

# Permit Fact Sheet

## General Information

Permit Number:	WI-0022055-09-0	
Permittee Name:	City of Princeton	
Address:	531 S. Fulton St.	
City/State/Zip:	Princeton WI 54968	
Discharge Location	5000 feet southeast of facility. The discharge point is on the north bank of the Fox River, 280 ft. south of CTH D and 25 feet downstream of the railroad bridge.	
Receiving Water	Fox River	
Stream Flow (Q <sub>7,10</sub> )	301 cfs	
Designated Uses	Fish and aquatic life biological use (warm water sport fish community in the Great Lakes Basin), recreation and non-public water supply	
Design Flow(s)	Annual Average	0.260 MGD
Significant Industrial Loading?	No significant industrial loading	
Operator at Proper Grade?	Facility Classification & Subclasses: Basic classification in subclasses: A4 – Ponds, Lagoons and Natural Systems; and L – Laboratory  Operator-in-Charge Certification: Ernest Schmidt has Basic level certification in subclasses A4 and L.	
Pretreatment Program Approval Date	N/A	

## Facility Description

The City of Princeton, in Green Lake County, operates an Aerated Lagoon wastewater treatment facility (WWTF) designed for an average annual flow of 0.26 MGD. Princeton wastewater collected in the system is all pumped through the Main Lift station and goes to the WWTF. At the Main Lift Station there is a sampler for taking influent samples, a grinder, a grit pump and grit chamber for grit removal, and the flowmeter. The WWTF consists of three ponds including two aerated lagoons and one settling pond. Once effluent passes out of the polishing lagoon by means of a telescoping valve it travels through the chlorine contact chamber. Treated effluent from the WWTF is discharged to the Fox River. The WWTF is located on a hill to the northwest of the City where it is not subject to flooding. Influent must be pumped to it by means of a lift station. All lagoons were synthetically lined in 2004 and sludge has yet to accumulate to the point of requiring removal.

## Substantial Compliance Determination

**Enforcement During Last Permit:** Review of the monthly discharge monitoring reports submitted by Princeton’s wastewater treatment plant for the period January 3, 2023, through March 28, 2023, identified continuing violations of the total phosphorus monthly average limit of 4.1 mg/L as well as continuing violations of the total ammonia nitrogen weekly

average limits of 17 mg/L. However, the facility responded in writing on May 22, 2023, with updated numbers showing that the facility has returned into compliance.

Sample Point Designation		
Sample Point Number	Discharge Flow, Units, and Averaging Period	Sample Point Location, WasteType/sample Contents and Treatment Description (as applicable)
701		Influent - Representative influent samples shall be collected from the main lift station prior to the comminutor & bar screen.
001	0.21 MGD (Avg. 7/1/2017 – 2/28/2022)	Effluent - Representative effluent samples shall be collected prior to the chlorine contact tank except that samples for fecal coliform and chlorine (when applicable) shall be collected at the end of the chlorine contact tank.
002	Not removed on a regular basis. Lagoon system.	Lagoon Sludge - Liquid sludge that accumulates in the lagoons. Representative samples shall be composited from each cell and compliance with the requirements of s. NR 204, Wisconsin Administrative Code, shall be assured prior to any disposal of sludge. Results of sludge analyses shall be reported on form 3400-49 "Waste Characteristics Report". All reports required by this section shall be submitted by January 31 following each year that sludge analysis occurs.

## 1 Influent – Monitoring Requirements

### Sample Point Number: 701- Influent

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

### Changes from Previous Permit:

No Changes.

### Explanation of Limits and Monitoring Requirements

Influent monitoring is needed to assess loading to the facility and treatment performance. Requirements for flow, BOD, and TSS are established in accordance with ch. NR 210.04(2), Wis. Adm. Code.

## 2 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	Monthly Avg	30 mg/L	Weekly	24-Hr Flow Prop Comp	
BOD5, Total	Weekly Avg	45 mg/L	Weekly	24-Hr Flow Prop Comp	
Suspended Solids, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Flow Prop Comp	
Suspended Solids, Total	Weekly Avg	45 mg/L	Weekly	24-Hr Flow Prop Comp	
Suspended Solids, Total	Monthly Avg	65.9 lbs/day	Weekly	Calculated	This is a final TMDL limit effective immediately. See TMDL section.
Suspended Solids, Total	Weekly Avg	108 lbs/day	Weekly	Calculated	This is a final TMDL limit effective immediately. See TMDL section.
pH Field	Daily Max	9.0 su	5/Week	Grab	
pH Field	Daily Min	6.0 su	5/Week	Grab	
Chlorine, Total Residual	Daily Max	38 ug/L	5/Week	Grab	
Chlorine, Total Residual	Monthly Avg	38 ug/L	5/Week	Grab	
Chlorine, Total Residual	Weekly Avg	38 ug/L	5/Week	Grab	
E. coli	Geometric Mean - Monthly	126 #/100 ml	Weekly	Grab	Applies May - September, annually.
E. coli		Percent	Monthly	Calculated	Applies May - September, annually. See the E. coli Percent Limit section below. Enter the result in the DMR on the last day of the month.
Phosphorus, Total	Monthly Avg	3.9 mg/L	Weekly	24-Hr Flow Prop Comp	This is an MDV interim limit effective for 2 years. After approx.. 2 years they

