.3% compared to 6% to 8%, and 10.9% compared to 16% to 20%, respectively)[1].

Table E-1. 2024 Consumptive-Use Coefficients Following the WBR Method

Total Annual Withdrawal[1]	2,007,522,980	gallons from Lake Michigan
Sum of Winter Withdrawals	475,454,232	gallons (Jan, Feb, and Dec 2025)
Sum of Spring Withdrawals	493,635,765	gallons (Mar, Apr, and May 2025)
Sum of Summer Withdrawals	533,789,383	gallons (Jun, Jul, and Aug 2025)
Sum of Fall Withdrawals	504,643,600	gallons (Sep, Oct, and Nov 2025)
Sum of Winter Withdrawals	475,454,232	gallons
% Annual Consumptive-use Coefficient	5.3	using Lake Michigan
Sum of Summer Withdrawals	533,789,383	gallons
% Summer Consumptive-use Coefficient	10.9	using Lake Michigan
[1] Lake Michigan water pumpage (purchased water) from Milwaukee Water Works		

However, calculating consumptive use, including any industry that uses water (food processing, beverage processing), and distribution system losses reported to the WPSC, including water main breaks, service leaks, or faulty pressure valves, results in greater consumptive use. Calculating the consumptive use, including the WBR method, water loss (WPSC), and water used by industry in food and beverage products, yields a 2025 consumptive use of 339,956,617 gallons or 16.9% (Table E-2).

[1] Shaffer, K.H. 2009. *Variations in Withdrawal, Return Flow, and Consumptive Use of Water in Ohio and Indiana, with Selected Data from Wisconsin, 1999–2004*. U.S. Geological Survey Scientific Investigations Report 2009–5096, 93 p. "The public-supply annual average consumptive-use coefficient calculated by use of the WBR method ranged from 6 to 8 percent, and the summer consumptive-use coefficient ranged from 16 to 20 percent for Ohio, Indiana, and Wisconsin." Pg. 65.

Table E-2. 2025 Total Calculated Consumptive Use with Industrial Usage

% Annual Consumptive-use Coefficient	5.3	
Total Pumpage	2,007,522,980	gallons from Lake Michigan
Water Loss (WPSC)	204,040,965	gallons
Water Used by Industry	30,209,600	gallon
Total Consumptive Use	339,956,617	gallons
	16.9%	

The 2025 consumptive-use coefficient for Lake Michigan water is calculated with the following equation:

> Lake Michigan Annual Consumptive-Use Coefficient (%) = [(Total Water Purchased from City of Milwaukee) – (Total Wastewater Return to Root River)] ÷ (Total Water Purchased from City of Milwaukee) x 100

The City returned less water to the Root River than was purchased from MWW during 2025, resulting in a consumptive-use coefficient for Lake Michigan water supply of 7.4%.

F. Water Conservation and Efficiency Plan

Requirement: A summary of the impact of the implemented Conservation and Efficiency Measures required under Wis. Admin. Code §§ NR 852.04 and NR 852.05, including quantifiable impacts to water use intensity, as defined in Wis. Admin. Code § NR 852.03(29). Water use intensity metric calculation methods as specified by the WDNR.

The City's 2025 conservation and efficiency measures (CEMs) are summarized in Table F-1.

Table F-1. 2025 Conservation and Efficiency Measures

Required CEM	2025 Activity
PWS – 1, Water Use Audit	Water loss is 11%.
PWS – 2, Leak Detection and Repair Program	Replaced 16,424 linear feet of mains. Inspected 1,467 hydrants and repaired leaks.
PWS – 3, Information and Education Outreach	Continued education programs and partnerships. This includes WWU's website, newsletters, bill stuffers, and bill messages (WWU and City of Waukesha), bill messages, newspaper articles, public service announcements, social media, brochures, advertisement content for City Park & Recreation Department Activity Guide, public outreach, community meetings, school programs, street signs (sprinkler ordinance requirements), yard signs (Brown Lawn Campaign), giveaways, and customer water-use audits and leak alerts.
PWS – 4, Source Measurement	All source water is metered and measured.
PWS – R1, Distribution System Pressure Management	The WWU manages system pressures in 10 pressure zones.
PWS – R2, Residential Demand Management Program	In 2025, 48 toilet rebates were issued, 10 showerhead rebates were issued, and 11 rain barrel rebates were issued. A sprinkling ordinance (for all customer classes) was enacted in 2006. Customers are allowed to irrigate twice a week. Street signs and annual mailers provide information on the sprinkling ordinance. Fines are also in place; 0 violators were reported in 2025. An irrigation ordinance (for all customer classes) was adopted in 2015 requiring permits for landscape irrigation systems to ensure irrigation systems are efficient; 2 permits were issued in 2025. Audit program (for residential and non-residential customers) determines high water consumption and sends a postcard to customers who may have a leak. In 2025, 24 residential water audits were conducted and 34 data logging reports were administered to evaluate for water leaks.
PWS – R3, Commercial and Industrial Demand Management Program	In 2025, 2 multi-family showerhead rebates were issued, 0 commercial toilet rebates were issued, and 3 multi-family toilet rebates were issued. The WWU followed-up again on a large multi-family account that applied for a toilet changeout in 2023, however, the multi-family facility has kept the toilet changeouts on hold. The utility received a new toilet rebate application for a large multi-family in 2025, but this project was also put on hold due the maintenance person's health issue. A large multi-family senior living center that participated in the Site-Specific Grant program completed replacing their cooling tower, however, $0 dollars were given out in 2025 while the water savings are still being verified; the incentive is anticipated to be paid in 2026. The WWU continues its audit program (for residential and non-residential customers). In 2025, 1 water audit was completed for a commercial customer and 56 datalogging reports were conducted for public, commercial, and industrial customers to evaluate water leaks.
PWS – R4, Water Reuse	The WWU is required to return 100% of the previous year's daily water demand; therefore, water reuse at a utility scale is not feasible.
Tier 3, Additional CEMs	In 2025, a water softener discontinuation program was implemented with the Clean Water Plant resulting in 1,902 water softener removal rebates.

PWS = public water system

F.1 Meter Testing

The water production meter at the Oklahoma Pump Station was tested on January 6, 2025, however, it began having issues with freezing the next day. On January 7, 2025 the WWU notified DNR that the WWU's Booster Pump Station (BPS) meter measuring flow from MWW would be used for reporting purposes until the MWW meter could be fixed. As of the end of 2025, MWW is still waiting for parts to repair their meter and use of the BPS meter continues for reporting.

Testing of the meters used for billing occurs in-house, based on the timing requirements of the WPSC. In 2025, 322 meters were tested.

F.2 Water Use Intensity Metrics

The 2025 per capita per day water use for residential, 2-family residential, 3-family residential, and multi-family residential customer categories is summarized in Table F-2.

Table F-2. 2025 Calculated Average Day Water Use per Capita

Customer Class	# of Customers	Annual Sales (gallons)
Residential	17,292	683,932,100
Res – 2 Family	1,176	84,706,100
Res – 3 Family	75	5,874,000
Multi-Family	947	327,939,100
Total	**19,490**	**1,102,451,300**
	Days in 2025	365
	Population in 2025[a]	71,461
	Residential per customer (gpd)	155
	Residential per capita (gpd)	42
	Total usage per capita (gpd)	62

gpd = gallon(s) per day

[a] Population from most recent U.S. Census on July 1, 2024 (https://www.census.gov/quickfacts/fact/table/waukeshacitywisconsin/PST045224)

The per capita per day water use calculated using a residential equivalent unit (REU) method is summarized in Table F-3.

Table F-3. 2025 Calculated Average Day Water Use per Residential Equivalent Unit

Meter Size (inches)	Number of Meters	REU Ratio[a]	REU
5/8	18,417	1	18,417
3/4	1,766	1	1,766
1	907	2.5	2,267.5
1 1/4	-	3.7	-
1 1/2	405	5	2,025
2	369	8	2,952
2 1/2	-	12.5	-
3	57	15	855
4	19	25	475
6	10	50	500
8	-	80	
10	-	122	
12	-	160	
Total	**21,950**	**-**	**29,257.5**

[a] From Wisconsin Public Service Commission

Average Day Residential Water Use per REU Calculation

Total Residential Water Sales	1,102,451,300	gallons
Average Day Residential Water Use	3,020,415	gpd
Average Day Residential Water Use/REU	103	gpd/REU

F.3 Water Volume Differences

There is a difference between the daily volume of water purchased from MWW and the volume that enters the WWU distribution system based on the presence of the onsite storage at the BPS. This is evident by comparing pumpage (purchased from MWW) and demand volumes:

- The maximum daily pumpage from MWW was 7,815,932 and occurred on July 23, 2025. This high pumpage day was associated with a very large water main break. The average daily pumpage from MWW was 5,500,063 gallons. This resulted in a ratio of maximum daily pumpage to average daily pumpage of 1.42.
- The maximum daily demand in the WWU distribution system was 6,636,600 gallons, which occurred on July 23,2025; and is attributed to not only the large water main break that occurred that day but also was during a week of temperatures that were greater than 80 degrees Fahrenheit (°F), with that specific day being 90°F. The average daily demand in the WWU distribution system was 5,012,098 gallons. This resulted in a ratio of maximum daily demand to average daily demand of 1.32.

The difference between the pumpage and demand volumes is relatively minor; however, different sections within WDNR may use the different volumes. For example, the water use and water supply section will likely use water demand volumes, whereas sections regulating with the Diversion Approval and return flow will likely use pumpage volumes.

G. Additional Conservation and Efficiency Measures

Requirement: A description of any additional Conservation and Efficiency Measures implemented.

Starting in 2006, the WWU implemented a variety of conservation programs. The WWU approved a conservation plan in 2012 that was updated in 2022. An analysis of water savings achieved since the 2012 plan was implemented demonstrates that, by 2021, the WWU has exceeded savings goals established for 2030 and 2050. The near-term program goals (years 1 to 5) were included as Table 5.3 of the 2022 report. Future reporting will include status updates of any new or additional measures implemented from the updated report.

In 2025, the WWU implemented a water softener discontinuation program with the CWP. This included a Water Softener Rebate Application whereby residential property owners were able to obtain $200 for disconnecting their water softeners. A higher initial rebate and the schedule for decreasing the rebate were publicized to encourage customers with softeners to act; the rebate was reduced to $150 after July 1, 2025. As of November 13, 2025, 1,876 water softeners were disconnected through this rebate program. The City has increased its budget for this rebate program to continue to encourage softener removals.

In 2025, WWU began investigating two possible additional incentives. The first incentive is for a washing machine rebate and the second for an ice maker rebate, which may be implemented in 2026.

H. Customers within Diversion Area

Requirement: A statement verifying that no customers outside of the diversion area were sold Lake Michigan water.

The WWU certifies no customers outside of the approved diversion area were sold Lake Michigan water in 2025.

I. Properties Served by Water Utility

Requirement: A spatially explicit description of the properties served by the City's water utility, in the manner prescribed by the DNR.

A map showing the area served by the WWU is included in Appendix C. An electronic geographic information system layer also will accompany this annual report submittal to the WDNR.

J. Existing Deep Aquifer Groundwater Wells

Requirement: A report of any City wells filled and sealed or changed to emergency use status in the past year. A description of deep aquifer groundwater wells maintained for emergency use, as allowed under Wis. Admin. Code § NR 810.22, and use of these wells in the previous year.

A copy of the November 2023 WDNR approval of extended well abandonment agreement for the utility wells is included in Appendix D.

K. Pharmaceutical and Personal Care Products Recycling and Reduction Program

Requirement: A summary of the implementation of the pharmaceutical and personal care products recycling and reduction program in the past year.

Refer to Appendix E.

L. Root River Monitoring

Requirement: For at least 10 years after the date the diversion begins, the City shall annually report the results of Root River monitoring to DNR. The report shall include a summary of the monitoring results and a summary of any impacts to the Root River from the City's wastewater discharge.

Refer to Appendix F.

M. Federal and State Permits and Approvals

Requirement: A statement of compliance with all applicable federal and state permits and approvals.

The City of Waukesha has complied with all applicable federal and state approvals.

N. Summary

Table N-1 is an executive summary of information provided previously.

Table N-1. Summary Table for Reporting Year 2025

Total Water Supply Pumpage from Lake Michigan	2,007,522,980	gallons
Total Water Sold	1,621,155,900	gallons
Population Served	71,461	people
Total per Capita Water Use per Day	62	gpd
Residential per Capita Water Use per Day	42	gpd
Maximum Day Water Pumpage	7,815,932	gallons
Average Day Water Pumpage	5,500,063	gallons
Ratio of Maximum Day Water Pumpage to Average Day Pumpage	1.42	
Average Day Water Pumpage per Residential Equivalency Unit	188	gpd/REU
Average Daily Demand to be Returned to the Root River in 2025	5.04	million gallons per day
Total Clean Water Plant Discharge	2,960,786,000	gallons
Total Clean Water Plant Discharge to the Fox River	1,102,781,000	gallons
Total Clean Water Plant Discharge to the Root River	1,858,005,000	gallons
Total Consumptive Use (WBR + loss + industry)	16.9%	

Appendix A. 2025 Daily Water Supply Volumes from Milwaukee Waterworks

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
1/1/2025	0	5,340,763
1/2/2025	0	5,305,988
1/3/2025	0	4,548,801
1/4/2025	0	5,138,660
1/5/2025	0	4,889,218
1/6/2025	0	3,399,633
1/7/2025	0	5,948,362
1/8/2025	0	4,622,332
1/9/2025	0	4,973,678
1/10/2025	0	4,282,261
1/11/2025	0	5,581,419
1/12/2025	0	5,786,333
1/13/2025	0	4,936,713
1/14/2025	0	5,556,014
1/15/2025	0	5,322,551
1/16/2025	0	5,045,724
1/17/2025	0	5,433,131
1/18/2025	0	5,187,090
1/19/2025	0	5,277,948
1/20/2025	0	4,773,928
1/21/2025	0	5,155,983
1/22/2025	0	4,661,273
1/23/2025	0	4,887,125
1/24/2025	0	5,647,192
1/25/2025	0	6,718,736
1/26/2025	0	5,313,225
1/27/2025	0	5,899,974
1/28/2025	0	5,199,941
1/29/2025	0	5,889,205
1/30/2025	0	4,635,112
1/31/2025	0	4,372,196
2/1/2025	0	6,209,519
2/2/2025	0	5,663,700
2/3/2025	0	4,816,031
2/4/2025	0	5,170,405
2/5/2025	0	5,356,896
2/6/2025	0	5,033,707

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
2/7/2025	0	5,554,663
2/8/2025	0	5,366,277
2/9/2025	0	4,676,592
2/10/2025	0	5,072,175
2/11/2025	0	5,233,917
2/12/2025	0	4,860,462
2/13/2025	0	5,014,523
2/14/2025	0	6,412,165
2/15/2025	0	4,850,308
2/16/2025	0	5,095,298
2/17/2025	0	4,681,870
2/18/2025	0	5,201,214
2/19/2025	0	5,243,364
2/20/2025	0	5,754,913
2/21/2025	0	6,350,367
2/22/2025	0	4,884,043
2/23/2025	0	5,059,660
2/24/2025	0	5,571,800
2/25/2025	0	5,541,839
2/26/2025	0	5,212,498
2/27/2025	0	4,392,506
2/28/2025	0	5,346,211
3/1/2025	0	5,666,388
3/2/2025	0	6,182,267
3/3/2025	0	5,257,840
3/4/2025	0	5,550,382
3/5/2025	0	4,391,683
3/6/2025	0	4,609,815
3/7/2025	0	5,402,549
3/8/2025	0	4,862,403
3/9/2025	0	6,649,705
3/10/2025	0	5,464,872
3/11/2025	0	5,037,474
3/12/2025	0	4,798,202
3/13/2025	0	5,285,766
3/14/2025	0	4,717,629
3/15/2025	0	6,616,977

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
3/16/2025	0	4,628,669
3/17/2025	0	5,402,109
3/18/2025	0	5,913,830
3/19/2025	0	4,668,137
3/20/2025	0	5,163,134
3/21/2025	0	4,256,902
3/22/2025	0	6,091,725
3/23/2025	0	5,410,180
3/24/2025	0	5,128,823
3/25/2025	0	4,865,628
3/26/2025	0	4,577,198
3/27/2025	0	4,673,015
3/28/2025	0	6,744,174
3/29/2025	0	4,476,275
3/30/2025	0	5,186,202
3/31/2025	0	4,331,937
4/1/2025	0	4,622,983
4/2/2025	0	6,183,916
4/3/2025	0	5,436,682
4/4/2025	0	5,274,570
4/5/2025	0	5,103,181
4/6/2025	0	5,149,954
4/7/2025	0	4,633,223
4/8/2025	0	5,579,477
4/9/2025	0	5,450,890
4/10/2025	0	5,843,067
4/11/2025	0	5,624,164
4/12/2025	0	4,654,661
4/13/2025	0	5,152,440
4/14/2025	0	5,227,371
4/15/2025	0	4,802,122
4/16/2025	0	5,888,419
4/17/2025	0	6,892,557
4/18/2025	0	4,811,029
4/19/2025	0	4,794,526
4/20/2025	0	5,250,631
4/21/2025	0	4,904,027
4/22/2025	0	4,577,937
4/23/2025	0	6,022,071

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
4/24/2025	0	6,758,861
4/25/2025	0	5,102,578
4/26/2025	0	5,273,496
4/27/2025	0	4,887,820
4/28/2025	0	5,610,352
4/29/2025	0	4,553,501
4/30/2025	0	5,099,520
5/1/2025	0	5,448,600
5/2/2025	0	5,598,357
5/3/2025	0	5,447,562
5/4/2025	0	5,804,967
5/5/2025	0	4,513,269
5/6/2025	0	5,030,520
5/7/2025	0	6,049,121
5/8/2025	0	6,265,532
5/9/2025	0	5,546,256
5/10/2025	0	5,295,870
5/11/2025	0	6,274,685
5/12/2025	0	6,477,170
5/13/2025	0	4,853,203
5/14/2025	0	6,058,319
5/15/2025	0	5,699,484
5/16/2025	0	4,470,766
5/17/2025	0	5,779,765
5/18/2025	0	4,637,401
5/19/2025	0	6,606,507
5/20/2025	0	5,797,626
5/21/2025	0	4,969,328
5/22/2025	0	5,701,744
5/23/2025	0	5,296,579
5/24/2025	0	5,377,467
5/25/2025	0	5,479,772
5/26/2025	0	6,182,829
5/27/2025	0	4,849,292
5/28/2025	0	5,004,542
5/29/2025	0	6,140,977
5/30/2025	0	6,463,292
5/31/2025	0	5,337,047
6/1/2025	0	5,590,474

APPENDIX A. 2025 DAILY WATER SUPPLY VOLUMES FROM MILWAUKEE WATERWORKS

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
6/2/2025	0	5,821,243
6/3/2025	0	5,685,736
6/4/2025	0	4,990,735
6/5/2025	0	6,914,630
6/6/2025	0	5,982,714
6/7/2025	0	5,253,273
6/8/2025	0	5,375,481
6/9/2025	0	5,622,877
6/10/2025	0	5,361,366
6/11/2025	0	5,094,436
6/12/2025	0	7,387,227
6/13/2025	0	5,767,043
6/14/2025	0	5,490,510
6/15/2025	0	5,800,152
6/16/2025	0	5,815,667
6/17/2025	0	5,691,860
6/18/2025	0	5,377,591
6/19/2025	0	6,416,609
6/20/2025	0	6,023,655
6/21/2025	0	5,825,412
6/22/2025	0	6,539,938
6/23/2025	0	5,943,831
6/24/2025	0	6,546,526
6/25/2025	0	4,789,101
6/26/2025	0	5,930,612
6/27/2025	0	5,900,926
6/28/2025	0	4,785,240
6/29/2025	0	6,251,322
6/30/2025	0	6,874,003
7/1/2025	0	6,474,447
7/2/2025	0	5,117,970
7/3/2025	0	6,925,538
7/4/2025	0	4,827,667
7/5/2025	0	5,712,484
7/6/2025	0	5,428,845
7/7/2025	0	6,184,080
7/8/2025	0	5,111,660
7/9/2025	0	4,764,373
7/10/2025	0	5,732,573

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
7/11/2025	0	7,000,373
7/12/2025	0	5,223,188
7/13/2025	0	5,351,457
7/14/2025	0	6,909,436
7/15/2025	0	5,537,237
7/16/2025	0	5,003,794
7/17/2025	0	5,325,551
7/18/2025	0	6,579,799
7/19/2025	0	5,890,507
7/20/2025	0	6,423,560
7/21/2025	0	4,901,896
7/22/2025	0	5,903,308
7/23/2025	0	7,815,932
7/24/2025	0	5,583,417
7/25/2025	0	5,995,721
7/26/2025	0	5,748,824
7/27/2025	0	5,905,882
7/28/2025	0	5,173,737
7/29/2025	0	5,886,957
7/30/2025	0	6,571,247
7/31/2025	0	6,037,133
8/1/2025	0	5,476,400
8/2/2025	0	5,074,900
8/3/2025	0	5,417,500
8/4/2025	0	4,817,500
8/5/2025	0	5,910,600
8/6/2025	0	7,516,700
8/7/2025	0	6,278,200
8/8/2025	0	5,814,000
8/9/2025	0	6,774,400
8/10/2025	0	5,270,300
8/11/2025	0	5,396,200
8/12/2025	0	5,561,800
8/13/2025	0	6,034,100
8/14/2025	0	5,123,200
8/15/2025	0	5,758,300
8/16/2025	0	5,821,700
8/17/2025	0	5,194,900
8/18/2025	0	6,089,400

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
8/19/2025	0	5,167,600
8/20/2025	0	5,641,900
8/21/2025	0	5,062,400
8/22/2025	0	5,296,800
8/23/2025	0	6,384,500
8/24/2025	0	6,666,700
8/25/2025	0	5,699,300
8/26/2025	0	6,202,500
8/27/2025	0	4,145,000
8/28/2025	0	6,693,800
8/29/2025	0	6,756,800
8/30/2025	0	5,541,300
8/31/2025	0	5,301,900
9/1/2025	0	6,236,500
9/2/2025	0	5,835,600
9/3/2025	0	4,339,400
9/4/2025	0	6,043,500
9/5/2025	0	6,120,900
9/6/2025	0	6,554,700
9/7/2025	0	5,008,600
9/8/2025	0	6,724,600
9/9/2025	0	6,269,600
9/10/2025	0	4,529,200
9/11/2025	0	7,019,600
9/12/2025	0	6,685,700
9/13/2025	0	5,522,500
9/14/2025	0	6,024,600
9/15/2025	0	5,247,500
9/16/2025	0	6,218,300
9/17/2025	0	5,283,900
9/18/2025	0	5,751,900
9/19/2025	0	6,813,800
9/20/2025	0	6,137,400
9/21/2025	0	5,020,800
9/22/2025	0	5,853,900
9/23/2025	0	5,631,100
9/24/2025	0	5,331,100
9/25/2025	0	4,934,700
9/26/2025	0	5,040,800

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
9/27/2025	0	6,677,000
9/28/2025	0	5,600,000
9/29/2025	0	6,443,300
9/30/2025	0	5,675,400
10/1/2025	0	5,048,600
10/2/2025	0	5,527,800
10/3/2025	0	5,955,400
10/4/2025	0	7,174,200
10/5/2025	0	5,421,600
10/6/2025	0	6,054,800
10/7/2025	0	4,741,600
10/8/2025	0	5,167,800
10/9/2025	0	6,282,500
10/10/2025	0	5,684,800
10/11/2025	0	5,318,000
10/12/2025	0	5,284,600
10/13/2025	0	5,990,800
10/14/2025	0	4,591,500
10/15/2025	0	4,576,400
10/16/2025	0	5,506,300
10/17/2025	0	6,596,400
10/18/2025	0	5,334,000
10/19/2025	0	5,252,300
10/20/2025	0	5,821,000
10/21/2025	0	4,525,100
10/22/2025	0	5,143,700
10/23/2025	0	4,987,100
10/24/2025	0	5,149,700
10/25/2025	0	5,313,000
10/26/2025	0	6,462,000
10/27/2025	0	4,412,800
10/28/2025	0	5,024,600
10/29/2025	0	5,378,600
10/30/2025	0	5,943,600
10/31/2025	0	5,442,800
11/1/2025	0	5,074,800
11/2/2025	0	5,387,900
11/3/2025	0	4,646,200
11/4/2025	0	5,020,100

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
11/5/2025	0	6,165,000
11/6/2025	0	6,817,600
11/7/2025	0	4,698,200
11/8/2025	0	5,959,700
11/9/2025	0	3,980,700
11/10/2025	0	5,654,000
11/11/2025	0	5,414,000
11/12/2025	0	5,726,900
11/13/2025	0	5,073,400
11/14/2025	0	5,538,200
11/15/2025	0	5,325,700
11/16/2025	0	6,141,500
11/17/2025	0	5,108,000
11/18/2025	0	4,787,200
11/19/2025	0	5,564,800
11/20/2025	0	6,066,100
11/21/2025	0	5,858,900
11/22/2025	0	5,242,400
11/23/2025	0	5,169,200
11/24/2025	0	5,349,700
11/25/2025	0	4,915,200
11/26/2025	0	4,528,000
11/27/2025	0	5,324,200
11/28/2025	0	6,149,700
11/29/2025	0	5,109,400
11/30/2025	0	5,157,600
12/1/2025	0	5,276,900
12/2/2025	0	4,403,300
12/3/2025	0	5,276,800
12/4/2025	0	6,361,500
12/5/2025	0	5,588,900
12/6/2025	0	5,381,000
12/7/2025	0	4,974,900
12/8/2025	0	5,924,400
12/9/2025	0	5,072,300
12/10/2025	0	4,561,200
12/11/2025	0	5,778,800
12/12/2025	0	6,691,100
12/13/2025	0	4,905,000

Date	Emergency Groundwater Supply (Gallons)	Milwaukee Water Works Supply (Gallons)
12/14/2025	0	5,031,900
12/15/2025	0	5,876,800
12/16/2025	0	5,676,000
12/17/2025	0	4,675,900
12/18/2025	0	6,499,100
12/19/2025	0	6,247,100
12/20/2025	0	5,383,100
12/21/2025	0	5,418,300
12/22/2025	0	5,889,400
12/23/2025	0	5,017,400
12/24/2025	0	4,879,900
12/25/2025	0	5,039,600
12/26/2025	0	6,503,200
12/27/2025	0	5,351,200
12/28/2025	0	5,128,300
12/29/2025	0	5,745,000
12/30/2025	0	5,234,300
12/31/2025	0	4,304,200

Appendix B. 2025 Daily Clean Water Plant Discharge Volumes to the Root and Fox Rivers

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
1/1/2025	1,320,000	5,310,000	6,630,000	Operating under 2023 return target; 2024 target not yet set.
1/2/2025	1,690,000	5,310,000	7,000,000	Operating under 2023 return target; 2024 target not yet set.
1/3/2025	1,499,000	5,090,000	6,589,000	Began operating under 2024 return target.
1/4/2025	1,456,000	5,090,000	6,546,000	
1/5/2025	1,563,000	5,090,000	6,653,000	
1/6/2025	1,517,000	5,090,000	6,607,000	
1/7/2025	1,435,000	5,090,000	6,525,000	
1/8/2025	1,598,000	5,090,000	6,688,000	
1/9/2025	1,442,000	5,090,000	6,532,000	
1/10/2025	1,362,000	5,100,000	6,462,000	
1/11/2025	1,529,000	5,090,000	6,619,000	
1/12/2025	1,578,000	5,090,000	6,668,000	
1/13/2025	1,349,000	5,090,000	6,439,000	
1/14/2025	1,265,000	5,090,000	6,355,000	
1/15/2025	1,360,000	5,090,000	6,450,000	
1/16/2025	1,475,000	5,090,000	6,565,000	
1/17/2025	1,489,000	5,090,000	6,579,000	
1/18/2025	1,381,000	5,090,000	6,471,000	
1/19/2025	1,335,000	5,090,000	6,425,000	
1/20/2025	1,279,000	5,090,000	6,369,000	
1/21/2025	1,281,000	5,090,000	6,371,000	
1/22/2025	1,314,000	5,100,000	6,414,000	
1/23/2025	1,296,000	5,090,000	6,386,000	
1/24/2025	1,435,000	5,090,000	6,525,000	
1/25/2025	1,475,000	5,090,000	6,565,000	
1/26/2025	1,622,000	5,090,000	6,712,000	
1/27/2025	1,628,000	5,090,000	6,718,000	
1/28/2025	1,566,000	5,090,000	6,656,000	
1/29/2025	1,465,000	5,090,000	6,555,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
1/30/2025	1,396,000	5,090,000	6,486,000	
1/31/2025	1,216,000	5,090,000	6,306,000	
2/1/2025	1,104,000	5,090,000	6,194,000	
2/2/2025	1,257,000	5,090,000	6,347,000	
2/3/2025	1,109,000	5,090,000	6,199,000	
2/4/2025	1,204,000	5,100,000	6,304,000	
2/5/2025	1,180,000	5,090,000	6,270,000	
2/6/2025	1,109,000	5,090,000	6,199,000	
2/7/2025	1,067,000	5,090,000	6,157,000	
2/8/2025	1,015,000	5,090,000	6,105,000	
2/9/2025	1,144,000	5,090,000	6,234,000	
2/10/2025	1,086,000	5,090,000	6,176,000	
2/11/2025	1,074,000	5,090,000	6,164,000	
2/12/2025	1,222,000	5,090,000	6,312,000	
2/13/2025	987,000	5,090,000	6,077,000	
2/14/2025	995,000	5,090,000	6,085,000	
2/15/2025	873,000	5,090,000	5,963,000	
2/16/2025	1,056,000	5,090,000	6,146,000	
2/17/2025	815,000	5,100,000	5,915,000	
2/18/2025	889,000	5,090,000	5,979,000	
2/19/2025	951,000	5,090,000	6,041,000	
2/20/2025	1,170,000	5,090,000	6,260,000	
2/21/2025	1,088,000	5,090,000	6,178,000	
2/22/2025	982,000	5,090,000	6,072,000	
2/23/2025	1,182,000	5,090,000	6,272,000	
2/24/2025	1,266,000	5,090,000	6,356,000	
2/25/2025	2,196,000	4,960,000	7,156,000	Return flow pumps did not restart at midnight due to a programming issue. This was corrected and confirmed with visual observation of pumps restarting the following day.

