

Permit Fact Sheet

General Information

Permit Number:	WI-0023469-10-0	
Permittee Name:	City of Brookfield	
Address:	21225 Enterprise Ave	
City/State/Zip:	Brookfield WI 53045	
Discharge Location:	South bank of Fox River approx. 1/4 mi east of Springdale Rd. downstream of Poplar Creek.	
Receiving Water:	Fox (IL) River (Upper Fox (IL) River Watershed, Upper Fox (IL) River Basin) in Waukesha County	
StreamFlow (Q _{7,10}):	7-Q ₁₀ = 6.7 cfs (cubic feet per second) 7-Q ₂ = 12 cfs 90-Q ₁₀ = 10.2 cfs Values from USGS for Station #05548300 updated on 01/14/2022	
Stream Classification:	Warm Water Sport Fish (WWSF) community, non-public water supply	
Discharge Type:	Existing, Continuous	
Design Flow(s)	Daily Maximum	31.25 MGD
	Weekly Maximum	28.1 MGD
	Monthly Maximum	20.0 MGD
	Annual Average	12.5 MGD
Significant Industrial Loading?	Yes, Brookfield identified 7 significant industrial users (3 being categorical users) in their application	
Operator at Proper Grade?	Rick Wenzel, OIC, is Advanced certified in all the plant's subclasses. Brookfield is an Advanced plant in A1- Suspended Growth, B-Solid Separation, C-Biological Solids, D-Disinfection, L-Laboratory, P-Total Phosphorus Nutrient Removal and SS-sanitary Sewage Collection System	
Approved Pretreatment Program?	Yes, approval date was May 29, 1985.	

Facility Description

The Fox River Water Pollution Control Commission (FRWPCC) operates a 12.5 MGD activated sludge wastewater treatment facility in the City of Brookfield. The plant serves approximately 52,000 people and 7 significant industries including portions of the City of Brookfield that lie west of the subcontinental divide, Lake Pewaukee Sanitary District, the City of Pewaukee, the Village of Pewaukee, the Town of Brookfield Sanitary District #4, and the southwest portion of the Village of Menomonee Falls.

Treatment consists of fine screening, grit removal, primary clarification, biological nutrient removal, secondary clarification, tertiary filtration, disinfection via chlorination and dechlorination and aeration before effluent is discharged to the Fox (IL) River. Biosolids processes include anaerobic digestion, gravity belt thickening, and storage before being land applied onto Department approved agricultural fields.

The permittee has requested blending approval as part of their permit application. Based on an evaluation of their request and associated documentation, blending is approved per s. NR 210.12(2), Wis. Adm. Code.

Substantial Compliance Determination

Enforcement During Last Permit: A notice of noncompliance was issued to the facility on April 11, 2023, for sanitary sewer overflows that occurred on February 27, 2022, and March 17, 2023. The facility has completed all previously required actions as part of the enforcement process.

After a desk top review of all discharge monitoring reports, CMARs, land application reports, compliance schedule items, and a site visit on May 16, 2023, conducted by DNR Wastewater Engineer, Nick Lent, this facility has been found to be in substantial compliance with their current permit, WI-0023469-09-1.

Sample Point Designation		
Sample Point Number	Discharge Flow, Units, and Averaging Period	Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)
701	9.23 MGD (Average from January 2019 to December 2023)	INFLUENT: 24-hour flow proportional composite samples shall be collected after fine screening and before grit removal. Samples at this location include the combined flows from the Brookfield and Pewaukee collection systems as well as plant recycle flows.
001	9.78 MGD (Average from January 2019 to December 2023)	EFFLUENT: 24-hour flow proportional composite samples shall be collected after disc filter phosphorus removal at the outlet of the deep bed filter building, prior to chlorination. Effluent grab samples shall be collected after dechlorination. Continuous temperature monitoring is conducted in the effluent flow channel approx. 15 feet back from the outfall apron.
004	1,174 dry U.S. tons (2023 permit application)	LIQUID SLUDGE: Compositated samples of anaerobically digested, gravity belt thickened, Class B liquid sludge shall be collected at the recirculation pumps in sludge storage.
010	0.021 MGD on May 17, 2020 No additional overflow events from 010 have occurred since May 2020.	OVERFLOW (Automatically-Activated): located in the City of Brookfield at S. 124th St. and Robinwood St. During times of wet weather untreated flow could be discharged to the Underwood Creek.
101	2.99 MGD (Average from September 2022 (4.64 MGD and April 2024 (1.35 MGD) blending events)	BLENDING: Sample point for reporting flow that is diverted away from biological and tertiary treatment into the excess flow primary clarifiers and is eventually blended with effluent from tertiary filters prior to disinfection. The permittee shall notify the Department when blending occurs. See 'Blending' requirements in the Standard Requirements section of the permit.
110	NA	FIELD BLANK: Collect Total Recoverable Mercury field blanks using standard sample handling procedures for grab samples collected at sample point 001.

Sample Point Designation		
Sample Point Number	Discharge Flow, Units, and Averaging Period	Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)
121	No data reported since new sample point	RECYCLE FLOWS: 24-hour flow proportional composite samples shall be collected in Preliminary Building #2 where recycle flow is pumped from the recycled wetwell.

1 Influent – Monitoring Requirements

Sample Point Number: 701- Combined Influent

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Daily	Calculated	See the ‘Influent Total Calculation and Reporting’ permit section.
BOD5, Total		mg/L	Daily	Calculated	See the ‘Influent Total Calculation and Reporting’ permit section.
Suspended Solids, Total		mg/L	Daily	Calculated	See the ‘Influent Total Calculation and Reporting’ permit section.
Cadmium, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	
Chromium, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	
Copper, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	
Lead, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	
Nickel, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	
Zinc, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	
Mercury, Total Recoverable		ng/L	Quarterly	24-Hr Flow Prop Comp	

Changes from Previous Permit:

Influent monitoring requirements were re-evaluated for the proposed permit term and no changes were made from the previous permit.

Explanation of Limits and Monitoring Requirements

BOD₅ and Total Suspended Solids (TSS): Tracking of BOD₅ and TSS are required for percent removal requirements found in s. NR 210.05, Wis. Adm. Code.

Cadmium, Chromium, Copper, Lead, Nickel, and Zinc: The proposed permit has the continuation of monitoring of influent for Cadmium, Chromium, Copper, Lead, Nickel, and Zinc as part the of approved pretreatment program.

Mercury, Total Recoverable: Mercury monitoring is included in the proposed permit pursuant to s. NR 106.145, Wis. Adm. Code. Required field blanks for Mercury monitoring per ss. NR 106.145(9) and (10), Wis. Adm. Code, requirements. The permittee shall collect a mercury field blank for each set of mercury samples (a set of samples may include a combination of influent, effluent or other samples all collected on the same day).

2 Inplant - Monitoring and Limitations

Sample Point Number: 101- Blending

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Per Occurrence	Continuous	See 'Blending Flow' permit section.
Time		hours	Per Occurrence	Calculated	Report the total duration of blending within a given day (12:00am - 11:59pm) in which the other bypass occurs. See 'Blending Flow' permit section.

Changes from Previous Permit:

Sample Point 101 Blending: the sample point name and description were edited to better represent how Brookfield operates their facility.

Explanation of Limits and Monitoring Requirements

The Department previously determined that the facility is able to practice blending pursuant to s. NR 210.12, Wis. Adm. Code. This sample point was edited to track the volume of wastewater that bypasses the secondary and tertiary treatment and the duration of the blending event pursuant s. NR 210.12(6), Wis. Adm. Code. The permittee is required to notify the department when blending occurs.

Sample Point Number: 110- Field Blank

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Mercury, Total Recoverable		ng/L	Quarterly	Blank	See 'Mercury Monitoring' section below.

Changes from Previous Permit:

None: Monitoring requirements were re-evaluated for the proposed permit term and no changes were made from the previous permit. **Explanation of Limits and Monitoring Requirements**

Required field blanks for Mercury monitoring per ss. NR 106.145(9) and (10), Wis. Adm. Code, requirements. The permittee shall collect a mercury field blank for each set of mercury samples (a set of samples may include a combination of influent, effluent or other samples all collected on the same day). The permittee shall report results of field blanks to the Department on Discharge Monitoring Reports.

Sample Point Number: 121- Recycle Flows

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Daily	Continuous	
BOD5, Total		mg/L	Daily	24-Hr Flow Prop Comp	
Suspended Solids, Total		mg/L	Daily	24-Hr Flow Prop Comp	

Changes from Previous Permit:

Sample Point 121 was added to account for the recycled flows.

Explanation of Limits and Monitoring Requirements

BOD₅ and Total Suspended Solids (TSS): Tracking of BOD5 and TSS are required for percent removal requirements found in s. NR 210.05, Wis. Adm. Code.

3 Surface Water - Monitoring and Limitations

Sample Point Number: 001- EFFLUENT

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Daily	Continuous	
BOD5, Total	Weekly Avg	23 mg/L	Daily	24-Hr Flow Prop Comp	Effective in January and February.
BOD5, Total	Weekly Avg	18 mg/L	Daily	24-Hr Flow Prop Comp	Effective in March.
BOD5, Total	Weekly Avg	17 mg/L	Daily	24-Hr Flow Prop Comp	Effective in April.
BOD5, Total	Weekly Avg	14 mg/L	Daily	24-Hr Flow Prop Comp	Effective in May and October.
BOD5, Total	Weekly Avg	11 mg/L	Daily	24-Hr Flow Prop Comp	Effective in June.

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
BOD5, Total	Weekly Avg	7.7 mg/L	Daily	24-Hr Flow Prop Comp	Effective in July.
BOD5, Total	Weekly Avg	8.8 mg/L	Daily	24-Hr Flow Prop Comp	Effective in August.
BOD5, Total	Weekly Avg	10 mg/L	Daily	24-Hr Flow Prop Comp	Effective in September.
BOD5, Total	Weekly Avg	19 mg/L	Daily	24-Hr Flow Prop Comp	Effective in November.
BOD5, Total	Weekly Avg	20 mg/L	Daily	24-Hr Flow Prop Comp	Effective in December.
BOD5, Total	Monthly Avg	23 mg/L	Daily	24-Hr Flow Prop Comp	Effective in January and February.
BOD5, Total	Monthly Avg	18 mg/L	Daily	24-Hr Flow Prop Comp	Effective in March.
BOD5, Total	Monthly Avg	17 mg/L	Daily	24-Hr Flow Prop Comp	Effective in April.
BOD5, Total	Monthly Avg	14 mg/L	Daily	24-Hr Flow Prop Comp	Effective in May and October.
BOD5, Total	Monthly Avg	11 mg/L	Daily	24-Hr Flow Prop Comp	Effective in June.
BOD5, Total	Monthly Avg	7.7 mg/L	Daily	24-Hr Flow Prop Comp	Effective in July.
BOD5, Total	Monthly Avg	8.8 mg/L	Daily	24-Hr Flow Prop Comp	Effective in August.
BOD5, Total	Monthly Avg	10 mg/L	Daily	24-Hr Flow Prop Comp	Effective in September.
BOD5, Total	Monthly Avg	19 mg/L	Daily	24-Hr Flow Prop Comp	Effective in November.
BOD5, Total	Monthly Avg	20 mg/L	Daily	24-Hr Flow Prop Comp	Effective in December.
Suspended Solids, Total	Weekly Avg	23 mg/L	Daily	24-Hr Flow Prop Comp	Effective in January and February.
Suspended Solids, Total	Weekly Avg	18 mg/L	Daily	24-Hr Flow Prop Comp	Effective in March.
Suspended Solids, Total	Weekly Avg	17 mg/L	Daily	24-Hr Flow Prop Comp	Effective in April.

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Suspended Solids, Total	Weekly Avg	14 mg/L	Daily	24-Hr Flow Prop Comp	Effective in May and October.
Suspended Solids, Total	Weekly Avg	11 mg/L	Daily	24-Hr Flow Prop Comp	Effective in June.
Suspended Solids, Total	Weekly Avg	10 mg/L	Daily	24-Hr Flow Prop Comp	Effective in July - September.
Suspended Solids, Total	Weekly Avg	19 mg/L	Daily	24-Hr Flow Prop Comp	Effective in November.
Suspended Solids, Total	Weekly Avg	20 mg/L	Daily	24-Hr Flow Prop Comp	Effective in December.
Suspended Solids, Total	Monthly Avg	23 mg/L	Daily	24-Hr Flow Prop Comp	Effective in January and February.
Suspended Solids, Total	Monthly Avg	18 mg/L	Daily	24-Hr Flow Prop Comp	Effective in March.
Suspended Solids, Total	Monthly Avg	17 mg/L	Daily	24-Hr Flow Prop Comp	Effective in April.
Suspended Solids, Total	Monthly Avg	14 mg/L	Daily	24-Hr Flow Prop Comp	Effective in May and October.
Suspended Solids, Total	Monthly Avg	11 mg/L	Daily	24-Hr Flow Prop Comp	Effective in June.
Suspended Solids, Total	Monthly Avg	10 mg/L	Daily	24-Hr Flow Prop Comp	Effective in July - September.
Suspended Solids, Total	Monthly Avg	19 mg/L	Daily	24-Hr Flow Prop Comp	Effective in November.
Suspended Solids, Total	Monthly Avg	20 mg/L	Daily	24-Hr Flow Prop Comp	Effective in December.
pH Field	Daily Max	9.0 su	Daily	Grab	
pH Field	Daily Min	6.0 su	Daily	Grab	
Dissolved Oxygen	Daily Min	9.5 mg/L	Daily	Grab	Effective in January and February.
Dissolved Oxygen	Daily Min	9.0 mg/L	Daily	Grab	Effective March - May, November, and December.
Dissolved Oxygen	Daily Min	8.5 mg/L	Daily	Grab	Effective in June and October.
Dissolved Oxygen	Daily Min	8.0 mg/L	Daily	Grab	Effective July - September.
E. coli	Geometric	126 #/100 ml	Daily	Grab	Limit effective May

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
	Mean - Monthly				through September annually.
E. coli	% Exceedance	10 Percent	Monthly	Calculated	Limit effective May through September annually. See the 'E. coli Percent Limit' section permit below. Enter the result in the DMR on the last day of the month.
Nitrogen, Ammonia Variable Limit		mg/L	Daily	See Permit	Report the calculated variable ammonia limit of the DMR year-round. See 'Daily Maximum Ammonia Limits' permit section.
Nitrogen, Ammonia (NH3-N) Total	Daily Max - Variable	mg/L	Daily	24-Hr Flow Prop Comp	Report Ammonia effluent value on the DMR year-round.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	15 mg/L	Daily	24-Hr Flow Prop Comp	Effective in January and March.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	16 mg/L	Daily	24-Hr Flow Prop Comp	Effective in February.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	14 mg/L	Daily	24-Hr Flow Prop Comp	Effective in April and December.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	11 mg/L	Daily	24-Hr Flow Prop Comp	Effective in May and October.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	7.9 mg/L	Daily	24-Hr Flow Prop Comp	Effective in June.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	4.4 mg/L	Daily	24-Hr Flow Prop Comp	Effective in July.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	5.0 mg/L	Daily	24-Hr Flow Prop Comp	Effective in August.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	12 mg/L	Daily	24-Hr Flow Prop Comp	Effective in November.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	7.3 mg/L	Daily	24-Hr Flow Prop Comp	Effective in September.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	6.9 mg/L	Daily	24-Hr Flow Prop Comp	Effective in January.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	7.4 mg/L	Daily	24-Hr Flow Prop Comp	Effective in February.

