Permit Fact Sheet

General Information

Permit Number	WI-0023221-09-0
Permittee Name and Address	City of Appleton 2006 East Newberry Street, Appleton, WI 54915-2758
Permitted Facility Name and Address	Appleton Wastewater Treatment Facility 2006 East Newberry Street, Appleton, Wisconsin
Permit Term	January 1, 2026 to December 31, 2030
Discharge Location	NW ¼ of the SE ¼ of Section 25, T21N, R17E, Outagamie County, ¾ mile east of College Ave (State Hwy 125) bridge at approximately latitude 44.26824º north and longitude 88.37023º west
Receiving Water	Lower Fox River in the Fox River/Appleton Watershed of the Fox River Basin (lower) in Outagamie County
Stream Flow ($Q_{7,10}$)	970 cfs
Stream Classification	Warm Water Sport Fish (WWSF) community, non-public water supply.
Discharge Type	Existing, Continuous
Annual Average Design Flow (MGD)	15.5 MGD
Industrial or Commercial Contributors	2 Categorical Industrial Contributors: Miller Electric Mfg Corp; Luvata 5 Significant Industrial Contributors: APPVION Paper; Vestis; Foremost Farms USA-Spencer St; N.W. Mauthe Superfund Site; Outagamie County Recycling & Solid Waste Dept
Plant Classification	A1 - Suspended Growth Processes; B - Solids Separation; C - Biological Solids/Sludges; P - Total Phosphorus; D - Disinfection; L - Laboratory; SS - Sanitary Sewage Collection System
Approved Pretreatment Program?	Yes.

Facility Description

The City of Appleton owns and operates an advanced, secondary, biological activated sludge wastewater treatment facility (WWTF). The Appleton WWTF (hereafter "Appleton") is designed for a hydraulic, annual average flow of 15.5 million gallons per day (MGD). Treatment processes consist of fine screening, grit removal, primary clarification, activated sludge-contact stabilization, and final clarification. Seasonal disinfection is achieved with liquid Sodium Hypochlorite addition in 2 chlorine contact chambers. Dechlorination is accomplished by the addition of liquid Sodium Bisulfite. Phosphorus is precipitated chemically with the addition of ferric chloride.

During typical operating conditions, effluent is discharged by gravity through outfall 001 (60" diffuser) to the south bank of the Fox River, approximately 0.75 mi east of the College Ave./Highway 125 bridge. However, during periods when high river flows prevent gravity discharge, three effluent screw pumps at pump station #1 convey effluent to the outfall chamber. This then flows by gravity to the 60" diffuser. If flows continue to be excessive, the outfall chamber surcharges into the outfall relief structure. That effluent volume discharges by gravity to the river through a separate 48" outfall main, adjacent to the diffuser. If flows are still unmanageable for the first two outfall pipes, three centrifugal pumps at pump

station #2 draw from the effluent end of chlorine contact tank #2. These discharge to the river through a 36" outfall main. This pipe is situated 400 feet upstream from station #1.

Polymer is added to the waste activated sludge (WAS), which is then conditioned by one of two dissolved air flotation thickeners (DAF). Primary sludge, WAS and hauled waste from the facility receiving station are then mixed and pre-heated and sent to one of two egg-shaped primary anaerobic digesters, for pathogen control and volatile solids reduction. Digested solids are then pumped to one of three belt filter presses for final dewatering, with the resultant Class B cake transferred by the combined conveyor to the onsite storage facility. Hauling and land application, are performed by private contract. Land application sites are approved by facility staff. The facility has also developed and operates a successful, department-approved, biosolids-compost program. Class B cake is hauled from the biosolids storage building at the treatment facility to a compost site located at the Outagamie County Landfill at where it is mixed with yard waste and/or wood chips and composted in aerated windrows to produce a Class A biosolids-compost product that is available for public use. Biosolids-compost product that does not meet Class A EQ requirements is land applied as Class B sludge.

Substantial Compliance Determination

After a desktop review of all discharge monitoring reports, CMARs, CMOMs, land application reports, compliance schedule items, and a site visit on 9/25/2024, this facility has been found to be in substantial compliance with their current permit.

Compliance determination made by Barti Oumarou on 10/17/2024.

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	14.33 MGD (2024)	Influent: 24-Hr flow proportional sampler and grab sampler located in influent channel pre-primary sedimentation. Flow meter located in the influent channel post grit/screen.
111		Field Blank: Sample point for reporting results of Mercury field blanks collected using standard sample handling procedures.
001	14.33 MGD (2024)	Effluent: 24-Hr flow proportional sampler located in the sampling device located in building J adjacent to outfall location. Grab collected using the sampler.
601		River Monitoring: Lower Fox River data collected at the Appleton Lutz Park-USGS/ACOE Gauge Station - and/or other alternative method or site approved by the Department - as reported by the Lower Fox River Discharger's Association shall be used in the determination of the daily CBOD5 wasteload allocation.
012	New outfall	Land Application: Class B, Liquid, primary anaerobically digested sludge. Samples collected after the primary anaerobic digesters (2). This outfall is provided for operational flexibility should treatment equipment failure occur. Sampling required only when discharge occurs.
013	New Outfall	Land Application: Class B, Liquid, secondary anaerobically digested sludge. Samples collected after the secondary anaerobic digesters (2). This outfall is provided for operational flexibility

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)**
		should treatment equipment failure occur. Sampling required only when discharge occurs.
003	6,600 Metric Tons	Land Application: Class B, Cake, anaerobically digested dewatered cake sludge. Sludge samples collected after the belt filter presses at the combined conveyor and from the storage building for analysis.
009		Land Application: Class B, Cake, Composted biosolids, Outfall 003 biosolids mixed with yard waste and/or wood chips and composted in aerated windrows.
010	375 Metric Tons	Land Application: Class A, Cake, Composted biosolids, Outfall 003 biosolids mixed with yard waste and/or wood chips and composted in aerated windrows.
011	New Outfall for Class A pathogen testing when sludge is stored.	Land Application: Class A, Cake, Composted biosolids, retest for pathogens. Pathogen test monitoring requirements, List 3, during periods when sewage sludge is distributed as EQ product or land applied.

Permit Requirements

1 Influent – Monitoring Requirements

1.1 Sample Point Number: 701- Total 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	Daily	24-Hr Flow Prop Comp	
Suspended Solids, Total		mg/L	Daily	24-Hr Flow Prop Comp	
Cadmium, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Chromium, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Copper, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Lead, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Nickel, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Zinc, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Mercury, Total Recoverable		ng/L	Quarterly	24-Hr Flow Prop Comp	See Mercury section.

Changes from Previous Permit:

Influent limitations and monitoring requirements were evaluated for this permit term and the following changes were made from the previous permit. See additional explanation of limits under "Explanation of Limits and Monitoring Requirements" below.

- BOD monitoring added.
- BOD and TSS sampling frequency updated to be 'Daily'.
- Chromium and Nickel sample type updated to be '24-Hr Flow Prop Comp'.