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
2/26/2025	2,095,000	5,100,000	7,195,000	
2/27/2025	1,578,000	5,090,000	6,668,000	
2/28/2025	1,268,000	5,090,000	6,358,000	
3/1/2025	1,030,000	5,090,000	6,120,000	
3/2/2025	1,292,000	5,090,000	6,382,000	
3/3/2025	1,094,000	5,090,000	6,184,000	
3/4/2025	1,370,000	5,090,000	6,460,000	
3/5/2025	3,527,000	5,090,000	8,617,000	
3/6/2025	2,471,000	5,090,000	7,561,000	
3/7/2025	2,471,000	5,090,000	7,561,000	
3/8/2025	2,022,000	5,090,000	7,112,000	
3/9/2025	2,093,000	5,090,000	7,183,000	
3/10/2025	1,414,000	5,555,000	6,969,000	Pump program interrupted; ran manually.
3/11/2025	1,089,000	5,090,000	6,179,000	
3/12/2025	1,414,000	5,090,000	6,504,000	
3/13/2025	1,738,000	5,100,000	6,838,000	
3/14/2025	1,332,000	5,090,000	6,422,000	
3/15/2025	1,556,000	5,090,000	6,646,000	
3/16/2025	1,925,000	5,090,000	7,015,000	
3/17/2025	2,317,000	5,090,000	7,407,000	
3/18/2025	2,006,000	5,090,000	7,096,000	
3/19/2025	2,265,000	5,090,000	7,355,000	
3/20/2025	2,290,000	5,090,000	7,380,000	
3/21/2025	2,158,000	5,090,000	7,248,000	
3/22/2025	1,806,000	5,090,000	6,896,000	
3/23/2025	2,427,000	5,090,000	7,517,000	
3/24/2025	2,605,000	5,090,000	7,695,000	
3/25/2025	2,410,000	5,100,000	7,510,000	
3/26/2025	2,142,000	5,090,000	7,232,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
3/27/2025	1,396,000	5,090,000	6,486,000	
3/28/2025	2,907,000	5,090,000	7,997,000	
3/29/2025	2,747,000	5,090,000	7,837,000	
3/30/2025	3,812,000	5,090,000	8,902,000	
3/31/2025	4,087,000	5,090,000	9,177,000	
4/1/2025	3,677,000	5,090,000	8,767,000	
4/2/2025	6,756,000	5,090,000	11,846,000	
4/3/2025	6,951,000	5,090,000	12,041,000	
4/4/2025	5,717,000	5,090,000	10,807,000	
4/5/2025	5,122,000	5,090,000	10,212,000	
4/6/2025	4,708,000	5,100,000	9,808,000	
4/7/2025	4,437,000	5,090,000	9,527,000	
4/8/2025	3,920,000	5,090,000	9,010,000	
4/9/2025	3,933,000	5,090,000	9,023,000	
4/10/2025	3,652,000	5,090,000	8,742,000	
4/11/2025	2,708,000	5,090,000	7,798,000	
4/12/2025	3,167,000	5,090,000	8,257,000	
4/13/2025	3,434,000	5,090,000	8,524,000	
4/14/2025	3,220,000	5,090,000	8,310,000	
4/15/2025	3,168,000	5,090,000	8,258,000	
4/16/2025	2,867,000	5,090,000	7,957,000	
4/17/2025	2,858,000	5,090,000	7,948,000	
4/18/2025	4,439,000	5,100,000	9,539,000	
4/19/2025	4,380,000	5,090,000	9,470,000	
4/20/2025	4,677,000	5,090,000	9,767,000	
4/21/2025	5,628,000	5,090,000	10,718,000	
4/22/2025	4,794,000	5,090,000	9,884,000	
4/23/2025	3,722,000	5,090,000	8,812,000	
4/24/2025	4,398,000	5,090,000	9,488,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
4/25/2025	3,617,000	5,090,000	8,707,000	
4/26/2025	3,347,000	5,090,000	8,437,000	
4/27/2025	3,549,000	5,090,000	8,639,000	
4/28/2025	3,428,000	5,100,000	8,528,000	
4/29/2025	3,196,000	5,090,000	8,286,000	
4/30/2025	3,121,000	5,090,000	8,211,000	
5/1/2025	4,236,000	5,090,000	9,326,000	
5/2/2025	3,462,000	5,090,000	8,552,000	
5/3/2025	3,197,000	5,090,000	8,287,000	
5/4/2025	3,367,000	5,090,000	8,457,000	
5/5/2025	3,148,000	5,090,000	8,238,000	
5/6/2025	3,074,000	5,090,000	8,164,000	
5/7/2025	3,082,000	5,090,000	8,172,000	
5/8/2025	2,875,000	5,090,000	7,965,000	
5/9/2025	2,302,000	5,100,000	7,402,000	
5/10/2025	2,469,000	5,090,000	7,559,000	
5/11/2025	2,649,000	5,090,000	7,739,000	
5/12/2025	2,752,000	5,090,000	7,842,000	
5/13/2025	2,789,000	5,090,000	7,879,000	
5/14/2025	2,602,000	5,090,000	7,692,000	
5/15/2025	2,680,000	5,090,000	7,770,000	
5/16/2025	2,685,000	5,090,000	7,775,000	
5/17/2025	2,348,000	5,090,000	7,438,000	
5/18/2025	2,365,000	5,090,000	7,455,000	
5/19/2025	2,207,000	5,090,000	7,297,000	
5/20/2025	3,403,000	5,090,000	8,493,000	
5/21/2025	4,923,000	5,100,000	10,023,000	
5/22/2025	4,908,000	5,090,000	9,998,000	
5/23/2025	3,973,000	5,090,000	9,063,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
5/24/2025	3,461,000	5,090,000	8,551,000	
5/25/2025	2,962,000	5,090,000	8,052,000	
5/26/2025	3,229,000	5,090,000	8,319,000	
5/27/2025	3,240,000	5,090,000	8,330,000	
5/28/2025	3,609,000	5,090,000	8,699,000	
5/29/2025	3,407,000	5,090,000	8,497,000	
5/30/2025	3,230,000	5,090,000	8,320,000	
5/31/2025	2,943,000	5,090,000	8,033,000	
6/1/2025	2,842,000	5,090,000	7,932,000	
6/2/2025	3,980,000	5,100,000	9,080,000	
6/3/2025	3,744,000	5,090,000	8,834,000	
6/4/2025	7,653,000	5,090,000	12,743,000	
6/5/2025	5,842,000	5,090,000	10,932,000	
6/6/2025	4,542,000	5,090,000	9,632,000	
6/7/2025	3,674,000	5,090,000	8,764,000	
6/8/2025	4,101,000	5,090,000	9,191,000	
6/9/2025	5,181,000	5,090,000	10,271,000	
6/10/2025	3,974,000	5,090,000	9,064,000	
6/11/2025	3,715,000	5,090,000	8,805,000	
6/12/2025	3,441,000	5,090,000	8,531,000	
6/13/2025	3,374,000	5,100,000	8,474,000	
6/14/2025	3,006,000	5,090,000	8,096,000	
6/15/2025	2,967,000	5,090,000	8,057,000	
6/16/2025	2,922,000	5,090,000	8,012,000	
6/17/2025	2,085,000	5,090,000	7,175,000	
6/18/2025	4,367,000	5,090,000	9,457,000	
6/19/2025	3,769,000	5,090,000	8,859,000	
6/20/2025	3,459,000	5,090,000	8,549,000	
6/21/2025	3,260,000	5,090,000	8,350,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
6/22/2025	3,261,000	5,090,000	8,351,000	
6/23/2025	3,095,000	5,090,000	8,185,000	
6/24/2025	3,745,000	5,090,000	8,835,000	
6/25/2025	3,484,000	5,100,000	8,584,000	
6/26/2025	4,353,000	4,530,000	8,883,000	Pumps shut off to troubleshoot potential pipeline leak; determined leak was not associated with the return flow pipe.
6/27/2025	3,411,000	5,100,000	8,511,000	
6/28/2025	2,849,000	5,090,000	7,939,000	
6/29/2025	2,876,000	5,090,000	7,966,000	
6/30/2025	3,971,000	5,090,000	9,061,000	
7/1/2025	2,889,000	5,090,000	7,979,000	
7/2/2025	2,724,000	5,090,000	7,814,000	
7/3/2025	2,434,000	5,090,000	7,524,000	
7/4/2025	2,536,000	5,090,000	7,626,000	
7/5/2025	2,399,000	5,090,000	7,489,000	
7/6/2025	3,323,000	5,090,000	8,413,000	
7/7/2025	2,952,000	5,090,000	8,042,000	
7/8/2025	2,794,000	5,100,000	7,894,000	
7/9/2025	2,352,000	5,090,000	7,442,000	
7/10/2025	3,980,000	5,090,000	9,070,000	
7/11/2025	4,516,000	5,090,000	9,606,000	
7/12/2025	4,338,000	5,090,000	9,428,000	
7/13/2025	3,638,000	5,090,000	8,728,000	
7/14/2025	2,729,000	5,090,000	7,819,000	
7/15/2025	2,982,000	5,090,000	8,072,000	
7/16/2025	3,425,000	5,090,000	8,515,000	
7/17/2025	2,973,000	5,090,000	8,063,000	
7/18/2025	2,783,000	5,090,000	7,873,000	
7/19/2025	2,516,000	5,100,000	7,616,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
7/20/2025	2,654,000	5,090,000	7,744,000	
7/21/2025	2,665,000	5,090,000	7,755,000	
7/22/2025	2,640,000	5,090,000	7,730,000	
7/23/2025	2,948,000	5,090,000	8,038,000	
7/24/2025	2,533,000	5,090,000	7,623,000	
7/25/2025	2,453,000	5,090,000	7,543,000	
7/26/2025	2,640,000	5,090,000	7,730,000	
7/27/2025	2,528,000	5,090,000	7,618,000	
7/28/2025	2,462,000	5,090,000	7,552,000	
7/29/2025	2,317,000	5,090,000	7,407,000	
7/30/2025	3,337,000	5,100,000	8,437,000	
7/31/2025	2,705,000	5,090,000	7,795,000	
8/1/2025	2,417,000	5,090,000	7,507,000	
8/2/2025	2,099,000	5,090,000	7,189,000	
8/3/2025	2,228,000	5,090,000	7,318,000	
8/4/2025	2,807,000	5,090,000	7,897,000	
8/5/2025	2,599,000	5,090,000	7,689,000	
8/6/2025	2,254,000	5,090,000	7,344,000	
8/7/2025	1,665,000	5,090,000	6,755,000	
8/8/2025	2,197,000	5,090,000	7,287,000	
8/9/2025	3,662,000	5,090,000	8,752,000	
8/10/2025	24,626,000	5,090,000	29,716,000	
8/11/2025	30,128,000	5,090,000	35,218,000	
8/12/2025	34,438,000	5,100,000	39,538,000	
8/13/2025	23,228,000	5,090,000	28,318,000	
8/14/2025	14,055,000	5,090,000	19,145,000	
8/15/2025	10,963,000	5,090,000	16,053,000	
8/16/2025	9,668,000	5,090,000	14,758,000	
8/17/2025	8,793,000	5,090,000	13,883,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
8/18/2025	9,089,000	5,090,000	14,179,000	
8/19/2025	8,680,000	5,090,000	13,770,000	
8/20/2025	7,451,000	5,090,000	12,541,000	
8/21/2025	6,854,000	5,090,000	11,944,000	
8/22/2025	5,312,000	5,090,000	10,402,000	
8/23/2025	5,530,000	5,090,000	10,620,000	
8/24/2025	5,283,000	5,090,000	10,373,000	
8/25/2025	4,994,000	5,100,000	10,094,000	
8/26/2025	4,628,000	5,090,000	9,718,000	
8/27/2025	4,571,000	5,090,000	9,661,000	
8/28/2025	4,243,000	5,090,000	9,333,000	
8/29/2025	4,030,000	5,090,000	9,120,000	
8/30/2025	3,618,000	5,090,000	8,708,000	
8/31/2025	3,429,000	5,090,000	8,519,000	
9/1/2025	3,908,000	5,090,000	8,998,000	
9/2/2025	4,332,000	5,090,000	9,422,000	
9/3/2025	3,863,000	5,090,000	8,953,000	
9/4/2025	3,612,000	5,090,000	8,702,000	
9/5/2025	2,530,000	5,090,000	7,620,000	
9/6/2025	2,863,000	5,100,000	7,963,000	
9/7/2025	3,007,000	5,090,000	8,097,000	
9/8/2025	2,997,000	5,090,000	8,087,000	
9/9/2025	3,058,000	5,090,000	8,148,000	
9/10/2025	3,553,000	5,090,000	8,643,000	
9/11/2025	3,381,000	5,090,000	8,471,000	
9/12/2025	2,494,000	5,090,000	7,584,000	
9/13/2025	3,008,000	5,090,000	8,098,000	
9/14/2025	2,896,000	5,090,000	7,986,000	
9/15/2025	2,042,000	5,090,000	7,132,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
9/16/2025	2,628,000	5,090,000	7,718,000	
9/17/2025	2,593,000	5,090,000	7,683,000	
9/18/2025	2,510,000	5,090,000	7,600,000	
9/19/2025	2,510,000	5,090,000	7,600,000	
9/20/2025	2,510,000	5,100,000	7,610,000	
9/21/2025	2,844,000	5,090,000	7,934,000	
9/22/2025	3,808,000	5,090,000	8,898,000	
9/23/2025	4,864,000	5,090,000	9,954,000	
9/24/2025	3,820,000	5,090,000	8,910,000	
9/25/2025	3,296,000	5,090,000	8,386,000	
9/26/2025	3,083,000	5,090,000	8,173,000	
9/27/2025	2,796,000	5,090,000	7,886,000	
9/28/2025	2,913,000	5,090,000	8,003,000	
9/29/2025	3,254,000	5,090,000	8,344,000	
9/30/2025	3,092,000	5,090,000	8,182,000	
10/1/2025	2,785,000	5,090,000	7,875,000	
10/2/2025	2,577,000	5,090,000	7,667,000	
10/3/2025	2,367,000	5,090,000	7,457,000	
10/4/2025	2,367,000	5,100,000	7,467,000	
10/5/2025	2,546,000	5,090,000	7,636,000	
10/6/2025	2,469,000	5,090,000	7,559,000	
10/7/2025	2,493,000	5,090,000	7,583,000	
10/8/2025	2,227,000	5,090,000	7,317,000	
10/9/2025	2,157,000	5,090,000	7,247,000	
10/10/2025	2,076,000	5,090,000	7,166,000	
10/11/2025	1,949,000	5,090,000	7,039,000	
10/12/2025	2,160,000	5,090,000	7,250,000	
10/13/2025	2,236,000	5,090,000	7,326,000	
10/14/2025	2,109,000	5,090,000	7,199,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

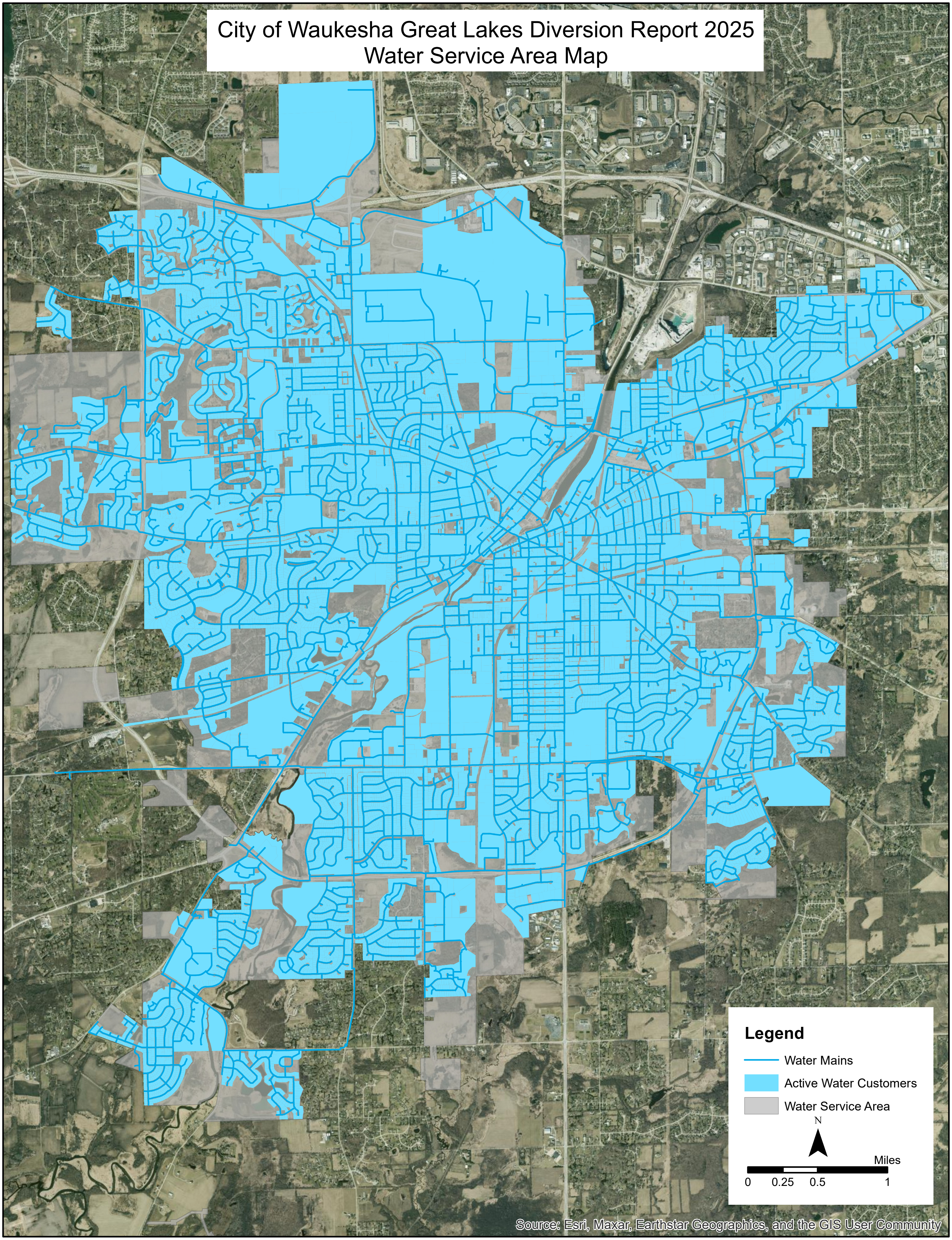
Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
10/15/2025	2,346,000	5,090,000	7,436,000	
10/16/2025	2,249,000	5,100,000	7,349,000	
10/17/2025	2,078,000	5,090,000	7,168,000	
10/18/2025	2,203,000	5,090,000	7,293,000	
10/19/2025	3,666,000	5,090,000	8,756,000	
10/20/2025	2,834,000	5,090,000	7,924,000	
10/21/2025	2,245,000	5,090,000	7,335,000	
10/22/2025	2,748,000	5,090,000	7,838,000	
10/23/2025	2,431,000	5,090,000	7,521,000	
10/24/2025	2,304,000	5,090,000	7,394,000	
10/25/2025	2,161,000	5,090,000	7,251,000	
10/26/2025	2,415,000	5,090,000	7,505,000	
10/27/2025	2,322,000	5,090,000	7,412,000	
10/28/2025	2,286,000	5,090,000	7,376,000	
10/29/2025	2,222,000	5,100,000	7,322,000	
10/30/2025	2,195,000	5,090,000	7,285,000	
10/31/2025	1,990,000	5,090,000	7,080,000	
11/1/2025	1,999,000	5,090,000	7,089,000	
11/2/2025	2,445,000	5,090,000	7,535,000	
11/3/2025	1,990,000	5,090,000	7,080,000	
11/4/2025	2,120,000	5,090,000	7,210,000	
11/5/2025	2,029,000	5,090,000	7,119,000	
11/6/2025	1,985,000	5,090,000	7,075,000	
11/7/2025	1,932,000	5,090,000	7,022,000	
11/8/2025	1,777,000	5,090,000	6,867,000	
11/9/2025	1,994,000	5,090,000	7,084,000	
11/10/2025	1,899,000	5,090,000	6,989,000	
11/11/2025	2,079,000	5,090,000	7,169,000	
11/12/2025	1,925,000	5,090,000	7,015,000	

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
11/13/2025	1,826,000	5,100,000	6,926,000	
11/14/2025	1,699,000	5,090,000	6,789,000	
11/15/2025	1,671,000	5,090,000	6,761,000	
11/16/2025	1,826,000	5,090,000	6,916,000	
11/17/2025	1,711,000	5,090,000	6,801,000	
11/18/2025	2,199,000	5,090,000	7,289,000	
11/19/2025	1,951,000	5,090,000	7,041,000	
11/20/2025	2,250,000	4,730,000	6,980,000	Return flow deficit due to pausing pumps for USGS flow meter equipment removal at reaeration building.
11/21/2025	1,663,000	5,090,000	6,753,000	
11/22/2025	1,642,000	5,100,000	6,742,000	
11/23/2025	1,670,000	5,090,000	6,760,000	
11/24/2025	1,707,000	5,090,000	6,797,000	
11/25/2025	1,679,000	5,090,000	6,769,000	
11/26/2025	1,769,000	5,090,000	6,859,000	
11/27/2025	1,511,000	5,090,000	6,601,000	
11/28/2025	1,313,000	5,090,000	6,403,000	
11/29/2025	1,492,000	5,090,000	6,582,000	
11/30/2025	1,681,000	5,090,000	6,771,000	
12/1/2025	1,620,000	5,090,000	6,710,000	
12/2/2025	1,755,000	5,090,000	6,845,000	
12/3/2025	1,675,000	5,090,000	6,765,000	
12/4/2025	1,684,000	5,090,000	6,774,000	
12/5/2025	1,604,000	5,100,000	6,704,000	
12/6/2025	1,592,000	5,090,000	6,682,000	
12/7/2025	1,609,000	5,090,000	6,699,000	
12/8/2025	1,656,000	5,090,000	6,746,000	
12/9/2025	1,719,000	5,090,000	6,809,000	
12/10/2025	1,806,000	5,090,000	6,896,000	

APPENDIX B. 2025 DAILY CLEAN WATER PLANT DISCHARGE VOLUMES TO THE ROOT AND FOX RIVERS

Date	Fox River Discharge Volume (gallons)	Root River Discharge Volume (gallons)	Total Clean Water Plant Discharge Volume (gallons)	Comments
12/11/2025	1,752,000	5,090,000	6,842,000	
12/12/2025	1,667,000	5,090,000	6,757,000	
12/13/2025	1,472,000	5,090,000	6,562,000	
12/14/2025	1,671,000	5,090,000	6,761,000	
12/15/2025	1,688,000	5,090,000	6,778,000	
12/16/2025	1,819,000	5,100,000	6,919,000	
12/17/2025	1,839,000	5,090,000	6,929,000	
12/18/2025	2,474,000	5,090,000	7,564,000	
12/19/2025	2,120,000	5,090,000	7,210,000	
12/20/2025	2,013,000	5,090,000	7,103,000	
12/21/2025	1,929,000	5,090,000	7,019,000	
12/22/2025	1,886,000	5,090,000	6,976,000	
12/23/2025	2,012,000	5,090,000	7,102,000	
12/24/2025	1,777,000	5,090,000	6,867,000	
12/25/2025	1,175,000	5,090,000	6,265,000	
12/26/2025	1,767,000	5,090,000	6,857,000	
12/27/2025	1,725,000	5,090,000	6,815,000	
12/28/2025	2,774,000	5,090,000	7,864,000	
12/29/2025	2,920,000	5,090,000	8,010,000	
12/30/2025	2,679,000	5,090,000	7,769,000	
12/31/2025	2,584,000	5,090,000	7,674,000	

Appendix C. 2025 Service Area Map


City of Waukesha Great Lakes Diversion Report 2025
Water Service Area Map
Legend
Water Mains
Active Water Customers
Water Service Area
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Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Appendix D. WDNR Approval of Extended Well Abandonment Agreement (November 2023)

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
141 NW Barstow St., Room 180
Waukesha, WI 53188

Tony Evers, Governor
Adam N. Payne, Secretary
Telephone 608-266-2621
Toll Free 1-888-936-7463
TTY Access via relay - 711

November 24, 2023

Waukesha Water Utility
Daniel Duchniak – Water Utility General Manager
115 Delafield St.
Waukesha, WI 53188

PWSID#: 26802380
Region: Southeast Region
County: Waukesha
File Code: 3300

Subject: Approval of Extended Well Abandonment Agreement for Utility Wells

Dear Mr. Duchniak:

The Wisconsin Department of Natural Resources, Division of Water, Bureau of Drinking Water and Groundwater, is conditionally approving the request for the following in accordance with NR 810.22.

Water system name: Waukesha Water Utility (Utility)
Date received: 11/24/2023
Length of time extension: None
Utility Representative: Daniel Duchniak. PE
Regional DNR Contact: Thanintr Ratarasarn – SE Waukesha
Project description: Extended Well Operation Agreement for Utility wells

Per NR 810.22, an emergency well is a well that is not routinely used. The well owner may obtain a written Extended Well Abandonment Agreement with the Department to allow a normally unused or standby well to remain operational and to delay well abandonment for the following Utility wells.

Well # 3 (WUWN BH429)
Well # 5 (WUWN BH431)
Well # 6 (WUWN BH432)
Well # 7 (WUWN BH433)
Well # 8 (WUWN BH434)
Well # 9 (WUWN BH435)
Well # 10 (WUWN BH436)
Well # 11 (WUWN RL255)
Well # 12 (WUWN RL256)
Well # 13 (WUWN WK947)

Approval conditions related to Chapter NR 809, NR 810, and NR 811, Wis. Adm. Code:

1. All wells shall be placed into emergency status no later than **December 31. 2023.**
2. Per the Great Lakes Compact Council approval and the DNR diversion approval, the wells shall not be used as part of the Utility's regular water supply and only used for emergency purposes.
3. The water system will restrict the use of the well if the water quality exceeds the primary drinking water standards to emergency use of no more than 2 days per quarter. The Department may authorize an extended period of use for an individual event if contacted by the Utility.

4. The water supplier shall notify all customers of the use of the well. A **Tier II** public notice, in accordance with **NR 809.52** shall be issued if this well is used.
5. The well water entering the distribution system may not exceed any bacteriological or nitrate drinking water standards.
6. The well water may not contain any volatile organic or synthetic organic contaminant levels exceeding the maximum contaminant level or MCL that could lead to further water quality degradation of the groundwater.
7. The well owner agrees to a 5 year cycle of reevaluation. Where the agreement is continued, it shall be renewed in writing every 5 years.
8. A 6-year cycle for water quality monitoring is established.
9. Bacteriological testing is conducted quarterly from the well.
10. Nitrate is monitored annually from the well.
11. The well meets current well construction and pump installation standards.
12. The well owner agrees to televise any well in excess of 70 years old at least once every 15 years.

Approval conditions related to other Department requirements: None

Approval constraints: This approval is based upon the representation that the information obtained by the department from the Waukesha Water Utility is complete and accurately represents the project being approved. Any approval of plans that do not fairly represent the project because they are incomplete, inaccurate, or of insufficient scope and detail is voidable at the option of the department.

If you have any questions, please do not hesitate to contact me by telephone at 262-765-0912, or by e-mail at Thanintr.Ratarasarn@Wisconsin.gov.

Sincerely,

Thanintr (Tony) Ratarasarn, MS, PE
Drinking Water Engineer

Cc: DG Files – Southeast Region
DG/5 - Madison

Attachments: Extended Well Abandonment Agreement Permit

EXTENDED WELL ABANDONMENT AGREEMENT BETWEEN THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES (DEPARTMENT) AND THE CITY OF WAUKESHA WATER UTILITY

PURPOSE

Per NR 810.22, an emergency well is a well that is not routinely used. The well owner may obtain a written extended well abandonment agreement with the department to allow a normally unused or standby well to remain operational and to delay well abandonment. This Agreement between the Department and the City of Waukesha Water Utility (PWSID # 26802380) has been written to satisfy the requirements of NR 810.22, Wis. Adm. Code. The City of Waukesha Water Utility owns and operates a well that is no longer used and shall place the following well into emergency status:

- Well # 3 (WUWN BH429)
- Well # 5 (WUWN BH431)
- Well # 6 (WUWN BH432)
- Well # 7 (WUWN BH433)
- Well # 8 (WUWN BH434)
- Well # 9 (WUWN BH435)
- Well # 10 (WUWN BH436)
- Well # 11 (WUWN RL255)
- Well # 12 (WUWN RL256)
- Well # 13 (WUWN WK947)

This agreement allows the City of Waukesha Water Utility the use of the above well for emergency purposes where the loss of the primary water source would necessitate the use of this well to protect health and human safety.

REQUIREMENTS

The City of Waukesha Water Utility agrees to comply and shall continuously comply with the following requirements for the well for which this agreement applies:

1. Per the Great Lakes Compact Council approval and the DNR diversion approval, the wells shall not be used as part of the Utility's regular water supply and only used for emergency purposes.The water system will restrict the use of the well if the water quality exceeds the primary drinking water standards to emergency use of no more than 2 days per quarter. The department may authorize an extended period of use for an individual event if contacted by the Utility.
2. The water supplier shall notify all customers of the use of the well. A Tier II public notice, in accordance with NR 809.52 shall be issued if this well is used.
3. The well water entering the distribution system may not exceed any bacteriological or nitrate drinking water standards.
4. The well water may not contain any volatile organic or synthetic organic contaminant levels exceeding the maximum contaminant level or MCL that could lead to further water quality degradation of the groundwater.
5. The well owner agrees to a 5 year cycle of reevaluation. Where the agreement is continued, it shall be renewed in writing every 5 years.
6. A 6-year cycle for water quality monitoring is established.
7. Bacteriological testing is conducted quarterly from the well. Nitrate is monitored annually from the well.
8. The well meets current well construction and pump installation standards.
9. The well owner agrees to televise any well in excess of 70 years old at least once every 15 years.

SIGNATURES

This agreement shall expire five years the date the well is placed into emergency status. The evaluation may be completed by the Department prior to the five-year anniversary, if the Department determines it is necessary.

11/28/2023		11/29/2023	
Thanintr Ratarasarn, PE Regional Water Supply Engineer WI Department of Natural Resources	Date	Daniel Duchniak, PE Water Utility General Manager City of Waukesha Water Utility	Date

Appendix E. Pharmaceutical and Personal Care Products Reduction Program – 2025 Annual Report

Memorandum

Subject	**City of Waukesha Pharmaceutical and Personal Care Products Reduction Program – 2025 Annual Report**
Project Name	City of Waukesha 2025 Diversion Reporting
From	Clean Water Plant: Plant Manager, Pretreatment Coordinator, Administrative Assistant Solid Waste: Solid Waste Coordinator Water Utility: Operations Manager
Date	February 16, 2026

The City of Waukesha, Wisconsin (City) received approval of its application for diverting Lake Michigan water with return flow on June 24, 2016 (Application Approval) and June 29, 2021 (Diversion Approval). As a condition of the approvals, the City is required to implement a Pharmaceutical and Personal Care Products (PPCP) Reduction Program. The purpose of this memorandum is to summarize the progress of the PPCP Reduction Program in 2025.

1. Background

The City operates the Clean Water Plant (CWP) to provide wastewater treatment to City residents and a small number of surrounding residential and commercial areas. There are various existing programs required as part of the CWP discharge permit that reduce the volume of wastewater and constituents in the wastewater conveyed to the CWP. One of these programs includes providing education about the importance of proper disposal of PPCPs, as well as promoting pharmaceutical collection boxes and collection events. The CWP also has partnered with the City's Recycling and Solid Waste Division, the City's Communications and Engagement Group, the City Police Department, and Waukesha County to coordinate efforts related to the PPCP Reduction Program. Examples of past PPCP reduction efforts by the City include:

- Attending Waukesha Night Out event and set up booth educating public on proper PPCP disposal.
- Promoting continuous pharmaceutical disposal collection boxes or kiosks at multiple locations within the City.
- Sponsoring National Prescription Drug Take Back Day collection events twice per year – typically, one event in April and a second event in October.
- Providing public education through multiple platforms, including the City, Department of Public Works (DPW), and CWP websites; City weekly email news; DPW mailed newsletters; direct water and sewer bill inserts; and social media postings on Facebook, City televisions within City Hall, and on community message boards.

The PPCP Reduction Program has focused primarily on educating the public, promoting pharmaceutical take-back events, and directly supporting the proper disposal of residential prescription and over-the-counter medications. The following sections provide a summary of the program accomplishments.

