

# Public Noticed Marshfield Draft Permit Fact Sheet

## General Information

Permit Number:	WI-0021024-09-0	
Permittee Name:	City of Marshfield	
Address:	2601 E 34th St.	
City/State/Zip:	Marshfield WI 54449	
Discharge Location:	Marshfield Wastewater Treatment Plant, 2601 East 34 <sup>th</sup> Street, Marshfield, WI 54449-5363 SE ¼ of NW ¼ of Section 22, T25N, R3E.	
Receiving Water:	Mill Creek, Located in the Mill Creek Watershed of the Upper Wisconsin River Central Sub-basin in Wood County (Outfall – Lat: 44.63026° N / Lon: 90.12925° W)	
StreamFlow (Q <sub>7,10</sub> ):	0.3 cfs	
Stream Classification:	Limited Aquatic Life, Non-public water supply	
Discharge Type:	Continuous, Existing	
Design Flow(s)	Annual Average	4.63 MGD
Significant Industrial Loading?	Yes, and includes the following: Foremost Farms Dairy (cheese making), Marshfield Clinic Medical Center, and Masonite Marshfield Door Systems (wood door manufacturing). Other contributors include St. Joseph's Hospital, Marshfield Water Plant, Golden Living Center-Three Oaks, Norwood Health Center, Balchem Sensory Effects (dairy food product manufacturing, formerly Quality Ingredients), Sabra Phoenix Marshfield (formerly Stony River, living center), Wiskerchen Cheese Inc, and Wenzel's Farm Sausage.	
Operator at Proper Grade?	Yes	
Approved Pretreatment Program?	N/A	

## Facility Description

The Marshfield Wastewater Treatment Facility treats wastewater from the City of Marshfield as well as the following significant industrial users, Foremost Farms Dairy (cheese making), Marshfield Clinic Medical Center, and Masonite Marshfield Door systems (wood door manufacturing). Other contributors include St. Joseph's Hospital, Marshfield Water Plant, Golden Living Center-Three Oaks, Norwood Health Center, Balchem Sensory Effects (dairy food product manufacturing, formerly Quality Ingredients), Sabra Phoenix Marshfield (formerly Stony River, living center), Wiskerchen Cheese Inc, and Wenzel's Farm Sausage. The facility has an annual average design flow of 4.63 million gallons per day (MGD) and treated an annual average influent flow of 2.83 MGD in 2023. The wastewater is treated with fine screening removal, activated sludge treatment using oxidation ditches, biological phosphorus removal backed up with chemical phosphorus removal, final clarification and gravity belt biosolids thickening. Effluent is discharged to Mill Creek and liquid sludge is land applied on Department approved sites.

Significant operational changes in the upcoming permit term includes tertiary filtration to improve effluent phosphorus removal, installation of low speed mixers to the 1<sup>st</sup> stage oxidation ditch, replacement of 2 surface aerator drives with variable speed drives, and installation of a second gravity belt sludge thickener. The permittee has requested blending approval as part of their permit application was evaluated and approved per s. NR 210.12(2), Wis. Adm. Code. Significant

monitoring and/or limit changes for the upcoming permit term are as follows: 1) addition of influent flow monitoring, 2) the sample point description for in plant sample point 102 has been changed to reflect blending approval and a time reporting requirement added, 3) removal of the effluent mercury variance limit but monitoring continues at the influent and effluent sample points as well as field blank for sample accuracy, 4) addition of effluent nitrogen ammonia limits with increased monitoring frequency, 5) addition of effluent PFOS and PFOA monitoring once every two months and an associated determination of need schedule in accordance with s. NR 106.98(2)(b), Wis. Adm. Code., 6) PFAS sludge sampling has been included for sludge sample point 003 pursuant to ss. NR 214.18(5)(b) and NR 204.06(2)(b)9., Wis. Adm. Code to quantitate risk, and 7) new sludge sample point 004 to account for oxidation ditch sludge removal.

## Substantial Compliance Determination

**Enforcement During Last Permit:** The Marshfield Wastewater Treatment Facility will be issued a Notice of Violation for a Sanitary Sewer Overflow resulting from a force main break which occurred on November 7<sup>th</sup>, 2023. The facility has taken substantial steps since November 7<sup>th</sup>, 2023 to prevent future spills and develop spill response measures and therefore the department is not requesting any required actions as part of the enforcement process. There have been no other enforcement actions taken in the last permit term.

After a desktop review of all discharge monitoring reports, CMARs, land application reports and a site visit on 10/5/2023 completed by Logan Rubeck, the Marshfield Wastewater Treatment Facility has been found to be in substantial compliance with their current permit.

Compliance determination entered by Logan Rubeck on 11/29/2023.

Sample Point Designation		
Sample Point Number	Discharge Flow, Units, and Averaging Period	Sample Point Location, WasteType/sample Contents and Treatment Description (as applicable)
702	Influent flow: 2.83 MGD (2023)	Representative influent samples shall be collected after the wet well and screening, but prior to the oxidation ditch.
101	No diverted flow was reported.	BLENDING: Sample point for reporting diverted flow from the influent splitter structure during high flow events. Flow bypasses the oxidation ditches after which it receives final clarification prior to discharge.
102	N/A	The mercury field blank shall be collected using standard handling procedures every day that mercury samples are collected at influent and effluent.
002	Effluent Flow: 2.76 MGD (2023)	Representative effluent composite samples shall be collected from the channel prior to the Parshall flume, after final clarification. Grab samples for DO and pH shall be collected after the Parshall flume.
003	Annual Estimate: 1012 Tons of sludge	Representative storage tank sludge samples shall be collected prior to landspreading and monitored quarterly for Lists 1, 2, 3, 4, and monitored once for PCBs and annual for PFAS parameters.
004	New Sludge Sample Point – No data	Representative oxidation ditch sludge samples shall be collected prior to landspreading and monitored once for Lists 1, 2, 3, and 4.

## 1 Influent – Monitoring Requirements

### Sample Point Number: 702- INFLUENT AFTER SCREENING

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Daily	Continuous	

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
BOD5, Total		mg/L	3/Week	24-Hr Flow Prop Comp	
CBOD5		mg/L	5/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total		mg/L	5/Week	24-Hr Flow Prop Comp	
Mercury, Total Recoverable		ng/L	Quarterly	24-Hr Flow Prop Comp	

### Changes from Previous Permit:

Addition of flow monitoring.

### Explanation of Limits and Monitoring Requirements

Monitoring of influent flow, BOD5 and total suspended solids is required by s. NR 210.04(2), Wis. Adm. Code, to assess wastewater strengths and volumes and to demonstrate the percent removal requirements in s. NR 210.05, Wis. Adm. Code, and in the Standard Requirements section of the permit. CBOD5 influent monitoring is required to demonstrate the percent removal requirement for that parameter required by s. NR 210.05(1)(d)3, Wis. Adm. Code. Quarterly influent mercury monitoring continues from the previous permit term and is to be sampled concurrently with the field blank and effluent mercury monitoring.

## 2 Inplant - Monitoring and Limitations

### Sample Point Number: 101- IN PLANT DIVERSION

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 (12:00 am - 11:59 pm) in which blending occurs. See Blending Flow permit section.

### Changes from Previous Permit:

Clarification of sample point description for blending and added time reporting.

### Explanation of Limits and Monitoring Requirements

Clarification of sample point description for blending and added time reporting.

Blending approval was given February 20, 2024 by the DNR to the City of Marshfield WWTP.

## Sample Point Number: 102- MERCURY FIELD BLANK

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Mercury, Total Recoverable		ng/L	Quarterly	Blank	Sample concurrently with influent and effluent Mercury sampling.

### Changes from Previous Permit:

None

### Explanation of Limits and Monitoring Requirements

The mercury field blank shall be collected using standard handling procedures every day that mercury samples are collected at the influent and effluent sample points.

