

Permit Fact Sheet

General Information

Permit Number:	WI-0021946-11-0	
Permittee Name:	CITY OF TOMAHAWK	
Address:	City Hall, PO Box 469	
City/State/Zip:	Tomahawk WI 54487	
Discharge Location:	W5846 Dean Road, Tomahawk, Wisconsin (SW ¼ NE ¼ of section 10; T34N-R6E)	
Receiving Water:	Unnamed tributary to the Wisconsin River in the Noisy and Pine Creeks Watershed in the Upper Wisconsin River Drainage Basin, Lincoln County.	
StreamFlow (Q _{7,10}):	0 cfs for the unnamed tributary and 750 cfs for Wisconsin River	
Stream Classification:	Based on an investigation of the receiving water, the classification of the unnamed tributary and the Wisconsin are both Warm Water Sport Fishery (WWSF), non-drinking water supply and within the ceded territory.	
Wild Rice Impacts: <i>(no specific wild rice standards exist at this time)</i>	No impacts identified at this location. There is wild rice confirmed downstream of Tomahawk, but distribution of wild rice beds is difficult to characterize. The conclusion of no impact is based on low effluent volumes in comparison to the river volumes and the continued presence of said rice beds. (Evaluation completed March 2017)	
Discharge Type:	Existing continuous	
Design Flow(s)	Annual Average	0.60 MGD
Significant Industrial Loading?	No	
Operator at Proper Grade?	Yes	
Approved Pretreatment Program?	N/A	

Facility Description

The City of Tomahawk owns and operates a domestic wastewater treatment facility. The annual average design flow is 600,000 gallons per day with actual flows averaging 478,000 gallons per day over the past five years (June 2019 – June 2024 data). The facility is a conventional activated sludge wastewater treatment system. The system consists of debris removal (a mechanically cleaned fine screen with manual bar screening available when the fine screen needs to be bypassed and a vortex grit separator) for the untreated wastewater (influent) prior to entering the treatment system. The influent enters the primary clarifier where solids are allowed to settle. Tomahawk utilizes biological phosphorus removal; wastewater flows into two selector tanks followed by three aeration tanks (air added) where it mixes with activated sludge metabolizing and reducing organic matter and biologically up taking phosphorus. Activated sludge is composed of settled solids containing naturally occurring bacteria recycled from the treatment system. Chemicals may be added if necessary to supplement the biological phosphorus removal process. The water is pumped into a final clarifier where remaining solids are settled out. The settled solids (sludge) are removed from the clarifier, rotary thickened and then pumped to an anaerobic digester which stabilizes the sludge and reduces harmful pathogens to safe levels. Some of the sludge is returned to the aeration tanks from the final clarifier to re-seed the new wastewater entering the tank, while the rest of the sludge is stored until it is land applied on Department approved agricultural sites.

Prior to discharging the treated wastewater (effluent) is disinfected using a UV system seasonally (May through September).

Substantial Compliance Determination

Enforcement During Last Permit: All conditions and standard requirements of the current permit are being met.

After a desk top review of all discharge monitoring reports, CMARs, land app reports, and a site visit by Andrzej Popieluch, WDNR, on 11/08/23, the City of Tomahawk has been found to be in substantial compliance with their current permit.

Sample Point Designation		
Sample Point Number	Discharge Flow, Units, and Averaging Period	Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)
701	INFLUENT Flow is not a required parameter	Representative samples shall be collected in the influent channel downstream of the grit removal system.
001	EFFLUENT An average of 0.478 MGD (June 2019 – June 2024 data)	Representative samples shall be collected after the ultraviolet disinfection unit prior to discharge to the effluent ditch tributary to the Wisconsin River.
002	SLUDGE An average of 44 dry metric tons. (2018 – 2023 data)	Representative samples shall be collected from the sludge storage tank mixing pump port and composited for analysis.
101	IN PLANT	In plant operational sampling is reported on the electronic Discharge Monitoring Report, but sampling is not a permit requirement.
102	Flow is not a required parameter.	
104		

1 Influent – Monitoring Requirements

Sample Point Number: 701- INFLUENT TO PLANT

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	
Suspended Solids, Total		mg/L	3/Week	24-Hr Comp	

Changes from Previous Permit:

Influent limitations and monitoring requirements were re-evaluated for the proposed permit term and no changes were required in this permit section. Sampling requirements and frequencies are the same as the previous permit.

Explanation of Limits and Monitoring Requirements

The parameters are standard for minor municipalities, as are monitoring and frequency requirements for municipal wastewater treatment plant. Tracking of BOD5, and Suspended Solids are required for percent removal requirements found in s. NR 210.05, Wis. Adm. Code.

In-plant - Monitoring and Limitations

Sample Point Number: 101- ANAEROBIC SLUDGE HAULED; 102- ANAEROBIC DIGESTOR, and 104- GENERAL PLANT

Sample Point Number: 101- ANAEROBIC SLUDGE HAULED

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Sludge Withdrawn		gal	Daily	Measure	

Sample Point Number: 102- ANAEROBIC DIGESTOR

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Sludge Pumpage Primary		gal	Daily	Measure	
Temperature, Digester		deg F	Daily	Measure	
Temperature, Digester Water In		deg F	Daily	Measure	
Temperature, Digester Water Out		deg F	Daily	Measure	
pH Digester		su	Daily	Measure	

Sample Point Number: 104- GENERAL PLANT

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Precipitation		in/day	Daily	Measure	
Temperature, Air		deg F	Daily	Measure	
Dissolved Oxygen, Mixed Liquor		mg/L	Daily	Measure	
Suspended Solids, Mixed Liquor		mg/L	Daily	Measure	
Suspended Solids, Volatile Mixed Liquor		mg/L	Daily	Measure	

Changes from Previous Permit:

In plant monitoring requirements were re-evaluated for the proposed permit term and no changes were required in this permit section. Sampling requirements and frequencies are the same as the previous permit.

Explanation of Limits and Monitoring Requirements

In-plant monitoring includes only general operational parameters, not permit requirements. They are not listed within the permit but are available on the electronic Discharge Monitoring Reports (eDMR) to record data. Measurement of inplant parameters are tools to assist the facility in maintaining a healthy treatment system.

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	
WLA Previous Day River Flow		cfs	3/Week	Gauge Station	INTERIM STEP - Monitoring required May through October. See the Waste Load Allocation Requirements section in the permit.
WLA Previous Day River Temp		deg F	3/Week	Gauge Station	INTERIM STEP - Monitoring required May through October. See the Waste Load Allocation Requirements section in the permit.
BOD ₅ , Variable Limit		lbs/day	3/Week	See Table	INTERIM STEP - Report applicable limit May through October. See the Waste Load Allocation Requirements section for applicable limits table.
WLA BOD ₅ Discharged	Daily Max - Variable	lbs/day	3/Week	Calculated	INTERIM LIMIT - Effective May through October, compare results to BOD ₅ Variable Limit column to determine compliance. See the Waste Load Allocation Requirements section and Effluent Limitations for BOD ₅ and Total Suspended

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
					Solids schedule.
BOD5, Total	Monthly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	INTERIM LIMIT - See the Effluent Limitations for BOD5 and Total Suspended Solids schedule in the permit.
BOD5, Total	Weekly Avg	30 mg/L	3/Week	24-Hr Flow Prop Comp	INTERIM LIMIT - See the Effluent Limitations for BOD5 and Total Suspended Solids schedule in the permit.
Suspended Solids, Total	Monthly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	INTERIM LIMIT - See the Effluent Limitations for BOD5 and Total Suspended Solids schedule in the permit.
Suspended Solids, Total	Weekly Avg	30 mg/L	3/Week	24-Hr Flow Prop Comp	INTERIM LIMIT - See the Effluent Limitations for BOD5 and Total Suspended Solids schedule in the permit.
pH Field	Daily Min	6.0 su	Daily	Grab	
pH Field	Daily Max	9.0 su	Daily	Grab	
Dissolved Oxygen	Daily Min	7.0 mg/L	3/Week	Grab	
E. coli	Geometric Mean - Monthly	126 #/100 ml	Weekly	Grab	Monitoring and limit effective May through September.
E. coli	% Exceedance	10 Percent	Monthly	Calculated	Monitoring and limit effective May through September. See the E. coli Percent Limit section in the permit. Enter the result in the DMR on the last day of the month.
Phosphorus, Total	Monthly Avg	1.0 mg/L	3/Week	24-Hr Flow Prop Comp	
Phosphorus, Total	Monthly Avg	2.7 lbs/month	Monthly	Calculated	Calculate the Total Monthly Discharge of phosphorus and report on the last day of the month on the DMR. See the Total

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
					Maximum Daily Load (TMDL) Limitations section in the permit.
Phosphorus, Total		lbs/yr	Monthly	Calculated	Beginning January 2026, 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 the Total Maximum Daily Load (TMDL) Limitations section.
Nitrogen, Ammonia (NH3-N) Total		mg/L	3/Week	24-Hr Flow Prop Comp	See the Ammonia Effluent Limits & Facility Modifications schedule in the permit.
PFOS		ng/L	1/ 2 Months	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule in the permit.
PFOA		ng/L	1/ 2 Months	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule in the permit.
Temperature		deg F	Monthly	Multiple Grab	Monthly monitoring is required January through September 2028. See the Effluent Temperature Monitoring section in the permit.
Temperature		deg F	3/Week	Multiple Grab	Monitoring 3 times a week is required October through December annually. See the Effluent Temperature Monitoring section and Temperature Limits Compliance schedule in the permit.
Nitrogen, Total Kjeldahl		mg/L	See Listed Qtr(s)	24-Hr Flow Prop Comp	See the Nitrogen Series Monitoring section for testing schedule in the

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
					permit.
Nitrogen, Nitrite + Nitrate Total		mg/L	See Listed Qtr(s)	24-Hr Flow Prop Comp	See the Nitrogen Series Monitoring section for testing schedule in the permit.
Nitrogen, Total		mg/L	See Listed Qtr(s)	Calculated	Total Nitrogen = Total Nitrogen Kjeldahl (mg/L) + Nitrite + Nitrate Nitrogen (mg/L). See the Nitrogen Series Monitoring section for testing schedule in the permit.
Copper, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	Monitoring is required during the 2027 calendar year.
Hardness, Total as CaCO ₃		mg/L	Monthly	24-Hr Flow Prop Comp	Monitoring is required during the 2027 calendar year.
Zinc, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	Monitoring is required during the 2027 calendar year.
Chloride		mg/L	Monthly	24-Hr Flow Prop Comp	Monitoring is required during the 2027 calendar year.

Changes from Previous Permit

Effluent limitations and monitoring requirements were re-evaluated for the proposed permit term and the following changes were made from the previous permit. See additional explanation of limits under “Explanation of Limits and Monitoring Requirements” below.

- The **flow rate** sample frequency was changed from “Continuous” to “Daily” to better represent practices at the facility.
- The receiving water classification has changed. This change resulted in more restrictive **BOD₅**, **total suspended solids** and **dissolved oxygen** limits. A schedule has been included to allow the facility time to meet the final BOD₅ and total suspended solids limits.
- Fecal Coliform monitoring and limits have been replaced by **Escherichia coli (E. coli)** based on revisions to multiple rules.
- A **phosphorus** limit to meet the Wisconsin River Basin TMDL waste load allocation has been included.
- Weekly and monthly average **ammonia** limits are required to protect water quality. A schedule has been included to allow the facility time to meet the final limitations.
- Based on current data **thermal limits** are needed during the months of October, November and December. A schedule has been included to confirm the requirement and if needed allow the facility time to meet the final limitations.

- Annual monitoring for the **nitrogen series** (nitrate +nitrite, total Kjeldahl nitrogen and total nitrogen) has been added to the permit.
- **PFOS and PFOA** monitoring once every two months has been included based on water supply sample results.

Explanation of Limits and Monitoring Requirements

More information on categorical and water quality-based limits (WQBEL) is found in the “Water Quality-Based Effluent Limitations for the City of Tomahawk (WI-0021946-11-0)” memo dated October 1, 2024.

Receiving Water Classification - To provide consistency in the application of limits across facilities and to appropriately protect aquatic life, the DNR is systematically reviewing stream classifications for waters that receive discharges from WPDES-permitted facilities. Reviews focus on sites where a permit is scheduled for reissuance and where questions have been identified regarding the appropriate receiving water’s classification. Based on the survey conducted on September 22, 2022, it was determined that calculating limits based on a limited aquatic life (LAL) community is no longer protective of the existing or the attainable aquatic life community. The receiving water, unnamed tributary to the Wisconsin River, has been classified as a Warm Water Sport Fish (WWSF) community and effluent limitations have been recalculated using this updated use designation. For more information on the methods used to review stream classifications and calculate limits see the “City of Tomahawk, Unnamed tributary (no WBIC) to the Wisconsin River, Lincoln County” survey dated September 24, 2024, and the Water Quality-Based Effluent Limits memo.

BOD5 - Due to the change in receiving water designation the categorical limits found in NR 210.05 are no longer considered adequate to protect water quality. Limits were recalculated using the 26-Pound equation. This is a simplified method that is used when site-specific information is not available. It uses assumed background dissolved oxygen levels and stream temperatures in addition to the design flow of the facility and the 7-Q10 of the receiving water. Final weekly and monthly average limits of 5.0 mg/L May through October and 10.0 mg/L November through April become effective at the end of the Effluent Limitations for BOD5 and Total Suspended Solids schedule found in section 4 of the permit and this document. Interim limits are equal to those found in the previous permit, a daily variable limit (May through October) based on the Wisconsin River NR 212.60 Wis. Adm. Code, a year round weekly average limit of 30 mg/L and a monthly average of 20 mg/L.

Total suspended solids (TSS) – TSS limits are regulated by NR 102.04(1), Wis. Adm. Code and are included whenever BOD5 limits are needed and are set equal to the BOD5 limits but no lower than 10 mg/L. Final weekly and monthly average limits of 10.0 mg/L become effective at the end of the Effluent Limitations for BOD5 and Total Suspended Solids schedule found in section 4 of the permit and this document. Interim limits are equal to those found in the previous permit, a weekly average limit of 30 mg/L and a monthly average of 20 mg/L.

pH - Categorical limits for pH are required per ch. NR 210 (Subchapter II) and NR 102.04(4)(c) Wis. Adm. Code.