2. Source Reduction Through Education

The following resources were reviewed for consideration in providing public education:

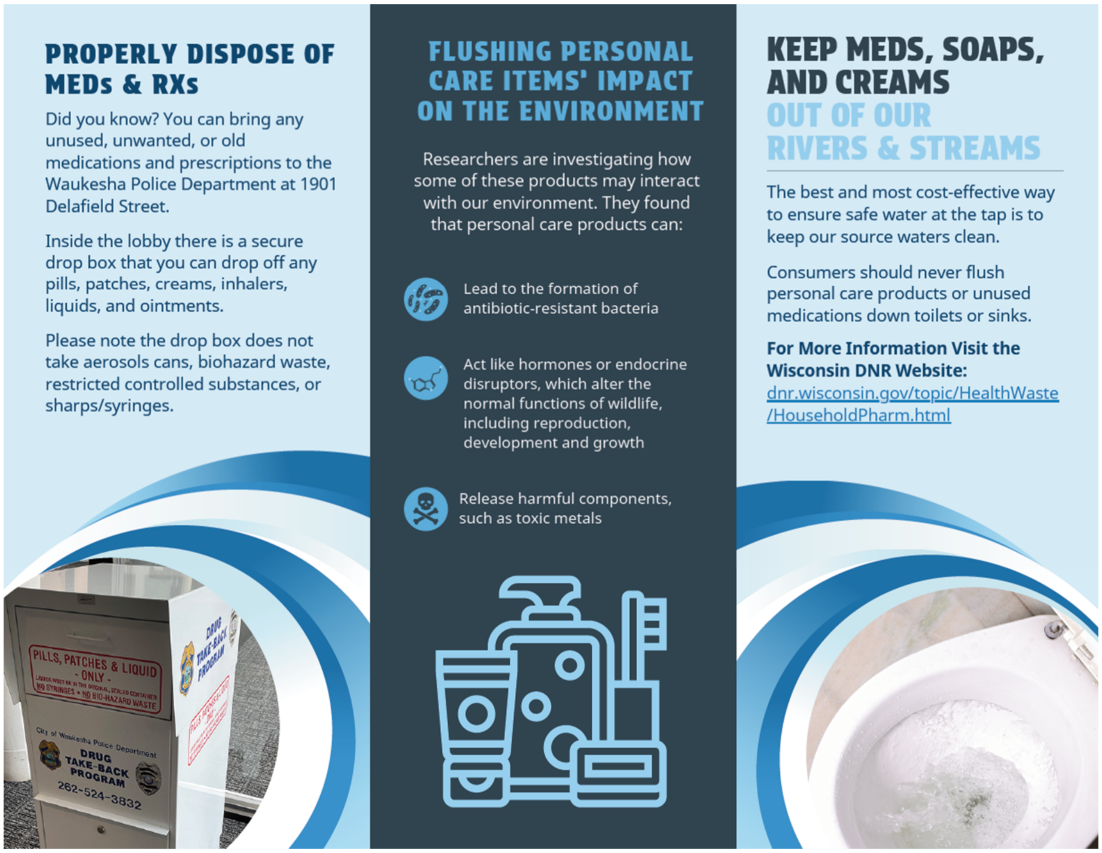
- Waukesha County Sheriff's Department – Prescription and Over-the-Counter Medicine Collection Program
- Wisconsin Department of Natural Resources (WDNR) – How to Safely Dispose of Household Pharmaceutical Waste
- WDNR – Pharmaceutical and Personal Care Products in the Environment
- Product Stewardship Institute
- Wisconsin Department of Health Services – Dose of Reality Partner Materials
- Water Environment Federation – Household Waste Disposal Chart
- U.S. Department of Justice – Year-Round Drop-Off Locations – Search Utility
- U.S. Drug Enforcement Administration (DEA) – Take Back Day

The following educational materials and promotional materials were made available to residents in 2025:

- Attended Waukesha Night Out event on August 6, 2025, and set up a booth for PPCP education (Figure 2-1).
  - Updated and distributed trifold flyer educating the public on proper personal care product disposal (Figure 2-2).
  - Displayed poster educating the public on proper PPCP disposal (Figure 2-1).

Figure 2-1. Waukesha Night Out Booth Setup for PPCP Education

Figure 2-2. Trifold Flyer Educating the Public on Proper Personal Care Product Disposal



- Included information regarding PPCPs in three newsletters, which are sent to approximately 31,000 addresses.
  - Spring Activity Guide Newsletter – Promoted only flushing toilet paper and no other personal care products. Promoted City's Disposal Guide which includes Personal Care Products and Pharmaceuticals.
  - Summer NewsSplash Newsletter- Promoted disposal guide article which includes proper disposal of personal care products and pharmaceuticals.
  - Fall Activity Guide Newsletter – Promoted Drug Take Back Day on October 25th.
- Updated list of acceptable PPCPs and PCPs for collection and disposal on City, CWP, Police, and Sheriff websites to be consistent and provide as much specificity as possible.
- The Waukesha Police Department provided an informational flyer created by the DEA for the October National Drug Take Back Day. Flyers were available to post in stores, cafes, and restaurants and at the public library.
- Distributed trifold flyer (Figure 2-2) at City Hall and the Waukesha Public Library educating the public on proper personal care product disposal.
- Included articles promoting Drug Disposal Program in the City's February and April 2025 e-newsletter. The e-newsletter typically is sent to more than 12,000 email addresses.

- Included articles promoting City's Disposal guide including information on Person Care Products and Pharmaceuticals in the City's June 2025 e-newsletter. The e-newsletter typically is sent to more than 12,000 email addresses.
- Included articles promoting Drug Take Back Day in the City's October 2025 e-newsletter. The e-newsletter typically is sent to more than 12,000 email addresses.
- Displayed material on City Hall and Police Department Message Boards with information on Police Department Drug Drop Box and "Toilet is not a trash can" messages.
- Presented at Local Academy classroom to Waukesha citizens educating on proper PPCP disposal.
- Updated the CWP website to include PPCP information (Figure 2-4) and website links for:
  - Resources regarding proper disposal of PPCPs and best practice recommendations
  - The City's drug disposal locations on the City's website under the Drug Disposal Program

Figure 2-4. Example PPCP Information on the CWP Website

Personal Care Products

Personal care products – also known as "health and beauty products"— are part of our daily lives. Many of these products are essential to sustain healthy hygiene, skin care and protection from UV rays, amongst other things. Of course, many of these products are also used for the sake of beautification and fragrance—both of which are socially relevant in our culture.

As essential as these products have become, there can be negative environmental effects when these products are disposed of. Many of the products contain micro plastics and other ingredients which will not easily biodegrade in the environment.

Unfortunately, even at our Clean Water treatment plant, we do not have the capability to filter and remove all these particles and many end up discharging straight into the Fox River.

Due to this potential harmful effect in the water system, there is a three-tiered recommendation for use and disposal of these products:

1. Start with buying only as much as needed, minimizing unused products needing to be disposed beyond normal use.
2. Consider purchasing more natural products containing fewer non-biodegradable ingredients.
3. In the event of an unwanted product, the recommended proper disposal is into your household trash container, which will be landfilled. The excess unwanted products should NOT be poured down a sink drain or flushed for disposal.

While excessive liquids are also not ideal for landfill environmental impact, this option is preferred due to the immediate negative impacts on the water system if sent down the drain. Modern landfills are designed to capture some liquids and manage them before they reach water resources.

Pharmaceuticals

Pharmaceuticals are important to dispose of properly. Pharmaceuticals are defined as "a compound manufactured for use as a medicinal drug" and may be prescribed by a doctor or purchased over the counter. All kinds must be handled with care when disposing.

Household Disposal Options

Pharmaceuticals should NEVER be flushed down the toilet or put down the drain. These materials are harmful to water quality. The Clean Water Plant (treatment plant) cannot remove the substances from the water, so the pharmaceuticals directly contaminate the Fox River and beyond. This is a serious concern.

City Drop-Off Options

The City of Waukesha Police Department has a drug-take-back program which any resident can utilize. There is a permanent collection box in the lobby of the police station (1901 Delafield St.) and the department regularly participates in the National Drug Takeback Days every spring and fall.

For more information, visit: https://www.waukesha-wi.gov/government/departments/drug-disposal-program.php

Other Drop-Off Options

Many local pharmacies and health care facilities have a drug collection box available to residents. Visit https://www.dhs.wisconsin.gov/opioids/permanent-drug-drop-boxes.htm to learn more and find locations in Waukesha County and the region.

- Social media articles were posted to the City's Facebook, Instagram, and X (formerly Twitter) accounts. The social media posts included articles such as the following:
  - "Products that shouldn't be flushed down the toilet" – Information on what should not end up in the sewer system on 1/31/2025.
  - "Earth Day Post" – Information about Earth Day including proper drug disposal on 4/22/2025.
  - "Drug Take Back Day" – Promoting Drug Take Back Day on 4/27/2025.
  - "National Drug Take Back Day" – Promoting National Drug Take Back Day on 10/22/2025 and 10/25/2025.

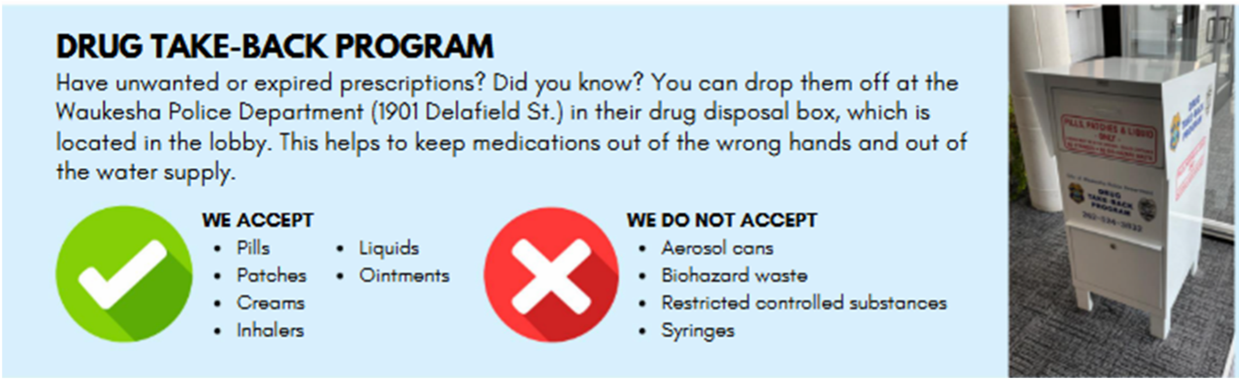
  Figure 2-5 includes an example of a social media post promoting the October National Drug Take Back Day.

Figure 2-5. Example Social Media Post Promoting the October National Drug Take Back Day

- The City has a "Disposal Guide" on its waste collection website detailing disposal options for personal care products and pharmaceuticals.
- "Drug Disposal Program" and "Think Before You Flush" articles regarding best practices for PPCP disposal were posted in the City's online "Residents Guide" and departmental websites for continuous availability to residents.

Figure 2-6 shows the continuous drop box information included in the City's online "Residents Guide."

Figure 2-6. Example Information about the Police Department Pharmaceutical Continuous Drop Box Published in the City's "Residents Guide"



3. Source Reduction Through Collection and Reuse

Collection events and continuous collection locations are a central part of the PPCP program. The events, continuous drop box locations, and quantity of collected PPCP are summarized in Table 3-1.

Table 3-1. Quantity of PPCP Collected in 2025

Date	Event Name or Location	Quantity and Units
October 2024 to April 2025	City Police Continuous Drop Box	664.2 lbs
April 2025 to October 2025	City Police Continuous Drop Box	680.6 lbs
April 26, 2025	National Drug Take Back Event	99.6 lbs
October 25, 2025	National Drug Take Back Event	186.8 lbs
	Total	1,631.2 lbs

lbs = pounds

The PPCP reduction program coordinators have discussed expanding the number of events and continuous drop box locations, including completing the following activities:

- Confirmed new drop box locations available within the City in 2025.
- Verified existing locations and contact information for continuous drop boxes for City police, County sheriff, and local pharmacies (included in Table 3-2).

Table 3-2. Locations of Continuous Drop Boxes

Location Name	Address
Waukesha Police Department (in front lobby)	1901 Delafield Street, Waukesha
Waukesha County Sheriff's Department (in lobby)	515 W. Moreland Boulevard, Waukesha
Waukesha Memorial Hospital (in pharmacy)	725 American Avenue, Waukesha
Walgreens	221 E. Sunset Drive, Waukesha
Meijer (in pharmacy)	801 E. Sunset Drive, Waukesha
CVS Pharmacy	1130 W. Sunset Drive, Waukesha

For significant sources of pharmaceuticals, the following activities were completed:

- Researched, discussed, and developed potential educational material geared toward entities that are potential significant sources of pharmaceuticals.
- Updated list of potential significant sources of pharmaceuticals for future coordination regarding education materials and source reduction (Tables 3-3 and 3-5).
- Contacted all potential significant sources of pharmaceuticals to ascertain and document their pharmaceutical collection and disposal practices.

Table 3-3. List of Potential Significant Sources of Pharmaceuticals

Type	Source
Hospitals	Ascension Wisconsin Hospital – Waukesha Rehabilitation Hospital of Wisconsin Waukesha Memorial Hospital
Clinics	Affiliated Dermatologists Aurora Urgent Care Concentra Urgent Care Doenier Family Medicine Endodontic Associates Froedtert Westbrook Health Center GI Associates Iris Health Clinic Moreland Endoscopy Center Moreland ENT Moreland Ob-Gyn Associates Oral and Maxillofacial Surgery ProHealth Care – Moreland Surgery Center ProHealth Care Medical Associates ProHealth Medical Group ProHealth Urgent Care Retina & Vitreous

Type	Source
	Urology Associates Waukesha County Dept. of Health & Human Services Waukesha Eye and Vision Clinic Waukesha Family Medicine Residency Center Waukesha Family Practice Clinic Waukesha Pediatric Associates Waukesha Surgical Specialists WisHope
Pharmacies	CVS Pharmacy Genoa Healthcare Meijer Pharmacy Moreland Plaza Pharmacy ProHealth Pharmacy Waukesha/Waukesha Memorial Hospital Walgreens Walmart Pharmacy
Veterinary Clinics/Animal Shelters	Center for Animal Rehabilitation Cream City Kitty Clinic Harmony Pet Clinic Humane Animal Welfare Society VCA Associates in Pet Care Animal Hospital Waukesha Walk-in Vet Clinic Westown Veterinary Clinic Wisconsin Veterinary Referral Hospital
Assisted Living Facilities	Avalon Square Heritage Memory Care New Perspective Senior Living – Waukesha Oak Hill Terrace Senior Living
Nursing Homes/ Community-based Residential Facilities	Aria of Waukesha Christian Homes Kensington Care and Rehab Center LindenGrove Waukesha Mission Creek Senior Living Summit Woods

Pharmaceutical disposal practices among the potential significant pharmaceutical sources are presented in Table 3-4.

Table 3-4. Pharmaceutical Disposal Summary from Potential Significant Sources

Disposal Method	Percentage of Use
Vendor	60%
Drop box collection site or other pharmacy	14%
Destruction media or absorbent	14%
No pharmaceutical dispensing or disposal	12%

Contacts with potential personal care product (PCP) sources in 2025 (Table 3-5) revealed that hospitals are similar to hotels in that PCPs that are not completely used are placed in the trash as the best disposal method. Retail establishments, including pharmacies and department stores, universally use contracted vendors such as return centers/reverse distributors and environmental management services to dispose of expired or unsold PCP inventory. Table 3-5 presents a list of potential significant sources of PCPs.

Table 3-5. List of Potential Significant Sources of PCPs

Type	Source
Hospitals	Ascension Wisconsin Hospital – Waukesha Rehabilitation Hospital of Wisconsin Waukesha Memorial Hospital
Pharmacies	CVS Pharmacy Moreland Plaza Pharmacy Walgreens
Department Stores	Meijer Target Walmart Supercenter

Non-prescription PCPs such as hair care, lotions, and ointments are not accepted at collection events or continuous drop box locations. This is in-part because they are not controlled substances. They may be part of residents' normal daily hygiene, and consequently disposal options simply include placing PCPs in garbage or solid waste receptacles. Reducing waste from disposing of unused PCPs through reuse opportunities has been considered, however, entities that may benefit from PCP reuse (for example, shelters) can receive more donated products than needed and there is concern that opened PCPs could be tampered with and present a safety hazard. These two issues severely limit reuse opportunities. Consequently, future PCP opportunities will likely focus on proper disposal if materials are discarded before the end of their useful life.

Additional PCP activities included:

- Reviewed general PCP educational information for use in updating Frequently Asked Questions, social media posts, and on associated City websites.
- Reviewed local ordinances and state laws related to PCP disposal best practices.
- Reviewed general PCP disposal and reuse best practices for consideration in future implementation.

- Reviewed additional opportunities for PCP reduction and reuse through the WDNR and U.S. Environmental Protection Agency (EPA).

4. Future Opportunities

Additional activities that will be considered in 2026 and beyond could include the following:

- General PPCP and PCP Information
  - Monitor best practices regarding pharmaceuticals and personal care products provided by the EPA and WDNR.
  - Maintain coordinated list of acceptable PPCPs and PCPs for collection and disposal on City, CWP, Police, and Sheriff websites.
- Source Reduction through Education
  - Connect with local schools for publishing educational material in their district newsletters and other communication outlets (e.g. “Green Teams”) or to provide educational materials as part of Earth Day instructional events.
  - Improve and expand the educational and awareness materials for significant PPCP sources.
  - Continue to develop and publish PPCP and PCP events and educational material on City Facebook, X, and Instagram accounts.
  - Continue to develop and publish content about PPCP and PCP by electronic methods such as the City’s website and e-newsletters.
  - Continue to develop and publish content about PPCP and PCP in DPW newsletters.
  - Develop and publish content about PPCP and PCP in water/sewer bill inserts.
- Source Reduction through Collection and Reuse
  - Continue to update list of potentially significant PCP sources in the City besides hospitals, pharmacies, and department stores to provide educational materials on proper disposal options.
  - Despite initial limitations, continue exploring opportunities to connect PCP sources with users to provide PCP reuse opportunities (for example, connecting hotels with shelters for reuse of unopened PCP).
  - Continue discussions with the Waukesha Police Department to expand collection opportunities at household hazardous waste events at the County’s contracted collection site.
  - Continue to update list of potentially significant PPCP sources in the City besides hospitals, pharmacies, nursing homes, and veterinary clinics.
  - Further provide PPCP and PCP collection opportunities and information to educate the public by staffing events/booths to specifically promote the PPCP program.

Appendix F. Root River Data Collection Summary (Post-Diversion: October 2024 through September 2025)

Prepared for:

CITY OF WAUKESHA

Root River Data Collection Summary

2025 Annual Reporting (Post-Diversion October 2024 through September 2025)

Prepared by:

SMITHGROUP

Supported by:

Jacobs

February 2026

CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
µg/L	microgram(s) per liter
cfs	cubic foot/feet per second
CH2M	CH2M HILL, Inc.
City	City of Waukesha
CPUE	catch per unit effort
E. coli	*Escherichia coli*
fps	foot (feet) per second
F-IBI	fish index of biological integrity
HBI	Hilsenhoff Biotic Index
IBI	Index of Biotic Integrity for Fish Communities
Jacobs	Jacobs Engineering Group Inc.
M-IBI	macroinvertebrate index of biological integrity mg/L
	milligram(s) per liter
mgd	million gallons per day
mg/L	milligrams per liter
MMSD	Milwaukee Metropolitan Sewerage District
MPTV	mean pollution tolerance value
mS/cm	milliSiemens per centimeter
NTU	nephelometric turbidity unit(s)
QAPP	Post-Return Flow Root River Monitoring and Quality Assurance Project Plan
S.U.	standard unit(s)
TSS	total suspended solids
USGS	U.S. Geological Survey
WDNR	Wisconsin Department of Natural Resources

1 BACKGROUND

The City of Waukesha, Wisconsin (City) transitioned to a Lake Michigan water supply beginning in October 2023 consistent with the 2021 Diversion Approval granted by the Wisconsin Department of Natural Resources (WDNR). The final transition was completed in November 2023. The Diversion Approval requires the City to monitor the Root River for a minimum of 10 years after the final transition to assess the impact of the return flow discharge and to report the assessment annually.

In preparation for the diversion, the City implemented a voluntary pre-diversion data collection program. The data collection began in 2017 to provide pre-diversion baseline water quality, flow, habitat, macroinvertebrate, and fish data (CH2M 2017). A summary of the pre-diversion data was included in Appendix G of the City's 2023 annual diversion report (Waukesha 2024). This report summarizes Root River monitoring and assessment of impact from the return flow during the second post-diversion reporting year October 2024 through September 2025 (the reporting period).

2 RETURN FLOW VOLUME

2.1 ROOT RIVER FLOW

During the reporting period, flow monitoring was completed at the City's Clean Water Plant (CWP). Table 2-1 summarizes monthly average return flow volumes to the Root River over this period. Return flow volumes were very consistent throughout the reporting period, with an average daily flow of 5.15 million gallons and a standard deviation of ±0.10 million gallons. Contributing to the minor deviation was the target daily return flow, which changed from 5.31 million gallons per day (mgd) in 2024 to 5.09 mgd in 2025. The consistency of daily return flow results in no significant change to the periodicity of return flow.

The peak return flow was recorded at 5.55 million gallons on March 10, 2025, after the return flow program was interrupted. Through a cooperative partnership with the City, the U.S. Geological Survey (USGS) maintained a flow gauge along the Root River approximately 760 feet upstream from the return flow outfall (USGS site 04087234) that was discontinued in April 2025. In September 2024, a new gauge was established downstream of the return flow outfall (USGS site 040872342). The flow values from the downstream gauge are presented as the Total Flow in Table 2-1, and the Root River flow was calculated by subtracting the return flow. During the reporting period, the average daily return flow ranged from 0.3%[1] to 81.2% of the total flow.

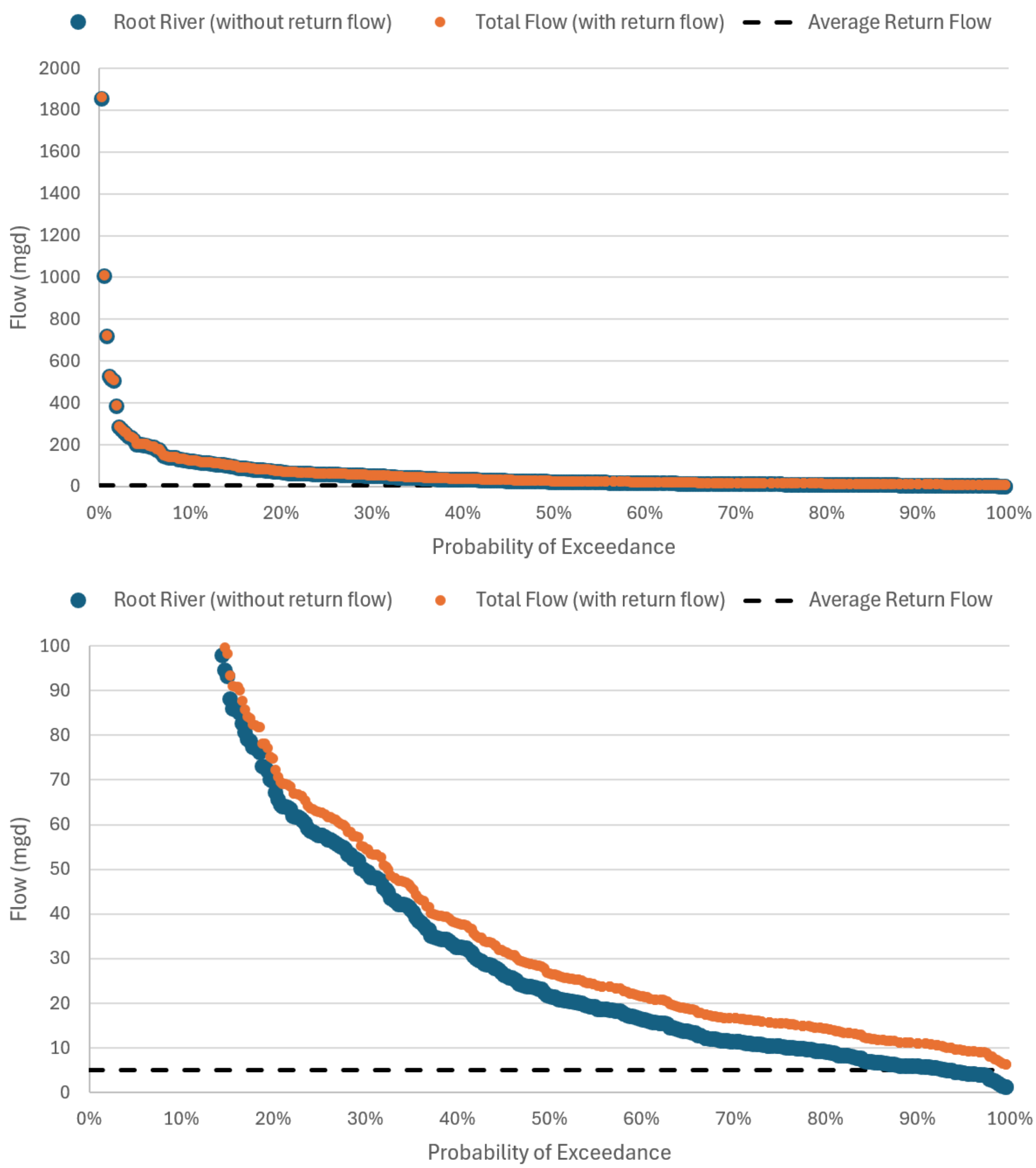
[1] Occurred after a historic rainfall event that resulted in high Root River flows.

TABLE 2-1. REPORTING PERIOD ROOT RIVER AND RETURN FLOWS

Month	Average Monthly Flow (mgd)			
	Root River (Total Flow – Return)	Return	Total Flow (USGS Gauge)	Return % of Total Flow
October 2024	14.71	5.31	20.03	26.5%
November 2024	7.94	5.31	13.25	40.1%
December 2024	36.69	5.31	42.00	12.6%
January 2025	15.88	5.10	20.99	24.3%
February 2025	8.81	5.09	13.89	36.6%
March 2025	9.05	5.11	14.15	36.1%
April 2025	94.80	5.09	99.89	5.1%
May 2025	117.68	5.09	122.77	4.1%
June 2025	59.37	5.07	64.45	7.9%
July 2025	58.84	5.09	63.93	8.0%
August 2025	75.24	5.09	80.33	6.3%
September 2025	179.15	5.09	184.24	2.8%

A flow duration curve of daily flows was developed for the Root River (without return flow) and the total flow (with return flow) to demonstrate the variability of the flow rate over time and the impact of the return flow on the river's hydrology (Figure 2-1).

FIGURE 2-1. FLOW DURATION CURVE OF DAILY ROOT RIVER FLOW AND TOTAL FLOW



The daily return flow rates are well within the return flow rates projected in the Diversion Approval. The Root River flow exceeded the average daily return flow rate (5.15 mgd) 93% of the time. In other words, over the 365 days of the reporting period, the daily return flow exceeded Root River flow 27 days. With the consistent daily return flow, the flow duration curve with return flow also shifts upwards uniformly and the average daily return flow impacts the Root River hydrology uniformly. These findings demonstrate that the return flow had minimal impact on the overall flow dynamics of the river, where the natural variability of the river's flow dominates the river's hydrological regime.

The two highest daily Root River flow values of 1,856 mgd and 1,006 mgd occurred on August 12 and 13, 2025, respectively. On August 9, 2025, the Greater Milwaukee Area experienced historic rainfall and flooding which led to the increased flows in the Root River[2] (see also Section 6.2.9).

[2] https://www.jsonline.com/story/weather/2025/08/11/milwaukee-storms-flooding-rivers-nws-explainer/85606358007/

2.2 ROOT RIVER WATER LEVEL AND VELOCITY

Using a hydraulic model was initially anticipated to evaluate changes in Root River water levels and velocity during the reporting period, assessing changes from the observed range of return flow and river flow over the year. The Southeastern Wisconsin Regional Planning Commission (SEWRPC) is developing a hydraulic model of the Root River for floodplain mapping that would replace the outdated HEC-2 model that currently exists at the return flow location. SEWRPC will share the model once complete, but the mainstem hydraulic model is still in draft form. Consequently, a hydraulic model is not available at this time, however the City will continue to coordinate with SEWRPC about potential use for this assessment as their model is developed.

As an alternative to the hydraulic model, USGS was consulted to estimate water levels from stage-discharge data collected as part of the river flow gaging. USGS did not recommend this approach because fallen trees, beaver activity, rain events, ice-out events, and the channel cross section morphology that currently affect the Root River channel would affect the stage-discharge data. While the USGS has methodologies to correct flow estimates from these factors, correcting stage estimates was not recommended[3].

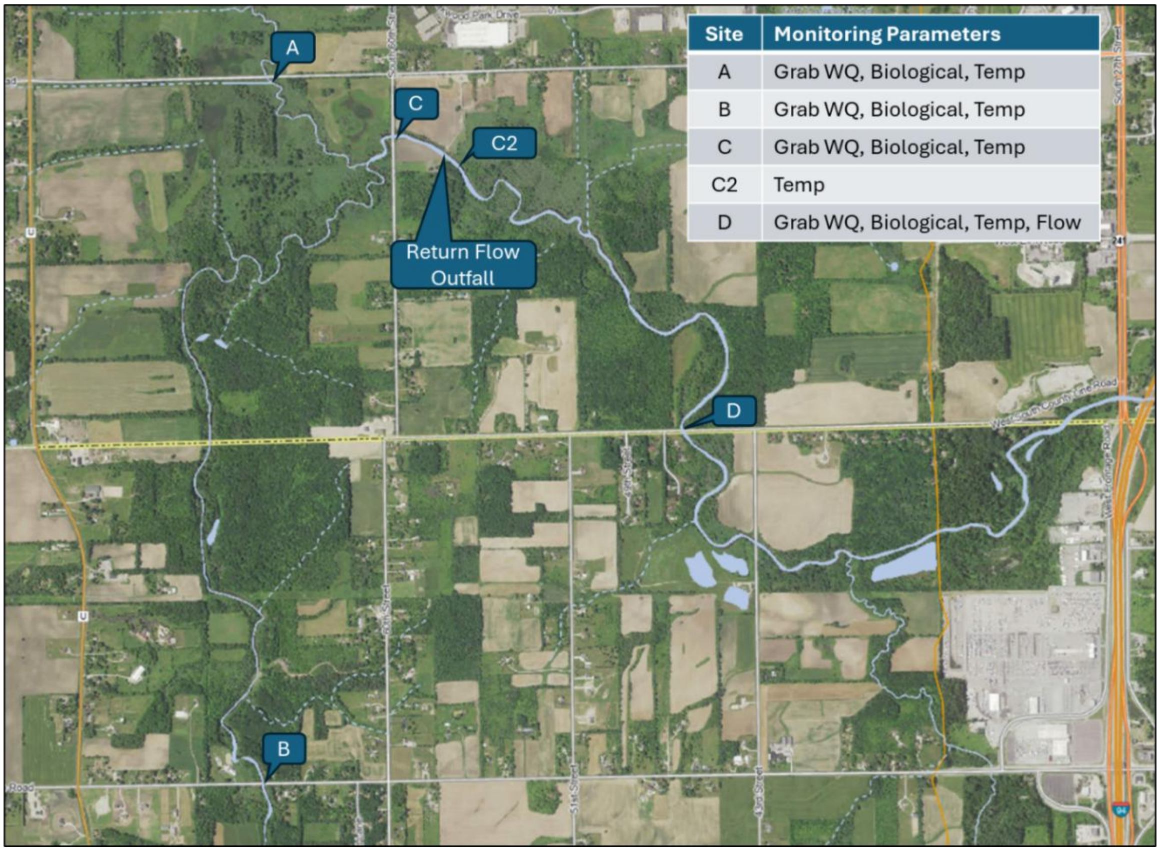
Velocity changes were estimated from the hydraulic model included in the Diversion Approval documents and summarized in the 2023 Pre-Diversion Root River Data Collection Summary Report (Jacobs 2024; Appendix G within Waukesha 2024). That hydraulic model calculated that a 12 mgd return flow rate results in an estimated 0.3 foot per second (fps) increase in water velocity during 2 mgd low-flow Root River conditions[4]. On the day with the highest percentage of return flow in the reporting period (February 23, 2025), the Root River had a very low flow of 1.18 mgd, with a return flow of 5.09 mgd. The ratio of reporting period Root River low-flow to return flow was proportionately less than the Diversion Approval modeling conditions; consequently, the increase in water velocity with return flow during the reporting period is anticipated to be less than 0.3 fps.

3 MONITORING LOCATIONS

Monitoring locations were upstream and downstream of the return flow outfall location (Figure 3-1) consistent with the Post-Return Flow Root River Monitoring and Quality Assurance Project Plan (Jacobs and SmithGroup 2025; QAPP).

[3] Email Communication between Anthony Debonis, Kassidy O'Malley, Brent Brown, and Rob Wauschbusch. Root River data. August 2 to August 5, 2024.
[4] Refer to Appendix K, Table 3, in Volume 4, City of Waukesha Return Flow Plan, of the City of Waukesha Application for Lake Michigan Diversion with Return Flow.

FIGURE 3-1. MONITORING LOCATIONS



Note: Root River flow monitoring transitioned from Site C to Site D prior to the reporting period in September 2024 as noted in Section 2.1 and the QAPP (Jacobs and SmithGroup 2025)

4 DATA ANALYSIS

Statistical analysis was completed to evaluate the differences between the pre-diversion period and the reporting period, sampling site locations, and seasons. The Mann-Whitney U Test was selected because it is a non-parametric statistical test used to compare differences between two independent data groupings. This test is particularly useful when the data does not follow a normal distribution or when sample sizes are small, which were conditions met by the reporting period dataset for some parameters (Jamil 2024).