## 3 Surface Water - Monitoring and Limitations

### Sample Point Number: 002- EFFLUENT TO MILL CREEK

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Daily	Continuous	
CBOD5	Monthly Avg	16 mg/L	5/Week	24-Hr Flow Prop Comp	
CBOD5	Weekly Avg	25 mg/L	5/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Monthly Avg	20 mg/L	5/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Weekly Avg	30 mg/L	5/Week	24-Hr Flow Prop Comp	
pH Field	Daily Max	9.0 su	5/Week	Grab	
pH Field	Daily Min	6.0 su	5/Week	Grab	
Dissolved Oxygen	Daily Min	4.0 mg/L	5/Week	Grab	
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	2.1 mg/L	5/Week	24-Hr Flow Prop Comp	Monitoring applies year round. Limit applies April and May.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	4.9 mg/L	5/Week	24-Hr Flow Prop Comp	Monitoring applies year round. Limit applies April and May.
Mercury, Total Recoverable		ng/L	Quarterly	Grab	See Mercury subsection. Sample concurrently with influent and field blank mercury monitoring, and also with WET tests.
Chloride		mg/L	Quarterly	24-Hr Flow Prop Comp	

<b>Monitoring Requirements and Limitations</b>					
<b>Parameter</b>	<b>Limit Type</b>	<b>Limit and Units</b>	<b>Sample Frequency</b>	<b>Sample Type</b>	<b>Notes</b>
Phosphorus, Total	Monthly Avg	1.0 mg/L	5/Week	24-Hr Flow Prop Comp	Limit effective throughout permit term.
Phosphorus, Total	6-Month Avg	10.37 lbs/day	5/Week	24-Hr Flow Prop Comp	Limit effective May 1, 2026. See TMDL subsection below and Phosphorus compliance schedule.
Phosphorus, Total	Monthly Avg	31.1 lbs/day	5/Week	24-Hr Flow Prop Comp	Limit effective May 1, 2026. See TMDL subsection and Phosphorus compliance schedule.
Phosphorus, Total		lbs/month	Monthly	Calculated	Calculate the Total Monthly Discharge of phosphorus and report on the last day of the month on the DMR. See TMDL section.
Phosphorus, Total		lbs/yr	Annual	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	
Acute WET		TUa	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET subsection.
Chronic WET	Monthly Avg	1.0 TUc	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET subsection.
PFOS		ng/L	1/ 2 Months	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule.
PFOA		ng/L	1/ 2 Months	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule.

## Changes from Previous Permit

Changes include removal of the mercury variance limit but monitoring continues, the addition of ammonia limits, and the addition of effluent PFOS and PFOA monitoring.

## Explanation of Limits and Monitoring Requirements

The effluent monitoring frequency for all parameters were considered. Monitoring frequencies are based on the size and type of the facility and are established to best characterize effluent quality and variability, to detect events of noncompliance, and to ensure fairness and consistency in permits issued across the state. Requirements in administrative code (NR 108, 205, 210 and 214 Wis. Adm. Code) and Section 283.55, Wis. Stats. were considered, where applicable, when determining the appropriate monitoring frequencies for pollutants that have final effluent limits in effect during this

permit term. For more information see the December 21, 2023 version of the Bureau of Water Quality Program Guidance Document “Monitoring Frequencies for Individual Wastewater Permits”. Using the criteria previously stated, the Department has increased ammonia nitrogen monitoring to 5/week to better align with similar facilities with ammonia limits.

Limits were determined for Marshfield’s existing discharge to Mill Creek using chs. NR 102, 105, 106, 205, 210 and 217 of the Wisconsin Administrative Code (where applicable). For additional information on any of the limits see the December 21, 2023 memo from Ben Hartenbower to Angela Parkhurst titled “Water Quality-Based Effluent Limitations for the Marshfield Wastewater Treatment Facility WPDES Permit No. WI-0021024”

**MUNICIPAL EFFLUENT LIMITS** –In accordance with the federal regulation 40 CFR 122.45(d), and to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, limits in this permit are to be expressed as weekly average and monthly average limits whenever practicable.

**CBOD/BOD, TSS and pH:** Monitoring and limits for these pollutants correspond to the requirements in the current permit since the facility has not increased the capacity of the wastewater treatment system since the last permit issuance, nor are increases expected during the term of the proposed permit. Pursuant to s. NR 210.05(1)(d), Wis. Adm. Code, the permittee is approved substituted CBOD5 effluent limitations for BOD5 limitations. The permittee has demonstrated that the conditions in s. NR 210.07(4) Wis. Adm. Code for making this substitution have been met and the department concurs. Limitations for CBOD5 are established in s. NR 210.05(1)(d), Wis. Adm. Code.

**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. Weekly average of 4.9 mg/L and monthly average of 2.1 mg/L during April and May each year are included to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes Monitoring is required year round for data collection to use for the next permit reissuance and meet the data requirements of s. NR 106.85, Wis. Adm. Code.

**Chloride-** 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 VII of ch. NR 106 establishes the procedure for calculating water quality based effluent limitations (WQBELs) for chloride. Because the effluent data are below the calculated limit, only monitoring is required to continue in the permit for data collection to use for the next permit reissuance and meet the data requirements of s. NR 106.85, Wis. Adm. Code.

**Mercury-** Requirements for mercury are included in s. NR 106.145 Wis. Adm. Code. The current permit requires quarterly monitoring of the influent and effluent for total recoverable mercury. A total of 30 effluent sampling results were available from November 2018 to August 2023 for total recoverable mercury. The average concentration was 0.88 ng/L, and the maximum was 3.1 ng/L. Because the 30-day P99 of available data (1.14 ng/L) is less than the most stringent WQBEL of 1.3 ng/L, no WQBEL for mercury is required for permit reissuance. Quarterly mercury monitoring is required to continue.

Since current treatment capability and PMP/SRM measures are expected to remain in place, the removal of the daily maximum mercury variance limit will not increase the concentration, level, or loading of mercury to Mill Creek. Therefore, antidegradation would not be applicable. To be consistent with antibacksliding requirements, the current limit may be removed in accordance with s. NR 207.12(4)(b), Wis. Adm. Code.

**Thermal-** 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. Based on the available discharge temperature data from January 2014 to December 2014, the maximum daily effluent temperature reported was 68 °F; therefore, no reasonable potential for exceeding the daily maximum limit exists, and no limits or monitoring are required in the permit.

**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 Marshfield is included within the Wisconsin River Basin TMDL, which was approved by EPA April 26, 2019. The TMDL establishes Waste Load Allocations (WLAs) for point source dischargers and determines the maximum amounts of phosphorus that can be discharged and still protect water quality. The final effluent limits and monitoring are 31.10 lbs/day monthly average and 10.37 lbs/day 6-month average and are to become effective per the phosphorus compliance schedule. An interim limit of 1.0 mg/L monthly average is effective throughout the permit term as serves as both the interim limit until the TMDL final limits become effective, as well as the facility's TBEL (technology based effluent limit).

**Total Nitrogen Monitoring (NO<sub>2</sub>+NO<sub>3</sub>, TKN and 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.

**PFOS and 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 industrial dischargers to be evaluated on a case-by-case basis to determine if monitoring is required pursuant to s. NR 106.98(2)(d), Wis. Adm. Code. The department evaluated the need for PFOS and PFOA monitoring taking into consideration industry type and other potential sources of PFOS or PFOA. Based on information available at the time the proposed permit was drafted, it was identified that the industrial discharger category may be a potential source of PFOS/PFOA.

Therefore, bimonthly monitoring is included. The initial determination of need 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.

**Whole Effluent Toxicity (WET):** Whole effluent toxicity (WET) testing requirements and limits (if applicable) 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>). Using this guidance, annual Acute and annual Chronic WET tests are required with a monthly average limit of 1.0 for Chronic WET tests.