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	7.6 mg/L	Daily	24-Hr Flow Prop Comp	Effective in March.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	8.1 mg/L	Daily	24-Hr Flow Prop Comp	Effective in April.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	5.6 mg/L	Daily	24-Hr Flow Prop Comp	Effective in May.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	3.8 mg/L	Daily	24-Hr Flow Prop Comp	Effective in June.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	2.0 mg/L	Daily	24-Hr Flow Prop Comp	Effective in July.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	2.2 mg/L	Daily	24-Hr Flow Prop Comp	Effective in August.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	3.2 mg/L	Daily	24-Hr Flow Prop Comp	Effective in September.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	5.0 mg/L	Daily	24-Hr Flow Prop Comp	Effective in October.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	5.8 mg/L	Daily	24-Hr Flow Prop Comp	Effective in November.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	6.2 mg/L	Daily	24-Hr Flow Prop Comp	Effective in December.
Phosphorus, Total	6-Month Avg	0.075 mg/L	Daily	24-Hr Flow Prop Comp	
Phosphorus, Total	Monthly Avg	0.225 mg/L	Daily	24-Hr Flow Prop Comp	
Phosphorus, Total	6-Month Avg	7.82 lbs/day	Daily	Calculated	
Chlorine, Total Residual	Daily Max	24 ug/L	Daily	Grab	Limit effective May - September and when chlorinating.
Chlorine, Total Residual	Weekly Avg	7.5 ug/L	Daily	Grab	Limit effective May - September and when chlorinating.
Chlorine, Total Residual	Monthly Avg	7.5 ug/L	Daily	Grab	Limit effective May - September and when chlorinating.
Chloride	Weekly Avg	590 mg/L	4/Week	24-Hr Flow Prop Comp	This is an interim limit effective May - November. See Chloride Variance section and the Schedules

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
					section for applicable chloride target value.
Chloride	Weekly Avg	620 mg/L	4/Week	24-Hr Flow Prop Comp	This is an interim limit effective December - April. See Chloride Variance section and the Schedules section for applicable chloride target value.
Chloride		lbs/day	4/Week	Calculated	
Nitrogen, Total Kjeldahl		mg/L	Quarterly	24-Hr Flow Prop Comp	
Nitrogen, Nitrite + Nitrate Total		mg/L	Quarterly	24-Hr Flow Prop Comp	
Nitrogen, Total		mg/L	Quarterly	Calculated	Total Nitrogen shall be calculated as the sum of reported values for Total Kjeldahl Nitrogen and Total Nitrite + Nitrate Nitrogen.
Cadmium, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	See 'Total Metals Analyses' and 'Sample Analysis' permit sections.
Chromium, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	See 'Total Metals Analyses' and 'Sample Analysis' permit sections.
Copper, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	See 'Total Metals Analyses' and 'Sample Analysis' permit sections.
Lead, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	See 'Total Metals Analyses' and 'Sample Analysis' permit sections.
Nickel, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	See 'Total Metals Analyses' and 'Sample Analysis' permit sections.
Zinc, Total Recoverable		ug/L	Quarterly	24-Hr Flow Prop Comp	See 'Total Metals Analyses' and 'Sample Analysis' permit sections.
Mercury, Total Recoverable		ng/L	Quarterly	Grab	See 'Mercury Monitoring' permit section.

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Acute WET		TUc	See Listed Qtr(s)	24-Hr Flow Prop Comp	Annual tests. See WET permit section.
Chronic WET	Monthly Avg	1.3 TUc	See Listed Qtr(s)	24-Hr Flow Prop Comp	Biannual tests. See WET permit section.
PFOS		ng/L	Monthly	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule in permit.
PFOA		ng/L	Monthly	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule in permit.
Temperature Maximum		deg F	Daily	Continuous	Monitoring in calendar year 2027. Dissipative cooling study in November 2027. See Dissipative Cooling Study schedule in permit.

Changes from Previous Permit

BOD₅, Total: Monthly average limits were added to the proposed permit to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code.

Suspended Solids, Total: Monthly average limits were added to the proposed permit to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code.

E. coli: Fecal coliform monitoring and limits have been replaced with Escherichia coli (E. coli) limits. E. coli limits of 126 #/100 ml as a monthly geometric mean that may not be exceeded and 410 #/100 ml as a daily maximum that may not be exceeded more than 10 percent of the time in any calendar month will apply.

Nitrogen – Ammonia: The variable daily maximum ammonia limit table has been expanded to include applicable limits at a lower effluent pH.

Phosphorus: The interim monthly average limit of 1.0 mg/L has been removed from the proposed permit.

Chlorine: Monthly average limits were added to the weekly average limits were added to the proposed permit to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code.

PFOS and PFOA: Monthly monitoring is included in the permit in accordance with s. NR 106.98(2)(a), Wis. Adm. Code.

Temperature: Daily continuous monitoring included for calendar year 2027 and a dissipative cooling study for November 2027.

Explanation of Limits and Monitoring Requirements

Monitoring Frequencies: Taking into consideration guidance and requirements in administrative code, effluent monitoring frequencies for the City of Brookfield’s permit were determined to be appropriate for pollutants that have final effluent limits in effect during this permit term.

Categorical Limits

BOD₅, Total Suspended Solids, pH, and Dissolved Oxygen: Standard municipal wastewater requirements for total suspended solids and pH are included based on ch. NR 210, Wis. Adm. Code, ‘Sewage Treatment Works’ requirements for discharges to fish and aquatic life streams. Tracking of BOD₅ and total suspended solids are required for percent removal requirements found in s. NR 210.05, Wis. Adm. Code and in the Standard Requirements section of the permit. Chapter NR 102, Wis. Adm. Code, ‘Water Quality Standards for Surface Waters’ also specifies requirements for pH for fish and aquatic life streams.

Water Quality Based Limits and Disinfection

Refer to the “Water Quality-Based Effluent Limitations for the City of Brookfield (Fox River Water Pollution Control Commission)” dated August 04, 2023 and prepared by Nicole Krueger, which was used for this reissuance.

E. coli: Revisions to bacteria surface water quality criteria to protect recreational uses and accompanying E. coli WPDES permit implementation procedures became effective May 1, 2020. The new rule requires that WPDES permits for facilities with required disinfection include monitoring for E. coli while facilities are disinfecting during the recreation period and establish effluent limitations for E. coli established in s. NR 210.06 (2), Wis. Adm Code. The administrative code rule changes included the following actions: revised the bacteria water quality criteria from fecal coliform to E. coli to protect recreation in ch. NR 102, Wis. Adm. Code.; removed fecal coliform criteria for certain individual waters from ch. NR 104, Wis. Adm. Code.; revised permit requirements for publicly and privately owned sewage treatment works in ch. NR 210, Wis. Adm. Code.; and, updated approved analytical methods for bacteria in ch. NR 219, Wis. Adm. Code. Additional data collected after the facility switched to a membrane filtration test method, they are able to meet E. coli limits upon reissuance therefore no schedule is needed.

Nitrogen – Ammonia: Current acute and chronic ammonia toxicity criteria for the protection of aquatic life are included in Tables 2C and 4B of ch. NR 105, Wis. Adm. Code. Subchapter IV of ch. NR 106 establishes the procedure for calculating water quality based effluent limitations (WQBELs) for ammonia. The variable daily maximum ammonia limit table has been expanded to include applicable limits at a lower effluent pH.

Phosphorus: Phosphorus requirements are based on the Phosphorus Rules that became effective 12/1/2010 as detailed in NR 102 Water Quality Standards and NR 217 Effluent Standards and Limitations for Phosphorus. Chapter NR 217 of the Wis. Adm. Code addresses point source dischargers of phosphorus to surface waters. The code categorically limits municipal dischargers of more than 150 pounds of phosphorus per month to 1.0 mg/L unless an alternative limit is approved. The monthly average limit of 1.0mg/L was removed because the monthly average WQBEL of 0.225 mg/L is more stringent. NR 217 also specifies WQBELs (water quality based effluent limits) for discharges of phosphorus to surface waters of the state from publicly and privately owned wastewater facilities. WQBELs for phosphorus are needed whenever the discharge contains phosphorus at concentrations or loadings that will cause or contribute to an exceedance of the water quality standards During the last permit term, s. 217.13 final limits went into effect. There is currently a TMDL in development for the Fox Illinois River for total phosphorus and total suspended solids.

Chlorine: Because chlorine is added as a disinfectant, effluent limitations are included to assure proper operation of the de-chlorination system. A monthly concentration limit of 7.5 ug/L was added to the proposed permit to meet the expression of limits requirements in s. NR 106.07, Wis. Adm. Code.

Chloride: The calculated 4-day P99 is above the applicable chronic limitation of 460 mg/L, so a chronic (weekly average) limit needs to be continued for the reissued permit. However, the permittee has re-applied for a variance from the chronic chloride water quality criterion, which requires EPA approval. An interim limit of 620 mg/L (December- April) and 590 mg/L (May-November) is included. As a condition of this variance target values of 560 mg/L (December-April) and 530 mg/L (May-November) and the implementation of chloride source reduction measures, intended to lead to compliance with the target value by the end of the permit term, are also included in the proposed permit. See the schedules section for the chloride compliance schedule. Acute and chronic chloride toxicity criteria for the protection of aquatic life are included in Tables 1 and 5 of ch. NR 105, Wis. Adm. Code; Subchapter IV of ch. NR 106 establishes the procedure for calculating water quality based effluent limitations (WQBELs) for chloride.

Chloride Source Reduction Measures:

1. Continue monitoring sites with greater than average chloride concentrations.
2. Continue gathering information about what type of softeners are in use.
3. Continue discussions with industries that have historically high chloride concentrations to communicate impacts of loadings to the POTW and encourage chloride reductions.
4. Continue salt brine application during winter road operations.
5. Identify and repair sanitary sewer system to reduce I/I & chlorides from snowmelt runoff.
6. City of Brookfield & contract communities sample/resample for chlorides in each of their wells.
7. Contract communities sample schools and laundromats.
8. Investigate the effectiveness of replacing a neighborhood's water softeners with demand-based softeners and compare the before and after results.
9. Contact retailers to find those who purchase large quantities of salt to track down the largest consumers for potential education and outreach.
10. Provide educational material on the City's Facebook page about DIR softeners and local water supply.
11. Provide educational material on the City's website and newsletter regarding ordinance 15.12.130E that new water softeners must be DIR.
12. Develop and propose a local ordinance change requiring a commercial and residential softener tune-up program, which involves qualified periodic servicing to ensure proper control settings and adjustments.
13. Implement a local limit for chloride and surcharge for exceedances.

Total Nitrogen Monitoring (TKN, Nitrite + Nitrate, Total N): The Department has included effluent monitoring for Total Nitrogen in the permit through the authority under §§ 283.55(1)(e), Wis. Stats., which allows the department to require the permittee to submit information necessary to identify the type and quantity of any pollutants discharged from the point source, and through s. NR 200.065(1)(h), Wis. Adm. Code, which allows for this monitoring to be collected during the permit term. Quarterly effluent monitoring for Total Nitrogen is included in the permit because of the potential for higher nitrogen loading resulting from higher flows (major facilities), higher concentrations, or both. More information on the justification to include total nitrogen monitoring in wastewater permits can be found in the "Guidance for Total Nitrogen Monitoring in Wastewater Permits" dated October 1, 2019.

As recommended in the Department's October 1, 2019, Guidance for Total Nitrogen Monitoring in Wastewater Permits, quarterly total nitrogen monitoring is recommended for all municipal major permittees. Total Nitrogen is the sum of nitrate, nitrite, and total kjeldahl nitrogen.

Cadmium, Chromium, Copper, Lead, Nickel, Zinc: Since Brookfield is a control authority subject to state and federal pretreatment requirements, the proposed permit will continue to include monitoring of effluent for cadmium, chromium, copper, lead, nickel and zinc.

Mercury: Representative data shows there is no reasonable potential for Brookfield to exceed the water quality-based 1.3 ng/L monthly average limit, therefore no mercury limit is in the proposed permit. Quarterly mercury monitoring is retained in the proposed permit. Requirements for mercury are included in s. NR 106.145, Wis. Adm. Code

Whole Effluent Toxicity (Acute and Chronic): Whole effluent toxicity (WET) testing requirements are determined in accordance with ss. NR 106.08 and NR 106.09 Wis. Adm. Code, as revised August 2016. (See the current version of the Whole Effluent Toxicity Program Guidance Document and checklist and WET information, guidance and test methods at <http://dnr.wi.gov/topic/wastewater/wet.html>). Annual acute monitoring is required because Brookfield is a major discharger with a design flow of greater than 1 MGD. Two times yearly chronic WET tests and a limit (monthly average limit of 1.3 TCu) are required because to the WET Checklist Summary and NR 106.08.

PFOS/PFOA: NR 106 Subchapter VIII – Permit Requirements for PFOS and PFOA Dischargers became effective on August 1, 2022. At the first reissuance of a WPDES permit after August 1, 2022, the new rule requires WPDES permits for major municipal dischargers, with an average flow rate greater than or equal to 5 MGD, at a minimum sample effluent on a monthly basis for PFOS and PFOA pursuant s. NR 106.98(2)(a), Wis. Adm. Code. The initial determination of the need for sampling shall be conducted for up to two years in order to determine if the permitted discharge has the

reasonable potential to cause or contribute to an exceedance of the PFOS or PFOA standards under s. NR 102.04(8)(d)1, Wis. Adm. Code.

Temperature: Requirements for Temperature are included in NR 102 Subchapter II Water Quality Standards for Temperature and NR 106 Subchapter V Effluent Limitations for Temperature. Thermal discharges must meet the Public Health criterion of 120 degrees F and the Fish & Aquatic Life criteria which are established to protect aquatic communities from lethal and sub-lethal thermal effects. The 2002 mixing zone study was reevaluated as part of this permit reissuance and was conditional approved as a dissipative cooling study in March 2024. Part of the conditional approval is to perform the study again according to s. NR 106.59, Wis. Adm. Code and Chapter 11 of the ‘Guidance for Implementation of Wisconsin’s Thermal Water Quality Standards’ (dated August 19, 2013) during the month of November. Monitoring is required in year 2027 and a dissipative cooling study is needed for November 2027 – see Schedule Section.

Sample Point Number: 010- OVERFLOW

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Volume		MGD	Per Occurrence	Estimated	
E. coli		#/100 ml	Per Occurrence	Grab	

Changes from Previous Permit

Sample Point 010 has been added for tracking potential sanitary sewer overflows (SSOs).

Explanation of Limits and Monitoring Requirements

Sample point 010 is intended to track any discharge of untreated wastewater through the overflow structure. Any discharge of untreated wastewater through the overflow structure to surface water is deemed a Sanitary Sewer Overflow (SSO) and is prohibited. In addition to the ‘Volume’ and ‘E. coli’ monitoring requirements shown above, the permittee shall report any discharges through any of these overflow structures to surface water as required by Standard Requirements permit subsection ‘Sanitary Sewage Overflows’.

The estimated ‘Volume’ of the overflow and results of ‘E. coli’ monitoring are to be reported on the Discharge Monitoring Reports.

4 Land Application - Monitoring and Limitations

Municipal Sludge Description						
Sample Point	Sludge Class (A or B)	Sludge Type (Liquid or Cake)	Pathogen Reduction Method	Vector Attraction Method	Reuse Option	Amount Reused/Disposed (Dry Tons/Year)
004	Class B	Liquid	Anaerobic Digestion	Volatile Solids Reduction and Injection	Land Application	1,174 dry tons/year

Municipal Sludge Description						
Sample Point	Sludge Class (A or B)	Sludge Type (Liquid or Cake)	Pathogen Reduction Method	Vector Attraction Method	Reuse Option	Amount Reused/Disposed (Dry Tons/Year)
				when land applied		
Does sludge management demonstrate compliance? Yes						
Is additional sludge storage required? No						
Is Radium-226 present in the water supply at a level greater than 2 pCi/liter? Yes						
If yes, special monitoring and recycling conditions will be included in the permit to track any potential problems in landapplying sludge from this facility						
Is a priority pollutant scan required? No, it was completed in 2019.						
Priority pollutant scans are required once every 10 years at facilities with design flows between 5 MGD and 40 MGD, and once every 5 years if design flow is greater than 40 MGD.						