The use of this test allowed detection of differences in the distributions of two datasets with reliability and validity, including in the presence of outliers or non-normal data distributions. Statistical analyses were conducted to evaluate whether changes in temperature and water quality were statistically significant. Statistical significance was evaluated at a p-value of 0.05, where a p-value less than 0.05 indicates that the observed differences are statistically significant, while a p-value greater than 0.05 indicates that the differences are not statistically significant.

It is important to note that the pre-diversion dataset is more than six times larger than the single year of data included in this reporting period. The insight and reliability of the statistical analyses will increase as subsequent years of post-diversion data are collected and the size of the datasets balance. Consequently, definitive conclusions are not presented at this time when comparing pre-diversion period and current reporting period statistics.

5 WATER TEMPERATURE

Continuous water temperature monitoring at Sites A, B, C, and D has been conducted by USGS since September 2016, and monitoring at Site C2 was initiated in October 2023 as part of the QAPP. Two HOBOTemp temperature data sondes are used at Sites A, B, and C2. Temperature at Site C is captured by an automated USGS gauge and one temperature data sonde located near the right riverbank. Temperature at Site D was previously captured using HOBOTemp temperature data sondes until transitioning to a continuous temperature probe in April 2025.

Data from sondes are regularly offloaded and the sondes are maintained and redeployed according to USGS continuous monitoring protocols. Temperature data are collected at hourly intervals at Sites A and B, at 5-minute intervals at Site C2, and at 15-minute intervals at Site C and Site D. For the next reporting period, the USGS will report each site at consistent hourly intervals.

Ambient river water temperatures are seasonal at all sites, where water temperature is coldest in December and January, and warmest in July and August. During the cold winter months, data loss may occur because of river water freezing as well as the removal of the automated USGS temperature probe at Site C to prevent damage. While the temperature probe is offline, a wired temperature sensor continues to collect data. Therefore, Site C temperature data is a combination of measurements from the automated probe and a wired sensor.

5.1 REPORTING PERIOD WATER TEMPERATURE

A summary of daily average water temperature statistics for the pre-diversion period and the reporting period is shown in Table 5-1. A daily average temperature was calculated by averaging hourly data by calendar day. For Site C2, and Sites C and D, where temperature is measured at 5-minute and 15-minute intervals, respectively, hourly temperature data was generated using the temperature recorded at the beginning of the hour.

TABLE 5-1. TEMPERATURE STATISTICS BY SITE USING DAILY AVERAGE TEMPERATURE

Site	Average	Minimum	Maximum	5th Percentile	50th Percentile (Median)	95th Percentile	Data Count (n)[a]
Pre-Diversion (January 2016 through September 2023)							
A	52	32	82	32	51	76	2,548
B	53	32	84	32	51	77	2,550
C	54	32	83	32	53	77	2,313
D	54	31	83	32	53	77	2,296
Reporting Period (October 2024 through September 2025)							
A	53	32	82	32	55	77	331
B	53	32	82	32	53	75	365
C	53	32	83	32	53	76	365
C2[b]	55	33	80	37	55	75	365
D	55	33	81	36	55	76	365

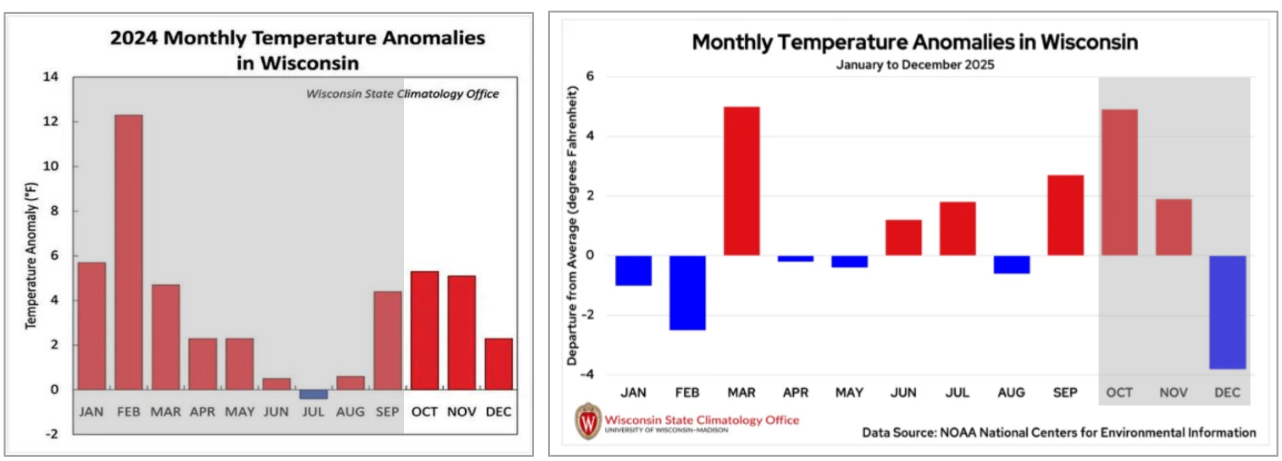
Site	Average	Minimum	Maximum	5th Percentile	50th Percentile (Median)	95th Percentile	Data Count (n)[a]
Post-Diversion (October 2023 through September 2025)							
A	54	32	82	32	55	76	675
B	53	32	82	32	53	75	731
C	53	32	83	32	53	76	731
C2[b]	54	33	80	36	55	74	731
D	54	32	81	35	55	75	731

Notes:
[a] Variation in daily average temperature data counts for each site in the pre-diversion period and the reporting period were observed because of impacts to data collection equipment at each site. Temperature data collection was impacted by sensor malfunctions, sensors freezing in the winter months, sensors being at or above water level during low flow conditions in the summer months, or sensors being damaged by debris and/or animals.
[b] Site C2 began operating post-diversion.

Consistent with reporting in 2024, average and median water temperatures during the current reporting period remained similar to or slightly higher than those observed in the pre-diversion period across all sites; the reporting period of October 2024 through September 2025 was slightly warmer compared to an average or median year observed during the pre-diversion period. This finding aligns with National Weather Service findings that 2024 was the warmest year on record in Wisconsin[5]. Although winter 2025 featured pronounced swings in cold and warm temperatures, shown in Figure 5-1, the year as a whole was warmer than average, ranking as the nineteenth warmest year on record in Wisconsin[6].

For the reporting period, 5th percentile and 95th percentile water temperature values were similar to the pre-diversion period. One notable difference was a warmer 5th percentile temperature of 36 degrees at Site D during the reporting period, compared to 32 degrees in the pre-diversion period. This may suggest that the introduction of return flow has a slight warming effect on river water temperature during the colder months. Conversely, maximum water temperatures were slightly cooler for all sites in the reporting period compared to pre-diversion conditions. This suggests that the reporting period warmer months were slightly cooler compared to the pre-diversion monitoring dataset.

FIGURE 5-1. 2024 AND 2025 MONTHLY TEMPERATURE ANOMALIES IN WISCONSIN



Source: Wisconsin State Climatology Office[5,6]

Mann-Whitney U Test analyses comparing pre-diversion water temperature to reporting period water temperature at each site are shown in Table 5-2. The results indicate that temperature differences

[5] https://climatology.nelson.wisc.edu/wisconsin-annual-2024-climate-summary/
[6] https://climatology.nelson.wisc.edu/annual-2025-climate-summary/

between the two data collection periods were statistically significant ($p<0.05$) for all sites except Site A, however the pre-diversion dataset has much more data than the reporting period (Table 5-1). This is different from the prior reporting period (October 2023 to September 2024) during which only Site A demonstrated statistically significant differences between the pre-diversion and reporting periods. The same statistical analyses comparing pre-diversion water temperature to post-diversion water temperature at each site are also shown in Table 5-2. The results indicate that differences in temperature between the two data collection periods were statistically significant ($p<0.05$) for all sites except Site C.

TABLE 5-2. MANN-WHITNEY U TEST: WATER TEMPERATURE BETWEEN PRE-DIVERSION, REPORTING PERIOD, AND POST-DIVERSION

Site	Comparison	Significantly Different Data Distributions		Median Values	
		p-value	Yes/No	Pre-Diversion	Reporting Period or Post-Diversion[a]
A	Pre-Diversion vs. Reporting Period	0.58	No	51	55
B	Pre-Diversion vs. Reporting Period	3.7 e-6	Yes	51	53
C	Pre-Diversion vs. Reporting Period	8.0 e-5	Yes	53	53
D	Pre-Diversion vs. Reporting Period	1.5 e-12	Yes	53	55
A	Pre-Diversion vs. Post Diversion	2.6 e-25	Yes	51	55
B	Pre-Diversion vs. Post Diversion	5.4 e-4	Yes	51	53
C	Pre-Diversion vs. Post Diversion	0.87	No	53	53
D	Pre-Diversion vs. Post Diversion	2.6 e-17	Yes	53	55

Note:
[a] Reporting Period is October 1, 2024, through September 30, 2025. Post Diversion is October 1, 2023, through September 30, 2025.

The differences in statistical results between the reporting period and post-diversion period demonstrate that while Sites B and D have been statistically warmer during the post-diversion period thus far, water temperature conditions at Site A and Site C have not been as consistent. Water temperatures observed at all sites may be the result of multiple factors, including natural and seasonal variation, regional and global impacts from weather trends and impacts to water temperature upstream of Site A and Site B. Water temperature analyses in future years with a larger dataset will support continued assessment into which of these factors, or other factors, have substantial influence on Root River water temperatures.

5.1.1 TEMPERATURE DIFFERENCES ACROSS SEASONS

Ambient river water temperatures are seasonal at all sites, where water temperature is coldest in the winter months, and warmest in the summer months. For the purposes of this monitoring program, the seasons are defined as:

- Fall: September through November
- Winter: December through February
- Spring: March through May
- Summer: June through August

Mann-Whitney U Test analyses comparing daily average water temperatures at Site C and Site D during each season are shown in Table 5-3 for the pre-diversion period, reporting period, and post-diversion period.

TABLE 5-3. MANN-WHITNEY U TEST: WATER TEMPERATURE SEASONALITY AT SITE C AND SITE D

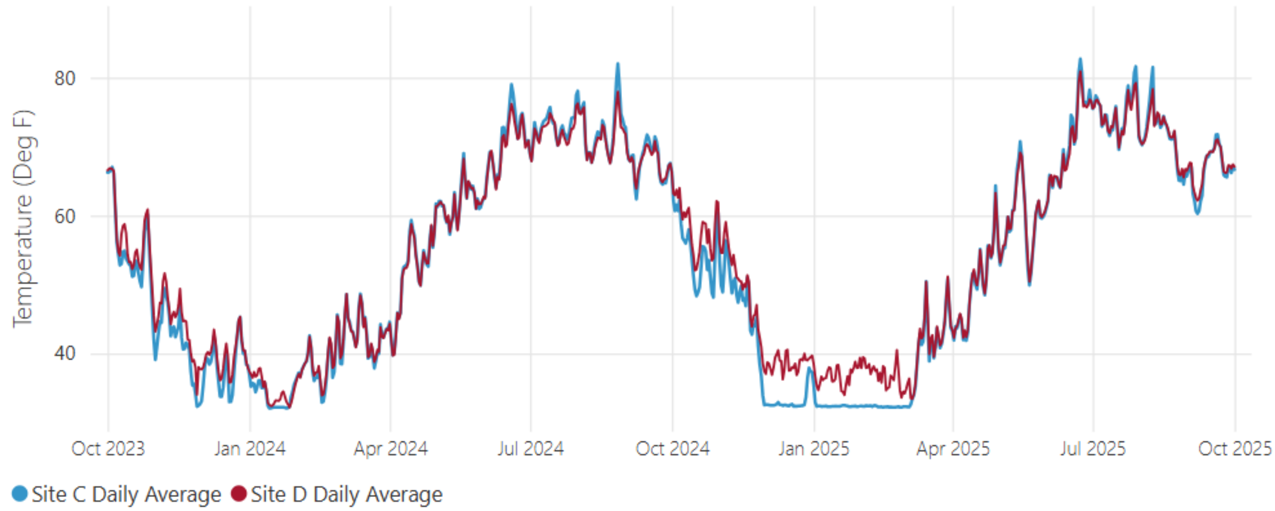
Season	Program Phase	Comparison	Significantly Different Data Distributions		Median Values	
			p-value	Yes/No	Site C	Site D
Fall	Pre-Diversion	Site C vs. Site D	1.3 e-5	Yes	55	54
Winter	Pre-Diversion	Site C vs. Site D	1.4 e-52	Yes	32	33
Spring	Pre-Diversion	Site C vs. Site D	1.5 e-4	Yes	48	49
Summer	Pre-Diversion	Site C vs. Site D	0.24	No	73	73
Fall	Reporting Period	Site C vs. Site D	3.6 e-15	Yes	56	59
Winter	Reporting Period	Site C vs. Site D	0.00	Yes	32	38
Spring	Reporting Period	Site C vs. Site D	0.16	No	50	50
Summer	Reporting Period	Site C vs. Site D	0.13	No	73	73
Fall	Post-Diversion	Site C vs. Site D	2.6 e-13	Yes	55	58
Winter	Post-Diversion	Site C vs. Site D	0.00	Yes	33	38
Spring	Post-Diversion	Site C vs. Site D	0.48	No	51	51
Summer	Post-Diversion	Site C vs. Site D	5.3 e-7	Yes	72	72

During the pre-diversion period, differences in daily average temperatures at Site C and Site D were statistically significant ($p<0.05$) for all seasons except summer. During the reporting period, differences in daily average temperature at Site C and Site D were statistically significant ($p< 0.05$) during the fall and winter only. For the combined post-diversion period, differences in daily average temperatures at Site C and Site D were statistically significant ($p<0.05$) for all seasons except spring.

Daily average temperatures at Site C compared to Site D have remained different during the fall and winter seasons, from the pre-diversion period through the post-diversion period thus far. During the pre-diversion period, differences resulted in a slightly warmer Site C in the fall and a slightly warmer Site D in the winter. In the post-diversion period, differences reflect a warmer Site D compared to Site C for both seasons. This continued divergence suggests that seasonal factors, such as ice formation and cold water mixing dynamics, and potentially return flow, may influence water temperature behavior at the two sites.

Figure 5-2 shows daily average temperature at Site C and Site D during the post-diversion period and visually illustrates the greater temperature separation in portions of the fall and winter months. In the rising portions of the graph (spring) the Site C and Site D temperatures are similar, and in summer months, Site D is commonly cooler than Site C.

FIGURE 5-2. POST-DIVERSION DAILY AVERAGE TEMPERATURE AT SITE C AND SITE D



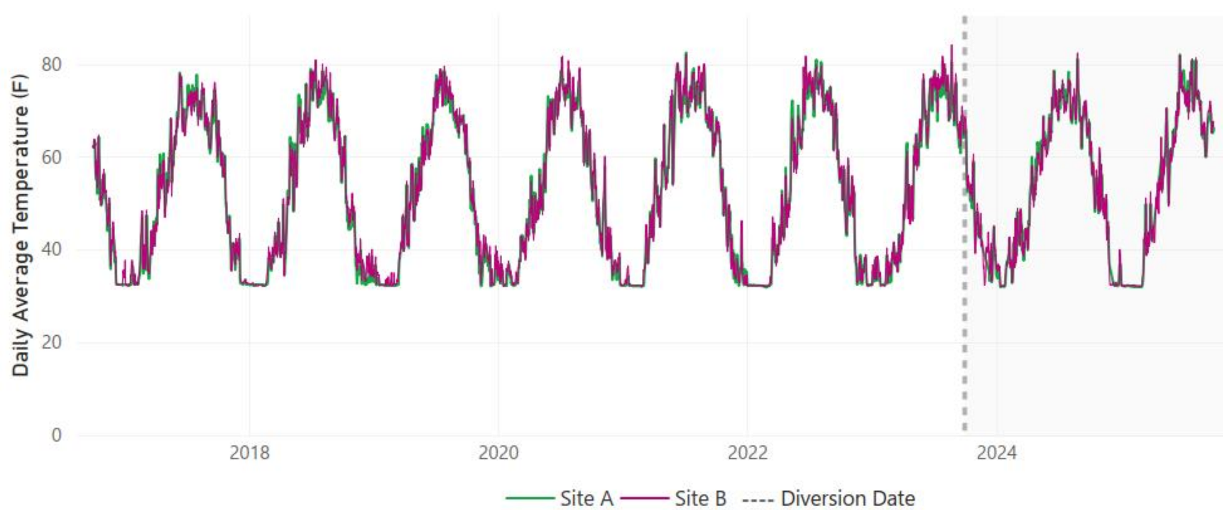
5.1.2 TEMPERATURE DIFFERENCES ACROSS SAMPLING SITES

Daily average water temperatures and differences across Sites A, B, C, C2 and D were assessed over pre-diversion and post-diversion periods.

5.1.2.1 SITE A AND SITE B

Sites A and B were plotted together to compare water temperature variations from the canal (Site B) and the mainstem (Site A). Both Sites A and B are upstream of the return flow location. Figure 5-3 presents these comparison results.

FIGURE 5-3. DAILY AVERAGE WATER TEMPERATURE AT SITES A AND B



Similar to reporting in 2024, daily average water temperatures at Site A and Site B differed by 0 to 2°F, on average, and followed similar trends observed during the pre-diversion period. Site B is generally warmer during the late summer through winter months (August through February), while Site A is generally warmer during the early spring and summer months (April through July).

Mann-Whitney U Test results of daily average water temperatures at Site A and Site B are shown in Table 5-4. Temperature differences between the two sites were statistically significant ($p<0.05$) during both the pre-diversion and post-diversion periods. Temperature differences observed during the current reporting period were not statistically significant. Although water temperatures at the two sites were similar over this reporting period, the broader post-diversion trend suggests that the sites exhibit distinct water temperature behaviors. Ongoing monitoring will continue to assess these behaviors as the post-diversion dataset expands.

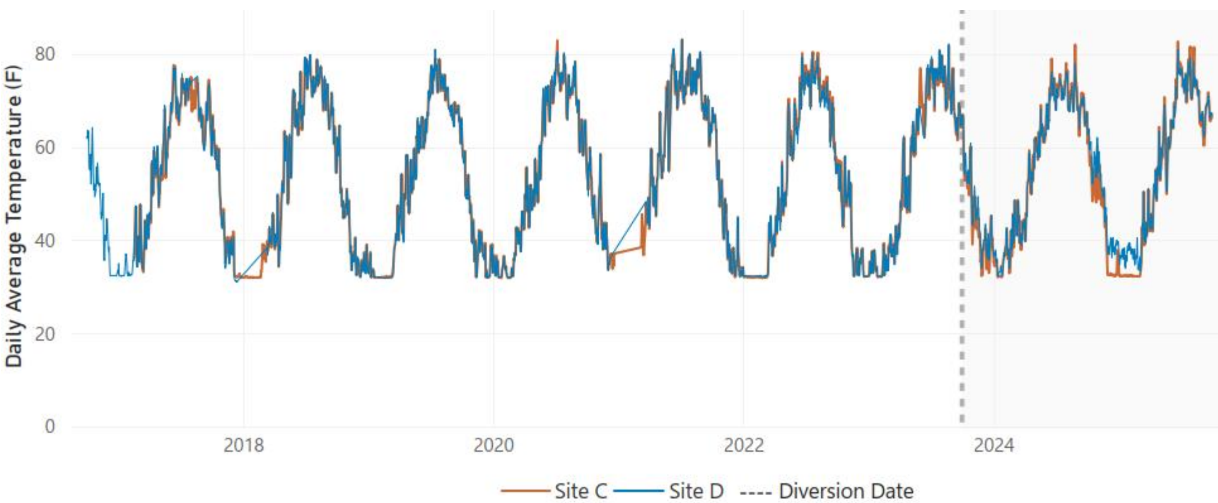
TABLE 5-4. MANN-WHITNEY U TEST: DAILY AVERAGE WATER TEMPERATURE AT SITE A AND SITE B

Program Phase	Comparison	Statistically Different Data Distributions		Median Values	
		p-value	Yes/No	Site A	Site B
Pre-Diversion	Site A vs. Site B	4.3 e-11	Yes	51	51
Reporting Period	Site A vs. Site B	0.20	No	55	53
Post-Diversion	Site A vs. Site B	4.3 e-4	Yes	55	53

5.1.2.2 SITE C, SITE C2, AND SITE D

Sites C, C2, and D were compared to assess temperature conditions at locations upstream (Site C), near downstream (Site C2), and farther downstream (Site D) of the return flow discharge location. Figure 5-4 presents these comparison results between Sites C and D.

FIGURE 5-4. DAILY AVERAGE WATER TEMPERATURE AT SITE C AND SITE D



Notes:
Water temperature data at Site C were unavailable in the winter of 2018 because of a stream freezing event (3 days of data missing). Temperature data at Site C were unavailable in the winter of 2021 because of monitoring equipment removal to prevent freezing (76 days of data missing). Water temperature data at Site D were unavailable in the winter of 2018 and the winter of 2021 because the temperature data sonde was impacted by ice events and/or animal interference (83 days and 103 days of data missing, respectively).

Differences in daily average water temperature followed similar trends as reported in 2024. Site D was slightly warmer than Site C in the winter and was similar to or slightly cooler than Site C in the summer. From October through February, daily average water temperatures at Site D were 0 to 6°F warmer than Site C. From June through July, daily average water temperatures at Site D were 0 to 1°F cooler than Site C. This trend deviates from pre-diversion conditions, during which Site D was, on average, cooler than Site C by 0 to 1°F during the winter months and warmer than Site C by 0 to 1°F during the summer months.

Mann-Whitney U Test results for daily average water temperatures at Site C and Site D are shown in Table 5-5. Temperature differences during the pre-diversion period were not statistically significant, whereas differences in both the reporting and post-diversion period were statistically significant ($p<0.05$). These results suggest that for baseline conditions prior to the start of return flow, Site C and Site D demonstrated similar temperatures because of natural, environmental, and other contributing factors. Temperatures differences at Site C and Site D in the reporting and post-diversion periods thus far appear to be influenced by a combination of several factors including seasonal variability between the winter and summer, regional weather trends, river flows, and potentially from the return flow. Given the limited dataset, continued monitoring will be essential to better characterize these preliminary temperature patterns.

TABLE 5-5. MANN-WHITNEY U TEST: AVERAGE DAILY WATER TEMPERATURE AT SITE C AND SITE D

Program Phase	Comparison	Statistically Different Data Distributions		Median Values	
		p-value	Yes/No	Site C	Site D
Pre-Diversion	Site C vs. Site D	0.19	No	53	53
Reporting Period	Site C vs. Site D	1.5 e-22	Yes	53	55
Post-Diversion	Site C vs. Site D	3.0 e-16	Yes	53	55

Figure 5-5 presents the results of a comparison of daily average water temperature monitoring at Sites C, C2, and D. Cooler temperatures at Site C as compared to Site C2 and Site D were observed during winter months in 2024 and 2025. The differences are more pronounced, but have less variability in 2025. The differences may be influenced in-part by the river flows, for example the January 2024 average flow was ten times greater than January 2025, where higher river flow are less prone to freeze.

FIGURE 5-5. DAILY AVERAGE TEMPERATURE AT SITES C, C2, AND D

For the reporting period, water temperatures measured at Site C2 are similar to Site D. Differences in average daily water temperature between Site C and Site C2 varied between 0 and 6°F, whereas Site C2 and Site D varied between 0 and 2°F.

Mann-Whitney U Test analyses of daily average temperature values at Site C, Site C2, and Site D are shown in Table 5-6. Results demonstrate that temperature differences at Site C compared to Site C2 are statistically significant ($p<0.05$) during the reporting and post-diversion period. Temperature differences at Site C2 compared to Site D are not statistically significant for the reporting and post-diversion periods.

TABLE 5-6. MANN-WHITNEY U TEST: WATER TEMPERATURE AT SITES C, C2, AND D

Program Phase	Comparison	Statistically Different Data Distributions		Median Values		
		p-value	Yes/No	Site C	Site C2	Site D
Reporting Period	Site C vs. Site C2	4.2 e-18	Yes	53	55	-
Reporting Period	Site C2 vs. Site D	0.52	No	-	55	55
Post Diversion	Site C vs. Site C2	2.2 e-14	Yes	53	55	-
Post Diversion	Site C2 vs. Site D	0.94	No	-	55	55

A box and whisker plot of the 15-minute and hourly temperatures for Site C and Site D is shown on Figure 5-6. The box represents the 25th through the 75th percentile of data, where 50% of the datapoints are within the box. The center line in the box represents the median and the triangle represents the mean. The lower and upper whiskers represent the 5th and 95th percentile, where 90% of the datapoints are between the whiskers. Outliers from the dataset are shown as points. The results show that both sites experience greater temperature variability during the fall, spring, and summer compared to winter. Site C and Site D also exhibit more pronounced temperature deviations during the winter months.

FIGURE 5-6. REPORTING PERIOD WATER TEMPERATURE BOX AND WHISKER PLOTS AT SITE C AND SITE D

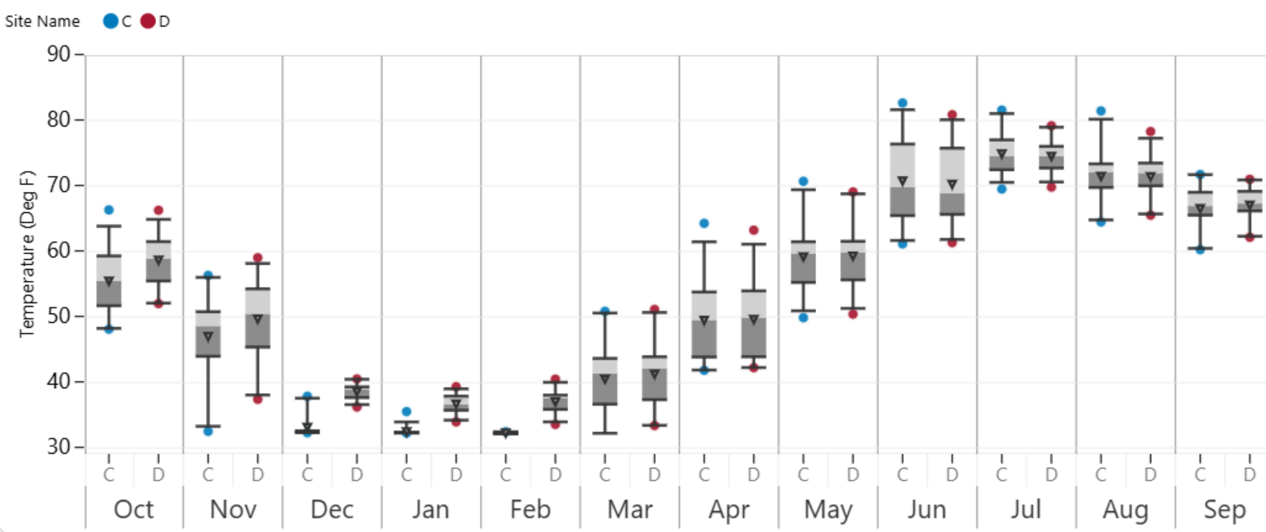


Table 5-7 summarizes the water temperature thresholds for the Root River. The ambient water temperatures are site specific to the Root River at Site C, while the sublethal and acute temperatures are default temperature thresholds for warm small rivers from Wisconsin Administrative Code NR102 (WDNR 2024).

TABLE 5-7. MONTHLY WATER TEMPERATURE THRESHOLDS

Month	Temperature Thresholds (°F)		
	Ambient	Sublethal	Acute
January	33	49	76
February	34	50	76
March	39	52	77
April	47	55	79

Month	Temperature Thresholds (°F)		
	Ambient	Sublethal	Acute
May	59	65	82
June	69	76	84
July	74	81	85
August	72	81	84
September	66	73	82
October	55	61	80
November	42	49	77
December	34	49	76

Daily average water temperature exceedances of the ambient, sublethal, and acute water temperature thresholds (Table 5-7) were assessed for Site C and Site D during the reporting period (Table 5-8). The daily average temperature was compared to the monthly temperature threshold and exceedances were summed. For example, if the daily average temperature at Site C exceeded the January ambient temperature threshold on January 3 and January 15, two exceedances were reported.

Total ambient and sublethal exceedances at Site C in the current reporting period were 174 and 38, respectively. Ambient exceedances at Site C decreased from 237 in the 2024 reporting period, while sublethal exceedances increased from 20. At Site D, total ambient and sublethal exceedances at Site D in the current reporting period were 266 and 45, respectively. Ambient exceedances at Site D were comparable to 2024 levels (261), whereas sublethal exceedances rose from 23 in the 2024 reporting period.

TABLE 5-8. REPORTING PERIOD DAILY AVERAGE WATER TEMPERATURE THRESHOLD EXCEEDANCES AT SITE C AND SITE D

Month	Site C			Site D		
	Ambient	Sublethal	Acute	Ambient	Sublethal	Acute
October 2024	17	4	-	24	9	-
November 2024	25	12	-	27	20	-
December 2024	4	-	-	31	-	-
January 2025	1	-	-	31	-	-
February 2025	-	-	-	27	-	-
March 2025	21	-	-	22	-	-
April 2025	18	6	-	18	5	-
May 2025	17	5	-	17	5	-
June 2025	16	9	-	14	6	-
July 2025	19	1	-	17	-	-
August 2025	16	1	-	15	-	-
September 2025	20	-	-	23	-	-

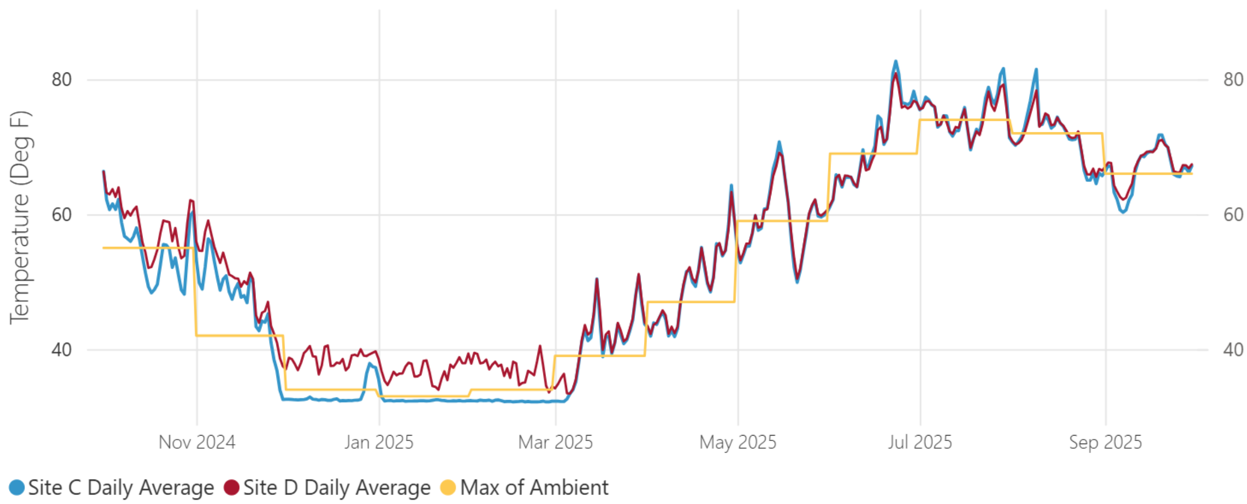
Note:
"-" indicates that no temperature threshold exceedances were recorded.

A time-based assessment of ambient threshold exceedances each month at Sites C and D is shown in Figure 5-7. Instances where the daily average water temperature is higher than the horizontal line representing the threshold indicate an exceedance. Similar to results observed in 2024, exceedances at

Site C and Site D occurred throughout the month and did not appear to occur more frequently at the beginning or end of any given month. This is consistent with results observed during the pre-diversion period.

Differences in ambient temperature exceedances appear to be driven by winter conditions, particularly from December 2024 through March 2025. During this period, water temperatures at Site C were cooler than those at Site D resulting in more frequent exceedances of the ambient threshold at Site D.

