Permit Fact Sheet

General Information

Permit Number	WI-0021741-09-0
Permittee Name and Address	Village of Denmark PO Box 310, Denmark, WI 54208
Permitted Facility Name and Address	Denmark Wastewater Treatment Facility 400 Mahlik Lane, Denmark, Wisconsin
Permit Term	October 01, 2025 to September 30, 2030
Discharge Location	Lat: 44° 21’ 11”N; Long: 87° 48’ 48”W
Receiving Water	Denmark Creek, a tributary to the Neshota River, in the West Twin River Watershed (TK01) in the Twin/Door/Kewaunee Basin in Brown County
Stream Flow ($Q_{7,10}$)	0 cfs for Denmark Creek; Denmark Creek is tributary to the Neshota River which has a 7-Q_{10} of 0.64 cfs at a point just upstream from the confluence with Denmark Creek
Stream Classification	Denmark Creek: Limited Forage Fishery (LFF) community listed in Table 5, Row 11, of s. NR 104.07(2), Wis. Adm. Code Neshota River: Warm Water Sport Fish (WWSF) community, non-public water supply
Discharge Type	Existing; Continuous
Annual Average Design Flow	0.60 MGD
Industrial or Commercial Contributors	Salm Partners: industrial sausage producer that contributes significant levels of chloride and BOD
Plant Classification	A2 - Attached Growth Processes; B - Solids Separation; C - Biological Solids/Sludges; P - Total Phosphorus; SS - Sanitary Sewage Collection System
Approved Pretreatment Program?	N/A

Facility Description

The Village of Denmark, in southeastern Brown County, owns and operates an advanced secondary wastewater treatment facility designed for an average flow of 0.60 MGD. The treatment facilities include preliminary treatment with a fine screen and grit removal, primary clarification, secondary (biological) treatment with a two-stage fixed film system consisting of a trickling filter followed by rotating biological contactors (RBCs) and then final clarification. Phosphorous removal is accomplished with chemical precipitation using ferric sulfate addition and tertiary sand filtration after final clarification. Treated effluent is aerated through step aeration prior to discharge via Outfall 001. By-product solids (sludge) generated during the treatment process are anaerobically digested and stored on-site until being land applied to Department-approved agricultural fields. This facility accepts hauled domestic wastewater.

Substantial Compliance Determination

Enforcement During Last Permit: On 7/1/21 a Notice of Noncompliance (NON) was sent for on-going chloride limit exceedances that had been occurring for several years. An enforcement conference was held in response to the NON and

the Village of Denmark and Salm Partners developed a Chloride Corrective Action Plan. Actions in the plan occurred in stages between 2021-2024. During that time, on 7/26/22, there was a chronic WET test failure. Additionally, there have been several SSO/TFOs during the previous permit term (3 SSO/TFOs in 2021; 1 in 2023; and 2 in 2024). During the previous permit term, DNR also issued both Denmark and Salm Partners multiple Notices of Violation (NOVs), with an enforcement conference held on 4/25/22, which was eventually closed-out. The facility has completed all previously required actions as part of the enforcement process.

After a desk top review of all discharge monitoring reports, CMARs, land application reports, compliance schedule items, and a site visit on 11/6/24, this facility has been found to be in substantial compliance with their current permit.

Compliance determination made by Mark Stanek, Wastewater Engineer on 11/6/24.

Sample Point Descriptions

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	0.47 MGD (Avg. 10/1/18-2/28/25)	Influent: Representative samples shall be collected from the influent channel prior to grit removal.
001	0.48 MGD (Avg. 10/1/18-2/28/25)	Effluent: Representative samples shall be collected prior to step aeration except for dissolved oxygen and pH which shall be after step aeration.
003	2,735,300 Gallons of sludge generated in 2024	Liquid Sludge: Representative samples of the anaerobically digested liquid sludge shall be collected from the sludge storage tank after complete mixing.

Permit Requirements

1 Influent – Monitoring Requirements

1.1 Sample Point Number: 701- Influent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Continuous	
BOD5, Total		mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total		mg/L	3/Week	24-Hr Flow Prop Comp	

1.1.1 Changes from Previous Permit:

Influent limitations and monitoring requirements were evaluated for this permit term and no changes were required.

1.1.2 Explanation of Limits and Monitoring Requirements

Monitoring of influent flow, BOD_5 and total suspended solids is required by s. NR 210.04(2), Wis. Adm. Code, to assess wastewater strengths and volumes and to demonstrate the percent removal requirements in s. NR 210.05, Wis. Adm. Code, and in the Standard Requirements section of the permit.

2 Surface Water - Monitoring and Limitations

2.1 Sample Point Number: 001- Effluent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Continuous	
BOD5, Total	Daily Max	30 mg/L	3/Week	24-Hr Flow Prop Comp	
BOD5, Total	Monthly Avg	15 mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Daily Max	30 mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Monthly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Weekly Avg	200 lbs/day	3/Week	Calculated	
Suspended Solids, Total	Monthly Avg	140 lbs/day	3/Week	Calculated	
Suspended Solids, Total		lbs/month	Monthly	Calculated	Calculate the Total Monthly Discharge of TSS and report on the last day of the month on the eDMR. See TMDL Calculations permit section.
Suspended Solids, Total		lbs/yr	Monthly	Calculated	Calculate the 12-month rolling sum of total monthly mass of TSS discharged and report on the last day of the month on the eDMR. See TMDL Calculations permit section.
pH Field	Daily Max	9.0 su	5/Week	Grab	
pH Field	Daily Min	6.0 su	5/Week	Grab	
Dissolved Oxygen	Daily Min	4.0 mg/L	5/Week	Grab	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
E. coli	Geometric Mean - Monthly	126 #/100 ml	Weekly	Grab	Monitoring and limit effective May through September annually per the Effluent Limitations for E. coli Schedule.
E. coli	% Exceedance	10 Percent	Monthly	Calculated	Monitoring and limit effective May through September annually per the Effluent Limitations for E. coli Schedule. See the E. coli Percent Limit permit section. Enter the result in the eDMR on the last day of the month.
Nitrogen, Ammonia (NH3-N) Total	Daily Max - Variable	mg/L	Weekly	24-Hr Flow Prop Comp	Limit applies year-round. See the Daily Maximum Ammonia Nitrogen (NH_3-N) Limits permit section.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	11 mg/L	Weekly	24-Hr Flow Prop Comp	Limit applies October-March.
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	4.8 mg/L	Weekly	24-Hr Flow Prop Comp	Limit applies April-September.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	4.9 mg/L	Weekly	24-Hr Flow Prop Comp	Limit applies October-March.
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	2.9 mg/L	Weekly	24-Hr Flow Prop Comp	Limit applies April-September.
Phosphorus, Total	Monthly Avg	1.0 mg/L	2/Week	24-Hr Flow Prop Comp	
Phosphorus, Total	Monthly Avg	4.3 lbs/day	2/Week	Calculated	
Phosphorus, Total	6-Month Avg	1.4 lbs/day	2/Week	Calculated	
Phosphorus, Total		lbs/month	Monthly	Calculated	Calculate the Total Monthly Discharge of phosphorus and report on the last day of the month on the eDMR. See TMDL Calculations permit section.
Phosphorus, Total		lbs/yr	Monthly	Calculated	Calculate the 12-month rolling sum of total monthly mass of phosphorus discharged and report on the last day of the month on

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
					the DMR. See TMDL Calculations permit section.
Chloride	Daily Max	1,200 mg/L	4/Week	24-Hr Flow Prop Comp	Interim limit. See the Chloride Variance - Implement Source Reduction Measures permit section and the Chloride Source Reduction Measures (Target Value) Schedule.
Chloride	Weekly Avg	980 mg/L	4/Week	24-Hr Flow Prop Comp	Interim limit. See the Chloride Variance - Implement Source Reduction Measures permit section and the Chloride Source Reduction Measures (Target Value) Schedule.
Nitrogen, Total Kjeldahl		mg/L	See Listed Qtr(s)	24-Hr Flow Prop Comp	Annual in rotating quarters. See Nitrogen Series Monitoring permit section.
Nitrogen, Nitrite + Nitrate Total		mg/L	See Listed Qtr(s)	24-Hr Flow Prop Comp	Annual in rotating quarters. See Nitrogen Series Monitoring permit section.
Nitrogen, Total		mg/L	See Listed Qtr(s)	Calculated	Annual in rotating quarters. See Nitrogen Series Monitoring permit section. Total Nitrogen shall be calculated as the sum of reported values for Total Kjeldahl Nitrogen and Total Nitrite + Nitrate Nitrogen.
Temperature Maximum		deg F	Daily	Grab	Monitoring only January-December 2029.
Acute WET		TUa	See Listed Qtr(s)	24-Hr Flow Prop Comp	See the Whole Effluent Toxicity (WET) Testing permit section.

2.1.1 Changes from Previous Permit

Effluent limitations and monitoring requirements were evaluated for this permit term and the following changes were made from the previous permit.

- Addition of TMDL-based mass limits for TSS and total phosphorus due to the Northeast Lakeshore Basin (NEL) total maximum daily load (TMDL) which was approved by EPA in October 2023.

- Addition of Escherichia coli (E. coli) monitoring and limits, to become effective per the Effluent Limitations for E. coli Schedule.
- Updated ammonia nitrogen weekly average and monthly average limits and addition of daily maximum variable limits applied year-round. See the permit for the daily maximum ammonia nitrogen limit table corresponding to various effluent pH values.
- Addition of annual total nitrogen monitoring (TKN, NO_2+NO_3 and Total N) in rotating quarters throughout the permit term.
- Increased temperature monitoring frequency to daily for one year (2029) to determine the need for temperature limits at the next permit reissuance.
- Increased acute whole effluent toxicity (WET) testing to 3x/permit term.
- Suspended/delayed chronic WET testing.

2.1.2 Explanation of Limits and Monitoring Requirements

Detailed discussions of limits and monitoring requirements can be found in the attached Water Quality-Based Effluent Limits (WQBEL) memo, by Michael Polkinghorn, Water Resources Engineer, dated August 29, 2024.

Monitoring Frequencies – The Monitoring Frequencies for Individual Wastewater Permits guidance (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 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.

Expression of Limits – In accordance with the federal regulation 40 CFR 122.45(d) and s. NR 205.065, Wis. Adm. Code, limits in this permit are to be expressed as weekly average and monthly average limits whenever practicable. Minor changes have been made to ammonia nitrogen effluent limits.

Disinfection and E. coli – Revisions to bacteria surface water quality criteria to protect recreational uses and accompanying E. coli WPDES permit implementation procedures became effective May 1, 2020.

Section NR 102.04(5)(a), Wis. Adm. Code, states that all surface waters shall be suitable for recreational use and meet the E. coli criteria established to protect this use. Section NR 102.04(5)(b), Wis. Adm. Code, states that exceptions to the disinfection requirement can be made if the Department determines, in accordance with the procedures specified in s. NR 210.06(3), Wis. Adm. Code, that disinfection is not required to meet water quality criteria. As part of the reissuance process, the requirements for disinfection were reviewed under s. NR 210.06(3), Wis. Adm. Code.

It was determined that the permittee is required to disinfect, during the months of May – September. See the WQBEL memo for further explanation.

At the end of the compliance schedule, disinfection requirements and E. coli limits of 126 #/100 ml as a monthly geometric mean that may not be exceeded and 410 #/100 ml as a daily maximum that may not be exceeded more than 10 percent of the time in any calendar month will apply. Monitoring is not required until the limit becomes effective at the end of the compliance schedule.

