

Permit Fact Sheet

General Information

Permit Number:	WI-0045942-07-0
Permittee Name:	UWM SCHOOL OF FRESHWATER SCIENCES (Formerly Great Lakes Research Facility)
Address:	600 E Greenfield Ave
City/State/Zip:	Milwaukee WI 53204
Discharge Location:	600 E Greenfield Ave and the KK River
Receiving Water:	Kinnickinnic River (Inner Harbor) (Kinnickinnic River Watershed – Milwaukee River Basin) In Milwaukee County
StreamFlow (Q _{7,10}):	90 cfs
Stream Classification:	Warm water sport fish community, non-public water supply

Facility Description

The permittee operates a fishery research facility where growth, behavioral, and physiological studies are performed. The source of wastewater being discharged from the facility is comprised of fish culture water and water used to clean the tanks.

Outfall 001 discharges from the fisheries research lab. Outfall 002 discharges from the aquaculture research lab. Outfall 003 is a newly constructed fisheries research laboratory however at this time only using a recirculated water system with no discharge to surface waters. Outfall 004 is used for reporting of the combined effluent from Outfall 001, 002 and 003 for those parameters that require combined totals and/or testing of combined samples. Flow from each lab is estimated using a calculation of the total amount of water dechlorinated, the amount of dechlorinated water used outside of the permitted labs, and estimates kept by each lab. The total flow is not measured but is estimated from each lab and then added and reported at Outfall 004. The flow from all three labs is combined in the storm sewer prior to discharge at the end of Greenfield Ave. The laboratories share dechlorination and water temperature controls, the water may be heated or chilled to maintain proper temperature for the test species.

Incoming tap water is dechlorinated with sulfite prior to being put into the fish tanks. A variety of chemicals may be added to fish tanks for cleaning, disinfection, and for therapeutic treatment of fish diseases. The concentrations of chemicals used for the treatment of fish diseases and parasites are strictly regulated to prevent short term and long-term injury to the fish. When fish are moved between tanks in the laboratory, the emptied tanks are cleaned with Liquinox (a phosphorus free soap) or Virkon-Aquatic (a veterinary disinfectant) and de-chlorinated water and rinsed to remove all traces of detergent before refilling.

Perox-Aid is also used as an external microbiocide. This is a 35% hydrogen peroxide solution. The calculated 24-hour discharge concentration is 2 mg/l if there were no reaction of the peroxide. Since there is no good method for monitoring residual and no residual byproducts of concern, the permit only requires reporting of usage.

Formalin and oxytetracycline are used for fish health. Limits are placed on the discharge of these chemicals to preclude aquatic toxicity in the combined discharge. Approval for any other additives is to be requested prior to use. Additional monitoring may be required as a condition of approval.

Under normal conditions each tank will have its water replenished at a maximum rate of 50-75 liters/min., resulting in turnover rates of 8-72 tank volumes per day depending on the species. Discharges from all of the tanks is routed into trench drains in the laboratories. The trench drain system is designed to carry the maximum expected discharge into the storm sewer system. The laboratories are also equipped with a hookup to the sanitary sewer for the discharge of any wastewater not suitable for discharge to surface water. For example, when fish must be treated with an additive that cannot be directly discharged to surface water, the discharge will be directed to the sanitary sewer. During this permit term, the facility plans to meet TMDL mass limits by unitizing recirculating systems and bubble bead filters.

Substantial Compliance Determination

Enforcement During Last Permit: No formal enforcement was taken during the last permit term.

After a desk top review of all discharge monitoring reports, compliance schedule items and a facility inspection on March 29, 2023, conducted by DNR Wastewater Engineer, Jacob Wedesky, this facility has been found to be in substantial compliance with their current permit.

Sample Point Designation		
Sample Point Number	Discharge Flow, Units, and Averaging Period	Sample Point Location, WasteType/sample Contents and Treatment Description (as applicable)
001	0.245 MGD (2021)	Effluent: Wastewater from the Fisheries Research Laboratory (located in Room 173) discharged to the combined effluent pipe. Representative grab sample taken from the sample manhole immediately after leaving the laboratory prior to the combined effluent.
002	0.135 MGD (2021)	Effluent: Wastewater from the Aquaculture Laboratory (located in Room 174) discharged to the combined effluent pipe. Representative grab sample taken from the sump in the discharge trench prior to leaving Room 174.
003	N/A – No surface water discharge.	Effluent: Wastewater from the Aquaculture Training Laboratory (located in Room 178) discharged to the combined effluent pipe. Representative grab sample taken in the sample manhole immediately outside the laboratory prior to the combined effluent.
004	0.388 MGD (2021)	Combined Effluent: Combined effluent calculation from all outfalls. WET test shall be a proportional 3-Hr Composite from sample point 001, 002 and 003.

1 Surface Water - Monitoring and Limitations

Sample Point Number: 001- Fisheries Research Laboratory; 002- Aquaculture Research Lab, and 003- Aquaculture Training Lab

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Monthly	Calculated	See Calculated Flow.

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
BOD5, Total	Daily Max	20 mg/L	Monthly	Grab	
BOD5, Total	Monthly Avg	20 mg/L	Monthly	Grab	
Suspended Solids, Total	Daily Max	12 mg/L	Monthly	Grab	Limit effective April - November.
Suspended Solids, Total	Daily Max	20 mg/L	Monthly	Grab	Limit effective December - March.
Suspended Solids, Total	Monthly Avg	12 mg/L	Monthly	Grab	
Suspended Solids, Total		lbs/day	Monthly	Calculated	See mass limitations in Outfall 004.
pH Field	Daily Min	6.0 su	Monthly	Grab	
pH Field	Daily Max	9.0 su	Monthly	Grab	
Phosphorus, Total	12-month Rolling Avg	1.0 mg/L	Monthly	Grab	
Phosphorus, Total		lbs/day	Monthly	Calculated	See phosphorus section and schedule.
PFOS		ng/L	1/ 2 Months	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule.
PFOA		ng/L	1/ 2 Months	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule.

Changes from Previous Permit

Changes highlighted in table.

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

Explanation of Limits and Monitoring Requirements

Water Quality Based Limits

Total Suspended Solids: Daily maximum and monthly average TSS limits from the current permit are continued. Additional concentration and mass limitations have been added based on the Milwaukee River TMDL (see below). The final TSS TMDL limits are included in the WQBEL and the proposed permit. The TMDL concentration and mass limitations for some months of the year are more restrictive (see WQBEL Part 5). The permit includes the limitation that is the most restrictive for each month. The WQBEL memo includes all TSS limitations, and a chart is included in the permit for informational purposes. The effluent data suggests that the permittee is able to immediately meet the required TSS limits therefore are effective upon permit reissuance. These limits are effective on the combined wastewater

discharge. The permittee is not able to sample the discharge after the effluent from each lab is combined in the storm sewer. Therefore, the permittee will calculate mass at each lab and then report the total combined mass at Outfall 004 for regulatory purposes. See Outfall 004.