Dissolved Oxygen (DO) - The DO limits in this permit are based on water quality standards from surface waters classified as a warm water sport fish community as specified in s. NR 102.04(4)(a), Wis. Adm. Code.

Disinfection - Fecal coliform monitoring and limits have been replaced with Escherichia coli (E. coli) monitoring and limits. E. coli limits of 126 #/100 ml as a monthly geometric mean that it may never be exceeded and 410 #/100 ml as a daily maximum may not be exceeded more than 10 percent of the time in any calendar month limits apply.

The following equation should be used to calculate percent exceedances.

$$\frac{\text{\# of Samples greater than 410\#/100}}{\text{Total \# of samples}} \times 100 = \% \text{ Exceedance}$$

Phosphorus – Phosphorus requirements are based on the Phosphorus Rules as detailed in NR 102 (water quality standards) and NR 217, Wis. Adm. Code (effluent standards and limitations for phosphorus). Chapter NR 217 of the Wis. Adm. Code addresses point source dischargers of phosphorus to surface waters. Currently in NR 217 Wis. Adm. Code there are three types of limit calculations used to determine if a phosphorus limit is needed: a technology based effluent limit (TBEL), a water quality-based effluent limit (WQBEL) determined by stream criteria and a WQBEL based on a Total Daily Maximum Daily Load (TMDL) allocation.

In the case of the City of Tomahawk:

- A TBEL of 1.0 mg/L is needed if a facility discharges more than the threshold of 150 pounds per month (s. NR 217.04(1)(a)1 Wis. Adm. Code). A limit of 1 mg/L has been a requirement at the facility over the previous permit term. Based on anti-backsliding rules (NR 207 Wis. Adm. Code) the limitation remains in effect this permit term.
- Based on the size and classification of the stream, the categorical water quality criterion for the unnamed tributary to the Wisconsin River is 100 ug/L. This criterion and instream background phosphorus data are used to calculate the stream criteria based WQBELs. The calculated WQBELs is 42.4 mg/L (monthly average). *The TMDL is more protective of the immediate receiving water therefore will be used to measure compliance.*
- The facility lies within the boundaries of the Wisconsin River total maximum daily load (TMDL) area. The TMDL was developed to address phosphorus water quality impairments. The Wisconsin River TMDL for total phosphorus was approved by the U.S. Environmental Protection Agency on April 26, 2019. Additional site-specific criteria (SSC) for Lakes Petenwell, Castle Rock, and Wisconsin and the related WLA included in Appendix K of the TMDL report were approved by the U.S. Environmental Protection Agency on July 9, 2020. More information about the TMDL can be found at <https://dnr.wisconsin.gov/topic/TMDLs/TMDLReports.html> Based on current criteria, the approved TMDL Waste Load Allocation (WLA) for Total Phosphorus is 669 lbs per year, which equates to 2.7 lbs/day monthly average.

Calculation and reporting of the total mass of phosphorus discharged over the past 12 months is required to track progress in meeting the overall TMDL requirements. The 12-month rolling sum equals the sum of the most recent 12 consecutive months of total monthly discharges. This value should be reported on the eDMR on the last day of each month.

Calculations needed to determine compliance with the wasteload allocation are:

- **Total Monthly Discharge (lbs/month)** = monthly average concentration (mg/L) x total flow for the month (MG/month) x 8.34.
- **12-Month Rolling Sum of Total Monthly Discharge (lbs/year)** = the sum of the most recent 12 consecutive months of total monthly discharges. This value should be reported on the eDMR on the last day of each month. Recording will begin after 12-months (January 2026).

Ammonia - Using current acute and chronic ammonia toxicity criteria found in Tables 2C and 4B of NR 105 Wis. Adm. Code and limit calculating procedures (Subchapter IV of 106, Wis. Adm. Code ammonia limitations were calculated for the facility. To protect water quality weekly average limits of 15 mg/L is required April through May and 10 mg/L June through September, monthly average limits of 6.0 mg/L May through April and 4.1 mg/L June through September which will become effective at the end of the Ammonia Effluent Limits & Facility Modifications schedule found in section 4 of the permit and this document.

PFOS + PFOA – NR 106 Subchapter VIII – Permit Requirements for PFOS and PFOA Dischargers became effective on August 1, 2022. At the first reissuance of a WPDES permit after August 1, 2022, the new rule requires WPDES permits for municipal dischargers with an average flow rate less than 1 MGD, to be evaluated on a case-by-case basis to determine if monitoring is required pursuant to s. NR 106.98(2)(c), Wis. Adm. Code. The department evaluated the need for PFOS and PFOA monitoring taking into consideration the presence of potential PFOS or PFOA industrial wastes, remediation sites and other potential sources of PFOS or PFOA. Based on information available at the time the proposed permit was drafted, it was identified that source water has known levels of PFOS/PFOA.

Therefore, monitoring once every two months is included. A sample frequency of 1/2 months means one sample is taken during any two-month period. Examples of 1/2 month sample would be every other month (Jan, March, May, etc.) or back-to-back months with a break in between (February & March, May & June, Aug & Sept, etc.). DMR Short Forms will be generated for the following time periods: January-February, March-April, May-June, July-August, September-October, and November-December. At a minimum one sample result will be present on each form.

Temperature - Using the administrative rules for thermal discharges detailed in NR 102 Subchapter II Water Quality Standards for Temperature and NR 106 Subchapter V Effluent Limitations for Temperature, effluent thermal limits were calculated. It was determined to meet the Public Health and Fish & Aquatic Life criteria, which were established to protect aquatic communities from lethal and sub-lethal thermal effects, Weekly average temperature limits of 61°F (October), 50°F (November) and 49°F (December) are needed at the facility. The limits will become effective at the end of the schedule, Temperature Limits Compliance schedule found in section 4 of the permit and this document. After one year of monitoring the facility will submit a report summarizing their ability to meet the limits. At that time the Department will re-evaluate and see if limits are still needed. Monthly monitoring January through September is required during 2028 in preparation for the next permit reissuance.

Nitrogen Series (nitrate +nitrite, total Kjeldahl nitrogen and total nitrogen) – In 2011, the Upper Mississippi River Basin Association (UMRBA) completed the report “Upper Mississippi River Nutrient Monitoring, Occurrence, and Local Impacts: A Clean Water Act Perspective”. Among the many recommendations of this report was that the states should expand their NPDES discharge monitoring requirements to include both phosphorus and nitrogen as they have important impacts on the mainstem upper Mississippi River as well as in the Gulf of Mexico. Consequently, the department developed the “Guidance for Total Nitrogen Monitoring in WPDES Permits” document dated October 2019, where annual effluent monitoring for total nitrogen (total nitrogen = total Kjeldahl + (nitrate+nitrite)) is required for municipal and industrial facilities discharging to surface waters. Section 283.55(1)(e) Wis. Stats. 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 s. NR 200.065 (1)(h) Wis. Adm. Code allows for this monitoring to be collected during the permit term. The schedule for this facility is as follows:

- July – September 2025
- April – June 2026
- January – March 2027
- October – December 2028
- July – September 2029

Testing shall continue after the permit expiration date (until the permit is reissued) in accordance with the requirements for 2026. For example, the next test would be required July - September 2030.

Metals (Copper, Hardness, Zinc and Chloride) – Based on a reasonable potential analysis of calculated limit based on NR 106.05 Wis. Adm. Code, limits are not needed this permit term. Monthly monitoring during the 2027 calendar year and will be used to determine if limits are needed for the next permit reissuance.

Sampling Frequencies - The “Monitoring Frequencies for Individual Wastewater Permits” guidance document (April 12, 2021) recommends that standard monitoring frequencies be included in individual wastewater permits based on the size and type of the facility, in order to characterize effluent quality and variability, to detect events of noncompliance, and to ensure fairness and consistency in permits issued across the state. Guidance and requirements in administrative code were considered when determining the appropriate monitoring frequencies for pollutants that have final effluent limits in effect during this permit term. The department has determined at this time that the facility meets the guidance and no changes in the monitoring frequency is required this permit term.

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	Volatile Solids Reduction	Land Apply	44 dry metric tons/year
Does sludge management demonstrate compliance? Yes						

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 additional sludge storage required? No						
Is Radium-226 present in the water supply at a level greater than 2 pCi/liter? No, the most recent set of samples taken in 2020 were below levels of detection.						
Is a priority pollutant scan required? No						

Sample Point Number: 002- MUNICIPAL SLUDGE

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Solids, Total		Percent	Annual	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Annual	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	Annual	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	Annual	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	Annual	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	Annual	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	Annual	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	Annual	Composite	
Lead Dry Wt	High Quality	300 mg/kg	Annual	Composite	
Mercury Dry Wt	Ceiling	57 mg/kg	Annual	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	Annual	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	Annual	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	Annual	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	Annual	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	Annual	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	Annual	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Annual	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	Annual	Composite	
Nitrogen, Total Kjeldahl		Percent	Annual	Composite	
Nitrogen, Ammonium (NH4-N) Total		Percent	Annual	Composite	

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

Changes from Previous Permit:

Sludge limitations and monitoring requirements were re-evaluated for the proposed permit term and the following changes were made from the previous permit. See additional explanation of limits under “Explanation of Limits and Monitoring Requirements” below.

- **PCB** monitoring is required during the 2026 calendar year.
- **PFAS** monitoring is required once during the permit term.

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.

4 Schedules

4.1 PFOS/PFOA Minimization Plan Determination of Need

Required Action	Due Date
<p>Report on Effluent Discharge: Submit a report on effluent PFOS and PFOA concentrations and include an analysis of trends in monthly and annual average PFOS and PFOA concentrations. This analysis should also include a comparison to the applicable narrative standard in s. NR 102.04(8)(d), Wis. Adm. Code.</p> <p>This report shall include all additional PFOS and PFOA data that may be collected including any influent, intake, in-plant, collection system sampling, and blank sample results.</p>	12/31/2026
<p>Report on Effluent Discharge and Evaluation of Need: Submit a final report on effluent PFOS and PFOA concentrations and include an analysis of trends in monthly and annual average PFOS and PFOA concentrations of data collected over the last 24 months. The report shall also provide a comparison on the likelihood of the facility needing to develop a PFOS/PFOA minimization plan.</p> <p>This report shall include all additional PFOS and PFOA data that may be collected including any influent, intake, in-plant, collection system sampling, and blank sample results.</p> <p>The permittee shall also submit a request to the department to evaluate the need for a PFOS/PFOA minimization plan.</p> <p>If the Department determines a PFOS/PFOA minimization plan is needed based on a reasonable potential evaluation, the permittee will be required to develop a minimization plan for Department approval no later than 90 days after written notification was sent from the Department. The Department will modify or revoke and reissue the permit to include PFOS/PFOA minimization plan reporting requirements along with a schedule of compliance to meet WQBELs. Effluent monitoring of PFOS and PFOA shall continue as specified in the permit until the modified permit is issued.</p> <p>If, however, the Department determines there is no reasonable potential for the facility to discharge PFOS or PFOA above the narrative standard in s. NR 102.04(8)(d), Wis. Adm. Code, no further action is required and effluent monitoring of PFOS and PFOA shall continue as specified in the permit.</p>	12/31/2027

4.2 Effluent Limitations for BOD5 and Total Suspended Solids

Required Action	Due Date
<p>Operational Evaluation Report: The permittee shall prepare and submit an Operational Evaluation Report to the Department for review and approval. The report shall include an evaluation of collected effluent data and proposed operational improvements that will optimize efficacy of the treatment plan to the extent possible enabling compliance with the final BOD5 and Total Suspended Solids (TSS) limitations. The report shall include a plan and schedule for implementation of the operational improvements. These improvements shall occur as soon as possible. The report shall state whether the operational improvements are expected to result in compliance with the final BOD5 and TSS limitations.</p> <p>If the Operational Evaluation Report concludes that the operational improvements are expected to result in compliance with the final BOD5 and TSS limitations, the permittee shall comply with the final limitations by December 31, 2026 and the permittee is not required to comply with subsequent</p>	12/31/2025

<p>milestones identified below in this compliance schedule ('Submit Facility Plan', 'Final Plans and Specifications', 'Treatment Plant Upgrade to Meet Limitations', 'Construction Upgrade Progress Report', 'Complete Construction', 'Achieve Compliance').</p> <p>FACILITY PLAN - If the Operational Evaluation Report concludes that operational improvements alone are not expected to result in compliance with the final BOD5 and TSS limitations, the permittee shall initiate development of a facility plan for meeting final limitations and comply with the remaining required actions in this schedule of compliance.</p>	
<p>Submit Facility Plan: If the Operational Evaluation Report concluded that the permittee cannot achieve final BOD5 and TSS limitations with operational improvements alone, 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 Department determines that the modifications are minor.</p>	12/31/2026
<p>Final Plans and Specifications: The permittee shall submit final construction plans to the Department for approval pursuant to ch. NR 108, Wis. Adm. Code, specifying treatment plant upgrades that must be constructed to achieve compliance with final BOD5 and TSS limitations and a schedule for completing construction of the upgrades by the complete construction date specified below.</p>	12/31/2027
<p>Treatment Plant Upgrade to Meet Limitations: The permittee shall initiate bidding, procurement, and/or construction of the project. The permittee shall obtain approval of the final construction plans and schedule from the Department pursuant to s. 281.41, Stats., prior to initiating activities defined as construction under ch. NR 108, Wis. Adm. Code. 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.</p>	12/31/2028
<p>Complete Construction: The permittee shall complete construction of wastewater treatment system upgrades.</p>	08/31/2029
<p>Achieve Compliance: The permittee shall achieve compliance with final BOD and TSS limitations.</p> <p>BOD - 5.0 mg/L as both weekly and monthly average limit May through October and 10.0 mg/L as both weekly and monthly average limit November through April.</p> <p>TSS - 10.0 mg/L as both weekly and monthly average limit year-round.</p>	12/31/2029

4.3 Ammonia Effluent Limits & Facility Modifications

This compliance schedule requires the permittee to achieve compliance by the specified date.