Total Nitrogen Monitoring (TKN, NO_2+NO_3, and Total N) – The Department has included effluent monitoring for Total Nitrogen in the permit through the authority under s. 283.55(1)(e), Wis. Stats. Testing is required during the following quarters: October – December 2025; July – September 2026; April – June 2027; January – March 2028; and October – December 2029.

Acute WET – Testing is required during the following three quarters: July – September 2026; April – June 2027; and October – December 2029.

Chronic WET – Testing is not required at this time. The chloride data (discussed in the WQBEL memo) meets the requirements of s. NR 106.89(4), Wis. Adm. Code, demonstrating that effluent chloride concentrations are consistently above two times the weekly average chloride WQBEL (800 mg/L). High chloride concentrations are a likely cause of

WET test failures and may mask other sources of chronic toxicity. Chronic WET testing requirements are delayed until chloride source reduction measures are implemented and result in effluent chloride concentrations that are no longer likely to cause chronic toxicity.

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)**
003	B	Liquid	Fecal Coliform	Volatile Solids Reduction	Land Application	2 Metric Tons disposed of in 2024
Does sludge management demonstrate compliance? Yes.						
Is additional sludge storage required? No.						
Is Radium-226 present in the water supply at a level greater than 2 pCi/liter? No.						
Is a priority pollutant scan required? N/A						

3.1 Sample Point Number: 003- Liquid 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	Limits apply only when sludge in land applied.
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	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
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	Monitoring required only when sludge is land applied.
Nitrogen, Ammonium (NH4-N) Total		Percent	Annual	Composite	
Phosphorus, Total		Percent	Annual	Composite	
Phosphorus, Water Extractable		% of Tot P	Annual	Composite	
Potassium, Total Recoverable		Percent	Annual	Composite	
PFOA + PFOS		ug/kg	Annual	Calculated	Report the sum of PFOA and PFOS. See PFAS Permit Sections for more information.
PFAS Dry Wt			Annual	Grab	Perfluoroalkyl and Polyfluoroalkyl Substances based on updated DNR PFAS List. See PFAS Permit Sections for more information.
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	Monitoring required in 2026. See Sludge Analysis for PCBs permit section and the Standard Requirements permit section for Monitoring and Calculating PCB Concentrations in Sludge.
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	

3.1.1 Changes from Previous Permit:

Sludge limitations and monitoring requirements were evaluated for this permit term and the following changes were made from the previous permit.

- The year in which sludge PCB monitoring is required has been updated to 2026.
- Addition of annual PFAS (PFOA + PFOS) monitoring pursuant to s. NR 204.06(2)(b)9., Wis. Adm. Code.

3.1.2 Explanation of Limits and Monitoring Requirements

Requirements for disposal, including land application of municipal sludge, are determined in accordance with ch. NR 204, Wis. Adm. Code. Ceiling and high-quality limits for metals in sludge are specified in s. NR 204.07(5). Requirements for

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

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

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 this WPDES permit pursuant to ss. NR 214.18(5)(b) and NR 204.06(2)(b)9., Wis. Adm. Code.

4 Schedules

4.1 Chloride Source Reduction Measures (Target Value)

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

Required Action	Due Date
Annual Chloride Progress Report: Submit an annual chloride progress report related to the source reduction activities for the previous year. The annual chloride progress report shall: Indicate which chloride source reduction measures or activities in the Source Reduction Plan have been implemented and state which, if any, source reduction measures from the Source Reduction Plan were not pursued and why. Include an assessment of whether each implemented source reduction measure appears to be effective or ineffective at reducing pollutant discharge concentrations and identify actions planned for the upcoming year; Include an analysis of trends in weekly, monthly and annual average chloride concentrations and total mass discharge of chloride based on chloride sampling and flow data; and Include an analysis of how effluent chloride varies with time and with significant loadings of chloride. Note that the interim limitation listed in the Surface Water section of this permit remains enforceable until new enforceable limits are established in the next permit issuance. The first annual chloride progress report is to be submitted by the Date Due.	03/31/2026
Annual Chloride Progress Report #2: Submit the chloride progress report, related to the source reduction activities for the previous year, as defined above.	03/31/2027
Annual Chloride Progress Report #3: Submit the chloride progress report, related to the source reduction activities for the previous year, as defined above.	03/31/2028
Annual Chloride Progress Report #4: Submit the chloride progress report, related to the source reduction activities for the previous year, as defined above.	03/31/2029
Final Chloride Report: Submit the final chloride report documenting the success in meeting the chloride target values of 1,080 mg/L (Daily Max) and 880 mg/L (Weekly Avg), as well as the anticipated future reduction in chloride sources and chloride effluent concentrations. The report shall: Summarize chloride source reduction measures that have been implemented during the current permit term and state which, if any, source reduction measures from the Source Reduction Plan were not	03/31/2030

pursued and why; Include an assessment of which source reduction measures appear to have been effective or ineffective. Evaluate any needed changes to the pollutant reduction strategy accordingly; Include an analysis of trends in weekly, monthly and annual average chloride concentrations and total mass discharge of chloride based on chloride sampling and flow data during the current permit term; and Include an analysis of how influent and effluent chloride varies with time and with significant loadings of chloride as identified in the source reduction plan. If the permittee intends to reapply for a chloride variance, for the reissued permit, proposed target limits and a detailed source reduction measures plan, outlining the source reduction activities proposed for the upcoming permit term, shall also be included per ss. NR 106.90 (5) and NR 106.83 (4), Wis. Adm. Code. An updated source reduction measures plan shall: Include an explanation of why or how each source reduction measure will result in reduced discharge of the target pollutant; and Evaluate any available information on pollutant sources, timing, and concentration to update the mass balance assumptions and expected sources of the pollutant, and Identify any information needs that would help to better determine pollutant sources and make plans to collect that information. Note that the target value is the benchmark for evaluating the effectiveness of the chloride source reduction measures but is not an enforceable limitation under the terms of this permit.	
Annual Chloride Reports After Permit Expiration: In the event that this permit is not reissued by the date the permit expires the permittee shall continue to submit annual chloride reports for the previous year following the due date of Annual Chloride Progress Reports listed above. Annual Chloride Progress Reports shall include the information as defined above.	

4.1.1 Explanation of Schedule

Chloride Source Reduction Measures (Target Value) – This schedule is required to ensure that the permittee maintains compliance with the conditions and requirements of receiving a variance from the chloride water quality-based effluent limits of 760 mg/L expressed as a daily maximum and 400 mg/L expressed as a weekly average. Since a compliance schedule is being granted, an interim limit is required, and the interim limits are established as 1,200 mg/L (as a daily maximum) and 980 mg/L (as a weekly average). The schedule requires that annual reports shall indicate which source reduction measures the permittee has implemented during each calendar year, and an analysis of chloride concentration and mass discharge data based on chloride sampling and flow data. The annual reports shall document progress made towards meeting the chloride target values of 1,080 mg/L (daily max) and 880 mg/L (weekly avg), by the end of the permit term.

4.2 Disinfection and Effluent Limitations for E. coli

The permittee shall install disinfection treatment and comply with surface water limitations for E. coli as specified. No later than 14 days following each compliance date, the permittee shall notify the Department in writing of its compliance or noncompliance. If a submittal is required, a timely submittal fulfills the notification requirement.

Required Action	Due Date
Progress Report: The permittee shall submit a progress report on development and submittal of a facility plan for upgrades to meet disinfection requirements and E. coli limits.	06/30/2026

Submit Facility Plan: The permittee shall submit a Facility Plan per s. NR 110.09, Wis. Adm. Code for meeting disinfection requirements and complying with E. coli surface water limitations. The permittee may submit an abbreviated facility plan if the Department determines that the modifications are minor.	04/30/2027
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 meet disinfection requirements per s. NR 210.06(1), Wis. Adm Code, achieve compliance with final E. coli limitations, and a schedule for completing construction of the upgrades by the complete construction date specified below.	03/31/2028
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.	09/30/2028
Construction Upgrade Progress Report: The permittee shall submit a progress report on construction upgrades.	09/30/2029
Complete Construction: The permittee shall complete construction of wastewater treatment system upgrades.	03/31/2030
Achieve Compliance: The permittee shall achieve compliance with final E. coli limitations.	04/30/2030

4.2.1 Explanation of Schedule

Disinfection and Effluent Limitations for E. coli – A compliance schedule is included in the permit to provide time for the permittee to investigate options for meeting new E. coli water quality-based effluent limits and disinfection requirements pursuant s. NR 210.06, Wis. Adm. Code, while coming into compliance with the limits as soon as reasonably possible.

Attachments

WQBEL Memo: Water Quality-Based Effluent Limitations for the Denmark Wastewater Treatment Facility WPDES Permit No. WI-0021741-09-0, by Michael Polkinghorn, Water Resources Engineer, dated August 29, 2024

Chloride Variance EPA Data Sheet

SRM (Source Reduction Measures) Plan, dated January 15, 2025, revised April 30, 2025

Justification Of Any Waivers From Permit Application Requirements

No waivers from permit application requirements were requested or granted.

Prepared By: Sarah Donoughe, Wastewater Specialist-Adv **Date:** May 5, 2025

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: August 29, 2024

TO: Sarah Donoughe – NER/Green Bay Service Center

FROM: Michael Polkinghorn – NOR/Rhinelander Service Center Michael Polkinghorn

SUBJECT: Water Quality-Based Effluent Limitations for the Denmark Wastewater Treatment Facility WPDES Permit No. WI-0021741-09-0

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 Denmark Wastewater Treatment Facility in Brown County. This municipal wastewater treatment facility (WWTF) discharges to the Denmark Creek to the Neshota River, located in the West Twin River Watershed in the Twin/Door/Kewaunee Basin. This discharge is included in the Northeast Lakeshore TMDL as approved by EPA on 10/30/2023. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1
BOD_5	30 mg/L			15 mg/L		1, 2
TSS	30 mg/L		200 lbs/day	20 mg/L 140 lbs/day		2, 3
pH	9.0 s.u.	6.0 s.u.				1, 2
Dissolved Oxygen		4.0 mg/L				1, 2
E. coli May – September				126 #/100 mL geometric mean		4
Ammonia Nitrogen						5, 6
Single April – September October – March	 3.6 mg/L 3.6 mg/L		 **3.6 mg/L** **3.6 mg/L**	 2.9 mg/L **3.6 mg/L**		
Variable April – September October – March	 Variable Variable		 4.8 mg/L **11 mg/L**	 2.9 mg/L 4.9 mg/L		
Phosphorus						3
Interim				1.0 mg/L		
Final				4.3 lbs/day	1.4 lbs/day	
Chloride						7
Interim	1,200 mg/L		980 mg/L			
Final	760 mg/L		400 mg/L			
Arsenic (Total Recoverable)						8
TKN, Nitrate+Nitrite, and Total Nitrogen						9

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Temperature						10
Acute WET						11
Chronic WET						12

Footnotes:

1. No changes from the current permit.
2. These limits are based on the Limited Forage Fish (LFF) community of the immediate receiving water as described in s. NR 104.02(3)(a), Wis. Adm. Code.
3. The TSS and phosphorus mass limits are based on the NE Lakeshore TMDL to address TSS and phosphorus water quality impairments within the TMDL area. The monthly average phosphorus limit is a technology-based limit which also functions as an interim limit for the phosphorus compliance schedule.
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. The reissued permit will include a compliance schedule to meet these limits.
5. 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.
6. The Denmark WWTF shall notify the Department if the single limit or the variable daily maximum limits based on effluent pH are preferred. The variable daily maximum ammonia nitrogen limit table corresponding to various effluent pH values may be included in the permit in place of the single limit of 3.6 mg/L.