Total Phosphorus: The Phosphorus Rules which became effective 12/1/2010 and detailed in NR 102 – Water Quality Standards for Wisconsin Surface Waters and NR 217 – Effluent Standards and Limitations for Phosphorus. Wisconsin Administrative Code, ch. NR 217, requires industrial facilities that discharge greater than 60 pounds of Total Phosphorus per month to comply with a 12-month average limit of 1.0 mg/L, or an approved alternative concentration limit. Available data demonstrates that the total monthly average phosphorus loading is greater than 60 lbs/month, and therefore a technology-based limit is included in accordance to s. NR 217.04(1)(a)2, Wis. Adm. Code. The 1.0 mg/L concentration limit applies as a 12-month rolling average and functions as an interim limit for the phosphorus compliance schedule.

TMDL (Total Maximum Daily Load) Derived Limits: Waste load allocations specified in TMDLs are expressed as WQBELs (water quality based effluent limits). The waste load allocated-derived WQBELs are consistent with the assumptions and requirements of the approved third party (Milwaukee Metropolitan Sewerage District) TMDL developed for the Milwaukee, Menomonee, and Kinnickinnic River watersheds, and approved by the EPA in March 2018. The final TMDL limits are included in both the WQBEL and permit surface water section.

The permittee will calculate mass for total suspended solids and total phosphorus for each lab on the same day monitoring for these parameters is conducted. The permittee will then add the total mass discharged from Outfalls 001, 002 and 003 and report the total mass discharged under Outfall 004 where compliance with mass limits will be determined.

Limits have changed due to a decrease in the maximum annual average flow during the previous permit term, resulting in a daily mass max limit needed for June and monthly average mass limit needed for January. See WQBEL Limit Memo for more detailed description.

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

Therefore, monthly monitoring is included. The initial determination of need sampling shall be conducted for up to two years in order to determine if the permitted discharge has the reasonable potential to cause or contribute to an exceedance of the PFOS or PFOA standards under s. NR 102.04(8)(d)1, Wis. Adm. Code.

Whole effluent toxicity (WET): The permittee shall obtain a representative sample from each lab and then combine these samples proportionate to flow from each lab to obtain a combined representative sample. The tests should be reported at Outfall 004 (effluents from Outfalls 001, 002, and 003) combined proportionally based on estimated flow volumes at the time of testing. The permit should require that the outfalls in use at the time of testing and the volume discharged from each outfall (used to determine the % effluent mixture for testing) be recorded on the WET Test Report Form for each test.

WET tests are preferred to be done during periods that coincide with additive use and that additives in use at the time of testing should be recorded on the WET Test Report Form.

Sample Point Number: 004- Combined Effluent

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Flow Rate		MGD	Monthly	Calculated	
Suspended Solids, Total	Daily Max	98.22 lbs/day	Monthly	Calculated	Limit effective in January.
Suspended Solids, Total	Daily Max	75.9 lbs/day	Monthly	Calculated	Limit effective in February.
Suspended Solids, Total	Daily Max	61.38 lbs/day	Monthly	Calculated	Limit effective in March.
Suspended Solids, Total	Daily Max	39.38 lbs/day	Monthly	Calculated	Limit effective in June.
Suspended Solids, Total	Daily Max	61.74 lbs/day	Monthly	Calculated	Limit effective in December.
Suspended Solids, Total	Monthly Avg	41.09 lbs/day	Monthly	Calculated	Limit effective in January.
Phosphorus, Total	Monthly Avg	1.39 lbs/day	Monthly	Calculated	Limit effective starting January 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.51 lbs/day	Monthly	Calculated	Limit effective starting February 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.49 lbs/day	Monthly	Calculated	Limit effective starting March 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.46 lbs/day	Monthly	Calculated	Limit effective starting April 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.53 lbs/day	Monthly	Calculated	Limit effective starting May 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.71 lbs/day	Monthly	Calculated	Limit effective starting June 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.55 lbs/day	Monthly	Calculated	Limit effective starting July 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.61 lbs/day	Monthly	Calculated	Limit effective starting August 2028 and continues annually.

Monitoring Requirements and Limitations					
Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Phosphorus, Total	Monthly Avg	1.26 lbs/day	Monthly	Calculated	Limit effective starting September 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.05 lbs/day	Monthly	Calculated	Limit effective starting October 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.03 lbs/day	Monthly	Calculated	Limit effective starting November 2028 and continues annually.
Phosphorus, Total	Monthly Avg	1.14 lbs/day	Monthly	Calculated	Limit effective starting December 2028 and continues annually.
Phosphorus, Total		lbs/day	Monthly	Calculated	See TMDL section for final total phosphorus mass limitations effective January 1, 2028.
Acute WET		TUa	See Listed Qtr(s)	3-Hr Comp	See WET section.

Changes from Previous Permit

TSS: Monthly average limit in January based on the Total Maximum Daily Load (TMDL) for the Milwaukee River Basin was added.

Total Phosphorus: Final limits from the Total Maximum Daily Load (TMDL) for the Milwaukee River Basin added with a schedule to become effective January 1, 2028.

Explanation of Limits and Monitoring Requirements

Water Quality Based Limits and WET Requirements

Refer to the “Water Quality-Based Effluent Limitations for the School of Freshwater Sciences WPDES Permit No. WI-0045942-07 Plant”, prepared by Nicole Krueger, dated September 14, 2023, and used for this reissuance.

Total Phosphorus and Total Suspended Solids: The permittee shall calculate the total mass TP and TSS from each lab and then report the total from all three labs under Outfall 004. The reported total mass TP and TSS reported at Outfall 004 will be used for permit compliance. The permittee may choose to take additional phosphorus data during portions of the proposed permit term to ensure that they have accurate representation of the discharge from each lab. The permittee must ensure the flow data is accurate and representative along with the phosphorus data. Mass is calculated on the same day TP and TSS sampling occurs at Outfalls 001, 002 and 003. Sampling for TP and TSS at 001, 002, and 003 must occur on the same day and the calculated total reported at Outfall 004 on the same day sampling occurs.

A compliance schedule is in the proposed permit to meet final TMDL TP limits by January 2028.

TMDL (Total Maximum Daily Load) Derived Limits: Waste load allocations specified in TMDLs are expressed as WQBELs (water quality based effluent limits). The waste load allocated-derived WQBELs are consistent with the assumptions and requirements of the approved third party (Milwaukee Metropolitan Sewerage District) TMDL developed

for the Milwaukee, Menomonee, and Kinnickinnic River watersheds, and approved by the EPA in March 2018. The final TMDL limits are included in both the WQBEL and permit surface water section.

The permittee will calculate mass for total suspended solids and total phosphorus for each lab on the same day monitoring for these parameters is conducted. The permittee will then add the total mass discharged from Outfalls 001, 002 and 003 and report the total mass discharged under Outfall 004 where compliance with mass limits will be determined.