Required Action	Due Date
Report on Effluent Discharges: Submit a report on effluent discharges of total ammonia nitrogen with conclusions regarding compliance.	12/31/2025
Action Plan or Facility Plan Amendment: Submit an action plan or facility plan amendment for treatment facility modifications for complying with the effluent limitation(s) as needed.	12/31/2026
Plans and Specifications: Submit plans and specifications for treatment facility modifications as needed.	12/31/2027
Initiate Actions: Initiate actions identified in the action plan or facility plan amendment.	12/31/2028
Complete Actions: Complete actions necessary to achieve compliance with the effluent limitation(s) for ammonia nitrogen.	08/31/2029
Achieve Compliance: The permittee shall achieve compliance with final Ammonia limitations.	12/31/2029

April and May - 15 mg/L weekly average limit and 6.0 mg/L monthly average limit	
June through September - 10.0 mg/L weekly average limit and 4.1 mg/L monthly average	

4.4 Temperature Limits Compliance

This compliance schedule requires the permittee to achieve compliance by the specified date.

Required Action	Due Date
Preliminary Compliance Report: Submit a preliminary compliance report indicating alternatives to achieve the final temperature limits. Informational Note: Refer to NR 106 Subchapters V & VI or NR 102.26, Wis. Adm. Code, for information regarding the re-evaluation of limits.	12/31/2025
Action Plan: Submit an action plan for complying with all applicable effluent temperature limits.	12/31/2026
Construction Plans: Submit construction plans (if construction is required for complying with effluent temperature limits) and include plans and specifications with the submittal.	12/31/2027
Initiate Actions: Initiate actions identified in the plan.	12/31/2028
Complete Actions: Complete actions necessary to achieve compliance with effluent temperature limits.	08/31/2029
Achieve Compliance: The permittee shall achieve compliance with final Thermal limitations. October - 61 deg F November - 50 deg F December - 49 deg F	12/31/2029

Explanation of Schedules

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.

Effluent Limitations for BOD5 and Total Suspended Solids and Ammonia Effluent Limits & Facility Modifications – Currently the facility is not able to consistently meet the final limits for BOD5, total suspended solids and ammonia. Schedules have been included to allow the facility time to meet limitations.

Temperature Limits Compliance - The schedule has been included to determine if thermal limits are needed. After one year of sampling the facility will report on their ability to meet the limits. If it is found that limits are not needed the permit will be modified and limits and schedule will stop. If limits are found to still be needed the schedule will continue.

Attachments:

Water Flow Schematic

Water Quality-Based Effluent Limitations for the City of Tomahawk (WI-0021946-11-0) memo dated October 1, 2024
City of Tomahawk, Unnamed tributary (no WBIC) to the Wisconsin River, Lincoln County memo dated September 9, 2024

Expiration Date:

December 31, 2029

Justification Of Any Waivers From Permit Application Requirements

No waivers from permit application requirements were requested or granted.

Prepared By: Sheri A. Snowbank **Wastewater Specialist**

Date: October 8, 2024

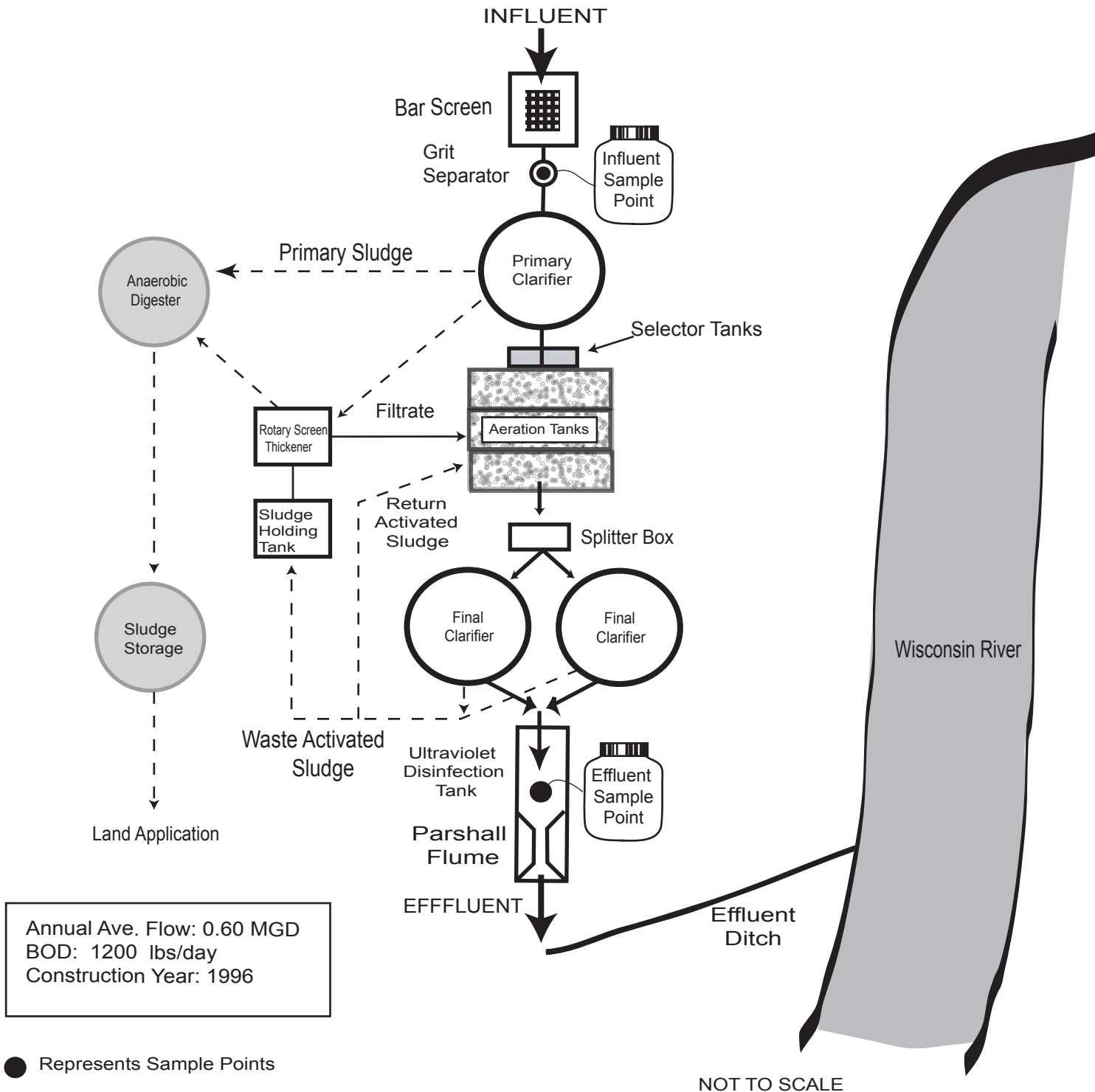
Date updated based on Factcheck comments: November 6, 2024 (No comments submitted.)

Date updated based on public notice comments:

Notice of reissuance was published in the Tomahawk Leader, PO Box 345, Tomahawk, WI 54487-0345.

CITY OF TOMAHAWK Wastewater Treatment Facility

The Tomahawk wastewater treatment facility is a conventional activated sludge plant that includes screening, grit removal, primary settling, aeration, secondary settling, biological and chemical phosphorus removal, seasonal ultraviolet disinfection anaerobic digestion, sludge thickening, and sludge storage. The treated effluent is discharged to an effluent ditch flowing into the Wisconsin River. The diagram below shows the treatment units and sampling locations.



Annual Ave. Flow: 0.60 MGD
BOD: 1200 lbs/day
Construction Year: 1996

● Represents Sample Points

NOT TO SCALE

CORRESPONDENCE/MEMORANDUM

DATE: October 1, 2024

TO: Sheri Snowbank – NOR/Spooner Service Center

FROM: Michael Polkinghorn – NOR/Rhineland Service Center *Michael Polkinghorn*

SUBJECT: Water Quality-Based Effluent Limitations for the City of Tomahawk
 WPDES Permit No. WI-0021946-11-0

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 City of Tomahawk in Lincoln County. This municipal wastewater treatment facility (WWTF) discharges to an unnamed tributary to the Wisconsin River, located in the Noisy and Pine Creeks Watershed in the Upper Wisconsin River Basin. This discharge is included in the Wisconsin River Basin 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 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Footnotes
Flow Rate					1
River Flow May – October					1
River Temperature May – October					1
BOD ₅					
Interim Year round May – October	Variable		30 mg/L	20 mg/L	2, 3
Final May – October November – April			5.0 mg/L 10 mg/L	5.0 mg/L 10 mg/L	
TSS					
Interim			30 mg/L	20 mg/L	2, 3
Final			10 mg/L	10 mg/L	
pH	9.0 s.u.	6.0 s.u.			1, 2
Dissolved Oxygen		7.0 mg/L			2
<i>E. coli</i> May – September				126 #/100 mL geometric mean	4
Ammonia Nitrogen April – May June – September			15 mg/L 10 mg/L	6.0 mg/L 4.1 mg/L	3
Phosphorus				1.0 mg/L 2.7 lbs/day	5
Temperature October November			61 °F 50 °F		6

3. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.
4. 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 concentration limit is a technology-based limit as described in subch. II of NR 217, Wis. Adm. Code. The mass limit is based on the WRB TMDL to address phosphorus water quality impairments within the TMDL area.
6. Monthly monitoring for 1 year is recommended for January – September to have updated temperature data at the next permit reissuance. Options available for potential relief from temperature limits are explained in detail in the August 15, 2013 Department *Guidance for Implementation of Wisconsin's Thermal Water Quality Standards*
<http://dnr.wi.gov/topic/surfacewater/documents/ThermalGuidance2edition8152013.pdf>
7. Monthly monitoring for 1 year is recommended during the reissued permit term.
8. Once every two months monitoring is required in accordance with s. NR 106.98(2), Wis. Adm. Code.
9. A more sensitive approved analytical method is recommended for future cadmium samples such that the limit of detection is less than or equal to 0.6 µg/L to better determine the need for cadmium limits at the next permit reissuance.
10. 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 (NO₃), nitrite (NO₂), 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 Michael Polkinghorn at (715) 360-3379 or Michael.Polkinghorn@wisconsin.gov and Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (3) – Narrative, discharge area map, & thermal table.

PREPARED BY: Michael A. Polkinghorn – Water Resources Engineer

E-cc: Michelle BalkLudwig, Regional Wastewater Supervisor – NOR/Spooner Service Center
Diane Figiel, Water Resources Engineer – WY/3
Nathaniel Willis, Wastewater Engineer – WY/3

Water Quality-Based Effluent Limitations for City of Tomahawk

WPDES Permit No. WI-0021946-11-0

Prepared by: Michael A. Polkinghorn

PART 1 – BACKGROUND INFORMATION

Facility Description

The City of Tomahawk wastewater treatment facility is a conventional activated sludge wastewater treatment system. Treatment consists of a mechanically cleaned fine screen with manual bar screening, vortex grit separator, primary clarification, biological phosphorus removal, 3 aeration basins, chemical phosphorus removal (optional), final clarification, and seasonal ultraviolet disinfection. Effluent is discharged on a continuous basis to an unnamed tributary (UT) to the Wisconsin River.

Attachment #2 is a discharge area map of Outfall 001.

Existing Permit Limitations

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

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Footnotes
Flow Rate					1
River Flow May – October					1
River Temperature May – October					1
BOD ₅ Year round May – October	Variable		30 mg/L	20 mg/L	2, 3
TSS			30 mg/L	20 mg/L	3
pH	9.0 s.u.	6.0 s.u.			3
Dissolved Oxygen		4.0 mg/L			3
Fecal Coliform May – September			656#/100 mL geometric mean	400#/100 mL geometric mean	4
Phosphorus				1.0 mg/L	5
Ammonia Nitrogen					1
Hardness (Total as CaCO ₃)					1
Copper (Total Recoverable)					1
Chloride					1

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Footnotes
Acute WET					

Footnotes:

1. Monitoring only.
2. Variable daily maximum mass BOD₅ WQBELs are required for any point source discharge to the Upper Wisconsin River (river miles 171.9-341.4) as described in s. 212.60, Wis. Adm. Code. The daily mass limit is equal to the baseline load of 275 lbs/day as determined by procedures in s. NR 212.60, Wis. Adm. Code. The tables below, based on Table 7m of ch. NR 212, Wis. Adm. Code, for each respective month provide the receiving water temperature and flow conditions where the resulting mass limit shall apply on a daily basis.

Daily Maximum BOD₅ Limits (lbs/day) – May

Flow cfs → ----- Temp ° F ↓	584 or less	585-778	779-972	973-1166	1167-1360	1361-1554	1555-1942	1943-2330	2331-2718	2719-3106	3107-3494	3495-3882	3883-4270	4271-4658	4659 or more
78+	275	275	275	275	275	275	275	275	275	275	275	275	275	275	
74-77	275	275	275	275	275	275	275	275	275	275	275	275			
70-73	275	275	275	275	275	275	275	275	275	275	275				
66-69	275	275	275	275	275	275	275	275	275						
62-65	275	275	275	275	275	275	275	275							
58-61	275	275	275	275	275	275									
54-57	275	275	275	275	275										
50-53	275	275	275												
46-49	275	275													
42-45	275														
41 or less															

Daily Maximum BOD₅ Limits (lbs/day) – June

Flow cfs → ----- Temp ° F ↓	584 or less	585-778	779-972	973-1166	1167-1360	1361-1554	1555-1942	1943-2330	2331-2718	2719-3106	3107-3494	3495-3882	3883-4270	4271-4658	4659 or more
78+	275	275	275	275	275	275	275	275	275	275	275	275	275	275	
74-77	275	275	275	275	275	275	275	275	275	275	275	275			
70-73	275	275	275	275	275	275	275	275	275	275	275				
66-69	275	275	275	275	275	275	275	275	275						
62-65	275	275	275	275	275	275	275								
58-61	275	275	275	275	275	275									
57 or less	275	275	275	275	275										

Daily Maximum BOD₅ Limits (lbs/day) – July & August

Flow cfs → ----- Temp	584 or less	585-778	779-972	973-1166	1167-1360	1361-1554	1555-1942	1943-2330	2331-2718	2719-3106	3107-3494	3495-3882	3883-4270	4271-4658	4659-5046	5047 or more
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Attachment #1

° F ↓																
78+	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
74-77	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
70-73	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
66-69	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
62-65	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
58-61	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
57 or less	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275

Daily Maximum BOD₅ Limits (lbs/day) – September

Flow cfs → ----- Temp ° F ↓	584 or less	585-778	779-972	973-1166	1167-1360	1361-1554	1555-1942	1943-2330	2331-2718	2719-3106	3107-3494	3495-3882	3883-4270	4271-4658	4659-5046	5047-5434	5435 or more
78+	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
74-77	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
70-73	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
66-69	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
62-65	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
58-61	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
57 or less	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275

Daily Maximum BOD₅ Limits (lbs/day) – October

Flow cfs → ----- Temp ° F ↓	584 or less	585-778	779-972	973-1166	1167-1360	1361-1554	1555-1942	1943-2330	2331-2718	2719-3106	3107-3494	3495-3882	3883-4270	4271-4658	4659-5046	5047-5434	5435 or more
78+	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
74-77	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
70-73	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
66-69	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
62-65	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
58-61	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
54-57	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
50-53	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
46-49	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275
42-45	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275

3. These limits are based on the Limited Aquatic Life (LAL) community of the immediate receiving water as described in s. NR 104.02(3)(b), Wis. Adm. Code.
4. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.
5. This is a technology-based limit as described in subch. II of NR 217, Wis. Adm. Code.