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
					should have to comply with a limit of 1 mg/L (HAC interim limit).
Phosphorus, Total	Monthly Avg	1.0 mg/L	Weekly	24-Hr Flow Prop Comp	This goes into effect starting April 1, 2026.
Phosphorus, Total		lbs/day	Monthly	Calculated	
Phosphorus, Total		lbs/month	Monthly	Calculated	Calculate the Total Monthly Discharge of TSS and report on the last day of the month on the DMR. See standard requirements section 5.4.2 for the appropriate formula.
Phosphorus, Total	Monthly Avg	1.4 lbs/yr	Monthly	Calculated	Calculate the 12-month rolling sum of total monthly mass of phosphorus discharged and report on the last day of the month on the DMR. See standard requirements section 5.4.2 for the appropriate formula.
Nitrogen, Ammonia Variable Limit		mg/L	Weekly	24-Hr Flow Prop Comp	See Daily Max Ammonia Limits section.
Nitrogen, Ammonia (NH3-N) Total	Daily Max - Variable	mg/L	Weekly	24-Hr Flow Prop Comp	See Daily Max Ammonia Limits section.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	17 mg/L	Weekly	24-Hr Flow Prop Comp	
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	17 mg/L	Weekly	24-Hr Flow Prop Comp	
Nitrogen, Total Kjeldahl		mg/L	See Listed Qtr(s)	24-Hr Flow Prop Comp	Annual in rotating quarters. See Nitrogen Monitoring Series section.
Nitrogen, Nitrite + Nitrate Total		mg/L	See Listed Qtr(s)	24-Hr Flow Prop Comp	Annual in rotating quarters. See Nitrogen Monitoring Series section.
Nitrogen, Total		mg/L	See Listed Qtr(s)	24-Hr Flow Prop Comp	Annual in rotating quarters. See Nitrogen Monitoring Series section. Total Nitrogen shall be calculated as the sum of reported values for Total Kjeldahl

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
					Nitrogen and Total Nitrite + Nitrate Nitrogen.

### Changes from Previous Permit

- TSS – Addition of weekly and monthly limits: weekly limit of 108 lbs/day and monthly limit of 65.9 lbs/day.
- Addition of E coli limits, removal of fecal coliform.
- Phosphorous – now has an LCA monthly interim limit of 3.9 mg/L and an HAC monthly interim limit of 1.0 mg/L.
- Addition of Nitrogen Monitoring Series.
- Removal of WET Testing.

### Explanation of Limits and Monitoring Requirements

#### Categorical Limits

Categorical limits are required per NR 210, Wis. Adm. Code, (sewage treatment works).

#### BOD5, TSS and pH

The effluent limitations for BOD5, TSS and pH are carried over into this permit. These limitations are not subject to change at this time because the receiving water characteristics have not changed.

#### E. Coli & Disinfection

Seasonal disinfection (May 1 – September 30) is required to protect recreational uses in waters having full fish and aquatic life use designation, like the Fox River. Bacteria limits apply during the disinfection season of May – September. No more than 10 percent of E. coli bacteria samples collected in any calendar month may exceed 410 count/100 mL.

On May 1, 2020, revisions to chs. NR 102 and NR 210, Wis. Adm. Code, became effective and replace fecal coliform limits with new Escherichia coli (E. coli) limits for protection of recreation uses. Since the facility is required to disinfect the following limits are included in the proposed permit in accordance with s. NR 210.06(2)(a)1, Wis. Adm. Code. The existing fecal coliform limit of 400 #/100 ml as a monthly geometric mean is replaced with E. coli limit of 126 #/100 ml as a monthly geometric mean and no more than 10 percent of E. coli bacteria samples collected in any calendar month may exceed 410 #/100 ml. The permittee indicated to the department that the permittee will be in compliance with E. coli limits immediately.

#### Phosphorus

Chapter NR 217 was revised on December 1, 2010, with the addition of Subchapter III, which includes WQBELs for phosphorus, based upon criteria contained in Chapter NR 102. The May 2, 2022, WQBEL memo presents recommendations for phosphorus WQBELs derived according to the procedure specified under s. NR 217.13, Wis. Adm. Code. In accordance with ch. NR 217.13(2), Wis. Adm. Code, the applicable WQBEL is 0.1 mg/L, in order to be protective of the receiving water.

Ch. 217.14(2), Wis. Adm. Code, requires phosphorus concentration WQBELs to be expressed as monthly average limits, except if that concentration is less than 0.3 mg/L, in which case the WQBEL may be expressed as an annual average. As described in the April 30, 2012 paper, “Justification for Use of Monthly, Growing Season and Annual Averaging Periods for Expression of WPDES Permit Limits for Phosphorus in Wisconsin”, and under the terms of the July 12, 2012, “Addendum to the National Pollutant Discharge Elimination System Memorandum of Agreement between the U.S. Environmental Protection Agency, Region 5 and the Wisconsin Department of Natural Resources”, a 6 month averaging period (May 1 to October 31 and November 1 to April 30) is appropriate for the expression of the concentration WQBEL,

and a monthly average limit three times the 6-month average concentration WQBEL is to also to be included in the permit. In summary, the applicable phosphorus WQBELs for this permit are 0.48 lbs/day as a 6-month average, and a monthly average of 1.4 lbs/day.

Under the phosphorus MDV, a level currently achievable (LCA) interim limit of 3.9 mg/L should be effective upon permit reissuance. A compliance schedule may be included in the permit until the highest attainable condition (HAC) limit of 1.0 mg/L can be met. The TMDL limits remain at 1.4 lbs/day as a monthly average and 0.48 lbs/day as a six-month average. The 6-month average limit is expressed as a seasonal average with averaging periods occurring from May through October and November through April. Compliance with the 6-month average limit is evaluated at the end of each 6-month period on April 30th and October 31st annually.] The 12-month rolling sum of total monthly phosphorus (lbs/yr) shall be reported each month for direct comparison to the facility’s WLA.