Limits have changed due to a decrease in the maximum annual average flow during the previous permit term, resulting in a daily mass max limit needed for June and monthly average mass limit needed for January. See WQBEL Limit Memo for more detailed description.

Whole effluent toxicity (WET): Whole effluent toxicity (WET) testing requirements are determined in accordance with ss. NR 106.08 and NR 106.09 Wis. Adm. Code, as revised August 2016. (See the current version of the Whole Effluent Toxicity Program Guidance Document and checklist and WET information, guidance and test methods at <http://dnr.wi.gov/topic/wastewater/wet.html>)

WET tests are preferred to be done during periods that coincide with additive use and that additives in use at the time of testing should be recorded on the WET Test Report Form. The permittee will by hand combine the samples taken from each outfall in proportion to the flow from each lab. Based on the use of additives only Acute testing, 2 x permit term, has been included in the proposed permit. Future permit terms may include further reduction of WET testing based on results during the proposed permit term and additive use.

2 Schedules

2.1 PFOS/PFOA Minimization Plan Determination of Need

Required Action	Due Date
<p>Report on Effluent Discharge: Submit a report on effluent PFOS and PFOA concentrations and include an analysis of trends in monthly and annual average PFOS and PFOA concentrations. This analysis should also include a comparison to the applicable narrative standard in s. NR 102.04(8)(d), Wis. Adm. Code.</p> <p>This report shall include all additional PFOS and PFOA data that may be collected including any influent, intake, in-plant, collection system sampling, and blank sample results.</p>	12/31/2024
<p>Report on Effluent Discharge and Evaluation of Need: Submit a final report on effluent PFOS and PFOA concentrations and include an analysis of trends in monthly and annual average PFOS and PFOA concentrations of data collected over the last 24 months. The report shall also provide a comparison on the likelihood of the facility needing to develop a PFOS/PFOA minimization plan.</p> <p>This report shall include all additional PFOS and PFOA data that may be collected including any influent, intake, in-plant, collection system sampling, and blank sample results.</p> <p>The permittee shall also submit a request to the department to evaluate the need for a PFOS/PFOA minimization plan.</p> <p>If the Department determines a PFOS/PFOA minimization plan is needed based on a reasonable potential evaluation, the permittee will be required to develop a minimization plan for Department approval no later than 90 days after written notification was sent from the Department. The Department will modify or revoke and reissue the permit to include PFOS/PFOA minimization plan reporting requirements along with a schedule of compliance to meet WQBELs. Effluent monitoring of PFOS and PFOA shall continue as specified in the permit until the modified permit is issued.</p>	12/31/2025

<p>If, however, the Department determines there is no reasonable potential for the facility to discharge PFOS or PFOA above the narrative standard in s. NR 102.04(8)(d), Wis. Adm. Code, no further action is required and effluent monitoring of PFOS and PFOA shall continue as specified in the permit.</p>	
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Explanation of Schedule

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

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

2.2 Total Maximum Daily Load (TMDL) - Based Phosphorus Effluent Limitations

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

Required Action	Due Date
<p>Annual Phosphorus Progress Report: Submit an annual progress report that shall discuss which phosphorus pollutant minimization measures have been implemented during the prior calendar year. The report shall include an analysis of trends in monthly average, annual total influent and effluent phosphorus concentrations and mass loading with conclusions regarding compliance.</p> <p>The first annual phosphorus progress report is to be submitted by the Date Due.</p>	12/31/2024
<p>Annual Phosphorus Progress Report #2: Submit a phosphorus progress report as defined above for the previous calendar year.</p>	12/31/2025
<p>Annual Phosphorus Progress Report #3: Submit a phosphorus progress report as defined above for the previous calendar year.</p>	12/31/2026
<p>Final Phosphorus Report: Submit a final report documenting the success in meeting the final TMDL-based phosphorus limitations specified in permit section 1.2.4.</p>	06/30/2027
<p>Achieve Compliance: The permittee shall achieve compliance with the final Phosphorus limitations, expressed as monthly average mass limits according to the Milwaukee River Basin TMDL. See permit section 1.2.4.5 Total Maximum Daily Load (TMDL) Limitations for more information.</p>	12/31/2027

Explanation of Schedule

Subsection NR 217.17, Wis. Adm. Code, allows the department to provide a schedule of compliance for water quality-based phosphorus limits where the permittee cannot immediately achieve compliance. This compliance schedule requires the permittee to comply with the final water quality-based phosphorus limits by January 1, 2028. This compliance schedule is being modified in the reissued permit in response to the Final Compliance Alternatives Plan, submitted by the permittee 12/28/2022, where it was determined the final phosphorus WQBEL would be met through flow reductions via recirculating systems. The length of the compliance schedule will remain the same to allow the permittee an appropriate amount of time to implement these changes. The compliance plan does not involve adaptive management or water quality trading.

Attachments: Water Quality-Based Effluent Limitations for the School of Freshwater Sciences, WPDES Permit No. WI-0045942-07 07, prepared by Nicole Krueger on September 14, 2023, corrected on November 8, 2023.

Expiration Date:

December 31, 2028

Justification Of Any Waivers From Permit Application Requirements

None requested.

Prepared By: Melanie Burns, Wastewater Specialist

Date: October 30, 2023

Date (post fact-check): November 10, 2023

Date (post public notice):

CORRESPONDENCE/MEMORANDUM

DATE: 09/14/2023 – updated 11/08/2023 for phosphorus limit correction

TO: Melanie Burns – SER

FROM: Nicole Krueger – SER *Nicole Krueger*

SUBJECT: Water Quality-Based Effluent Limitations for the School of Freshwater Sciences
 WPDES Permit No. WI-0045942-07

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 School of Freshwater Sciences in Milwaukee County. This industrial facility discharges to the Kinnickinnic River, located in the Kinnickinnic River Watershed in the Milwaukee River Basin. This discharge is included in the Milwaukee River TMDL as approved by EPA. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfalls 001, 002, 003, and 004.

Outfalls 001 (Fisheries Research Laboratory), 002 (Aquaculture Research Lab), 003 (Aquaculture Training Lab)

Parameter	Daily Maximum	Daily Minimum	Monthly Average	12-month Rolling Average	Footnotes
Flow Rate					1,2
BOD ₅	20 mg/L		20 mg/L		1,3
TSS					
Dec – March	20 mg/L		12 mg/L		
April – Nov	12 mg/L		12 mg/L		
pH	9.0 s.u.	6.0 s.u.			1
Phosphorus				1.0 mg/L	4
PFOS and PFOA					5

Outfall 004 (Combined Effluent from Outfalls 001, 002, and 003)

Parameter	Daily Maximum	Monthly Average	Footnotes
Flow Rate			1,2
TSS			6
January	98.22 lbs/day	41.09 lbs/day	
February	75.90 lbs/day		
March	61.38 lbs/day		
June	39.38 lbs/day		
December	61.74 lbs/day		
Phosphorus			6
Acute WET			7,8

Footnotes:

1. No changes from the current permit.
2. Monitoring only.

3. Limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code, are included in bold.
4. The monthly average phosphorus limit is a technology-based limit which also functions as an interim limit for the phosphorus compliance schedule.
5. Monitoring is required in accordance with s. NR 106.98(2), Wis. Adm. Code.
6. The TSS and phosphorus mass limits are based on the Total Maximum Daily Load (TMDL) for the Milwaukee River Basin to address phosphorus water quality impairments within the TMDL area. The TMDL was approved by EPA in March 2018. The phosphorus limits are shown below:

Month	Monthly Average TP Effluent Limit (lbs/day)
January	1.39
February	1.51
March	1.49
April	1.46
May	1.53
June	1.71
July	1.55
August	1.61
September	1.26
October	1.05
November	1.03
December	1.14

7. 2x/permit term acute WET testing is recommended.
8. Sampling WET concurrently with any chemical-specific toxic substances and additive usage 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).