Sample Point Number: 004- Liquid Sludge

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Solids, Total		Percent	Quarterly	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Quarterly	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	Quarterly	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	Quarterly	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	Quarterly	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	Quarterly	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	Quarterly	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	Quarterly	Composite	
Lead Dry Wt	High Quality	300 mg/kg	Quarterly	Composite	
Mercury Dry Wt	Ceiling	57 mg/kg	Quarterly	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	Quarterly	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	Quarterly	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	Quarterly	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	Quarterly	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	Quarterly	Composite	

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Selenium Dry Wt	High Quality	100 mg/kg	Quarterly	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Quarterly	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	Quarterly	Composite	
Nitrogen, Ammonium (NH ₄ -N) Total		Percent	Quarterly	Composite	
Nitrogen, Total Kjeldahl		Percent	Quarterly	Composite	
Phosphorus, Total		Percent	Quarterly	Composite	
Phosphorus, Water Extractable		% of Tot P	Quarterly	Composite	
Potassium, Total Recoverable		Percent	Quarterly	Composite	
Radium 226 Dry Wt		pCi/g	Annual	Composite	
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	Sample in 2025.
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	Sample in 2025.
PFOA + PFOS		ug/kg	Annual	Calculated	Report the sum of PFOA and PFOS. See PFAS Permit Sections for more information.

Changes from Previous Permit:

PCB: Updated monitoring year to 2025.

PFAS: Annual monitoring is included in the permit pursuant s. NR 204.06(2)(b)9, Wis. Adm. Code.

Priority pollutant scan: Removed since it was completed in 2019.

Explanation of Limits and Monitoring Requirements

Requirements for land application of municipal sludge are determined in accordance with ch. NR 204 Wis. Adm. Code. Ceiling and high quality limits for metals in sludge are specified in s. NR 204.07(5). Requirements for pathogens are specified in s. NR 204.07(6) and in s. NR 204.07 (7) for vector attraction requirements. Limitations for PCBs are addressed in s. NR 204.07(3)(k). Radium requirements are addressed in s. NR 204.07(3)(n).

PFAS: The presence and fate of PFAS in municipal and industrial sludges is an emerging public health concern. EPA is currently developing a risk assessment to determine future land application rates and expects to release this risk assessment by the end of 2024. In the interim, the department has developed the “Interim Strategy for Land Application of Biosolids and Industrial Sludges Containing PFAS”.

Water Extractable Phosphorus- Water extractable phosphorus (WEP) is the coefficient for determining plant available phosphorus from measured total phosphorus. In Wisconsin, the Penn State Method is utilized and is expressed in percent. While a total P may be significant, the WEP may show that only a small percentage of the P is available to plants because of factors such as treatment processes and chemical addition that “tie-up” phosphorus limiting the amount of phosphorus

that is plant available. As part of the Wisconsin's nutrient management plan (NMP) requirements, the accounting of all fertilizers must be included over the NMP cycle. The fertilizer value of the waste needs to be communicated to the farmer and accounted for in the NMP.

5 Schedules

5.1 Dissipative Cooling Study

Required Action	Due Date
<p>Complete Dissipative Cooling Study: Submit Dissipative Cooling Study: An updated dissipative cooling study for the existing outfall meeting the following requirements shall be submitted by the date due for determining the need for sub-lethal effluent limitations at the time of next permit reissuance: 1) A written description of the physical characteristics of the receiving water or outfall that encourage rapid dilution, diffusion, dispersion, or dissipation of heat; 2) A written description of the presence or absence of other thermal loads to the receiving stream; 3) The minimum and maximum effluent temperature for each calendar week monitored.</p> <p>Note: Only the month of November has the potential for thermal limit exceedances; therefore the dissipative cooling study shall be conducted in November.</p> <p>The study shall also include any site-specific information collected as part of the study, including: 1) Information regarding the biological quality of the animal and plant community of the receiving water including, but not limited to, species composition, richness, diversity, density, distribution, age structure, spawning incidence, and presence of any state or federally listed threatened or endangered species; 2) Data concerning the physical characteristics of the receiving water or permitted outfalls that encourage rapid dilution, diffusion, dispersion, and/or dissipation of heat; 3) The minimum and maximum temperature of the receiving water upstream of all permitted outfalls for each calendar month monitored.</p>	03/01/2028

5.1.1 Explanation of Dissipative Cooling Study Schedule

Brookfield performed a mixing zone study in September 2002 which demonstrated 100% mixing with the receiving water. The previous WQBEL evaluations used the conclusion of this study to evaluate dissipative cooling and did not recommend temperature limits. However, the mixing zone study was not completed during the month of November when a limit is needed and did not include all necessary items required to approve a dissipative cooling study. Therefore, a dissipative cooling study shall be completed during the month of November when a weekly average limit is needed. Monitoring only is recommended for the rest of the months of 2027.

5.2 Chloride Source Reduction Measures (Target Value)

As a condition of the variance to the water quality based effluent limitation(s) for chloride granted in accordance with s. NR 106.83(2), Wis. Adm. Code, the permittee shall perform the following actions.

Required Action	Due Date
<p>Annual Chloride Progress Report: Submit an annual chloride progress report related to the source reduction activities for the previous year. The annual chloride progress report shall:</p> <p>Indicate which chloride source reduction measures or activities in the Source Reduction Plan have</p>	01/31/2025

<p>been implemented and state which, if any, source reduction measures from the Source Reduction Plan were not pursued and why. Include an assessment of whether each implemented source reduction measure appears to be effective or ineffective at reducing pollutant discharge concentrations and identify actions planned for the upcoming year;</p> <p>Include an analysis of trends in weekly, monthly and annual average chloride concentrations and total mass discharge of chloride based on chloride sampling and flow data; and</p> <p>Include an analysis of how effluent chloride varies with time and with significant loadings of chloride. Note that the interim limitation listed in the Surface Water section of this permit remains enforceable until new enforceable limits are established in the next permit issuance.</p> <p>The first annual chloride progress report is to be submitted by the Date Due.</p>	
<p>Annual Chloride Progress Report #2: Submit the chloride progress report, related to the source reduction activities for the previous year, as defined above.</p>	01/31/2026
<p>Annual Chloride Progress Report #3: Submit the chloride progress report, related to the source reduction activities for the previous year, as defined above.</p>	01/31/2027
<p>Annual Chloride Progress Report #4: Submit the chloride progress report, related to the source reduction activities for the previous year, as defined above.</p>	01/31/2028
<p>Final Chloride Report: Submit the final chloride report documenting the success in meeting the chloride target value of 560 mg/L December - April and 530 mg/L May - November as well as the anticipated future reduction in chloride sources and chloride effluent concentrations.</p> <p>The report shall:</p> <p>Summarize chloride source reduction measures that have been implemented during the current permit term and state which, if any, source reduction measures from the Source Reduction Plan were not pursued and why;</p> <p>Include an assessment of which source reduction measures appear to have been effective or ineffective. Evaluate any needed changes to the pollutant reduction strategy accordingly;</p> <p>Include an analysis of trends in weekly, monthly and annual average chloride concentrations and total mass discharge of chloride based on chloride sampling and flow data during the current permit term; and</p> <p>Include an analysis of how influent and effluent chloride varies with time and with significant loadings of chloride as identified in the source reduction plan.</p> <p>If the permittee intends to reapply for a chloride variance, for the reissued permit, proposed target limits and a detailed source reduction measures plan, outlining the source reduction activities proposed for the upcoming permit term, shall also be included per ss. NR 106.90 (5) and NR 106.83 (4), Wis. Adm. Code. An updated source reduction measures plan shall:</p> <p>Include an explanation of why or how each source reduction measure will result in reduced discharge of the target pollutant; and</p> <p>Evaluate any available information on pollutant sources, timing, and concentration to update the mass balance assumptions and expected sources of the pollutant, and</p> <p>Identify any information needs that would help to better determine pollutant sources and make plans to collect that information.</p> <p>Note that the target value is the benchmark for evaluating the effectiveness of the chloride source reduction measures but is not an enforceable limitation under the terms of this permit.</p>	01/31/2029

Annual Chloride Reports After Permit Expiration: In the event that this permit is not reissued by the date the permit expires the permittee shall continue to submit annual chloride reports for the previous year following the due date of Annual Chloride Progress Reports listed above. Annual Chloride Progress Reports shall include the information as defined above.	
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5.2.1 Explanation of Chloride Source Reduction Measures Schedule

This compliance schedule is a condition of receiving a variance from the chronic water quality based chloride limit of 460 mg/L. Since a compliance schedule is being granted, an interim limit is required, and for Brookfield the limits are established as 620 mg/L (December-April) and 590 mg/L (May-November). The schedule requires that annual reports shall indicate which source reduction measures Brookfield has implemented during each calendar year, and an analysis of chloride concentration and mass discharge data based on chloride sampling and flow data. The annual reports shall document progress made towards meeting the chloride target value of 560 mg/L (December-April) and 530mg/L (May-November) by the end of the permit term.

5.3 PFOS/PFOA Minimization Plan Determination of Need

Required Action	Due Date
<p>Report on Effluent Discharge: Submit a report on effluent PFOS and PFOA concentrations and include an analysis of trends in monthly and annual average PFOS and PFOA concentrations. This analysis should also include a comparison to the applicable narrative standard in s. NR 102.04(8)(d), Wis. Adm. Code.</p> <p>This report shall include all additional PFOS and PFOA data that may be collected including any influent, intake, in-plant, collection system sampling, and blank sample results.</p>	10/01/2025
<p>Report on Effluent Discharge and Evaluation of Need: Submit a final report on effluent PFOS and PFOA concentrations and include an analysis of trends in monthly and annual average PFOS and PFOA concentrations of data collected over the last 24 months. The report shall also provide a comparison on the likelihood of the facility needing to develop a PFOS/PFOA minimization plan.</p> <p>This report shall include all additional PFOS and PFOA data that may be collected including any influent, intake, in-plant, collection system sampling, and blank sample results.</p> <p>The permittee shall also submit a request to the department to evaluate the need for a PFOS/PFOA minimization plan.</p> <p>If the Department determines a PFOS/PFOA minimization plan is needed based on a reasonable potential evaluation, the permittee will be required to develop a minimization plan for Department approval no later than 90 days after written notification was sent from the Department. The Department will modify or revoke and reissue the permit to include PFOS/PFOA minimization plan reporting requirements along with a schedule of compliance to meet WQBELs. Effluent monitoring of PFOS and PFOA shall continue as specified in the permit until the modified permit is issued.</p> <p>If, however, the Department determines there is no reasonable potential for the facility to discharge PFOS or PFOA above the narrative standard in s. NR 102.04(8)(d), Wis. Adm. Code, no further action is required and effluent monitoring of PFOS and PFOA shall continue as specified in the permit.</p>	10/01/2026

5.3.1 Explanation of PFOS/PFOA Minimization Plan Determination of Need Schedule

As stated above, NR 106 Subchapter VIII – Permit Requirements for PFOS and PFOA Dischargers became effective on August 1, 2022. S. NR 106.98, Wis. Adm. Code, specifies steps to generate data in order to determine the need for reducing PFOS and PFOA in the discharge. Data generated per the effluent monitoring requirements will be used to determine the need for developing a PFOS/PFOA minimization plan. As part of the schedule, the permittee is required to submit two annual Reports on Effluent Discharge.

Special Reporting Requirements

None.

Other Comments:

None.

Attachments:

Water Quality Based Effluent Limits, dated August 04, 2023, updated April 19, 2024, prepared by Nicole Krueger, Effluent Limits Calculator

Chloride Variance Documents

Chloride SRM dated February 5, 2024

EPA Data Sheet

Expiration Date:

September 30, 2029

Justification Of Any Waivers From Permit Application Requirements

No waivers were requested from permit application monitoring and reporting requirements.

Prepared By: Victoria Ziegler

Wastewater Specialist

Date: March 11, 2024

CORRESPONDENCE/MEMORANDUM

DATE: 08/04/2023 – updated 04/19/2024 per facility comments

TO: Melanie Burns – SER

FROM: Nicole Krueger – SER *Nicole Krueger*

SUBJECT: Water Quality-Based Effluent Limitations for the City of Brookfield (Fox River Water Pollution Control Commission)
 WPDES Permit No. WI-0023469-10

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from Brookfield in Waukesha County. This municipal wastewater treatment facility (WWTF) discharges to the Fox (IL) River, located in the Upper Fox (IL) River Watershed in the Upper Fox (IL) Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

The following recommendations are made on a chemical-specific basis at Outfall 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD ₅						3
January – February			23 mg/L	23 mg/L		
March			18 mg/L	18 mg/L		
April			17 mg/L	17 mg/L		
May			14 mg/L	14 mg/L		
June			11 mg/L	11 mg/L		
July			7.7 mg/L	7.7 mg/L		
August			8.8 mg/L	8.8 mg/L		
September			10 mg/L	10 mg/L		
October			14 mg/L	14 mg/L		
November			19 mg/L	19 mg/L		
December			20 mg/L	20 mg/L		
TSS						3,4
January – February			23 mg/L	23 mg/L		
March			18 mg/L	18 mg/L		
April			17 mg/L	17 mg/L		
May			14 mg/L	14 mg/L		
June			11 mg/L	11 mg/L		
July			10 mg/L	10 mg/L		
August			10 mg/L	10 mg/L		
September			10 mg/L	10 mg/L		
October			14 mg/L	14 mg/L		
November			19 mg/L	19 mg/L		
December			20 mg/L	20 mg/L		
pH	9.0 s.u.	6.0 s.u.				1
Dissolved Oxygen						1
January – February		9.5 mg/L				
March – May, Nov – Dec		9.0 mg/L				

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
June and October July – September		8.5 mg/L 8.0 mg/L				
Bacteria						5
Interim Limit Fecal Coliform				400 #/100 mL geometric mean		
Final Limit <i>E. coli</i>				126 #/100 mL geometric mean		
Ammonia Nitrogen	Variable		Table	Table		6
Phosphorus				0.225 mg/L	0.075 mg/L 7.82 lbs/day	1,4
Residual Chlorine	24 µg/L		7.5 µg/L	7.5 µg/L		3
Chloride			460 mg/L			1,7
PFOS and PFOA						8
TKN, Nitrate+Nitrite, and Total Nitrogen						9
Mercury						1,2
Acute WET						10,11
Chronic WET				1.3 TUc		10,11
Temperature						12

Footnotes:

1. No changes from the current permit.
2. Monitoring only.
3. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code, are included in bold.
4. A Total Maximum Daily Load (TMDL) is being developed for the Fox (IL) River Basin to address phosphorus and TSS water quality impairments within the TMDL area. This TMDL will likely result in limitations for phosphorus and TSS that must be included in WPDES permits, which may be different than those calculated for this reissuance. TMDL-derived limits may be included in lieu of or in addition to the calculated limits upon permit reissuance or modification once the TMDL has been approved by U.S. EPA, according to s. NR 217.16, Wis. Adm. Code.
5. Bacteria limits apply during the disinfection season of May through September. The fecal coliform interim limit will apply until the end of the compliance schedule when *E. coli* limits take effect. Additional final limit: No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 count/100 mL.
6. The following tables summarize the variable daily maximum, and weekly and monthly average limits:

Daily Maximum Limits

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
6.0 ≤ pH ≤ 6.1	69	7.0 < pH ≤ 7.1	42	8.0 < pH ≤ 8.1	8.9
6.1 < pH ≤ 6.2	68	7.1 < pH ≤ 7.2	38	8.1 < pH ≤ 8.2	7.3
6.2 < pH ≤ 6.3	66	7.2 < pH ≤ 7.3	33	8.2 < pH ≤ 8.3	6.0
6.3 < pH ≤ 6.4	65	7.3 < pH ≤ 7.4	29	8.3 < pH ≤ 8.4	4.9
6.4 < pH ≤ 6.5	62	7.4 < pH ≤ 7.5	25	8.4 < pH ≤ 8.5	4.1
6.5 < pH ≤ 6.6	60	7.5 < pH ≤ 7.6	22	8.5 < pH ≤ 8.6	3.4

6.6 < pH ≤ 6.7	57	7.6 < pH ≤ 7.7	18	8.6 < pH ≤ 8.7	2.8
6.7 < pH ≤ 6.8	54	7.7 < pH ≤ 7.8	15	8.7 < pH ≤ 8.8	2.3
6.8 < pH ≤ 6.9	50	7.8 < pH ≤ 7.9	13	8.8 < pH ≤ 8.9	2.0
6.9 < pH ≤ 7.0	46	7.9 < pH ≤ 8.0	11	8.9 < pH ≤ 9.0	1.7

Weekly and Monthly Average Limits

	Weekly Average mg/L	Monthly Average mg/L
January	15	6.9
February	16	7.4
March	15	7.6
April	14	8.1
May	11	5.6
June	7.9	3.8
July	4.4	2.0
August	5.0	2.2
September	7.3	3.2
October	11	5.0
November	12	5.8
December	14	6.2

7. This is the WQBEL for chloride. Alternative effluent limits of 590 mg/L for May – November and 620 mg/L for December – April (based on previous 4-day P₉₉ data) as weekly averages may be included in the permit in place of this limit if the chloride variance application that was submitted is approved by EPA. If the variance is not approved, a mass limit of 48,000 lbs/day and a wet weather mass limit of 108,000 lbs/day would also be required.
8. Monthly monitoring is required in accordance with s. NR 106.98(2), Wis. Adm. Code.
9. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, quarterly total nitrogen monitoring is recommended for all municipal major permittees. Total Nitrogen is the sum of nitrate (NO₃), nitrite (NO₂), and total kjeldahl nitrogen (TKN) (all expressed as N).
10. 1x yearly acute and 2x yearly chronic WET monitoring is recommended. The Instream Waste Concentration (IWC) to assess chronic test results is 74% According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 75%, 50%, 25% & 12.5% and the dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the Fox (IL) River.
11. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Tests should be done in rotating quarters, to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).
12. A dissipative cooling study for November should be completed during the permit term.