Daily Maximum Ammonia Nitrogen Limits

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
$6.0 \leq pH \leq 6.1$	54	$7.0 < pH \leq 7.1$	33	$8.0 < pH \leq 8.1$	6.9
$6.1 < pH \leq 6.2$	53	$7.1 < pH \leq 7.2$	30	$8.1 < pH \leq 8.2$	5.7
$6.2 < pH \leq 6.3$	52	$7.2 < pH \leq 7.3$	26	$8.2 < pH \leq 8.3$	4.7
$6.3 < pH \leq 6.4$	51	$7.3 < pH \leq 7.4$	23	$8.3 < pH \leq 8.4$	3.9
$6.4 < pH \leq 6.5$	49	$7.4 < pH \leq 7.5$	20	$8.4 < pH \leq 8.5$	3.2
$6.5 < pH \leq 6.6$	47	$7.5 < pH \leq 7.6$	17	$8.5 < pH \leq 8.6$	2.7
$6.6 < pH \leq 6.7$	45	$7.6 < pH \leq 7.7$	14	$8.6 < pH \leq 8.7$	2.2
$6.7 < pH \leq 6.8$	42	$7.7 < pH \leq 7.8$	12	$8.7 < pH \leq 8.8$	1.8
$6.8 < pH \leq 6.9$	39	$7.8 < pH \leq 7.9$	10	$8.8 < pH \leq 8.9$	1.6
$6.9 < pH \leq 7.0$	36	$7.9 < pH \leq 8.0$	8.4	$8.9 < pH \leq 9.0$	1.3

7. The alternative interim limits based on the previous chloride variance limits in the current permit may be included in the reissued permit in place of the chloride WQBELs if the chloride variance application that was submitted is approved by EPA. In the absence of a variance, the Denmark WWTF would be subject to the chloride WQBELs, dry and wet weather mass limits, and any expression of limits-required limits.
8. A more sensitive approved analytical method is recommended for future arsenic samples such that the limit of detection is less than or equal to 2.66 µg/L to better determine the need for arsenic limits at the next permit reissuance.
9. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, annual total nitrogen monitoring is recommended for all minor municipal

permittees. Total nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), and total Kjeldahl nitrogen (TKN) (all expressed as N).

10. Daily temperature monitoring for 1 year is recommended during the reissued permit term to determine the need for temperature limits at the next permit reissuance.
11. Three acute whole effluent toxicity (WET) tests are recommended during the reissued permit term. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Tests should be done in rotating quarters, to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).
12. Section NR 106.89(4), Wis. Adm. Code, states chronic chloride WQBELs shall be included during the reissued permit term in place of both the chronic WET limit and testing. The effluent chloride data (May 2024 – June 2024) discussed in Part 2 of this evaluation meets the requirements of s. NR 106.89(4), Wis. Adm. Code, demonstrating effluent chloride concentrations are consistently above 2x the weekly average chloride WQBEL (800 mg/L). High chloride concentrations are likely causing chronic WET failures and would likely mask other sources of chronic toxicity in the effluent. Chronic WET requirements will be delayed until chloride source reduction measures are implemented to the point effluent chloride concentrations are no longer likely to cause chronic 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.

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Attachment #1

Water Quality-Based Effluent Limitations for
Denmark Wastewater Treatment Facility

WPDES Permit No. WI-0021741-09-0

Prepared by: Michael A. Polkinghorn

PART 1 – BACKGROUND INFORMATION

Facility Description

The Village of Denmark owns and operates an advanced secondary wastewater treatment facility. The treatment facilities include: preliminary treatment with a fine screen and grit removal, primary clarification, secondary treatment with a two-staged fixed film system consisting of a trickling filter followed by rotating biological contactors (RBCs), and clarification. Phosphorus removal is accomplished by chemical precipitation using ferric sulfate addition. Treated effluent is aerated through step-aeration prior to discharge. Effluent is discharged on a continuous basis via Outfall 001 to Denmark Creek to the Neshota River.

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

Existing Permit Limitations

The current permit, expired on 09/30/2023, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						
BOD_5	30 mg/L			15 mg/L		1, 2
TSS	30 mg/L			20 mg/L		1, 2
pH	9.0 s.u.	6.0 s.u.				1, 2
Dissolved Oxygen		4.0 mg/L				1, 2
Ammonia Nitrogen April – September October – March	 3.9 mg/L 3.9 mg/L		 4.8 mg/L **11 mg/L**	 2.9 mg/L 4.9 mg/L		3
Phosphorus						
Interim				1.0 mg/L		4
Final				0.225 mg/L	0.075 mg/L	
Chloride						
Interim	1,200 mg/L		980 mg/L			5
Final	760 mg/L		400 mg/L			
Temperature	Variable		Variable			6
Acute WET						7
Chronic WET						7

Footnotes:

1. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
2. These limits are based on the Limited Forage Fish (LFF) community of the immediate receiving water as described in s. NR 104.02(3)(a), Wis. Adm. Code.
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. The monthly average phosphorus limit is a technology-based limit which also functions as an interim limit for the phosphorus compliance schedule.
5. This facility has an approved chloride variance as described in s. NR 106.83(2), Wis. Adm. Code. The interim limits are target values for implementation and anticipated effectiveness of source reduction activities.
6. The following temperature WQBELs are subject to be removed from the permit as described in s. NR 106.56(12), Wis. Adm. Code, upon updated temperature monitoring and completion of a dissipative cooling study.

Monthly Temperature Limits

Month	Daily Maximum (°F)	Weekly Average (°F)	Month	Daily Maximum (°F)	Weekly Average (°F)
January	78	54	July	86	81
February	79	54	August	86	79
March	80	57	September	85	73
April	81	63	October	83	63
May	84	70	November	80	54
June	85	77	December	79	54

7. Two acute and chronic whole effluent toxicity (WET) tests were required during the current permit. The IWC for chronic WET was 85%.

Receiving Water Information

- Name: Denmark Creek to the Neshota River
- Waterbody Identification Code (WBIC): 89100 for Denmark Creek. 88200 for Neshota River.
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code:
  - Denmark Creek: LFF community as listed in Table 5, Row 11 of s. NR 104.07(2), Wis. Adm. Code, from Denmark downstream to the Neshota River. The natural community is an "Cool-Cold Headwater" and is only used for WET related decisions.
  - Neshota River: Warm Water Sport Fish (WWSF) community. This surface waterbody is approx. 0.6 mi downstream of Outfall 001.
  - Both surface waterbodies are non-public water supplies. Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: Low flows in Denmark Creek are zero. The following 7-Q_{10} and 7-Q_2 values for the Neshota River are from USGS (Station TK6 or SE ¼, SE ¼, Section 22, T22N – R22E) at River Road, approx. 1.4 mi NE of Denmark WI:
  7-Q_{10} = 0.64 cubic feet per second (cfs)
  7-Q_2 = 0.88 cfs
  Harmonic Mean Flow = 5.0 cfs using a drainage area of 39.2 mi^2

The Harmonic Mean has been estimated based on average flow and the 7-Q_{10} using an equation from U.S. EPA's *Technical Support Document for Water Quality-Based Toxics Control* (March 1991, EPA/505/2-90-001, pgs. 88-89).

- Hardness: 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. 25% for Neshota River.
- 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: None.
- Impaired water status: Denmark Creek is on the Clean Water Act (CWA) Section 303(d) list for a phosphorus impairment (entire stream length). The Neshota River is also on the CWA Section 303(d) list for a phosphorus impairment (stream mi 14.22 – 17.22). Outfall 001 is included Northeast Lakeshore TMDL which addresses phosphorus and TSS impairments within the TMDL area.

Effluent Information

- Design flow rate(s):
  Annual average = 0.725 million gallons per day (MGD)
  For reference, the actual average flow from October 2018 – June 2024 was 0.478 MGD.
- Hardness = 448 mg/L as $CaCO_3$. This value represents the geometric mean of data (n = 4, September 2022 – October 2022) from the permit application.
- 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 2 industrial contributors (Salm Partners). Water supply from Denmark Waterworks.
- Total Phosphorus Wasteload Allocation: 436 lbs/year (See Appendix K of the TMDL document)
- Total Suspended Solids Wasteload Allocation: 35,573 lbs/year (See Appendix L of the TMDL document)
- Additives: Ferric sulfate for chemical phosphorus removal.
- Effluent characterization: This facility is categorized as a minor municipality, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus chloride and hardness.
- 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 chloride data prior to May 2024 is excluded from this evaluation due to the significant decrease in the use of water softeners in the sewershed resulting from a change of the municipal water supply.

Chloride Effluent Data

Statistics	Conc. (mg/L)
1-day P_{99}	1,447
4-day P_{99}	1,066
30-day P_{99}	863
Mean	760
Std	229

Attachment #1

Sample size	58
Range	130 – 1,158

Copper Effluent Data

Sample Date	Conc. (µg/L)	Sample Date	Conc. (µg/L)	Sample Date	Conc. (µg/L)
09/28/2022	7.5	10/26/2022	8.8	11/23/2022	11
10/05/2022	11	11/02/2022	9.8	11/30/2022	9.5
10/12/2022	8.6	11/09/2022	13	12/07/2022	8.0
10/19/2022	10	11/16/2022	11		
1-day P_{99} = 14 µg/L					
4-day P_{99} = 12 µg/L					

The following table presents the average concentrations and loadings at Outfall 001 from October 2018 – June 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*
BOD_5	7.1 mg/L
TSS	11 mg/L
pH field	8.0 s.u.
Dissolved Oxygen	9.47 mg/L
Ammonia Nitrogen	0.24 mg/L
Phosphorus	0.53 mg/L
Chloride	760 mg/L
Temperature	61 °F

*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 P_{99}) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q_{10}

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. Adm. Code, (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used

for other limits along with the 1-Q_{10} receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards. The mass balance equation is provided below.

$$\text{Limitation} = \frac{(WQC)\,(Qs + (1-f)\,Qe) - (Qs - f\,Qe)\,(Cs)}{Qe}$$

Where:

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

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

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

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

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

If the receiving water is effluent dominated under low stream flow conditions, the 1-Q_{10} 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 Denmark WWTF and the limits are set based on the 1-Q_{10} 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-Q_{10} (estimated as 80% of 7-Q_{10})), 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	<14		<14
Cadmium	448	57.6	57.6	11.5	<0.3		<0.3
Chromium	301	4,446	4,446	889	<1.3		<1.3
Copper	448	63.9	63.9			14	13
Lead	356	365	365	72.9	<3.5		<3.5
Nickel	268	1,080	1,080	216	9.6		9.6
Zinc	333	345	345	68.9	11		11
Chloride (mg/L)		757	**757**			**1,447**	**1,158**

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

* * Per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016 consideration of ambient concentrations and 1-Q_{10} flow rates yields a more restrictive limit than the 2 × ATC method of limit calculation.