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

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

PREPARED BY: Nicole Krueger, Water Resources Engineer – SER

E-cc: Jacob Wedesky, Wastewater Engineer – SER
 Bryan Hartsook, Regional Wastewater Supervisor – SER
 Diane Figiel, Water Resources Engineer – WY/3
 Nathaniel Willis, Wastewater Engineer – WY/3

Attachment #1
**Water Quality-Based Effluent Limitations for
School of Freshwater Sciences**

WPDES Permit No. WI-0045942-07

Prepared by: Nicole Krueger

PART 1 – BACKGROUND INFORMATION

Facility Description

The School of Freshwater Sciences (formally called Great Lakes Water Institute) operates a fishery research facility where growth, behavioral, and physiological studies are performed. The source of wastewater being discharged from the facility is comprised of fish culture water and water used to clean the tanks.

Outfall 001 discharges from the fisheries research lab. Outfall 002 discharges from the aquaculture research lab. Outfall 003 has not been utilized yet but will discharge from a newly constructed aquaculture training research lab. Outfall 004 is used for reporting of the combined effluent from Outfall 001, 002 and 003. Flow from each lab is estimated using a calculation of the total amount of water dechlorinated, the amount of dechlorinated water used outside of the permitted labs, and estimates kept by each lab. The total flow is not measured but the estimate from each lab is summed and reported at Outfall 004. The flow from all three labs is combined in the storm sewer prior to discharge at the end of Greenfield Ave.

Incoming tap water is dechlorinated with sulfite prior to being pumped into the fish tanks. A variety of additives are used in the fish tanks for cleaning, disinfection, and for therapeutic treatment of fish diseases. The concentrations of chemicals used for the treatment of fish diseases and parasites are strictly regulated to prevent short term and long term injury to the fish. When fish are moved between tanks in the laboratory, the emptied tanks are cleaned and rinsed to remove all traces of detergent before refilling.

Under normal conditions each tank will have its water replenished at a maximum rate of 50-75 liters/min., resulting in turnover rates of 8-72 tank volumes per day depending on the species. Discharges from all of the tanks is routed into trench drains in the laboratories. The laboratories are also equipped with a hookup to the sanitary sewer for the discharge of any wastewater not suitable for discharge to surface water. School of Freshwater Sciences has plans to reduce their effluent flow rate to meet the TMDL mass limits by utilizing recirculating systems and bubble bead filters.

Attachment #2 is a map of the area showing the approximate location of Outfalls 001, 002, and 003.

Existing Permit Limitations

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

Outfalls 001 (Fisheries Research Laboratory), 002 (Aquaculture Research Lab), 003 (Aquaculture Training Lab)

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Monthly Average	12-month Rolling Average	Footnotes
Flow Rate					1
BOD ₅	20 mg/L		20 mg/L		2,3
TSS					
Dec – March	20 mg/L		12 mg/L		
April – Nov	12 mg/L		12 mg/L		
pH	9.0 s.u.	6.0 s.u.			2
Phosphorus				1.0 mg/L	4

Outfall 004 (Combined Effluent from Outfalls 001, 002, and 003)

Parameter	Daily Maximum	Footnotes
Flow Rate		1
TSS		
January	98.22 lbs/day	
February	75.90 lbs/day	
March	61.38 lbs/day	
December	61.74 lbs/day	
Phosphorus		5,6
Acute WET		7

Footnotes:

1. Monitoring only.
2. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC) and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
3. Limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code, are included in bold.
4. This technology-based effluent limit also serves as an interim limit.
5. The phosphorus TMDL mass limits are shown below:

Month	Monthly Average TP Effluent Limit (lbs/day)
January	1.39
February	1.51
March	1.49
April	1.46
May	1.53
June	1.71
July	1.55
August	1.61
September	1.26
October	1.05
November	1.03

6. A compliance schedule is in the current permit to meet the final TMDL limits by January 2028.
7. Acute WET testing is required twice during the permit term.

Receiving Water Information

- Name: Kinnickinnic River
- Waterbody Identification Code (WBIC): 15100
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply. Note: Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q₁₀ and 7-Q₂ values are estimates where Jones Island NCCW discharge is located from modeling analyses which was submitted by Milwaukee Metropolitan Sewerage District, approximately 3,000 feet upstream of where Outfall 004 is located.
 - 7-Q₁₀ = 90 cfs (cubic feet per second)
 - 7-Q₂ = 90 cfs (7-Q₁₀ data used in absence of specific estimate)
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: 25%.
- Source of background concentration data: Background data from the Kinnickinnic River is used for this evaluation. The numerical values are shown in the tables below. If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations.
- Multiple dischargers: There are several other dischargers to the Kinnickinnic River, however they are not in the immediate vicinity and the mixing zones do not overlap. Therefore, the other dischargers do not impact this evaluation.
- Impaired water status: The Kinnickinnic River is 303(d) listed as impaired for chloride, total phosphorus, PCBs, E. coli, fecal coliform, and unspecified metals.

Effluent Information

- Flow rate(s):
 - Outfall 001:
 - Maximum annual average = 0.25 MGD (Million Gallons per Day)
 - Actual average = 0.21 MGD (01/01/2019 – 06/30/2023)
 - Outfall 002:
 - Maximum annual average = 0.16 MGD
 - Actual average = 0.087 MGD (01/01/2019 – 06/30/2023)
 - Outfall 003:
 - Actual average = 0 MGD
 - Outfall 004 (combined flow from Outfalls 001, 002, and 003):
 - Maximum annual average = 0.39 MGD
 - Actual average = 0.30 MGD (01/01/2019 – 06/30/2023)
- Hardness:
 - Outfall 001: 146 mg/L as CaCO₃

Outfall 002: 138 mg/L as CaCO₃

The effluent hardness data is from 06/20/2023 – 06/29/2023 from the current 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: City of Milwaukee municipal supply.
- Additives: There are several additives used for Outfall 001 which are summarized in the additives section of this memo.
- Effluent characterization: This facility is categorized as a secondary industry, so the permit application required effluent sampling for chloride, nitrogen, sulfate 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.