Continued monitoring for total recoverable cadmium, chromium, copper, lead, nickel and zinc is also required because Brookfield operates a local pretreatment program for the many industries that discharge to the treatment facility.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Nicole Krueger at Nicole.Krueger@wisconsin.gov Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (4) – Narrative, Thermal Table, Outfall Map, and 2007 Ammonia Limits Calculations

PREPARED BY: Nicole Krueger, Water Resources Engineer – SER

E-cc: Nick Lent, Wastewater Engineer – SER

Bryan Hartsook, Regional Wastewater Supervisor – SER

Diane Figiel, Water Resources Engineer – WY/3

Kari Fleming, Environmental Toxicologist – WY/3

Michael Polkinghorn, Water Resources Engineer – NOR/Rhineland Service Center

Laura Dietrich, Wastewater Specialist – WY/Waukesha

Attachment #1
**Water Quality-Based Effluent Limitations for
 City of Brookfield**

WPDES Permit No. WI-0023469-11

Prepared by: Nicole Krueger

PART 1 – BACKGROUND INFORMATION

Facility Description

The City of Brookfield (Fox River Water Pollution Control Commission) operates a 12.5 MGD activated sludge wastewater treatment facility. The plant serves approximately 52,000 people and 10 significant industries. Treatment consists of fine screening, grit removal, primary clarification, biological nutrient removal, secondary clarification, tertiary filtration, disinfection via chlorination and dechlorination and aeration before effluent is discharged to the Fox (IL) River. Biosolids processes include anaerobic digestion, gravity belt thickening, and storage before being land applied onto Department approved agricultural fields.

Attachment #2 is a map of the area showing the approximate location of Outfall 001.

Existing Permit Limitations

The current permit, expiring on 12/31/2023, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1
BOD ₅						
January – February			23 mg/L			
March			18 mg/L			
April			17 mg/L			
May			14 mg/L			
June			11 mg/L			
July			7.7 mg/L			
August			8.8 mg/L			
September			10 mg/L			
October			14 mg/L			
November			19 mg/L			
December			20 mg/L			
TSS						
January – February			23 mg/L			
March			18 mg/L			
April			17 mg/L			
May			14 mg/L			
June			11 mg/L			
July			10 mg/L			
August			10 mg/L			
September			10 mg/L			

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
October November December			14 mg/L 19 mg/L 20 mg/L			
pH	9.0 s.u.	6.0 s.u.				2
Dissolved Oxygen January – February March – May, Nov – Dec June and October July – September		9.5 mg/L 9.0 mg/L 8.5 mg/L 8.0 mg/L				
Fecal Coliform May – September			972#/100 mL geometric mean	400#/100 mL geometric mean		3
Ammonia Nitrogen	Variable		Table	Table		4
Phosphorus Interim Final				1.0 mg/L 0.225 mg/L	0.075 mg/L 7.82 lbs/day	5
Residual Chlorine Chloride May – November December – April	38 µg/L		7.5 µg/L	7.5 µg/L		3
TKN, Nitrate+Nitrite, and Total Nitrogen						1
Mercury						1
Acute WET						6
Chronic WET				1.3 TUc		6
Temperature						1

Footnotes:

1. Monitoring only.
2. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
3. Limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code, are included in bold.
4. The following tables summarize the variable daily maximum, and weekly and monthly average limits:

Daily Maximum Limits

Effluent pH, s.u.	NH ₃ -N mg/L	Effluent pH, s.u.	NH ₃ -N mg/L	Effluent pH, s.u.	NH ₃ -N mg/L
6.0 < pH ≤ 6.1	108	7.0 < pH ≤ 7.1	66	8.0 < pH ≤ 8.1	14
6.1 < pH ≤ 6.2	106	7.1 < pH ≤ 7.2	59	8.1 < pH ≤ 8.2	11
6.2 < pH ≤ 6.3	104	7.2 < pH ≤ 7.3	52	8.2 < pH ≤ 8.3	9.4
6.3 < pH ≤ 6.4	101	7.3 < pH ≤ 7.4	46	8.3 < pH ≤ 8.4	7.8

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6.4 < pH ≤ 6.5	98	7.4 < pH ≤ 7.5	40	8.4 < pH ≤ 8.5	6.4
6.5 < pH ≤ 6.6	94	7.5 < pH ≤ 7.6	34	8.5 < pH ≤ 8.6	5.3
6.6 < pH ≤ 6.7	89	7.6 < pH ≤ 7.7	29	8.6 < pH ≤ 8.7	4.4
6.7 < pH ≤ 6.8	84	7.7 < pH ≤ 7.8	24	8.7 < pH ≤ 8.8	3.7
6.8 < pH ≤ 6.9	78	7.8 < pH ≤ 7.9	20	8.8 < pH ≤ 8.9	3.1
6.9 < pH ≤ 7.0	72	7.9 < pH ≤ 8.0	17	8.9 < pH ≤ 9.0	2.6

Weekly and Monthly Average Limits

	Weekly Average mg/L	Monthly Average mg/L
January	15	6.9
February	16	7.4
March	15	7.6
April	14	8.1
May	11	5.6
June	7.9	3.8
July	4.4	2
August	5.0	2.2
September	7.3	3.2
October	11	5
November	12	5.8
December	14	6.2

5. The final phosphorus limits became effective October 1, 2021.
6. Acute and chronic WET testing is required annually. The IWC for chronic WET was 74%.

Monitoring for total recoverable cadmium, chromium, copper, lead, nickel and zinc is also required because Brookfield operates a local pretreatment program for the many industries that discharge to the treatment facility.

Receiving Water Information

- Name: Fox (IL) River
- Waterbody Identification Code (WBIC): 742500
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q₁₀ and 7-Q₂ values are from USGS for Station #05548300 updated on 01/14/2022, where Outfall 001 is located.

7-Q₁₀ = 6.7 cfs (cubic feet per second)

7-Q₂ = 12 cfs

90-Q₁₀ = 10.2 cfs

Harmonic Mean Flow = cfs using a drainage area of 22.9 mi²

The Harmonic Mean has been estimated based on average flow and the 7-Q₁₀ using an equation from U.S. EPA's *Technical Support Document for Water Quality-Based Toxics Control* (March 1991, EPA/505/2-90-001, pgs. 88-89).

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
7-Q ₁₀ (cfs)	12	12	20	30	18	12	9.3	9.0	8.0	10	14	12
7-Q ₂ (cfs)	24	27	47	56	39	26	20	17	18	22	28	25

The low flows used in the previous evaluation (2018) were:

7-Q₁₀ = 2.2 cfs

7-Q₂ = 4.8 cfs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
7-Q ₁₀ (cfs)	3.6	4.7	10	20	10	6.5	3.4	3.2	2.8	3.4	4.9	4.0
7-Q ₂ (cfs)	7.8	10.2	21.8	43.6	21.8	14.2	7.4	7.0	6.1	7.4	10.7	8.7

- Hardness = 303 mg/L as CaCO₃. This value represents the geometric mean of data from 06/12/2022 – 09/27/2022 from chronic WET testing.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: 100% from a mixing zone study conducted in September 2002.
- Source of background concentration data: Metals data from the Fox (IL) River in Waukesha County is used for this evaluation. Upstream chloride data was collected by Brookfield. The numerical values are shown in the tables below. If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations. Background data for calculating effluent limitations for ammonia nitrogen are described later.
- Multiple dischargers: There are several other dischargers to the Fox (IL) River, however they are not in the immediate vicinity and the mixing zones do not overlap. Therefore, the other dischargers do not impact this evaluation.
- Impaired water status: The immediate receiving water is 303(d) listed as impaired for total phosphorus, total suspended solids, and PCBs.

Effluent Information

- Design flow rate(s):
 - Annual average = 12.5 MGD (Million Gallons per Day)
 - Peak daily = 31.25 MGD
 - Peak weekly = 28.1 MGD
 - Peak monthly = 20.0 MGD
- For reference, the actual average flow from 01/01/2019 – 04/30/2023 was 9.49 MGD.
- Hardness = 467 mg/L as CaCO₃. This value represents the geometric mean of data from the permit reissuance application from 02/16/2023 – 02/25/2023.
- Acute dilution factor used in accordance with s. NR 106.06(3)(c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water source: Domestic wastewater with water supply from wells with wastewater from 7 significant industrial contributors.
- Additives: Aluminum sulfate and a polymer are used for phosphorus removal, sodium hypochlorite is used for disinfection, and sodium bisulfite is used for dechlorination.
- Effluent characterization: This facility is categorized as a major municipal, so the permit application required effluent sample analyses for all the “priority pollutants” except for the Dioxins and Furans as specified in s. NR 200.065, Table 1, Wis. Adm. Code. The permit-required monitoring for Cd, Cl, Cr,

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Cu, Pb, Ni, Hg and Zn is used in this evaluation.

- Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled “MEAN EFFL. CONC.”. Otherwise, substances with multiple effluent data are shown in the tables below or in their respective parts in this evaluation.

Effluent Data

	Chloride mg/L		Cadmium µg/L**
1-day P ₉₉	733	1-day P ₉₉	
4-day P ₉₉	629	4-day P ₉₉	
30-day P ₉₉	568	30-day P ₉₉	
Mean	536	Mean*	0.02
Std	74.7	Std	
Sample size	219	Sample size	17
Range	270 – 825	Range	<0.19 – 0.31
	Chromium µg/L***		Copper µg/L
1-day P ₉₉		1-day P ₉₉	15.5
4-day P ₉₉		4-day P ₉₉	11.8
30-day P ₉₉		30-day P ₉₉	9.74
Mean*	0.0	Mean	8.69
Std		Std	2.34
Sample size	17	Sample size	17
Range	<0.83 - <1.10	Range	4.9 – 13
	Lead µg/L***		Nickel µg/L**
1-day P ₉₉		1-day P ₉₉	
4-day P ₉₉		4-day P ₉₉	
30-day P ₉₉		30-day P ₉₉	
Mean*	0.0	Mean*	6.47
Std		Std	10.9
Sample size	17	Sample size	17
Range	<4.3	Range	<1.2 – 34
	Mercury ng/L		Zinc µg/L
1-day P ₉₉	0.72	1-day P ₉₉	42.1
4-day P ₉₉	0.55	4-day P ₉₉	32.4
30-day P ₉₉	0.46	30-day P ₉₉	27.1
Mean	0.41	Mean*	24.4
Std	0.11	Std	6.12
Sample size	17	Sample size	17
Range	0.2 – 0.59	Range	14 – 36

* Results below the level of detection (LOD) were included as zeroes in calculation of average.

**There were less than 11 detected results.

***No detected results.

The following table presents the average concentrations and loadings at Outfall 001 from 01/01/2019 – 04/30/2023 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6), Wis. Adm. Code:

Parameter Averages with Limits

	Average Measurement	Average Mass Discharged
BOD ₅	1.94 mg/L*	
TSS	1.54 mg/L*	
pH field	7.7 s.u.	
Phosphorus	0.40 mg/L	33 lbs/day
Ammonia Nitrogen	0.09 mg/L*	
Chloride	536 mg/L	41,377 lbs/day
Chlorine	0.42 µg/L*	
Dissolved Oxygen	9.6 mg/L	

*Results below the level of detection (LOD) were included as zeroes in calculation of average.

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P₉₉) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q₁₀

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Code, (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q₁₀ receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards. The mass balance equation is provided below.

$$\text{Limitation} = \frac{(\text{WQC}) (Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)}{Q_e}$$

Where:

WQC = Acute toxicity criterion or secondary acute value according to ch. NR 105, Wis. Adm. Code.

Q_s = average minimum 1-day flow which occurs once in 10 years (1-day Q₁₀)
 if the 1-day Q₁₀ flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q₁₀).

Q_e = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

C_s = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e), Wis. Adm. Code.

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If the receiving water is effluent dominated under low stream flow conditions, the 1-Q₁₀ method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is the case for Brookfield.

The following tables list the calculated WQBELs for this discharge along with the results of effluent sampling for all the detected substances. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L) and mercury (ng/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 5.39 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD.* mg/L	ATC	MEAN BACK-GRD.	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Chlorine		19.0		24.3	4.86	0.42		138.8
Arsenic		340	9.63	431	86.3	<1.1		
Cadmium	457	58.9	0.23	75.1	15.0	0.02		0.31
Chromium	301	4446	4.24	5677	1135	<0.83		
Copper	467	66.4	10.3	82.0			15.5	13
Lead	356	365	4.40	464	92.9	<4.3		
Mercury (ng/L)		830	0.20	1060			0.72	0.59
Nickel	268	1080	1.22	1379		6.47		34
Zinc	333	345	12.93	437		42.1		36
Chloride (mg/L)		757	204	910			737	825

* The indicated hardness may differ from the effluent hardness because the effluent hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the acute criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

** Per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016 consideration of ambient concentrations and 1-Q₁₀ flow rates yields a more restrictive limit than the 2 × ATC method of limit calculation.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 6.7 cfs (¼ of the 7-Q₁₀), as specified in s. NR 106.06(4)(c), Wis. Adm. Code

SUBSTANCE	REF. HARD.* mg/L	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Chlorine		7.28		9.80	1.96	0.42	
Arsenic		152	9.63	202	40.3	<1.1	
Cadmium	175	3.82	0.23	5.06	1.01	0.02	
Chromium	301	326	4.24	437	87.4	<0.83	
Copper	303	26.7	10.3	32.4		11.8	
Lead	303	81.7	4.40	109	21.7	<4.3	
Mercury (ng/L)		440	0.20	592			0.55
Nickel	268	120	1.22	161	32.3	6.47	
Zinc	303	317	12.93	423			32.4
Chloride (mg/L)		395	204	461			629

* The indicated hardness may differ from the receiving water hardness because the receiving water hardness exceeded the maximum range in ch. NR 105, Wis. Adm. Code, over which the chronic criteria are applicable. In that case, the maximum of the range is used to calculate the criterion.