The phosphorus limit of 3.9 mg/L is an interim limit set in accordance with s. NR. 217.17, Wis. Adm. Code. The interim limit will remain in effect unless a more stringent limit is required at a future permit issuance by ss. NR 217.13 and NR 217.16(2), Wis. Adm. Code, or the limit is relaxed following procedures outlined in ch. NR 207, Wis. Adm. Code. Sampling and reporting of phosphorus concentrations and masses discharged shall begin upon the permit effective date.

**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 (effective March 1, 2004). Subchapter III of ch. NR 106 establishes the procedure for calculating water quality based effluent limitations (WQBELs) for ammonia (effective March 1, 2004). Ammonia limits are necessary for the City of Princeton as described in the WQBEL memo dated May 2, 2022. Regulatory changes to s. NR 205.065, Wis. Adm. Code, became effective September 1, 2016, that requires limits in this permit to be expressed as weekly average and monthly average limits whenever practicable. These changes are based on 40 CFR 122.45(d).

**Total Nitrogen Monitoring (NO2+NO3, 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. 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.

### 3 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)
002	B	Liquid	Fecal Coliform	Lagoon	Land Application	Lagoon
Does sludge management demonstrate compliance? <b>Yes</b>						
Is additional sludge storage required? <b>No</b>						
Is Radium-226 present in the water supply at a level greater than 2 pCi/liter? <b>Yes, the City of Princeton has a radium removal system for its water supply.</b>						

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)
Is a priority pollutant scan required? No						

### Sample Point Number: 002- Lagoon 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	
Mercury Dry Wt	Ceiling	57 mg/kg	Once	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	Once	Composite	
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	
Radium 226 Dry Wt		pCi/g	Once	Composite	
Nitrogen, Total Kjeldahl		Percent	Annual	Composite	See the "List 2 Analysis" section for more information.
Nitrogen, Ammonium (NH4-N) Total		Percent	Annual	Composite	See the "List 2 Analysis" section for more information.

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Phosphorus, Total		Percent	Annual	Composite	See the "List 2 Analysis" section for more information.
Phosphorus, Water Extractable		% of Tot P	Annual	Composite	See the "List 2 Analysis" section for more information.
Potassium, Total Recoverable		Percent	Annual	Composite	See the "List 2 Analysis" section for more information.
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	Analysis required 2024. See the "Sludge Analysis for PCBs" section and the Standard Requirements for more information.
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	Analysis required 2024. See the "Sludge Analysis for PCBs" section and the Standard Requirements for more information.
PFOA + PFOS		ug/kg	Once	Calculated	Report the sum of PFOA and PFOS. See PFAS Permit Sections for more information.
PFAS Dry Weight			Once	Grab	Perfluoroalkyl and Polyfluoroalkyl Substances based on updated DNR PFAS List. See PFAS Permit Sections for more information.

### Changes from Previous Permit:

PFAS - Monitoring with a Once frequency is included in the permit pursuant s. NR 204.06(2)(b)9., Wis. Adm. Code.

### 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) Wis. Adm. Code. Requirements for pathogens are specified in s. NR 204.07(6) and in s. NR 204.07 (7) Wis. Adm. Code for vector attraction requirements. Limitations for PCBs are addressed in s. NR 204.07(3)(k) Wis. Adm. Code. Radium requirements are addressed in s. NR 204.07(3)(n) Wis. Adm. Code.

**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.

## 4 Schedules

### 4.1 Land Application Management Plan

A management plan is required for the land application system.

Required Action	Due Date
<p>Land Application Management Plan Submittal: Submit an update to the management plan to optimize the land application system performance and demonstrate compliance with ch. NR 204, Wis. Adm. Code, if land application of sludge is planned to occur during the permit term. This management plan shall 1) specify information on pretreatment processes (if any); 2) identify land application sites; 3) describe site limitations; 4) address vegetative cover management and removal; 5) specify availability of storage; 6) describe the type of transporting and spreading vehicle(s); 7) specify monitoring procedures; 8) track site loading; 9) address contingency plans for adverse weather and odor/nuisance abatement; and 10) include any other pertinent information. Once approved, all landspreading activities shall be conducted in accordance with the plan. Any changes to the plan must be approved by the Department prior to implementing the changes.</p> <p>This plan must be submitted at least 60 days prior to land application of sludge.</p>	

### 4.2 Phosphorus Multi-Discharger Variance Interim Limit (1.0 mg/L)

The permittee shall comply with the 1.0 mg/L MDV interim effluent limit by the end of this compliance schedule.

Required Action	Due Date
<p>Submit Final Compliance Plan: The permittee shall submit a Facility Plan per s. NR 110.09, Wis. Adm. Code. The permittee may submit an abbreviated facility plan if the modifications are determined to be minor according to the Department].</p>	09/30/2024
<p>Submit Plans &amp; Specifications: The permittee shall submit final construction plans to the Department for approval pursuant to s. 281.41, Wis. Stats., specifying treatment plant upgrades that must be constructed to achieve compliance with the interim phosphorus effluent limit and a schedule for completing construction of the upgrades by the 'Complete Construction' date specified below.</p>	03/31/2025
<p>Treatment Plant Upgrade: Upon approval of the final construction plans and schedule by the Department and pursuant to s. 281.41, Wis. Stats., the permittee shall initiate construction of the treatment plant upgrades in accordance with the approved plans and specifications.</p>	09/30/2025
<p>Construction Upgrade Progress Report: The permittee shall submit a progress report on construction upgrades.</p>	12/31/2025
<p>Complete Construction and Achieve Compliance: The permittee shall complete construction and achieve compliance with the phosphorus interim effluent limit of 1.0 mg/L.</p>	03/31/2026

## **Explanation of Schedules**

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.