Receiving Water Information

- Name: UT to Wisconsin River
- Waterbody Identification Code (WBIC): NA for UT. Wisconsin River is 1179900.
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code:
 - o UT: Warm Water Sport Fish (WWSF) community. The previous limit evaluation (July 2018)

- o treated the UT as an LAL community.
- o Wisconsin River: WWSF community. This waterbody is approx. 0.5 mi downstream of Outfall 001.
- o All surface waterbodies are considered non-public water supplies.
- o Information about the site visit for determining the biological potential of the prior stated surface waterbodies is discussed in greater detail in the Receiving Water Classification Memorandum (September 2024) and will be available in the future in the permit file for the City of Tomahawk.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: Low flows for the UT are zero at Outfall 001. The following 7-Q₁₀ and 7-Q₂ values are for the Wisconsin River from USGS for Station UW41 or SW ¼, SW ¼, Section 10, T34N – R6E, at the Tomahawk Dam. This is approx. 0.4 mi upstream of the confluence with the UT.
 - 7-Q₁₀ = 750 cubic feet per second (cfs)
 - 7-Q₂ = 1,190 cfs
- Hardness: Effluent hardness is used in place of receiving water because there is no receiving water flow upstream of the discharge.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: Not applicable where the receiving water low flows are zero.
- Source of background concentration data: Background concentrations are not included because they do not impact the calculated WQBEL when the receiving water low flows are equal to zero.
- Multiple dischargers: There are several other dischargers to the Wisconsin 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: There are no known impairments for the UT or the Wisconsin River at Outfall 001. Outfall 001 is included in the WRB TMDL which addresses phosphorus water quality impairments within the TMDL area.

Effluent Information

- Design flow rate(s):
 - Annual average = 0.60 million gallons per day (MGD)
 - Peak daily = 1.27 MGD
 - Peak weekly = 1.01 MGD
 - Peak monthly = 0.726 MGD
- For reference, the actual average flow from January 2019 – July 2024 was 0.49 MGD.
- Hardness = 119 mg/L as CaCO₃. This value represents the geometric mean of data (n = 19, February 2019 – December 2023 from permit required monitoring.
- 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 no industrial contributors. Water supply from municipal wells.
- Total Phosphorus Wasteload Allocation: 669 lbs/yr, 1.83 lbs/day (*Appendix K of Total Maximum Daily Loads for Total Phosphorus in the Wisconsin River Basin, April 2019, page 24*).
- Additives: Ferric is available for chemical phosphorus removal but is typically not used during treatment.
- 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. The permit required monitoring for hardness, copper, chloride, and ammonia nitrogen.

Attachment #1

- 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 zinc data (n = 11, April 2018 – June 2018) is utilized to better determine the need for zinc limits in the permit.
- Effluent ammonia nitrogen data (n = 4, February 2016 – November 2016) is utilized to better determine the need for ammonia nitrogen limits in the permit.

Chloride Effluent Data

Statistics	Conc. (mg/L)
1-day P ₉₉	376
4-day P ₉₉	259
30-day P ₉₉	199
Mean	169
Std	65
Sample size	12
Range	130 - 370

Copper Effluent Data

Statistics	Conc. (µg/L)
1-day P ₉₉	9.4
4-day P ₉₉	6.7
30-day P ₉₉	4.7
Mean	3.8
Std	1.7
Sample size	21
Range	<1.0 - 7.4

“<” means that the pollutant was not detected at the indicated level of detection. The mean concentration was calculated using zero in place of the non-detected results.

Zinc Effluent Data

Statistics	Conc. (µg/L)
1-day P ₉₉	43
4-day P ₉₉	38
30-day P ₉₉	35
Mean	34
Std	3.7
Sample size	12
Range	28 - 40

The following table presents the average concentrations and loadings at Outfall 001 from January 2019 – July 2024 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6), Wis. Adm. Code:

Parameter Averages with Limits

	Average Measurement*	Average Mass Discharged
BOD ₅	5.9 mg/L	23 lbs/day
TSS	4.8 mg/L	
pH field	6.7 s.u.	
Dissolved Oxygen	4.3 mg/L	
Fecal Coliform	11 #/100 mL	
Phosphorus	0.23 mg/L	

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

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

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

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

Acute Limits based on 1-Q₁₀

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

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

Where:

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

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

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

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

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

Attachment #1

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

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 = 0 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD. mg/L	ATC	MAX. EFFL. LIMIT*	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Arsenic		340	340	68.0	<1.0		<1.0
Cadmium	119	12.6	12.6	2.5	<1.4		<1.4
Chromium	119	2,079	2,079	416	<6.7		<6.7
Copper	119	18.3	18.3			9.4	7.4
Lead	119	126	126	25.3	<1.5		<1.5
Nickel	119	544	544	109	2.2		2.2
Zinc	119	140	140			43	40
Chloride (mg/L)		757	757			376	370

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

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 0 cfs (¼ of the 7-Q₁₀), as specified in s. NR 106.06(4)(c), Wis. Adm. Code

SUBSTANCE	REF. HARD. mg/L	CTC	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Arsenic		152.2	152	30.4	<1.0	
Cadmium	119	2.82	2.82	0.6	<1.4	
Chromium	119	152.34	152	30.5	<6.7	
Copper	119	12.01	12.0			6.7
Lead	119	33.13	33.1	6.6	<1.5	
Nickel	119	60.47	60	12.1	2.2	
Zinc	119	140.15	140			38
Chloride (mg/L)		395	395			259

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 = 0 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

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SUBSTANCE	HTC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	370	370	74.0	<1.4
Chromium (+3)	3,818,000	3,818,000	763,600	<6.7
Lead	140	140	28.0	<1.5
Nickel	43,000	43,000	8,600	2.2

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 0 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HCC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3	13.3	2.66	<1.0

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 not recommended during the reissued permit term.** Monitoring recommendations are made in the paragraphs below:

Cadmium – Considering available effluent data from , the mean effluent concentration is nondetectable at <1.4 µg/L. This is below 1/5th of the calculated cadmium WQBELs; **therefore, limits or monitoring are not recommended during the reissued permit term.** In addition, the limit of detection of the submitted sample for cadmium is <1.4 µg/L using the EPA 200.7 analytical method. This is higher than 1/5th of the calculated limit (0.6 µg/L) based on CTC and is not certain if a nondetect sample is actually lower than that value. **A more sensitive approved analytical method is recommended for future cadmium samples such that the limit of detection is less than or equal to 0.6 µg/L to better determine the need for cadmium limits at the next permit reissuance.**

Copper/chloride/zinc – Considering the available respective effluent data from the previous and current permit terms (October 2017 – December 2023), there is no reasonable potential demonstrated for copper, chloride, and zinc limits. However, all these substances would have demonstrated reasonable potential for a limit(s) should the mean effluent concentration be compared to 1/5th of the respective limit(s) in the case less than 11 detectable samples are available. **Therefore, monthly monitoring for 1 year is recommended during the reissued permit term for copper, chloride, and zinc. Hardness monitoring at the same frequency is also recommended because of the relationship between hardness and daily maximum limits based on ATC.**

Mercury – The permit application did not require monitoring for mercury because the City of Tomahawk 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

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in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5), Wis. Adm. Code.” A review of the past five years of sludge characteristics data reveals that all the sample results are within expected analytical ranges and well below the 17 mg/kg level. The average concentration in the sludge from May 2019 – May 2023 was nondetectable at <1 mg/kg. **Therefore, mercury monitoring is not recommended during the reissued permit term.**

PFOS and PFOA – The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98(2), Wis. Adm. Code. Available monitoring sample data from the Tomahawk Waterworks (PWS ID: 73501274) is provided in the table below:

Water Supply PFAS Data

Sample Date	Sample ID	Well #	PFOS (ng/L)	PFOA (ng/L)
04/18/2023	CB03764-03	BG209	3.2	9.8
04/18/2023	CB03764-01	BG208	2.6	9.7
09/07/2023	CB10675-03	BG209	3.6	17
09/07/2023	CB10675-01	BG208	3.8	17
12/06/2023	CB14806-01	BG208	3.6	18
12/06/2023	CB14806-03	BG209	4.4	20
02/12/2024	CC01508-01	BG209	4.3	21
02/13/2024	CC01507-01	BG208	3.5	18
05/07/2024	CC04908-01	BG209	3.5	18
05/08/2024	CC04908-03	BG208	3.0	16
Average =			3.6	16

The limited data above shows the municipal water supply is above 1/5th of the applicable PFOS criteria. Based on the type of discharge and known levels of PFOS/PFOA in the source water, **PFOS and PFOA monitoring is recommended at a once every two months frequency during the reissued permit term.**

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR CONVENTIONAL POLLUTANTS

The BOD₅ and TSS limits in the current permit are based on the protection of the LAL community of the immediate receiving water as described in s. NR 104.02(3)(b), Wis. Adm. Code. Because this classification is recommended to be changed to a WWSF community based on the recent receiving water reclassification, these limits will be reevaluated at this time.

BOD₅ & DO

In establishing BOD₅ limitations, the primary intent is to prevent a lowering of dissolved oxygen levels in the receiving water below water quality standards as specified in ss. NR 102.04(4)(a) and (b). The 26-lb method is the most frequently used approach for calculating BOD₅ limits when resources are not available to develop a detailed water quality model. This simplified model was developed in the 1970's by the Wisconsin Committee on Water Pollution on the Fox, Wisconsin, Oconto, and Flambeau Rivers. Further studies throughout the 1970's proved this model to be relatively accurate. The model has since then been used by the Department on many occasions when resources are not available to perform a site-specific model. The "26" value stems from the following equation:

$$\frac{26 \text{ lbs/day}}{\text{ft}^3/\text{sec}} * \frac{1 \text{ day}}{86,400 \text{ sec}} * \frac{454,000 \text{ mg}}{\text{lbs}} * \frac{1 \text{ ft}^3}{28.32 \text{ L}} = 4.8 = 2.4 * 2 \text{ mg/L}$$

The 4.8 mg/L has been calculated by taking 2.4 mg/L which is the number one receives when converting 26 lbs. of BOD/day/cfs into mg/L, multiplied by 2.0 which is the change in the DO level. A typical background DO level for Wisconsin waters is 7 mg/L, so a 2 mg/L decrease is allowed to meet the 5 mg/L standard for warm water streams. The above relationship is temperature dependent and an appropriate temperature correction factor is applied. The 26-lb method is based on a typical 24°C summer value for warm water streams. Adjustments for temperature are made using the following equation:

$$k_t = k_{24} (0.967^{(T-24)})$$

Where k_{24} = 26 lbs. of BOD/day/cfs

Calculations based on Full Assimilative Capacity at 7-Q₁₀ Conditions:

$$Limitation(mg / L) = 2.4(DO_{stream} - DO_{std}) \left(\frac{(7Q_{10} + Q_{eff})}{Q_{eff}} \right) (0.967^{(T-24)})$$

Where:

Q_{eff} = effluent flow = 0.60 MGD

DO_{stream} = background dissolved oxygen = 7.0 mg/L

DO_{std} = dissolved oxygen criteria from s. NR 102.04(4), Wis. Adm. Code = 5.0 mg/L

7-Q₁₀ = 0 cfs

T = Receiving water temperature from s. NR 102.25, Wis. Adm. Code

Because no dilution is available in the receiving water, the calculated limits would be the lowest that the Department typically gives to facilities per standing policy. **These effluent limitations are 5.0 mg/L during May – October and 10 mg/L during November – April, expressed as weekly average limits. A dissolved oxygen limit of 7.0 mg/L as a daily minimum is also recommended.** This is consistent with the assumed dissolved oxygen effluent concentration in the calculation of the BOD₅ limitations. Mass limits for BOD₅ are not required because the receiving water will be effluent dominated.

The monthly average BOD₅ limits of 5.0 and 10 mg/L are required during May – October and November – April respectively to satisfy the expression of limits requirements as described in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes.

A review of effluent BOD₅ monitoring data (n = 873, January 2019 – July 2024) averaged monthly shows the facility would have exceeded the 5.0 mg/L monthly average limit 24 times. The 10 mg/L monthly average limit would have been exceeded 1 time. Because the facility would have been noncompliant with the monthly average limits, they would also have been noncompliant with the weekly average limits. **Therefore, a compliance schedule is needed during the reissued permit term to meet the BOD₅ limits. The BOD₅ limits in the current permit are recommended to be the interim limits during the compliance schedule.**

The current permit has variable daily maximum mass BOD₅ WQBELs required for any point source discharge to the Upper Wisconsin River (river miles 171.9-341.4) as described in s. 212.60, Wis. Adm. Code. The daily mass limit is equal to the baseline load of 275 lbs/day as determined by procedures in s.