Attachment #1

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 0 cfs (¼ of the 7-Q_{10}), 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 MAX CONC.	4-day P_{99}
Arsenic		152.2	152	30.4	<14		
Cadmium	175	3.82	3.82	0.8	<0.3		
Chromium	301	325.75	326	65.2	<1.3		
Copper	448	37.36	37.4				12
Lead	356	95.51	95.5	19.1	<3.5		
Nickel	268	120.18	120	24.0	9.6		
Zinc	333	344.68	345	68.9	11		
Chloride (mg/L)		395	**395**			**1,048**	**1,066**

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

Monthly Average Limits based on Wildlife Criteria (WC)

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

Monthly Average Limits based on Human Threshold Criteria (HTC)

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

SUBSTANCE	HTC	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	370	370	74.0	<0.3
Chromium	3,818,000	3,818,000	763,600	<1.3
Lead	140	140	28	<3.5
Nickel	43,000	43,000	8,600	9.6

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	<14

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

Conclusions and Recommendations

Based on a comparison of the effluent data and calculated effluent limitations, **effluent limitations are required for chloride.** Limits and/or monitoring recommendations are made in the paragraphs below:

Arsenic – Considering available effluent data from September 2022, the mean effluent concentration is nondetectable at <14 µg/L. This is below 1/5th of the calculated arsenic WQBELs; **therefore, limits or monitoring are not recommended during the reissued permit term.** In addition, the limit of detection of the submitted sample for arsenic is <14 µg/L using the EPA 200.7 analytical method. This is higher than 1/5th of the calculated limit (2.66 µg/L) based on HCC and is not certain if a nondetect sample is actually lower than that value. **A more sensitive approved analytical method is recommended for future arsenic samples such that the limit of detection is less than or equal to 2.66 µg/L to better determine the need for arsenic limits at the next permit reissuance.**

Chloride – Considering available effluent data from the current permit term (May 2024 – June 2024), the 1-day and 4-day P_{99} concentrations of effluent data are 1,447 and 1,066 mg/L respectively. These are higher than the calculated chloride WQBELs; therefore, **the daily maximum limit of 760 mg/L and the weekly average limit of 400 mg/L are recommended during the reissued permit term.**

Subchapter VII of ch. NR 106, Wis. Adm. Code, provides for a chloride variance from water quality standards. Denmark WWTF has a chloride variance in the current permit and has requested this variance to continue during the reissued permit term. That variance may be granted subject to the following conditions:

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

Interim Limit for Chloride

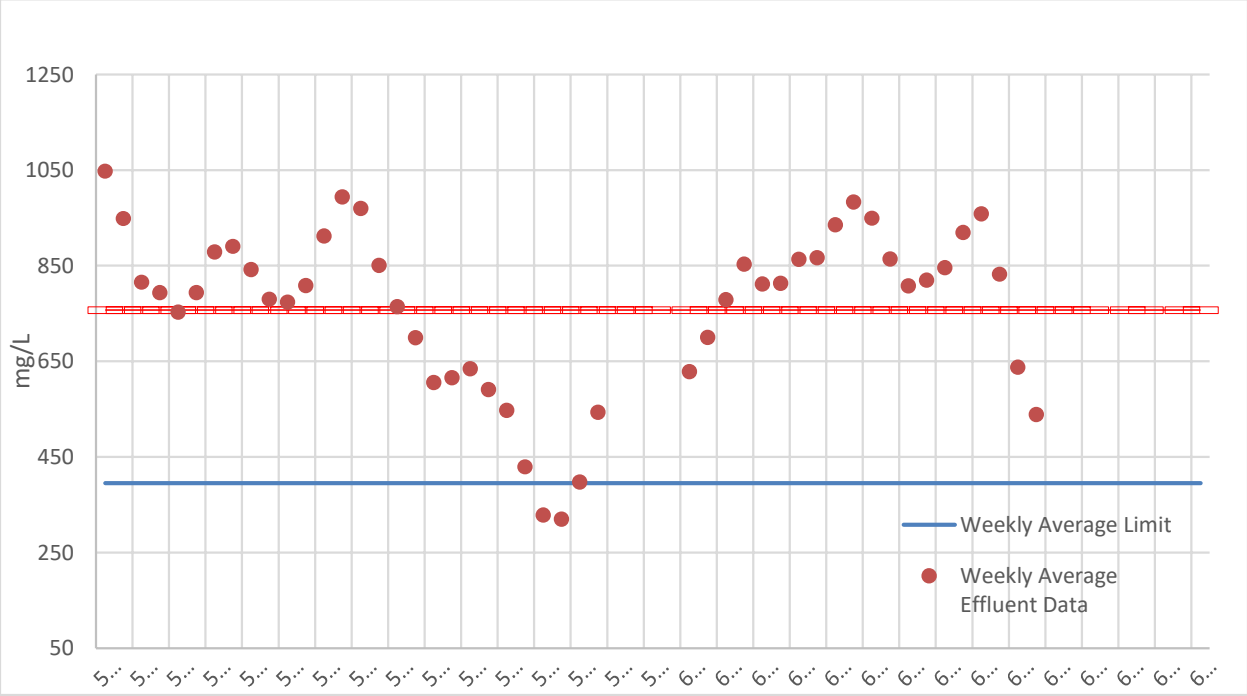
Section NR 106.82(9), Wis. Adm. Code, defines a "Weekly average interim limit" as either the 4-day P_{99} concentration or 105% of the highest weekly average concentration of the representative data. The equivalent code for a daily maximum interim limit is as described in s. NR 106.82(4), Wis. Adm. Code.

The 4-day P_{99} concentration is 1,066 mg/L and 105% of the 4-day maximum concentration is 1,100 mg/L. Both of these values are less stringent than the interim weekly average limit of 980 mg/L in the current permit. Similarly, the 1-day P_{99} concentration is 1,447 mg/L and 105% of the 1-day maximum concentration is 1,216 mg/L. Both of these values are less stringent than the interim daily maximum limit of 1,200 mg/L in the current permit. The Department does not find it appropriate to increase either limit as the facility must show progress towards meeting the chloride water quality standards as part of the chloride variance approval process. **Therefore, the current interim variance limits are recommended to continue during the reissued permit term assuming the chloride variance is reapproved.** These limits may be reevaluated as updated effluent chloride data becomes available to the Department relative to the timeline of the variance approval.

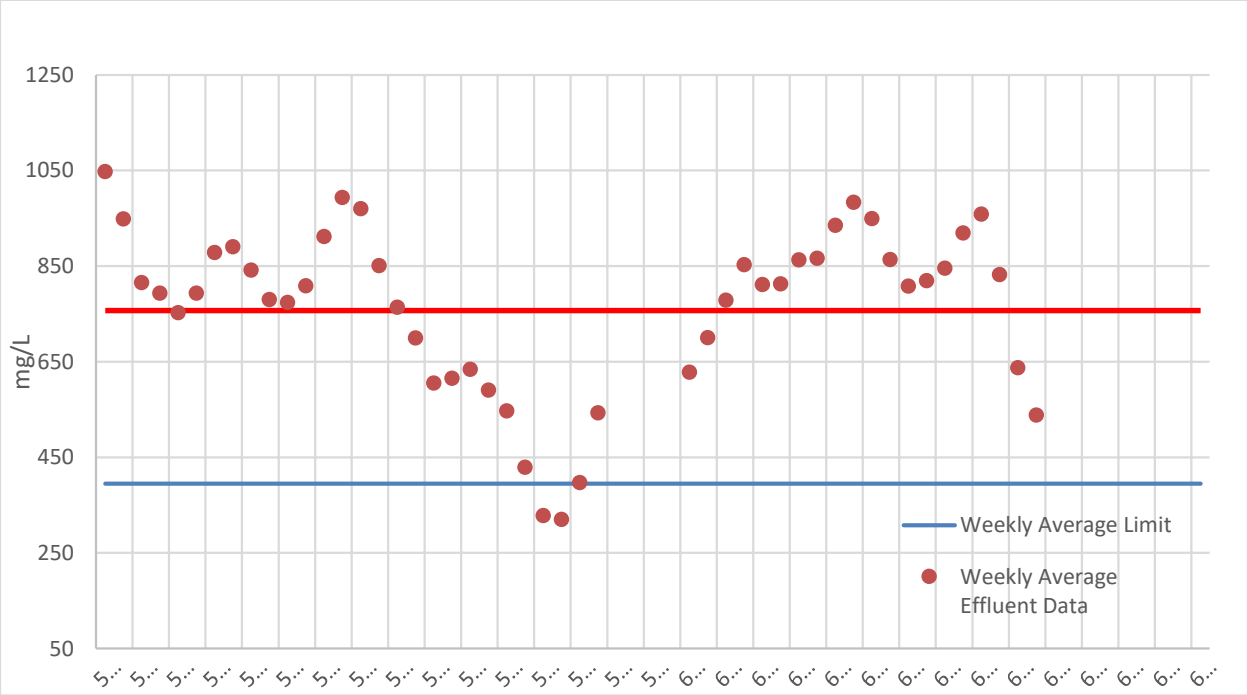
The two graphs presented below show effluent chloride concentrations both over the current permit term (October 2018 – June 2024) and the period after the facility switched water supply sources (May 2024 – June 2024):

Attachment #1

Chloride Effluent Data (October 2018 – June 2024)



Chloride Effluent Data (May 2024 – June 2024)



In the absence of a variance, the Denmark WWTF would be subject to the prior stated limits, dry and wet weather mass limits, and any expression of limits-required limits.

Mercury – The permit application did not require monitoring for mercury because the Denmark WWTF is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3, Wis. Adm. Code, a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, "there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5), 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 March 2019 – March 2023 was 1.1 mg/kg, with a maximum reported concentration of 1.5 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 Brown County Water Authority, whose intake is from Manitowoc Waterworks, (PWS ID: 43603648) is provided in the table below:

Water Supply PFAS Data

Sample Date	Sample ID	Well #	PFOS (ng/L)	PFOA (ng/L)
02/09/2023	CB01316-04	CBCWA Intake	0.93	1.8
05/23/2023	CB05451-01	CBCWA Intake	0.81	1.9
		Average =	0.87	1.9

The limited data above shows the municipal water supply is below 1/5th of the applicable PFOS criteria. Based on the type of discharge, the effluent flow rate, the type of indirect dischargers contributing to the collection system and known levels of PFOS/PFOA in the source water, **PFOS and PFOA monitoring is not recommended during the reissued permit term.** The Department may re-evaluate the need for sampling at the next permit reissuance if new information becomes available that suggests PFOS or PFOA may be present in the discharge.

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

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004, which includes criteria based on both acute and chronic toxicity to aquatic life. The current permit has daily maximum, weekly average and monthly average limits year-round. These limits are re-evaluated at this time due to the following changes:

- Subchapter IV of ch. NR 106, Wis. Adm. Code allows limits based on available dilution instead of limits set to twice the acute criteria.
- The maximum expected effluent pH has changed.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

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

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

Where:

A = 0.411 and B = 58.4 for an LFF community, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 2,100 sample results were reported from October 2018 – June 2024. The maximum reported value was 8.81 s.u. (Standard pH Units). The effluent pH was 8.42 s.u. or less 99% of the time. The 1-day P_{99}, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 8.44 s.u. The mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 8.43 s.u. Therefore, a value of 8.44 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 8.44 s.u. into the equation above yields an ATC = 3.62 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 the nitrogen limits or based on the 1-Q_{10} method if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits shall apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1-Q_{10} (estimated as 80 % of 7-Q_{10}) and the 2×ATC approach are shown below.

Daily Maximum Ammonia Nitrogen Determination

Method	Ammonia Nitrogen Limit (mg/L)
2×ATC	7.2
1-Q_{10}	3.6

The 1-Q_{10} method yields the most stringent limits for the Denmark WWTF.