FIGURE 5-7. REPORTING PERIOD DAILY AVERAGE TEMPERATURE COMPARISON WITH AMBIENT THRESHOLD



5.1.3 REPORTING PERIOD WATER TEMPERATURE OBSERVATIONS

When assessing the impact of return flow, key themes from the QAPP were considered such as changes in river water temperature upstream and downstream of return flow, seasonal differences, and the spatial extent of temperature.

Consistent with observations in 2024, river water temperatures both upstream and downstream of return flow were slightly warmer than pre-diversion conditions. This aligns with this reporting period being warmer than an average pre-diversion year. Unlike the 2024 findings, however, water temperatures at Site B, Site C, and Site D differed from their pre-diversion values, while temperatures at Site A remained within statistically similar ranges to those observed during the pre-diversion period. This change from 2024 results underscores the variability within the datasets across years and the need for continued monitoring to refine early findings. Field teams collecting water quality samples note challenges in collecting water samples at upstream sites due to frozen river conditions (as observed in winter 2024/2025 at Sites A, B, and C in Figures 5-2 through 5-5 when water temperatures were reported at or near 32 degrees), where freezing river conditions did not exist at downstream Sites C2 and D. Biological impacts of frozen versus flowing river conditions will also be considered in future assessments.

Seasonal trends along the Root River followed pre-diversion conditions, where water temperature is coldest in December and January and warmest in July and August. Seasonal water temperature trends when comparing Site C and Site D did demonstrate variations. During the reporting period, Site D was 0 to 6°F warmer in the winter and 0 to 1°F cooler in the summer compared to Site C. Considering the river water temperature data from the prior reporting period (October 2023 through September 2024), the river is cooler downstream of return flow in summer months and warmer in winter months. However, because these trends also align with conditions observed in the summer of 2022 and there are only two winters of record, the extent to which return flow and natural variation are each impacting water temperatures are not conclusive. This will continue to be assessed in subsequent reporting periods.

The spatial extent of water temperature changes caused by return flow is inconclusive at this stage of the reporting period. There is substantially less reporting period water temperature data compared to the pre-diversion period. Therefore, subsequent years of data collection will increase confidence in the assessment of return flow impacts.

6 WATER QUALITY

During the reporting period, Root River water quality was measured consistent with the QAPP. Water quality was assessed at four sampling locations: Sites A, B, C, and D.

6.1 DATA QUALITY

Water quality data collected as part of the diversion monitoring activities were reviewed quarterly to evaluate completeness and accuracy and underwent additional quality control at the end of the reporting period. Field data were also reviewed to identify and assess potential outliers resulting from equipment malfunctions, meter calibration issues, sampling method errors, or other conditions documented by field personnel.

During the reporting period, both field and laboratory results were reviewed, and no data points were excluded due to quality concerns. During the February 2025 sampling event, Site A was inaccessible due to river ice cover; therefore, no field measurements were collected at Site A during that month. All remaining data points that fell outside the expected parameter ranges identified in the QAPP are discussed in the following sections.

6.2 REPORTING PERIOD WATER QUALITY

A summary of water quality during the reporting period for Sites A through D is shown in Table 6-1. As part of the QAPP, expected data ranges were established to support the assessment of data quality. The last two columns in Table 6-1 show the number and percent of data points that fell outside of the parameter expected range during the reporting period. Parameters that include data points outside of the QAPP expected range include turbidity, specific conductance, orthophosphate, and total suspended solids (TSS).

Data points outside of the expected turbidity range are greater than the 120 nephelometric turbidity units (NTUs) expected maximum, ranging from 127 NTUs to 207 NTUs. For the higher turbidity values, these occurrences may be the result of field water quality meter malfunctions or inaccurate calibrations. In cases where field teams did not note issues with the equipment or field procedures, the turbidity data have remained in the dataset. Some occurrences of high turbidity levels also coincided with precipitation events where temporary increases in turbidity are expected (refer to Section 6.2.8.1). These data remained in the dataset.

Data points outside of the orthophosphate expected range are less than 0.01 milligram per liter (mg/L). The orthophosphate expected range was set based on the anticipated laboratory limit of detection. Orthophosphate results that fall below the expected range minimums do not impact reporting period water quality observations. These data remained in the dataset.

Two data points exceeded the chlorophyll maximum expected range of 360 µg/L. Both exceedances occurred at Site B, while chlorophyll concentrations measured at other monitored sites during the same sampling events did not exhibit similarly elevated values. The spatially isolated nature of these exceedances suggests they reflect localized site-specific conditions rather than a system-wide water quality response. The results passed applicable quality assurance and quality control review, and no laboratory or field issues were identified. Therefore, these data remained in the dataset.

Data points outside the TSS expected range are greater than the 175 mg/L expected maximum. These occurrences were infrequent (n = 5), and they passed quality assurance and quality control procedures by the Wisconsin State Laboratory of Hygiene. These data remained in the dataset.

Three dissolved oxygen (DO) measurements exceeded the expected maximum range of 15 mg/L. These elevated values occurred during a single season sampling event in February 2025. Elevated DO conditions during cold-weather periods are consistent with increased oxygen solubility at lower water temperatures and seasonal physical processes such as enhanced mixing and reaeration. The field teams did not indicate issues with sampling, therefore these data remained in the dataset.

TABLE 6-1. REPORTING PERIOD WATER QUALITY SUMMARY AT SITE A THROUGH SITE D

Parameter	Unit	All Sites (A-D)					
		5th Percentile	Median ± Standard Deviation	95th Percentile	QAPP Expected Range[a]	Data Points Outside of Expected Range	Percent of Data Points Outside of Expected Range (%)
pH	S.U.	7.41	7.72 ± 0.21	8.04	6 to 10	0	0.00%
Dissolved Oxygen	mg/L	6.43	9.07 ± 2.26	13.49	0.01 to 15	3	0.94%
Temperature	deg Celsius	0.10	13.30 ± 7.15	23.50	-5 to 35	0	0.00%
Turbidity	NTU	2.81	11.17 ± 29.65	57.06	0.1 to 120	8	2.23%
Specific Conductance	mS/cm	0.53	0.86 ± 0.17	1.10	0.1 to 10	0	0.00%
Phosphorus	mg/L	0.05	0.12 ± 0.10	0.36	0.01 to 5	0	0.00%
Orthophosphate	mg/L	0.01	0.03 ± 0.03	0.11	0.01 to 3	8	9.41%
Total Nitrogen	mg/L	0.77	3.31 ± 3.02	10.74	0.01 to 15	0	0.00%
Nitrate-Nitrite	mg/L	0.07	2.11 ± 2.95	9.75	0.01 to 15	0	0.00%
Ammonia	mg/L	0.02	0.06 ± 0.05	0.18	0.01 to 3	0	0.00%
TSS	mg/L	9.92	34.5 ± 63.29	219.60	1 to 175	5	5.88%
Chlorophyll	µg/L	2.58	9.23 ± 80.90	60.90	0.01 to 360	2	2.35%

Notes:
[a] Post-Return Flow Root River Monitoring Plan and Quality Assurance Project Plan. Jacobs, 2023. µg/L = microgram(s) per liter
deg Celsius = degree(s) Celsius (°C)
S.U. = standard unit(s)

6.2.1 ROOT RIVER AND CWP WATER QUALITY COMPARISONS

The CWP prepares monthly discharge monitoring reports (DMR) that summarize water quality results required through the Wisconsin Pollutant Discharge Elimination System (WPDES) permit requirements for return flow. The WPDES permit requires more frequent monitoring of the return flow water quality than is completed in the Root River monitoring QAPP to ensure that the receiving water quality is protected. The differences in the WPDES and QAPP monitoring requires careful review to ensure that proper conclusions are drawn from data comparisons. As noted in Section 4, definitive conclusions are not presented herein because the post-diversion dataset is much smaller than the pre-diversion dataset, however additional complexities of comparing return flow and Root River monitoring data require the following considerations:

- The WPDES permit includes averaging periods such as weekly, monthly and 6-months intervals for non-toxic parameters like phosphorus, dissolved oxygen, and total suspended solids. This approach recognizes that any impact is assessed over a longer period of time, treatment processes have normal variations, and single sample values are not reflective of typical discharge conditions. However, all Root River water quality (less temperature) are discrete samples collected once or twice per month. This difference in data collection frequency must be considered when comparing the datasets. For example in the prior reporting period (October 2023 through September 2024), while return flow ammonia concentrations met permit limits for the entire reporting period and were most commonly nondetectable, Root River monitoring showed an increase in ammonia between Sites C and D. A basic comparison might suggest that return flow had an impact, however the single Root River sample was coincidentally collected on one of two days in the month when daily ammonia levels were above nondetection levels but still well within permit limits. Further supporting this interaction, the current reporting period saw no significant difference between Site C and D.
- Various natural environmental factors can impact changes in water quality between sites that are not associated with return flow. For example, total suspended solids at an upstream site can be low if the river has a slow velocity, while a downstream site could have higher values if natural geomorphic features in the river suspend sediment. Similarly, flow conditions, oxygen levels, light, or biological activity between sites can impact phosphorus or nitrogen concentrations.
- Each of the Root River QAPP water quality parameters are not individually critical for assessing river health. Instead, they were included to support a potential future water quality model, similar to the one completed prior to the Diversion Approval. For example, there is no chlorophyll limit included in the WPDES permit; however, phosphorus, temperature, and nitrogen could influence chlorophyll levels and a model's ability to assess natural or anthropogenic changes. Each water quality parameter is summarized below, though not all are suitable for individually assessing the impacts to the river.

During the reporting period, the CWP met all effluent water quality permit conditions except for a minor exceedance of the Root River 6-month non-growing season phosphorus limit (0.065 mg/L compared to 0.060 mg/L). This exceedance was due to 2.5 months of construction issues between February and April 2025 at the CWP that impacted the effluent filters. However, the CWP effluent was still less than the Root River (and Fox River) phosphorus water quality standard of 0.075 mg/L and the monthly phosphorus limits were met during all months. As additional data is collected during the post-diversion period, a better understanding of the natural variability within the Root River, from return flow, and caused simply by differences in data collection frequency will be achieved. These conditions should be considered when comparing pre- and post-diversion data.

6.2.2 PHOSPHORUS

Median phosphorus levels for growing and non-growing seasons at each site during the reporting period are shown in Table 6-2. All median phosphorus levels exceeded 0.075 mg/L (water quality criterion) in this reporting period.

TABLE 6-2. MEDIAN PHOSPHORUS CONCENTRATION DURING THE REPORTING PERIOD

Season	Root River Phosphorus (mg/L)				
	All Sites	Site A	Site B	Site C	Site D
Growing Season (October 2024, May 2025 – September 2025)	0.13	0.11	0.19	0.15	0.13
Non-growing Season (November 2024 – April 2025)	0.11	0.11	0.19	0.12	0.09

Throughout the reporting period, average phosphorus concentrations across all sites were higher during the growing season than during the non-growing season. This magnitude of this seasonal pattern was not consistent across individual sites. Site B exhibited the highest average phosphorus concentrations during both the growing and non-growing seasons. Site A showed the lowest phosphorus concentrations during the growing season, while Site D had the lowest concentrations during the non-growing season. Downstream of the confluence of the Root River and Root River Canal, phosphorus concentrations at Site C were intermediate relative to the upstream sites, consistent with expectations of mixed flow conditions following the convergence of Site A and Site B. Site D showed lower phosphorus concentrations in both seasons, indicating further downstream attenuation and the dilution from return flow. Seasonal increases in phosphorus during the growing season are consistent with enhanced biological activity and seasonal nutrient dynamics throughout the system.

Phosphorus concentrations of the return flow were measured daily at the CWP. Table 6-3 summarizes the seasonal averages, while monthly averages are shown on Figure 6-1. The seasonal average phosphorus concentrations of the return flow were consistently lower than the water quality criterion and median phosphorus concentrations observed at all Root River locations. Figure 6-1 further illustrates that, on a monthly basis, the average phosphorus concentrations of the return flow were lower than the monthly median phosphorus concentrations at each Root River sampling site, except for February 2025 at Sites B, C, and D.

TABLE 6-3. AVERAGE CWP PHOSPHORUS LEVELS DURING THE REPORTING PERIOD

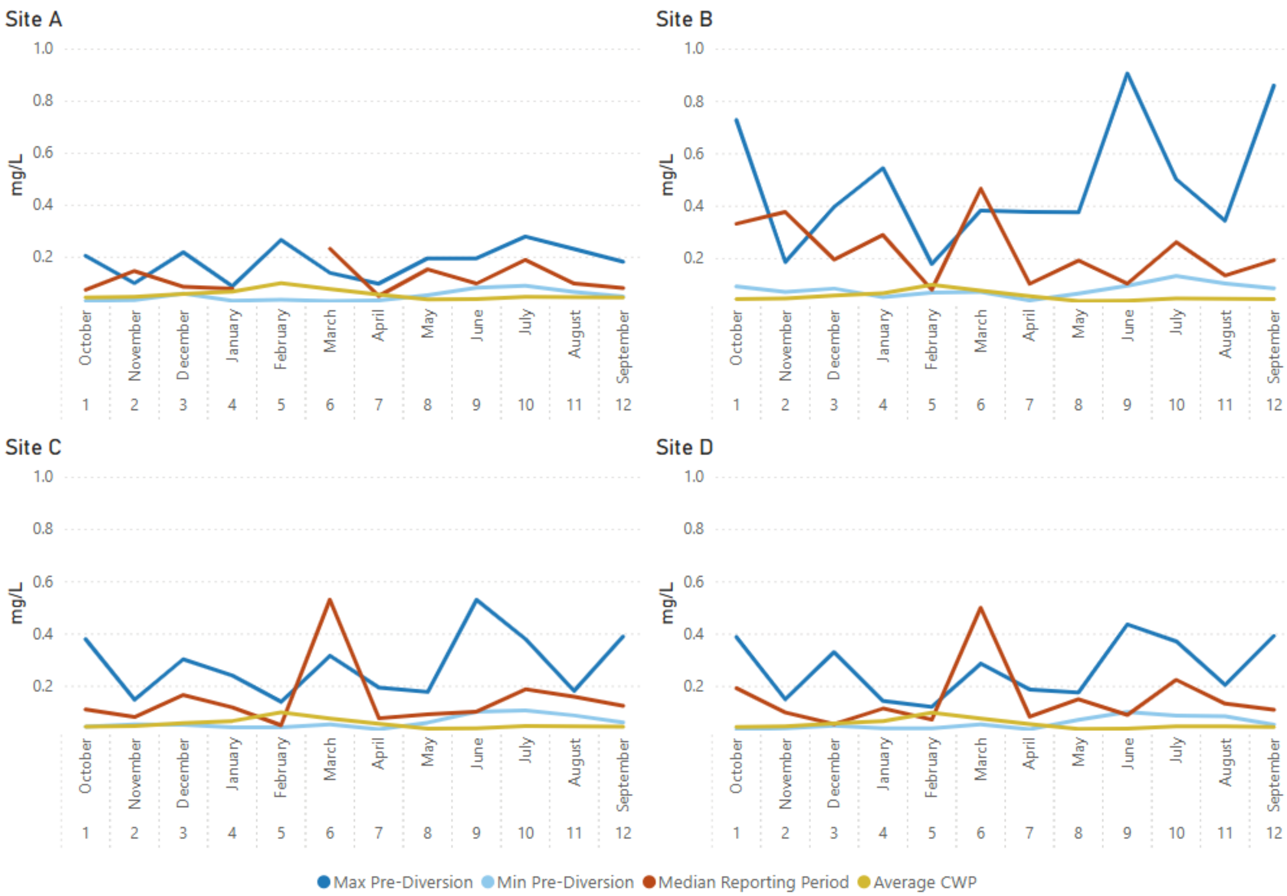
Season	CWP Phosphorus (mg/L)
Growing Season (October 2023, May 2024 – September 2024)	0.041
Non-growing Season (November 2023 – April 2024)	0.065

Phosphorus levels across sites, seasons, and reporting periods were also compared through graphical summaries (Figures 6-1 and 6-2) and statistical analyses (Tables 6-4 and 6-5). Observations about these results are summarized below.

6.2.2.1 OBSERVATIONS OF REPORTING PERIOD PHOSPHORUS CONCENTRATIONS COMPARED TO PRE-DIVERSION PERIOD

The minimum and maximum phosphorus concentrations during the pre-diversion period were compared to the reporting period median phosphorus concentrations in the Root River and average phosphorus concentrations in the CWP return flow (Figure 6-1).

FIGURE 6-1. MEDIAN ROOT RIVER AND AVERAGE RETURN FLOW (CWP) PHOSPHORUS CONCENTRATIONS DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE



Note: For the months of January to May and November to December, the median reporting period data are based on a single sampling data point in the Root River. For the months of June to October, data are based on two sampling data points. CWP data are derived from daily samples.

Observations from this comparison include:

- The reporting period median monthly concentrations for Sites A, B, C, and D were within the range of maximum monthly phosphorus values reported in the pre-diversion period for all months, except March 2025. This trend was consistent with the prior reporting period (October 2023 through September 2024).
- In all cases, the average monthly phosphorus concentrations of the return flow were less than the Root River maximum monthly phosphorus values and were regularly less than the minimum monthly phosphorus values reported in the pre-diversion period. This trend was consistent with the prior reporting period (October 2023 through September 2024).
- Monthly average return flow phosphorus concentrations at all sites were lower than Root River concentrations for all months, except February 2025.
- The phosphorus concentration peaks at downstream Sites C and D have similar patterns from

upstream Site B, suggesting that Site B has a significant influence on Site D. This trend was consistent with the prior reporting period (October 2023 through September 2024).

6.2.2.2 OBSERVATIONS OF PHOSPHORUS DIFFERENCES ACROSS SEASONS

A box and whisker plot was developed for the reporting period growing and non-growing seasons across Sites A through D (Figure 6-2). A series of Mann-Whitney U Tests were developed for comparison between the growing and non-growing seasons, and the pre-diversion, reporting period, and post-diversion program phases (Table 6-4).

FIGURE 6-2. REPORTING PERIOD PHOSPHORUS BOX AND WHISKER PLOTS: SITES A THROUGH D

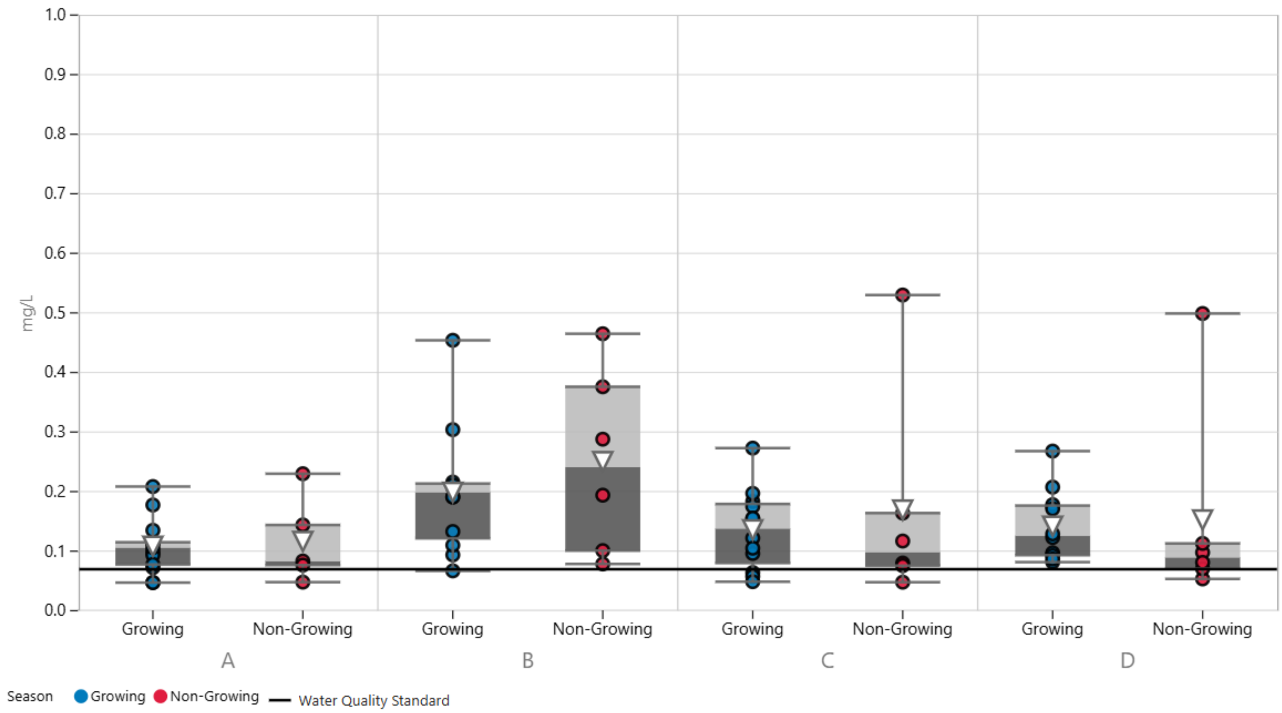


TABLE 6-4. MANN-WHITNEY U TEST: PHOSPHORUS DURING GROWING AND NON-GROWING SEASONS

Program Phase	Comparison	Significantly Different Data Distributions		Median Values	
		p-value	Yes/No	Growing	Non-growing
Pre-Diversion	Growing vs. Non-Growing	$< 1 \times 10^{-10}$	Yes	0.13	0.07
Reporting Period	Growing vs. Non-Growing	0.0672	No	0.12	0.09
Post-Diversion	Growing vs. Non-Growing	3.13×10^{-5}	Yes	0.14	0.09
Season	Comparison	p-value	Yes/No	Median Values	
				Pre-Diversion	Reporting Year or Post-Diversion
Growing Season	Pre-Diversion vs. Reporting Period	0.214	No	0.13	0.12
Non-Growing Season	Pre-Diversion vs. Reporting Period	5.66×10^{-3}	Yes	0.07	0.09
Growing Season	Pre-Diversion vs. Post-Diversion	0.227	No	0.13	0.14
Non-Growing Season	Pre-Diversion vs. Post-Diversion	3.92×10^{-6}	Yes	0.07	0.09

Observations from these comparisons include:

- During the reporting period, phosphorus concentrations were not statistically greater in the growing season compared to the non-growing season (Table 6-4, $p>0.05$).
- Site B had the highest average and median growing and non-growing season phosphorus concentrations.
- The growing and non-growing season average and median phosphorus concentrations followed similar trends between Sites C and Site D.
- Statistical differences in phosphorus between pre-diversion and reporting period results may be due to the single year of reporting period data and different climate patterns, runoff, biological activity and phosphorus cycling.

6.2.2.3 OBSERVATIONS OF PHOSPHORUS DIFFERENCES ACROSS SAMPLING SITES

A Mann-Whitney U Test for comparing sites between pre-diversion, reporting period, and post-diversion program phases is summarized in Table 6-5.

TABLE 6-5. MANN-WHITNEY U TEST: PHOSPHORUS COMPARISON ACROSS SAMPLING SITES

		Significantly Different Data Distributions		Median Values	
Program Phase	Comparison	p-value	Yes/No	Site A	Site B
Pre-Diversion	Site A vs Site B	$< 1 \times 10^{-10}$	Yes	0.08	0.16
Reporting Period	Site A vs Site B	3.70×10^{-3}	Yes	0.11	0.19
Post-Diversion	Site A vs Site B	2.48×10^{-7}	Yes	0.10	0.20
				Site A	**Site C**
Pre-Diversion	Site A vs Site C	1.18×10^{-5}	Yes	0.08	0.11
Reporting Period	Site A vs Site C	0.231	No	0.11	0.12
Post-Diversion	Site A vs Site C	1.64×10^{-2}	Yes	0.10	0.13
				Site B	**Site C**
Pre-Diversion	Site B vs Site C	1.47×10^{-7}	Yes	0.16	0.11
Reporting Period	Site B vs Site C	2.95×10^{-2}	Yes	0.19	0.12
Post-Diversion	Site B vs Site C	1.50×10^{-3}	Yes	0.20	0.13
				Site C	**Site D**
Pre-Diversion	Site C vs Site D	0.605	No	0.11	0.11
Reporting Period	Site C vs Site D	0.990	No	0.12	0.11
Post-Diversion	Site C vs Site D	0.866	No	0.13	0.13

Observations from these comparisons include:

- No statistically significant difference was observed in phosphorus concentrations between Site C (median 0.12 mg/L) and Site D (median 0.11 mg/L) during the reporting period (Table 6-5, $p>0.05$). This trend was consistent with the pre-diversion and prior reporting period (October 2023 through September 2024).
- Phosphorus concentrations showed an increase from Site A to Site B, a decrease from Site B to Site C, and no significant change from Site C to Site D. This trend was consistent with the prior reporting period (October 2023 through September 2024).
- Contrary to the prior reporting period (October 2023 through September 2024), no significant

change in phosphorus concentrations was observed from Site A to Site C in the reporting period.

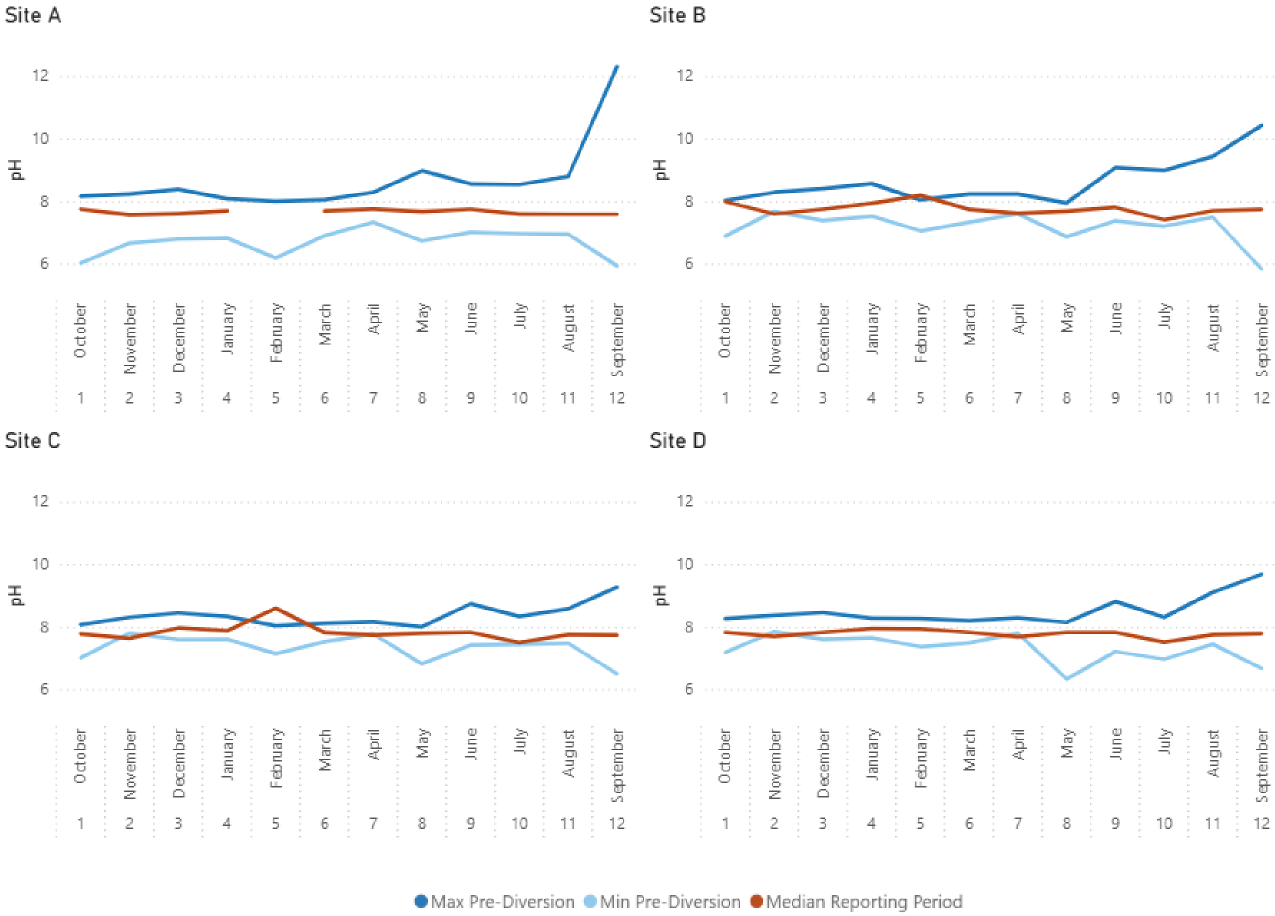
- The results of the reporting period, besides the relationship between Sites A and C, are consistent with the pre-diversion period, indicating a consistent trend of high phosphorus levels at Site B mix with lower levels at Site A, resulting in an intermediate concentration at Site C.
- Statistically significant differences in phosphorus concentrations ($p<0.05$) were observed across various sites: between Sites A and B, where median concentrations increased from 0.11 mg/L to 0.19 mg/L; and between Sites B and C, where median concentrations decreased from 0.19 mg/L to 0.12 mg/L.
- Site A saw the greatest increase in median phosphorus concentration between the pre-diversion period and the reporting period, with a median value increase of 34%. In comparison, Sites B and C saw increases of 18% and 12%, respectively, while Site D saw a decrease of 1.4%.

6.2.3 FIELD PH

6.2.3.1 OBSERVATIONS OF REPORTING PERIOD PH COMPARED TO PRE-DIVERSION PERIOD

Median pH levels at the sampling sites for the reporting period ranged between 7.65 and 7.75. Across the reporting period and when analyzed by sampling sites, slightly higher pH levels are observed at downstream sites compared to upstream. To evaluate the changes between the pre-diversion and reporting periods, the median monthly pH levels were compared (Figure 6-3). The median monthly pH levels during the reporting period were consistently within the range of the minimum and maximum values recorded in the pre-diversion period, consistent with prior reporting period (October 2023 through September 2024). This indicates that pH levels observed in the reporting period are within the historical variability observed prior to the diversion.

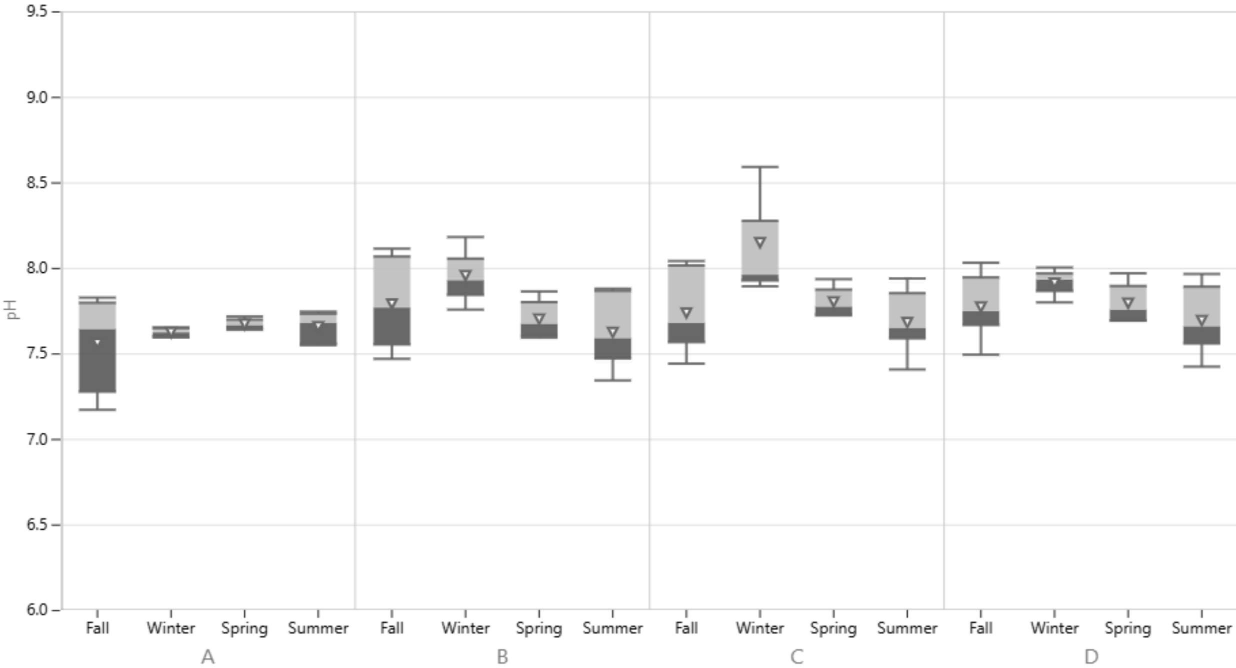
FIGURE 6-3. MEDIAN ROOT RIVER PH DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE



6.2.3.2 OBSERVATIONS OF PH DIFFERENCES ACROSS SEASONS

A comparison of pH variability across sampling sites and seasons is shown in Figure 6-4.