NR 212.60, Wis. Adm. Code. The updated BOD₅ WQBELs for the protection of the UT are equivalent to mass limits of 53 lbs/day (5.0 mg/L, May – October) and 106 lbs/day (10 mg/L, November – April) using the peak daily design flow of 1.27 MGD. These are more stringent than the 275 lbs/day baseline load; **therefore, the monthly BOD₅ tables and the associated river monitoring are recommended to be removed during the reissued permit term.**

Total Suspended Solids (TSS)

Total suspended solids (TSS) effluent limits are regulated via narrative standards described in NR 102.04(1), Wis. Adm. Code. TSS effluent limits are included whenever BOD₅ WQBELs are needed and are set equal to the BOD₅ limits but no lower than 10 mg/L per Department policy. **Because BOD₅ WQBELs are recommended, the weekly average TSS limit of 10 mg/L is also recommended during the reissued permit term.**

Similar to BOD₅, a monthly average TSS limit is also needed to satisfy expression of limits requirements. **Therefore, the monthly average TSS limit of 10 mg/L is required during the reissued permit term.**

A review of effluent TSS monitoring data (n = 874, January 2019 – July 2024) averaged weekly shows the facility would have exceeded the 10 mg/L weekly average limit 6 times. A review of monthly average effluent TSS data shows the 10 mg/L monthly average limit would not have been exceeded. **Therefore, a compliance schedule is needed during the reissued permit term to meet the TSS limits. The TSS limits in the current permit are recommended to be the interim limits during the compliance schedule.**

pH

The current permit for the City of Tomahawk has the daily minimum and daily maximum limit range of 6.0 – 9.0 s.u. which are categorical limits for a discharge to an LAL community receiving water. These existing pH limits will control the discharge to meet the pH water quality standards as described in s. NR 102.04(4)(c), Wis. Adm. Code. **Therefore, the pH limits are recommended to continue during the reissued permit term.**

PART 4 – 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 City of Tomahawk 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 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 = 0.411 and B = 58.4 for a WWSF community, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 2,039 sample results were reported from January 2019 – July 2024. The maximum reported value was 8.6 s.u. (Standard pH Units). The effluent pH was 7.2 s.u. or less 99% of the time. The 1-day P₉₉, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 7.3 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 7.2 s.u. Therefore, a value of 7.3 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 7.3 s.u. into the equation above yields an ATC = 27.77 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 either set equal to two times ATC or the mass balance equation based on the 1-Q₁₀ low flow if it is determined that the prior stated method is not sufficiently protective of fish and aquatic life. The more restrictive calculated limits shall apply.

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

Daily Maximum Ammonia Nitrogen Determination

Method	Ammonia Nitrogen Limit (mg/L)
2×ATC	56
1-Q ₁₀	28

The 1-Q₁₀ low flow method yields the most stringent limits for the City of Tomahawk.

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 – WWSF Community

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	54	7.0 < pH ≤ 7.1	33	8.0 < pH ≤ 8.1	6.9
6.1 < pH ≤ 6.2	53	7.1 < pH ≤ 7.2	30	8.1 < pH ≤ 8.2	5.7
6.2 < pH ≤ 6.3	52	7.2 < pH ≤ 7.3	26	8.2 < pH ≤ 8.3	4.7
6.3 < pH ≤ 6.4	51	7.3 < pH ≤ 7.4	23	8.3 < pH ≤ 8.4	3.9
6.4 < pH ≤ 6.5	49	7.4 < pH ≤ 7.5	20	8.4 < pH ≤ 8.5	3.2
6.5 < pH ≤ 6.6	47	7.5 < pH ≤ 7.6	17	8.5 < pH ≤ 8.6	2.7
6.6 < pH ≤ 6.7	45	7.6 < pH ≤ 7.7	14	8.6 < pH ≤ 8.7	2.2
6.7 < pH ≤ 6.8	42	7.7 < pH ≤ 7.8	12	8.7 < pH ≤ 8.8	1.8
6.8 < pH ≤ 6.9	39	7.8 < pH ≤ 7.9	10	8.8 < pH ≤ 8.9	1.6
6.9 < pH ≤ 7.0	36	7.9 < pH ≤ 8.0	8.4	8.9 < pH ≤ 9.0	1.3

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

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Weekly average and monthly average limits for ammonia nitrogen are based on chronic toxicity criteria (CTC) in ch. NR 105, Wis. Adm. Code. The 30-day CTC for ammonia in waters classified as a WWSF community is calculated by the following equation, according to subchapter IV of NR 106, Wis. Adm. Code.

$$CTC = E \times \{ [0.0676 \div (1 + 10^{(7.688 - pH)})] + [2.912 \div (1 + 10^{(pH - 7.688)})] \} \times C$$

Where:

pH = the pH (s.u.) of the receiving water,

E = 0.854,

C = the minimum of 2.85 or $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Present), or

C = $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Absent), and

T = the temperature (°C) of the receiving water – (Early Life Stages Present), or

T = the maximum of the actual temperature (°C) and 7 – (Early Life Stages Absent)

The 4-day criterion is equal to the 30-day criterion multiplied by 2.5. The 4-day criteria are used in a mass-balance equation with the 7-Q₁₀ (4-Q₃, if available) to derive weekly average limitations. And the 30-day criteria are used with the 30-Q₅ (estimated as 85% of the 7-Q₂ if the 30-Q₅ is not available) to derive monthly average limitations. The stream flow value is further adjusted to temperature; 100% of the flow is used if the Temperature ≥ 16 °C, 25% of the flow is used if the Temperature < 11 °C, and 50% of the flow is used if the Temperature ≥ 11 °C but < 16 °C.

Section NR 106.32 (3), Wis. Adm. Code, provides a mechanism for less stringent weekly average and monthly average effluent limitations when early life stages (ELS) of critical organisms are absent from the receiving water. This applies only when the water temperature is less than 14.5 °C, during the winter and spring months. Burbot, an early spawning species, are not believed to be present in the UT, based on conversations with local fisheries biologists. So “ELS Absent” criteria apply from October – March, and “ELS Present” criteria will apply from April – September for a WWSF community.

The background pH is based on the 4-day P₉₉ of effluent pH data (January 2019 – July 2024). Background maximum temperature data is based on Table 2 of s. NR 102.25, Wis. Adm. Code. These values are shown in the table below, with the resulting criteria and effluent limitations.

Weekly & Monthly Ammonia Nitrogen Limits – WWSF Community

		Spring	Summer	Winter
		April & May	June – Sept.	Oct. - March
Effluent Flow	Q _e (MGD)	0.60	0.60	0.60
Background Information	7-Q ₁₀ (cfs)	0	0	0
	7-Q ₂ (cfs)	0	0	0
	Maximum Temperature (°C)	14	21	10
	pH (s.u.)	6.97	6.97	6.97
Criteria mg/L	4-day Chronic			
	Early Life Stages Present	14.94	10.13	
	Early Life Stages Absent			20.00
	30-day Chronic			
	Early Life Stages Present	5.98	4.05	
	Early Life Stages Absent			8.00
Effluent Limitations	Weekly Average			
	Early Life Stages Present	15	10	

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		Spring	Summer	Winter
		April & May	June – Sept.	Oct. - March
mg/L	Early Life Stages Absent			20
	Monthly Average			
	Early Life Stages Present	6.0	4.1	
	Early Life Stages Absent			8.0

Effluent Data

The following table evaluates the statistics based upon ammonia data reported from February 2016 – December 2022, with those results being compared to the calculated limits to determine the need to include ammonia limits in the City of Tomahawk permit for the respective month ranges. That need is determined by calculating 99th upper percentile (or P₉₉) values for ammonia during each of the month ranges and comparing the daily maximum values to the daily maximum limit.

Ammonia Nitrogen Effluent Data

Statistics	Conc. (mg/L)
1-day P ₉₉	25
4-day P ₉₉	14
30-day P ₉₉	6.3
Mean	3.2
Std	5.5
Sample size	16
Range	0.01 - 18

Based on this comparison, a weekly average limit is recommended during June – September and monthly average limits are recommended during April – May and June – September.

The weekly average limit of 15 mg/L is required during April – May to satisfy the expression of limits requirements as described in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes. If a monitoring frequency other than 3x/wk is used during the reissued permit term, then this limit should be reevaluated.

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

Month Range	Weekly Average (mg/L)	Monthly Average (mg/L)
April & May	15	6.0
June – September	10	4.1

PART 5 – WATER QUALITY-BASED EFFLUENT LIMITATIONS

Attachment #1
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:

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 the City of Tomahawk'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 – September. No changes are recommended to the current recreational period and the required disinfection season.

Effluent Data

The City of Tomahawk has monitored effluent *E. coli* from August 2022 – July 2023 and a total of 22 results are available. A geometric mean of 126 counts/100 mL was never exceeded, with a maximum monthly geometric mean of 4.3 counts/100 mL. Effluent data has never exceeded 410 counts/100 mL, with maximum reported value of 10 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 6 – 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 City of Tomahawk 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

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 City of Tomahawk, the total phosphorus WLAs are 669 lbs/yr and 1.83 lbs/day.

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, 6-month average mass limits are also included. The following equation shows the calculation of equivalent effluent concentration:

$$\begin{aligned} \text{TP Equivalent Effluent Concentration} &= \text{Daily WLA} \div (\text{Flow Rate} * \text{Conversion Factor}) \\ &= 1.83 \text{ lbs/day} \div (0.60 \text{ MGD} * 8.34) \\ &= 0.37 \text{ mg/L} \end{aligned}$$

Since this value is greater than 0.3 mg/L, the WLA should be expressed as a monthly average mass limit for total phosphorus and no six-month average limit is required.

$$\begin{aligned} \text{TP Monthly Average Permit Limit} &= \text{daily WLA} * \text{monthly average multiplier} \\ &= 1.83 \text{ lbs/day} * 1.47 \\ &= 2.7 \text{ lbs/day} \end{aligned}$$

The multiplier used in the monthly average calculation was used as recommended in TMDL implementation guidance. A coefficient of variation (CV) was calculated, based on phosphorus mass monitoring data, to be 0.62. This value, along with monitoring frequency, is used to select the multiplier. The current permit specifies phosphorus monitoring as 3x/wk; 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.

Effluent Data

The following table lists the statistics for effluent phosphorus concentrations from January 2019 – July 2024. 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.

Attachment #1

Phosphorus Effluent Data

Statistics	Conc. (mg/L)	Mass Discharge (lbs/day)
1-day P ₉₉	0.64	2.9
4-day P ₉₉	0.40	1.8
30-day P ₉₉	0.28	1.2
Mean	0.23	0.92
Std	0.12	0.57
Sample Size	876	876
Range	0.01 - 1.5	0.04 - 6.0

A review of the calculated monthly average mass phosphorus loadings (n = 67, January 2019 – July 2024) shows the facility would have been 99% compliant with the TMDL limit or only 1 monthly average would have exceeded the TMDL limit. **Therefore, the monthly average limit of 2.7 lbs/day is recommended to be 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.

In accordance with s. NR 106.53(2)(b), Wis. Adm. Code, the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), Wis. Adm. Code, the highest 7-day rolling average flow rate for a calendar month is used to determine the sub-lethal (weekly average) effluent limitation. These values were based off actual flow reported from January 2019 – July 2024. Because the receiving water flow is zero, the limits are set equal to thermal WQC. The complete thermal calculations are included as attachment #3.

The table below summarizes the maximum temperatures reported during monitoring from February 2016 – January 2017 along with the calculated limits:

Monthly Temperature Effluent Limits

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(°F)
JAN	47	48	49	76
FEB	44	44	50	76

Attachment #1

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(°F)
MAR	46	47	52	76
APR	49	49	55	78
MAY	55	62	65	82
JUN	61	61	75	85
JUL	65	66	80	86
AUG	66	67	79	85
SEP	66	67	72	84
OCT	64	64	61	80
NOV	58	59	50	77
DEC	52	54	49	76

Reasonable Potential

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

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

Comparing the representative highest effluent temperature to the calculated effluent limits determines the reasonable potential of exceeding the effluent limits. The months in which limitations are recommended are shown in bold. **Based on this analysis, weekly average limits are recommended during October – December. Monthly monitoring for 1 year is recommended for January – September to have updated temperature data at the next permit reissuance.**

The following general options are available for a facility to explore potential relief from the temperature limits:

- Effluent monitoring data: Verification or additional effluent monitoring (flow and/or temperature) may be appropriate if there were questions on the representativeness of the current effluent data.

Attachment #1

- Dissipative cooling demonstration: Effluent limitations based on sub-lethal criteria may be adjusted based on the potential for heat dissipation from municipal treatment plants as described in s. NR 106.59(4), Wis. Adm. Code.
- Collection of site-specific ambient temperature: default background temperatures for streams in Wisconsin, so actual data from the direct receiving water may provide for relaxed thermal limits but only if the site-specific temperatures are lower than the small stream defaults used in the above tables
- A variance to the water quality standard: This is typically considered to be the least preferable and most complex option as it requires the evaluation of the other alternatives.

These options are explained in additional detail in the August 15, 2013 Department *Guidance for Implementation of Wisconsin's Thermal Water Quality Standards*

<http://dnr.wi.gov/topic/surfacewater/documents/ThermalGuidance2edition8152013.pdf>

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 (2022)*.

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. **WET testing is not recommended at this time because of the low risk in effluent toxicity.**

Discharge Area Map

Aerial photo (Leaf off 2018-2020) from Surface Water Data Viewer. The facility is north of Dean Road (red polygon). Effluent is piped to the outfall (red dot). Black triangle is the location currently shown in the SWDV as the outfall location, which is slightly off, ~100 ft SE of observed outfall.