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 – LFF Community

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
$6.0 \leq pH \leq 6.1$	54	$7.0 < pH \leq 7.1$	33	$8.0 < pH \leq 8.1$	6.9
$6.1 < pH \leq 6.2$	53	$7.1 < pH \leq 7.2$	30	$8.1 < pH \leq 8.2$	5.7
$6.2 < pH \leq 6.3$	52	$7.2 < pH \leq 7.3$	26	$8.2 < pH \leq 8.3$	4.7
$6.3 < pH \leq 6.4$	51	$7.3 < pH \leq 7.4$	23	$8.3 < pH \leq 8.4$	3.9
$6.4 < pH \leq 6.5$	49	$7.4 < pH \leq 7.5$	20	$8.4 < pH \leq 8.5$	3.2
$6.5 < pH \leq 6.6$	47	$7.5 < pH \leq 7.6$	17	$8.5 < pH \leq 8.6$	2.7
$6.6 < pH \leq 6.7$	45	$7.6 < pH \leq 7.7$	14	$8.6 < pH \leq 8.7$	2.2
$6.7 < pH \leq 6.8$	42	$7.7 < pH \leq 7.8$	12	$8.7 < pH \leq 8.8$	1.8
$6.8 < pH \leq 6.9$	39	$7.8 < pH \leq 7.9$	10	$8.8 < pH \leq 8.9$	1.6
$6.9 < pH \leq 7.0$	36	$7.9 < pH \leq 8.0$	8.4	$8.9 < pH \leq 9.0$	1.3

Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)
The weekly and monthly average ammonia nitrogen limits calculation from the previous limit evaluation (March 2005) do not change because there have been no changes in the effluent and receiving water flow rates. The calculations from the previous limit evaluation are shown in attachment #2.

Effluent Data
The following table evaluates the statistics based upon ammonia data reported from October 2018 – June 2024, with those results being compared to the calculated limits to determine the need to include ammonia limits in the Denmark WWTF permit for the respective month ranges. That need is determined by calculating 99th upper percentile (or P_{99}) 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 (mg/L)	April – September	October - March
1-day P_{99}	2.3	1.9
4-day P_{99}	1.3	1.0
30-day P_{99}	0.57	0.47
Mean*	0.24	0.24
Std	0.56	0.41
Sample size	715	777
Range	0.1 - 8.1	0.1 - 7.9

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

Based on this comparison, daily maximum limits are needed year-round. The Denmark WWTF shall notify the Department if the single limit or the variable daily maximum limits based on effluent pH are preferred.

Expression of Limits
Revisions to ch. NR 106, Wis. Adm. Code, in September 2016 aligned Wisconsin's WQBELs with 40 CFR § 122.45(d), which specifies that effluent limits for continuous dischargers must be expressed as weekly and monthly averages for publicly owned treatment works and as daily maximums and monthly averages for all other dischargers, unless shown to be impracticable. Because daily maximum ammonia limits are necessary for Denmark WWTF, weekly and monthly average limits are also required under this code revision.

The methods for calculating limitations for municipal treatment facilities to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(3), Wis. Adm. Code, and are as follows:

> Whenever a daily maximum limitation is determined necessary to protect water quality, a weekly and monthly average limitation shall also be included in the permit and set equal to the daily maximum limit unless a more restrictive limit is already determined necessary to protect water quality.

If the single limit is preferred, then the weekly average limit year-round and the monthly average limit during October – March are recommended to be 3.6 mg/L during the reissued permit term.

The monthly average limit of 2.9 mg/L during April – September is recommended to continue during the reissued permit term.

If the variable daily maximum limits are preferred, the weekly and monthly average limits in the current permit are recommended to continue during the reissued permit term.

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. 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.

Final Ammonia Nitrogen Limits

	Daily Maximum mg/L	Weekly Average mg/L	Monthly Average mg/L
Single April – September	3.6 mg/L	**3.6 mg/L**	2.9 mg/L
Single October – March	3.6 mg/L	**3.6 mg/L**	**3.6 mg/L**
Variable April – September	Variable	4.8 mg/L	2.9 mg/L
Variable October – March	Variable	**11 mg/L**	4.9 mg/L

PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR BACTERIA

Section NR 102.04(5), Wis. Adm. Code, states that all surface waters shall be suitable for supporting recreational use and shall meet *E. coli* criteria during the recreation season. Section NR 102.04(5)(b), Wis. Adm. Code, allows the Department to make exceptions when it determines, in accordance with s. NR 210.06(3), Wis. Adm. Code, that wastewater disinfection is not required to meet *E. coli* limits and protect the recreational use. Section NR 210.06(3), Wis. Adm. Code, tasks the Department with determining the need for disinfection using a site-specific analysis based on potential risk to human or animal health. It sets out the factors that must be considered in determining the necessity to disinfect municipal wastewater or to change the length of the disinfection season.

The Denmark WWTF had previously been exempted from disinfection based on the LAL or LFF community classification of the receiving water. Section NR 210.06(3)(g), Wis. Adm. Code, states that disinfection decisions may be made based on the hydrologic classifications listed in s. NR 104.02(1), Wis. Adm. Code (**not** on the water quality classifications - i.e., LFF, LAL - that are defined in s. NR 104.02(3), Wis. Adm. Code). The hydrologic classification for Denmark Creek is listed in ch. NR 104, Wis. Adm. Code, as noncontinuous. Discharges to noncontinuous streams with $Q_{7,10}$ values < 0.1 cfs usually result in effluent-dominated situations. The risk of illness is related to the concentration of *E. coli* and therefore dilution is an important consideration when considering risk to human health. Since little to no dilution is present in these situations, disinfection should not be exempted based solely on this hydrological classification.

The Department has considered the information required by s. NR 210.06(3), Wis. Adm. Code, and has determined that the discharge cannot meet bacteria limits without disinfection. 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.

These limits are required during May through September. The reissued permit will include a compliance schedule to meet these limits.

PART 5 – PHOSPHORUS & TSS

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

Because the Denmark WWTF currently has a limit of 1.0 mg/L, **this limit should be included in the reissued permit.** This limit remains applicable unless a more stringent WQBEL is given. In addition, the need for a WQBEL for phosphorus must be considered.

TMDL Limits – Phosphorus
Total phosphorus (TP) effluent limits in lbs/day are calculated as recommended in the *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs* (April 2020) and are based on the annual phosphorus wasteload allocation (WLA) given in pounds per year. This WLA found in Appendix K of the *Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids in the Northeast Lakeshore Region* report is expressed as a maximum annual load (lbs/yr). For the Denmark WWTF, the annual WLA is 436 lbs/yr.

For the reasons explained in the April 30, 2012 paper entitled *Justification for Use of Monthly, Growing Season and Annual Average Periods for Expression of WPDES Permit Limits for Phosphorus Discharges in Wisconsin*, WDNR has determined that the phosphorus WQBELs set equal to WLAs would not be consistent with the assumptions and requirements of the TMDL. Therefore, limits given to facilities included in the Northeast Lakeshore Basin TMDL are given monthly average mass limits and, if the equivalent effluent concentration is less than or equal to 0.3 mg/L, six-month average mass limits are also included. The following equation shows the calculation of equivalent effluent concentration:

$$\text{TP Equivalent Effluent Concentration} = \text{WLA} \div (365 \text{ days/yr} * \text{Flow Rate} * \text{Conversion Factor})$$
$$= 436 \text{ lbs/yr} \div (365 \text{ days/yr} * 0.725 \text{ MGD} * 8.34)$$
$$= 0.198 \text{ mg/L}$$

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

Attachment #1

TP 6-Month Average Permit Limit = WLA ÷ 365 days/yr * multiplier
= (436 lbs/yr ÷ 365 days/yr) * 1.21
= 1.4 lbs/day

TP Monthly Average Permit Limit = TP 6-Month Average Permit Limit * 3
= 1.4 lbs/day * 3
= 4.3 lbs/day

The multiplier used in the six-month average calculation was determined according to the implementation guidance. A coefficient of variation was calculated, based on phosphorus mass monitoring data, to be 0.6. This is the standard deviation divided by the mean of mass data. This value, along with monitoring frequency, is used to select the multiplier. The current permit specifies phosphorus monitoring as 2x/wk; if a different monitoring frequency is used, the stated limits should be reevaluated.

The monthly average limit of 4.3 lbs/day and the 6-month average limit of 1.4 lbs/day are recommended during the reissued permit term. The limits are equivalent to concentrations of 0.72 and 0.24 mg/L respectively at the facility design flow of 0.725 MGD.

The TMDL establishes TP wasteload allocations to reduce the loading in the entire watershed including WLAs to meet water quality standards for tributaries in the Northeast Lakeshore Basin. **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.

Interim Limit – Phosphorus

An interim limit is needed when a compliance schedule is included in the permit to meet the TMDL limits. This limit should reflect a value which the facility is able to currently meet; however, it should also consider the receiving water quality, keeping the water from further impairment. **Therefore, the monthly average interim limit of 1.0 mg/L, equal to the existing technology-based limit, is recommended to continue during the reissued permit term.** The following table lists the statistics for effluent phosphorus levels from October 2018 – June 2024.

Phosphorus Effluent Data

Statistics	Concentration (mg/L)	Mass Discharge (lbs/day)
1-day P_{99}	1.3	6.8
4-day P_{99}	0.85	4.1
30-day P_{99}	0.64	2.8
Mean	0.53	2.2
Std	0.23	1.3
Sample Size	1,503	1,503
Range	0.06 - 2	0 - 14.7

TMDL Limits – TSS

Total Suspended Solids (TSS) effluent limits in lbs/day are calculated as recommended in the *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs (*April 2020). This WLA found in Appendix L of the *Total Maximum Daily Loads for Total Phosphorus and Total Suspended Solids in the Northeast Lakeshore Region* report is expressed as a maximum annual load (lbs/yr). For the Denmark WWTF, the annual WLA is 35,573 lbs/yr.

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

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

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

TSS Monthly Average Permit Limit = WLA ÷ 365 days/yr * multiplier
= (35,573 lbs/yr ÷ 365 days/yr) * 1.47
= 140 lbs/day

TSS Weekly Average Permit Limit = WLA ÷ 365 days/yr * multiplier
= (35,573 lbs/yr ÷ 365 days/yr) * 2.07
= 200 lbs/day

The multiplier used in the weekly average and monthly average calculation was determined according to implementation guidance. A coefficient of variation was calculated, based on TSS mass monitoring data, to be 0.73. This is the standard deviation divided by the mean of mass data. Because phosphorus optimization efforts by the facility are expected to reduce phosphorus effluent variability, it is believed those efforts will also increase TSS treatment capability and thereby reduce TSS effluent variability. Thus, the maximum anticipated coefficient of variation expected by the facility is 0.6. This value, along with monitoring frequency, is used to select the multiplier. The current permit specifies TSS monitoring as 3x/week; if a different monitoring frequency is used, the stated limits should be reevaluated.

The weekly average limit of 200 lbs/day and the monthly average limit of 140 lbs/day are recommended during the reissued permit term. The limits are equivalent to concentrations of 33 and 24 mg/L respectively at the facility design flow of 0.725 MGD.

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

Effluent Data

The following table summarizes effluent total suspended solids monitoring data from October 2018 – June 2024.

Attachment #1

Total Suspended Solids Effluent Data

Statistics	Concentration (mg/L)	Mass Discharge (lbs/day)
1-day P_{99}	27	163
4-day P_{99}	18	94
30-day P_{99}	13	60
Mean	11	44
Std	4.9	32
Sample Size	1,492	1,492
Range	2 - 57	0 - 483

Upon comparison of calculated weekly and monthly average mass TSS data against the TSS mass limits, the Denmark WWTF can currently meet the TSS mass limits. **Therefore, a compliance schedule is not needed during the reissued permit term.**

PART 6 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR THERMAL

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

In accordance with s. NR 106.53(2)(b), Wis. Adm. Code, the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), Wis. Adm. Code, the highest 7-day rolling average flow rate for a calendar month is used to determine the sub-lethal (weekly average) effluent limitation. These values were based off actual flow reported from October 2018 – June 2024.