Explanation of Limits and Monitoring Requirements

Monitoring of influent flow, BOD5 and total suspended solids is required by s. NR 210.04(2), Wis. Adm. Code, to assess wastewater strengths and volumes and to demonstrate the percent removal requirements in s. NR 210.05, Wis. Adm. Code, and in the Standard Requirements section of the permit. Appleton previously had CBOD limits that have been changed to BOD limitations, see effluent section for explanation.

Appleton WWTF discharges more than 5 MGD and is currently required to administer a pretreatment program. Monthly monitoring is required for cadmium, chromium, copper, lead, nickel, and zinc. This permit includes mercury influent monitoring for mercury monitoring, per s. NR 106.145, Wis. Adm. Code.

2 Inplant - Monitoring and Limitations

2.1 Sample Point Number: 111- Field Blank

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Mercury, Total Recoverable		ng/L	Monthly	Blank	See Mercury section.

Changes from Previous Permit:

In-plant limitations and monitoring requirements were evaluated for this permit term and no changes were required in this permit section.

Explanation of Limits and Monitoring Requirements

Mercury Field Blank- Monitoring is included in the permit pursuant to s. NR 106.145, Wis. Adm. Code. Field blanks must meet the requirements under s. NR 106.145(9) and (10), Wis. Adm. Code. The permittee shall collect a mercury field blank for each set of mercury samples (a set of samples may include a combination of influent, effluent or other samples all collected on the same day). Field blanks are required to verify a sample has not been contaminated during collection, transportation or analysis.

3 Surface Water - Monitoring and Limitations

3.1 Sample Point Number: 001- Effluent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
BOD5	Weekly Avg	45 mg/L	Daily	24-Hr Flow Prop Comp	
BOD5	Monthly Avg	30 mg/L	Daily	24-Hr Flow Prop Comp	
Suspended Solids, Total	Weekly Avg	45 mg/L	Daily	24-Hr Flow Prop Comp	
Suspended Solids, Total	Monthly Avg	30 mg/L	Daily	24-Hr Flow Prop Comp	
Suspended Solids, Total	Weekly Avg	2,434 lbs/day	Daily	Calculated	
Suspended Solids, Total	Monthly Avg	1,322 lbs/day	Daily	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 DMR. See TMDL Calculations section.
Suspended Solids, Total		lbs/year	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 DMR. See TMDL Calculations section.
pH Field	Daily Min	6.0 su	Daily	Grab	
pH Field	Daily Max	9.0 su	Daily	Grab	
E. coli	Geometric Mean - Monthly	126 #/100 ml	Weekly	Grab	May - September

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
E. coli	% Exceedance	10 Percent	Monthly	Grab	May – September. See the E. coli Percent Limit section. Enter the result in the DMR on the last day of the month.
Chlorine, Total Residual	Daily Max	38 ug/L	Daily	Grab	May - September
Chlorine, Total Residual	Monthly Avg	38 ug/L	Daily	Grab	May - September
Chlorine, Total Residual	Weekly Avg	38 ug/L	Daily	Grab	May - September
Nitrogen, Ammonia (NH3-N) Total	Daily Max	29 mg/L	Daily	24-Hr Flow Prop Comp	
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	28 mg/L	Daily	24-Hr Flow Prop Comp	January - March
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	29 mg/L	Daily	24-Hr Flow Prop Comp	April – May, and October - December
Nitrogen, Ammonia (NH3-N) Total	Weekly Avg	11 mg/L	Daily	24-Hr Flow Prop Comp	June - September
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	10 mg/L	Daily	24-Hr Flow Prop Comp	January - March
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	11 mg/L	Daily	24-Hr Flow Prop Comp	April - May
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	4.4 mg/L	Daily	24-Hr Flow Prop Comp	June - September
Nitrogen, Ammonia (NH3-N) Total	Monthly Avg	18 mg/L	Daily	24-Hr Flow Prop Comp	October - December
Phosphorus, Total	Monthly Avg	1.0 mg/L	Daily	24-Hr Flow Prop Comp	
Phosphorus, Total	6-Month Avg	23 lbs/day	Daily	Calculated	
Phosphorus, Total	Monthly Avg	69 lbs/day	Daily	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 DMR. See TMDL Calculations section.
Phosphorus, Total		lbs/year	Monthly	Calculated	Calculate the 12-month rolling sum of total monthly mass of phosphorus

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
					discharged and report on the last day of the month on the DMR. See TMDL Calculations section.
Mercury, Total Recoverable	Daily Max	2.8 ng/L	Monthly	Grab	Interim limit effective upon effective date. See Mercury section and schedule.
Mercury, Total Recoverable	Monthly Avg	1.3 ng/L	Monthly	Grab	Final WQBEL effective on December 31, 2031. See Mercury section and schedule.
Cadmium, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Chromium, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Copper, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Lead, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Nickel, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
Zinc, Total Recoverable		ug/L	Monthly	24-Hr Flow Prop Comp	
PFOS		ng/L	Monthly	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule.
PFOA		ng/L	Monthly	Grab	Monitoring only. See PFOS/PFOA Minimization Plan Determination of Need schedule.
Nitrogen, Total Kjeldahl		mg/L	Quarterly	24-Hr Flow Prop Comp	
Nitrogen, Nitrite + Nitrate Total		mg/L	Quarterly	24-Hr Flow Prop Comp	
Nitrogen, Total		mg/L	Quarterly	Calculated	Total Nitrogen shall be calculated as the sum of reported values for Total Kjeldahl Nitrogen and Total

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
					Nitrite + Nitrate Nitrogen.
Acute WET	Daily Max	1.0 TUa	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET section.
Chronic WET	Monthly Avg	11 TUc	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET section.
WLA BOD_5 Value		lbs/day	Daily	See Table	May - October
WLA Adjusted Value		lbs/day	Daily	Calculated	May - October
WLA BOD_5 Discharged	Daily Max - Variable	lbs/day	Daily	Calculated	May - October
WLA 7 Day Sum Of WLA Values		lbs/day	Daily	Calculated	May - October
WLA 7 Day Sum Of BOD_5 Discharged	Daily Max - Variable	lbs/day	Daily	Calculated	May - October

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. See additional explanation of limits under "Explanation of Limits and Monitoring Requirements" below.

- **Flow-** The permittee has been reporting influent flow at both Sampling Point 701 and Outfall 001. There is not an effluent flow meter therefore effluent flow reporting is removed.
- **BOD & CBOD-** All limits and monitoring previously reported as $CBOD_5$ are changed to BOD_5. This permit includes BOD WLA limits that were reported at Outfall 008. The department has determined that it is appropriate for all BOD WLA to be reported at the main effluent outfall, in this case Outfall 001. Sample frequency increased to 'Daily'.
- **Total Suspended Solids TMDL Limits-** Mass based TSS limits of 2,424 lbs/day as a weekly average and 1,322 lbs/day as a monthly average are effective in the permit to comply with requirements of the Lower Fox Wolf River TMDL. Effluent concentration (mg/L) shall be monitored and reported daily upon permit reissuance and will be used to calculate amounts reported for mass-based limits. Reporting of lbs/month and lbs/year added.
- **pH-** Sample type changed to grab to reflect the required holding time for pH. Continuous pH sample type is not applicable to limit compliance.
- **E. coli-** Fecal coliform monitoring and limits have been replaced with Escherichia coli (E. coli) monitoring and limits.
- **Ammonia-** Limits updated.
- **Mercury-** An interim limit of 2.8 ng/L as a daily maximum and required PMP efforts continue for maintenance of effluent quality at or below current levels until the end of the mercury compliance schedule to meet the final mercury limit of 1.3 ng/L monthly average.
- **Phosphorus TMDL Limits-** Mass based phosphorus limits of 69 lbs/day as a six-month average and 23 lbs/day as a monthly average are effective in the permit to comply with requirements of the Lower Fox Wolf River TMDL. Effluent concentration (mg/L) shall be monitored and reported daily upon permit reissuance and will be used to calculate amounts reported for mass-based limits. Reporting of lbs/month and lbs/year added.