Monthly Average Limits based on Wildlife Criteria (WC)

RECEIVING WATER FLOW = 10.2 cfs (¼ of the 90-Q₁₀), as specified in s. NR 106.06(4), Wis. Adm. Code

SUBSTANCE	WC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	30-day P ₉₉
Mercury (ng/L)	1.3	0.20	1.88	0.46

Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 22.9 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P ₉₉
Cadmium	370	0.23	807	161	0.02	
Chromium (+3)	3818000	4.24	8331337	1666267	<0.83	
Lead	140	4.40	300	60.1	<4.3	
Mercury (ng/L)	1.5	0.20	3.0			0.41
Nickel	43000	1.22	93830	18766	6.47	
Silver	43000	1.22	93830	18766	3.5	

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 22.9 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HCC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3	9.63	17.6	3.53	<1.1
Chloroform	1960		4277	855	0.10
1,4-Dichlorobenzene	163		356	71.1	0.12

In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because no effluent limits are needed based on HCC, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations

Based on a comparison of the effluent data and calculated effluent limitations, effluent limitations are required for chlorine and chloride.

Total Residual Chlorine – Because chlorine is added as a disinfectant, effluent limitations are recommended to assure proper operation of the de-chlorination system. Section NR 210.06(2)(b), Wis. Adm. Code, states, “When chlorine is used for disinfection, the daily maximum total residual chlorine concentration of the discharge may not exceed 0.10 mg/L.” Because the WQBELs are more restrictive, they are recommended instead. Specifically, a daily maximum limit of 24 µg/L is required. The current weekly and monthly average effluent limitations of 7.5 µg/L should be included in the permit because they are more restrictive than the daily maximum limit.

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The calculated weekly average limit of 9.8 µg/L is less restrictive than the current limit due to the updated low flows increasing and allowing more dilution. If Brookfield would like to request an increase to the existing permit limits for chlorine, an assessment of their effluent data consistent with the requirements of ss. NR 207.04(1)(a) and (c), Wis. Adm. Code, must be provided. This evaluation is on a parameter-by-parameter basis and includes consideration of operations, maintenance and temporary upsets. If the facility can successfully demonstrate the need for increased effluent limitations required in ch. NR 207, Wis. Adm. Code, then a recalculation of the specific effluent limitation will be provided.

Mercury – Considering available effluent data from the current permit term, the concentrations are below the calculated WQBELs, so limits are not needed. **Mercury monitoring is recommended to continue in the reissued permit** to determine if limits are needed in the next permit reissuance evaluation.

Chloride – Considering available effluent data from the current permit term (01/01/2019 – 04/06/2023), the 1-day P₉₉ chloride concentration is 733 mg/L, and the 4-day P₉₉ of effluent data is 629 mg/L.

Because the 4-day P₉₉ exceeds the calculated weekly average WQBEL, an effluent limit is needed in accordance with s. NR 106.05(4)(b), Wis. Adm. Code.

However, Subchapter VII of ch. NR 106, Wis. Adm. Code, provides for a variance from water quality standards for this substance, and Brookfield has requested such a variance. That variance may be granted subject to the following conditions:

- 1) The permit shall include an “Interim” limitation intended to prevent an increase in the discharge of Chloride;
- 2) The permit shall specify “Source Reduction Measures” to be implemented during the permit term, with periodic progress reports; and
- 3) The permit shall include a “Target Limit” or “Target Value” to gage the effectiveness of the Source Reduction Measures, and progress toward the WQBELs.

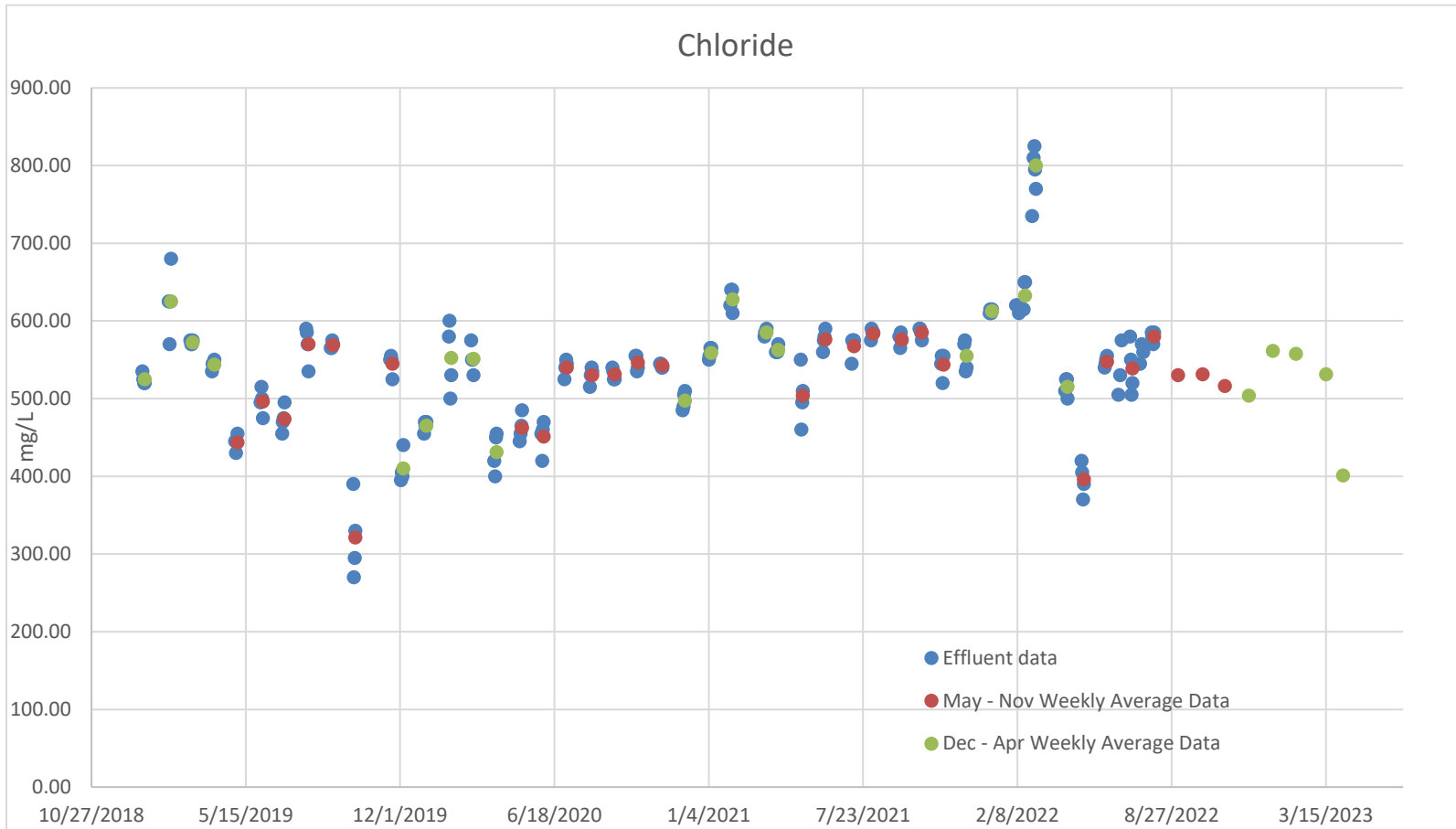
Interim Limit for Chloride

Section NR 106.82(9), Wis. Adm. Code, defines a “Weekly average interim limitation” as either the 4-day P₉₉ concentration or 105% of the highest weekly average concentration of the representative data. The current seasonal interim limits are 590 mg/L for May – November and 620 mg/L for December – April which are based on 4-day P₉₉’s from the 2012 WQBEL memo.

Seasonal Effluent Chloride

Chloride mg/L	All Data	May - November	December - April
1-day P ₉₉	733	682	779
4-day P ₉₉	629	599	658
Max 4-day average	800	585	800
Mean	536	523	551
Std	74.7	61.7	85.3
Sample size	219	118	101
Range	270 – 825	270 – 590	365 – 825

The graph below also summarizes the chloride data:



Although the 4-day P₉₉ effluent chloride concentrations at Brookfield are higher than the current interim limits of 590 and 620 mg/L, the Department does not find it appropriate to increase the interim concentration limit in the reissued permit, because it would be counterproductive to meeting the final WQBEL. **Therefore, the current weekly average interim chloride limit is recommended for permit reissuance.**

A target limit and permit language for Source Reduction Measures are not recommended as part of this evaluation. These should follow contact with Brookfield. Though if the Department and Brookfield are unable to reach agreement on all the terms of a Chloride Variance, the calculated limits described earlier should be included in the permit, in accordance with s. NR 106.83(3), Wis. Adm. Code.

Chloride Monitoring Recommendations

Four samples per month (on consecutive days) are recommended. This allows for averaging of the results to compare with the interim limit and allows the use of the average in determining future interim limits, and degree of success with chloride reduction measures.

In the absence of a variance, Brookfield would be subject to the WQBEL of 460 mg/L as a weekly average rounded to two significant figures; the weekly average mass limit of 48,000 lbs/day ($460 \text{ mg/L} \times 12.5 \text{ MGD} \times 8.34$); and an alternative wet weather mass limit of 108,000 lbs/day ($460 \text{ mg/L} \times 28.1 \text{ MGD} \times 8.34$) based on the peak weekly design flow rate.

PFOS and PFOA – The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98(2), Wis. Adm. Code. Previous monitoring produced a PFOS result of 6.82 ng/L and a PFOA result of 3.88 ng/L. The PFOS result is greater than one fifth of the criteria. Based on the type of discharge, the effluent flow rate, the types of indirect dischargers contributing to the collection system, and the available PFOS/PFOA monitoring data, **PFOS and PFOA monitoring is recommended monthly.**

**PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS
FOR BOD, TSS AND AMMONIA NITROGEN**

The weekly and monthly average BOD, TSS and ammonia nitrogen limits could potentially increase with the increase in the receiving water low flows. However, to allow an increase in a limit above an existing limit the facility must demonstrate the need for the higher limits consistent with s. NR 207.04(1), Wis. Adm. Code.

If Brookfield would like to request an increase to the existing permit limits for BOD₅, TSS, or ammonia nitrogen an assessment of their effluent data consistent with the requirements of ss. NR 207.04(1)(a) and (c), Wis. Adm. Code, must be provided. This evaluation is on a parameter-by-parameter basis and includes consideration of operations, maintenance and temporary upsets. If the facility can successfully demonstrate the need for increased effluent limitations required in ch. NR 207, Wis. Adm. Code, then a recalculation of the specific effluent limitation will be provided.

An initial review suggests that the requirements of s. NR 207.04(1)(a), Wis. Adm. Code, do not appear to be met based on BOD₅, TSS, and Ammonia Nitrogen effluent concentrations based on data from 01/01/2019 – 04/30/2023. **Therefore, the current weekly and monthly average limits for BOD, TSS and Ammonia Nitrogen are required to be retained in the reissued permit consistent with s. NR 207.04(2), Wis. Adm. Code.** Effluent data collected during the current permit term is summarized below:

Effluent Data

	Ammonia mg/L	BOD₅ mg/L	TSS mg/L
1-day P ₉₉	1.26	5.28	7.96
4-day P ₉₉	0.70	4.29	4.90
30-day P ₉₉	0.29	2.69	2.62
Mean*	0.09	1.94	1.54
Std	0.49	0.88	1.73
Sample size	1581	1579	1581
Range	<0.04 – 6.43	<2 – 10.1	<2 – 13.2

*Values lower than the level of detection were substituted with a zero

The previously calculated weekly and monthly ammonia limits are shown in Attachment #4.

Expression of Limits

The current permit only contains weekly average limits for BOD₅ and TSS. Sections NR 106.07(3) and NR 205.067(7), Wis. Adm. Code require WPDES permits contain weekly average and monthly average limitations for municipal dischargers whenever practicable and necessary to protect water quality.

Therefore, monthly average limits equal to the current weekly BOD₅ and TSS are required to meet expression of limits requirements in addition to the weekly average limits.

Daily Maximum Limits for Ammonia

Daily maximum limitations are based on acute toxicity criteria in ch. NR 105, Wis. Adm. Code, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation:

$$ATC \text{ in mg/L} = [A \div (1 + 10^{(7.204 - pH)})] + [B \div (1 + 10^{(pH - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warm Water Sport fishery, and
 pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 1581 sample results were reported from 01/02/2019 – 04/30/2023. The maximum reported value was 8.5 s.u. (Standard pH Units). The effluent pH was 8.1 s.u. or less 99% of the time. The 1-day P₉₉, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 8.1 s.u. The mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 8.1 s.u. Therefore, a value of 8.1 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 8.1 s.u. into the equation above yields an ATC = 7.0 mg/L.

Daily Maximum Ammonia Nitrogen Effluent Limitations Calculation Method – Ammonia

In accordance with s. NR 106.32(2), Wis. Adm. Code daily maximum ammonia limitations are either set equal to two times the nitrogen limits if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits shall apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1-Q₁₀ (estimated as 80 % of 7-Q₁₀) and the 2×ATC approach are shown below.

Daily Maximum Ammonia Nitrogen Determination

	Ammonia Nitrogen Limit mg/L
2×ATC	14
1-Q ₁₀	8.9

The 1-Q₁₀ method yields the most stringent limits for Brookfield. The current permit has variable daily maximum effluent limits based on effluent pH. Presented below is a table of daily maximum limitations corresponding to various effluent pH values based on the 1-Q₁₀ method.

Daily Maximum Ammonia Nitrogen Limits – WWSF

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
6.0 ≤ pH ≤ 6.1	69	7.0 < pH ≤ 7.1	42	8.0 < pH ≤ 8.1	8.9
6.1 < pH ≤ 6.2	68	7.1 < pH ≤ 7.2	38	8.1 < pH ≤ 8.2	7.3
6.2 < pH ≤ 6.3	66	7.2 < pH ≤ 7.3	33	8.2 < pH ≤ 8.3	6.0

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Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
6.3 < pH ≤ 6.4	65	7.3 < pH ≤ 7.4	29	8.3 < pH ≤ 8.4	4.9
6.4 < pH ≤ 6.5	62	7.4 < pH ≤ 7.5	25	8.4 < pH ≤ 8.5	4.1
6.5 < pH ≤ 6.6	60	7.5 < pH ≤ 7.6	22	8.5 < pH ≤ 8.6	3.4
6.6 < pH ≤ 6.7	57	7.6 < pH ≤ 7.7	18	8.6 < pH ≤ 8.7	2.8
6.7 < pH ≤ 6.8	54	7.7 < pH ≤ 7.8	15	8.7 < pH ≤ 8.8	2.3
6.8 < pH ≤ 6.9	50	7.8 < pH ≤ 7.9	13	8.8 < pH ≤ 8.9	2.0
6.9 < pH ≤ 7.0	46	7.9 < pH ≤ 8.0	11	8.9 < pH ≤ 9.0	1.7

The current permit has daily maximum limits based on 2×ATC which are less stringent than the calculated limits based on dilution. **The limits calculated in this evaluation based on the 1-Q₁₀ method are recommended in the reissued permit.**

**PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS
FOR BACTERIA**

On May 1, 2020, revisions to chs. NR 102 and NR 210, Wis. Adm. Code, became effective which replace fecal coliform limits with new *Escherichia coli* (*E. coli*) limits for protection of recreational uses. Section NR 210.06(2)(a)1, Wis. Adm. Code, includes two limits which must be included in permits for facilities which are required to disinfect:

1. The geometric mean of *E. coli* bacteria in effluent samples collected in any calendar month may not exceed 126 counts/100 mL.
2. No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 counts/100 mL.

E. coli monitoring is recommended at the same frequency that fecal coliform monitoring is required in the current permit. Brookfield’s current permit requires daily monitoring. Any additional monitoring beyond what is required by the permit must also be reported on the DMR as required in the standard requirements section of the permit.

These limits are required during May through September. No changes are recommended to the current recreational period and the required disinfection season.

Effluent Data

Brookfield has monitored effluent *E. coli* from 05/01/2022 – 05/07/2023 and a total of 160 results are available using Colilert. A geometric mean of 126 counts/100 mL was exceeded in two out of the six months that data was collected, with a maximum monthly geometric mean of 134 counts/100 mL when substituting 200.5 counts/100 mL for the results of >200.5 counts/100 mL. Effluent data did not exceed 410 counts/100 mL. The maximum reported value was >200.5 counts/100 mL. Based on this effluent data it appears that the facility cannot consistently meet new *E. coli* limits and a compliance schedule is recommended in the reissued permit.