Temperature Limits for Receiving Waters with Unidirectional Flow

(calculation using default ambient temperature data)

Facility:	City of Tomahawk	7-Q₁₀:	0.00 cfs	Temp Dates	Flow Dates
Outfall(s):	001	Dilution:	25%	Start:	02/01/16
Date Prepared:	9/10/2024	f:	0	End:	01/30/17
Design Flow (Qe):	0.60 MGD	Stream type:	Upper Wisconsin River		
Storm Sewer Dist.	0 ft	Qs:Qe ratio:	0.0 :1		
		Calculation Needed?	YES		

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)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Qesl) (MGD)	Daily Maximum Flow Rate (Qea) (MGD)		Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)		(MGD)	(MGD)		(°F)	(°F)	(°F)	(°F)
JAN	33	49	76	0	0.471	0.515	0	47	48	49	76
FEB	33	50	76	0	0.441	0.469	0	44	44	50	76
MAR	35	52	76	0	0.782	0.885	0	46	47	52	76
APR	44	55	78	0	1.033	1.120	0	49	49	55	78
MAY	60	65	82	0	0.990	1.113	0	55	62	65	82
JUN	70	75	85	0	0.714	0.791	0	61	61	75	85
JUL	75	80	86	0	0.694	0.727	0	65	66	80	86
AUG	73	79	85	0	0.592	0.645	0	66	67	79	85
SEP	65	72	84	0	0.736	0.781	0	66	67	72	84
OCT	51	61	80	0	0.612	0.627	0	64	64	61	80
NOV	39	50	77	0	0.506	0.569	0	58	59	50	77
DEC	33	49	76	0	0.457	0.500	0	52	54	49	76

DATE: 9-24-2024 FILE REF: NA

TO: Mike Polkinghorn, Limit Calculator; Amy Garbe, Compliance Engineer

FROM: Aaron Marti, Stream Biologist; Kristi Minahan, Water Quality Standards; Diane Figiel, Limit Calculator Coordinator

SUBJECT: City of Tomahawk, Unnamed tributary (no WBIC) to the Wisconsin River, Lincoln County

Overview of issue

In preparation for reissuance of the City of Tomahawk permit, staff were requested to do a site visit to determine the appropriate stream classifications for the receiving waters. Tomahawk is a continuous discharger, with an annual average design flow of 0.60 MGD (1.1 cfs).

The immediate receiving water is described in the permit as an “effluent ditch tributary” (Segment 1, no WBIC) to the Wisconsin River (WBIC 1179900). No segments of the tributary are listed as Limited Aquatic Life or Limited Forage Fish (LAL/LFF) in ch. NR 104, but in 2003 the tributary was proposed to be listed as LAL. The 2018 permit limits were based on LAL; no downstream protection phosphorus limits were needed due to dilution.

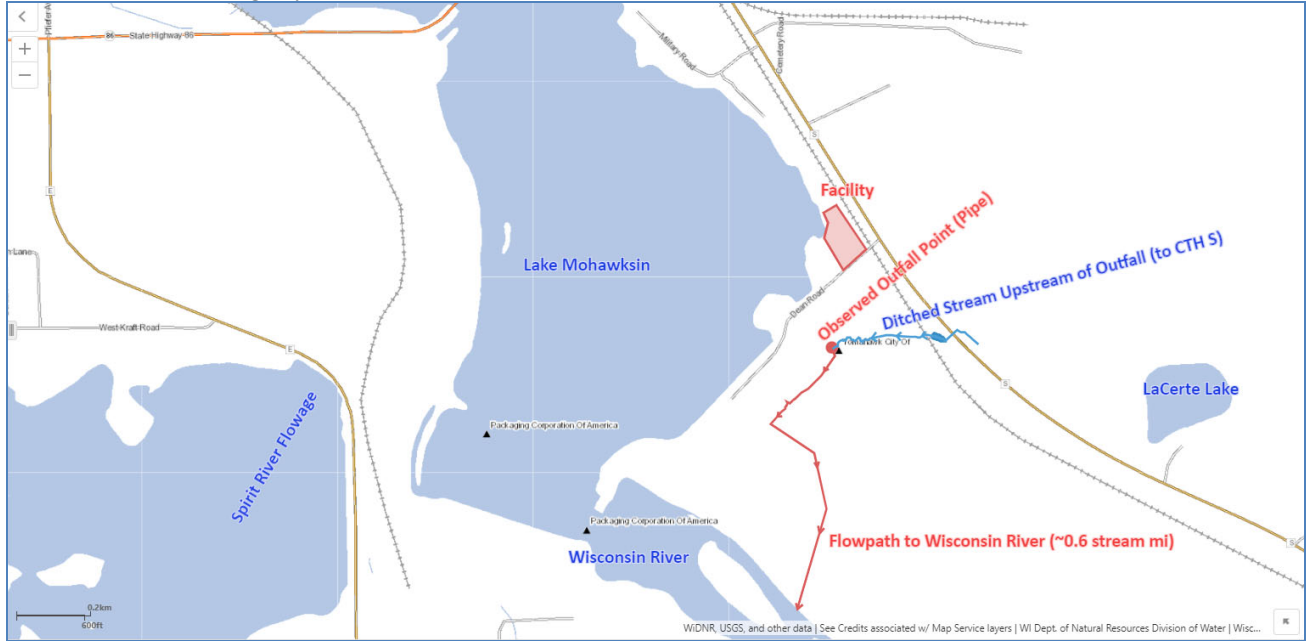
Aaron Marti, stream biologist, conducted a site visit and fish and habitat surveys on 9-22-2022. The main objectives of this site visit were to determine whether the tributary meets the definition of wastewater effluent channel (WWEC) in ch. NR 104, and if not, determine the appropriate stream classification.

Summary of recommendations

- **Segments 1-4: Unnamed tributary (no WBIC) to the Wisconsin River**
 - *Codified designated use:* Not listed as LAL or LFF in ch. NR 104.
 - *Classification used for previous permit issuance:* LAL
 - *Previous stream class recommendations:* The 2003 proposal recommended LAL for the “ditch from the WWTP outfall in the NWQ SEQ T34N R6E S10 to the confluence with the Wisconsin River”. This was based on a stream classification memo by William Jaeger in 1995.
 - *Modeled Natural Community:* NA
 - *New recommended Natural Community and Designated Use:*
 - Natural Community is expected to be either Warm Headwater or Cool-Warm Headwater.
 - Recommended Designated Use is Warmwater (either of the above NC categories fit the Warmwater Designated Use)
- **Segment 5: Wisconsin River (WBIC 1179900)**
 - *Codified designated use:* Warmwater
 - *Classification used for previous permit issuance:* Warmwater
 - *Previous stream class recommendations:* NA
 - *Modeled Natural Community:* Large River
 - *New recommended NC & DU:* Not evaluated; no change

Site overview maps

Map 1. Map from Surface Water Data Viewer. The facility is north of Dean Road (red polygon). Effluent is piped to the outfall (red dot). Black triangle is the location currently shown in the SWDV as the outfall location, which is slightly off, ~100 ft SE of observed outfall.



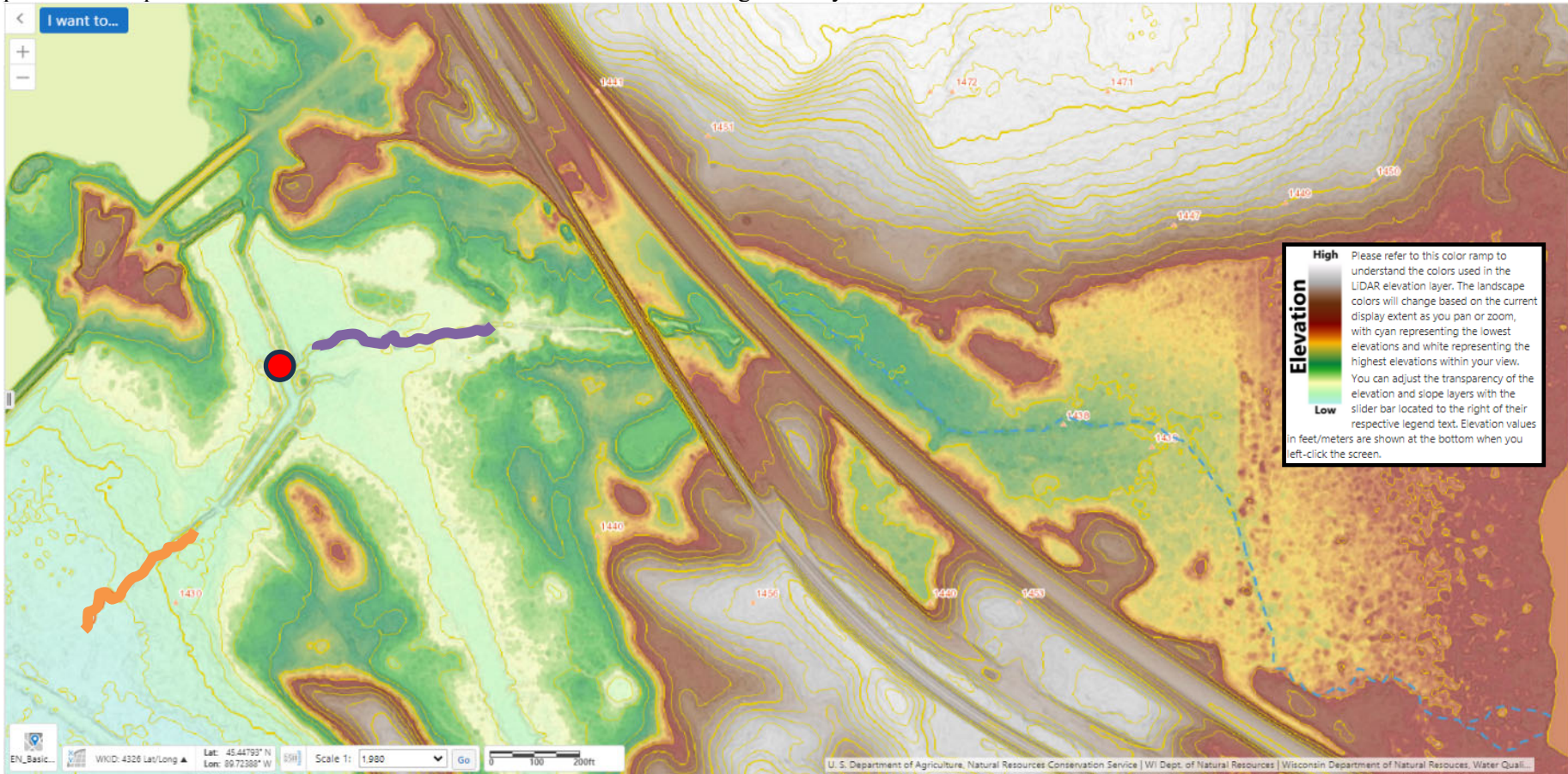
Map 2. Aerial photo (Leaf off 2018-2020) from Surface Water Data Viewer.



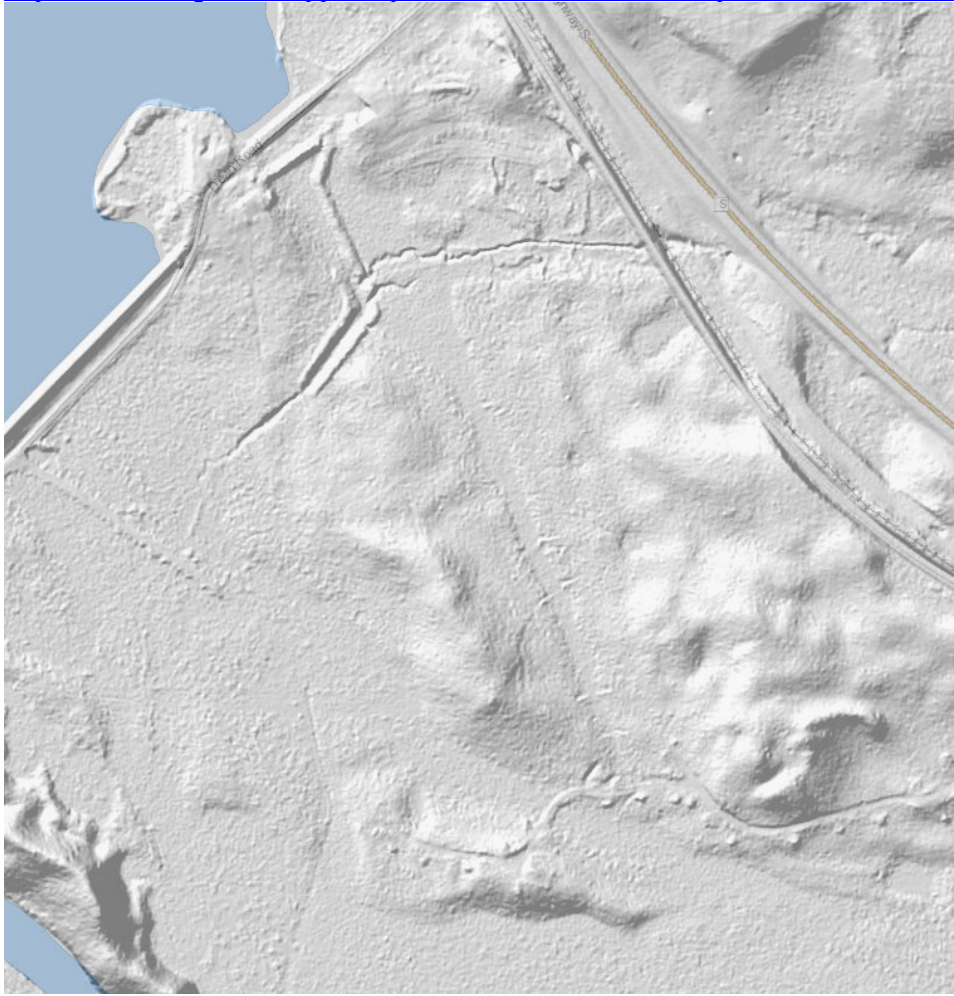
Map 3. Map from Wisconsin Wetland Inventory LIDAR Viewer with derived topography. Fish and Qualitative Habitat Survey Sites/Reaches (**Upstream in purple** and **Downstream in orange**) as well as outfall location (red circle) are noted. Approximate historic/current probable flowpath from LaCerte Lake to observed CTH S stream crossing noted by hatched blue line.



Map 4. Map from Wisconsin Wetland Inventory LIDAR Viewer with derived topography and LIDAR elevation scaling. Fish and Qualitative Habitat Survey Sites/Reaches (Upstream in purple and Downstream in orange) as well as outfall location (red circle) are noted. Approximate historic/current probable flowpath from LaCerte Lake to observed CTH S stream crossing noted by hatched blue line.



Map 5. LIDAR image from <https://www.arcgis.com/apps/mapviewer/index.html?webmap=f2e49a42f5e14dd5845536408279da9d>.



Map 6. Historic aerial image from 1938, before any onsite ditching was evident. (<https://search.library.wisc.edu/digital/A7SNPC4TMGXMCY86/full>)



Map 7A and 7B. Historic aerial photo from 1950 (historicaerials.com/viewer, Lat 45.44576 N; Long 89.72158 W). 7A shows the same extent as the 1938 photo; 7B (next page) shows a closer view of the area near the facility outfall. At this date, before the facility was constructed in 1954, the image shows an existing ditch. The 1964 and 1980 maps from the same source are very similar to this.