FIGURE 6-4. REPORTING PERIOD FIELD PH BOX AND WHISKER PLOT BY SITE AND SEASON



Observations from this comparison include:

- There is little pH variability across sites and seasons.
- The minor seasonal pH variability differs by site, with the median Site A pH varying narrowly from 7.58–7.68 (range 0.10), while Site B ranged from 7.54 (summer) to 7.91 (winter) (range 0.37).

6.2.3.3 OBSERVATIONS OF PH DIFFERENCES ACROSS SAMPLING SITES

A Mann-Whitney U Test for comparing sites between pre-diversion, reporting period, and post-diversion program phases is summarized in Table 6-6.

TABLE 6-6. MANN-WHITNEY U TEST: PH COMPARISON ACROSS SAMPLING SITES

Program Phase	Comparison	Significantly Different Data Distributions		Median Values	
		p-value	Yes/No	Site A	Site B
Pre-Diversion	Site A vs Site B	6.46×10^{-3}	Yes	7.72	7.75
Reporting Period	Site A vs Site B	2.87×10^{-2}	Yes	7.65	7.72
Post-Diversion	Site A vs Site B	4.40×10^{-2}	Yes	7.66	7.68
				Site A	Site C
Pre-Diversion	Site A vs Site C	$< 1 \times 10^{-10}$	Yes	7.72	7.84
Reporting Period	Site A vs Site C	1.18×10^{-4}	Yes	7.65	7.74
Post-Diversion	Site A vs Site C	5.52×10^{-5}	Yes	7.66	7.73
				Site B	Site C
Pre-Diversion	Site B vs Site C	2.86×10^{-7}	Yes	7.75	7.84
Reporting Period	Site B vs Site C	0.421	No	7.72	7.74
Post-Diversion	Site B vs Site C	0.116	No	7.68	7.73
				Site C	Site D
Pre-Diversion	Site C vs Site D	1.68×10^{-2}	Yes	7.84	7.86
Reporting Period	Site C vs Site D	0.503	No	7.74	7.75
Post-Diversion	Site C vs Site D	0.337	No	7.73	7.77

Observations from these comparisons include:

- Although the median pH values are very similar, statistically significant differences in pH were consistently observed between Site A and Sites B and C across all program phases ($p < 0.05$).
- During the reporting period, no statistically significant difference was observed in pH between Sites B and C and Sites C and D ($p>0.05$). This represents a change from pre-diversion conditions, during which these site pairs exhibited statistically different pH distributions ($p<0.05$).
- Across all phases, median pH values at Sites A and B were generally slightly lower than those observed at Sites C and D. Unlike other evaluated water quality parameters, pH at downstream sites does not appear to reflect a simple averaging of upstream conditions at Sites A and B. Instead, pH levels demonstrate a consistent spatial gradient, with slightly higher median values observed at downstream locations. This pattern is consistent with observations from the prior reporting period (October 2023 through September 2024).
- Although several site-to-site pH differences were statistically significant, the overall variability in pH was low and values remained within expected ranges defined in the QAPP.

6.2.4 FIELD DISSOLVED OXYGEN

6.2.4.1 OBSERVATIONS OF REPORTING PERIOD DISSOLVED OXYGEN COMPARED TO PRE-DIVERSION PERIOD

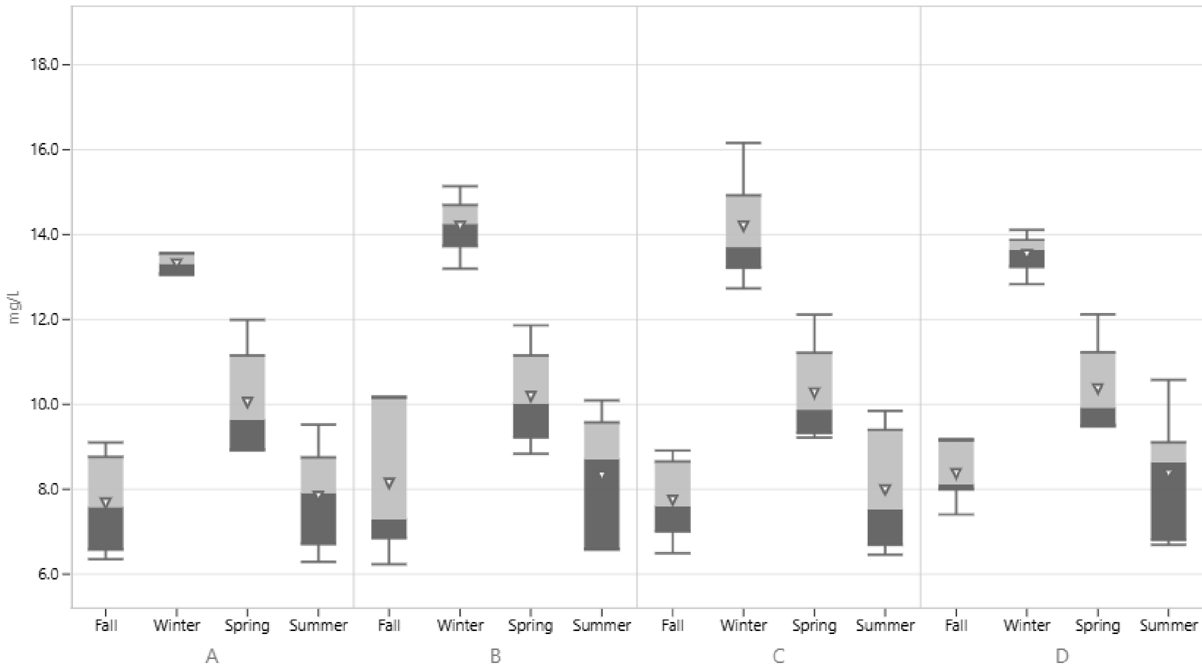
Field DO measurements collected during the reporting period at Sites A through D were compared to pre-diversion minimum and maximum values (Figures 6-5). Median monthly dissolved oxygen concentrations during the reporting period generally fell within the range of values observed during the pre-diversion period, consistent with the prior reporting period (October 2023 through September 2024) conditions. Notable exceptions were limited and seasonally isolated. Median dissolved oxygen concentrations at Sites A, B, and D were lower than pre-diversion median values during November. In addition, the only instance in which dissolved oxygen exceeded the pre-diversion maximum occurred at Site C during February. Overall, these observations indicate that dissolved oxygen levels during the reporting period remain within the range of historical variability observed prior to the diversion, with no persistent or site-wide departures from pre-diversion conditions.

FIGURE 6-5. MEDIAN ROOT RIVER DISSOLVED OXYGEN DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE

6.2.4.2 OBSERVATIONS OF DISSOLVED OXYGEN DIFFERENCES ACROSS SEASONS

A comparison of DO variability across sampling sites and seasons is shown in Figure 6-6.

FIGURE 6-6. REPORTING PERIOD FIELD DISSOLVED OXYGEN BOX AND WHISKER PLOT BY SITE AND SEASON



Observations from these comparisons include:

- Winter exhibits the highest median DO at all sites while Summer has the lowest median DO across the sampling sites. This consistent winter peak and summer drop across all sites indicates strong seasonal control, likely driven by water temperatures and photosynthesis. This result is consistent with the pre-diversion and the prior reporting period (October 2023 through September 2024) results.
- Site-specific differences are most apparent during summer and early fall, when dissolved oxygen variability increases. During these warmer periods, Site C frequently exhibits lower DO than upstream Sites A and B, while Site D often shows partial recovery downstream, with DO values comparable to or higher than those at Site C. This pattern is less evident during winter and spring, when DO concentrations are more uniform across sites.

6.2.4.3 OBSERVATIONS OF DISSOLVED OXYGEN DIFFERENCES ACROSS SAMPLING SITES

A Mann-Whitney U Test for comparing sites between pre-diversion, reporting period, and post-diversion program phases is summarized in Table 6-7.

TABLE 6-7. MANN-WHITNEY U TEST: DISSOLVED OXYGEN COMPARISON ACROSS SAMPLING SITES

		Significantly Different Data Distributions		Median Values	
Program Phase	Comparison	p-value	Yes/No	Site A	Site B
Pre-Diversion	Site A vs Site B	0.274	No	8.66	9.08
Reporting Period	Site A vs Site B	0.083	No	8.85	9.58
Post-Diversion	Site A vs Site B	0.163	No	8.02	8.71
				Site A	Site C
Pre-Diversion	Site A vs Site C	0.078	No	8.66	8.08
Reporting Period	Site A vs Site C	0.477	No	8.85	9.05
Post-Diversion	Site A vs Site C	0.773	No	8.02	7.88
				Site B	Site C
Pre-Diversion	Site B vs Site C	9.16×10^{-3}	Yes	9.08	8.08
Reporting Period	Site B vs Site C	0.189	No	9.58	9.05
Post-Diversion	Site B vs Site C	0.193	No	8.71	7.88
				Site C	Site D
Pre-Diversion	Site C vs Site D	0.499	No	8.08	8.14
Reporting Period	Site C vs Site D	4.09×10^{-2}	Yes	9.05	9.23
Post-Diversion	Site C vs Site D	6.27×10^{-3}	Yes	7.88	8.64

Observations from these comparisons include:

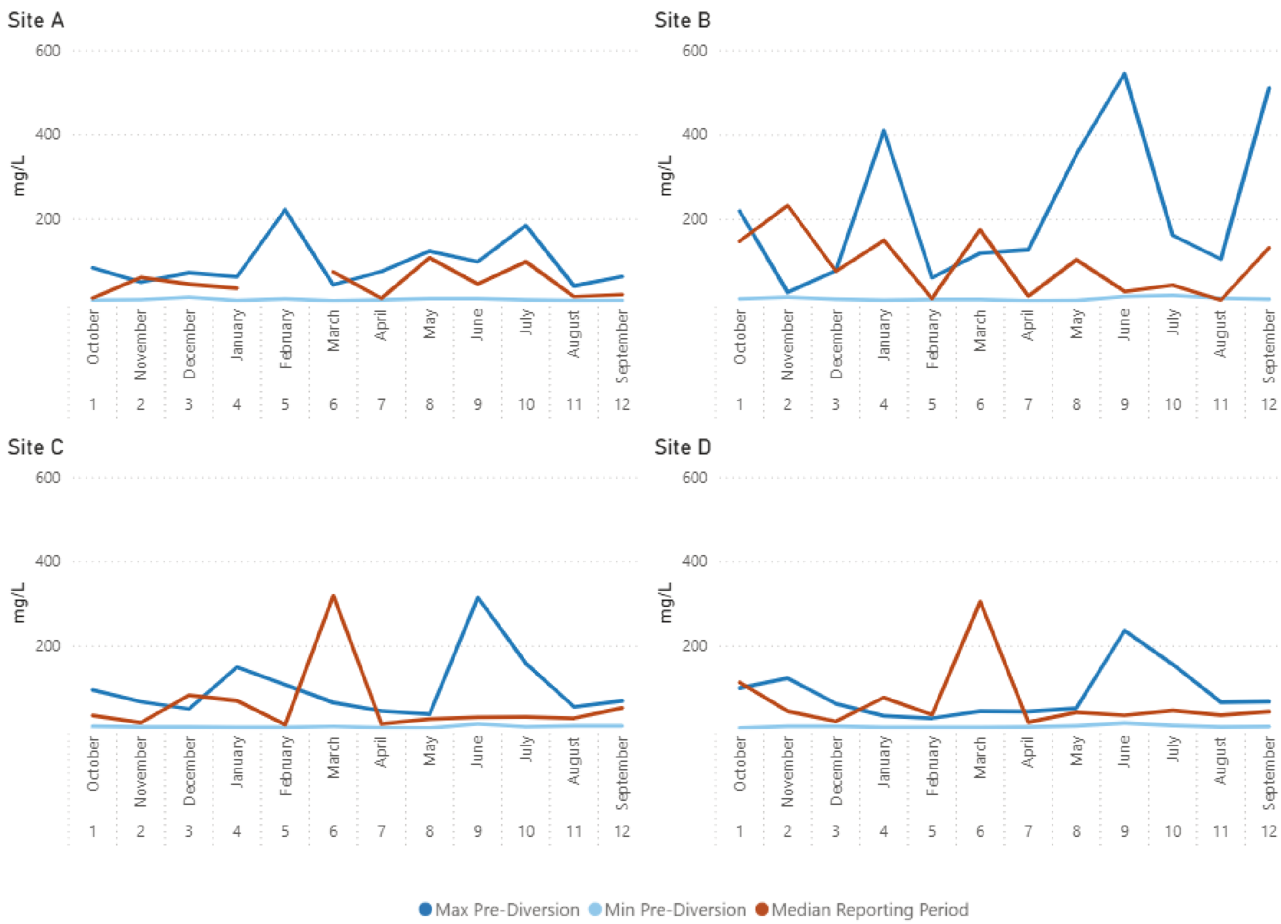
- During the reporting period, dissolved oxygen differed significantly between Sites C and D, a pattern not observed under pre-diversion conditions. Specifically, median dissolved oxygen was higher at Site D (9.23 mg/L) than at Site C (9.05 mg/L). This result is consistent with the prior reporting period (October 2023 through September 2024).
- No statistically significant differences in dissolved oxygen were observed between Sites A and B, Sites A and C, or Sites B and C during Reporting Period ($p > 0.05$ for all comparisons). These results are consistent with the prior reporting period (October 2023 through September 2024).
- Median dissolved oxygen concentrations during the reporting period were higher at all sites compared to the prior reporting period (October 2023 through September 2024) and the pre-diversion periods. For example, between the prior reporting period and current reporting period, medians increased from 6.90 to 8.85 mg/L at Site A, 6.90 to 9.58 mg/L at Site B, 7.81 to 9.05 mg/L at Site C, and 6.90 to 9.23 mg/L at Site D.

6.2.5 TOTAL SUSPENDED SOLIDS

6.2.5.1 OBSERVATIONS OF REPORTING PERIOD TOTAL SUSPENDED SOLIDS COMPARED TO PRE-DIVERSION PERIOD

The concentration of total suspended solids (TSS) at Sites A through D during the reporting period was compared to pre-diversion minimum and maximum values (Figure 6–7). Median monthly TSS concentrations during the reporting period generally fell within the range observed during the pre-diversion period for the months of April through September. However, during several months, the median TSS concentration during the reporting period exceeded the maximum TSS concentration observed during the pre-diversion period. These exceedances occurred in November 2024 at Sites A and B; December 2024 at Site C; January and February 2025 at Site D; March 2025 at Sites A, B, C, and D; and October 2024 at Site D, and may have been due to active road construction or different hydrologic conditions between the two periods. TSS concentrations can be highly sensitive to these types of variables. The historic August 9-10, 2025 rainfall event (Section 6.2.9) did not coincide with sampling events so impacts were not observed in the sampling data.

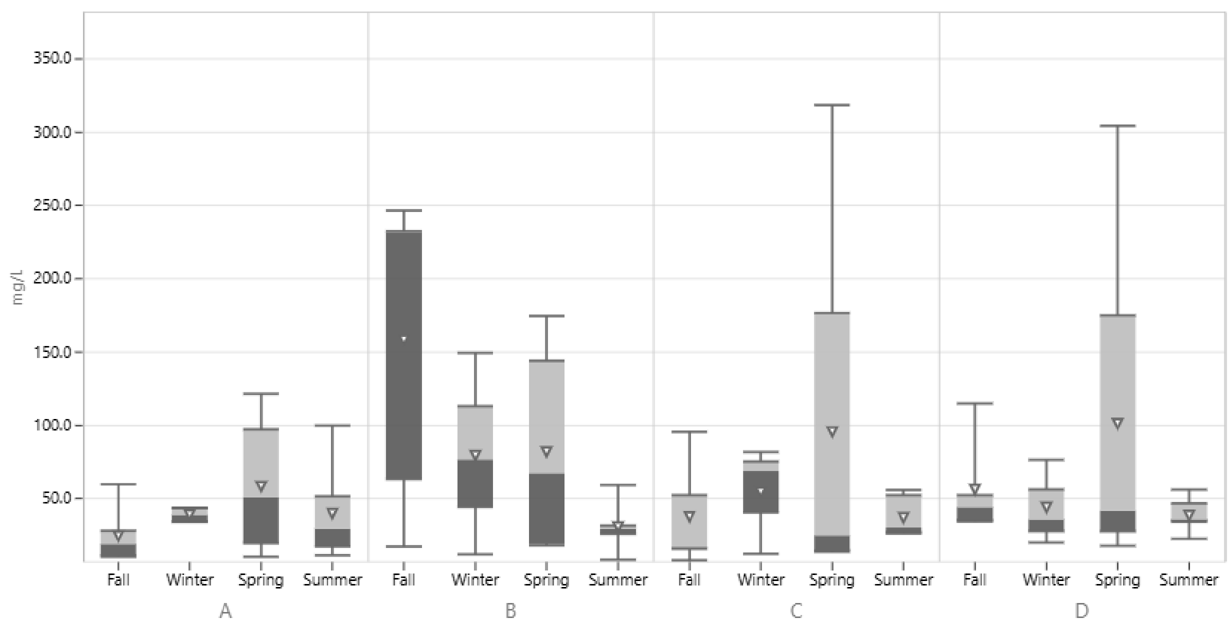
FIGURE 6-7. MEDIAN ROOT RIVER TOTAL SUSPENDED SOLIDS DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE



6.2.5.2 OBSERVATIONS OF TOTAL SUSPENDED SOLIDS ACROSS SEASONS

A comparison of TSS variability across sampling sites and seasons during the reporting period is shown in Figure 6-8.

FIGURE 6-8. REPORTING PERIOD TOTAL SUSPENDED SOLIDS BOX AND WHISKER PLOT BY SITE AND SEASON



Observations from these comparisons include:

- During the summer and winter months, TSS concentrations remained within the expected range of 1–175 mg/L, with summer samples ranging from 7.8 to 99.45 mg/L and winter samples ranging from 11.4 to 149 mg/L.
- Site B demonstrated the greatest variability in TSS and accounted for several of the highest measurements observed during the period, including fall sampling concentrations ranging from 231 to 246 mg/L.
- Spring and fall TSS concentrations were generally within the expected range but included three TSS values in spring and two in fall that exceeded the expected range.
- Seasonal medians were relatively consistent, with no season showing persistently elevated TSS across all samples; variability within seasons was driven primarily by a small number of high-magnitude river flow events rather than sustained conditions.

6.2.5.3 OBSERVATIONS OF TOTAL SUSPENDED SOLIDS ACROSS SAMPLING SITES

A Mann-Whitney U Test for comparing sites between pre-diversion, reporting period, and post-diversion program phases is summarized in Table 6-8.

TABLE 6-8. MANN-WHITNEY U TEST: TOTAL SUSPENDED SOLIDS COMPARISON ACROSS SAMPLING SITES

Program Phase	Comparison	Significantly Different Data Distributions		Median Values	
		p-value	Yes/No	Site A	Site B
Pre-Diversion	Site A vs Site B	5.72×10^{-5}	Yes	17.50	29.50
Reporting Period	Site A vs Site B	0.226	No	28.20	31.20
Post-Diversion	Site A vs Site B	1.67×10^{-2}	Yes	21.60	31.40
				Site A	Site C
Pre-Diversion	Site A vs Site C	0.213	No	17.50	22.30
Reporting Period	Site A vs Site C	0.751	No	28.20	29.60
Post-Diversion	Site A vs Site C	0.354	No	21.60	24.10
				Site B	Site C
Pre-Diversion	Site B vs Site C	2.10×10^{-3}	Yes	29.50	22.30
Reporting Period	Site B vs Site C	0.372	No	31.20	29.60
Post-Diversion	Site B vs Site C	0.075	No	31.40	24.10
				Site C	Site D
Pre-Diversion	Site C vs Site D	0.894	No	22.30	21.00
Reporting Period	Site C vs Site D	0.151	No	29.60	38.70
Post-Diversion	Site C vs Site D	0.079	No	17.50	29.50

Observations from this comparison include:

- During the reporting period, median TSS concentrations were lowest at Site A (28.20 mg/L) and highest at Site D (38.70 mg/L). This pattern differs from the prior reporting period (October 2023 through September 2024), when Site B exhibited the highest median TSS.
- Five samples exceeded 175 mg/L during the reporting period. This included single exceedances at Sites C and D on March 5, 2025, which may have been influenced by precipitation events, bank erosion, or riverbed disturbance during sampling.
- Site B experienced three exceedances across separate sampling events, suggesting a recurring pattern of elevated TSS at this location.
- No statistically significant differences in TSS concentrations were detected among sites during the reporting period. This contrasts with both the pre-diversion and the prior reporting period (October 2023 through September 2024), when significant differences were observed between Sites A and B and between Sites B and C.

6.2.6 E. COLI

Return flow *E. coli* levels were measured by the CWP once per week during the disinfection period (September 2024 and May through September 2025) of the reporting period. Root River monitoring was conducted at Sites C and D. These data are summarized in Table 6-9.

TABLE 6-9. AVERAGE RETURN FLOW AND ROOT RIVER E. COLI LEVELS DURING THE REPORTING PERIOD

Month	Return Flow (CFU/100 mL)	Site C (CFU/100 mL)	Site D (CFU/100 mL)
October 2024	-	246	295
November 2024	-	225	321
December 2024	-	86	86
January 2025	-	133	132
February 2025	-	109	249
March 2025	-	833	504
April 2025	-	85	132
May 2025	<1	146	98
June 2025	2	279	171
July 2025	26	3,448	1,935
August 2025	11	235	201
September 2025	<1	160	52

Note:
CFU/100 mL = colony-forming units per 100 milliliters
"-" no data is available

6.2.6.1 OBSERVATIONS OF E. COLI

- Return flow continued to exhibit substantially lower E. coli concentrations than Sites C and D, reaffirming the prior reporting period (October 2023 through September 2024) conclusions. When measured, return flow concentrations were typically 2 to 3 orders of magnitude lower than river concentrations, including multiple instances of measurements below detection (<1 CFU/100 mL).
- E. coli decreased between Sites C and D during periods when return flow concentrations were below detection or orders of magnitude lower.
- Overall, the reporting period sampling results strengthen the conclusion that E. coli dynamics in the Root River are influenced by factors beyond return flow, such as localized runoff, sediment resuspension, wildlife inputs, and in-stream processes.

6.2.7 CHLORIDES

Return flow chloride levels were measured by the CWP on five consecutive days each month of the reporting period consistent with permit requirements. Single-day monthly chloride monitoring was completed in the Root River at Sites C and D consistent with the QAPP (Table 6-10).

TABLE 6-10. RETURN FLOW AND ROOT RIVER CHLORIDE LEVELS DURING THE REPORTING PERIOD

Month	Return Flow (mg/L)	Site C (mg/L)	Site D (mg/L)
October 2024	359	134	255
November 2024	335	164	195
December 2024	334	147	216
January 2025	378	208	239
February 2025	364	192	247
March 2025	375	188	170
April 2025	385	116	129
May 2025	364	121	158
June 2025	347	134	167
July 2025	364	73	88
August 2025	321	115	170
September 2025	332	138	232

6.2.7.1 OBSERVATIONS OF CHLORIDES

- All Root River chloride levels (above and below return flow) were well below water quality standards (chronic criteria = 395 mg/L), consistent with the prior reporting period (October 2023 through September 2024) observations.
- Chloride concentrations were generally higher at Site D than at Site C throughout the reporting period, indicating a downstream increase across most months.
- The largest increases in chloride concentrations between sites C and D occurred during periods of lower river flow (October and November 2024, July to September 2025), consistent with the prior reporting period (October 2023 through September 2024) observations.

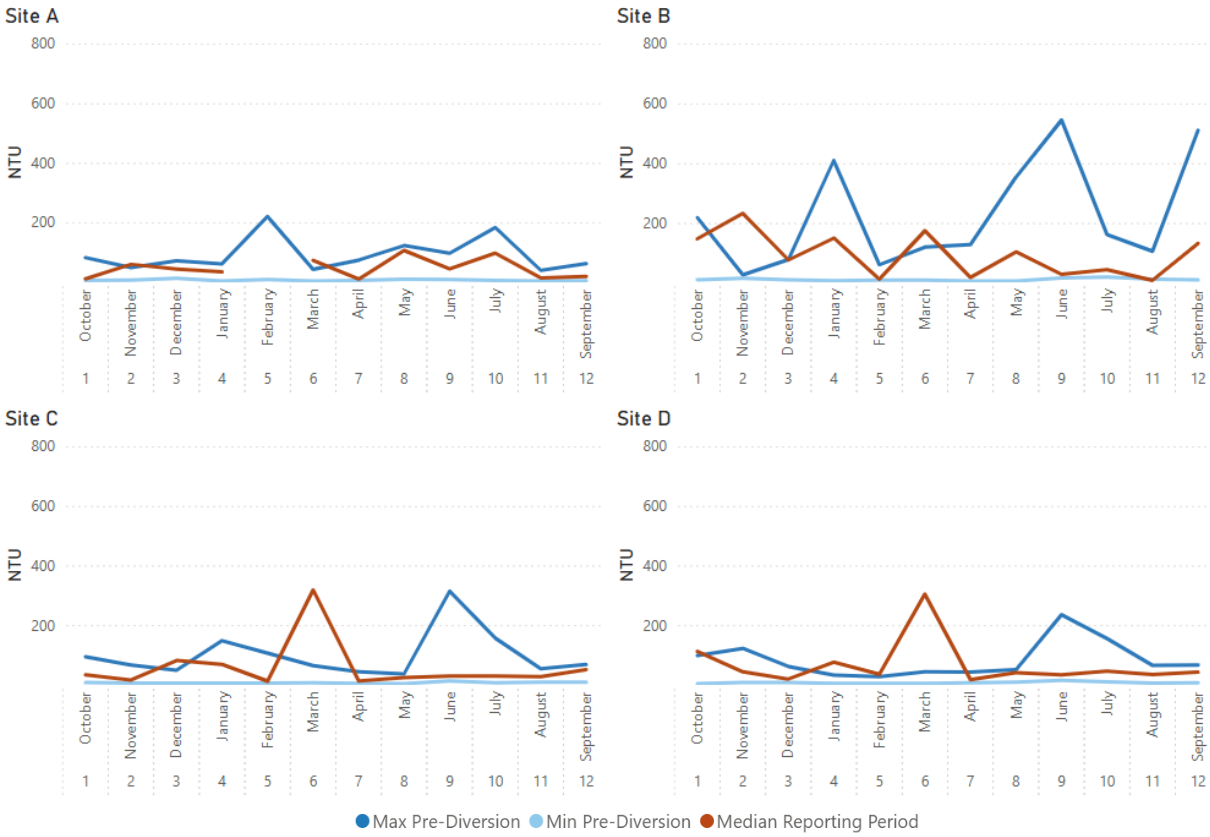
6.2.8 OTHER WATER QUALITY PARAMETERS

Graphical summaries of additional parameters collected as part of the QAPP are included in the following subsections. These include turbidity (Figure 6-9), specific conductance (Figure 6-10), orthophosphate (Figure 6-11), total nitrogen (Figure 6-12), nitrate-nitrite (Figure 6-13), ammonia (Figure 6-14), and chlorophyll (Figure 6-15). General observations also are summarized following each figure.

6.2.8.1 TURBIDITY

Figure 6-9 compares the maximum and minimum turbidity readings during the pre-diversion period with the median turbidity results from the reporting period.

FIGURE 6-9. MEDIAN TURBIDITY DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE



TURBIDITY OBSERVATIONS

- Upstream peaks in turbidity are similarly reflected in downstream locations during the reporting period, as was also observed in the prior reporting period (October 2023 through September 2024).
- In March of 2025, the median reporting period turbidity at all sites exceeded the pre-diversion maximum. Sampling in that month occurred on March 5, 2025, and followed a rainfall event on that day in which the peak gauge height increased 3.98 feet from the previous day (March 4, 2024)[7] and the Hales Corners/Whitnall Park/Boerner Botanical Gardens National Oceanic and Atmospheric Administration station recorded a rainfall accumulation of 1.10 inches[8].

[7] https://waterdata.usgs.gov/monitoring-location/04087234/#dataTypeId=continuous-00065-0&period=P7D&showMedian=false
[8] https://www.weather.gov/wrh/Climate?wfo=mkx

6.2.8.2 SPECIFIC CONDUCTANCE

Figure 6-10 compares the maximum and minimum specific conductance readings during the pre-diversion period with the median specific conductance results from the reporting period.

FIGURE 6-10. MEDIAN SPECIFIC CONDUCTANCE DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE

SPECIFIC CONDUCTANCE OBSERVATIONS

- Specific conductance at all sites remained below the pre-diversion maximum during the reporting period, with the exception of Site D in December, which slightly exceeded the pre-diversion maximum, and Site C in February, which fell below the pre-diversion minimum.

6.2.8.4 ORTHOPHOSPHATE

Figure 6-11 compares the maximum and minimum orthophosphate results during the pre-diversion period with the median orthophosphate results from the reporting period.

FIGURE 6-11. MEDIAN ORTHOPHOSPHATE DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE

ORTHOPHOSPHATE OBSERVATIONS

- Orthophosphate concentrations exceeded pre-diversion maximum concentrations during the reporting period only in March at Site A.
- Results indicate that upstream Sites A and B influenced downstream orthophosphate concentrations at Sites C and D, as elevated concentrations observed in March and July were also reflected at downstream locations.
- During the reporting period, orthophosphate concentrations decreased on average from 0.04 mg/L at Site C to 0.03 mg/L at Site D, consistent with the prior reporting period (October 2023 through September 2024) results.

6.2.8.5 TOTAL NITROGEN

Figure 6-12 compares the maximum and minimum total nitrogen results during the pre-diversion period with the median total nitrogen results from the reporting period.

FIGURE 6-12. MEDIAN TOTAL NITROGEN DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE

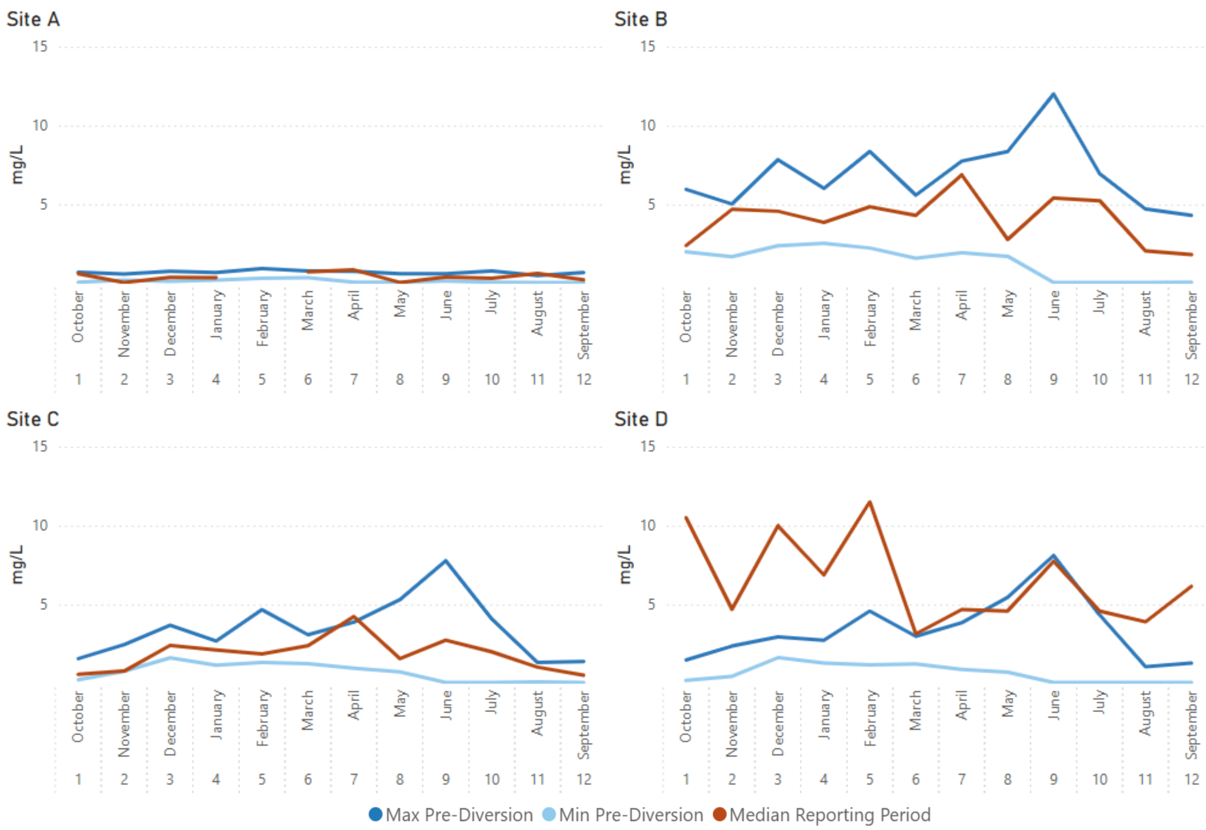
TOTAL NITROGEN OBSERVATIONS

- Increases in total nitrogen concentrations above the pre-diversion maximum values were observed primarily at site D from October 2024 – March 2025 and in August – September 2025.
- See also nitrate-nitrite in Section 6.2.8.6.