- **PFOS and PFOA-** Monthly monitoring is in included in the permit in accordance with s. NR 106.98(2)(c), Wis. Adm. Code.
- **Total Nitrogen Monitoring (TKN, N02+N03 and Total N)-** Quarterly monitoring was added to the proposed permit.
- **WET-** Chronic WET limit and annual monitoring added.
- **WLA BOD Value, WLA Adjusted Value, WLA BOD Discharged, WLA 7 Day Sum of WLA Values, WLA 7 Day sum of BOD Discharged-** These parameters were previously reported under Outfall 008. This update for consistency with e-reporting and the outfall in which these limits are effective. Additionally, these parameters are now calculated off BOD sampling and no longer based on CBOD.

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 dated October 9, 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. Chlorine sampling frequency increased to Daily in alignment is standard chlorine sampling frequencies for all permittees and because the method of chlorine addition used at the facility. Sample frequency for BOD, TSS, Chlorine, Ammonia and TP have been increased to 'Daily' based on the size of the facility.

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.

BOD/CBOD: The previous permit included CBOD limitations instead of BOD due to an effluent limitation variance pursuant s. NR 210.07(4), Wis. Adm. Code. However, that variance is only applicable to limitations under s. NR 210.05(1) to (3), Wis. Adm. Code. The variance is not applicable to water quality based waste load allocations under ch. NR 212, Wis. Adm. Code.

In addition, the department determined that the BOD categorical limitations under s. NR 210.05(1), Wis. Adm. Code are able to be met, therefore a CBOD variance under s. NR 210.07(4), Wis. Adm. Code is no longer needed or included.

Lower Fox River Total Maximum Daily Load (TMDL): The permitted facility is located within the Lower Fox Lower Fox River Basin Total Maximum Daily Load (LFWRB TMDL), which was approved by EPA May 18, 2012. The TMDL establishes Waste Load Allocations (WLAs) for point source dischargers and determines the maximum amounts of phosphorus and total suspended solids that can be discharged and still protect water quality. The final effluent limits and monitoring expressed in the permit were derived from and comply with the applicable water quality criterion and are consistent with the assumptions and requirements of the EPA-approved WLAs in the TMDL.

Mercury– In pervious permit terms the permittee was granted a mercury variance. During the current permit term the facility has had success reducing effluent mercury concentrations. Using data from the previous permit term the department determined that the facility did not have reasonable potential. However, the permittee requested the department reevaluate the mercury data using the most recent data. This evaluation found that the permittee does have reasonable potential to exceed the mercury limit. Therefore, the permit includes a mercury limit with a schedule for compliance. The permittee is required to continue the actions in the pollutant minimization plan to maintain effluent quality at or below current levels. The permittee withdrew the mercury variance application.

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 major municipal dischargers, with an average flow rate greater than or equal to 5 MGD, at a minimum sample

effluent on a monthly basis for PFOS and PFOA pursuant s. NR 106.98(2)(a), Wis. Adm. Code. The initial determination of the need for 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.

3.2 Sample Point Number: 008- WLA CBOD5 Reporting

Changes from Previous Permit

Effluent limitations and monitoring requirements were evaluated for this permit term and moved to be in Outfall 001. Sample Point has been deactivated.

Explanation of Limits and Monitoring Requirements

In the previous permit Sample Point 008 was used for reporting compliance with WLA limits for discharges from outfall 001, in accordance with ch. NR 212, Wis. Adm. Code. For consistency and clarity, the department is updating permits with these WLA limits to be at the main Outfall as these are calculated limits based on the effluent concentration at Outfall 001.

3.3 Sample Point Number: 601- River Monitoring

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
WLA Previous Day River Flow		cfs	Daily	Gauge Station	Monitoring required May - October.
WLA Previous Day River Temp		deg F	Daily	Measure	Monitoring required May – October.
WLA Previous 4 Day Avg River Flow		cfs	Daily	Calculated	Monitoring required May - October.

Changes from Previous Permit

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

Explanation of Limits and Monitoring Requirements

Sample Point 601 is used for reporting the flow and temperature values used for determining the waste load allocation (WLA) values for BOD_5, in accordance with ch. NR 212, Wis. Adm. Code, which apply May through October and are specified in Tables 1-5, in Outfall 001of the permit.

4 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)
012	B	Liquid		Incorporation	Land Application	New Outfall
013	B	Liquid		Incorporation	Land Application	New Outfall
003	B	Cake		Incorporation	Land Application	
009	B	Cake	Fecal Coliform		Land Application	
010	A	Cake	Fecal Coliform		Land Application/ Distribution	
011	A	Cake	Fecal Coliform		Land Application/ Distribution	New Outfall

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**

If yes, special monitoring and recycling conditions will be included in the permit to track any potential problems in landapplying sludge from this facility

Is a priority pollutant scan required? **Yes**

Priority pollutant scans are required once every 10 years at facilities with design flows between 5 MGD and 40 MGD, and once every 5 years if design flow is greater than 40 MGD.

4.1 Sample Point Number: 012- Class B LIQ Primary Digestion; 013- Class B LIQ Secondary Digestion

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Quarterly	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Quarterly	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	1/ 2 Months	Composite	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Cadmium Dry Wt	Ceiling	85 mg/kg	1/ 2 Months	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	1/ 2 Months	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	1/ 2 Months	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	1/ 2 Months	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	1/ 2 Months	Composite	
Lead Dry Wt	High Quality	300 mg/kg	1/ 2 Months	Composite	
Mercury Dry Wt	Ceiling	57 mg/kg	1/ 2 Months	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	1/ 2 Months	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	1/ 2 Months	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	1/ 2 Months	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	1/ 2 Months	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	1/ 2 Months	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	1/ 2 Months	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	1/ 2 Months	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	1/ 2 Months	Composite	
Nitrogen, Total Kjeldahl		Percent	1/ 2 Months	Composite	
Nitrogen, Ammonium (NH4-N) Total		Percent	1/ 2 Months	Composite	
Phosphorus, Total		Percent	1/ 2 Months	Composite	
Phosphorus, Water Extractable		% of Tot P	1/ 2 Months	Composite	
Potassium, Total Recoverable		Percent	1/ 2 Months	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.

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. See additional explanation of limits under "Explanation of Limits and Monitoring Requirements" below.

PCB- Monitoring year updated.

PFAS –Monitoring is required annually pursuant to s. NR 204.06(2)(b)9, Wis. Adm. Code.