Interim Limit

The permit will include a compliance schedule to meet these limits. During the compliance schedule, an interim limit applies to prevent back-sliding from the current level of disinfection during the compliance schedule period. Therefore, the current **fecal coliform limit shall be included in the reissued permit as**

an interim limit of 400 counts/100 mL as a monthly geometric mean. Any weekly geometric mean limit which was included in the current permit for expression of limits purposes does not need to be included in the permit as an interim limit.

PART 5 – PHOSPHORUS

Technology-Based Effluent Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Because Brookfield currently has a limit of 1.0 mg/L, this limit should be included in the reissued permit.

Water Quality-Based Effluent Limits (WQBEL)

Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to s. NR 102.06, Wis. Adm. Code, which establish phosphorus standards for surface waters. Subchapter III of NR 217, Wis. Adm. Code, establishes procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

Section NR 102.06(3)(a), Wis. Adm. Code, specifically names river segments for which a phosphorus criterion of 0.100 mg/L applies. For other stream segments that are not specified in s. NR 102.06(3)(a), Wis. Adm. Code, s. NR 102.06(3)(b), Wis. Adm. Code, specifies a phosphorus criterion of 0.075 mg/L. The phosphorus criterion of 0.075 mg/L applies for the Fox (IL) River.

The conservation of mass equation is described in s. NR 217.13(2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs) provided below.

$$\text{Limitation} = [(WQC)(Qs + (1-f) Qe) - (Qs - f Qe) (Cs)] / Qe$$

Where:

WQC = 0.075 mg/L for the Fox (IL) River

Qs = 100% of the 7-Q₂ of 12 cfs

Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code

Qe = effluent flow rate = 12.5 MGD = 19.3 cfs

f = the fraction of effluent withdrawn from the receiving water = 0

Section NR 217.13(2)(d), Wis. Adm. Code, specifies that the background phosphorus concentration used in the limit calculation formula shall be calculated as a median using the procedures specified in s. NR 102.07(1)(b) to (c), Wis. Code. All representative data from the most recent 5 years shall be used, but data from the most recent 10 years may be used if representative of current conditions.

A previous evaluation resulted in a WQBEL of 0.075 mg/L using background concentrations that are greater than 0.075 mg/L from three different locations in the Fox (IL) River. Section NR 217.13(2)(d), Wis. Adm. Code, states that the determination of upstream concentrations shall be evaluated at each permit reissuance. Additional data were considered in estimating the background phosphorus concentration.

A review of all available in stream total phosphorus data from the 50' upstream of Outfall 001, collected by the facility. The median of this data is 0.135 mg/L (n=25) from 05/02/2013 – 10/05/2017.

Substituting a background concentration above criteria into the limit calculation equation above would result in a calculated limit that is less than the applicable criterion of 0.075 mg/L. However, s. NR 217.13(7), Wis. Adm. Code, specifies that “if the WQBEL calculated pursuant to the procedures in this section is less than the phosphorus criterion specified in s. NR 102.06, Wis. Adm. Code, for the water body, **the effluent limit shall be set equal to the criterion.**”

Effluent Data

The following table summarizes effluent total phosphorus monitoring data from 10/01/2021 – 04/30/2023. Data prior to 10/01/2021 is excluded in this evaluation because the final WQBEL limits became effective after this date.

Total Phosphorus Effluent Data

	Phosphorus mg/L	Phosphorus lbs/day
1-day P ₉₉	0.237	29.5
4-day P ₉₉	0.141	16.1
30-day P ₉₉	0.093	8.86
Mean	0.071	5.84
Std	0.046	6.03
Sample size	576	576
Range	0.013 – 0.396	1 – 58.2

Reasonable Potential Determination

The calculated WQBEL of 0.075 mg/L is less than the current technology-based limit of 1.0 mg/L, so the WQBEL must be included in the permit per s. NR 217.15(2), Wis. Adm. Code.

Limit Expression

According to s. NR 217.14(2), Wis. Adm. Code, because the calculated WQBEL is less than or equal to 0.3 mg/L, the effluent limit of 0.075 mg/L may be expressed as a six-month average. If a concentration limitation expressed as a six-month average is included in the permit, a monthly average concentration limitation of 0.225 mg/L, equal to three times the WQBEL calculated under s. NR 217.13, Wis. Adm. Code shall also be included in the permit. The six-month average should be averaged during the months of May – October and November – April.

Mass Limits

A mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code, because the discharge is to a surface water that is to or upstream of a phosphorus impaired water. **This final mass limit shall be 0.075 mg/L × 8.34 × 12.5 MGD = 7.82 lbs/day expressed as a six-month average.**

TMDL Under Development

A Total Maximum Daily Load (TMDL) is being developed for the Fox (IL) River Basin for phosphorus. The TMDL will address phosphorus water quality impairments within the basins and provide waste load allocations (WLA) required to meet water quality standards. This TMDL will likely result in phosphorus

and TSS limitations that must be included in WPDES permits, which may be different than those calculated in this WQBEL memo. TMDL-derived phosphorus limits may be included in lieu of or in addition to the current s. NR 217.13, Wis. Adm. Code limits.

PART 6 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR THERMAL

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

In accordance with s. NR 106.53(2)(b), Wis. Adm. Code, the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), Wis. Adm. Code, the highest 7-day rolling average flow rate for a calendar month is used to determine the sub-lethal (weekly average) effluent limitation. These values were based off actual flow reported from 01/01/2019 – 04/30/2023.

The table below summarizes the maximum temperatures reported during monitoring from 01/01/2022 – 12/27/2022.

Monthly Temperature Effluent Data & Limits

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(°F)
JAN	53	55	60	99
FEB	52	53	59	90
MAR	52	53	62	98
APR	52	60	63	107
MAY	57	60	69	92
JUN	62	65	82	93
JUL	65	70	87	92
AUG	66	71	88	92
SEP	66	70	77	85
OCT	64	64	66	89
NOV	60	62	55	95
DEC	56	57	58	96

Reasonable Potential

Permit limits for temperature are recommended based on the procedures in s. NR 106.56, Wis. Adm. Code.

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- An acute limit for temperature is recommended for each month in which the representative daily maximum effluent temperature for that month exceeds the acute WQBEL. The representative daily maximum effluent temperature is the greater of the following:
 - (a) The highest recorded representative daily maximum effluent temperature
 - (b) The projected 99th percentile of all representative daily maximum effluent temperatures
- A sub-lethal limitation for temperature is recommended for each month in which the representative weekly average effluent temperature for that month exceeds the weekly average WQBEL. The representative weekly average effluent temperature is the greater of the following:
 - (a) The highest weekly average effluent temperature for the month.
 - (b) The projected 99th percentile of all representative weekly average effluent temperatures for the month

Comparing the representative highest effluent temperature to the calculated effluent limits determines the reasonable potential of exceeding the effluent limits. The months in which limitations are recommended are shown in bold. Based on this analysis, weekly average temperature maximum limits are necessary for the month of November.

Brookfield performed a mixing zone study in September 2002 which demonstrated 100% mixing with the receiving water. The previous WQBEL evaluations used the conclusion of this study to evaluate dissipative cooling and did not recommend temperature limits. However, the mixing zone study was not completed during the month of November when a limit is needed and did not include all necessary items required to approve a dissipative cooling study. **It's recommended that a dissipative cooling study be completed during the month of November when a weekly average limit is needed. Monitoring only is recommended for the rest of the months of the year.**

PART 7 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional judgment of staff familiar with the discharge after consideration of the guidance in the *Whole Effluent Toxicity (WET) Program Guidance Document (2022)*.

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC₅₀ (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09(2)(b), Wis. Adm Code.
- Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure. To assure that a discharge is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC₂₅ (Inhibition Concentration) greater than the instream waste concentration (IWC), according to s. NR 106.09(3)(b), Wis. Adm Code. The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of **74%** shown in the WET Checklist summary below was calculated according to the following equation, as specified in s. NR 106.03(6), Wis. Adm Code:

Attachment #1

$$IWC \text{ (as \%)} = Q_e \div \{(1 - f) Q_e + Q_s\} \times 100$$

Where:

Q_e = annual average flow = 12.5 MGD = 19.3 cfs

f = fraction of the Q_e withdrawn from the receiving water = 0

Q_s = 100% of the 7-Q₁₀ = 6.7 cfs

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.
- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), receiving water must be used as the dilution water and primary control in chronic WET tests, unless the use of different dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the receiving water location, upstream and out of the influence of the mixing zone and any other known discharge. The specific receiving water location must be specified in the WPDES permit.
- Shown below is a tabulation of all available WET data for Outfall 001. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08(3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations.

WET Data History

Date Test Initiated	Acute Results LC ₅₀ %				Chronic Results IC ₂₅ %				Footnotes
	<i>C. dubia</i>	Fathead minnow	Pass or Fail?	Used in RP?	<i>C. dubia</i>	Fathead Minnow	Pass or Fail?	Use in RP?	
08/16/2005					>100	>100	Pass	Yes	
06/20/2006	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
12/12/2006					>100	>100	Pass	Yes	
05/15/2007					>100	>100	Pass	Yes	
06/24/2008	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
10/14/2008					>100	>100	Pass	Yes	
03/17/2009	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
06/15/2010					91.9	>100	Pass	Yes	
11/02/2010	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
03/15/2011					>100	>100	Pass	Yes	
10/18/2011	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
03/06/2012	>100	>100	Pass	Yes					
03/26/2013					>100	>100	Pass	Yes	
09/17/2013	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
03/25/2014	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
09/30/2014					>100	>100	Pass	Yes	
03/10/2015					>100	>100	Pass	Yes	
09/10/2015	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
06/21/2016					>100	>100	Pass	Yes	
12/13/2016	>100	>100	Pass	Yes	>100	>100	Pass	Yes	

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04/04/2017	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
11/14/2017					>100	>100	Pass	Yes	
06/25/2019	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
02/04/2020	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
11/30/2021	>100	>100	Pass	Yes	79.2	>100	Fail	Yes	1
02/08/2022					>100	>100	Pass	Yes	
03/01/2022					75.6	>100	Fail	Yes	1
06/21/2022					>100	>100	Pass	Yes	
07/19/2022	>100	>100	Pass	Yes	91.6	>100	Pass	Yes	
08/30/2022					>100	>100	Pass	Yes	
09/27/2022					>100	>100	Pass	Yes	
03/14/2023	>100	>100	Pass	Yes					
04/04/2023					>100	>100	Pass	Yes	

Footnotes:

1. These tests failed at the time of testing, because IC25 values were below the previous IWC of 90%. These would not be considered failures if compared to the newly calculated IWC of 74%. The IWC changed because USGS provided updated low flows in 2022.

Brookfield submitted a toxicity reduction evaluation (TRE) following the 11/30/2021 and 03/01/2022 chronic WET failures. It was thought that an overuse of alum was the cause of the failures. The TRE report, submitted in December 2022, did not conclude with certainty that the cause of the toxicity was alum and that toxicity was permanently removed. There was also another toxicity detect on 07/19/2022. Since the source(s) of toxicity were not definitively identified and removed, all tests from 08/16/2005 – 04/04/2023 are believed to be representative and were used in the reasonable potential evaluation.

- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. **WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.**

$$\text{Acute Reasonable Potential} = [(TU_a \text{ effluent}) (B)(AMZ)]$$

$$\text{Chronic Reasonable Potential} = [(TU_c \text{ effluent}) (B)(IWC)]$$

According to s. NR 106.08(6)(d), Wis. Adm. Code, TU_a and TU_c effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC_{50} , IC_{25} or $IC_{50} \geq 100\%$).

Acute Reasonable Potential = $0 < 1.0$, reasonable potential is not shown, and a limit is not required.

$$\text{Chronic Reasonable Potential} = [(TU_c \text{ effluent}) (B)(IWC)]$$

Chronic WET Limit Parameters

TU _c (maximum) 100/IC ₂₅	B (multiplication factor from s. NR 106.08(6)(c), Wis. Adm. Code, Table 4)	IWC
100/75.6 =	2.6	74%

1.32	Based on 4 detects	
------	--------------------	--

$$[(TUc \text{ effluent}) (B)(IWC)] = 2.5 > 1.0$$

Therefore, reasonable potential is shown for chronic WET limits using the procedures in s. NR 106.08(6) and representative data from 08/16/2005 – 04/04/2023.

Expression of WET limits

Chronic WET limit = $[100/IWC] TU_c = 1.3 TU_c$ expressed as a monthly average

The WET checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other related permit conditions. The checklist indicates whether acute and chronic WET limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code. The checklist steps the user through a series of questions, assesses points based on the potential for effluent toxicity, and suggests monitoring frequencies based on points accumulated during the checklist analysis. As toxicity potential increases, more points accumulate, and more monitoring is recommended to ensure that toxicity is not occurring. A summary of the WET checklist analysis completed for this permittee is shown in the table below. Staff recommendations based on best professional judgment are provided below the summary table. For guidance related to reasonable potential and the WET checklist, see Chapter 1.3 of the WET Guidance Document: <https://dnr.wisconsin.gov/topic/Wastewater/WET.html>.

WET Checklist Summary

	Acute	Chronic
AMZ/IWC	Not Applicable. 0 Points	IWC = 74 %. 15 Points
Historical Data	16 tests used to calculate RP. No tests failed. 0 Points	31 tests used to calculate RP. 2 tests failed with previous IWC. 0 Points
Effluent Variability	Little variability, no violations or upsets, consistent WWTF operations. 0 Points	Same as Acute. 0 Points
Receiving Water Classification	Warmwater sport fish classification. 5 Points	Same as Acute. 5 Points
Chemical-Specific Data	Reasonable potential for limits for no substances based on ATC; Ammonia nitrogen limit carried over from the current permit. Chlorine, cadmium, copper, mercury, nickel, zinc, ammonia and chloride detected. Additional Compounds of Concern: Silver, 1-4 dichlorobenzene, and chloroform. 5 Points	Reasonable potential for limits for chloride based on CTC; Ammonia nitrogen limit carried over from the current permit. Chlorine, cadmium, copper, mercury, nickel, zinc, and ammonia detected. Additional Compounds of Concern: Silver, 1-4 dichlorobenzene, and chloroform. 10 Points
Additives	1 Biocide and 3 Water Quality Conditioners added. Permittee has proper P chemical SOPs in place: Yes	All additives used more than once per 4 days.