6.2.8.6 NITRATE-NITRITE

Figure 6-13 compares the maximum and minimum nitrate-nitrite results during the pre-diversion period with the median nitrate-nitrite results from the reporting period.

FIGURE 6-13. MEDIAN NITRATE-NITRITE DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE



NITRATE-NITRITE OBSERVATIONS

- Nitrate-nitrite levels exhibited trends similar to those of total nitrogen during the reporting period.
- In October 2024 – March 2025 and in August – September 2025, nitrate-nitrite levels at Site D were greater than upstream concentrations and pre-diversion maximums.
- The observed peaks October through February may in part be due to low flow conditions in the Root River; however quarterly sampling of return flow did not follow a similar trend as observed at Site D.

6.2.8.7 AMMONIA

Figure 6-14 compares the maximum and minimum ammonia results during the pre-diversion period with the median ammonia results from the reporting period.

FIGURE 6-14. MEDIAN AMMONIA DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE

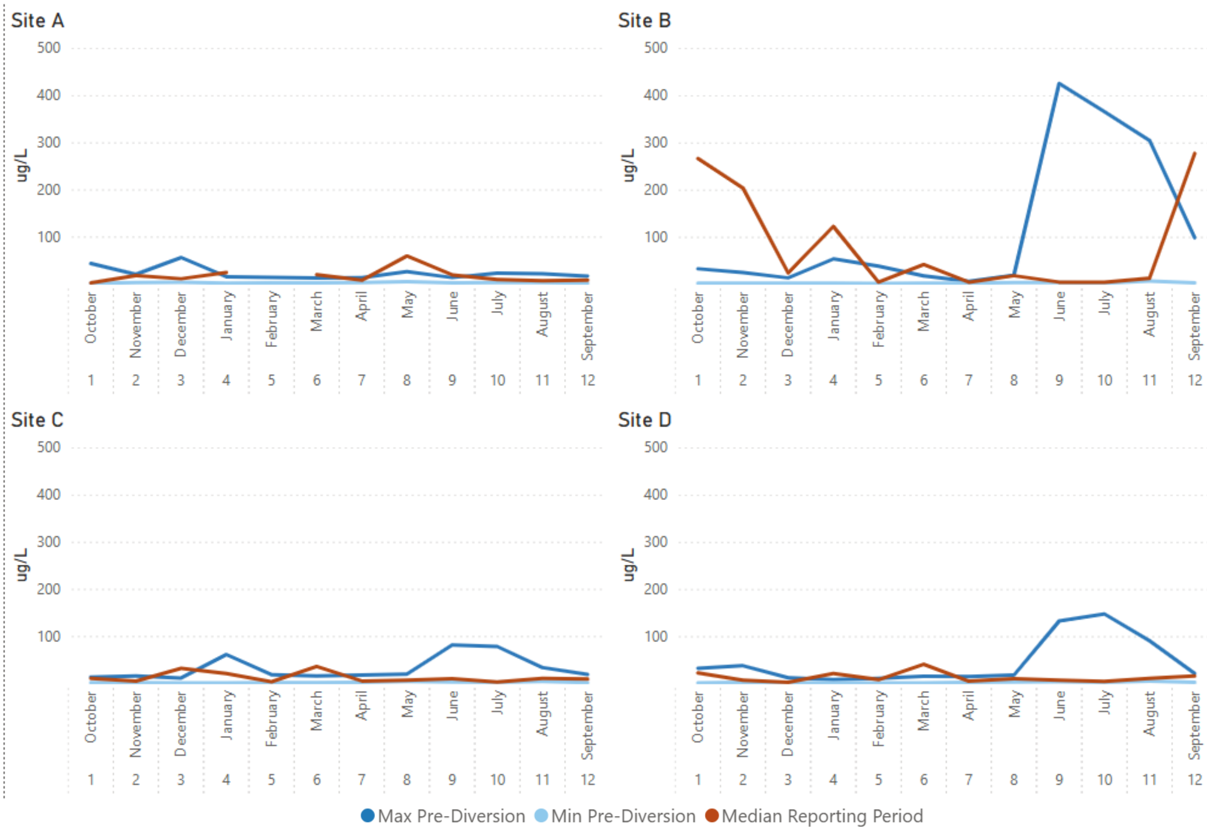
AMMONIA OBSERVATIONS

- Except for a slight excursion at Site A in July and Site B in November, all ammonia samples fell within the pre-diversion minimum and maximum concentration levels.

6.2.8.8 CHLOROPHYLL

Figure 6-15 compares the maximum and minimum chlorophyll results during the pre-diversion period with the median chlorophyll results from the reporting period.

FIGURE 6-15. MEDIAN CHLOROPHYLL DURING THE REPORTING PERIOD COMPARED TO PRE-DIVERSION RANGE



CHLOROPHYLL OBSERVATIONS

- During the reporting period, median chlorophyll concentrations decreased from 9.23 µg/L at Site C to 7.32 µg/L at Site D, which contrasts the pre-diversion and the prior reporting period (October 2023 through September 2024), when chlorophyll concentrations increased between these sites.
- Chlorophyll concentrations at Site D generally remained within the historical range observed in the pre- diversion period, except for a slight deviation in January and March, which were also observed at all other monitoring sites.
- Site B exhibited the greatest increases in chlorophyll concentrations during the reporting period in comparison to the prior reporting period (October 2023 through September 2024) and the pre-diversion periods, exceeding the pre-diversion maximum in October, November, December, January, March, and September.

6.2.9 WATERSHED IMPACTS

Watershed impacts from environmental events as well as human activity during the reporting period were reviewed to assess potential observational impacts in recorded water quality data. The following activities were completed to summarize watershed impacts during the reporting period:

- Performed Internet searches for local news stories.
- Queried the *Milwaukee Journal Sentinel* online articles.
- Obtained records from the WDNR Spills Coordinator, the WDNR Municipal Separate Storm Sewer System, and WDNR Wastewater Engineers.
- Conducted verbal conversations with local farmers.

Upstream of Site B on the Root River Canal, upstream of the return flow outfall, there are two active wastewater discharges governed by Wisconsin Pollutant Discharge Elimination System permits (Permittee 1 and Permittee 2). Permittee 1 violated the effluent chloride weekly average limit for three weeks out of the reporting period. Permittee 2 violated the effluent total phosphorus monthly average limit in September 2025. Both facilities operate under the Multi-Discharger Variance (MDV) for phosphorus and are, therefore, permitted to have phosphorus discharges above the water quality criterion (0.075 mg/L). The MDV limits are much higher than the water quality criterion and consequently these exceedances have greater impact on the canal's ability to meet the phosphorus criterion. Water quality data collected during the reporting period demonstrated higher phosphorus levels at Site B consistent with the presence of these discharges.

To assess acute impacts on the Root River during the reporting period, spill activities were reviewed using the WDNR Environmental Cleanup and Brownfields Redevelopment database. During the reporting period, a total of three spills were recorded along the Root River, with all three spills located upstream of Site B on the Root River Canal. Spill activity in the Root River area during the reporting period with potential impacts to sampling sites are summarized in Table 6-11.

TABLE 6-11. SPILL INCIDENTS UPSTREAM OF SAMPLING SITES DURING THE REPORTING PERIOD

Start and End Date	Spill Substance	Amount Released	Location	Potential Sampling Site(s) Impacted	Description
11-18-2024 to 11-20-2024	Petroleum	Unknown	Parking Lot of Cottage 11 at Southern Wisconsin Center, Union Grove	Sites B, C, C2, and D	Oil and melted plastic washed into the parking lot drain while fighting a vehicle fire
5-9-2025 to 6-2-2025	Chlorine Pool Water	Unknown	13825 Paddock Parkway	Sites B, C, C2, and D	Discharge of private pool water into the storm sewer
6-26-2025 to 7-2-2025	Cooking Oil	100 gallons	S 109th St and W Lincoln Ave	Sites B, C, C2, and D	Cooking oil was dumped into the storm drain. Impacts were noted at Hale Creek, but no impacts to the Root River were recorded.

To assess the impacts of petroleum, chlorine pool water, and cooking oil, reviews of turbidity and pH data over these dates were conducted. There did not appear to be a direct correlation between these dates and variations in the monitoring data. Consequently, it is unknown if these spills had an impact on the river.

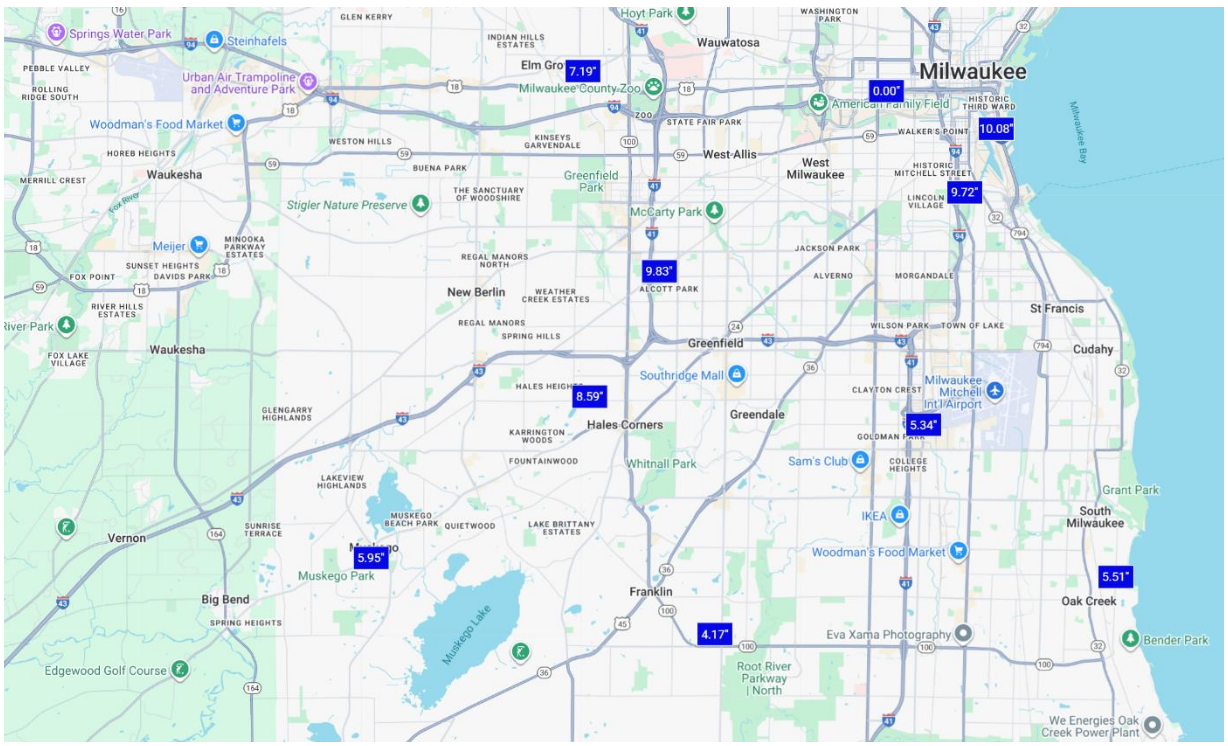
Two road construction projects upstream of Site A may have contributed to more significant thick, soft sediments at the site than in previous years, as discussed in Section 7.3.1. The construction projects that occurred during the reporting period are described in Table 6-12.

TABLE 6-12. ROAD CONSTRUCTION PROJECTS POTENTIALLY CONTRIBUTING TO SILTATION AT SITE A

Location	Start and End Date	Description of Work
S 76th St from S County Line Rd to S Creekview Ct, West of Site A[9]	05-05-2025 to 09-27-2025	Reconstruction of pavement structure, improvement of roadway culvert crossings, and replacement of driveway culverts
WIS 100 from S 60th St to St. Martins Rd, North and Northwest of Site A[10]	04-08-2025 to 11-17-2025	Replacement of concrete pavement, upgrades of storm sewer systems, installation of new traffic signals, and addition of multi-use path

An additional event that impacted the Root River watershed was the historic rainfall and flooding in the Greater Milwaukee area on August 9 and 10, 2025. Figure 6-16 shows rain gauge data from the Milwaukee Metropolitan Sewerage District (MMSD) for that time. The Root River at Franklin, WI was under flood warnings during and after this event[11]. As mentioned in Section 2.1, the USGS gauge of the Root River at W. Eight Mile Road (Site D) also recorded the highest daily flow values of the reporting period on August 12 and 13, 2025.

FIGURE 6-16. SOUTHEASTERN WISCONSIN RAIN GAUGE DATA AUGUST 9-10, 2025



Source: https://www.mmsd.com/about-us/milwaukee-rain-facility-information

[9] https://county.milwaukee.gov/files/county/transportation-services/Transportation-Services/News/251117_76th-Street_Brief_Reopening.pdf
[10] https://www.franklinwi.gov/Files/Engineering/Sept-2025-Project-Update-WIS-100-Reconstruction.pdf
[11] https://www.jsonline.com/story/weather/2025/08/11/milwaukee-storms-flooding-rivers-nws-explainer/85606358007/

7 WATER-DEPENDENT RESOURCES

Fish, benthic macroinvertebrate, and quantitative habitat evaluation surveys were completed at Sites A through D starting in 2017. Pre-diversion conditions included sampling prior to November 2023 as documented in the Pre-Diversion Root River Data Collection Summary (Jacobs 2024) and augmented by the Root River Data Collection Summary 2024 Annual Reporting (Jacobs 2025). This report incorporates the reporting period events from the 2024 macroinvertebrate and habitat surveys (Orlofske 2026), and the November 2024 and July 2025 fish surveys (Schulz 2025a, 2025b). Table 7-1 summarizes the pre-diversion, post-diversion, and reporting period macroinvertebrate and habitat survey dates between 2017 and 2025. Surveys were completed at each location when water levels permitted safe access to the sites (water height of 2.5 feet or less at Site A, 2 feet or less at Site B, and 4.5 feet or less at Sites C and D) and when there was no risk from severe weather events.

TABLE 7-1. SUMMARY OF MACROINVERTEBRATE AND HABITAT SURVEY EVENTS

Year	Benthic Macroinvertebrate Sampling		Quantitative Habitat Evaluation			
	September	November	Site A	Site B	Site C	Site D
2017	Sept. 11	Nov. 2	Sept. 21	Sept. 19	Sept. 24	Sept. 19
2018	Sept. 13	Nov. 17	Sept. 27	Sept. 20	Sept. 14	Sept. 14
2019	Sept. 5	Nov. 13	Sept. 6	Sept. 20	Sept. 26	Nov. 14
2020	Sept. 3	Nov. 4	Sept. 18	Sept. 11	Sept. 24	Sept. 17
2021	Sept. 3	Nov. 3	Aug. 5	July 27	July 29	Aug. 6
2022	Sept. 2	Nov. 2	July 13	July 8	July 14	July 18
2023	Sept. 1	Nov. 11	July 7	July 3	July 18	July 17
2024	Sept. 3[b]	Nov. 2[a,b]	July 19[b]	July 1[b]	July 11[b]	July 12[b]
2025	Sept. 2[a,c]	Nov. 6[c]	July 3[a,c]	July 2[a,c]	July 22[a,c]	July 28[a,c]

Notes:
[a] = reporting period flow conditions
[b] = events included in this report
[c] = results not available to be included in this report

Table 7-2 summarizes the sampling dates for the pre-diversion, post-diversion, and reporting period fish surveys conducted between 2017 and 2025. All sites were sampled as part of the same survey, except in 2017, when a second event for Sites C and D was required for sampling over the defined study reach.

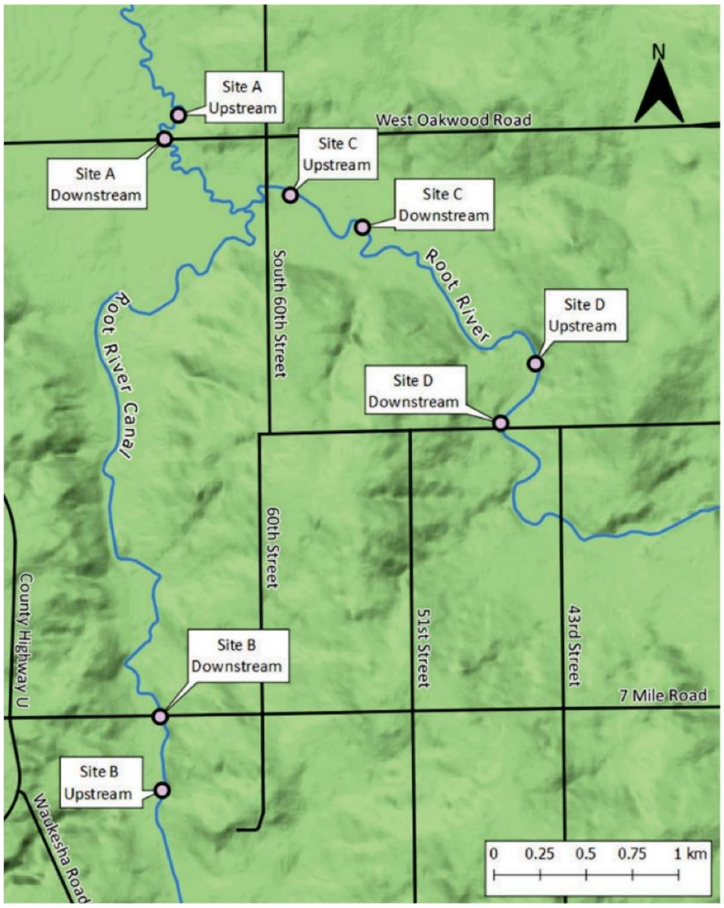
TABLE 7-2. SUMMARY OF FISH SURVEY EVENTS

Year	Fish Surveys	
	Summer	Fall
2017	July 27 & 28, Sept. 1	Nov. 7 & 8
2018	July 9 & 10	Nov. 13 & 14
2019	July 26 & 27	Nov. 8 & 9
2020	Aug. 7 & 8	Nov. 5 & 7
2021	July 20 & 22	Nov. 4 & 6
2022	July 22 & 23	Nov. 10 & 11
2023	July 20 & 21	Nov. 6 & 7
2024	July 22 & 23	Nov. 16 & 17[a,b]
2025	July 18 & 21[a,b]	Nov. 3 & 7[c]

Notes:
[a] = reporting period flow conditions
[b] = events included in this report
[c] = results not available to be included in this report

The sampling reaches were established in 2017 and repeated through 2025 (Figure 7-1). Reach lengths differed for each location in proportion to the stream width. Although water levels and, therefore, stream widths differ over the years, the transects established in 2017 were maintained throughout each year, including resampling in 2024 and 2025 for consistent comparisons. The return flow outfall is near the upstream end of Site C reach.

FIGURE 7-1. SURVEY REACHES



7.1 FISH COMMUNITY

Fish sampling was conducted in accordance with the Standard Operating Procedure for the Collection, Identification, and Enumeration of Fishes for the Pre-Return Flow Root River Data Collection Plan (CH2M 2017) and the QAPP (Jacobs and SmithGroup 2025) for post-diversion and reporting period conditions. Captured fish were identified in the field, counted, and released. Four metrics were evaluated at each sampling location from 2017 through 2025: Catch Per Unit Effort (CPUE), Shannon Diversity Index, Index of Biotic Integrity for Warm Water Fish Communities (Warm F-IBI), and Index of Biotic Integrity for Cool-Warm Water Fish Communities (Cool-Warm F-IBI). Data from these analyses are displayed in graphics below as summer (July, August, and September sampling dates) and fall (November sampling dates) for comparison of seasonal differences. Single values for summer and fall events during the post-diversion reporting period are shown in comparison to the ranges observed during pre-diversion conditions (box and whisker plots). As additional post-diversion data is collected, box and whisker plots may be prepared for comparing the ranges observed between pre- and post-diversion conditions.

No threatened, endangered, or special-concern species were encountered at any of these locations. One fish collected at Site B in November 2024 presented a deformity, erosion, lesion, or tumor.

7.1.1 CATCH PER UNIT EFFORT

CPUE is the number of fish caught per hour of sampling and provides information on the overall density of fish in the river. Fish exhibit spatial and temporal variations in their distribution and activity; therefore, CPUE can vary widely. The CPUE during the summer and fall surveys is shown on Figures 7-2 and 7-3. The final July 2024 data were confirmed with the draft data included in the 2024 report. The November 2024 and July 2025 data are included in this report as part of the reporting period flow environment. The data for November 2025 fish sampling dates were unavailable at the time of this report and, therefore, will be incorporated in the next annual report.

FIGURE 7-2. SUMMER FISH SURVEY CATCH PER UNIT EFFORT

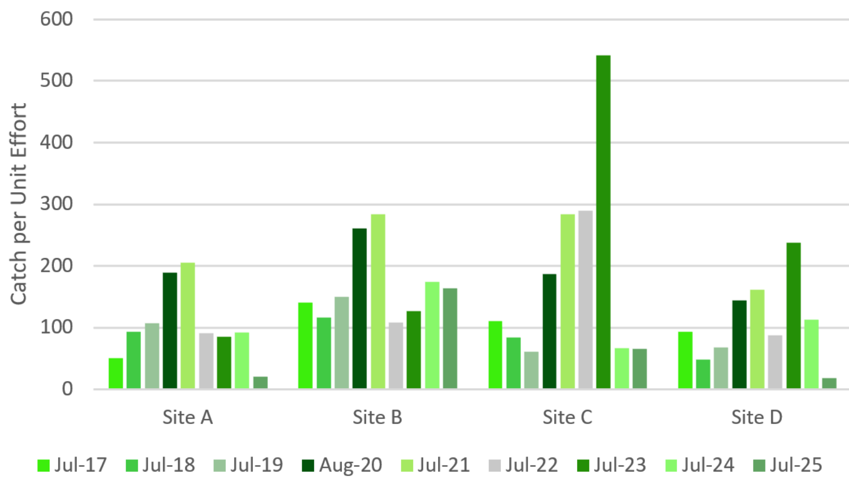
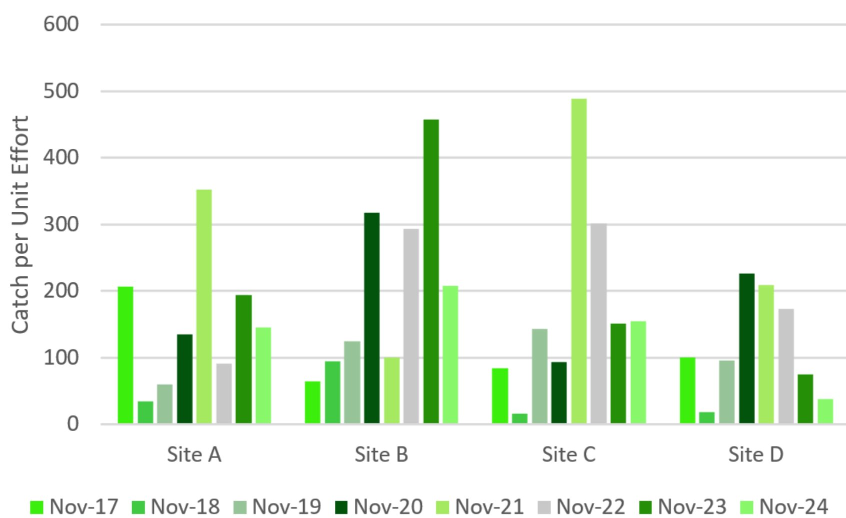


FIGURE 7-3. FALL FISH SURVEY CATCH PER UNIT EFFORT



7.1.1.1 CPUE OBSERVATIONS

- The total number of individuals captured at each location during the summer and fall sampling events continues to be variable without a clear trend across sites or dates.
- Of the July 2025 CPUE values, Site B and Site C are within the range of pre-diversion values and are consistent with the July 2024 values. While Site A and Site D had the lowest CPUE of all sampling events, they are more consistent (lower standard error) than Site C, with Site A also being more consistent than Site B.
- The low Site A CPUE value in July 2025 may have been caused by the site being difficult to navigate as noted by the field teams due to silty, muddy substrate, dense patches of elodea, and multiple deadfalls. The low Site D CPUE value in July 2025 may have been caused by parts of the site being

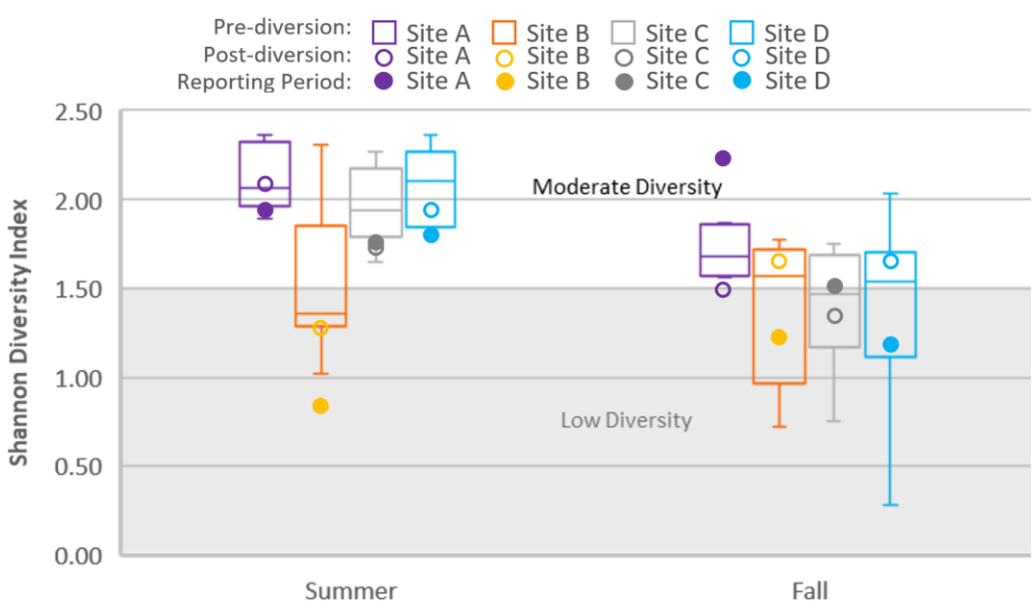
difficult or impossible to navigate due to depth, debris, and deadfalls.

- November 2024 CPUE values are within the range of pre-diversion values. Site A, C, and D values are relatively consistent with the November 2023 CPUE values. The Site B November 2024 CPUE was not consistent with the November 2023 CPUE, however, the November 2023 CPUE at Site B was higher than the pre-diversion range.

7.1.2 SHANNON DIVERSITY INDEX

Shannon Diversity Index allows comparison of both the richness (number of species present) and evenness (number of individuals per species) of species in a community. This provides a measure of diversity that can be used to compare communities, habitats, or locations regarding how many individuals of how many species are present. The Shannon Diversity Index typically ranges from 0 to 3.5, where values from 0 to 1.5 indicate low diversity, values from 1.51 to 2.5 indicate moderate diversity, and values above 2.51 indicate high diversity. Figure 7-4 shows Shannon Diversity Index values across summer (July, August, and September) and fall (November) sampling events for pre-diversion (box and whisker plot), post-diversion (open circles), and reporting period (solid circle) events.

FIGURE 7-4. SHANNON DIVERSITY INDEX COMPARING PRE-DIVERION AND POST-DIVERSION PERIODS



7.1.2.1 SHANNON DIVERSITY INDEX OBSERVATIONS

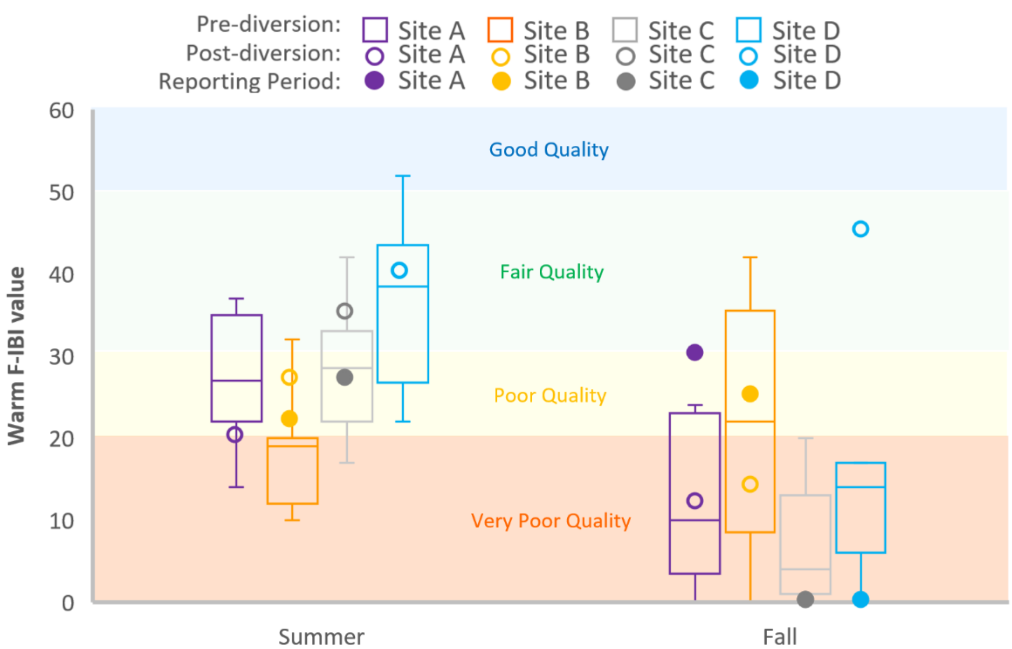
- With the exception of Site B (summer and fall) and Site D (fall), each sampling site during the reporting period maintained the same low or moderate diversity rating as compared to the pre-diversion median value.
- July 2025 Shannon Diversity Index for Sites A and C were within the range of pre-diversion events. Sites A, C, and D were also very consistent with the July 2024 sampling events, with the Shannon Diversity Indices being within 0.15 units.
- In July 2025, Site B continued to be the most variable summer site with the lowest value of all summer sampling events due to a high percentage of the sample consisting of two of the most common fish species.
- November 2024 values were within the range of pre-diversion events with the exception of Site A, with the highest value of all fall sampling events.

- In November 2024, Site C was very consistent with the median of the pre-diversion events and similar to November 2023.

7.1.3 INDEX OF BIOTIC INTEGRITY FOR WARM WATER FISH COMMUNITIES

The IBI is a set of calculations based on the ecological characteristics of the fish present in each community. The Warm F-IBI calculation accounts for the number of each species caught; the number of tolerant, hardy species versus the number of intolerant, sensitive species; the number of native versus the number of introduced species; the ecological niches (carnivore, omnivore, herbivore) of the species in the sample; the presence of species that require clean, sediment-free gravel and pebbles to spawn; and the presence of certain species (darters, sunfish, suckers, and salmonids) in the sample. The resulting calculation is a single value indicating the overall quality of the stream habitat, indicating the likelihood of environmental degradation or pollution. The Warm F-IBI score ranges from 0 to 100, with scores of 0 to 19 rated as very poor quality, 20 to 29 rated as poor quality, 30 to 49 rated as fair quality, 50 to 64 rated as good quality, and 65 to 100 rated as excellent quality. Figure 7-5 shows Warm F-IBI values across summer (July, August, and September) and fall (November) sampling events.