## **Attachments:**

May 2, 2022 Water Quality-Based Effluent Limitations for the Princeton Wastewater Treatment Facility, WPDES Permit No. WI-0022055-09

## **Expiration Date:**

March 31, 2029

## **Justification Of Any Waivers From Permit Application Requirements**

No waivers from permit application requirements granted.

**Prepared By: Sarah Adkins, Wastewater Specialist**

**Date: February 8, 2024**

# CORRESPONDENCE/MEMORANDUM

DATE: 05/02/2022

TO: Heidi Schmitt Marquez – NER

FROM: Nicole Krueger – SER *Nicole Krueger*

SUBJECT: Water Quality-Based Effluent Limitations for the Princeton Wastewater Treatment Facility  
WPDES Permit No. WI-0022055-09

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 Princeton wastewater treatment facility in Green Lake County. This municipal wastewater treatment facility (WWTF) discharges to the Fox River, located in the Fox River/Berlin Watershed in the Upper Fox River Basin. This discharge is included in the Upper Fox and Wolf River Basin TMDL as approved by EPA. 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 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1,2
BOD <sub>5</sub>			45 mg/L	30 mg/L		1
TSS			45 mg/L 108 lbs/day	30 mg/L 65.9 lbs/day		1,3
pH	9.0 s.u.	6.0 s.u.				1
Residual Chlorine	38 µg/L		38 µg/L	38 µg/L		1
Bacteria						4
<i>E. coli</i>				126 #/100 mL geometric mean		
Ammonia Nitrogen	Variable		17 mg/L	17 mg/L		5
Phosphorus LCA Interim Limit HAC Interim Limit Final WQBEL				3.9 mg/L 1.0 mg/L 1.4 lbs/day	0.48 lbs/day	3,6
TKN, Nitrate+Nitrite, and Total Nitrogen						7

Footnotes:

1. No changes from the current permit.
2. Monitoring only.
3. The TSS and phosphorus mass limits are based on the Total Maximum Daily Load (TMDL) for the Upper Fox and Wolf River Basin TMDL to address phosphorus water quality impairments within the TMDL area. The TMDL was approved by EPA in February 2020.
4. Bacteria limits apply during the disinfection season of May through September. Additional final limit: No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 count/100 mL.

5. The variable daily maximum ammonia nitrogen limit table corresponding to various effluent pH values may be included in the permit in place of the single limit. These limits apply year-round.

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	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
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

6. Under the phosphorus MDV, a level currently achievable (LCA) interim limit of 3.9 mg/L should be effective upon permit reissuance. A compliance schedule may be included in the permit until the highest attainable condition (HAC) limit of 1.0 mg/L can be met. The TMDL limits remain at 1.4 lbs/day as a monthly average and 0.48 lbs/day as a six-month average.
7. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, annual total nitrogen monitoring is recommended for all minor 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).

No WET testing is required because information related to the discharge indicates low to no risk for toxicity.

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](mailto:Nicole.Krueger@wisconsin.gov) or Diane Figiel at [Diane.Figiel@wisconsin.gov](mailto:Diane.Figiel@wisconsin.gov).

Attachments (3) – Narrative, Map, & Thermal Table

PREPARED BY: Nicole Krueger, Water Resources Engineer

E-cc: Barti Oumarou, Wastewater Engineer – NER  
 Heidi Schmitt Marquez, Regional Wastewater Supervisor – NER  
 Diane Figiel, Water Resources Engineer – WY/3

Attachment #1  
**Water Quality-Based Effluent Limitations for  
 Princeton Wastewater Treatment Facility**

**WPDES Permit No. WI-0022055-09**

Prepared by: Nicole Krueger

**PART 1 – BACKGROUND INFORMATION**

**Facility Description**

The City of Princeton, in Green Lake County, operates an Aerated Lagoon wastewater treatment facility (WWTF). The WWTF consists of two ponds with a subsurface aeration system and a third pond for effluent polishing. All lagoons are synthetically lined. Once effluent passes out of the polishing lagoon by means of a telescoping valve it travels through the chlorine contact chamber. Treated effluent from the WWTF is discharged to the Fox River.

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

**Existing Permit Limitations**

The current permit, expiring on 06/30/2022, 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 <sub>5</sub>			45 mg/L	30 mg/L		2
TSS			45 mg/L	30 mg/L		2
pH	9.0 s.u.	6.0 s.u.				2
Residual Chlorine	38 µg/L		38 µg/L	38 µg/L		
Fecal Coliform May – September			656#/100 mL geometric mean	400#/100 mL geometric mean		
Ammonia Nitrogen	Variable		17 mg/L	17 mg/L		3
Phosphorus Interim Final				4.1 mg/L 0.3 mg/L	0.1 mg/L	4
Acute WET						5

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. Ammonia daily maximum limits:

Effluent pH - s.u.	NH <sub>3</sub> -N Limit – mg/L	Effluent pH - s.u.	NH <sub>3</sub> -N Limit – mg/L
pH ≤ 7.9	> 17	8.4 < pH ≤ 8.5	6.4
7.9 < pH ≤ 8.0	17	8.5 < pH ≤ 8.6	5.3
8.0 < pH ≤ 8.1	14	8.6 < pH ≤ 8.7	4.4

Attachment #1

8.1 < pH ≤ 8.2	11	8.7 < pH ≤ 8.8	3.7
8.2 < pH ≤ 8.3	9.4	8.8 < pH ≤ 8.9	3.1
8.3 < pH ≤ 8.4	7.8	8.9 < pH ≤ 9.0	2.6
		9.0 < pH	< 2.6

4. A compliance schedule is in the current permit to meet the final WQBEL by 07/01/2026.
5. Acute WET testing is required twice during the permit term.