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

PFAS- The presence and fate of PFAS in municipal and industrial sludges is an emerging public health concern. EPA has developed a draft risk assessment to determine future land application rates and released this risk assessment in January of 2025. The Department is evaluating this new information. Until a decision is made, the "Interim Strategy for Land Application of Biosolids and Industrial Sludges Containing PFAS" should be followed.

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.

4.2 Sample Point Number: 003- Class B Cake Sludge

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	1/ 2 Months	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	1/ 2 Months	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	1/ 2 Months	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	1/ 2 Months	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	1/ 2 Months	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	1/ 2 Months	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	1/ 2 Months	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	1/ 2 Months	Composite	
Lead Dry Wt	High Quality	300 mg/kg	1/ 2 Months	Composite	
Mercury Dry Wt	Ceiling	57 mg/kg	1/ 2 Months	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	1/ 2 Months	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	1/ 2 Months	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	1/ 2 Months	Composite	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Nickel Dry Wt	High Quality	420 mg/kg	1/ 2 Months	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	1/ 2 Months	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	1/ 2 Months	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	1/ 2 Months	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	1/ 2 Months	Composite	
Nitrogen, Total Kjeldahl		Percent	1/ 2 Months	Composite	
Nitrogen, Ammonium (NH4-N) Total		Percent	1/ 2 Months	Composite	
Phosphorus, Total		Percent	1/ 2 Months	Composite	
Phosphorus, Water Extractable		% of Tot P	1/ 2 Months	Composite	
Potassium, Total Recoverable		Percent	1/ 2 Months	Composite	
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	Once in 2027.
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	Once in 2027.
Municipal Sludge Priority Pollutant Scan			Once	Composite	As specified in ch. NR 215.03 (1-4), Wis. Adm. Code.
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.

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. See additional explanation of limits under "Explanation of Limits and Monitoring Requirements" below.

PCB- Monitoring year updated.

PFAS –Monitoring is required annually pursuant to s. NR 204.06(2)(b)9, Wis. Adm. Code.

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

PFAS- The presence and fate of PFAS in municipal and industrial sludges is an emerging public health concern. EPA has developed a draft risk assessment to determine future land application rates and released this risk assessment in January of 2025. The Department is evaluating this new information. Until a decision is made, the "Interim Strategy for Land Application of Biosolids and Industrial Sludges Containing PFAS" should be followed.

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.

4.3 Sample Point Number: 009- Biosolids - Compost Class B

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

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Kjeldahl					
Nitrogen, Ammonium (NH4-N) Total		Percent	Quarterly	Composite	
Phosphorus, Total		Percent	Quarterly	Composite	
Phosphorus, Water Extractable		% of Tot P	Quarterly	Composite	
Potassium, Total Recoverable		Percent	Quarterly	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.

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. See additional explanation of limits under "Explanation of Limits and Monitoring Requirements" below.

PCB- Monitoring year updated.

PFAS –Monitoring is required annually pursuant to s. NR 204.06(2)(b)9, Wis. Adm. Code.

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

PFAS- Sampling only required if discharge from Outfall 009 occurs within the sampling period. The presence and fate of PFAS in municipal and industrial sludges is an emerging public health concern. EPA has developed a draft risk assessment to determine future land application rates and released this risk assessment in January of 2025. The Department is evaluating this new information. Until a decision is made, the "Interim Strategy for Land Application of Biosolids and Industrial Sludges Containing PFAS" should be followed.

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.

4.4 Sample Point Number: 010- Biosolids- Compost Class A

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Quarterly	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Quarterly	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	Quarterly	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	Quarterly	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	Quarterly	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	Quarterly	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	Quarterly	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	Quarterly	Composite	
Lead Dry Wt	High Quality	300 mg/kg	Quarterly	Composite	
Mercury Dry Wt	Ceiling	57 mg/kg	Quarterly	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	Quarterly	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	Quarterly	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	Quarterly	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	Quarterly	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	Quarterly	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	Quarterly	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Quarterly	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	Quarterly	Composite	
Nitrogen, Total Kjeldahl		Percent	Quarterly	Composite	
Nitrogen, Ammonium (NH4-N) Total		Percent	Quarterly	Composite	
Phosphorus, Total		Percent	Quarterly	Composite	
Phosphorus, Water Extractable		% of Tot P	Quarterly	Composite	
Potassium, Total Recoverable		Percent	Quarterly	Composite	
PFOA + PFOS		ug/kg	Annual	Calculated	Report the sum of PFOA and PFOS. See PFAS Permit Sections for more information.

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
PFAS Dry Wt			Annual	Grab	Perfluoroalkyl and Polyfluoroalkyl Substances based on updated DNR PFAS List. See PFAS Permit Sections for more information.

Changes from Previous Permit:

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

PFAS –Monitoring is required annually pursuant to s. NR 204.06(2)(b)9, Wis. Adm. Code.

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), Wis. Adm. Code. Requirements for pathogens are specified in s. NR 204.07(6) and in s. NR 204.07 (7), Wis. Adm. Code for vector attraction requirements.

PFAS- The presence and fate of PFAS in municipal and industrial sludges is an emerging public health concern. EPA has developed a draft risk assessment to determine future land application rates and released this risk assessment in January of 2025. The Department is evaluating this new information. Until a decision is made, the "Interim Strategy for Land Application of Biosolids and Industrial Sludges Containing PFAS" should be followed.

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.

4.5 Sample Point Number: 011- Pathogen Treatment Monitoring

Changes from Previous Permit:
Sampling Point 011 added.

Explanation of Limits and Monitoring Requirements
This sampling point is for pathogen treatment monitoring as part of the requirements of Class A sludge. When Class A sludge is stored retesting for pathogens is required. Sampling Point 011 is for reporting of this pathogen retesting.

5 Schedules

5.1 Water Quality Based Effluent Limits (WQBELs) for Mercury

The permittee shall comply with the WQBELs for Mercury as specified.

Required Action	Due Date

Annual Mercury Progress Report: Submit an annual mercury progress report. The annual mercury progress report shall: Indicate which mercury source reduction measures or activities have been implemented; Include an analysis of the trends in monthly and annual average mercury concentrations of mercury based on mercury sampling and flow data; and Include an analysis of how influent and effluent mercury varies with time and with significant loadings of mercury. The first annual mercury progress report is to be submitted by the Date Due.	01/01/2027
Annual Mercury Progress Report #2: Submit the mercury progress report as defined above.	01/01/2028
Annual Mercury Progress Report #3: Submit the mercury progress report as defined above.	01/01/2029
Annual Mercury Progress Report #4: Submit the mercury progress report as defined above.	01/01/2030
Final Mercury Report: Submit the mercury progress report as defined above.	12/01/2030
Mercury WQBELs Effective Date: The mercury WQBELs become effective.	12/31/2030

Explanation of Schedule

This schedule is included for the permittee to comply with mercury WQBELs. Since a compliance schedule is being granted, an interim limit is required, and is established at 2.8 mg/L as a daily maximum. The schedule requires that annual reports shall indicate which source reduction measures have been implemented during each calendar year, and an analysis of mercury concentration and mass discharge data based on mercury sampling and flow data. The annual reports shall document progress made towards meeting the final water quality based effluent limit.