Acute and Chronic tests are required in the following quarters:

July – September 2024

October – December 2025

January – March 2026

April – June 2027

July – September 2028

## **4 Land Application - Monitoring and Limitations**

<b>Municipal Sludge Description</b>						
<b>Sample Point</b>	<b>Sludge Class (A or B)</b>	<b>Sludge Type (Liquid or Cake)</b>	<b>Pathogen Reduction Method</b>	<b>Vector Attraction Method</b>	<b>Reuse Option</b>	<b>Amount Reused/Disposed (Dry Tons/Year)</b>
003	B	Liquid	Fecal Coliform	Injection/Incorporation	Land Application	1012 tons
004	B	Cake	Fecal Coliform	Injection/Incorporation	Land Application	Unknown
Does sludge management demonstrate compliance? Yes						
Is additional sludge storage required? No. Adequate storage available of 400,000 gallons (min 265 days, which exceeds the required 180 days of storage needed.)						
Is Radium-226 present in the water supply at a level greater than 2 pCi/liter? No						
If yes, special monitoring and recycling conditions will be included in the permit to track any potential problems in land applying sludge from this facility						
Is a priority pollutant scan required? no						
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: 003- STORAGE TANK SLUDGE**

<b>Monitoring Requirements and Limitations</b>					
<b>Parameter</b>	<b>Limit Type</b>	<b>Limit and Units</b>	<b>Sample Frequency</b>	<b>Sample Type</b>	<b>Notes</b>
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	
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	



Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Nitrogen, Total Kjeldahl		Percent	Quarterly	Composite	
Nitrogen, Ammonium (NH <sub>4</sub> -N) Total		Percent	Quarterly	Composite	
Phosphorus, Total		Percent	Quarterly	Composite	
Phosphorus, Water Extractable		% of Tot P	Quarterly	Composite	
Potassium, Total Recoverable		Percent	Quarterly	Composite	
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	Sample once in 2025
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	Sample once in 2025
PFOA + PFOS		ug/kg	Annual	Calculated	Report the sum of PFOA and PFOS. See PFAS Permit Sections for more information.
PFAS Dry Wt			Annual	Grab	Perfluoroalkyl and Polyfluoroalkyl Substances based on updated DNR PFAS List. See PFAS Permit Sections for more information.

### Sample Point Number: 004- OXIDATION DITCH SLUDGE

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Solids, Total		Percent	Once	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Once	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	Once	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	Once	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	Once	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	Once	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	Once	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	Once	Composite	
Lead Dry Wt	High Quality	300 mg/kg	Once	Composite	
Nitrogen, Total Kjeldahl	Ceiling	57 mg/kg	Once	Composite	
Nitrogen, Total Kjeldahl	High Quality	17 mg/kg	Once	Composite	

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Molybdenum Dry Wt	Ceiling	75 mg/kg	Once	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	Once	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	Once	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	Once	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	Once	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Once	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	Once	Composite	
Nitrogen, Total Kjeldahl		Percent	Once	Composite	
Nitrogen, Ammonium (NH <sub>4</sub> -N) Total		Percent	Once	Composite	
Phosphorus, Total		Percent	Once	Composite	
Phosphorus, Water Extractable		% of Tot P	Once	Composite	
Potassium, Total Recoverable		Percent	Once	Composite	

## Changes from Previous Permit:

**Sample Point 003 PFAS** – Annual monitoring is included in the permit pursuant s. NR 204.06(2)(b)9., Wis. Adm. Code.

**New Sample Point 004** – New sample point to account for oxidation ditch sludge removal. No PCB or PFAS sampling required due to the one time land application and the similar nature of sludge at sample point 003 which already has that sampling included.

## 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).

**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”.

Collecting sludge data on PFAS concentrations from a wide range of wastewater treatment facilities will help protect public health from exposure to elevated levels of PFAS and determine the department’s implementation of EPA’s recommendations. To quantitate this risk, PFAS sampling has been included in the proposed WPDES permit pursuant to ss. NR 214.18(5)(b) and NR 204.06(2)(b)9., Wis. Adm. Code.

**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.

**New Sample Point 004-** New sample point to account for oxidation ditch sludge removal. No PCB or PFAS sampling required due to the one time land application and the similar nature of sludge at sample point 003 which already has that sampling included.

## 5 Schedules

### 5.1 Total Maximum Daily Load Limits (TMDLs) for Total Phosphorus

The permittee shall comply with the TMDLs for Phosphorus as specified. No later than 14 days following each compliance date, the permittee shall notify the Department in writing of its compliance or noncompliance. If a submittal is required, a timely submittal fulfills the notification requirement.

Required Action	Due Date
Treatment Plant Upgrade to Meet TMDLs: The permittee shall initiate construction of the upgrades. The permittee shall obtain approval of the final construction plans and schedule from the Department pursuant to s. 281.41, Stats. Upon approval of the final construction plans and schedule by the Department pursuant to s. 281.41, Stats., the permittee shall construct the treatment plant upgrades in accordance with the approved plans and specifications.	08/31/2024
Construction Upgrade Progress Report #1: The permittee shall submit a progress report on construction upgrades.	06/30/2025
Complete Construction: The permittee shall complete construction of wastewater treatment system upgrades.	02/28/2026
Achieve Compliance: The permittee shall achieve compliance with final phosphorus TMDLs. Limits become effective May 1, 2026.	04/30/2026

### 5.2 PFOS/PFOA Minimization Plan Determination of Need

Required Action	Due Date
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.  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.	04/30/2025
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.  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.	04/30/2026

<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>	
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## Explanation of Schedules

### **TMDL Limits for Total Phosphorus:**

A compliance schedule is included in the permit to provide time for the permittee to investigate options for meeting phosphorus water quality-based effluent limits while coming into compliance with the limits as soon as reasonably possible.

### **PFOS/PFOA Minimization Plan Determination of Need**

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.

If the Department determines that a minimization plan is needed, the permit will be modified or revoked/reissued to include additional requirements.

## Other Comments:

None

## Attachments:

Water Quality Based Effluent Limits: Memo from Ben Hartenbower to Angela Parkhurst titled “Water Quality-Based Effluent Limitations for the Marshfield Wastewater Treatment Facility WPDES Permit No. WI-0021024 dated December 21, 2023.

Blending Approval Memo

Public Notice: Marshfield News Herald, PO Box 70, Marshfield, WI 54449-0070

## Expiration Date:

March 31, 2029

## Justification Of Any Waivers From Permit Application Requirements

N/A

Prepared By: Angela Parkhurst

Wastewater Specialist

Date: March 3, 2024

# CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: December 21, 2023

TO: Angela Parkhurst– WCR/Eau Claire

FROM: Benjamin Hartenbower – WCR/Eau Claire

SUBJECT: Water Quality-Based Effluent Limitations for the Marshfield Wastewater Treatment Facility  
WPDES Permit No. WI-0021024

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 the Marshfield Wastewater Treatment Facility in Wood County. This municipal wastewater treatment facility (WWTF) discharges to Mill Creek, located in the Mill Creek Watershed in the Central Wisconsin River Basin. This discharge is included in the Wisconsin River TMDL as approved by EPA on April 26, 2019 with site-specific criteria approved by EPA on July 9, 2020. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 002:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
CBOD <sub>5</sub>			25 mg/L	16 mg/L		1
TSS			30 mg/L	20 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Dissolved Oxygen		4.0 mg/L				1
Ammonia Nitrogen April & May			4.9	<b>2.1</b>		3
Mercury						2
Chloride						2
PFOS and PFOA						4
Phosphorus TBEL TMDL Limit				1.0 mg/L 31.10 lbs/day	10.37 lbs/day	5
TKN, Nitrate+Nitrite, and Total Nitrogen						6
Acute WET						7
Chronic WET				1.0 TU <sub>c</sub>		7,8

## 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 106.33(2) and NR 205.065(7), Wis. Adm. Codes, are included in bold.
4. Every other month monitoring is required in accordance with s. NR 106.98(2), Wis. Adm. Code.
5. The phosphorus mass limit is based on the Total Maximum Daily Load (TMDL) for the Wisconsin River Basin to address phosphorus water quality impairments within the TMDL area. The TMDL was approved by EPA on April 26, 2019 with site-specific criteria approved by EPA on July 9, 2020.