The following table presents the average concentrations and loadings at Outfalls 001, 002, and 004 from 01/01/2019 – 06/30/2023 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6), Wis. Adm. Code:

Parameter Averages with Limits

	001 Average Measurement	002 Average Measurement	004 Average Mass Discharged
BOD ₅	2.18 mg/L*	0.84 mg/L*	
TSS	1.23 mg/L*	0.53 mg/L*	2.39 lbs/day
pH field	7.58 s.u.	7.72 s.u.	
Phosphorus	0.61 mg/L	0.60 mg/L	1.49 lbs/day

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

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

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

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

Acute Limits based on 1-Q₁₀

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

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

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

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-Q₁₀ method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is not the case for the School of Freshwater Sciences and the limits are set based on two times the acute toxicity criteria.

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 = 72 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	ATC	MEAN BACK-GRD.	MAX. EFFL. LIMIT*	1/5 OF EFFL. LIMIT	001 MEAN EFFL. CONC.	002 MEAN EFFL. CONC.
Chloride (mg/L)	757	79	1514	303	17.1	16.3
Sulfate**	612		612	122	34.6	34.5

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

** The limit for this substance is based on a secondary value. Acute limits are set equal to the secondary value rather than two times or using the 1-Q₁₀ s. NR 106.06(3)(b)2 and s. NR 105.05(2)(f)6, Wis. Adm. Code.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 22.5 cfs (¼ of the 7-Q₁₀), as specified in s. NR 106.06(4)(c), Wis. Adm. Code

SUBSTANCE	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT 001	1/5 OF EFFL. LIMIT 001	001 MEAN EFFL. CONC.	WEEKLY AVE. LIMIT 002	1/5 OF EFFL. LIMIT 002	002 MEAN EFFL. CONC.
Chlorine	7.28		431	86.1		669	134	
Chloride (mg/L)	395	79	18776	3755	17.1	29115	5823	16.3
Sulfate*	407		23750640	4750128	34.6	36884577	7376915	34.5

* The limit for this substance is based on a secondary value.

Conclusions and Recommendations

Based on a comparison of the effluent data and calculated effluent limitations, effluent limitations are not required.

PFOS and PFOA – The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98(2), Wis. Adm. Code. Based on the known levels of PFOS/PFOA in the source water, PFOS and PFOA monitoring is recommended at a once every two months frequency.

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

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. Given the fact that the School of Freshwater Sciences does not currently have ammonia nitrogen limits, the need for limits is evaluated at this time. The available ammonia data from the current permit application is shown below:

Effluent Ammonia

Sample Date	001 Ammonia Nitrogen mg/L	002 Ammonia Nitrogen mg/L
06/20/2023	0.28	0.18
06/23/2023	0.45	0.18
06/26/2023	0.23	0.15
06/29/2023	0.26	0.20

These concentrations are low, and well below any of the calculated WQBELs based on the applicable acute and chronic ammonia criteria for the receiving water. Therefore, **no ammonia WQBELs are necessary. No ammonia limits or monitoring are recommended in the reissued permit.**

PART 4 – PHOSPHORUS

Technology-Based Effluent Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires industrial facilities that discharge greater than 60 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 School of Freshwater Sciences currently has a limit of 1.0 mg/L as a 12-month rolling average, this limit should be included in the reissued permit. This limit remains applicable unless a more stringent WQBEL is given.

Total Maximum Daily Load – Milwaukee River Basin

The total maximum daily load (TMDL) report addresses phosphorus water quality impairments within the Milwaukee River Basin and provides waste load allocations (WLAs) required to meet water quality standards. Effluent limitations based on these WLAs must be included in WPDES permits according to s. NR 217.16, Wis. Adm. Code.

Because the Milwaukee River Basin TMDL was developed to protect and improve the water quality of all streams and rivers within the basin, and the s. NR 217.13, Wis. Adm. Code, and the WQBEL has not taken effect for the School of Freshwater Sciences, the TMDL-based limits can be included in the WPDES permit in place of the s. NR 217.13, Wis. Adm. Code, WQBEL. The TMDL-based limits should

be expressed in a manner consistent with the wasteload allocation and assumptions of the TMDL.

The monthly average total phosphorus (TP) effluent limits in lbs/day are calculated based on the maximum monthly phosphorus WLA given in pounds per month as suggested in the TMDL report and implementation guidance. The monthly maximum TP WLAs for this facility are found in Appendix A of the Milwaukee River Basin TMDL report. **The monthly average limits shown in the table below are recommended in place of the s. NR 217.13, Wis. Adm. Code, limit, and should be expressed in pounds per day.** For informational purposes, the TMDL mass limits in the following table are equivalent to monthly average concentrations ranging 0.32 mg/L to 0.53 mg/L at the maximum annual flow of 0.39 MGD from the current permit term.

**Total Phosphorus Wasteload Allocations and Effluent Limits
Sum of WLAs for Outfalls 001 and 002**

Month	Monthly Maximum TP WLA ¹ (lbs/month)	Days Per Month	Monthly Average TP Effluent Limit ² (lbs/day)
Jan	43.18	31	1.39
Feb	42.18	28	1.51
Mar	46.28	31	1.49
Apr	43.84	30	1.46
May	47.42	31	1.53
Jun	51.24	30	1.71
Jul	48.06	31	1.55
Aug	49.80	31	1.61
Sep	37.72	30	1.26
Oct	32.64	31	1.05
Nov	31.04	30	1.03
Dec	35.48	31	1.14

Footnotes:

1- Milwaukee River Basin TMDL Appendix A. Monthly Total Suspended Solids Wasteload Allocation by Permitted Point Source. Table A.17 for the Kinnickinnic River

2- Monthly Average Total P effluent limit (lbs/day) = monthly Total P WLA (lbs/month) ÷ days per month

These limits are equivalent to the limits in the current permit which are scheduled to become effective by 01/01/2028. These monthly average limits should apply to Outfall 004 because it is the combination of Outfalls 001 and 002 and will also include Outfall 003 in the future.

Effluent Data

The following table summarizes effluent total phosphorus monitoring data from 01/24/2019 – 06/13/2023.

Total Phosphorus Effluent Data – Outfall 004

	Outfall 001 Phosphorus mg/L	Outfall 002 Phosphorus mg/L	Outfall 004 Phosphorus lbs/day
1-day P ₉₉	0.98	1.22	3.83
4-day P ₉₉	0.78	0.87	2.50
30-day P ₉₉	0.67	0.69	1.82

Attachment #1

	Outfall 001 Phosphorus mg/L	Outfall 002 Phosphorus mg/L	Outfall 004 Phosphorus lbs/day
Mean	0.61	0.60	1.49
Std	0.13	0.20	0.70
Sample size	54	54	54
Range	0.45 – 1.2	0.035 – 1.3	0 – 5.25

Interim Limit

An interim limit is required per s. NR 217.17, Wis. Adm. Code, when a compliance schedule is needed in the permit to meet the WQBEL. The interim limit should reflect a concentration that the facility is able to meet without investing in additional “temporary” treatment, but also should prevent backsliding from current conditions. Therefore, **it is recommended that the interim limit be set equal to 1.0 mg/L for permit reissuance along with requirements for optimization of phosphorus removal.** This interim limit is the same as the current technology-based limit, but the reissued permit will also include requirements for optimization of phosphorus removal.