The previous limit evaluation (November 2011) determined the temperature limits based on the thermal water quality standards of Denmark Creek (LFF community) are also protective of the thermal water quality standards of the Neshota River (WWSF community) due to the available assimilative capacity and estimated cooling over the 0.6 mi of downstream travel. An initial review of the temperature limits between the LFF and WWSF communities indicates that this is still the case. Therefore, only temperature limits based on Denmark Creek will be considered further in this evaluation.

The table below summarizes the maximum temperatures reported during monitoring during October 2018 – June 2024 along with the calculated limits.

Attachment #1

Monthly Temperature Effluent Data & Limits

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	**59**	61	**54**	78
FEB	**58**	63	**54**	79
MAR	**60**	63	**57**	80
APR	59	61	63	81
MAY	64	68	70	84
JUN	68	70	77	85
JUL	71	75	81	86
AUG	73	74	79	86
SEP	71	74	73	85
OCT	**69**	71	**63**	83
NOV	**65**	68	**54**	80
DEC	**62**	64	**54**	79

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 temperature limits would be needed during the months of October – March. The complete thermal table used for this calculation is included as attachment #3.

The Denmark WWTF has completed multiple dissipative cooling (DC) studies during October 2020 – February 2021 and were reviewed and approved by the Department in June 2021 for implementation in the reissued permit. The DC studies have shown the amount of DC demonstrated in Denmark Creek

during October – February is significant enough to justify removing the weekly average temperature limits year-round from the permit. **Therefore, temperature limits are not recommended during the reissued permit term.** Details of the DC approval are included in the DC Evaluation Checklist in the permit file. **Weekly temperature monitoring for 1 year is recommended during the reissued permit term to determine the need for temperature limits at the next permit reissuance.**

Future WPDES Permit Reissuance
Dissipative cooling requests must be re-evaluated every permit reissuance. The permittee is responsible for submitting an updated DC request prior to permit reissuance. Such a request must either include:
a) A statement by the permittee that there have been no substantial changes in operation of, or thermal loadings to, the treatment facility and the receiving water; or
b) New information demonstrating DC to supplement the information used in the previous DC determination. If significant changes in operation or thermal loads have occurred, additional DC data must be submitted to the Department.

PART 7 – WHOLE EFFLUENT TOXICITY (WET)

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

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09(2)(b), Wis. Adm Code.

- Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure. To assure that a discharge is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} (Inhibition Concentration) greater than the instream waste concentration (IWC), according to s. NR 106.09(3)(b), Wis. Adm Code. The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of 100% shown in the WET Checklist summary below was calculated according to the following equation, as specified in s. NR 106.03(6), Wis. Adm Code:

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

Where:
Q_e = annual average flow = 0.725 MGD = 1.12 cfs.
f = fraction of the Q_e withdrawn from the receiving water = 0.
Q_s = ¼ of the 7-Q_{10} = 0 cfs ÷ 4 = 0 cfs.

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the

Department prior to use. The primary control water must be specified in the WPDES permit.

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), receiving water must be used as the dilution water and primary control in chronic WET tests, unless the use of different dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the receiving water location, upstream and out of the influence of the mixing zone and any other known discharge. The specific receiving water location must be specified in the WPDES permit.

- Shown below is a tabulation of all available WET data for Outfall 001. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08(3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations. Significant changes were made to WET test methods in 2004 and these changes were assumed to be fully implemented by certified labs by no later than June 2005. Therefore, WET testing performed June 2005 to present are included in the table below:

WET Data History

Date Test Initiated	Acute Results LC_{50} %				Chronic Results IC_{25} %				Footnotes or Comments
	C. dubia	Fathead minnow	Pass or Fail?	Used in RP?	*C. dubia*	Fathead Minnow	Pass or Fail?	Use in RP?	
11/03/2009	>100	>100	Pass	No	>100	>100	Pass	No	1
08/05/2010	>100	>100	Pass	No	>100	>100	Pass	No	1
03/07/2017	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
03/28/2017	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
04/11/2017	>100	>100	Pass	Yes					
04/17/2017					82.1	>100	Fail	Yes	
01/28/2020	>100	>100	Pass	Yes	87.0	>100	Pass	Yes	
07/26/2022	>100	>100	Pass	Yes	81.3	97.3	Fail	Yes	
08/20/2024	>100	>100	Pass	Yes	>100	>100	Pass	Yes	

Footnotes:

1. *Tests done by S-F Analytical, July 2008 – March 2011.* The DNR has reason to believe that WET tests completed by SF Analytical Labs from July 2008 through March 31, 2011, were not performed using proper test methods. Therefore, WET data from this lab during this period has been disqualified and was not included in the analysis.

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

  Acute Reasonable Potential = [(TUa effluent) (B)(AMZ)]

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

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

Chronic Reasonable Potential = [(TU_c effluent) (B)(IWC)]

Chronic WET Limit Parameters

TUc (maximum) $100/IC_{25}$	**B** (multiplication factor from s. NR 106.08(6)(c), Wis. Adm. Code, Table 4)	IWC
100/81.3 = 1.23	3.0 Based on 3 detects	100%

[(TUc effluent) (B)(IWC)] = 3.7 > 1.0

Therefore, reasonable potential is shown for chronic WET limits using the procedures in s. NR 106.08(6), Wis. Adm. Code, and representative data from March 2017 – July 2022.

Expression of WET limits

Chronic WET limit = [100/IWC] TU_c = 1.0 TU_c expressed as a monthly average.

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

WET Checklist Summary

	Acute	**Chronic**
AMZ/IWC	Not applicable. **0 Points**	IWC = 100%. **15 Points**
Historical Data	Six tests used to calculate RP. No tests failed. **0 Points**	Six tests used to calculate RP. Two tests failed. **0 Points**
Effluent Variability	Multiple limit exceedances, mostly chloride. NONs sent for chloride and TSS. NOVs sent for chloride. **10 Points**	Same as acute. **10 Points**
Receiving Water Classification	"Cool-Cold Headwater" natural community. **5 Points**	Same as acute. **5 Points**

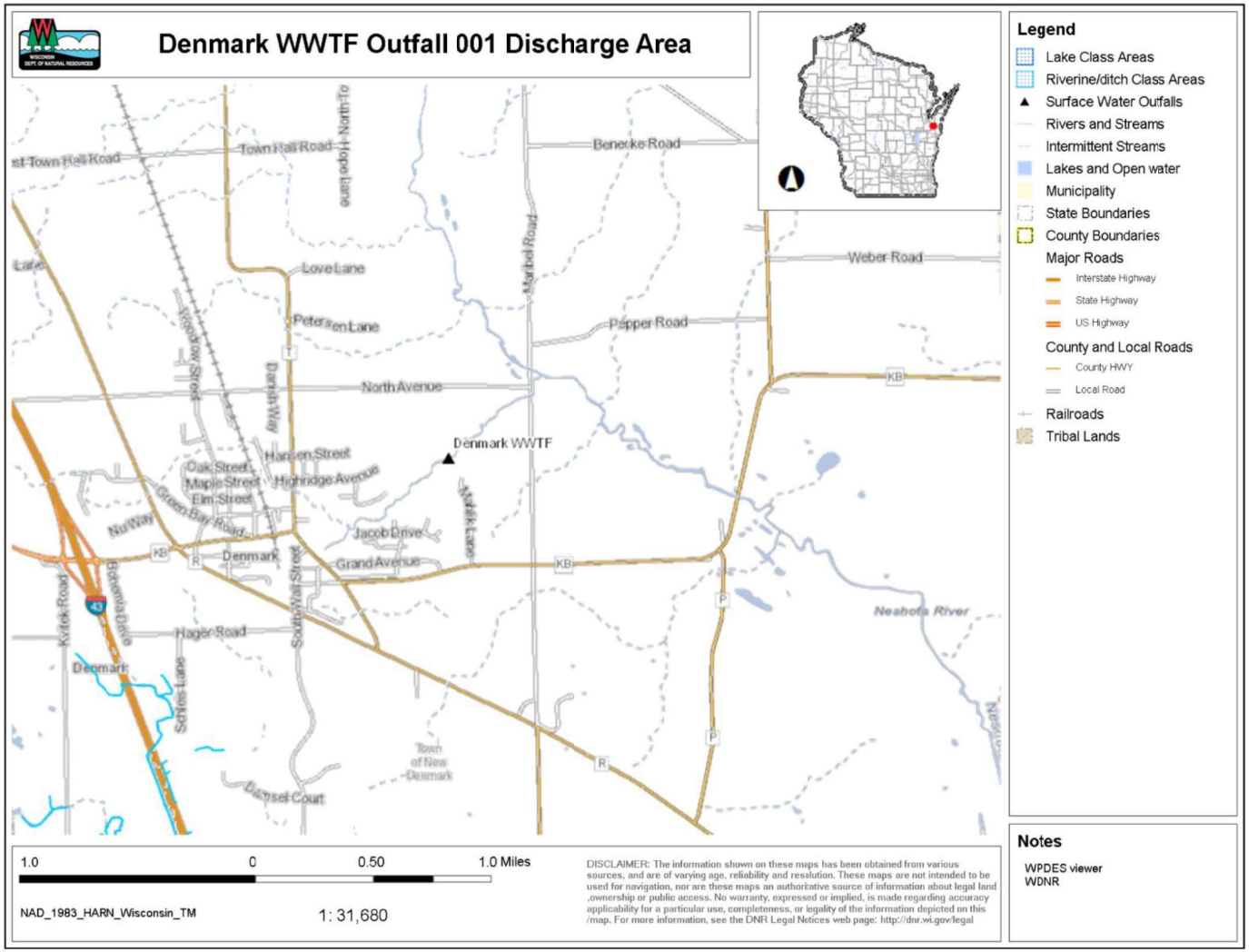
Attachment #1

	Acute	Chronic
Chemical-Specific Data	Reasonable potential for ammonia nitrogen and chloride limits based on ATC; Copper, nickel, and zinc detected. No additional compounds of concern. **9 Points**	Reasonable potential for chloride limits based on CTC; ammonia nitrogen limits carried over from current permit. Copper, nickel, and zinc detected. No additional compounds of concern. **8 Points**
Additives	No biocides and 1 water quality conditioner added. Permittee has proper P chemical SOPs in place: Yes. **1 Point**	All additives used more than once per 4 days. **1 Point**
Discharge Category	Two industrial contributors. **6 Points**	Same as acute. **6 Points**
Wastewater Treatment	Secondary or better. **0 Points**	Same as acute. **0 Points**
Downstream Impacts	No impacts known. **0 Points**	Same as acute. **0 Points**
Recommended Monitoring Frequency		Quarterly chronic tests recommended.
TRE Recommended? (from Checklist)	No.	Yes.