6. 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 major municipal permittees. Total Nitrogen is the sum of nitrate (NO<sub>3</sub>), nitrite (NO<sub>2</sub>), and total kjeldahl nitrogen (TKN) (all expressed as N).
7. Annual WET tests are recommended in the reissued permit. 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).
8. The Instream Waste Concentration (IWC) to assess chronic test results is 100%. 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 002 shall be a grab sample collected from Mill Creek.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Benjamin Hartenbower at (715) 225-4705 or Benjamin.Hartenbower@wisconsin.gov or Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (3) – Narrative, 2016 Ammonia Calculations, & Map

PREPARED BY: \_\_\_\_\_ Date: \_\_\_\_\_  
Benjamin Hartenbower, PE,  
Water Resources Engineer

E-cc:  
Logan Rubeck, Wastewater Engineer – WCR/Eau Claire  
Geisa Thielen, Regional Wastewater Supervisor – WCR/Eau Claire  
Diane Figiel, Water Resources Engineer – WY/3  
Scott Provost, Water Quality Biologist – WCR/Wisconsin Rapids  
Kari Fleming, Permit Section Chief – WY/3  
Michael Polkinghorn, Water Resources Engineer – NOR/Rhineland  
Nate Willis, Wastewater Engineer – WY/3

Attachment #1  
**Water Quality-Based Effluent Limitations for  
the Marshfield Wastewater Treatment Facility  
WPDES Permit No. WI-0021024**

Prepared by: Benjamin P. Hartenbower

**PART 1 – BACKGROUND INFORMATION**

**Facility Description:**

Treatment processes include influent pumping, preliminary treatment, activated sludge and solids handling. Influent pumping consists of 3 screw pumps. Preliminary treatment consists of 2 step screens, flow measurement and influent sampling. The activated sludge process consists of 2 oxidation ditches with flexibility to run single, parallel or in series. For the past several years the plant has been operating both ditches in a series mode. Consistent biological phosphorus removal is achieved by directing influent and RAS to the first stage ditch, operated with minimal aeration, thus creating a selector zone. The 2nd stage ditch is then fully aerated. Facilities for adding ferric chloride to precipitate phosphorus are on standby if needed. Alkalinity addition is also on standby when and if needed. The plant has 3 final clarifiers to settle out the activated sludge from the final effluent. Two clarifiers are normally on line with the third available for redundancy and high flow events. After clarification, final effluent flow is sampled and measured. As a final step, flow goes over cascade aeration which brings dissolved oxygen up to near saturation levels.

Attachment #3 is a map of the area showing the approximate location of Outfall 002.

Disinfection of the effluent is not required at this time. It should be noted that recreational use surveys and other information may be re-evaluated in the future to ensure the conditions of s. NR 210.06(3), Wis. Adm. Code, are being met. This re-evaluation could result in requiring disinfection of the effluent at that time.

**Existing Permit Limitations**

The current permit, which expired on September 30, 2023, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
CBOD <sub>5</sub>			25 mg/L	16 mg/L		1
TSS			30 mg/L	20 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Dissolved Oxygen		4.0 mg/L				1
Ammonia Nitrogen						2
Mercury	4.8 ng/L					3
Chloride						2
Phosphorus Interim Final				1.0 mg/L 0.225 mg/L	0.075 mg/L, 2.9 lbs/day	4

Attachment #1

TKN, Nitrate+Nitrite, and Total Nitrogen						2
Acute WET						5
Chronic WET				1.0 TUc		6

Footnotes:

1. 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.
2. Monitoring Only.
3. Variance Limit
4. A compliance schedule is in the current permit to meet the final WQBEL by September 30, 2025.
5. Acute WET testing required: Jan - March 2019, Apr - June 2020, July - Sept 2021, Oct - Dec 2022, and Jan - March 2023.
6. Chronic WET testing required: Jan - March 2019, Apr - June 2020, July - Sept 2021, Oct - Dec 2022, and Jan - March 2023. The IWC for chronic WET was 100%.

**Receiving Water Information**

- Name: Mill Creek
- Waterbody Identification Code (WBIC): 1398600
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Limited Aquatic Life (LAL), non-public water supply.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: USGS for Station 05400658 near Marshfield, in Mill Creek.  
 $7-Q_{10} = 0.03$  cfs (cubic feet per second)  
 $7-Q_2 = 0.09$  cfs  
 Harmonic Mean Flow = 0.25 cfs using a drainage area of 2.0 mi<sup>2</sup>.  
 The Harmonic Mean has been estimated based on average flow and the  $7-Q_{10}$  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).
- Hardness = 292 mg/L as CaCO<sub>3</sub>. This value represents the geometric mean of four effluent samples collected from 11/03/2022 to 11/21/2022. Effluent hardness is used in place of receiving water because Mill Creek is over 99% effluent dominated at this location.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: 25%
- Source of background concentration data: Metals data from the Big Eau Pleine River at Cherokee is used for this evaluation because there is no data available for Mill Creek and the Big Eau Pleine River is within the same ecological landscape so ambient water quality characteristics are expected to be similar. 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: The Blenker Sherry and Hewitt SD Wastewater Treatment Facilities also discharge to Mill Creek. However, the other dischargers do not impact this evaluation.
- Impaired water status: Mill Creek is impaired for Low Dissolved Oxygen and Total Phosphorus and is part of the Wisconsin River TMDL.



**Effluent Information:**

- Design Flow Rates(s):  
Annual Average = 4.63 MGD (Million Gallons per Day)  
For reference, the actual average flow from October 2018 to September 2023 was 2.640 MGD.
- Hardness = 292 mg/L as CaCO<sub>3</sub>. This value represents the geometric mean of four effluent samples collected from 11/03/2022 to 11/21/2022.
- 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 the wells and non-domestic contribution from Foremost Farms, Marshfield Medical Center, Masonite, Balchem Corporation, Wenzel's Farm LLC, and Wiskerchen Cheese Inc.
- Additives: Ferric Chloride
- Total Phosphorus Wasteload Allocation: 3356 lbs/year = 9.188 lbs/day
- Effluent characterization: This facility is categorized as a major municipal discharger, 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 Ammonia, Mercury, Chloride, and Phosphorus from October 2018 to September 2023 is used in this evaluation.

**Chemical Specific Effluent Data at Outfall 002**

	Mercury ng/L	Chloride mg/L
1-day P <sub>99</sub>	2.84	431
4-day P <sub>99</sub>	1.71	387
30-day P <sub>99</sub>	1.14	361
Mean	0.88	387
Std	0.55	33
Sample size	20	48
Range	0.53 - 3.1	270 - 390

**Chemical Specific Effluent Data at Outfall 002**

Sample Date	Copper µg/L
11/03/2022	4.3
11/14/2022	3.8
11/17/2022	4.0
11/21/2022	4.2
11/24/2022	4.5
11/28/2022	4.5
12/01/2022	8.2
12/05/2022	5.9
12/08/2022	4.6
12/12/2022	5.5
12/15/2022	4.8

Attachment #1

Sample Date	Copper µg/L
1-day P <sub>99</sub>	8.5
4-day P <sub>99</sub>	6.6

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.”.

The following table presents the average concentrations and loadings at Outfall 002 from October 2018 to September 2023 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

**Parameter Averages with Limits**

	Average Measurement	Average Mass Discharged
CBOD <sub>5</sub>	3.2 mg/L*	
TSS	6.0 mg/L*	
pH	7.27 s.u.	
Dissolved Oxygen	8.4 mg/L	
Mercury	0.88 ng/L	
Phosphorus	0.28 mg/L	6.48 lbs/day

\*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 99<sup>th</sup> percentile (or P<sub>99</sub>) 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-Q<sub>10</sub>**

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-Q<sub>10</sub> 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.

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

Where:

Attachment #1

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

Qs = average minimum 1-day flow which occurs once in 10 years (1-day Q<sub>10</sub>)  
if the 1-day Q<sub>10</sub> flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q<sub>10</sub>).

Qe = 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

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

If the receiving water is effluent dominated under low stream flow conditions, the 1-Q<sub>10</sub> 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 the City of Marshfield's Wastewater Treatment Facility.

The following tables list the calculated WQBELs for this discharge along with the results of effluent sampling for all the 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 = 0.02 cfs, (1-Q<sub>10</sub> (estimated as 80% of 7-Q<sub>10</sub>)), 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 <sub>99</sub>	1-day MAX. CONC.
Arsenic		339.8		340.9	68.2	<0.85		
Cadmium	292	98.78	0.025	99.1	19.8	<0.19		
Chromium (+3)	292	4340.32	0.337	4354.9	871	<1.1		
Chromium (+6)		16.02		16.1	3.2	1.8		
Copper	292	42.69	1.266	42.8			8.5	8.2
Lead	292	301.41	0.283	302.4	60.5	<4.3		
Mercury		830	5.531	832.76			2.84	3.1
Nickel	268	1080.28		1083.9	216.8	4.6		
Zinc	292	307.54	2.011	308.6	61.7	31		
Chloride		757		760			431	390
Phenol***		4409.8		4409.8	882.0	1.2		

\* 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-Q<sub>10</sub> flow rates yields a more restrictive limit than the 2 × ATC method of limit calculation.

Attachment #1

\*\*\* The limit for this substance is based on a secondary value. Acute limits are set equal to the secondary value rather than two times or using the 1-Q<sub>10</sub> s. NR 106.06(3)(b)2 and s. NR 105.05(2)(f)6, Wis. Adm Code.