**Receiving Water Information**

- Name: Fox River
- Waterbody Identification Code (WBIC): 117900
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply. Note: Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q<sub>10</sub> and 7-Q<sub>2</sub> values are from USGS for Station 04073365, just upstream of where Outfall 001 is located.
  - 7-Q<sub>10</sub> = 301 cfs (cubic feet per second)
  - 7-Q<sub>2</sub> = 403 cfs
  - Harmonic Mean Flow = 429 cfs using a drainage area of 962 mi<sup>2</sup>

The Harmonic Mean has been estimated based on average flow and the 7-Q<sub>10</sub> 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).

The previous low flows were more conservative because the flows used were from a station upstream of Puckaway Lake
- Hardness = 195 mg/L as CaCO<sub>3</sub>. This value represents the geometric mean of data from WET testing from Green Lake Sanitary District and Princeton WWTF from 07/23/1997 – 08/28/2008.
- % 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 Fox River is used for this evaluation. 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 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 not 303(d) listed as impaired. The Fox River downstream of Lake Winnebago is 303(d) listed as impaired for PCBs and total phosphorus.

**Effluent Information**

- Design flow rate(s):
  - Annual average = 0.26 MGD (Million Gallons per Day)
  - For reference, the actual average flow from 07/01/2017 to 02/28/2022 was 0.21 MGD.
- Hardness = 273 mg/L as CaCO<sub>3</sub>. This value represents the geometric mean of data from the permit reissuance application from 01/01/2022 to 01/10/2022.
- 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 wells.

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- Additives: Sulfuric acid is added for pH control.
- Effluent characterization: This facility is categorized as a minor municipality, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus ammonia, chloride, hardness and phosphorus.
- 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**

Sample Date	Copper µg/L	Sample Date	Copper µg/L	Sample Date	Copper µg/L
01/01/2022	13	01/13/2022	8	01/25/2022	7
01/04/2022	7	01/16/2022	6	01/28/2022	10
01/07/2022	17	01/19/2022	6	01/31/2022	7
01/10/2022	7	01/22/2022	6		
1-day P <sub>99</sub> = 20 µg/L					
4-day P <sub>99</sub> = 13 µg/L					

Sample Date	Chloride mg/L
01/01/2022	211
01/04/2022	226
01/07/2022	227
01/10/2022	231
Average	224

The following table presents the average concentrations and loadings at Outfall 001 from 07/01/2017 to 02/28/2022 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6), Wis. Adm. Code:

**Averages of Parameters with Limits**

	Average Measurement
BOD <sub>5</sub>	4.83 mg/L*
TSS	3.79 mg/L*
pH field	7.92 s.u.
Phosphorus	2.71 mg/L
Ammonia Nitrogen	6.48 mg/L*
Fecal Coliform	42.9 #/100 mL

\*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)

**Daily Maximum Limit Calculation Method**

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. In accordance with s. NR 106.06(3)(b), limitations based on acute toxicity are either set equal to two times the acute criteria (the final acute value) or calculated using the mass balance equation below, whichever is more restrictive.

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

Where:

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

Q<sub>s</sub> = 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>).

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

In this case, limits set equal to two times the acute criteria are more restrictive and this method is used to calculate the daily maximum limits shown in the table below.

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

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

RECEIVING WATER FLOW = 240.8 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	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P <sub>99</sub>	1-day MAX. CONC.
Arsenic		340	680	136	<1		
Cadmium	273	32.6	65.2	13.0	<2		
Chromium	273	4104	8208	1642	<3		
Copper	273	40.0	80.0			20	17
Lead	273	282	564	113	<1		
Nickel	268	1080	2161	432	<8		
Zinc	273	290	579	116	18		
Chloride (mg/L)		757	1514	303	224		



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\* 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.

\*\* The 2 × ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q<sub>10</sub> flow rates per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016.

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

RECEIVING WATER FLOW = 75.25 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	28248	5650	<1	
Cadmium	175	3.82		718	144	<2	
Chromium	195	228	13	40497	8099	<3	
Copper	195	18.3	3	2886			13
Lead	195	53.4		10040.2	2008	<1	
Nickel	195	91.8		17269	3454	<8	
Zinc	195	216		40593	8119	18	
Chloride (mg/L)		395	12.8	71887	14377	224	

\* 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)**

The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

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

RECEIVING WATER FLOW = 107.3 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.
Cadmium	370		99057	19811	<2
Chromium (+3)	3818000	13	1022161324	204432265	<3
Lead	140		37481	7496	<1
Nickel	43000		11512071	2302414	<8

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

RECEIVING WATER FLOW = 107.3 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	2	3027	605	<1

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 no toxic substances in this section.

Mercury – The permit application did not require monitoring for mercury because Princeton is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3., Wis. Adm. Code, a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, “there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5).” However, sludge sampling is not available because Princeton is a lagoon system and has not removed sludge in the last five years. It is not expected that there are exceedances of the high-quality mercury concentration based on similar municipal treatment plants and the lack of industries. **No monitoring is recommended.**

**PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN**

The weekly and monthly average 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. BOD<sub>5</sub> and TSS limits would not increase with an increased low flow because the current limits are the maximum limits publicly owned treatment works would be required to meet per s. NR 210.05 Wis. Adm. Code.

If Princeton would like to request an increase to the existing permit limits for 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.