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	Acute	Chronic
	6 Points	6 Points
Discharge Category	7 Industrial Contributors.	Same as Acute.
	11 Points	11 Points
Wastewater Treatment	Secondary treatment.	Same as Acute.
	0 Points	0 Points
Downstream Impacts	No impacts known.	Same as Acute.
	0 Points	0 Points
Total Checklist Points:	27 Points	47 Points
Recommended Monitoring Frequency (from Checklist):	1x yearly	2x yearly
Limit Required?	No	Yes Limit = 1.3 TU _c
TRE Recommended? (from Checklist)	No	No

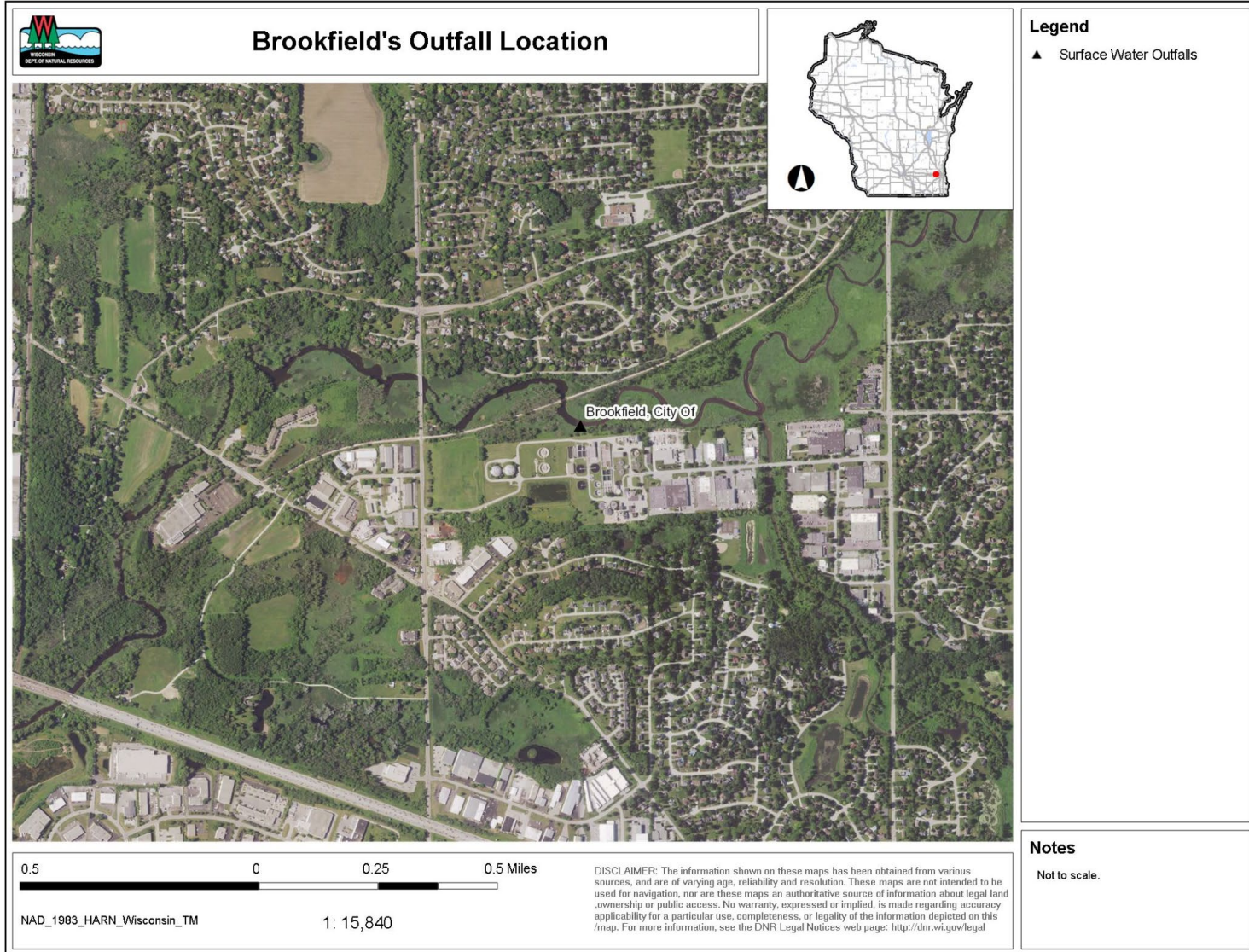
- After consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, 1x yearly acute and 2x yearly chronic WET tests are recommended in the reissued permit. Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).
- According to the requirements specified in s. NR 106.08, Wis. Adm. Code, a chronic WET limit is required. The chronic WET limit shall be expressed as 1.3 TU_c as a monthly average in the effluent limits table of the permit.
- A minimum of annual chronic monitoring is required because a chronic WET limit is required. Federal regulations in 40 CFR Part 122.44(i) require that monitoring occur at least once per year when a limit is present.
- A minimum of annual acute and chronic monitoring is recommended because Brookfield is a major municipal discharger with a design flow greater than 1.0 MGD. Federal regulations at 40 CFR Part 122.21(j) require at least 4 acute and chronic WET tests with each permit application on samples collected since the previous reissuance.

Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

Facility:	Brookfield	7-Q₁₀:	6.70 cfs	Temp Dates		Flow Dates	
Outfall(s):	001	Dilution:	100%	Start:	01/01/22		01/01/19
Date Prepared:	6/14/2023	f:	0	End:	12/27/22		04/30/23
Design Flow (Q_e):	12.50 MGD	Stream type:	Small warm water sport or forage fish co				
Storm Sewer Dist.	0 ft	Q_s:Q_e ratio:	0.3 :1				
		Calculation Needed?	YES				

Month	Water Quality Criteria			Receiving Water Flow Rate (Q _s) (cfs)	Representative Highest Effluent Flow Rate (Q _e)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	T _a (default)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Q _{esl}) (MGD)	Daily Maximum Flow Rate (Q _{ea}) (MGD)		Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)		(MGD)	(MGD)		(°F)	(°F)	(°F)	(°F)
JAN	33	49	76	12	11.594	14.370	0	53	55	60	99
FEB	34	50	76	12	13.321	23.110	0	52	53	59	90
MAR	38	52	77	20	17.893	24.030	0	52	53	62	98
APR	48	55	79	30	17.407	21.780	0	52	60	63	107
MAY	58	65	82	18	21.250	27.820	0	57	60	69	92
JUN	66	76	84	12	12.319	15.630	0	62	65	82	93
JUL	69	81	85	9.3	12.331	14.390	0	65	70	87	92
AUG	67	81	84	9	11.294	12.580	0	66	71	88	92
SEP	60	73	82	8	18.474	34.020	0	66	70	77	85
OCT	50	61	80	10	15.239	22.010	0	64	64	66	89
NOV	40	49	77	14	12.791	19.060	0	60	62	55	95
DEC	35	49	76	12	11.963	15.630	0	56	57	58	96



2007 Weekly and Monthly Average Ammonia Limits Calculations

Overview of Ammonia Rule Changes: The changes to ch. NR 105 establish acute (daily) and chronic (weekly and monthly) criteria for ammonia in-stream, based on updated information on ammonia toxicity. Acute criteria are dependent on the classification of the receiving water and on the pH of the discharge. Chronic criteria are dependent on the classification, temperature and pH of the receiving water. In addition, the chronic criteria for most classifications of receiving water are dependent on the presence or absence of early life stages of fish. For fish species other than burbot, the presence of early life stages is assumed in April and when the average temperature is equal to or greater than 14.6 degrees Celsius. Burbot are known to reproduce in colder water beginning in January of the year. There have been a large number of surveys in the Southeastern Wisconsin river basins over the years, and no burbot have been found (communication with Sue Beyler, SER Fisheries Biologist). In addition, the Department's Master Fish file and Becker's Fishes of Wisconsin have no record of burbot in the Illinois Fox River basin. Therefore the criteria for the Illinois Fox River will not be determined to protect the early life stages of burbot.

The changes to ch. NR 106 establish procedures for determining effluent limitations. For acute (daily maximum) limits, the limit equals twice the acute criterion established in conformance with ch. NR 105, unless a zone of initial dilution has been approved for a discharger. The acute limit is dependent on the maximum effluent pH, which in this case is represented by the 99th percentile of 7.8 s.u.

S. NR 106.32(3)(c)1. specifies that for weekly average (4-day chronic) limits, the limit is a mass balance based on the average annual design flow of the plant and the average minimum 7-day flow that occurs once every ten years (7Q10). For monthly average (30-day chronic) limits, the limit is a mass balance based on the average annual design flow of the plant and the average minimum 30-day flow that occurs once in five years (30Q5) or 85% of the average minimum 7-day flow that occurs once every two years (7Q2). Per s. NR 106.32(3)(c)3. and 4.(also in s. NR 106.06(4)(c)3. and 4.), the percentage of stream flow used is related to the temperature of the stream, unless the permittee has made a demonstration of a zone of free passage or rapid dilution, so that the mixing zone is minimized. Since Brookfield has made such a demonstration of rapid mixing of the discharge and receiving water, 100% of the corresponding low flows for all seasons can be used to determine ammonia limitations.

Attachment #4

For the purposes of determining ammonia limits, additional stream data is used:

River Background Parameters			
Month	Temperature (degrees C)	pH (su)	Ammonia (mg/l)
January	1	7.8	0.1
February	1	7.8	0.1
March	7	8.0	0.1
April	10	7.9	0.02
May	16	7.8	0.04
June	19	7.8	0.06
July	24	7.9	0.06
August	20	8.0	0.1
September	16	7.9	0.1
October	10	7.9	0.03
November	4	8.0	0.05
December	1	7.9	0.1

(Background data from 1993 facility planning limits report for Brookfield, prepared by James W. Schmidt, WDNR)

Based on the criteria in ch. NR 105, the procedures for limit determinations in ch. NR 106, and the effluent and stream data noted above, the calculated limitations for ammonia are:

Calculated Ammonia Limits for Brookfield (mg/l)			
Month	Daily Maximum	Weekly Average	Monthly Average
Jan	7.8	15	6.9
Feb	7.8	16	7.4
Mar	7.8	15	7.6
Apr	7.8	14	8.1
May	7.8	11	5.6
Jun	7.8	7.9	3.8
Jul	7.8	4.4	2
Aug	7.8	5	2.2
Sep	7.8	7.3	3.2
Oct	7.8	11	5
Nov	7.8	12	5.8
Dec	7.8	14	6.2

Proposed City of Brookfield Chloride SRM Plan 2025-2029

	SRM Initiative	Year 1 2024/25	Year 2 2025/26	Year 3 2026/27	Year 4 2027/28	Year 5 2028/29
1.	Continue monitoring sites with greater than average chloride concentrations.	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
2.	Continue gathering information about what type of softeners are in use.	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
3.	Continue discussions with industries that have historically high chloride concentrations to communicate impacts of loadings to the POTW and encourage chloride reductions.	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
4.	Continue salt brine application during winter road operations.	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
5.	Identify and repair sanitary sewer system to reduce I/I & chlorides from snowmelt runoff.	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
6.	City of Brookfield & contract communities sample/resample for chlorides in each of their wells.	Resample		Resample		
7.	Contract communities sample schools and laundromats.	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
8.	Investigate the effectiveness of replacing a neighborhood's water softeners with demand-based softeners and compare the before and after results.	Propose	Select a neighborhood & sample before	Replace softeners	Sample after	Evaluate
9.	Contact retailers to find those who purchase large quantities of salt to track down the largest consumers for potential education and outreach.	Contact retailers	Contact consumers			
10.	Provide educational material on the City's Facebook page about DIR softeners and local water supply.	Annually	Annually	Annually	Annually	Annually
11.	Provide educational material on the City's website and newsletter regarding ordinance 15.12.130E that new water softeners must be DIR.	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
12.	Develop and propose a local ordinance change requiring a commercial and residential softener tune-up program, which involves qualified periodic servicing to ensure proper control settings and adjustments.	Develop	Propose	Implement		
13.	Implement a local limit for chloride and surcharge for exceedances.	Evaluate	Propose	Implement		

Facility Specific Chloride Variance Data Sheet

Directions: Please complete this form electronically. Record information in the space provided. Select checkboxes by double clicking on them. Do not delete or alter any fields. For citations, include page number and section if applicable. Please ensure that all data requested are included and as complete as possible. Attach additional sheets if needed.

Section I: General Information

A. Name of Permittee: City of Brookfield

B. Facility Name: City of Brookfield Fox River Water Pollution Control Center (FRWPCC)

C. Submitted by: Wisconsin Department of Natural Resources

D. State: Wisconsin **Substance:** Chloride **Date completed:** March 19, 2024

E. Permit #: WI-0023469-10-0 **WQSTS #:** (EPA USE ONLY)

F. Duration of Variance **Start Date:** July 1, 2024 **End Date:** June 30, 2029

G. Date of Variance Application: May 17, 2023

H. Is this permit a: First time submittal for variance
 Renewal of a previous submittal for variance (Complete Section IX)

I. Description of proposed variance: Variance for chloride from the water quality-based effluent limit of 460 mg/L, expressed as a weekly average limit, to an interim limit of 620 mg/L from December-April and 590 mg/L from May- November. The permit will include requirements to implement source reduction measures and a target value of 560 mg/L from December-April and 530 mg/L from May-November as a weekly average.

J. List of all who assisted in the compilation of data for this form

Name	Email	Phone	Contribution
Victoria Ziegler	Victoria.Ziegler@wisconsin.gov	414-391-8946	Permit drafter
Nick Lent	Nicholas.Lent@wisconsin.gov	414-239-1938	Compliance
Nicole Krueger	Nicole.Krueger@wisconsin.gov	414-897-5750	Parts II D-H and J

Section II: Criteria and Variance Information

A. Water Quality Standard from which variance is sought: Chloride

B. List other criteria likely to be affected by variance: None

C. Source of Substance: drinking water supply, winter road salt applications, water softeners, and some industry

D. Ambient Substance Concentration: 204 mg/L Measured Estimated
 Default Unknown

E. If measured or estimated, what was the basis? Include citation. Geomean of the data that was collected upstream of Outfall 001 by the facility from 01/03/2019 – 04/06/2023.

F. Average effluent discharge rate: 12.5 MGD (annual average design flow) **Maximum effluent discharge rate:** 31.25 MGD (peak daily design flow)

G. Effluent Substance Concentration: Peak weekly = 800 mg/L Measured Estimated
Average = 536 mg/L Default Unknown

H. If measured or estimated, what was the basis? Include Citation. Permit-required chloride sampling from 01/01/2019 – 04/06/2023.

I. Type of HAC: Type 1: HAC reflects waterbody/receiving water conditions
 Type 2: HAC reflects achievable effluent conditions
 Type 3: HAC reflects current effluent conditions

J. Statement of HAC: The Department has determined the highest attainable condition of the receiving water is achieved through the application of the variance limit in the permit, combined with a permit requirement that the permittee implement its Chloride SRM plan. Thus, the HAC at commencement of this variance is 620 mg/L from December-April and 590 mg/L from May- November, which reflects the greatest chloride reduction achievable with the current treatment processes, in conjunction with the implementation of the permittee's

Chloride SRM plan. The current effluent condition is reflective of on-site optimization measures that have already occurred. This HAC determination is based on the current economic feasibility of available compliance options for Brookfield (see Economic Section below) and is held at the previous permit term's interim limit to comply with state antibacksliding regulations. The permittee may seek to renew this variance in the subsequent reissuance of this permit; the Department will reevaluate the HAC in its review of such a request. A subsequent HAC cannot be defined as less stringent than this HAC.

- K. Variance Limit:** 590 mg/L for May – November and 620 mg/L for December – April
L. Level currently achievable (LCA): 599 mg/L for May – November and 658 mg/L for December – April

M. What data were used to calculate the LCA, and how was the LCA derived? (Immediate compliance with LCA is required.)
 Data from the current permit term (01/01/2019 – 04/06/2023)

N. Explain the basis used to determine the variance limit (which must be ≤ LCA). Include citation.
 Chapter NR 106, Subchapter VII, Wis. Adm. Code, allows for a variance; the imposition of a less restrictive interim limit; a compliance schedule that stresses source reduction and public education; and allowance for a target value or limit to be a goal for reduction.

 The proposed variance limit of 590 mg/L from May – November and 620 mg/L from December - April is equivalent to the current variance limit which was the 4-day P₉₉ of these time periods from a previous permit term (November 2007 – September 2012). The limit is established in accordance with s. 283.15(5), Wis. Stats. and ch. NR 106 Subchapter II, Wis. Adm. Code.

- O. Select all factors applicable as the basis for the variance provided** 1 2 3 4 5 6
under 40 CFR 131.10(g). Summarize justification below:

Use of reverse osmosis treatment at the WWTF was evaluated. That treatment was estimated to result in an average cost that would be about 5.11% of the MHI. Installing centralized lime softening on the current municipal water supply system was also evaluated, and the estimated cost of doing so would be about 4.73% of the MHI. Those cost estimates are in the range in which the application of either treatment would be expected to result in substantial and widespread economic and social impacts to the community. Without a variance, meeting the water quality-based effluent limit of 460 mg/L would result in substantial and widespread economic and social impacts.