Map 7B. (see earlier caption)



Review of historic aerial images and documents for Wastewater Effluent Channel (WVEC) determination

An important part of this review is to determine whether the classification of wastewater effluent channel was appropriately applied in previous issuances of this permit. The codified definition in Wis. Adm. Code states:

“ch. NR 104.02(1)(d) *Wastewater effluent channels*. This classification includes discharge conveyances constructed primarily for the purpose of transporting wastes from a facility to a point of discharge. Drainage ditches (including those established under ch. 88, Stats.) constructed primarily for the purposes of relieving excess waters on agricultural lands shall not be construed as effluent channels. Modifications made to natural watercourses receiving wastewater effluents for the purpose of increasing or enhancing the natural flow characteristics of the stream shall not be classified as effluent channels.”

Under ch. NR 104.02(3)(b), the Limited Aquatic Life classification “shall be applied to all surface waters classified as effluent channel, wetland or diffuse surface water.” (and may be applied to other waters). Therefore, if it is a WVEC, it is automatically an LAL, but if it is not a WVEC, then its designated use should be based on the fish community that it is capable of supporting. Limited Aquatic Life is applied to waters that do not support a fish community.

Current maps and the site visit showed that there is clearly a natural stream upstream of the outfall, indicating that the system downstream of the outfall was likely originally a natural stream as well. Farther downstream, the ditched portion has also begun to re-meander. This raised questions as to whether the WVEC and LAL classifications had been appropriately applied in the past.

The City of Tomahawk WWTP was originally constructed in 1954, with major plant upgrades in 1971 and 1997. Prior to the early 1950s, the City of Tomahawk was discharging directly from the sanitary sewers to the Wisconsin River. After this time, the City of Tomahawk WWTP has been discharging to an “existing surface drainage ditch”. The initial 1953-4 facility plans could not be found in DNR’s microfiche to verify whether the ditch was constructed specifically to take wastewater. In 1971 they extended the outfall pipe further downstream to discharge to the wider portions of the ditch. A 1971 letter from R. G. Jones (consultant) to the DNR acknowledges that the wastewater will be discharged to an existing ditch system, and outlines plans to reconstruct their lines and alter part of the ditch. It is clear that the ditch system (a surface water) existed prior to this construction.

It appears that the basis for previously applying LAL limits in the permit was likely based on William Jaeger’s 1995 stream classification memo, informed by a 1994 letter from Eric Shaffer of Mid-States Associates on behalf of the facility, providing excerpts of 1953 site plans. The Shaffer letter and Jaeger memo note that there was a previously existing ditch system before construction of the Tomahawk WWTP. Jaeger speculated that “The pre-existing ditch was probably constructed to convey wastewater from the dam drainage system,” and stated that part of the ditch appeared to be constructed to convey wastewater from the facility. However, water that filters through the earthen dam would not be considered “wastewater,” as it was termed in the 1995 Jaeger memo. Further, his characterization of a constructed section of the ditch likely reflects the 1971 alterations of the pre-existing ditch system. During his 1994 visit, he found very minimal aquatic life.

Minahan and Figiel reviewed historic aerial images with Kathy Turner, NRCS Northeast Area Resource Soil Scientist, on 2-20-2024. From the 1938 aerial, there was a natural stream in the present-day location upstream of the outfall, which then entered a low swath of “muck” soils indicating saturation (in the area of the outfall, based on soil maps). The natural stream resumes just south of the outfall and flows south, then enters floodplain soils that would flow to the southeast toward the Wisconsin River (following the flowpath of the currently ditched channels). From the 1950 map, prior to facility construction in 1954 the area had been extensively ditched. This may have been in part due to what appears to be a secondary dam outlet discharging some water from the dam (surface water) into the ditch system. The Tomahawk WWTP constructed its outfall adjacent to the existing ditches so that effluent could enter the ditch system, and later modified part of the existing channel to take greater flows. Therefore it does not appear that this channel fits the definition of a wastewater effluent channel because (a) there was an existing natural stream prior to ditching, (b) the natural stream system was largely converted to a ditched system prior to facility construction, and (c) the ditches appear to have been originally channelized to take surface water overflow from L. Mohawksin, not wastewater from the facility. Therefore, the aquatic life that is existing now, and was likely historically present, should be protected with the appropriate designated use classification based on the fish community, and permit limits based on that designation should be applied.

There is a short “stub” of 5-10 meters length from the outlet to where the discharge meets the main body of water that does not appear to be part of the natural stream system and may well have been constructed for the outfall. This short stretch could be considered WWEC. However, it may not make a difference in the application of permit limits.

Site observations and habitat survey results (if available)

- **Segment 1 (most upstream): (Purple Line on Maps 3 and 4) - Station “Unnamed tributary to Wisconsin River 40 m Upstream from Tomahawk WWTP outfall”**
 - This segment was established as a Fish and Monitoring Station; mean stream width ~0.8 m.
 - Despite historic ditching, stream is either re-meandering entirely (West half survey reach) or beginning to re-meander within ditched channel (East half survey reach).
 - Formation of undercut banks in areas, presumably from high spring flow and snowmelt events.
 - Bank erosion and deposition evident in many areas along this segment from stream attempting to re-carve itself through geomorphic processes; glossy buckthorn presence common in stream bank areas and some areas of Alder (*Alnus* spp.), with buckthorn likely having allelopathic effects (releasing plant toxins) leading to issues with herbaceous vegetation reestablishment on stream banks (coupled with overcanopy shade).
 - Qualitative Habitat Survey conducted on this stream reach with a Total Score of 28.
 - Width:Depth Ratio, Fine Sediments, and Cover for Fish received “poor” ratings.
 - Low shallow water was abundant and perpetuated by continual erosional/depositional relationship along dredged banks (i.e. deposition of fine sediments [organics, silts, fine sands] leads to filling in of deeper holes and runs thus making river shallow because of wide dredged area between banks).
 - Undercut banks and other possible (game)fish cover such as coarse woody habitat were observed onsite (Photo 1), but could not qualify as such in the scoring because of 0.2m depth requirement unattainable due to above bullet point.
 - Habitat and physicochemical conditions were adequate enough to provide cover and suitable habitat to a single individual particular sportfish; see fish survey results discussion for Segment 1 (Photos 2 and 3).
 - Water levels were low at time of survey (per discussion with private landowner who granted access permissions to site).
 - May have led to lower overall scoring for some metrics within the survey (i.e. Cover For Fish, Riffle:Riffle/Bend:Bend, Width:Depth Ratio).
 - Abundant finer woody debris (~1” diameter or smaller) and overhanging shrubs (vegetation) observed both in-stream and on banks in many areas along station; in-stream areas functioned as “mini-riffle” areas and were often the areas fish were captured as part of fish survey.
 - These function as fish habitat for smaller non-game species but could not be accounted for in scoring given habitat protocol criteria for size and water depth.
 - Water physicochemistry results from in-field sonde readings indicate colder, more oxygen rich, and lower conductivity water as compared to outfall site (segment 2) and downstream fish site (segment 4).
 - Iron floc areas within and upgradient of survey reach suggest groundwater baseflow prevalent throughout stream/survey reach (Photo 4).
- **Segment 2: WWTP Outfall Area; Outfall location on Maps 1-4**
 - Short “Stub” of a dredged discharge area, appx 5-10 m long, where discharge from outflow pipe flows downstream to meet up with existing baseflow from upstream (i.e. segment 1) flow.
 - Water physicochemistry measurements (from sonde) at this area indicated:
 - a nearly 5x increase in conductivity
 - a 6.5°C increase in water temperature
 - a > 1 mg l⁻¹ decrease in dissolved oxygen (See Photo 5)

- Abundant filamentous/biofilm algal growth on hard benthic surfaces in this area (i.e. woody debris, coarse rock substrates, etc) and downstream in Segment 3 that were not present in upstream stretches (see background of Photo 5).
 - Suggests substantial nutrient contributions from discharge and may seasonally buffer dissolved oxygen concentrations and saturation via primary production.
- Abundant odor present starting in this segment and present throughout further downstream segments.
- **Segment 3: Downstream from WWTP Outfall Area, Straight bermed area (Segment 2) to start of Segment 4 station**
 - This section of stream is among the most widened and ditched within the observed segments along its entirety; nearly no sinuosity is present in channel.
 - Substrates characterized by generally sandy material with some sparse gravel, cobbles, and fine woody habitat—most of which was colonized by algae and biofilms observed in Segment 2.
 - Landowner who provided permissions for access had previously set minnow traps with other family members in stream near a culvert crossing.
 - Minnow traps yielded “little suckers and sunfish” per description of landowner, along with “occasionally a few other minnows that [they] couldn’t identify”.
 - Culvert crossing located approximately 45.44503, -89.72241.
 - Culvert received some recent upgrades/maintenance by WWTP per discussion with landowner (last 10 years).
 - Culvert is two ~24” diameter black plastic pipes that were somewhat high velocity at time of observation, appear improperly set (depth/angle), and likely a barrier to fish passage at some or most flows.
 - This flow barrier may have led to low capture numbers for fish survey in Segment 1 at the time of the survey, but also must be passable during different times of the year given capture of a single individual particular sportfish; see Segment 1 fish survey results.
- **Segment 4: (Orange Line on Maps 3 and 4) “Unnamed tributary to Wisconsin River Appx 200 m Downstream from Tomahawk WWTP outfall”**
 - This segment was established as a Fish and Monitoring Station; mean stream width ~1.5 m.
 - Stream is either downcutting and re-meandering entirely (West half survey reach) or beginning to re-meander within ditched channel (East half survey reach; downstream Segment 3).
 - Formation of undercut banks in areas, especially under large root masses of riparian trees and downed in-channel coarse and fine woody habitat, presumably from high spring flow and snowmelt events (Photos 6 and 7).
 - Some limited bank erosion in this stretch but overall much better than Segment 1.
 - Western half of the survey reach within sedge meadow and alder thicket wetland complex has good undercut banks in some areas along with a number of shallower pools and evident sinuosity formation occurring (Photo 8).
 - Qualitative Habitat Survey was conducted on this stream reach with a Total Score of 48.
 - Width:Depth ratio rated Poor; Fine Sediments, Cover for Fish, and Pool area rated as Fair.
 - Width:Depth poor primarily due to the Eastern half of station.
 - Water levels were low at time of survey (per discussion with private landowner who granted access permissions to site).
 - May have led to lower overall scoring for some metrics within the survey based on water depth requirements, etc. mentioned as reasons within Segment 1.
 - Water physicochemistry results from sonde indicate water within survey reach is:
 - Approximately 1°C cooler than Segment 2 Outfall, but still 5°C warmer than Segment 1, indicating some thermal mitigation from incoming baseflow/groundwater along survey reach as well as buffering from Segment 1 water.

- Slightly more oxygen rich (59.9% DO Sat and 6.92 mg DO L⁻¹) than both Segment 2 Outfall and Segment 1 sites.
- Elevated in conductivity (817 us cm-1) compared to segment 1, but slightly lower than Segment 2 outfall station, indicating some dilution from incoming baseflow/groundwater along survey reach as well as buffering from Segment 1 water.

Fish survey results (if available)

- Fish survey results from 9-22-2022. The number of fish caught is sufficient to establish the presence of a fish community (along with other fish observed but not caught due to electrofishing obstructions, etc.), but is not enough to run a fish IBI (requires 25 fish).
- Segment 1 (Furthest upstream; Purple Line on Maps 3 and 4)
 - Low overall fish capture during survey due to factors listed in “Site Observations” section above for Segment 1 and downstream segments

Species (common name)	Number	Thermal Guild (C,T,W)	Stream Size (S,M,L)	Tolerance (IT,IM,T)
central mudminnow	6	T	S	T
burbot	1	T	L	IM

- Segment 4 (Furthest Downstream; Orange Line on Maps 3 and 4):
 - Somewhat lower overall fish capture due to factors listed in “Site Observations” section

Species (common name)	Number	Thermal Guild (C,T,W)	Stream Size (S,M,L)	Tolerance (IT,IM,T)
central mudminnow	8	T	S	T
white sucker	11	T	M	T
johnny darter	1	T	M	IM

Discussion and Designated Use Recommendations

Note: Recommendations from this site visit are shown at the top of this memo.

During the site visit, the channel morphology both upstream and downstream of the ditched areas and the observed flowing water from under CTH S (to the E/NE of the outfall) down to the current site both indicate that this appears to be a pre-existing stream that was ditched, not an effluent ditch in its entirety. Aside from the short “stub” of 5-10 meters length that may be a WWEC, both the site visit and review of historic images indicate that this appears to generally follow the location of a previous natural watercourse.

Based on data gathered thusfar, there are plenty of fish to establish the presence of an existing fish community, but no natural community verification was done at this time given low overall capture rate for both fish surveys conducted as part of this effort. Low capture is likely attributable to human-caused habitat alterations (i.e., ditching and widening causing bank erosion and shallowing of streambed, culvert passability) as well as overall difficulty seeing and netting fish due to abundant fine woody debris and fine sediments in and across the streambed. Habitat scores were poor to fair overall for both surveys, but this again is due primarily to human induced in-stream alterations which did not allow for reasonable relative scoring of habitat features present due to lack of water depth. Despite these alterations, fish were still caught in both surveys, habitat such as undercuts and woody materials were present (but not eligible to be scored due to water depth from channel widening), and numerous areas of groundwater baseflow were noted within the segments observed—all of which do support fish, likely more seasonally (i.e. spring rain and snow melt) outside of the standard summer fish index period.

Despite low fish capture, a number of lines of evidence, including fish species captured in both surveys, landowner accounts of fish species previously observed/captured by minnow trapping/casual observations, and local habitat and hydrologic factors, indicate that this community likely existed as a Cool-Warm Headwater community prior to habitat conversion through ditching and other disturbances. Both Cool-Warm Headwater and Warm Headwater fall into the Warmwater Designated Use category. The Designated Use of LAL is for waters that cannot support fish, so LAL is not appropriate in this case. Limited Forage Fish (LFF) is also not appropriate because two species of intermediate tolerance were captured, indicating that this is not a limited community (which would be indicated by the presence of only tolerant species), and habitat is sufficient.