The current weekly and monthly average limits are 17 mg/L. An initial review suggests that the requirements of s. NR 207.04(1)(a), Wis. Adm. Code, do not appear to be met based ammonia nitrogen effluent concentrations based on data from 07/01/2017 to 02/28/2022. **Therefore, the current weekly and monthly average limits for ammonia nitrogen are required to be retained in the reissued permit consistent with s. NR 207.04(2), Wis. Adm. Code.**

**Effluent Data**

The table below summarizes effluent data from 07/01/2017 to 02/28/2022.

<b>Ammonia Nitrogen Effluent Data</b>	
	Ammonia Nitrogen mg/L
1-day P <sub>99</sub>	27
4-day P <sub>99</sub>	15

Attachment #1

30-day P <sub>99</sub>	9.1
Mean*	6.5
Std	5.4
Sample size	213
Range	<0.1 – 20

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

**Daily Maximum Ammonia Limits**

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 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.

**Daily Maximum Ammonia Nitrogen Limits – WWSF, WWFF & LFF**

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	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
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

Section NR 106.33(2), Wis. Adm. Code, was updated effective September 1, 2016. As a result, seasonal 20 and 40 mg/L thresholds for including ammonia limits in municipal discharge permits are no longer applicable under current rules. As such, the table has been expanded from the table in the current permit to included ammonia nitrogen limits throughout the pH range.

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

On May 1, 2020, revisions to chs. NR 102 and NR 210, Wis. Adm. Codes, 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:

Attachment #1

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. Because Princeton’s permit requires weekly monitoring, the 410 counts/100 mL limit will effectively function as a daily maximum limit unless the facility performs additional 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**

Princeton has monitored effluent *E. coli* from 05/04/2021 to 09/22/2021 and a total of 20 results are available. A geometric mean of 126 counts/100 mL was exceeded in 0 times during these 5 months, with a maximum monthly geometric mean of 93 counts/100 mL. Effluent data has exceeded 410 counts/100 mL 0 times. The maximum reported value was 259 counts/100 mL. Based on this effluent data **it appears that the facility can meet new *E. coli* limits and a compliance schedule is not needed in the reissued permit.**

**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 Princeton does not currently have an existing technology-based limit, the need for this limit in the reissued permit is evaluated. The data demonstrates that the annual monthly average phosphorus loading is less than 150 lbs/month, which is the threshold for municipalities in accordance to s. NR 217.04(1)(a)1, Wis. Adm. Code, and therefore no technology-based limit is required.

**Annual Average Mass Total Phosphorus Loading**

Month	Monthly Avg. mg/L	Total Flow MG/month	Total Phosphorus lb./mo.
Jan 2021	3.0	4.8	120
Feb 2021	2.6	4.0	86.8
Mar 2021	3.4	5.3	149
April 2021	3.2	5.0	132
May 2021	3.5	4.7	139
June 2021	4.2	3.7	127
July 2021	3.8	5.6	178
Aug 2021	3.9	7.1	232
Sept 2021	3.8	4.1	132
Oct 2021	4.0	4.1	140
Nov 2021	3.9	3.9	127
Dec 2021	3.9	4.4	145

Average	142
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Total P (lbs/month) = Monthly average (mg/L) × total flow (MG/month) × 8.34 (lbs/gallon)  
Where total flow is the sum of the actual (not design) flow (in MGD) for that month

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* (April 2020) and are based on the annual phosphorus wasteload allocation (WLA) given in pounds per year. This WLA found in Appendix H of the *Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids in the Upper Fox and Wolf River Basins (UFW TMDL)* report dated February 2020 are expressed as maximum annual loads (lbs/year).

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 facilities included in the Upper Fox and Wolf River Basins TMDL are given monthly average mass limits and, 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:

$$\begin{aligned} \text{TP Equivalent Effluent Concentration} &= \text{WLA} \div (\text{365 days/yr} * \text{Flow Rate} * \text{Conversion Factor}) \\ &= 135 \text{ lbs/yr} \div (\text{365 days/yr} * \text{0.26 MGD} * \text{8.34}) \\ &= 0.17 \text{ mg/L} \end{aligned}$$

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.

$$\begin{aligned} \text{TP 6-Month Average Permit Limit} &= \text{WLA} \div \text{365 days/yr} * \text{multiplier} \\ &= (135 \text{ lbs/yr} \div \text{365 days/yr}) * 1.30 \\ &= 0.48 \text{ lbs/day} \end{aligned}$$

$$\begin{aligned} \text{TP Monthly Average Permit Limit} &= \text{TP 6-Month Average Permit Limit} * 3 \\ &= 0.48 \text{ lbs/day} * 3 \\ &= 1.4 \text{ lbs/day} \end{aligned}$$

The multiplier used in the six-month average calculation was determined according to the implementation guidance. A coefficient of variation was calculated, based on phosphorus mass monitoring data, to be 0.6. This is the standard deviation divided by the mean of mass data. This value, along with monitoring frequency, is used to select the multiplier. The current permit specifies phosphorus monitoring as weekly; if a different monitoring frequency is used, the stated limits should be reevaluated.

Six-month average and monthly average mass effluent limits are recommended for this discharge. The limits are equivalent to a concentration of 0.22 mg/L and 0.66 mg/L respectively at the facility design flow of 0.26 MGD.

Attachment #1

The UFW TMDL establishes TP wasteload allocations to reduce the loading in the entire watershed including WLAs to meet water quality standards for tributaries to the Upper Fox and Wolf 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.

**Effluent Data**

The following table summarizes effluent total phosphorus monitoring data from 07/01/2017 to 02/28/2022.