FIGURE 7-5. INDEX OF BIOTIC INTEGRITY FOR WARM WATER FISH COMMUNITIES: PRE-DIVERION AND POST-DIVERSION PERIODS



Note: All sites in November 2018 and Sites A and D in July 2025 were below the minimum required number of individuals to calculate warm F-IBI.

7.1.3.1 WARM WATER FISH IBI OBSERVATIONS

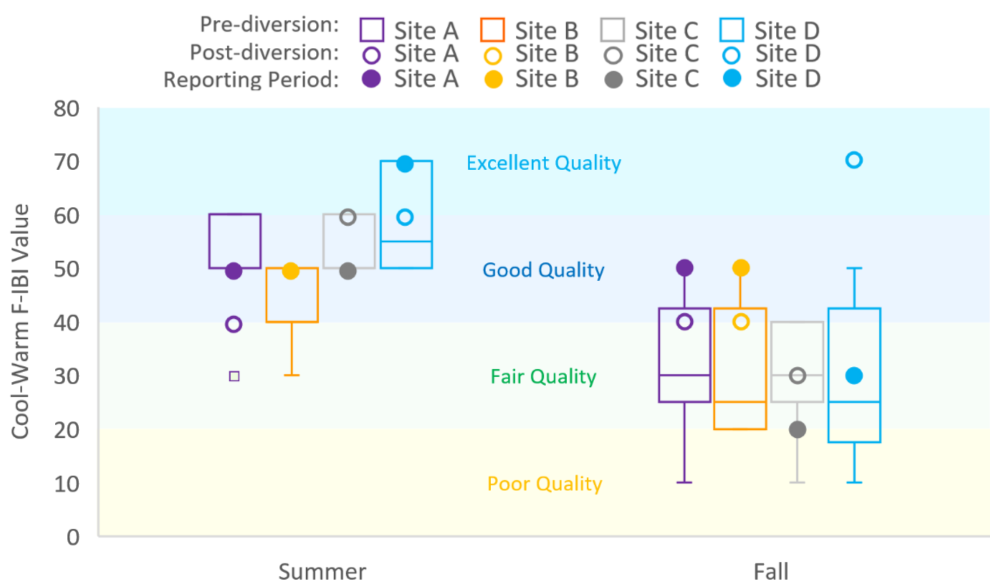
- Insufficient sample counts prevented calculating Warm F-IBI scores for the reporting period summer event at Sites A and D.
- All reporting period locations with Warm F-IBI scores were within the range observed during the pre-diversion conditions, except for Site A in November 2024, which had the highest value of all fall events and rated as fair quality for the first time
- In November 2024, Sites C and D received Warm F-IBI values of 0. This condition was also observed during pre-diversion events, likely due to the sampling event being completed in November (outside of traditional sampling months).

- In July 2025, Sites B and C had poor quality ratings, consistent with pre-diversion Warm F-IBI values and Site B in July 2024.

7.1.4 INDEX OF BIOTIC INTEGRITY FOR COOL-WARM WATER FISH COMMUNITIES

The Cool-Warm F-IBI calculation accounts for the number of native minnow species; the number of intolerant species; the percentage of tolerant species; the number of benthic invertivore species; and the percentage of omnivores. The resulting calculation is a single value indicating the overall quality of the stream habitat, indicating the likelihood of environmental degradation or pollution. The Cool-Warm F-IBI score ranges from 0 to 100, with scores of 0 to 20 rated as poor quality, 21 to 40 rated as fair quality, 41 to 60 as good quality, and 61 to 100 rated as excellent quality. Figure 7-6 shows Cool- Warm F-IBI values across summer (July, August, and September) and fall (November) sampling events.

FIGURE 7-6. INDEX OF BIOTIC INTEGRITY FOR COOL-WARM WATER FISH COMMUNITIES: PRE-DIVERSION AND POST-DIVERSION PERIODS



Note: The pre-diversion box and whisker plot for Summer Site A includes a minimum F-IBI value of 30 (square point).

7.1.4.1 COOL-WARM FISH IBI OBSERVATIONS

- All reporting period samples are within the range of pre-diversion Cool-Warm F-IBI values.
- In July 2025, Site B had the same Cool-Warm F-IBI value as in July 2024.
- All reporting period samples were similar to the previous year's reporting period samples except for Site D which in November 2024 had a fair value and November 2023 had an excellent quality value.
- The reporting period ratings were the same as the median pre-diversion ratings except Site D (summer) and Sites A and B (fall) had higher ratings (good to excellent and fair to good, respectively).

7.2 MACROINVERTEBRATES

Macroinvertebrate surveys were conducted following WDNR guidelines for wadeable streams. These surveys have been repeated at the same locations in the Root River and Root River Canal each year since 2017 in September and November. For surveys in 2017-2023, a minimum macroinvertebrate count of 100 specimens was used. In 2024, a minimum macroinvertebrate count of 250 specimens was implemented to be consistent with anticipated 2026 updates to Wisconsin's Consolidated Assessment and Listing Methodology.

7.2.1 HILSENHOFF BIOTIC INDEX

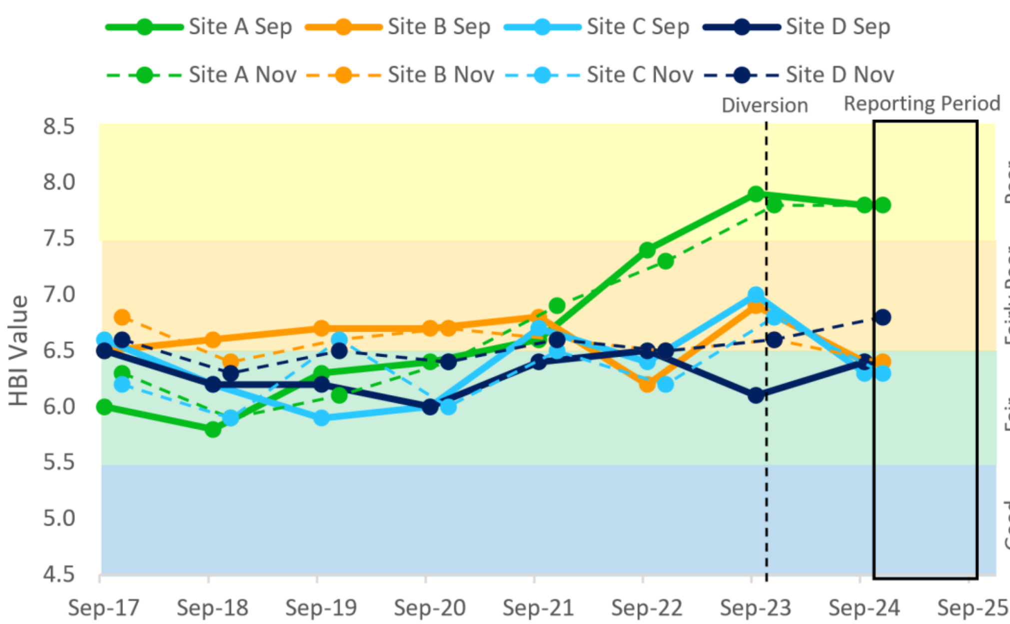
The Hilsenhoff Biotic Index (HBI) value (index ranges from 0 to 10, with lower values indicating higher quality and higher values indicating lower quality) is used to indicate overall water quality – specifically, the presence of organic pollution that would deprive organisms, such as aquatic macroinvertebrates, of dissolved oxygen necessary for cellular respiration. Samples containing more individuals with greater tolerance scores result in greater HBI values, indicating lower water quality and a greater probability of organic pollution. Conversely, samples containing more individuals with lower tolerance scores result in lower HBI values, indicating higher water quality and a smaller probability of organic pollution (Hilsenhoff 1988). Table 7-3 summarizes the range of HBI values correlating to a water quality rating and degree of organic pollution.

TABLE 7-3. HILSENHOFF BIOTIC INDEX RANGES

HBI Value	Water Quality Rating	Degree of Organic Pollution
<3.50	Excellent	None apparent
3.51 to 4.50	Very Good	Possible slight
4.51 to 5.50	Good	Some
5.51 to 6.50	Fair	Fairly significant
6.51 to 7.50	Fairly Poor	Significant
7.51 to 8.50	Poor	Very significant
8.51 to 10.00	Very Poor	Severe

Figure 7-7 summarizes the range of HBI values for each sampling site over the past 8 years. Overall, macroinvertebrate metric and index values have remained relatively consistent across most years and seasons despite minor fluctuations in taxonomic composition of the benthic macroinvertebrates. As with composition, metric and index scores appear to follow large-scale conditions, such as water level. Surveys during low-flow periods (2018, 2021, 2022, 2023, and 2024) are more similar. Likewise, surveys during high-flow periods (2019 and 2020) are more similar. However, fluctuations among years are still relatively minor.

FIGURE 7-7. HILSENHOFF BIOTIC INDEX BY SITE AND SAMPLING DATE



7.2.1.1 HBI OBSERVATIONS FOR REPORTING PERIOD CONDITIONS

- HBI values in 2024 were within the range of previous values for all sites except for Site D in November which was higher (poorer water quality) than previous values at Site D. However, the fairly poor rating had been observed at Site D in November samples several times since the monitoring began in 2017.
- In 2024, HBI values at Site A were consistent with HBI values in 2023, indicating poor water quality and a very significant degree of organic pollution.
- From 2023 to 2024, HBI values at Sites B and C decreased in both September and November, indicating improved water quality with ratings changing from fairly poor quality to fair quality.
- The average HBI score for September 2024 (6.8 ± 0.7) and November (6.8 ± 0.7) were the same indicating low seasonal variability for HBI across all sites.
- The HBI scores are consistent with patterns observed in the mean pollution tolerance values for each of the sites.

7.2.2 MACROINVERTEBRATE INDEX OF BIOTIC INTEGRITY

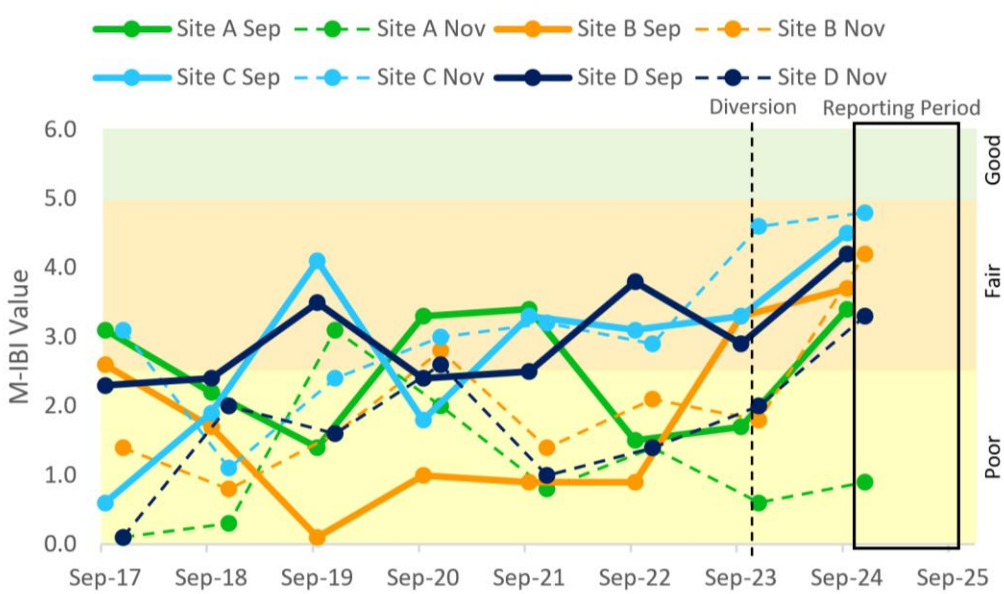
The wadeable stream macroinvertebrate index of biotic integrity (M-IBI) is an index calculated using component metrics to estimate water quality conditions. The following metrics are included in the M-IBI for wadeable streams: species richness, Ephemeroptera-Plecoptera-Trichoptera, Mean Pollution Tolerance Value, proportion of depositional taxa, proportion of Diptera, proportion of Chironomidae, proportion of shredders, proportion of scrapers, proportion of gatherers, proportion of Isopoda, and proportion of Amphipoda. The resulting M-IBI values are compared to a scale to determine the water quality rating (WisCALM, 2024). M-IBI ranges from 0 to infinity with lower values indicating poor quality and higher values indicating excellent water quality. This scale is opposite of the HBI scale. Table 7-4 summarizes the range of M-IBI values and the correlating water quality condition category by site and sampling date (Orlofske 2025, 2026).

TABLE 7-4. WADEABLE STREAM MACROINVERTEBRATE INDEX OF BIOTIC INTEGRITY RANGES

M-IBI Value	Water Quality Condition Category
>7.5	Excellent
5.0 to 7.4	Good
2.5 to 4.9	Fair
<2.5	Poor

The interpretation of the M-IBI values are consistent with the HBI and mean pollution tolerance values. Overall, the M-IBI values indicate that all sites experienced some degree of organic pollution. Figure 7-8 summarizes the range of M-IBI values for each sampling site over the past 8 years.

FIGURE 7-8. MACROINVERTEBRATE INDEX OF BIOTIC INTEGRITY BY SITE AND SAMPLING DATE



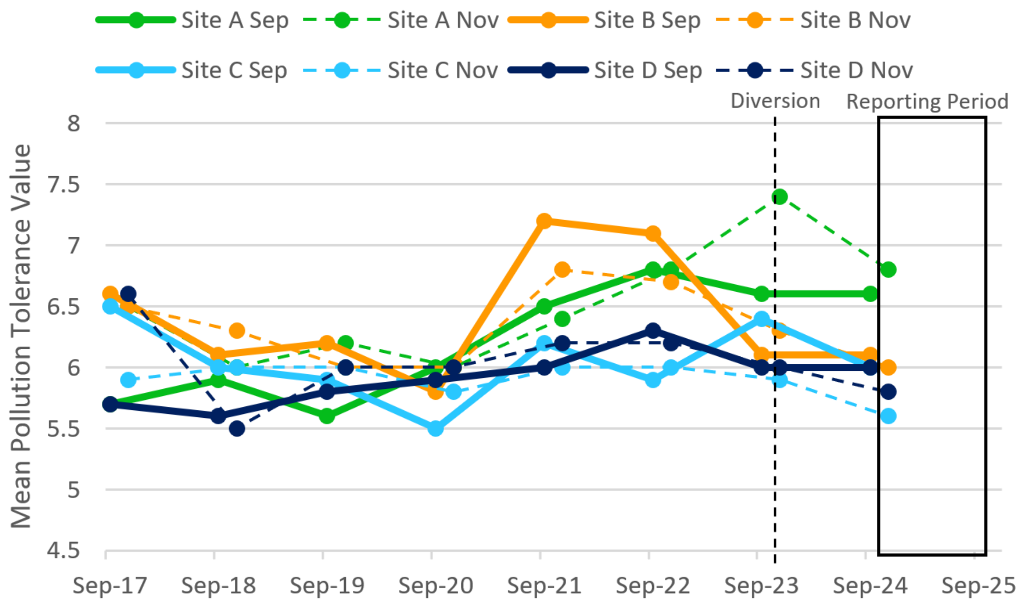
7.2.2.1 M-IBI OBSERVATIONS FOR REPORTING PERIOD CONDITIONS

- In 2024, M-IBI values for all sites indicated fair water quality except Site A in November which indicated poor water quality.
- From 2023 to 2024, M-IBI increased for all sites in both September and November.
- In 2024, Sites B, C, and D logged the highest M-IBI values of the past 8 years of surveys in September and November.

7.2.3 MEAN POLLUTION TOLERANCE VALUE

The mean pollution tolerance value (MPTV) represents the average pollution tolerance value for the macroinvertebrates collected in a sample. Low tolerance values are assigned to taxa that are considered sensitive to organic pollution while higher tolerance values are assigned to taxa that are considered tolerant to organic pollution. This metric calculates the average tolerance score for the taxa present in the sample and is complementary to the HBI because both measures use the same tolerance values. However, the MPTV is not influenced by macroinvertebrate abundance. The MPTV has a range from 0 to 10, with lower values indicating lower average pollution tolerance values (fewer high tolerance value taxa or more low tolerance value taxa) and higher values indicating higher average pollution tolerance values (fewer low tolerance value taxa or more high tolerance value taxa). Figure 7-9 summarizes the range of MPTV for each sampling site over the past 8 years.

FIGURE 7-9. MEAN POLLUTION TOLERANCE VALUE BY SITE AND SAMPLING DATE



7.2.3.1 MPTV OBSERVATIONS FOR REPORTING PERIOD CONDITIONS

- In 2024, MPTV were within the range of pre-diversion values for all sites except Site C in November 2024 which was lower (i.e. more low tolerance taxa) than all previous November values.
- From September 2023 (pre-diversion) to September 2024, the MPTV stayed the same for Sites A, B, and D, and decreased (i.e. more low tolerance taxa) for Site C.
- From November 2023 to November 2024, the MPTV decreased for all sites.
- The average MPTV scores for September 2024 (5.7 ± 0.2) and November 2024 (5.7 ± 0.6) were essentially identical.
- The same as past observations, pollution-tolerant taxa continue to be more common than pollution-sensitive taxa at all four locations for each sampling period.

7.2.4 ADDITIONAL REPORTING PERIOD OBSERVATIONS

Several new taxa were observed for the first time in the 2024 benthic macroinvertebrate surveys, including the finger-net caddisfly (Philopotamidae, *Chimarra*), the aquatic moth (Pyralidae, *Petrophila*), the hover fly (Syphidae, *Chrysogaster*), and the moth (Psychodidae, *Pericoma*). These new taxa have moderate tolerance values except for *Chrysogaster* which is highly tolerant. All other benthic macroinvertebrate taxa observed in 2024 have been present in at least one sample during the previous 7 years of surveys. The highly pollution-sensitive winter stonefly (*Taeniopteryx*), that was first observed in 2023 at Site C, was observed again in 2024 at Sites B and C. The pollution-tolerant Chironominae subfamily was the most abundant taxon observed in 2024 as it has been between 2017 and 2022 (not 2023). The second most abundant taxon observed in 2024 was the Amphipod, *Hyalella*, which was the most abundant macroinvertebrate taxon observed during the 2023 surveys. *Hyalella* is classified as pollution tolerant and seems to benefit from the expanding area of submerged macrophytes, particularly at Site A where the poorest water quality conditions were reported during the biological surveys. The high proportion of Chironominae and *Hyalella* contribute to MPTV and HBI values that indicate water quality impairment.

7.3 HABITAT

A wadeable stream quantitative habitat evaluation was conducted at each site and over the entire sampling period. Prior to 2021, habitat assessment surveys were conducted in September alongside the aquatic macroinvertebrate sampling. However, the timing of the habitat evaluation changed in 2021 to assess conditions present during summer fish surveys. This change was made to better align with staffing availability and the habitat assessment protocols. No significant changes were observed by the field teams by switching the assessment period to a month earlier in the year.

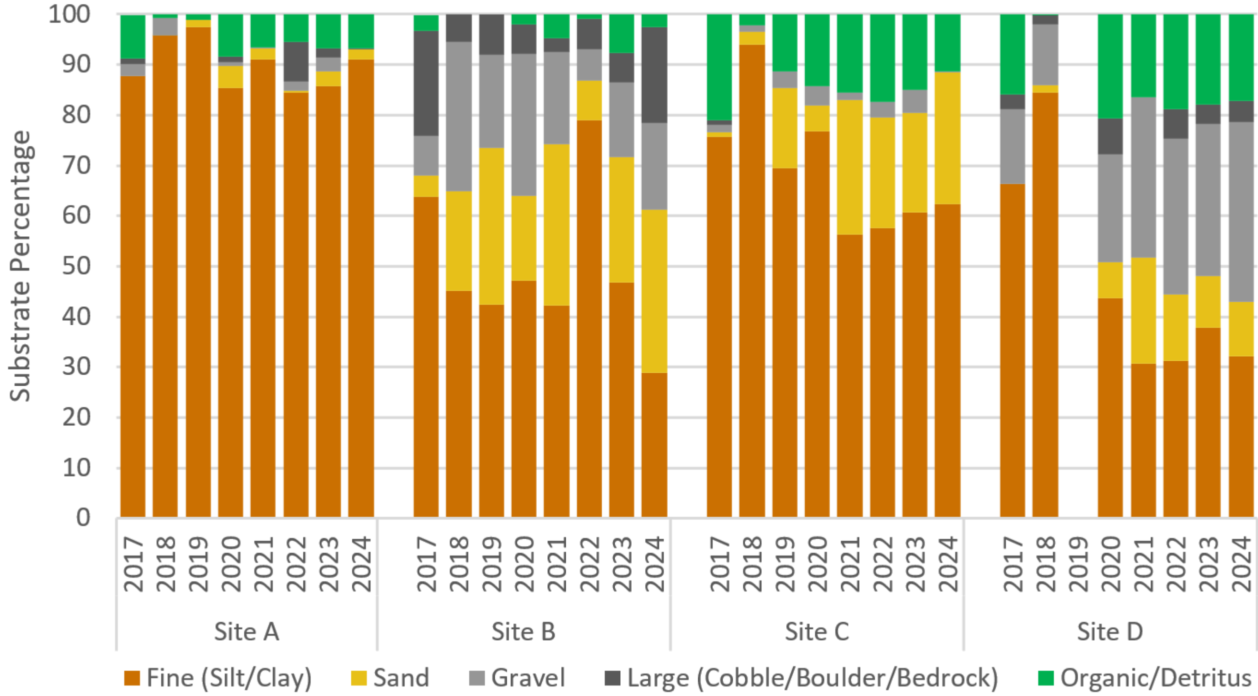
The same physical and chemical parameters – specifically, pH (S.U.), dissolved oxygen (mg/L), conductivity (mS/cm), water temperature (°C), and turbidity (NTU) – measured during the macroinvertebrate surveys also were assessed during the habitat surveys. These parameters were generally consistent with the values measured during the routine water quality monitoring. Water temperatures were generally warm (19.9°C ± 1.6°C) during the habitat surveys, consistent with their classification as warm water streams. Variation in precipitation events and the associated effects on flow among survey dates may contribute to the minor variations observed in these parameters among sites and sampling dates. The persistence of log jams and coarse woody debris in the channels observed during summer habitat assessment surveys and both benthic macroinvertebrate collection periods suggest that sediment sorting and redistribution at each of these Root River and Root River Canal locations may only occur during peak flows (the spring freshet). One transect at Site D was shifted due to the presence of a log jam completely blocking the channel. Moderate to low flow conditions in 2024 were generally similar to the flows measured during the 2021, 2022, and 2023 habitat assessment surveys.

Substrate, adult gamefish cover, bank erosion data, and algal abundance from the 2024 habitat surveys and embeddedness data measured during the 2024 macroinvertebrate surveys are summarized in the following subsections. The data from 2025 habitat monitoring were unavailable at the time of this report and will be incorporated in the next annual report.

7.3.1 SUBSTRATE DATA

Overall, the four sites continue to be dominated by fine sediment, including a relatively high percentage of silt, clay, and sand with smaller contributions of larger bed material and moderate amounts of organic material, including the submerged and emergent macrophytes. Organic material continues to be a dynamic component of the substrate at most locations. Figure 7-10 summarizes the substrate breakdown by material percentage for each site over the past 8 years of surveys. While habitat surveys prior to 2021 were conducted in September and surveys in 2021 and onward are conducted in July, substrate data does not appear to differ by season.

FIGURE 7-10. PERCENTAGE OF SUBSTRATE MATERIALS BY SITE AND SAMPLING DATE



Note: Unsafe conditions prevented the collection of sediment variables at Site D in 2019.

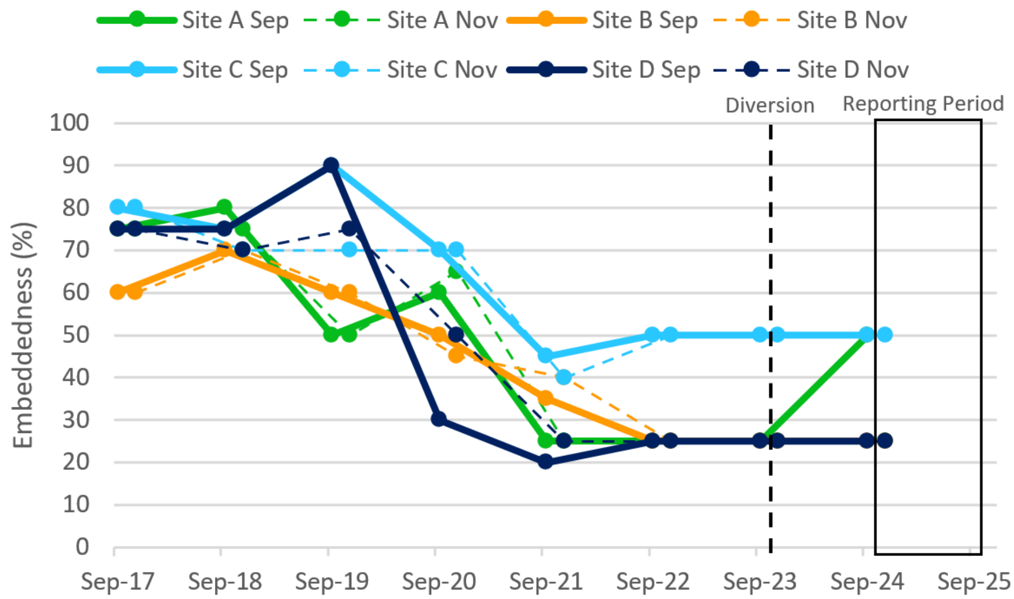
7.3.1.1 SUBSTRATE OBSERVATIONS FOR REPORTING PERIOD CONDITIONS

- Sites A and B appear to have more living organic substrate while Sites C and D collect more detritus.
- In 2024, Site A recorded the highest percentage of fine sediment (silt and clay) of all the sites. The fine sediment at Site A has been noted by the field teams to be noticeably increasing over the past few years.
- In 2024, the extent of submerged macrophytes at Sites A and B had noticeably increased.
- In 2024, Site B had the highest percentage of large substrate (cobble and boulder) of all the sites.
- The percentage of fine sediments were very similar over the last four years at Site C with each year slightly increasing since 2021. This may be influenced by the increased fine sediments at upstream Site A.
- Site D continues to have the lowest percentage of fine sediments and is very similar to the past four years.

7.3.2 EMBEDEDDNESS

Embeddedness is the extent to which coarse substrate (gravel, cobble, and boulders) are surrounded by the fine sediment (silt, clay, sand) of the streambed. Higher levels of embeddedness mean less space is available for macroinvertebrate habitats in between the coarse substrate particles. Embeddedness was measured during the macroinvertebrate surveys in September and November of each year. Figure 7-11 shows the embeddedness percentage for each site over the past 8 years of surveys. Overall, embeddedness has trended downward and then has stabilized over the past few years around 25-50%.

FIGURE 7-11. EMBEDDEDNESS PERCENTAGE BY SITE AND SAMPLING DATE



7.3.3 COVER FOR ADULT GAME FISH

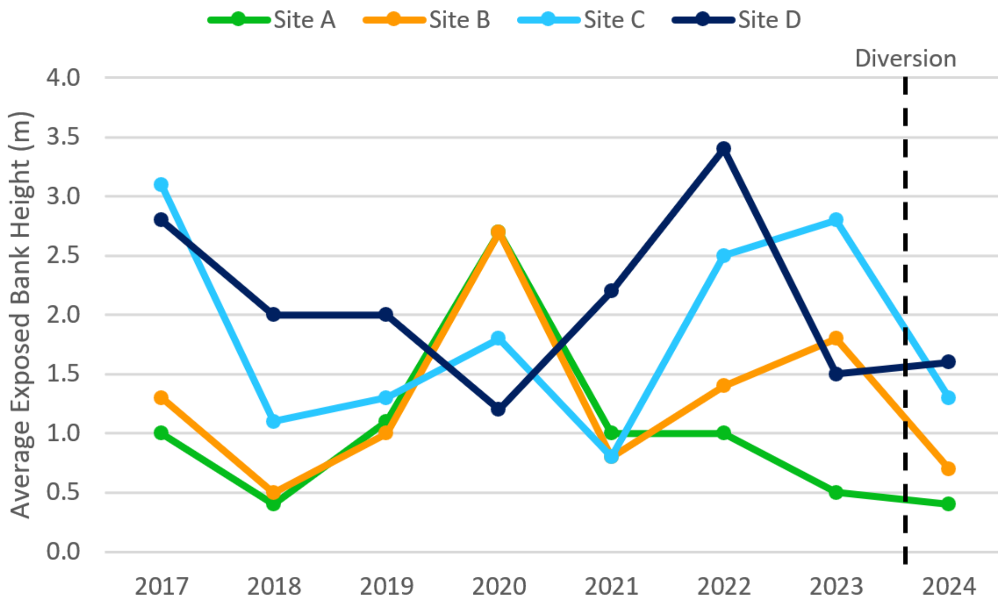
Evidence of fish habitat was documented as part of the surveys. Fish habitat was documented at all sites; however, the type of habitat and the extent of the habitat (number of transects) differed at each location.

The proportion and distribution of gamefish habitat differs slightly among years, but several types of fish habitat generally are available in each study reach each year. The proportion of transects with fish habitat in 2024 was 90.4%, the highest recorded amount in the past 8 years of surveys. The most common type of fish habitat observed in 2024 included emergent macrophytes (present at 66.7% of transects) followed by submerged macrophytes (49.05%) and woody debris (39.2%). These habitats likely represent the most important resources for fish at these sites given how woody debris has been a dominant fish cover and macrophyte coverage has been increasing in recent years. Despite variation among flow conditions and survey timing, woody debris continues to be the dominant fish cover among all sites, while submerged macrophyte beds persist, particularly at Site A, and overhanging banks appear in a few places. Woody debris and emergent macrophytes occurred at all sites in 2024.

7.3.4 BANK EROSION

During the quantitative habitat evaluation, the degree of bank erosion was assessed by measuring the height of exposed soil within 1 meter of the wetted edge on the left and right banks (facing upstream) at each transect. The evaluation of the extent of exposed bank is influenced by water depth and discharge in the channel at the time of the survey. Thus, these instantaneous, empirical values should still be considered estimates of site characteristics. The average bank erosion measurement for 2024, collected during a low to moderate flow period was 1.0 meters ± 0.5 meters, similar to the bank erosion estimates reported in pre-diversion years 2018, 2019, 2021 and 2023. In 2024, Sites C and D had the greatest extent of exposed banks. Site A had the lowest extent of exposed banks, however, the flow conditions at Site A may have obscured the bank erosion due to water depth. Figure 7-12 presents the average exposed bank heights from 2017 to 2024. Overall, the 2024 average bank erosion measurements are within the range of pre-diversion measurements. The recent extended period of low to moderate flows (2021-2024) could be conducive to vegetation establishment on the banks which contribute to lower values of bank erosion.

FIGURE 7-12. AVERAGE EXPOSED BANK HEIGHT BY SITE AND SAMPLING DATE



7.3.5 ALGAL ABUNDANCE

Algal abundance sampling began during the 2021 habitat assessment using an algal viewing bucket. The percentage of algae present was documented at each transect to the nearest 10% at each channel position representing one-fifth of the stream width. Algae generally were observed infrequently:

- In 2021, 38% of transects at Site A, 8% of transects at Site B, and 7% of transects at Site D had visible algae;
- In 2022, 8% of transects at Site A had visible algae;
- In 2023, 31% of transects at Site A, and 25% of transects at Site B had visible algae;
- In 2024, none of the sites had visible algae.

Overall, the presence of attached and filamentous algae is low at all Root River and Root River Canal locations. This is consistent with the low percentage of benthic macroinvertebrates categorized as scrapers in each of the benthic macroinvertebrate monitoring samples.

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