5.2 PFOS/PFOA Minimization Plan Determination of Need

Required Action	Due Date
Report on Effluent Discharge: Submit a report on effluent PFOS and PFOA concentrations and include an analysis of trends in monthly and annual average PFOS and PFOA concentrations. This analysis should also include a comparison to the applicable narrative standard in s. NR 102.04(8)(d), Wis. Adm. Code. This report shall include all PFOS and PFOA data collected including any voluntary influent, intake, in-plant, collection system sampling, and blank sample results.	01/01/2027
Report on Effluent Discharge and Evaluation of Need: Submit a final report on effluent PFOS and PFOA concentrations and include an analysis of trends in monthly and annual average PFOS and PFOA concentrations of data collected over the last 24 months. The report shall also provide a comparison on the likelihood of the facility needing to develop a PFOS/PFOA minimization plan. This report shall include all PFOS and PFOA data collected including any voluntary influent, intake, in-plant, collection system sampling, and blank sample results. The permittee shall also submit a request to the department to evaluate the need for a PFOS/PFOA minimization plan. 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	01/01/2028

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. 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.	

Explanation of Schedule

As stated above, ch. NR 106 Subchapter VIII – Permit Requirements for PFOS and PFOA Dischargers became effective on August 1, 2022. Section 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.

5.3 Sludge Management Plan

A sludge management plan is required.

Required Action	Due Date
Sludge Management (SMP) Plan Submittal: Submit a sludge management plan (SMP) to optimize the treatment and disposal of sludge by the Due Date. The SMP shall include a description of the facilities management program for department approval pursuant to s. NR 204.11(1), Wis. Adm. Code. The plan shall include separate sections for each type of sewage sludge including liquid, cake, algae liquid, dried algae, etc. If there will be designated land application sites for each waste type, they should be listed by legal location and department assigned site number. The SMP shall provide standardized information for communication to operators and the department for no less than the following: 1) Sample point, influent point and outfall monitoring locations shown on a schematic and with photos; 2) Monitoring requirements at each influent point(s), sampling point(s) and outfall location(s); 3) Sampling protocols for each location and parameters at each location including treatment temperature, moisture content (total solids), fecal concentration as required; 4) Monitoring frequencies at each sample point, influent point and outfall; 5) Analytical methods with appropriate hold times and chain of custody procedures; 6) Multiple operational algae drying durations that include start up, operation and shutdown of treatment facilities that facilitates Roberts operator needs for flexibility. 7) Provide planned moisture content intervals for each option; 8) Provide documentation relating to temperature monitoring data recording, retrieval and printing out the data when requested;	01/01/2027

9) Storage, pickup and transportation details associated with all outfalls and influent locations; 10) Dryer start up instructions and details associated with overcoming lack of appropriate temperatures or when exceeding moisture content limits; 11) Collection, storage, disposal/buyer information for cake algae detailing deliveries; and 12) Collection, storage, and disposal processes of dried algae when algae does not meet minimum requirements to meet Class A and EQ requirements. The SMP shall be developed to have inherent flexibility and to allow for frequent updates as processing may change.	

Explanation of Schedule

An up-to-date Sludge Management Plan is required that documents how the permittee will manage the land application of biosolids consistent with ch. NR 204, Wis. Adm. Code.

Other Comments

None

Attachments

Water Quality Based Effluent Limits dated 10/9/2024

Water Quality Based Effluent Limits dated 12/8/2021

Mercury Water Quality Based Effluent Limit dated 11/13/2025

Justification Of Any Waivers From Permit Application Requirements

No waivers requested or granted as part of this permit reissuance

Prepared By: Jennifer Jerich, Wastewater Specialist

Date: 10/29/2025
Revision date post fact check: 11/14/2025
Revision date post public notice:

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: October 9, 2024

TO: Sarah Adkins – NER/Oshkosh Service Center

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

SUBJECT: Updated Water Quality-Based Effluent Limitations for the Appleton Wastewater Treatment Facility
WPDES Permit No. WI-0023221-09-0

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 Appleton Wastewater Treatment Facility in Outagamie County. This municipal wastewater treatment facility (WWTF) discharges to the Fox River, located in the Fox River/Appleton Watershed in the Lower Fox River Basin. This discharge is included in the Lower Fox River Basin (LFRB) Total Maximum Daily Load (TMDL) as approved by EPA on May 18, 2012. 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
Flow River May – October						1, 2
River Temp May – October						1, 2
$CBOD_5$ Year round May – October	 Variable		 40 mg/L	 25 mg/L		1, 3
TSS			45 mg/L 2,434 lbs/day	30 mg/L 1,322 lbs/day		1, 4
pH	9.0 s.u.	6.0 s.u.				1
E. coli May – September				126 #/100 mL geometric mean		5
Residual Chlorine	38 µg/L		**38 µg/L**	**38 µg/L**		1, 6
Ammonia Nitrogen Year round January – March April May June – September October – December	 29 mg/L		 28 mg/L 29 mg/L **29 mg/L** 11 mg/L **29 mg/L**	 10 mg/L 11 mg/L 11 mg/L 4.4 mg/L 18 mg/L		6
Phosphorus						1, 4, 7
Interim				1.0 mg/L		
Final				69 lbs/day	23 lbs/day	
Mercury (Total Recoverable)						8

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Cadmium (Total Recoverable)						9
Chromium (Total Recoverable)						9
Copper (Total Recoverable)						9
Lead (Total Recoverable)						9
Nickel (Total Recoverable)						9
Zinc (Total Recoverable)						9
PFOS and PFOA						10
TKN, Nitrate+Nitrite, and Total Nitrogen						11
Acute WET	1.0 TUa					12, 14
Chronic WET				11 TUc		13, 14

Footnotes:

1. No changes from the current permit.
2. Monitoring performed at Sample Point 601.
3. Compliance with the daily maximum limits is determined at Sample Point (Outfall) 008. The $CBOD_5$ WLA tables from the current permit should be retained in the reissued permit.
4. The total suspended solids (TSS) and phosphorus mass limits are based on the LFRB TMDL to address TSS and phosphorus water quality impairments within the TMDL area.
5. Additional final limit: No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 count/100 mL.
6. 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.
7. The monthly average phosphorus concentration limit is a technology-based effluent limit (TBEL) which also functions as an interim limit for the phosphorus compliance schedule. A compliance schedule is in the current permit to meet the final WQBELs by 01/01/2023.
8. Monthly monitoring and PMP efforts are recommended to continue during the reissued permit term to maintain effluent quality at or below current levels.
9. Continued monitoring for total recoverable cadmium, chromium, copper, lead, nickel and zinc is also required because Appleton WWTF operates a local pretreatment program for the many industries that discharge to the treatment facility.
10. Monthly monitoring is required in accordance with s. NR 106.98(2), Wis. Adm. Code.
11. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, quarterly total nitrogen monitoring is recommended for all major municipal permittees. Total Nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), and total Kjeldahl nitrogen (TKN) (all expressed as N).
12. The acute WET limit of 1.0 TUa and 2x/yr 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. If a satisfactory phosphorus chemical SOP is established and implemented at the facility prior to permit reissuance, then WET testing can be reduced to annual acute tests in the reissued permit.