**Total Phosphorus Effluent Data**

	<b>Phosphorus mg/L</b>	<b>Phosphorus lbs/day</b>
1-day P <sub>99</sub>	5.5	14
4-day P <sub>99</sub>	3.9	8.4
30-day P <sub>99</sub>	3.1	5.7
Mean	2.7	4.5
Std	0.90	2.6
Sample size	214	214
Range	0.44 – 4.75	0.46 – 20

**Multi-Discharge Variance Interim Limit**

With the permit application, Princeton has applied for the phosphorus multi-discharger variance (MDV). Conditions of the phosphorus MDV require the facility to comply with an interim phosphorus limit in lieu of meeting the final WQBEL. A review of effluent phosphorus data indicates that Princeton will be unable to comply with the 0.8 mg/L phosphorus limits required under s. 283.16 (6) (a) 1., Wis. Stats. Therefore, the recommended interim limit, pursuant to s. 283.16 (6) (am), Wis. Stats., is 1.0 mg/L as a monthly average. A compliance schedule may be appropriate to meet this interim limit but compliance with 1.0 mg/L shall be no later than the end of the reissued permit.

The effluent data indicates that 4-day P<sub>99</sub> value of **3.9 mg/L is a level currently achievable (LCA)** for the discharge. A limit of 3.9 mg/L as a monthly average should not be exceeded during the compliance schedule.

**PART 6 – TOTAL SUSPENDED SOLIDS**

**TMDL Limits**

Total Suspended Solids (TSS) effluent limits in lbs/day are calculated as recommended in the *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs* (April 2020). This WLAs found in Appendix I of the *Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids in the Upper Fox and Wolf Basins (UFW TMDL)* report dated February 2020 are expressed as maximum annual loads (lbs/year). The WLA for Princeton is 12,671 lbs/year or 34.7 lbs/day.

Attachment #1

Revisions to chs. NR 106 and 205, Wis. Adm. Code align Wisconsin water quality-based effluent limits with 40 CFR 122.45(d), which requires WPDES permits to contain the following concentration limits, whenever practicable and necessary to protect water quality:

- Weekly average and monthly average limitations for continuous discharges subject to ch. NR 210.
- Daily maximum and monthly average limitations for all other discharges.

Princeton is a municipal treatment facility and is therefore subject to weekly average and monthly average TSS limits derived from TSS annual WLAs.

$$\begin{aligned} \text{TSS Weekly Average Permit Limit} &= \text{Daily WLA} * \text{Weekly multiplier} \\ &= 34.7 \text{ lbs/day} * 3.11 \\ &= 108 \text{ lbs/day} \end{aligned}$$

$$\begin{aligned} \text{TSS Monthly Average Permit Limit} &= \text{Daily WLA} * \text{Monthly multiplier} \\ &= 34.7 \text{ lbs/day} * 1.90 \\ &= 65.9 \text{ lbs/day} \end{aligned}$$

The multiplier used in the weekly average and monthly average calculation was determined according to implementation guidance. A coefficient of variation was calculated, based on TSS mass monitoring data, to be 0.8. This is the standard deviation divided by the mean of mass data. However, it is believed that the optimization of the wastewater treatment system to achieve the WLA-derived permit limits will reduce effluent variability. Thus, the maximum anticipated coefficient of variation expected by the facility is 0.6. This value, along with monitoring frequency, is used to select the multiplier. The current permit specifies TSS monitoring as 3/week; if a different monitoring frequency is used, the stated limits should be reevaluated.

Weekly average and monthly average mass effluent limits are recommended for this discharge. The limits are equivalent to a concentration of 50 mg/L and 30 mg/L respectively at the facility design flow of 0.26 MGD.

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 TSS. Rolling 12-month sums can be compared directly to the annual wasteload allocation.

**Effluent Data**

The following table summarizes effluent total phosphorus monitoring data from 07/01/2017 to 02/28/2022.

**TSS Effluent Data**

	<b>TSS mg/L</b>	<b>TSS lbs/day</b>
1-day P <sub>99</sub>	14	32
4-day P <sub>99</sub>	8.8	18
30-day P <sub>99</sub>	5.3	11
Mean	3.8	8.4
Std	2.7	6.4

Attachment #1

Sample size	222	173
Range	<2 – 17	0.85 – 38

Princeton can currently meet the calculated TMDL limits so these limits are recommended to become effective upon permit reissuance.

**PART 7 – 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.

Due to the amount of upstream flow available for dilution in the limit calculation ( $Q_s:Q_e >20:1$ ), the lowest calculated limitation is 120° F (s. NR 106.55(6)(a), Wis. Adm. Code).