**Weekly Average Limits based on Chronic Toxicity Criteria (CTC)**

RECEIVING WATER FLOW = 0.01 cfs (¼ of the 7-Q<sub>10</sub>), 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 <sub>99</sub>
Arsenic		152.2		152.4	30.5	<0.85	
Cadmium	175	3.82	0.025	3.8	0.8	<0.19	
Chromium (+3)	292	317.94	0.337	318.3	63.7	<1.1	
Chromium (+6)		10.98		11	2.2	1.8	
Copper	292	25.91	1.266	25.9			6.6
Lead	292	78.92	0.283	79	15.8	<4.3	
Mercury		440	5.531	440.45			1.71
Nickel	268	169.08		169.3	33.9	4.6	
Zinc	292	307.46	2.011	307.8	61.6	31	
Chloride		395		395			387
Phenol		2172.3		2174.6	434.9	1.2	

\* 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 = 0.02 cfs (¼ of the 90-Q<sub>10</sub>), as specified in s. NR 106.06 (4), Wis. Adm. Code.

SUBSTANCE	WC	MEAN BACK- GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P <sub>99</sub>
Mercury	1.3	5.531	1.3			1.14

**Monthly Average Limits based on Human Threshold Criteria (HTC)**

RECEIVING WATER FLOW = 0.06 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 <sub>99</sub>
Cadmium	880	0.025	888	178	<0.19	
Chromium (+3)	8400000	0.337	8472629	1694526	<1.1	
Chromium (+6)	16800		16945	3389	2	
Lead	2240	0.283	2259.4	451.9	<4.3	
Mercury	336	5.531	338.86			1.14
Nickel	110000		110951	22190	4.6	
Methylene Chloride	328000		330836	66167.2	0.21	

**Monthly Average Limits based on Human Cancer Criteria (HCC)**

RECEIVING WATER FLOW = 0.06 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	40		40.35	8.07	<0.85
Methylene Chloride	9600		9683	1936.6	0.21

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, limits are not required for toxic substances.

Chloride – Considering available effluent data from the current permit term (January 2022 to December 2022), the 1-day P<sub>99</sub> chloride concentration is 431 mg/L, and the 4-day P<sub>99</sub> of effluent data is 387 mg/L.

These effluent concentrations are below the calculated WQBELs for chloride, therefore no effluent limits are needed. Chloride monitoring is recommended to continue to ensure that sample results are available at the next permit issuance to meet the data requirements of s. NR 106.85, Wis. Adm. Code.

Mercury – The WQBEL for total recoverable mercury is set equal to the most stringent criterion of 1.3 ng/L, according to s. NR 106.06 (6), Wis. Adm. Code, because the background concentration in the receiving water and similar inland streams is known to exceed 1.3 ng/L.

The current permit requires quarterly monitoring of the influent and effluent for total recoverable mercury. A total of 30 effluent sampling results are available from November 2018 to August 2023 for total recoverable mercury. The average concentration was 0.88 ng/L, and the maximum was 3.1 ng/L. Because the 30-day P<sub>99</sub> of available data (1.14 ng/L) is less than the most stringent WQBEL of 1.3 ng/L, **no WQBEL for mercury is required for permit reissuance. Quarterly mercury monitoring is recommended to continue.**

#### **Antidegradation and Antibacksliding**

Since current treatment capability and PMP/SRM measures are expected to remain in place, the removal of the daily maximum mercury variance limit will not increase the concentration, level, or loading of mercury to Mill Creek. Therefore, antidegradation would not be applicable. To be consistent with antibacksliding requirements, the current limit may be removed in accordance with s. NR 207.12(4)(b), Wis. Adm. Code.

PFOS and PFOA – The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98(2), Wis. Adm. Code. Monitoring of the Marshfield Utilities water supply produced PFOS average of 12.18 ng/L with a maximum result of 101 ng/L and a maximum PFOA result of 15.7 ng/L. The PFOS results are greater than the criterion of 8 ng/L. Based on levels detected in the source water, **every other month PFOS and PFOA monitoring is recommended.**

### **PART 3 – WATER QUALITY-BASED Effluent Limitations for AMMONIA NITROGEN**

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. Given the fact that the Marshfield Wastewater Treatment Facility does not currently have ammonia nitrogen limits, the need for limits is evaluated at this time.

#### **Daily Maximum Limits based on Acute Toxicity Criteria (ATC):**

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.

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

Where:

A = 0.633 and B = 90.0 for Limited Aquatic Life, and  
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 1305 sample results were reported from October 2018 to September 2023. The maximum reported value was 7.60 s.u. (Standard pH Units). The effluent pH was 7.50 s.u. or less 99% of the time. The 1-day P<sub>99</sub>, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 7.60 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 7.60 s.u. Therefore, a value of 7.60 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 7.6 s.u. into the equation above yields an ATC = 26.25 mg/L.

#### Daily Maximum Ammonia Nitrogen Effluent Limitations Calculation Method

In accordance with s. NR 106.32(2), Wis. Adm. Code daily maximum ammonia limitations are calculated using the 1-Q<sub>10</sub> receiving water low flow 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-Q<sub>10</sub> (estimated as 80 % of 7-Q<sub>10</sub>) and the 2×ATC approach are shown below.

#### Daily Maximum Ammonia Nitrogen Determination

	Ammonia Nitrogen Limit mg/L
2×ATC	52.50
1-Q <sub>10</sub>	26.34

The 1-Q<sub>10</sub> method yields the most stringent limits for the Marshfield Wastewater Treatment Facility.

Presented below is a table of daily maximum limitations corresponding to various effluent pH values. Use of this table is not necessarily recommended in the permit, but it is presented herein for informational purposes.

#### Daily Maximum Ammonia Nitrogen Limits – LAL

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	84	7.0 < pH ≤ 7.1	51	8.0 < pH ≤ 8.1	11
6.1 < pH ≤ 6.2	82	7.1 < pH ≤ 7.2	46	8.1 < pH ≤ 8.2	8.9
6.2 < pH ≤ 6.3	80	7.2 < pH ≤ 7.3	41	8.2 < pH ≤ 8.3	7.3
6.3 < pH ≤ 6.4	78	7.3 < pH ≤ 7.4	36	8.3 < pH ≤ 8.4	6.0
6.4 < pH ≤ 6.5	76	7.4 < pH ≤ 7.5	31	8.4 < pH ≤ 8.5	5.0
6.5 < pH ≤ 6.6	72	7.5 < pH ≤ 7.6	26	8.5 < pH ≤ 8.6	4.1
6.6 < pH ≤ 6.7	69	7.6 < pH ≤ 7.7	22	8.6 < pH ≤ 8.7	3.4
6.7 < pH ≤ 6.8	65	7.7 < pH ≤ 7.8	19	8.7 < pH ≤ 8.8	2.9
6.8 < pH ≤ 6.9	61	7.8 < pH ≤ 7.9	16	8.8 < pH ≤ 8.9	2.4
6.9 < pH ≤ 7.0	56	7.9 < pH ≤ 8.0	13	8.9 < pH ≤ 9.0	2.0

#### Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)

The weekly and monthly average ammonia nitrogen limits calculation from the previous memo do not change because there have been no changes in the effluent and receiving water flow rates. **The calculations from the previous WQBEL memo are shown in Attachment #2.**

**Effluent Data**

The following table evaluates the statistics based upon ammonia data reported from October 2018 to September 2023, with those results being compared to the calculated limits to determine the need to include ammonia limits in the Marshfield Wastewater Treatment Facility permit for the respective month ranges.

**Ammonia Nitrogen Effluent Data**

Ammonia Nitrogen mg/L	April & May	June- September	October- March
1-day P <sub>99</sub>	15.90	4.35	15.52
4-day P <sub>99</sub>	8.71	2.50	8.44
30-day P <sub>99</sub>	4.10	1.09	4.08
Mean	2.24	0.50	2.31
Std	3.46	1.02	3.33
Sample size	40	80	120
Range	0.05 - 13.91	0.04 - 6.31	0.04 - 16.37

Based on this comparison, weekly limits are required in April and May.

**Expression of Limits**

Revisions to ch. NR 106, Wis. Adm. Code, in September 2016 aligned Wisconsin's WQBELs with 40 CFR § 122.45(d), which specifies that effluent limits for continuous dischargers must be expressed as weekly and monthly averages for publicly owned treatment works and as daily maximums and monthly averages for all other dischargers, unless shown to be impracticable. Because a weekly ammonia limit is necessary during April and May for the Marshfield Wastewater Treatment Facility, a monthly average limit is also required under this code revision.