13. The chronic WET limit of 11 TUc and annual chronic WET tests are recommended during the reissued permit term. The Instream Waste Concentration (IWC) to assess chronic test results is 9%. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 30%, 10%, 3% & 1% and the dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the Fox River upstream of the confluence of Outfall 001.
14. 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).

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 (2) – Narrative & discharge area map.

PREPARED BY: Michael A. Polkinghorn – Water Resources Engineer

E-cc: Barti Oumarou, Wastewater Engineer – NER/Oshkosh Service Center
Heidi Schmitt-Marquez, Regional Wastewater Supervisor – NER/Green Bay Service Center
Diane Figiel, Water Resources Engineer – WY/3
Kari Fleming, Environmental Toxicologist – WY/3
Nathaniel Willis, Wastewater Engineer – WY/3

Attachment #1

Water Quality-Based Effluent Limitations for
Appleton Wastewater Treatment Facility

WPDES Permit No. WI-0023221-09-0

Prepared by: Michael A. Polkinghorn

PART 1 – BACKGROUND INFORMATION

Facility Description

The City of Appleton owns and operates an advanced, secondary, biological activated sludge wastewater treatment facility. Treatment processes consist of: screening, grit removal, primary clarification, activated sludge-contact stabilization, and final clarification. Seasonal disinfection is achieved with liquid sodium hypochlorite addition in two chlorine contact chambers. Dechlorination is accomplished by the addition of liquid sodium bisulfite. Phosphorus is precipitated chemically, with the addition of ferric chloride and/or ferrous sulfate. During typical operating conditions, effluent is discharged on a continuous basis by gravity via Outfall 001 (60" diffuser) to the south bank of the Fox River, approximately 0.75 mi east of the College Ave./Highway 125 bridge. However, during periods when high river flows prevent gravity discharge, three effluent screw pumps at pump station #1, convey effluent to the outfall chamber. This then flows by gravity to the 60" diffuser. If flows continue to be excessive, the outfall chamber surcharges into the outfall relief structure. That effluent volume discharges by gravity to the River, through a separate 48" outfall main, adjacent to the diffuser. If flows are still unmanageable for the first two outfall pipes, three centrifugal pumps at pump station #2, draw from the effluent end of chlorine contact tank #2. These discharge to the River through a 36" outfall main. This pipe is situated 400 feet upstream from station #1.

The WQBEL memo dated December 2021 for the 9th issuance of Appleton WWTF's permit is being reevaluated due to multiple holds to the reissued permit. Upon initial review of the effluent limitations and monitoring requirements recommended in the December 2021 WQBEL memo, only the following parameters could potentially change in comparison to this request:

- Need of mercury WQBELs and interim limit based on permit-required mercury monitoring
- Need of PFOA/PFOS monitoring
- The need of WET WQBELs based on permit-required WET monitoring

This evaluation will consider the present discharge characteristics with the priorly listed parameters only. **Determinations made for other parameters made in the previous WQBEL Evaluation (December 2021) will remain unchanged.** The following effluent limitations and monitoring requirements for the current permit, expired on 03/31/2022, are included below for informational purposes:

Outfall 001

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1, 2
$CBOD_5$			40 mg/L	25 mg/L		2

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
TSS			45 mg/L 2,434 lbs/day	30 mg/L 1,322 lbs/day		2, 3
pH	9.0 s.u.	6.0 s.u.				2
Fecal Coliform May – September			**656#/100 mL** **geometric mean**	400#/100 mL geometric mean		2, 4
Residual Chlorine	38 µg/L		**38 µg/L**	**38 µg/L**		2, 4
Ammonia Nitrogen Year round January – March April May June – September October – December	29 mg/L		 28 mg/L 29 mg/L 11 mg/L	 10 mg/L 11 mg/L 11 mg/L 4.4 mg/L 18 mg/L		2, 5
Phosphorus						2, 3, 6
Interim				1.0 mg/L		
Final				69 lbs/day	23 lbs/day	
Mercury						7
Interim	3.4 ng/L					
Final				1.3 ng/L		
Cadmium (Total Recoverable)						2, 8
Chromium (Total Recoverable)						2, 8
Copper (Total Recoverable)						2, 8
Lead (Total Recoverable)						2, 8
Nickel (Total Recoverable)						2, 8
Zinc (Total Recoverable)						2, 8
Acute WET	1.0 TU_a					9
Chronic WET						9

Footnotes:

1. Monitoring only.
2. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
3. The total suspended solids (TSS) and phosphorus mass limits are based on the LFRB TMDL to address TSS and phosphorus water quality impairments within the TMDL area.
4. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.

5. The weekly and monthly average limits are based on multiple discharges to this section of the Fox River, including the Appleton WWTF, Grand Chute Menasha West SC WWTF, Heart of the Valley MSD WWTF, and the Neenah Menasha SC WWTF.
6. The monthly average phosphorus concentration limit is a technology-based effluent limit (TBEL) which also functions as an interim limit for the phosphorus compliance schedule. A compliance schedule is in the current permit to meet the final WQBELs by 01/01/2023.
7. The interim limit is an alternative mercury effluent limit based on the variance granted by EPA as described in s. NR 106.145(4), Wis. Adm. Code, for the current permit term. This limit is based on the 1-day P_{99} of effluent data and includes implementation of a pollutant minimization plan.
8. Continued monitoring for total recoverable cadmium, chromium, copper, lead, nickel and zinc is also required because Appleton WWTF operates a local pretreatment program for the many industries that discharge to the treatment facility.
9. The current permit required annual acute and chronic whole effluent toxicity (WET) tests in order to collect seasonal information about the discharge.

Sample Point 601

Parameter	Footnotes
Flow River May – October	1
River Temp May – October	1

Sample Point (Outfall) 008

Parameter	Daily Maximum	Footnotes
$CBOD_5$ May – October	Variable	2, 3, 4

Footnotes:

1. Monitoring only.
2. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
3. Variable $CBOD_5$ daily maximum mass WQBELs are required for any point source discharge to the Lower Fox River (river miles 0 – 40.0) as described in s. 212.40, Wis. Adm. Code. The tables below, based on Table 1b of ch. NR 212, Wis. Adm. Code, for each respective month provide the receiving water temperature and flow conditions where the resulting mass limit shall apply on a daily basis, such that the actual discharge may not exceed 120.0% of the mass limit for that day.
4. Additional Limit: The sum of the actual daily discharges for any 7-consecutive-day-period may not exceed the sum of the daily mass limit values for the same 7-consectutive-day-period based on the tables below.