PART 5 – TOTAL SUSPENDED SOLIDS

The TMDL also has wasteload allocations (WLAs) for total suspended solids (TSS). For an industrial discharge, the limits for TSS must be expressed as daily maximums and monthly averages. The current permit includes TMDL mass limits.

Monthly average and daily maximum mass effluent TMDL limit calculations are shown in the tables below. Consistent with Section 6.4.1 of the Milwaukee River TMDL Report, in cases where the equivalent TSS concentration limit is < 12 mg/L, the effluent limit will be expressed as a concentration of 12 mg/L, instead of a mass limit.

**Total Suspended Solids Wasteload Allocations
Sum of WLAs for Outfall 001 and 002**

Month	Monthly TSS WLA ¹ (lbs/month)	Days Per Month	Monthly Ave TSS Effluent Limit ² (lbs/day)	Equivalent Conc. Limit ³ at 0.39 MGD (mg/L)
Jan	1273.9	31	41.09	12.6
Feb	889.12	28	31.75	9.76
March	796.12	31	25.68	7.90
April	419.38	30	13.98	4.30
May	442.60	31	14.28	4.39
June	494.44	30	16.48	5.07
July	263.48	31	8.50	2.61
Aug	269.84	31	8.70	2.68
Sept	214.74	30	7.16	2.20
Oct	269.56	31	8.70	2.67
Nov	473.92	30	15.80	4.86
Dec	800.88	31	25.83	7.94

Month	Daily TSS WLA ⁴ (lbs/day)	Daily Max TSS Effluent Limit ⁵ (lbs/day)	Equivalent Conc. Limit ³ at 0.39 MGD (mg/L)
Jan	98.22	98.22	30.2
Feb	75.90	75.90	23.3
March	61.38	61.38	18.9
April	33.42	33.42	10.3
May	34.12	34.12	10.5
June	39.38	39.38	12.1
July	20.32	20.32	6.2
Aug	20.80	20.80	6.4
Sept	17.10	17.10	5.3
Oct	20.78	20.78	6.4
Nov	37.76	37.76	11.6
Dec	61.74	61.74	19.0

Footnotes:

Attachment #1

1- Milwaukee River TMDL Appendix A. Monthly Total Suspended Solids Wasteload Allocation by Permitted Point Source. Table A.19

2- Monthly average TSS effluent limit (lbs/day) = maximum monthly TSS WLA (lbs/month) ÷ days per month

3-Equivalent Concentration = mass / (maximum annual average flow * 8.34)

4- Milwaukee River TMDL Appendix A. Daily Total Suspended Solids Wasteload Allocation by Permitted Point Source. Table A.18

5- Daily maximum TSS effluent limit (lbs/day) = daily TSS WLA (lbs/day)

Because the monthly average TSS effluent limits for February – December and daily maximum TSS effluent limits for April – May and July – November equate to concentration limits of less than 12 mg/L, mass-based limits for TSS are not needed for permit reissuance. Instead, **it is recommended that the monthly average and daily maximum limit of 12 mg/L be included in the reissued permit for these months.**

Below is the summary table of limits recommended for TSS:

Effluent TMDL TSS Limits

Month	Daily Max TSS Effluent Limit (lbs/day)	Monthly Ave TSS Effluent Limit (lbs/day)	Daily Max TSS Effluent Limit (mg/L)	Monthly Ave TSS Effluent Limit (mg/L)
Jan	98.22	41.09		
Feb	75.90			12
Mar	61.38			12
Apr			12	12
May			12	12
Jun	39.38			12
Jul			12	12
Aug			12	12
Sep			12	12
Oct			12	12
Nov			12	12
Dec	61.74			12

The current permit has a daily maximum limit of 12 mg/L for April – November and a monthly average limit of 12 mg/L year-round. This varies slightly from the calculated recommendations in this evaluation because the maximum annual average flow has decreased during this permit term, resulting in a daily mass max limit needed for June and monthly average mass limit needed for January. The previous WQBEL memo used a flow rate of 0.52 MGD for Outfall 004 which resulted in lower equivalent concentrations (below 12 mg/L) for these months so the TMDL mass limits were not previously recommended.

The current concentration limits (daily max of 12 mg/L for April – November and monthly average of 12 mg/L year-round) should be continued in the reissued permit for antibacksliding purposes in s. NR 207.12, Wis. Adm. Code.

Limits based on a WLA should be given in a permit regardless of reasonable potential. The following table lists the statistics for TSS as both a concentration and a mass, reported from 01/24/2019 – 06/23/2023 for informational purposes.

Effluent TSS Data

	TSS (mg/L)	TSS (lbs/day)
1-day P ₉₉	6.19	9.27
4-day P ₉₉	3.64	5.08
30-day P ₉₉	1.94	2.49
Mean	1.23	1.44
Std	1.36	2.10
Sample Size	54	72
Range	0 – 8.6	0 – 7.5

The School of Freshwater Sciences is currently meeting the recommended limits and **no compliance schedule is needed.**

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.

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

The table below summarizes the maximum temperatures reported during monitoring from January 2006 – December 2018.

Effluent Temperature Data

Month	Representative Highest Monthly Effluent Temperature Outfall 001		Representative Highest Monthly Effluent Temperature Outfall 002		Calculated Effluent Limit	
	Weekly Maximum	Daily Maximum	Weekly Maximum	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(°F)	(°F)	(°F)
JAN	60	60	66	66	-	120
FEB	64	64	68	68	-	120
MAR	62	66	66	66	-	120
APR	66	66	66	68	-	120
MAY	63	69	66	68	-	120
JUN	63	70	66	70	-	120
JUL	64	65	66	66	-	120
AUG	68	68	68	74	-	120

Attachment #1						
SEP	66	66	71	71	-	120
OCT	63	63	71	71	-	120
NOV	60	60	62	62	-	120
DEC	60	60	64	64	-	120

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

Based on the available effluent data, **no effluent limits or monitoring are recommended for temperature.** The complete thermal table used for the limit calculation is in Attachment #3.

PART 7 – WHOLE EFFLUENT TOXICITY (WET)

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

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC₅₀ (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09(2)(b), Wis. Adm Code.
- Chronic testing is usually not recommended where the ratio of the 7-Q₁₀ to the effluent flow exceeds 100:1. For the School of Freshwater Sciences, that ratio is approximately 108:1. With this amount of dilution, there is believed to be little potential for chronic toxicity effects in the Kinnickinnic River associated with the discharge from the School of Freshwater Sciences, **so the need for chronic WET testing will not be considered further.**
- 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.