The methods for calculating limitations for municipal treatment facilities to conform to 40 CFR 122.45(d) are specified in s. NR 106.33(2), Wis. Adm. Code, and are as follows:

Whenever a weekly average limitation is determined necessary to protect water quality, a monthly average limitation shall also be included in the permit.

Therefore, **monthly and weekly average limits for April and May** are recommended in the permit.

**Conclusions and Recommendations**

In summary, after rounding to two significant figures, the following ammonia nitrogen limitations are recommended. No mass limitations are recommended in accordance with s. NR 106.32(5), Wis. Adm. Code.



**Final Ammonia Nitrogen Limits**

	Weekly Average mg/L	Monthly Average mg/L
April & May	4.9	<b>2.1</b>

**PART 4 – 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 the Marshfield Wastewater Treatment Facility currently has a limit of 1.0 mg/L, this limit should be included in the reissued permit. This limit remains applicable unless a more stringent WQBEL is given.

In addition, the need for a WQBEL for phosphorus must be considered.

**TMDL Limits – Phosphorus**

Total phosphorus (TP) effluent limits in lbs/day are calculated as recommended in the *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs* (May 2020). The wasteload allocations (WLA) that implement site-specific criteria for Lakes Petenwell, Castle Rock, and Wisconsin are found in Appendix K of the *Total Maximum Daily Loads for Total Phosphorus in the Wisconsin River Basin (WRB TMDL)* report dated April 26, 2019 and are expressed as maximum annual loads (lbs/year) and maximum daily loads (lbs/day). The WLA that implement statewide criteria found in Appendix J of the TMDL report are no longer applicable following approval of these site-specific criteria. The daily WLAs in the WRB TMDL equals the annual WLA divided by the number of days in the year. Therefore, the daily WLA is an annual average. Since the derivation of daily WLAs from annual WLAs does not take effluent variability or monitoring frequency into consideration, maximum daily WLAs from the WRB TMDL should not be used directly as permit effluent limits.

For the reasons explained in the April 30, 2012 paper entitled *Justification for Use of Monthly, Growing Season and Annual Average Periods for Expression of WPDES Permit Limits for Phosphorus Discharges in Wisconsin*, WDNR has determined that the phosphorus WQBELs set equal to WLAs would not be consistent with the assumptions and requirements of the TMDL.

Therefore, limits given to continuously discharging facilities covered by the WRB TMDL are given monthly average mass limits. If the equivalent effluent concentration is less than or equal to 0.3 mg/L, six-month average mass limits are also included. The following equation shows the calculation of equivalent effluent concentration:

$$\begin{aligned} \text{TP Equivalent Effluent Concentration} &= \text{Daily WLA} \div (\text{Flow Rate} * \text{Conversion Factor}) \\ &= 9.188 \text{ lbs/day} \div (4.630 \text{ MGD} * 8.34) \end{aligned}$$

$$\begin{aligned} &\text{Attachment \#1} \\ &= 0.24 \text{ mg/L} \end{aligned}$$

Since this value is less than 0.3 mg/L, both a six-month average mass limit and a monthly average mass limit are applicable for total phosphorus. The monthly average limit is set equal to three times the six-month average limit.

$$\begin{aligned} \text{TP 6-Month Average Permit Limit} &= \text{Daily WLA} * 6\text{-Month average multiplier} \\ &= 9.188 \text{ lbs/day} * 1.13 \\ &= 10.37 \text{ lbs/day} \end{aligned}$$

$$\begin{aligned} \text{TP Monthly Average Permit Limit} &= \text{TP 6-Month Average Permit Limit} * 3 \\ &= 10.37 \text{ lbs/day} * 3 \\ &= 31.10 \text{ lbs/day} \end{aligned}$$

The multiplier used in the six-month average calculation was determined according to TMDL implementation guidance. A coefficient of variation was calculated, based on phosphorus mass monitoring data, to be 1.91. The facility is not currently able to meet the permit limits based on the WLA, so the standard CV of 0.60 is used. This value, along with monitoring frequency, is used to select the multiplier. The current permit specifies phosphorus monitoring as 5/week; if a different monitoring frequency is used, the stated limits should be reevaluated.

The WRB TMDL establishes TP wasteload allocations to reduce the loading in the entire watershed including WLAs to meet water quality standards for tributaries to the Wisconsin River. Therefore, WLA-based WQBELs are protective of immediate receiving waters and TP WQBELs derived according to s. NR 217.13, Wis. Adm. Code are not required.

Since wasteload allocations are expressed as annual loads (lbs/yr), permits with TMDL-derived monthly average permit limits should require the permittee to calculate and report rolling 12-month sums of total monthly loads for TP. Rolling 12-month sums can be compared directly to the annual wasteload allocation. Six-month average limits apply in the periods May – October and November – April.

### Interim Limit – Phosphorus

An interim limit is needed when a compliance schedule is included in the permit to meet the TMDL limits. This limit should reflect a value which the facility is able to currently meet; however, it should also consider the receiving water quality, keeping the water from further impairment. It's recommended that the interim limit be set equal to 1.0 mg/L, expressed as a monthly average. This value reflects the current TBEL. The following table lists the statistics for effluent phosphorus levels from October 2018 to September 2023 for informational purposes. In the cases where reporting the mass discharge is not required in the current permit, the mass is calculated using the reported phosphorus concentration and the effluent flow rate for that day.

**Total Phosphorus Statistics**

	Concentration (mg/L)	Mass Discharge (lbs/day)
1-day P <sub>99</sub>	1.45	54.05
4-day P <sub>99</sub>	0.79	30.68
30-day P <sub>99</sub>	0.43	13.53

Attachment #1

Mean	0.28	6.51
Std	0.30	12.45
Sample Size	1304	1304
Range	0.07 - 7.48	1.30 - 374.05

**Conclusions:**

In summary, the following limits are recommended by this evaluation:

- Total Phosphorus concentration limit of 1.0 mg/L
- Monthly average Total Phosphorus mass limit of 31.10 lbs/day
- Six-month average Total Phosphorus mass limit of 10.37 lbs/day

### **PART 5 – WATER QUALITY-BASED Effluent Limitations for THERMAL**

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in Chapters NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. The daily maximum effluent temperature limitation shall be 86 °F for discharges to surface waters classified as Limited Aquatic Life according to s. NR 104.02(3)(b)1, Wis. Adm. Code, except for those classified as wastewater effluent channels and wetlands regulated under ch. NR 103 [s. NR 106.55(2), Wis. Adm. Code] which has a daily maximum effluent temperature limitation of 120 °F.

**Reasonable Potential**

Based on the available discharge temperature data from January 2014 to December 2014, the maximum daily effluent temperature reported was 68 °F; therefore, no reasonable potential for exceeding the daily maximum limit exists, and **no limits or monitoring are recommended**.

**Monthly Temperature Effluent Data & Limits**

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	50	50	-	86
FEB	48	49	-	86
MAR	48	49	-	86
APR	49	49	-	86
MAY	56	58	-	86
JUN	63	64	-	86
JUL	66	67	-	86
AUG	67	68	-	86
SEP	66	68	-	86
OCT	62	65	-	86
NOV	59	60	-	86
DEC	54	55	-	86

**PART 6 – 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 LC<sub>50</sub> (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 IC<sub>25</sub> (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 **100%** 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

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

Where:

$Q_e$  = annual average flow = 4.630 MGD = 7.164 cfs

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

$Q_s$  = 1/4 of the 7- $Q_{10}$  = 0.03 cfs  $\div$  4 = 0.01 cfs

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual*, 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.
- 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 002 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 002. 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 <sub>50</sub> %				Chronic Results IC <sub>25</sub> %					Footnotes  or Comments
	<i>C. dubia</i>	Fathead minnow	Pass or Fail?	Used in RP?	<i>C. dubia</i>	Fathead Minnow	Algae (IC50)	Pass or Fail?	Use in RP?	
07/28/1992				No	43.4	>100		Fail	No	1
06/22/1993	>100	>100	Pass	No	87.2	60		Fail	No	1
08/03/1993				No	30.3	40.6		Fail	No	1
08/17/1993				No	61	68.5		Fail	No	1
02/14/1994	>100	>100	Pass	No						1
09/19/1995	>100	>100	Pass	No		96		Fail	No	1
10/14/1995				No	>100			Pass	No	1
04/02/1996				No	>100	66.2		Fail	No	1
05/07/1996				No	>100	50.5		Fail	No	1
11/05/1996	>100	>100	Pass	No						1
01/22/1997	>100	>100	Pass	No						1
05/13/1997	>100	>100	Pass	No						1