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, **3x acute WET tests are recommended during the reissued permit term.** Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, quarterly chronic WET tests would be recommended during the reissued permit term. According to the requirements specified in s. NR 106.08, Wis. Adm. Code, the monthly average chronic WET limit of 1.0 TU_C would also be required. In addition, a toxicity reduction evaluation (TRE) would also be recommended due to the number of failed chronic tests to find and fix the source of toxicity and achieve compliance with the chronic WET limit. **However, s. NR 106.89(4), Wis. Adm. Code, states chronic chloride WQBELs shall be included during the reissued permit term in place of both the chronic WET limit and testing.** The effluent chloride data (May 2024 – June 2024) discussed in Part 2 of this evaluation meets the requirements of s. NR 106.89(4), Wis. Adm. Code, demonstrating effluent chloride concentrations are consistently above 2x the weekly average chloride WQBEL (800 mg/L). High chloride concentrations are likely causing chronic WET failures and would likely mask other sources of chronic toxicity in the effluent. Chronic WET requirements will be delayed until chloride source reduction measures are implemented to the point effluent chloride concentrations are no longer likely to cause chronic toxicity.

Attachment #2



Attachment #3

Temperature Limits for Receiving Waters with Unidirectional Flow

(calculation using default ambient temperature data)

						Temp Dates	Flow Dates
Facility:	Denmark WWTF		**7-Q_{10}:**	0	cfs		
Outfall(s):	001		**Dilution:**	25%		**Start:** 10/01/18	10/01/18
Date Prepared:	8/7/2024		**f:**	0		**End:** 03/23/24	03/23/24
Design Flow (Qe):	0.725	MGD	**Stream type:**	Limited forage fish community			
Storm Sewer Dist.	0	ft	**Qs:Qe ratio:**	0.0	:1		
			Calculation Needed?	YES			

Month	Water Quality Criteria			Receiving Water Flow Rate (Qs)	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)	Daily Maximum Flow Rate (Qea)		Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(cfs)	(MGD)	(MGD)		(°F)	(°F)	(°F)	(°F)
JAN	37	54	78	0	0.688	1.119	0	59	61	54	78
FEB	39	54	79	0	0.690	0.819	0	58	63	54	79
MAR	43	57	80	0	0.887	1.564	0	60	63	57	80
APR	50	63	81	0	0.924	1.185	0	59	61	63	81
MAY	59	70	84	0	0.815	1.371	0	64	68	70	84
JUN	64	77	85	0	0.572	0.853	0	68	70	77	85
JUL	69	81	86	0	0.584	0.887	0	71	75	81	86
AUG	68	79	86	0	0.740	1.013	0	73	74	79	86
SEP	63	73	85	0	0.862	1.183	0	71	74	73	85
OCT	55	63	83	0	0.820	1.085	0	69	71	63	83
NOV	46	54	80	0	0.756	1.079	0	65	68	54	80
DEC	40	54	79	0	0.709	1.041	0	62	64	54	79

Facility Specific Chloride Variance Data Sheet

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

Section I: General Information

A. Name of Permittee: Village of Denmark

B. Facility Name: Denmark Wastewater Treatment Facility

C. Submitted by: Wisconsin Department of Natural Resources

D. State: Wisconsin **Substance:** Chloride **Date completed:** May 5, 2025

E. Permit #: WI-0021741-09-0 **WQSTS #:** (EPA USE ONLY)

F. Duration of Variance **Start Date:** October 1, 2025 **End Date:** September 30, 2030

G. Date of Variance Application: April 28, 2023

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

I. Description of proposed variance:

The Village of Denmark Wastewater Treatment Facility (WWTF) discharges to Denmark Creek, a tributary to the Neshota River in the West Twin River Watershed in Brown County. The Village of Denmark seeks a variance to the water quality standards for chloride for its WWTF.

The Department concludes that the Village of Denmark has met the requirements of s. NR 106.83(2), Wis. Adm. Code, and s. 283.15, Wis. Stats. The Department further concludes that requiring the Village of Denmark to meet the water quality standard for chloride would result in substantial and widespread adverse social and economic impacts in its service area. Furthermore, the Department concludes that there is no feasible pollutant control technology that can be applied to achieve compliance with the chloride water quality-based effluent limit (WQBEL). The Department therefore proposes that this permit include a discharger-specific variance to the chloride water quality standard for aquatic life.

The proposed variance for chloride is from the WQBELs of 400 mg/L as a weekly average and 760 mg/L as a daily maximum, to interim limits of 980 mg/L expressed as a weekly average limit and 1,200 mg/L expressed as a daily maximum limit. The Department concludes that the interim limits reflect the greatest pollutant reduction achievable by the permittee with the pollutant control technologies currently applied in the permittee's WWTF. The permit requires the permittee to implement Source Reduction Measures (SRMs). The Department considers the highest attainable condition (HAC) of the receiving water to be the interim limits – applied for the term of the variance – combined with the permittee's implementation of SRMs. The term of the proposed variance is five years, concurrent with the term of the proposed WPDES permit. The underlying designated uses and criteria of Wisconsin's chloride water quality standards (WQS) will be retained, and all other applicable WQS will remain in effect with adoption of the proposed variance.

This is a renewal of a previous submittal to EPA for a chloride variance for this permittee. The previous permit for this facility contained an interim chloride limit, target value and requirements to implement source reduction measures, in accordance with s. NR 106.83(2), Wis. Adm. Code.

Citation: An interim chloride effluent limitation under s. NR 106.83(2), Wis. Adm. Code represents a variance to water quality standards authorized by s. 283.15, Wis. Stats., and 40 CFR §131.14.

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

Name	Email	Phone	Contribution
Sarah Donoughe	Sarah.Donoughe@Wisconsin.gov	920-366-6076	Permit Drafter
Mark Stanek	Mark.Stanek@Wisconsin.gov	920-808-0670	Compliance Engineer
Michael Polkinghorn	Michael.Polkinghorn@Wisconsin.gov	715-360-3379	Limit Calculator

Section II: Criteria and Variance Information

A. Water Quality Standard from which variance is sought: Chloride (400 mg/L chronic toxicity criterion and 760 mg/L acute toxicity criterion)

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

C. Source of Substance: Industrial contributors (Salm Partners), water softeners, and road salt intrusion

D. Ambient Substance Concentration: N/A ☒ **Measured** ☐ **Estimated** ☒ **Default** ☐ **Unknown**

E. **If measured or estimated, what was the basis? Include citation.** Background chloride value was not needed since Denmark Creek has a low flow of zero.

F. Average effluent discharge rate: 0.478 MGD (Oct. 2018 – June 2024), annual average design flow = 0.725 MGD **Maximum effluent discharge rate:** 1.56 MGD (03/31/2023)

G. Effluent Substance Concentration: 1-day P_{99} = 1,669 mg/L; 4-day P_{99} = 1,208 mg/L ☒ **Measured** ☐ **Estimated** ☐ **Default** ☐ **Unknown**

H. If measured or estimated, what was the basis? Include Citation. P_{99} values based on effluent chloride data during May 2024 – December 2024 and the P_{99} calculation procedure as described in s. NR 106.05(5), Wis. Adm. Code.

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

J. Statement of HAC: The Department has determined the highest attainable condition of the receiving water is achieved through the application of the variance limit in the permit, combined with a permit requirement that the permittee implement its Chloride SRM plan. Thus, the HAC at commencement of this variance is 1,200 mg/L as a daily maximum and 980 mg/L as a weekly average, which reflects the greatest chloride reduction achievable with the current treatment processes, in conjunction with the implementation of the permittee's Chloride SRM plan. The current effluent condition is reflective of on-site optimization measures that have already occurred. This HAC determination is based on the economic feasibility of available compliance options for the Village of Denmark WWTF at this time (see Economic Section below). The permittee may seek to renew this variance in the subsequent reissuance of this permit; the Department will reevaluate the HAC in its review of such a request. A subsequent HAC cannot be defined as less stringent than this HAC.

K. Variance Limit: 1,200 mg/L daily maximum and 980 mg/L as weekly average

L. Level currently achievable (LCA): 1-day P_{99} = 1,669 mg/L, 4-day P_{99} = 1,208 mg/L

M. What data were used to calculate the LCA, and how was the LCA derived? (*Immediate compliance with LCA is required.)*
LCAs derived using P_{99} calculation as provided in Part H.

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

Chloride variance limits are chosen using procedures as described in s. NR 106.82(4) and (9), Wis. Adm. Codes, because reasonable potential was demonstrated for both the daily maximum and weekly average chloride WQBELs. In this case the calculated daily maximum and weekly average target values based on effluent chloride data (May 2024 – December 2024) are both less stringent than the current variance limits in the permit, so those limits are required to continue as the variance limits during the reissued permit term.

O. Select all factors applicable as the basis for the variance provided under 40 CFR 131.10(g). Summarize justification below: ☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5** ☒ **6**
The use reverse osmosis treatment at the WWTF was evaluated. The treatment was estimated to result in an average cost per household that would be 11.09% of the MHI. The use of lime softening was also evaluated. The cost of lime softening was estimated to result in an average cost per household that would be 2.16% of the MHI.

Those cost estimates are in the range in which the application of either treatment would be expected to result in substantial and widespread economic and social impacts to the community.

Section III: Location Information

A. Counties in which water quality is potentially impacted: Brown; Kewaunee; Manitowoc

B. Receiving waterbody at discharge point: Denmark Creek

C. Flows into which stream/river? Neshota River **How many miles downstream?** Approx. 1 mile

D. Coordinates of discharge point (UTM or Lat/Long): 44º 21' 11" N Latitude, 87º 48' 48" W Longitude

E. What is the distance from the point of discharge to the point downstream where the concentration of the substance falls to less than or equal to the chronic criterion of the substance for aquatic life protection?
Approx. 6.5 mi downstream of discharge.

F. Provide the equation used to calculate that distance *(Include definitions of all variables, identify the values used for the clarification, and include citation):*
(Interim limit in mg/L x effluent design flow in cfs) + (background concentration mg/L x background stream flow in cfs)) / (effluent design flow in cfs + background stream flow in cfs) = $\leq$ 395 mg/L.

(980 mg/L x 1.12 cfs) + (0 mg/L x 0.64 cfs) / (1.12 cfs + 0.64 cfs) = 331 mg/L < 395 mg/L

Denmark Creek flows for approx. 0.6 mi downstream from the discharge until confluence with the Neshota River. The Neshota River flows for another 5.9 mi downstream until the distance of where the chronic chloride criterion is met is reached. The annual 7-Q_{10} at this location of the Neshota River is 2.2 cfs from the Wisconsin Surface Water Data Viewer Natural Communities layer. There is no background chloride data for the Neshota River upstream of its confluence with the discharge, so the background concentration is assumed to be 0 mg/L. Assuming a weekly average discharge concentration of 980 mg/L and background concentration of 0 mg/L, the calculated mixed instream chloride is 331 mg/L, which is below criteria.

G. What are the designated uses associated with the direct receiving waterbody, and the designated uses for any downstream waterbodies until the water quality standard is met?
The receiving water is designated as a limited forage fish (LFF) community and the downstream waters are designated as warm water sport fish (WWSF) community, non-public water supply.

H. Identify all other variance permittees for the same substance which discharge to the same stream, river, or waterbody in a location where the effects of the combined variances would have an additive effect on the waterbody: None.

Permit Number	Facility Name	Facility Location	Variance Limit [mg/L]
N/A			

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

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

River Mile	Pollutant	Impairment
0.00-4.65	Total Phosphorus	Degraded Biological Community

***K.* Please list any contributors to the POTW in the following categories:**
May need to contact facility for this information

Food processors (cheese, vegetables, meat, pickles, soy sauce, etc.)	Salm Partners (two locations)

Metal Plating/Metal Finishing	None
Car Washes	DePere Road Car Wash
Municipal Maintenance Sheds (salt storage, truck washing, etc.)	None
Laundromats	None
Other presumed commercial or industrial chloride contributors to the POTW	None

L. If the POTW does not have a DNR-approved pretreatment program, is a sewer use ordinance enacted to address the chloride contributions from the industrial and commercial users? If so, please describe.
There is a sewer use ordinance that requires a surcharge fee on its industrial users, if they go above a specified concentration limit. The Village of Denmark will be revisiting this concentration limit and will likely be lowering that concentration limit.