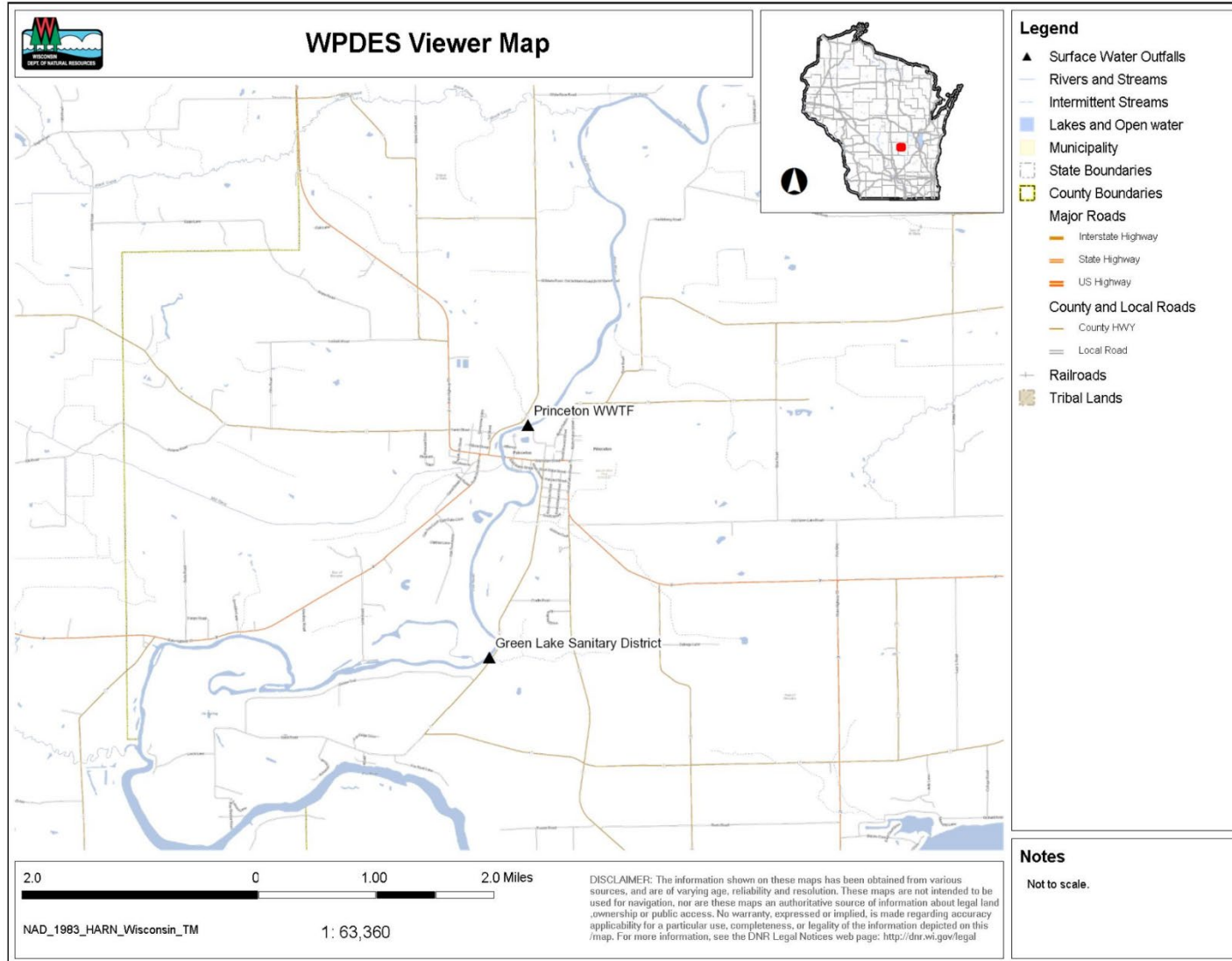
Because this is a lagoon treatment system of domestic waste with no industrial contributors, there is no reasonable potential for the discharge to exceed 120° F. **No monitoring is recommended in the reissued permit.**

**PART 8 – 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 (October 29, 2019)*.

Guidance in Chapter 1.11 of the WET Guidance Document (WET Testing of Minor Municipal Discharges) was consulted. This is a minor municipal discharge (< 1.0 MGD) comprised solely of domestic wastewater, with no history of WET failures and no toxic compounds detected at levels of concern. No WET testing is recommended at this time because of the low risk in effluent toxicity.





**Temperature limits for receiving waters with unidirectional flow**

(calculation using default ambient temperature data)

<b>Facility:</b>	Princeton	<b>7-Q<sub>10</sub>:</b>	301.00	cfs	<b>Temp Dates</b>		
<b>Outfall(s):</b>	001	<b>Dilution:</b>	25%		<b>Start:</b>	01/00/00	
<b>Date Prepared:</b>	3/29/2022	<b>f:</b>	0		<b>End:</b>	01/00/00	
<b>Design Flow (Qe):</b>	0.26 MGD	<b>Stream type:</b>	Small warm water sport or forage fish co				
<b>Storm Sewer Dist.</b>	0 ft	<b>Qs:Qe ratio:</b>	187.1	:1		07/01/17	
		<b>Calculation Needed?</b>	NO				02/28/22

Month	Water Quality Criteria			Receiving Water Flow Rate (Qs) (cfs)	Representative Highest Effluent Flow Rate (Qe)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Ta (default) (°F)	Sub-Lethal WQC (°F)	Acute WQC (°F)		7-day Rolling Average (Qesl) (MGD)	Daily Maximum Flow Rate (Qea) (MGD)		Weekly Average (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	33	49	76	301.00	0.291	0.407	0	-	-	NA	120
FEB	34	50	76	301.00	0.259	0.310	0	-	-	NA	120
MAR	38	52	77	301.00	0.828	0.924	0	-	-	NA	120
APR	48	55	79	301.00	0.394	0.528	0	-	-	NA	120
MAY	58	65	82	301.00	0.438	0.632	0	-	-	NA	120
JUN	66	76	84	301.00	0.316	0.506	0	-	-	NA	120
JUL	69	81	85	301.00	0.347	0.491	0	-	-	NA	120
AUG	67	81	84	301.00	0.508	0.716	0	-	-	NA	120
SEP	60	73	82	301.00	0.899	0.991	0	-	-	NA	120
OCT	50	61	80	301.00	0.624	0.701	0	-	-	NA	120
NOV	40	49	77	301.00	0.366	0.424	0	-	-	NA	120
DEC	35	49	76	301.00	0.276	0.400	0	-	-	NA	120