## Attachment #1

01/14/2014					>100	>100		Pass	Yes	
02/25/2014					>100	>100		Pass	Yes	
08/12/2014					>100	>100		Pass	Yes	
02/10/2024					>100	>100		Pass	Yes	
10/13/2015					>100	>100		Pass	Yes	
05/24/2016					>100	>100		Pass	Yes	
10/18/2016					>100	>100		Pass	Yes	
01/17/2017	>100	>100	Pass	Yes	>100	>100		Pass	Yes	
07/27/2017					>100	>100		Pass	Yes	
01/22/2019	>100	>100	Pass	Yes	>100	>100		Pass	Yes	
06/09/2020	>100	>100	Pass	Yes	>100	>100		Pass	Yes	
08/24/2021	>100	>100	Pass	Yes	>100	>100		Pass	Yes	
10/25/2022	>100	>100	Pass	Yes	<b>74.6</b>	>100		Fail	Yes	
12/13/2022					>100	>100		Pass	Yes	
01/31/2023	>100	>100	Pass	Yes	>100	>100		Pass	Yes	

## Footnotes:

1. *Data Not Representative*. Significant changes were made to WET test methods in 2004 and these changes were assumed to be fully implemented by certified labs by no later than June 2005.
- 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.**

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

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

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

<b>TU<sub>c</sub></b> (maximum) 100/IC <sub>25</sub>	<b>B</b> (multiplication factor from s. NR 106.08(6)(c), Wis. Adm. Code, Table 4)	<b>IWC</b>
100/74.6 = 1.3 TU <sub>c</sub>	6.2 Based on 1 detect	100%

$$[(TU_c \text{ effluent})(B)(IWC)] = 8.3 > 1.0$$

Therefore, reasonable potential is shown for a chronic WET limit using the procedures in s. NR 106.08(6) and representative data from 2014 to 2023.

#### Expression of WET limits

Chronic WET limit =  $[100/IWC] TU_c = 1.0 TU_c$  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

	<b>Acute</b>	<b>Chronic</b>
<b>AMZ/IWC</b>	Not Applicable. <b>0 Points</b>	IWC = 100%. <b>15 Points</b>
<b>Historical Data</b>	Six tests used to calculate RP. No tests failed. <b>0 Points</b>	15 tests used to calculate RP. One test failed. <b>0 Points</b>
<b>Effluent Variability</b>	Little variability, no violations or upsets, consistent WWTF operations. <b>0 Points</b>	Same as Acute. <b>0 Points</b>
<b>Receiving Water Classification</b>	< 4 mi to WWSF (5 pts) <b>5 Points</b>	Same as Acute. <b>5 Points</b>

## Attachment #1

	<b>Acute</b>	<b>Chronic</b>
<b>Chemical-Specific Data</b>	No reasonable potential for limits based on ATC; Ammonia, Chloride, Chromium, Copper, Mercury, Nickel and Zinc detected. (3 pts) Additional Compounds of Concern: Methylene Chloride and Phenol (2 pts) <b>5 Points</b>	Reasonable potential for Ammonia limit based on CTC; (5 pts) Chloride, Chromium, Copper, Mercury, Nickel and Zinc detected. (3 pts) Additional Compounds of Concern: Methylene Chloride and Phenol (2 pts) <b>10 Points</b>
<b>Additives</b>	One Water Quality Conditioner added. (1 pt) Permittee has proper P chemical SOPs in place <b>1 Point</b>	Additive used more than once per 4 days. <b>1 Point</b>
<b>Discharge Category</b>	Six Industrial Contributors. (10 pts) <b>10 Points</b>	Same as Acute. <b>10 Points</b>
<b>Wastewater Treatment</b>	Secondary or Better <b>0 Points</b>	Same as Acute. <b>0 Points</b>
<b>Downstream Impacts</b>	No impacts known <b>0 Points</b>	Same as Acute. <b>0 Points</b>
<b>Total Checklist Points:</b>	<b>21 Points</b>	<b>41 Points</b>
<b>Recommended Monitoring Frequency (from Checklist):</b>	1x yearly	1x yearly
<b>Limit Required?</b>	No	Yes Limit = 1.0 TU <sub>c</sub>
<b>TRE Recommended? (from Checklist)</b>	No	No

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, annual acute and 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 1.0 TU<sub>c</sub> 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 the Marshfield Wastewater Treatment Facility 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. Therefore, annual monitoring is recommended in the permit term, so that data will be available for the next permit application.



**Ammonia Calculations from the March 29, 2016 WQBEL Memo:****AMMONIA (as N) LIMITS (LAL Reach)**

Effluent Flow (mgd): 4.63

Effluent Flow (cfs): 7.164

## Effluent pH data:

Begin Date 01-Mar-11

End Date 31-Aug-15

# of Samples 1173

Maximum 7.5

Average 6.78

Standard Deviation 0.269

Estimated 99th Percentile 7.4

Max. Effluent pH (s.u.): 7.40

**BACKGROUND INFORMATION:**

	Oct-Mar	Apr - May	Jun-Sep
4Q3 (cfs)			
7Q10 (cfs)	0.03	0.03	0.03
30Q5 (cfs)	0.07	0.07	0.07
7Q2 (cfs)			
Ammonia (mg/L) (1)	0.21	0.07	0.04
Temperature (deg C) (2)	7	13	23
pH (std. units) (3)	7.9	8.4	8.4
% of river flow used:	100	100	100
Reference weekly flow:	0.03	0.03	0.03
Reference monthly flow:	0.07	0.07	0.07
<b>CRITERIA (in mg/L):</b>			
Acute (@ effl. pH):	35.40	35.40	35.40
4-day Chronic (@ backgrd. pH):	74.2	23.2	12.2
30-day Chronic (@ backgrd. pH)	29.7	9.3	4.9
<b>EFFLUENT LIMITS (in mg/L):</b>			
Daily maximum	70.80	70.80	70.80
Weekly average	75	23	12
Monthly average	30	9.4	4.9
(1) Default Data			
(2) Default Data			
(3) Mill Creek at CTH E			

## Attachment #2

<b>AMMONIA (as N) LIMITS (WWSF Reach)</b>			
Effluent Flow (mgd):	4.63		
Effluent Flow (cfs):	7.164		
Effluent pH data:			
Begin Date	01-Mar-11		
End Date	31-Aug-15		
# of Samples	1173		
Maximum	7.5		
Average	6.78		
Standard Deviation	0.269		
Estimated 99th Percentile	7.4		
Max. Effluent pH (s.u.):	7.40		
<b>BACKGROUND INFORMATION:</b>			
	<b>Oct-Mar</b>	<b>Apr - May</b>	<b>Jun-Sep</b>
4Q3 (cfs)			
7Q10 (cfs)	0.2	0.2	0.2
30Q5 (cfs)	0.8	0.8	0.8
7Q2 (cfs)			
Ammonia (mg/L) (1)	0.21	0.07	0.04
Temperature (deg C) (2)	7	13	23
pH (std. units) (3)	100	100	100
% of river flow used:	0.2	0.2	0.2
Reference weekly flow:	0.8	0.8	0.8
Reference monthly flow:	100	100	100
<b>CRITERIA (in mg/L):</b>			
Acute (@ effl. pH):	22.97	22.97	22.97
4-day Chronic (@ backgrd. pH):			
early life stages present	6.99	3.22	1.87
early life stages absent	11.36	3.56	1.87
30-day Chronic (@ backgrd. pH)			
early life stages present	2.80	1.29	0.75
early life stages absent	4.54	1.42	0.75
<b>EFFLUENT LIMITS (in mg/L):</b>			
Daily maximum	46	46	46
Weekly average			
early life stages present	7.2	3.3	1.9
early life stages absent	11.7	3.7	
Monthly average			
early life stages present	3.09	1.4	0.8
early life stages absent	5.0	1.6	
(1) Default Data			
(2) Default Data			
(3) Mill Creek at CTH E			

Next, the amount of nitrification that may take place between the outfall and CTH K needs to be accounted for. When temperatures are below 10°C no decay is expected, so the limits to protect the warm water sport fish reach are controlling. For the spring and summer conditions in-stream decay is expected so a first order decay model will be used. Based on the available literature a

## Attachment #2

decay rate of  $0.25 \text{ day}^{-1}$  at  $20^{\circ}\text{C}$  has been suggested as a default rate. Ammonia decay rates are dependent on temperature with nitrification essentially non-existent in the winter. A temperature correction factor of  $\theta = 1.08$  is used for temperatures above  $10^{\circ}\text{C}$  ( $k_t = k_{20} \theta^{(T-20)}$ ).