Attachment #1

Daily Max $CBOD_5$ Limits (lbs/day): May – June

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
86 OR MORE	2471	2583	2793	3041	3307	3575	3836	4080	4341	4599	5010	5598	6453	8085	9301
82 TO 85	2457	2585	2810	3086	3373	3655	3926	4175	4456	4810	5263	5902	6806	8605	10076
78 TO 81	2423	2582	2850	3168	3487	3791	4109	4483	4903	5222	5676	6461	7491	9511	11553
74 TO 77	2387	2578	2905	3261	3600	4027	4470	4902	5251	5597	6172	6996	8064	10632	12724
70 TO 73	2361	2588	2969	3366	3856	4361	4847	5215	5616	6032	6667	7665	8677	12032	12724
66 TO 69	2363	2644	3070	3619	4189	4753	5178	5611	6107	6576	7292	8310	9537	12724	12724
62 TO 65	2410	2735	3339	3990	4652	5151	5670	6222	6759	7302	8219	9176	10822	12724	12724
58 TO 61	2521	3017	3776	4568	5178	5823	6486	7083	7783	8482	9303	10646	12724	12724	12724
54 TO 57	2852	3500	4483	5250	6081	6863	7668	8573	9249	9997	11220	12724	12724	12724	12724
50 TO 53	3431	4324	5346	6437	7426	8576	9536	10501	11574	12724	12724	12724	12724	12724	12724
46 TO 49	4451	5402	6797	8227	9770	11068	12517	12724	12724	12724	12724	12724	12724	12724	12724
42 TO 45	5852	7153	9231	11401	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724
41 OR LESS	8092	10298	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724

Daily Max $CBOD_5$ Limits (lbs/day): July

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
86 OR MORE	2456	2558	2783	3035	3253	3311	3413	3565	3699	3767	3964	4322	4867	6437	7520
82 TO 85	2476	2598	2807	3074	3325	3476	3585	3680	3778	3988	4290	4668	5415	7041	8380
78 TO 81	2458	2619	2860	3136	3394	3619	3809	4017	4271	4492	4809	5444	6255	8155	9995
74 TO 77	2462	2617	2903	3194	3460	3783	4181	4480	4749	5006	5515	6172	6987	9425	11842
70 TO 73	2438	2639	2936	3247	3661	4156	4644	4952	5284	5664	6190	6833	7779	10938	12724
66 TO 69	2433	2671	2997	3465	4039	4616	5053	5501	5945	6349	6820	7555	8776	12724	12724
62 TO 65	2467	2729	3222	3874	4571	5095	5633	6209	6620	6991	7601	8563	10155	12724	12724
61 OR LESS	2548	2946	3692	4533	5177	5859	6527	6961	7444	7961	8810	10126	12323	12724	12724

Daily Max $CBOD_5$ Limits (lbs/day): August

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
86 OR MORE	2163	2254	2473	2740	3005	3242	3447	3626	3789	3938	4141	4327	4750	6066	6947
82 TO 85	2163	2275	2509	2790	3056	3299	3513	3695	3875	4020	4304	4568	5265	6666	7736

78 TO 81	2163	2309	2567	2864	3148	3401	3626	3827	4132	4438	4701	5297	5981	7640	9264
74 TO 77	2163	2332	2624	2940	3237	3506	3841	4241	4559	4857	5342	5913	6687	8808	11001
70 TO 73	2163	2356	2681	3013	3334	3808	4257	4611	4971	5354	5909	6548	7369	10252	12724
66 TO 69	2165	2414	2765	3159	3707	4237	4657	5067	5533	6031	6542	7201	8298	12011	12724
62 TO 65	2221	2499	2938	3566	4198	4697	5202	5740	6362	6704	7250	8126	9616	12724	12724
61 OR LESS	2319	2685	3402	4161	4778	5425	6110	6690	7125	7596	8370	9611	11684	12724	12724

Daily Max $CBOD_5$ Limits (lbs/day): September

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
86 OR MORE	2163	2163	2163	2397	2692	2964	3218	3452	3674	3877	4146	4420	4845	6093	6986
82 TO 85	2163	2163	2163	2458	2759	3037	3288	3518	3754	3965	4136	4557	5279	6649	7740
78 TO 81	2163	2163	2229	2558	2872	3165	3433	3675	3894	4069	4463	5167	5888	7548	9264
74 TO 77	2163	2163	2309	2652	2978	3282	3560	3836	4156	4471	4981	5751	6549	8691	10992
70 TO 73	2163	2163	2385	2744	3079	3480	3829	4176	4556	4936	5612	6363	7169	10133	12724
66 TO 69	2163	2163	2491	2867	3377	3804	4217	4642	5105	5611	6310	6977	8059	11902	12724
62 TO 65	2163	2216	2623	3237	3759	4249	4764	5294	5927	6457	6990	7864	9387	12724	12724
58 TO 61	2163	2367	3067	3709	4315	4962	5642	6386	6844	7301	8064	9322	11429	12724	12724
54 TO 57	2240	2834	3638	4405	5236	6142	6863	7427	8064	8771	9925	11751	12724	12724	12724
50 TO 53	2784	3506	4494	5607	6740	7542	8350	9271	10289	11387	12724	12724	12724	12724	12724
46 TO 49	3584	4519	6027	7494	8573	9802	11180	12708	12724	12724	12724	12724	12724	12724	12724
42 TO 45	4900	6390	8415	10088	12004	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724
41 OR LESS	7203	9360	12179	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724

Daily Max $CBOD_5$ Limits (lbs/day): October

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
66 OR MORE	2163	2163	2195	2576	2919	3298	3712	4152	4633	5164	6084	6844	8033	12165	12724
62 TO 65	2163	2163	2313	2800	3250	3737	4268	4804	5465	6181	6805	7735	9340	12724	12724
58 TO 61	2163	2163	2645	3189	3786	4442	5130	5902	6613	7078	7870	9183	11414	12724	12724
54 TO 57	2163	2395	3094	3846	4681	5587	6546	7153	7801	8519	9711	11619	12724	12724	12724
50 TO 53	2300	2924	3890	4995	6219	7210	8021	8942	9979	11099	12724	12724	12724	12724	12724
46 TO 49	2943	3846	5331	6910	8153	9383	10767	12303	12724	12724	12724	12724	12724	12724	12724
42 TO 45	4127	5585	7698	9549	11449	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724
41 OR LESS	6394	8457	11476	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724

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

Receiving Water Information

- Name: Fox River
- Waterbody Identification Code (WBIC): 117900
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply. Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q_{10} and 7-Q_2 values are from USGS for the Fox River at Wrightstown.
  7-Q_{10} = 970 cubic feet per second (cfs)
  7-Q_2 = 1,380 cfs
  90-Q_{10} = 1,330 cfs
  Harmonic Mean Flow = 3,280 cfs using a drainage area of 6,010 mi^2.
  It should be noted that the low-flow location is approximately 13 miles downstream of Outfalls 001. Typically, low flows should be estimated upstream of the confluence of the receiving water with the discharge, so the discharge does not influence the measured flow. Additional low flow data is available from USGS for the Fox River at Appleton WI, where the drainage area was determined to be 5,950 mi^2. This is a difference of 60 mi^2 or 1% between the two positions on the Fox River. In this case, the resulting change in the low-flows is not significant and the original USGS low-flows will be used in this evaluation.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: 25%.
- Source of background concentration data: Metals data are from the Wolf River at New London, WI due to the limited availability of background data for the Fox River upstream of Outfall 001. The Wolf River is within the same ecological landscape so ambient water quality characteristics are expected to be similar. The numerical values are shown in the tables in Part 2 of this evaluation, in the columns titled "MEAN BACK-GRD.". 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: Multiple dischargers were integrated in the weekly and monthly average ammonia nitrogen limits for the Appleton WWTF along with 3 other facilities in this section of the Fox River. Otherwise, the effects of multiple dischargers were not historically considered for other parameters due to not being in the immediate vicinity and the belief mixing zones are not overlapping. Therefore, the other dischargers do not impact this evaluation.
- Impaired water status: The Fox River is on the CWA Section 303(d) list and is impaired by phosphorus and polychlorinated biphenyls (PCBs). It is included in the LFRB TMDL area for phosphorus and TSS.