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

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

B. Are all industrial users in compliance with local pretreatment limits for chloride? If not, please include a list of industrial users that are not complying with local limits and include any relevant correspondence between the POTW and the industry (NOVs, industrial SRM updates and timeframe, etc)
N/A

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

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

Section V: Public Notice

A. Has a public notice been given for this proposed variance? ☒ Yes ☐ No
B. If yes, was a public hearing held as well? ☒ Yes ☐ No ☐ N/A
C. What type of notice was given?
☒ Notice of variance included in notice for permit ☐ Separate notice of variance
D. Date of public notice: TBD – May 2025 **Date of hearing:** July 1, 2025
E. Were comments received from the public in regards to this notice or hearing? *(If yes, see notice of final determination)* ☐ Yes ☐ No

Section VI: Human Health

A. Is the receiving water designated as a Public Water Supply? ☐ Yes ☒ No
B. Applicable criteria affected by variance: No human health criteria for chloride

C. Identify any expected impacts that the variance may have upon human health, and include any citations:
None

Section VII: Aquatic Life and Environmental Impact

A. Aquatic life use designation of receiving water: See section 3 part G.
B. Applicable criteria affected by variance: ATC = 757 mg/L, CTC = 395 mg/L

C. Identify any environmental impacts to aquatic life expected to occur with this variance, and include any citations:
Daily maximum variance limit does not exceed any genus mean acute values.

Weekly average variance limit exceeds ceriodaphnia, daphnia, physa, and lirceus genus mean chronic values.

D. List any Endangered or Threatened species known or likely to occur within the affected area, and include any citations: None that would affect the water quality criterion, as the chronic toxicity criterion for chloride is more stringent than all genus mean chronic values for organisms with chloride toxicity data. As a result, no endangered species with data would need more protection than already provided by the existing criterion.

County	Species	Status
N/A		

Citation: U.S. Fish & Wildlife Service – Environmental Conservation Online System (http://www.fws.gov/endangered/) and National Heritage Index (http://dnr.wi.gov/topic/nhi/)

Section VIII: Economic Impact and Feasibility

A. Describe the permittee's current pollutant control technology in the treatment process:

B. What modifications would be necessary to comply with the current limits? Include any citations.
There is currently no treatment technology at the Denmark Wastewater Treatment Facility that can remove chloride from the effluent discharge. Treatment technologies that can remove chloride include reverse osmosis, electrodialysis and distillation.

C. How long would it take to implement these changes?
It would take approximately 2 to 3 years to plan, design, construct and install a reverse osmosis treatment system, however, it would not be economically feasible.

D. Estimate the capital cost *(Citation)*: $675,000 *(WDNR Form 3400-193 Chloride Variance Application)*

E. Estimate additional O & M cost *(Citation)*: $219,000 *(WDNR Form 3400-193 Chloride Variance Application)*

F. Estimate the impact of treatment on the effluent substance concentration, and include any citations:
The amount of chloride that could be removed from Denmark's surface water effluent discharge is dependent on what percentage of the effluent flow would be designed to be treated by a reverse osmosis treatment unit.

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

H. Is it technically and economically feasible for this permittee to modify the treatment process to reduce the level of the substance in the discharge? ☐ **Yes** ☒ **No** ☐ **Unknown**
Reverse osmosis (RO) treatment of the Village of Denmark WWTF effluent to meet the WQBEL is technically feasible. However, it is not economically feasible. See DNR Variance Application and screening tool for costs of RO. Use of RO at the WWTF was evaluated; the resulting total cost for sewer user rates was estimated to result in an average cost to households that would be 11.09% of the MHI. Lime softening treatment at the Village of Denmark WWTF to meet the WQBEL is technically feasible. However, it is not economically feasible. See DNR Chloride Variance Economic Eligibility Tool (Lime Softening) for costs of lime softening. Use of lime softening was evaluated; the resulting total cost for sewer user rates was estimated to result in an average cost to households that would be 2.16% of the MHI. Increases of these magnitudes would cause substantial and widespread adverse social and economic impacts in the area where the discharge is located.

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

J. If yes, what prevents this from being done? Include any citations.
The cost of adding RO to the existing WWTF's treatment train would cause substantial and widespread adverse social and economic impacts in the area where the discharge is located. Implementation of the SRMs in the proposed permit is preferable economically and environmentally to installing RO.

K. List any alternatives to current practices that have been considered, and why they have been rejected as a course of action, including any citations:
Use of reverse osmosis and municipal lime softening at the WWTF were evaluated; however, these are not economically feasible alternatives.

Section IX: Compliance with Water Quality Standards

A. Describe all activities that have been, and are being, conducted to reduce the discharge of the substance into the receiving stream. This may include existing treatments and controls, consumer education, promising centralized or remote treatment technologies, planned research, etc. Include any citations.
The Village changed its water supply from well water to water supplied by the Brown County Water Authority, which originates from a surface water source and has a very low hardness level. The result is that its residential users no longer need to soften their water. Chloride contributions from its residential users have been greatly reduced. Source reduction measures have been implemented at Salm Partners, Denmark's primary source of chlorides to the sanitary sewer. Effluent samples are collected every day from both of Salm Partners' industrial facilities via a 24-hour flow composite sampler contained in a locked building that is only accessible by the Village of Denmark. The Wisconsin DNR has taken enforcement actions against the Village of Denmark and Salm Partners during the previous permit term. Results from the enforcement actions required Salm Partners to implement chloride reduction measures and employee education. Salm Partners was submitting monthly update reports to the Department for over a year. Salm Partners has made numerous improvements at its facilities in an effort to reduce overall chloride loading. See also, the Denmark Chloride Source Reduction Measures Plan, dated January 15, 2025; revised April 30, 2025.

B. Describe all actions that the permit requires the permittee to complete during the variance period to ensure reasonable progress towards attainment of the water quality standard. Include any citations.
Continue to work with Salm Partners and share the sampling data that is collected. Change the sewer use ordinance to lower the concentration limit that triggers a surcharge fee and implement a local limit for chlorides following a local limits study. Inspect and repair collection system manholes to minimize street runoff of water with road salt brine from entering the collection system. If Salm Partners continues to be the source of chloride effluent exceedances for the Village of Denmark Wastewater Treatment Facility, the Department will utilize its authority to take stepped enforcement actions. See also, the Denmark Chloride Source Reduction Measures Plan, dated January 15, 2025; revised April 30, 2025.

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

A. Date of previous submittal: July 31, 2018 **Date of EPA Approval:** August 13, 2018

B. Previous Permit #: WI-0021741-08-0 **Previous WQSTS #:** (EPA USE ONLY)

C. Effluent substance concentration: 1-day P99 = 1,447 mg/L; 4-day P99 = 1,066 mg/L **Variance Limit:** 1,200 mg/L (daily max.) and 980 mg/L (weekly avg.)

D. Target Value(s): 1,080 mg/L (daily max.) and 880 mg/L (weekly avg.) **Achieved?** ☐ Yes ☒ No ☐ Partial

E. For renewals, list previous steps that were to be completed. Show whether these steps have been

Condition of Previous Variance	Compliance
A. 1. Continue to educate homeowners on the impact of chloride from residential softeners, discuss options	☒ Yes ☐ No

available for increasing softener salt efficiency, and seek reduction.	
A. 2. Mandate through ordinance participation in a residential and commercial softener tune-up program involving qualified servicing to ensure proper control settings and adjustments.	☒ **Yes** ☐ **No**
B. 1. Mandate through ordinance a chloride limit on industrial sources, so that the water quality based limits at the municipal treatment facility are not exceeded.	☐ **Yes** ☒ **No**
B. 2. Work with industrial and commercial contributors to prevent increases in the amount of chloride discharged and seek reductions from those sources.	☒ **Yes** ☐ **No**
B. 3. Inspect 23 manholes in the collection system each year and conduct repairs. All manholes will be inspected every 15 years.	☒ **Yes** ☐ **No**

Denmark Final Chloride Report
Pollutant Minimization Plan (PMP) and Planned Source Reduction Measures (SRMs)
January 15, 2025
Revised April 30, 2025

SRM/PMP Activities	1st Year	2nd Year	3rd Year	4th Year	5th Year
1. SRMs Targeting Water Softeners					
a. Educate softener owners of the impact of chlorides on water quality by sending out informational brochures to customers about the CBCWA water supply and its associated hardness, the need to increase softener efficiency and the reduced frequency of regeneration, reducing the use of softened water, the need for softening in general, and posting this information on the Village's website.	x	x	x	x	x
b. Evaluate the feasibility of a residential softener tune-up, replacement, and removal program sponsored by Salm Partners. If the residential softener program is feasible, start implementing in Year 3. If not, document the reasons in the Annual Report.	x		x		
2. Sewer Use Ordinance					
a. Conduct a local limits study to determine an effective chloride limit and recalculated surcharge fee for industrial sources, necessary to maintain compliance with the Village of Denmark's WPDES Permit chloride limits.		x	x		
b. Implement (through Ordinance) a new chloride limit and surcharge fee for industrial sources based on conclusions of the local limits study.				x	
3. Infrastructure Improvements					
a. Inspect at least twenty-three (23) manholes annually. Repair or replacement manholes as needed based on findings.	x	x	x	x	x
b. Annual televising and inspecting of sanitary sewer piping, manholes, and lateral connections. Schedule repairs or replacement as needed based on findings.	x	x	x	x	x
4. Municipal Road Maintenance Actions					
a. Conduct an annual meeting with the Village of Denmark's snow removal contractor to discuss Best Management Practices for salt use minimization during the winter months.	x	x	x	x	x
b. Research training opportunities for safe salting practices. If salt applicators for the Village are already trained in safe salting practices, document this is the Annual Reports. If not, encourage the implementation of annual trainings, such as those through the WI Salt Wise program, for salt applicators to incorporate those practices into standard operating procedures and remind them annually.		x	x	x	x
5. Industrial Contributors (Salm Partners) SRMs					
a. Conduct annual meetings with Salm Partners and annual inspections at both Salm facilities. Document meeting minutes, inspection findings, new/additional sources of chlorides identified, actions taken to address new/additional sources of chlorides discharged, and where appropriate, the development of plans to implement additional SRM's at Salm Partners. Discuss the results of the annual meetings and inspections in the Annual Chloride Reports.	x	x	x	x	x
b. Train staff at both the Woodrow and Hager Road facilities on the makeup process, to reduce overall salt use and prevent over-saturation of the brine solution. Document the number and/or percentage of employees that have been trained with each Annual Report.	x	x	x	x	x
c. Implement engineering enhancements to the brine system to minimize brine loss to the sanitary sewer system.	x				
d. Conduct drain cover upgrades to prevent product loss and the associated chloride discharge.	x				
e. Implement closed-loop glycol chilling systems on line QX5 at the Woodrow facility to reduce softened water requirements.		x			
f. Implement closed-loop glycol chilling systems on line QX1 at the Woodrow facility to reduce softened water requirements.			x		
g. Investigate avenues for brine re-use and other brine disposal activities aimed at reducing chloride loadings to the Denmark WWTF. Document findings with each Annual Report.	x	x	x	x	x