Attachment #1

- Shown below is a tabulation of all available WET data for combined Outfalls 001 and 002. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08(3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations.

WET Data History

Date Test Initiated	Acute Results LC ₅₀ %				Footnotes or Comments
	<i>C. dubia</i>	Fathead minnow	Pass or Fail?	Used in RP?	
11/13/2002	>100	>100	Pass	Yes	
02/25/2003	>100	>100	Pass	Yes	
08/28/2003	>100	>100	Pass	Yes	
09/03/2003	>100	>100	Pass	Yes	
09/21/2004	>100	>100	Pass	Yes	
11/07/2007	>100	>100	Pass	Yes	
03/25/2010	>100	>100	Pass	No	1
12/13/2011	>100	>100	Pass	Yes	
02/24/2020	>100	>100	Pass	Yes	
05/21/2023	>100	>100	Pass	No	2

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.
 2. The samples for this test were collected incorrectly and cannot be used in the RP determination.
- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. **WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.**

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

According to s. NR 106.08(6)(d), Wis. Adm. Code, TU_a and TU_c effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC₅₀, IC₂₅ or IC₅₀ ≥ 100%).

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

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
AMZ/IWC	Not Applicable. 0 Points
Historical Data	9 tests used to calculate RP. No tests failed. 0 Points
Effluent Variability	Little variability, no violations or upsets, no wastewater treatment. 10 Points
Receiving Water Classification	Warmwater sport fish 5 Points
Chemical-Specific Data	Reasonable potential for limits for no substances based on ATC; Chloride, chlorine, and ammonia detected. Additional Compounds of Concern: None. 3 Points
Additives	4 Biocides and 1 Water Quality Conditioner added. Permittee has proper P chemical SOPs in place: Not in use. 13 Points
Discharge Category	Fisheries and aquaculture research. 0 Points
Wastewater Treatment	No treatment. 10 Points
Downstream Impacts	No impacts known. 0 Points
Total Checklist Points:	41 Points
Recommended Monitoring Frequency (from Checklist):	1x yearly
Limit Required?	No
TRE Recommended? (from Checklist)	No

- A lack of wastewater treatment here does not increase the risk of toxicity since this is not a complex industrial discharge, therefore the 10 points added for effluent variability (given due to no treatment) and the 10 points added for no treatment by the WET Checklist are not relevant to this evaluation.

Attachment #1

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, 2/permit term acute WET tests are recommended in the reissued permit. WET testing should continue after the permit expiration date (until the permit is reissued).
- It is recommended that the School of Freshwater Sciences complete these WET tests while additives are in use to determine if any additives are causing toxicity issues. The permit should specify quarter(s) for testing when additive use is most likely to occur. The permit should state that WET tests are preferred to be done during periods that coincide with additive use and that additives in use at the time of testing should be recorded on the WET Test Report Form.
- The tests should be completed on Outfall 004 (effluents from Outfalls 001, 002, and 003) combined proportionally based on estimated flow volumes at the time of testing. The permit should require that the outfalls in use at the time of testing and the volume discharged from each outfall (used to determine the %effluent mixture for testing) be recorded on the WET Test Report Form for each test.

PART 8 – ADDITIVE REVIEW

Unlike the metals and toxic substances evaluated in Part 2, most additives have not undergone the amount of toxicity testing needed to calculate water quality criteria. Instead, in cases where the minimum data requirements necessary to calculate a WQC are not met, a secondary value can be used to regulate the substance, according to s. NR 105.05, Wis. Adm. Code. Whenever an additive is discharged directly into a surface water without receiving treatment or an additive is used in the treatment process and is not expected to be removed before discharge, a review of the additive is needed. Secondary values should be derived according to s. NR 105.05, Wis. Adm. Code. Guidance related to conducting an additive review can be found in *Water Quality Review Procedures for Additives* (2019) (<http://dnr.wi.gov/topic/wastewater/Guidance.html>).

Additive Parameters – Outfall 004 (combined 001 and 002)

Additive Name	Manufacturer	Purpose of Additive including where added	Intermittent or Continuous Feed	Frequency of Use		Maximum/Average Quantity Used	Concentration of Additive at the Outfall	Potential Use Restriction mg/L ¹	Is Additive Authorized in Current Permit?
				Months per/yr.	Days/week				
100% Liquinox	Alconox	Tank cleaning	Intermittent	12	1	0.024 mg/L 0.004 mg/L	0.015 mg/L		Yes
21.4% Virkon-Aquatic	Lanxess	Disinfection	Intermittent	1	1	0.030 mg/L 0.010 mg/L	0.034 mg/L		Yes
Hydrogen peroxide 35%	Arkema	Microbiocide egg treatment	Intermittent	1	1	0.264 mg/L 0.002 mg/L	0.007 mg/L	0.16	Yes
Parasite – S	Syndel	Disease Control	Intermittent	2	1	0.132 mg/L 0.020 mg/L	0.069 mg/L		No
Betadine	Betadine	Disinfection	Intermittent	2	1	0.003 mg/L 0.002 mg/L	0.006 mg/L		No
Sodium sulfite	Various	Chlorine neutralization	Continuous	12	7	70 lbs/day 24 lbs/day	0 mg/L		Yes