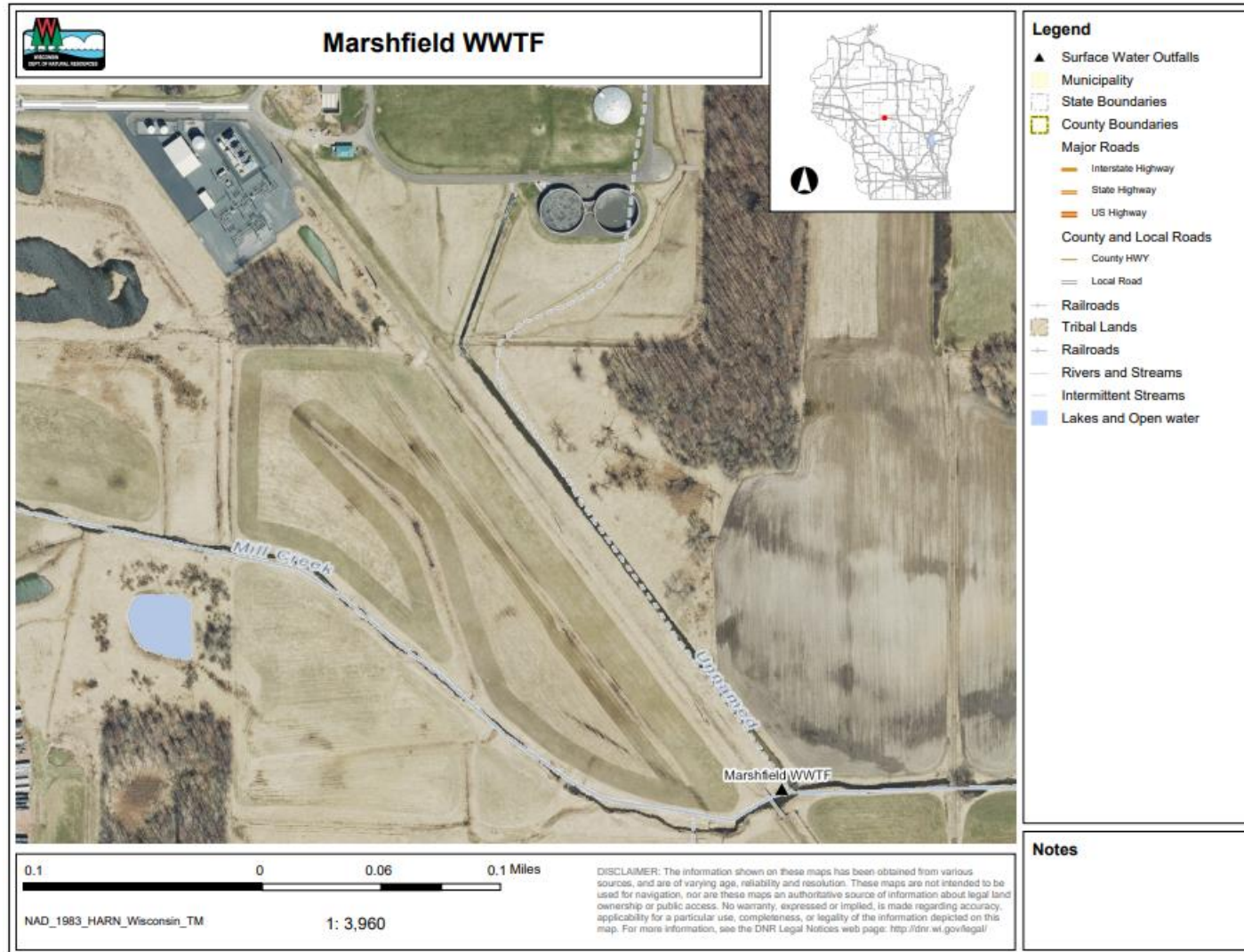
$$N_{\text{Limit}} = \left( \frac{N_{\text{down}}}{\text{EXP}(-k_t T)} \right)$$

Where:  $N_{\text{Limit}}$  = Ammonia limit needed to protect downstream use (mg/L)  
 $N_{\text{down}}$  = Ammonia Criteria for downstream use (mg/L)  
 $-k_t$  = Ammonia decay rate at background stream temperature ( $\text{day}^{-1}$ )  
 $T$  = Travel time from outfall to downstream use (day)

Compiling the above information it was determined that the following effluent limits should be applied:

Calculated Chronic Limits:	Oct-Mar	Apr - May	Jun-Sep
Weekly Average (mg/L)	11.7	4.9	4.4
Monthly Average (mg/L)	5.0	2.1	1.9

Attachment #3





February 20<sup>th</sup>, 2024

Memo to City of Marshfield's WWTF file

Contacts – Thomas Turchi, Director of Public Works and Mark Kivela, Wastewater Superintendent

From: Logan Rubeck, Area Basin Engineer

Subject: Blending Approval Memo to Add Blending to WPDES Permit No. WI-0021024-09-0

### **Approval**

Blending is hereby approved, and conditions will be included in the City of Marshfield's WPDES Permit No. WI-0021024-09-0, per Wis. Administrative Code s. NR 210.12 (2). The Department has determined that blending may be necessary during wet weather and other high flow conditions.

A condition for blending states that: Untreated or partially treated wastewater that is routed around a biological treatment process or a portion of a biological treatment process shall be recombined with the biologically treated wastewater, and the combined flow shall be disinfected, if required by the WPDES permit, prior to discharge. Additionally, wastewaters shall meet the effluent limitations established in the permit. These criteria shall be followed.

### **Blending Plant Settings**

The City of Marshfield's wastewater treatment plant has the ability to divert flow at the influent splitter box when the inflow is greater than 18 MGD. The actual flow rate at which diversion occurs may be higher based on high flow event procedures outlined in the Request for Blending Approval Attachment. When a diversion does occur, the flow bypasses the oxidation ditches and goes to the final clarifiers. There it is combined with the influent that receives treatment in the oxidation ditches. The flow from the final clarifiers is then discharged.

### **Summary of Blending Events During Previous Permit Term**

There were no blending events that occurred during the City of Marshfield's current permit term under WPDES Permit No. WI-0021024-08-0 which became effective October 1, 2018.

### **Additional Information**

Specifics regarding the process flow capacity of each treatment unit, feasible alternatives, severe property damage risks, and data concerning recent flow can be found in the April 4<sup>th</sup>, 2023 document titled "Request for Blending Approval Attachment to WPDES Permit Application Checklist". This information supports s. NR 210.12(2)(a), Wis. Adm. Code.

### **Efforts to Reduce Inflow/Infiltration (I/I)**

The City of Marshfield's Capacity, Management, Operation and Maintenance (CMOM) Plan goals include continuous inspection and testing of the collection system to identify areas of wet weather inflow in the system. Goals also include performing system wide maintenance including cleaning and replacement. The City has an incentive in place for homeowners to replace leaking laterals. Manholes

and other system components are to be rehabilitated as needed. Please see the Marshfield Compliance Maintenance Annual Report for a detailed list of I/I reduction efforts.

The CMOM was reviewed during the site visit on 10/05/2023 and the facility is meeting the conditions of the CMOM program. These efforts support s. NR 210.12(2)(b), Wis. Adm. Code.

**Approval of Blending Design**

The department approved the City of Marshfield's request for approval of a design for blending on February 20<sup>th</sup>, 2024 (meeting requirement s. NR 210.12(2)(d), Wis. Adm. Code). As part of the blending approval, the City provided documentation that demonstrated that there were no feasible alternatives to blending (per s. NR 210.12(2)(c), Wis. Adm. Code).