Section III: Location Information

A. Counties in which water quality is potentially impacted: Waukesha County

B. Receiving waterbody at discharge point: Fox (IL) River (WBIC 742500)

C. Flows into which stream/river? Illinois River **How many miles downstream?** ~160 mi

D. Coordinates of discharge point (UTM or Lat/Long): Lat. 43.005329, Long. -88.7946

E. What is the distance from the point of discharge to the point downstream where the concentration of the substance falls to less than or equal to the chronic criterion of the substance for aquatic life protection?
 About 17 miles downstream of Brookfield, there is enough dilution from other flows such as the Mukwonago River for the instream chloride concentration to be below the chronic criterion of 395 mg/L.

F. Provide the equation used to calculate that distance (Include definitions of all variables, identify the values used for the clarification, and include citation):
 Mass balance equation solving for the cumulative stream flow needed to result in an instream concentration less than or equal to the chronic toxicity criteria of 395 mg/L.

$$(\text{interim limit in mg/L} \times \text{effluent design flow in cfs}) + (\text{background concentration in mg/L} \times \text{background stream flow in cfs}) / (\text{effluent design flow in cfs} + \text{background stream flow in cfs}) = \leq 395 \text{ mg/L.}$$

Brookfield background: 620 mg/L limit and 12.5 MGD design flow, 7Q10 = 6.7 cfs

Waukesha background: 620 mg/L limit and 14 MGD design flow

The Q₇₋₁₀ of the Fox River at Mukwonago is 33 cfs which would provide enough dilution for the instream chloride concentration to be less than 395 mg/L.

G. What are the designated uses associated with the direct receiving waterbody, and the designated uses for any downstream waterbodies until the water quality standard is met?

Warm Water Sport Fish (WWSF) community, non-public water supply

H. Identify all other variance permittees for the same substance which discharge to the same stream, river, or waterbody in a location where the effects of the combined variances would have an additive effect on the waterbody:

Permit Number	Facility Name	Facility Location	Variance Limit [mg/L]
WI-0020559-08-0	City of Sussex	Sussex, WI (Spring Creek, upstream of Brookfield)	511 mg/L (Dec – Apr) 500 mg/L (May – Nov)
WI-0029971-09-0	City of Waukesha	Waukesha, WI (Fox River, downstream of Brookfield)	620 mg/L (Dec – Apr) 570 mg/L (May – Nov)

NOTE; in-stream data from Fox River just upstream and downstream from both the City of Brookfield and Waukesha POTW discharges demonstrates that the chloride concentration is well below the 395 mg/L criteria.

I. Please attach a map, photographs, or a simple schematic showing the location of the discharge point as well as all variances for the substance currently draining to this waterbody on a separate sheet

J. Is the receiving waterbody on the CWA 303(d) list? If yes, please list the impairments below. Yes No Unknown

River Mile	Pollutant	Impairment
113-171	Total Phosphorus	Degraded Biological Community
113-171	PCB	Contaminated Fish Tissue
varies	Total Suspended Solids	Sedimentation

K. Please list any contributors to the POTW in the following categories:

Food processors (cheese, vegetables, meat, pickles, soy sauce, etc.)	A.L. Schutzman Co. and Legacy Bakehouse
Metal Plating/Metal Finishing	Aluma-Tec Industries, Fabri-Tech Inc., and Harken Inc.
Car Washes	Jilly's, Full Service, BP, Mister Car Wash, and Kwik Trip
Municipal Maintenance Sheds (salt storage, truck washing, etc.)	Brookfield Highway Dept. 19700 Riverview Dr.
Laundromats	Choice, Maytag, US, and Brookfield Laundry
Other presumed commercial or industrial chloride contributors to the POTW	Hospitals, Health Care Facilities, Hotels, and Large Chain Restaurants

L. If the POTW does not have a DNR-approved pretreatment program, is a sewer use ordinance enacted to address the chloride contributions from the industrial and commercial users? If so, please describe.

Approved pretreatment program. Approval date May 29, 1985.

Section IV: Pretreatment (complete this section only for POTWs with DNR-Approved Pretreatment Programs. See w:\Variances\Templates and Guidance\Pretreatment Programs.docx)

A. Are there any industrial users contributing chloride to the POTW? If so, please list.

ProHealth Center, Brookfield Suites Hotel, Elmbrook Hospital, and Marriott Hotel make up over 50% of the monitored industrial chloride mass (18%, 13%, 12%, and 9%, respectively) during 2019-2022. However, the

total contribution from industrial softening makes up only 5% of the total chloride in the influent during those same years. Those four industries combined contribute 2.5% of the total mass of chlorides coming into the FRWPPC.

B. Are all industrial users in compliance with local pretreatment limits for chloride? If not, please include a list of industrial users that are not complying with local limits and include any relevant correspondence between the POTW and the industry (NOVs, industrial SRM updates and timeframe, etc)
Brookfield's sewer use ordinance does not include a pretreatment chloride limit. Brookfield plans to continue to investigate development of a pretreatment chloride limit in coordination with the Department during the next permit term.

C. When were local pretreatment limits for chloride last calculated?
N/A

D. Please provide information on specific SRM activities that will be implemented during the permit term to reduce the industry's discharge of the variance pollutant to the POTW.

1. Continue discussions with industries that have historically high chloride concentrations to communicate impacts of loadings to the POTW and encourage chloride reductions.
2. Provide educational material on the City's website and newsletter regarding ordinance 15.12.130E that new water softeners must be demand initiated regeneration, DIR.
3. Implement a local limit for chloride and surcharge for exceedances.

Section V: Public Notice

A. Has a public notice been given for this proposed variance? Yes No
B. If yes, was a public hearing held as well? Yes No N/A
C. What type of notice was given?
 Notice of variance included in notice for permit Separate notice of variance
D. Date of public notice: May 1, 2024 **Date of hearing:** June 20, 2024
E. Were comments received from the public in regards to this notice or hearing? (If yes, see notice of final determination) Yes No

Section VI: Human Health

A. Is the receiving water designated as a Public Water Supply? Yes No
B. Applicable criteria affected by variance: No human health criteria for chloride
C. Identify any expected impacts that the variance may have upon human health, and include any citations:
None

Section VII: Aquatic Life and Environmental Impact

A. Aquatic life use designation of receiving water: Warm water sport fish community
B. Applicable criteria affected by variance: Chronic toxicity criterion for chloride is 395 mg/L per ch. NR 105, Wis. Adm. Code.
C. Identify any environmental impacts to aquatic life expected to occur with this variance, and include any citations:
The proposed interim limits of 620 mg/L for December – April and 590 mg/L for May – November results in instream concentrations of 513 mg/L and 491 mg/L at the edge of the regulatory mixing zone (100% of the 7Q10 of 6.7 cfs). This value exceeds the genus mean chronic value for one of the 13 species used to determine the criteria (Water flea - Ceriodaphnia dubia; 417 mg/L).
D. List any Endangered or Threatened species known or likely to occur within the affected area, and include any citations:
Plant
Wafer-ash (Threatened)
Bee
Rusty Patched Bumble Bee (Threatened)

Section VIII: Economic Impact and Feasibility

A. Describe the permittee’s current pollutant control technology in the treatment process: The permittee operates a 12.5 million gallon per day (MGD) activated sludge wastewater treatment facility that serves approximately 52,000 people and 10 significant industries. Treatment consists of fine screening, grit removal, primary clarification, activated sludge/biological nutrient removal, secondary clarification, tertiary filtration, disinfection via chlorination and dechlorination and aeration before effluent is discharged to the Fox (IL) River. Biosolids processes include anaerobic digestion, gravity belt thickening, and storage prior to beneficial reuse on Department approved agricultural fields.

B. What modifications would be necessary to comply with the current limits? Include any citations.
Upgrading Brookfields’s treatment plant to include a reverse osmosis (RO) treatment system for removing chloride from the wastewater effluent would allow the permittee to comply with the chloride WQBELs.

Upgrading the public water supply with a centralized lime softening treatment system would eliminate the need for residential and commercial water softeners and potentially eliminate the major source of chlorides to the wastewater treatment facility (water softener regeneration brine).

C. How long would it take to implement these changes?
As noted above in Section II-O, the cost of providing reverse osmosis at the wastewater treatment facility or centralized lime softening for the drinking water system were evaluated and determined to be prohibitively expensive.

D. Estimate the capital cost (Citation): RO Treatment: \$14,062,500 (Variance Application)

Lime Softening: \$62,880,027 (source: Facility Inputs for Lime Softening Eligibility Calculation 2024)

E. Estimate additional O & M cost (Citation): RO Treatment: \$4,562,500 (Variance Application)

Lime Softening: \$4,524,534 (Facility Inputs for Lime Softening Eligibility Calculation 2024)

F. Estimate the impact of treatment on the effluent substance concentration, and include any citations:
Treatment for chlorides at the plant without a RO system would have little impact. Proper implementation of SRMs is anticipated to reduce the current effluent chloride concentrations by approximately 10 – 15 % over the next five years. To consistently meet the final water quality-based effluent of 460 mg/L the current effluent concentration would need to be reduced by at least 25 %. A centralized lime softening system for drinking water would eliminate the need for point of use softeners and the associated chloride brine generated during the regeneration/backwash cycle that is ultimately discharged to the wastewater treatment system. Neither option is considered economically feasible.

G. Identify any expected environmental impacts that would result from further treatment, and include any citations:
End-of-pipe RO wastewater treatment technology for chloride produces concentrated brine that can be as much or more of an environmental liability than the untreated effluent. Since the concentrated brine cannot be further treated, the only recourse for the disposal of the brine is transfer to another community, which is often not feasible. Appropriate chloride source reduction activities are preferable environmentally to effluent end-of-pipe treatment in most cases since the byproduct of treatment (production of a concentrated brine) does not remove the load of chloride from the environment.

There would be impacts associated with the disposal of brine from RO process. These could include air pollution impacts from trucking brine off site and increased chloride impacts at the point where brine is discharged.

H. Is it technically and economically feasible for this permittee to modify the treatment process to reduce the level of the substance in the discharge? Reverse osmosis (RO) treatment of the City of Brookfield WWTP effluent to meet the WQBEL is technically feasible. However, it is not economically feasible. See DNR variance application and screening tool Yes No Unknown

for costs of reverse osmosis. Use of RO at the WWTP was evaluated; the resulting total cost for sewer user rates was estimated to result in an average cost to households that would be 5.11 % of the MHI. An increase of this magnitude would cause substantial and widespread adverse social and economic impacts the area where the discharge is located.

Lime softening treatment of the municipal water supply – in lieu of ion-exchange is technically feasible and would potentially enable the WWTP effluent to meet the chloride WQBEL. However, lime softening is not economically feasible. See the Chloride Variance Economic Eligibility Tool (Lime Softening) screening tool for costs of lime softening. Use of municipal lime softening was evaluated; the resulting cost for sewer user rates was estimated to result in an average cost to households that would be 4.73% of the MHI. An increase of this magnitude would cause substantial and widespread adverse social and economic impacts the area where the discharge is located.

I. If treatment is possible, is it possible to comply with the limits on the substance? Yes No Unknown

J. If yes, what prevents this from being done? Include any citations.
 End of pipe RO treatment could reduce effluent chloride concentrations to chronic toxicity criterion; however, attaining this standard would cause substantial and widespread adverse social and economic impacts in the area where the discharge is located.

K. List any alternatives to current practices that have been considered, and why they have been rejected as a course of action, including any citations:
 Reverse Osmosis (RO) - not economically feasible (5.11% MHI)

 Regional Lime Softening Treatment – not economically feasible (4.73% MHI)

Section IX: Compliance with Water Quality Standards

A. Describe all activities that have been, and are being, conducted to reduce the discharge of the substance into the receiving stream. This may include existing treatments and controls, consumer education, promising centralized or remote treatment technologies, planned research, etc. Include any citations.
 Public outreach and education regarding water softening and the use of chloride for deicing. Meeting with industrial and commercial contributors to discuss the same. Water softener tune ups have been completed and a brine reclaim system has been put in place at one or more industries.

B. Describe all actions that the permit requires the permittee to complete during the variance period to ensure reasonable progress towards attainment of the water quality standard. Include any citations.
 The proposed permit requires the permittee to (a) maintain effluent quality at or below the interim effluent limitation specified in the table above, (b) implement the chloride source reduction measures specified below, (c) follow the Source Reduction Plan and (d) perform the actions listed in the compliance schedule.

1. Continue monitoring sites with greater than average chloride concentrations.
2. Continue gathering information about what type of softeners are in use.
3. Continue discussions with industries that have historically high chloride concentrations to communicate impacts of loadings to the POTW and encourage chloride reductions.
4. Continue salt brine application during winter road operations.
5. Identify and repair sanitary sewer system to reduce I/I & chlorides from snowmelt runoff.
6. City of Brookfield & contract communities sample/resample for chlorides in each of their wells.
7. Contract communities sample schools and laundromats.
8. Investigate the effectiveness of replacing a neighborhood’s water softeners with demand-based softeners and compare the before and after results.
9. Contact retailers to find those who purchase large quantities of salt to track down the largest consumers for potential education and outreach.
10. Provide educational material on the City’s Facebook page about DIR softeners and local water supply.

11. Provide educational material on the City's website and newsletter regarding ordinance 15.12.130E that new water softeners must be DIR.
12. Develop and propose a local ordinance change requiring a commercial and residential softener tune-up program, which involves qualified periodic servicing to ensure proper control settings and adjustments.
13. Implement a local limit for chloride and surcharge for exceedances.

Section X: Compliance with Previous Permit (Variance Reissuances Only)

A. Date of previous submittal: <u>October 2, 2017</u>	Date of EPA Approval: <u>October 25, 2018</u>
B. Previous Permit #: <u>0023469-09-0</u>	Previous WQSTS #: _____ (EPA USE ONLY)
C. Effluent substance concentration: Peak Daily = 825 mg/L Average All Data = 536 mg/L 4-day P99 = 629 mg/l	Variance Limit: December – April: 620 mg/L May – November: 590 mg/L
D. Target Value(s): December – April: 560 mg/L May – November: 530 mg/L	Achieved? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Partial

E. For renewals, list previous steps that were to be completed. Show whether these steps have been completed in compliance with the terms of the previous variance permit. Attach additional sheets if necessary.

Condition of Previous Variance	Compliance
Continue to monitor for chloride at existing industrial locations and commercial properties that have variable chloride concentrations to determine trend, or that have concentrations that are higher than “average” chloride concentration in the effluent of the treatment plant.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Monitor for chlorides at locations with less than five years of data and at additional large water users or properties with likely higher chloride concentrations (e.g. schools and laundromats)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Meet with large chloride dischargers in accordance with ordinance 13.20.110 H to discuss chloride reduction options including brine reclamation systems.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Participate as chair of the TAC to the SEWRPC for their new Regional Chloride Study	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Add a line on cross connection inspection form to determine if water softener is time or demand based unit and, at the time of inspection, provide information to the property owner on water softener maintenance and system settings that reduce overall salt use. Provide information to the property owner of a time-based unit about the advantages of switching to a demand based unit. Gather data from all properties as meters are changed out and provide, in the final annual report, recommendations on how best to reduce chlorides based on the data collected.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Refine mass balance of sources by incorporating new data for additional properties and existing properties in the collection system.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

<p>Develop a plan for conducting additional chloride testing at the wastewater plant to understand fluctuations and patterns of chloride concentrations as it enters the wastewater plant from different interceptors and as it makes its way through the plant treatment processes, including recycle flow.</p>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Provide educational material in the City newsletter, City water and sewer bill, and website regarding ordinance 15.12.130 E. that new water softeners be demand initiated regeneration.</p>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Investigate a chloride surcharge for large chloride dischargers (commercial, industrial and institutional – e.g. schools).</p>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Continue brine application for anti-icing during winter road operations.</p>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Implement identified repairs to the sanitary sewer system to reduce I/I and chlorides from snowmelt runoff.</p>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Develop and propose local ordinance changes requiring a bypass around softeners and outside hose bibs to be plumbed to unsoftened water.</p>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<p>Provide an active program to engage the residential community regarding chloride source reduction. The program could include studying appropriate outreach methodologies, partnering with outreach groups (such as Southeastern Wisconsin Watersheds Trust), and providing outreach at local events.</p>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No