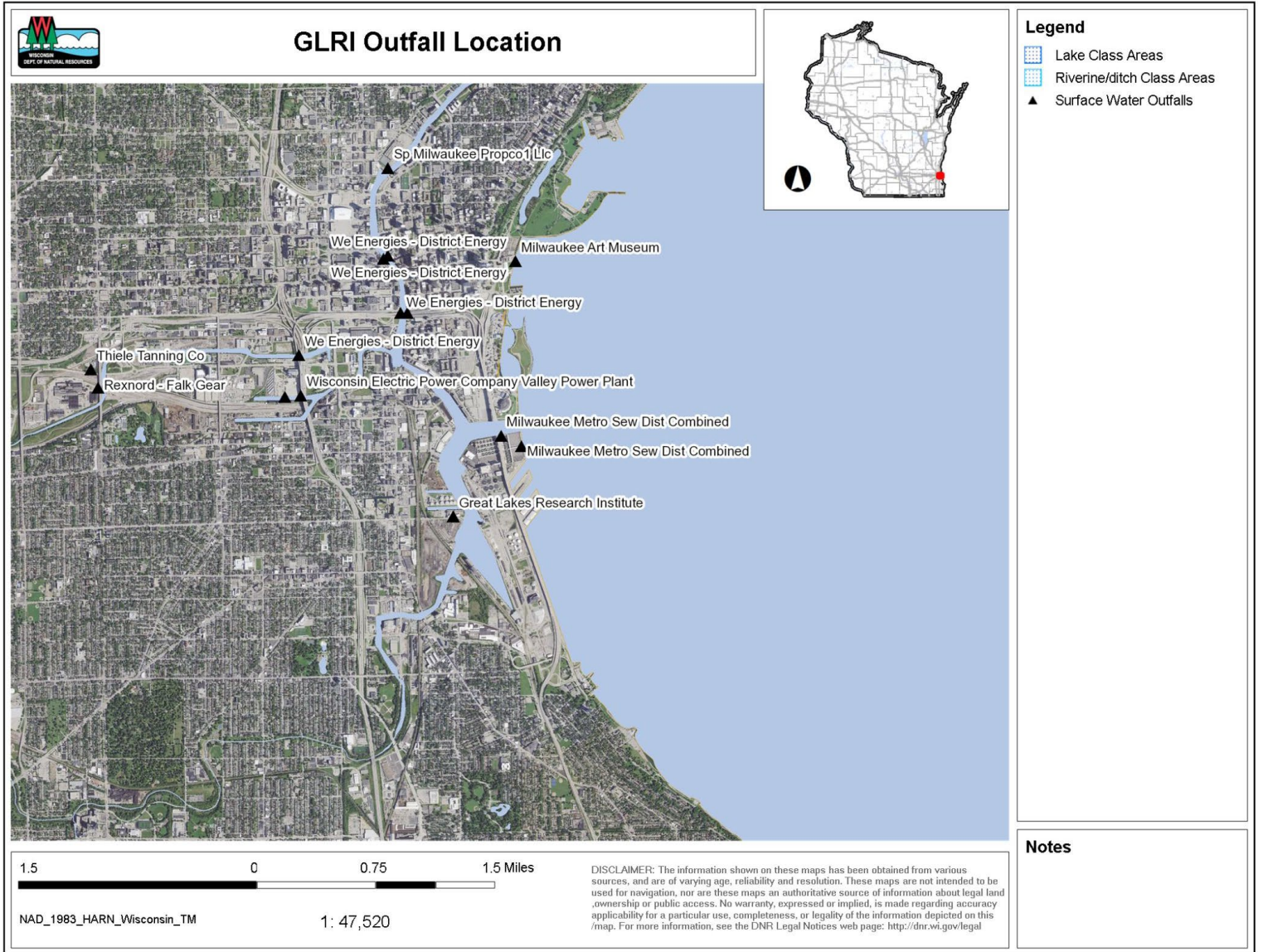
1. Calculated based on toxicity data provided
2. Evaluation are not necessary for additives that have active ingredients consisting only of chlorine, caustic soda (sodium hydroxide), hypochlorite, sulfuric acid, hydrochloric acid

Sodium sulfite: A review is not needed because this additive is not expected to be present in the effluent.

Attachment #1

Hydrogen peroxide 35%: The maximum effluent concentration of hydrogen peroxide in the discharge is much lower than the calculated limits for protection of aquatic life. Therefore, this additive is approved at the listed usage rates.

100% Liquinox, 21.4% Virkon-Aquatic, Parasite – S, Betadine: The facility has not submitted adequate toxicity information for these additives. The previous approvals were based on toxicity data from ingredients for each additive, not the whole product. Until more information is obtained and secondary values can be calculated, **use of these additives are not approved.**



Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

Facility:	School of Freshwater Sciences	7-Q₁₀:	90.00 cfs	Temp Dates		Flow Dates	
Outfall(s):	001	Dilution:	25%	Start:	01/25/06	Flow Dates	01/24/19
Date Prepared:	8/10/2023	f:	0	End:	12/31/18	Flow Dates	06/13/23
Design Flow (Q_e):	0.16 MGD	Stream type:	Small warm water sport or forage fish co ▼				
Storm Sewer Dist.	0 ft	Q_s:Q_e ratio:	90.9 :1				
		Calculation Needed?	NO				

Month	Water Quality Criteria			Receiving Water Flow Rate (Q _s) (cfs)	Representative Highest Effluent Flow Rate (Q _e)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	T _a (default) (°F)	Sub-Lethal WQC (°F)	Acute WQC (°F)		7-day Rolling Average (Q _{esl}) (MGD)	Daily Maximum Flow Rate (Q _{ea}) (MGD)		Weekly Average (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	33	49	76	90.00	0.272	0.272	0	60	60	NA	120
FEB	34	50	76	90.00	0.260	0.260	0	64	64	NA	120
MAR	38	52	77	90.00	0.249	0.249	0	62	66	NA	120
APR	48	55	79	90.00	0.255	0.255	0	66	66	NA	120
MAY	58	65	82	90.00	0.280	0.280	0	63	69	NA	120
JUN	66	76	84	90.00	0.335	0.335	0	63	70	NA	120
JUL	69	81	85	90.00	0.266	0.266	0	64	65	NA	120
AUG	67	81	84	90.00	0.258	0.258	0	68	68	NA	120
SEP	60	73	82	90.00	0.300	0.300	0	66	66	NA	120
OCT	50	61	80	90.00	0.268	0.268	0	63	63	NA	120
NOV	40	49	77	90.00	0.290	0.290	0	60	60	NA	120
DEC	35	49	76	90.00	0.274	0.274	0	60	60	NA	120

Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

Facility:	School of Freshwater Sciences	7-Q₁₀:	90.00 cfs	Temp Dates		Flow Dates	
Outfall(s):	002	Dilution:	25%	Start:	01/25/06	Flow Dates	01/24/19
Date Prepared:	8/10/2023	f:	0	End:	12/31/18	Flow Dates	06/13/23
Design Flow (Q_e):	0.16 MGD	Stream type:	Small warm water sport or forage fish co ▼				
Storm Sewer Dist.	0 ft	Q_s:Q_e ratio:	90.9 :1				
		Calculation Needed?	NO				

Month	Water Quality Criteria			Receiving Water Flow Rate (Q _s) (cfs)	Representative Highest Effluent Flow Rate (Q _e)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	T _a (default) (°F)	Sub-Lethal WQC (°F)	Acute WQC (°F)		7-day Rolling Average (Q _{esl}) (MGD)	Daily Maximum Flow Rate (Q _{ea}) (MGD)		Weekly Average (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	33	49	76	90.00	0.162	0.162	0	66	66	NA	120
FEB	34	50	76	90.00	0.145	0.145	0	68	68	NA	120
MAR	38	52	77	90.00	0.154	0.154	0	66	66	NA	120
APR	48	55	79	90.00	0.214	0.214	0	66	68	NA	120
MAY	58	65	82	90.00	0.155	0.155	0	66	68	NA	120
JUN	66	76	84	90.00	0.192	0.192	0	66	70	NA	120
JUL	69	81	85	90.00	0.125	0.125	0	66	66	NA	120
AUG	67	81	84	90.00	0.125	0.125	0	68	74	NA	120
SEP	60	73	82	90.00	0.135	0.135	0	71	71	NA	120
OCT	50	61	80	90.00	0.284	0.284	0	71	71	NA	120
NOV	40	49	77	90.00	0.251	0.251	0	62	62	NA	120
DEC	35	49	76	90.00	0.288	0.288	0	64	64	NA	120