The capture of a burbot within Segment 1 is of particular note given passability, habitat, and physicochemical factors observed in all segments while onsite in Fall 2022 which would all adversely affect its passage to and presence in Segment 1. This suggests that the burbot traveled over 1 kilometer upstream from the Wisconsin River during winter melt or spring flow conditions in Spring 2022, with localized conditions in Segment 1 existing throughout Summer 2022 that allowed the burbot to survive long enough to be captured in fall 2022. This suggests that burbot among other fish such as white suckers and other possible gamefish (e.g. panfish, northern pike, muskellunge, etc.) may travel upstream from the Wisconsin River to use this habitat seasonally during winter thaw and spring flow conditions as part of their overall lifecycle. Indeed, undercut banks and re-meandering of the stream channel within wide-dredged/ditched segments as observed during the habitat survey work suggests water levels are much higher seasonally. Alternatively, there may also be an upstream surface connection to LaCerte Lake allowing gamefish from this lake to travel downstream, but given the limitations of field investigations and access permissions, this possibility remains unknown. Regardless, gamefish passage from up- or downstream would explain the burbot caught in Segment 1. Based on these factors, as well as habitat observations noted above, a designated use of Warmwater for the entirety of this receiving water both upstream and downstream of the discharge are warranted at minimum.

Recommendations for potential future monitoring: Additional monitoring is not necessary for purposes of issuing appropriate permit limits, as warmwater limits are necessary to protect the existing fish community found in the stream, but future monitoring may be useful if there is a desire to more fully characterize the stream system. Future survey efforts at this site could comprise 1) full quantitative habitat survey(s) at both upstream and downstream survey reaches, and 2) repeated fish surveys (same locations) in the early portion of the fish survey index period, as low water conditions coupled with stream widening and abundant small brush on the streambed made fish capture difficult during Fall 2022. Numerous fish were visually observed (stuck in brush) but not capturable with a net (i.e., water too shallow to dip or swirl fish out of brush). Additionally, pending access permissions and overall wadeability, potential further upstream connections (upgradient of CTH S) to LaCerte Lake could be explored (i.e., does the stream observed at the crossing at CTH S extend all or part of the way to the lake, constituting permanent or temporary seasonal connection for fish and aquatic life?).

Are code changes and/or a Use Attainability Analysis needed?

No code change is needed, as it is not currently listed in code as LAL or LFF, and it is not recommended to add it to code because it does not fit the categories of WWEC or LAL. Limits based on Warmwater are recommended, which are in line with the current code and the existing fish community.

Attachments

- Photos (with number & brief description of location)
- Habitat surveys

Photos:



Photo 1. Photo of habitat typical within Segment 1. Note very wide channel, extensive undercut banks and some mass wasting of banks near point of bend (top left corner of photo) suggesting that large spring flood and snowmelt events do fill up the channel for a period of time during spring despite extensive stream widening from historic ditching in sections. Extensive buildup of fine woody material throughout reach and accumulation of dark fine sediments within wetted area made fish capture difficult as part of fish survey. Larger coarse woody habitat and undercut banks were not able to be counted as habitat due to water depth requirements but were common in survey reach.



Photo 2. Side profile photo of burbot (*Lota lota*) captured as part of Segment 1 fish survey upstream of Tomahawk WWTP outfall during Fall 2022.



Photo 3. Top profile photo of burbot (*Lota lota*) captured as part of Segment 1 survey upstream of Tomahawk WWTP outfall during Fall 2022.



Photo 4. An example of iron films and floc observed in abundance within channel upstream of Segment 1 survey and at select locations throughout Segment 1. Both water temperature and observation of these redox reaction materials suggest strong groundwater baseflow inputs throughout Segment 1, which likely are applicable to the entire stream but obscured by fine material deposition (from erosion) and alteration of physicochemical conditions (T, DO, pH, Conductivity) from WWTP discharge in Segments 2, 3, and 4.



Photo 5. Picture of multiparameter sonde measurements directly downgradient of Tomahawk WWTP Outfall.



Photo 6. A representative photo of the eastern half of the Segment 4 fish station (looking downstream towards western half beyond Alder in background of photo). Abundant coarse woody material in and across the channel. Note channel width (wetted) is much larger than in Segment 1 due to WWTP outfall discharge.



Photo 7. A representative photo of the eastern half of the Segment 4 fish station (looking at left bank) displaying abundant coarse woody material in channel and along bank, as well as formation of undercut banks.



Photo 8. An example of the western half of Segment 4 survey area (looking downstream, first bend up from start of station). Extensive undercut bank formation in spots and ample in-channel vegetation and overhanging vegetation. Some areas of deeper pools and multiple coarse woody habitat features.

**Wadable Stream Qualitative Fish Habitat Rating
for Streams < 10 m wide**

Form 3600-532A (R 6/07)

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Instructions: Bold fields must be completed. Record all measurements in metric units.

Station Summary				
Stream Name	Waterbody ID Code	SWIMS Station ID	FH Database ID	
UNT WIL RIVER 40 M US TOMAHAWK	NA	NA		
Date (MMDDYYYY)	Station Name			
09222022	WWT Butte			
Latitude - Longitude Determination Method Used				Datum Used
Start Latitude	Start Longitude	End Latitude	End Longitude	County
45.446015	-89.721431			LINCOLN
Water Characteristics				
Time (24-hr clock)	Air Temperature (C)	Water Temperature (C)	Conductivity (µs/cm)	Transparency (cm)
13:30		11.1	187.5	
Dissolved Oxygen (mg/l)		Dissolved Oxygen % Saturation		pH
6.24		36.7		6.53
Flow (m ³ /sec)	Water Level (check one - measure distance if Above or Below Normal):			Water Clarity:
	<input type="checkbox"/> Normal <input checked="" type="checkbox"/> Below: _____ (m) <input type="checkbox"/> Above: _____ (m)			<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Turbid <input type="checkbox"/> Stained
Channel and Basin Characteristics				
Mean Stream Width (m)		Station Length (m)		
3		100		
Channel Condition: (check one)	<input type="checkbox"/> Natural	<input checked="" type="checkbox"/> > 20-year-old Channelization	<input type="checkbox"/> 10- to 20-year-old Channelization	<input type="checkbox"/> < 10-year-old Channelization
<input type="checkbox"/> Concrete Channel				
Percent Channelization	Sinuosity	Gradient (m/km)	Stream Order	Basin Area (km ²)
80				

Comments / Notes

Water level appears very low - temperature and Iron flux suggest hypoxic dominant conditions (Both within and US of station); Scoring may have been better under spring conditions or normal water levels, water levels low based on landowner observations. Many areas with undercut banks that could support fish under higher water conditions. Lots of woody debris of multiple size classes. Channel shows migration despite being ditched 70+ years ago (channel visible on 1950 image). Potential beaver activity upgradient US of where stream crosses railroad grade and CTA S.

Wadable Stream Qualitative Fish Habitat Rating for Streams < 10 m wide

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Rating Item	Excellent	Good	Fair	Poor	Score
Riparian Buffer Width (m) Width of contiguous undisturbed land uses; meadow, shrubs, woodland, wetland, exposed rock	Riparian zone well protected; buffer wide (> 10.0 m) 15	Riparian zone protected, but buffer width moderate (5.0 - 10.0 m) 10	Riparian zone moderately disturbed, buffer narrow (1.0 - 4.9 m) 5	Most of the riparian zone disturbed, buffer very narrow or absent (< 1.0 m) 0	15
Bank Erosion Width of bare soil on bank, along transects	No significant bank erosion; < 0.20 m of bank is bare soil 15	Limited erosion; 0.20 - 0.50 m of bank is bare soil 10	Moderate erosion; 0.51 - 1.0 m of bank is bare soil 5	Extensive erosion; > 1.0 m of bank is bare soil 0	5
Pool Area % of stream length in pools	Pools common; wide, deep, slow velocity habitat, balanced by other habitats; 40 to 60% of station 10	Pools present; not frequent or over-abundant; 30 to 39% or 61 to 70% of station 7	Pools present, but either rare or overly dominant, few other habitats present; 10 to 29% or 71 to 90% of station 3	Pools either absent or dominant, not balanced by other habitats; < 10% or > 90% of station 0	3
Width:Depth Ratio Average stream width divided by average thalweg depth in runs and pools	Streams very deep and narrow; width/depth ≤ 7 15	Stream relatively deep and narrow; width/depth 8-15 10	Stream moderately deep and narrow; width/depth 16-25 5	Stream relatively wide and shallow; width/depth > 25 0	0
Riffle:Riffle or Bend:Bend Ratio Average distance between riffles or bends divided by average stream width	Diverse habitats; meandering stream with deep bends and riffles common; ratio < 10 15	Diverse habitats; bends and riffles present, but not abundant; ratio 10 to 14 10	Habitat diversity low; occasional riffles or bends, ratio 15 to 25 5	Habitat monotonous; riffles or bends rare; generally continuous run habitat; ratio > 25 0	5
Fine Sediments % of the substrate that is < 2 mm (sand, silt, or clay)	Fines rare or absent, < 10% of the stream bed 15	Fines present but limited, generally in stream margins or pools; 10 to 20% of stream bed 10	Fines common in mid-channel areas, present in riffles and extensive in pools; 21 to 60% 5	Fines extensive in all habitats; > 60% of stream bed covered 0	0
Cover for Fish % of the stream area with cover	Cover/shelter for fish abundant; > 15% of stream 15	Cover common, but not extensive; 10 - 15% of stream 10	Occasional cover, limited to one or two areas; 5 - 9% of stream 5	Cover rare or absent; limited to < 5% of stream 0	0
Total Score					28

**Wadable Stream Qualitative Fish Habitat Rating
 for Streams < 10 m wide**

Form 3600-532A (R 6/07)

Instructions: Bold fields must be completed. Record all measurements in metric units.

Station Summary				
Stream Name	UNT	Waterbody ID Code	SWIMS Station ID	FH Database ID
UNT To WI River 200m DS Tomahawk bridge		N/A	N/A	
Date (MMDDYYYY)	Station Name			
9-22-2022	outfall			
Latitude - Longitude Determination Method Used				Datum Used
Start Latitude	Start Longitude	End Latitude	End Longitude	County
45.44376	-89.723494	45.444863	-89.722774	LINCOLN
Water Characteristics				
Time (24-hr clock)	Air Temperature (C)	Water Temperature (C)	Conductivity (µs/cm)	Transparency (cm)
12:00		16.5	817	
Dissolved Oxygen (mg/l)	Dissolved Oxygen % Saturation		pH	
5.8	59.9		6.92	
Flow (m ³ /sec)	Water Level (check one - measure distance if Above or Below Normal):			Water Clarity:
	<input type="checkbox"/> Normal <input checked="" type="checkbox"/> Below: _____ (m) <input type="checkbox"/> Above: _____ (m)			<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Turbid <input type="checkbox"/> Stained
Channel and Basin Characteristics				
Mean Stream Width (m)		Station Length (m)		
1.5		100		
Channel Condition: (check one)	<input type="checkbox"/> Natural	<input checked="" type="checkbox"/> > 20-year-old Channelization	<input type="checkbox"/> 10- to 20-year-old Channelization	<input type="checkbox"/> < 10-year-old Channelization
				<input type="checkbox"/> Concrete Channel
Percent Channelization	Sinuosity	Gradient (m/km)	Stream Order	Basin Area (km ²)
60				
Comments / Notes				

Wadable Stream Qualitative Fish Habitat Rating for Streams < 10 m wide

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Rating Item	Excellent	Good	Fair	Poor	Score
Riparian Buffer Width (m) Width of contiguous undisturbed land uses; meadow, shrubs, woodland, wetland, exposed rock	Riparian zone well protected; buffer wide (> 10.0 m) 15	Riparian zone protected, but buffer width moderate (5.0 - 10.0 m) 10	Riparian zone moderately disturbed, buffer narrow (1.0 - 4.9 m) 5	Most of the riparian zone disturbed, buffer very narrow or absent (< 1.0 m) 0	15
Bank Erosion Width of bare soil on bank, along transects	No significant bank erosion; < 0.20 m of bank is bare soil 15	Limited erosion; 0.20 - 0.50 m of bank is bare soil 10	Moderate erosion; 0.51 - 1.0 m of bank is bare soil 5	Extensive erosion; > 1.0 m of bank is bare soil 0	10
Pool Area % of stream length in pools	Pools common; wide, deep, slow velocity habitat, balanced by other habitats; 40 to 60% of station 10	Pools present; not frequent or over-abundant; 30 to 39% or 61 to 70% of station 7	Pools present, but either rare or overly dominant, few other habitats present; 10 to 29% or 71 to 90% of station 3	Pools either absent or dominant, not balanced by other habitats; < 10% or > 90% of station 0	3
Width:Depth Ratio Average stream width divided by average thalweg depth in runs and pools	Streams very deep and narrow; width/depth ≤ 7 15	Stream relatively deep and narrow; width/depth 8-15 10	Stream moderately deep and narrow; width/depth 16-25 5	Stream relatively wide and shallow; width/depth > 25 0	0
Riffle:Riffle or Bend:Bend Ratio Average distance between riffles or bends divided by average stream width	Diverse habitats; meandering stream with deep bends and riffles common; ratio < 10 15	Diverse habitats; bends and riffles present, but not abundant; ratio 10 to 14 10	Habitat diversity low; occasional riffles or bends, ratio 15 to 25 5	Habitat monotonous; riffles or bends rare; generally continuous run habitat; ratio > 25 0	10
Fine Sediments % of the substrate that is < 2 mm (sand, silt, or clay)	Fines rare or absent, < 10% of the stream bed 15	Fines present but limited, generally in stream margins or pools; 10 to 20% of stream bed 10	Fines common in mid-channel areas, present in riffles and extensive in pools; 21 to 60% 5	Fines extensive in all habitats; > 60% of stream bed covered 0	5
Cover for Fish % of the stream area with cover	Cover/shelter for fish abundant; > 15% of stream 15	Cover common, but not extensive; 10 - 15% of stream 10	Occasional cover, limited to one or two areas; 5 - 9% of stream 5	Cover rare or absent; limited to < 5% of stream 0	5
Total Score					48