Effluent Information

- Design flow rate(s):
  Annual average = 15.5 million gallons per day (MGD)
  For reference, the actual average flow from September 2019 – August 2024 was 12.3 MGD.
- 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 7 industrial contributors.

- Water supply: Appleton Water Plant (Lake Winnebago) and 2 industrial wells.
- Additives: The Appleton WWTF uses 4 additives in their process and are listed below:
  - Sodium hypochlorite – chlorination
  - Sodium bisulfite – dechlorination
  - Ferric chloride – chemical phosphorus removal
  - Ferrous sulfate – chemical phosphorus removal
- Mercury field blanks (Sample Point 111) indicated contamination was present from either sample transportation or environmental sources via 9 detects. Therefore, the effluent mercury samples associated with those blanks are not used in this evaluation. The field blanks and effluent samples in question are shown in the table below:

Detectable Mercury Field Blanks & Effluent Data

Sample Date	SP 111 (ng/L)	Outfall 001 (ng/L)
08/01/2021	0.38	1.6
09/01/2021	0.19	1.2
04/01/2022	0.22	0.64
12/01/2022	0.28	0.87
03/01/2023	0.39	1.1
04/01/2023	0.22	0.62
07/01/2023	0.21	2.4
04/01/2024	0.19	1.0
07/01/2024	0.25	1.2

- Substances with multiple effluent data are shown in the tables below or in their respective parts in this evaluation.

Mercury Effluent Data

Statistics	Conc. (ng/L)
1-day P_{99}	2.66
4-day P_{99}	1.72
30-day P_{99}	1.23
Mean	1.01
Std	0.49
Sample size	51
Range	0.38 - 3.2

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

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 not the case for Appleton WWTF 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 for all the detected substances.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 776 cfs, (1-Q_{10} (estimated as 80% of 7-Q_{10})), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	ATC	MAX. EFFL. LIMIT*	1-day P_{99}	1-day MAX. CONC.
Mercury (ng/L)	830	1,660.0	2.66	3.2

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

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 243 cfs (¼ of the 7-Q_{10}), as specified in s. NR 106.06(4)(c), Wis. Adm. Code

Attachment #1

SUBSTANCE	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	4-day P_{99}
Mercury (ng/L)	440		440	1.72

Monthly Average Limits based on Wildlife Criteria (WC)
RECEIVING WATER FLOW = 333 cfs (¼ of the 90-Q_{10}), as specified in s. NR 106.06(4), Wis. Adm. Code

SUBSTANCE	WC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	30-day P_{99}
Mercury (ng/L)	1.3		1.3	1.23

Monthly Average Limits based on Human Threshold Criteria (HTC)
RECEIVING WATER FLOW = 820 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	30-day P_{99}
Mercury (ng/L)	1.5		1.5	1.23

Conclusions and Recommendations
Limits and/or monitoring recommendations are made in the paragraphs below:

Mercury – Considering available effluent data from the current permit term (n = 51, September 2019 – August 2024), the 1-day, 4-day, and 30-day P_{99} values are 2.66, 1.72, and 1.23 ng/L respectively. These levels are below the calculated mercury WQBELs; **therefore, limits are not recommended during the reissued permit term. Monthly monitoring and PMP efforts are recommended to continue during the reissued permit term to maintain effluent quality at or below current levels.**

The current permit has the interim limit of 3.4 ng/L as a daily maximum and is an alternative mercury effluent limit based on the variance granted by EPA as described in s. NR 106.145(4), Wis. Adm. Code. **This limit is recommended to be removed during the reissued permit term because reasonable potential for mercury WQBELs is not demonstrated.** This limit removal meets the antidegradation/antibacksliding requirements of ch. NR 207, Wis. Adm. Code, because mercury PMP efforts are recommended to continue in the reissued permit.

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 type of discharge and the effluent flow rate, **PFOS and PFOA monitoring is recommended at a monthly frequency during the reissued permit term.**

PART 3 – 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 9% 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 = 15.5 MGD = 24.0 cfs
  f = fraction of the Q_e withdrawn from the receiving water = 0
  Q_s = ¼ of the 7-Q_{10} = 970 cfs ÷ 4 = 243 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. In addition, the Department 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, available WET data after March 31, 2011 is shown in the table below:

Attachment #1

WET Data History

Date Test Initiated	Acute Results LC_{50} % (% survival in 100% effluent)				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?	
08/09/2011	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
05/01/2012	>100	>100	Pass	Yes					
10/16/2012	>100	>100	Pass	Yes	NA	NA	NA	No	1
11/06/2012	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
03/06/2013	>100	>100	Pass	Yes					
08/20/2013	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
05/20/2014	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
11/18/2014	75.2	>100	Fail	Yes					
12/16/2014	>100	>100	Pass	Yes					
01/27/2015	>100	>100	Pass	Yes					
08/18/2015	>100	>100	Pass	Yes					
05/16/2017	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
07/17/2018	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
10/08/2019	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
02/25/2020	>100	>100	Pass	Yes					
04/28/2020	>100	>100	Pass	Yes	59.6	52	Pass	Yes	
06/29/2021	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
07/12/2022	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
06/20/2023	>100	>100	Pass	Yes	>100	>100	Pass	Yes	

Footnotes:

1. *Qualified or Inconclusive Data.* Data quality concerns were noted during testing which calls into question the reliability of the test results.

- 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)]
  Chronic Reasonable Potential = [(TUc effluent) (B)(IWC)]

  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 = [(TU_a effluent) (B)]

Attachment #1

Acute WET Limit Parameters

TUa (maximum) $100/LC_{50}$	**B** (multiplication factor from s. NR 106.08(5)(c), Wis. Adm. Code, Table 4)
100/75.2 = 1.33	6.2 Based on 1 detect

[(TUa effluent) (B)(AMZ)] = 8.2 > 1.0

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

Chronic WET Limit Parameters

100/52 = 1.9	6.2 Based on 1 detect	9%

[(TUc effluent) (B)(IWC)] = 1.1 > 1.0

Therefore, reasonable potential is shown for both acute and chronic WET limits using the procedures in s. NR 106.08(6), Wis. Adm. Code, and representative data from August 2011 – June 2021.

Expression of WET limits

Acute WET limit = **1.0 TU_a expressed as a daily maximum**

Chronic WET limit = [100/IWC] TU_c = **11 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 = 9%. **0 Points**
Historical Data	Eighteen tests used to calculate RP. No tests failed. **0 Points**	Eleven tests used to calculate RP. One tests failed. **0 Points**

Attachment #1

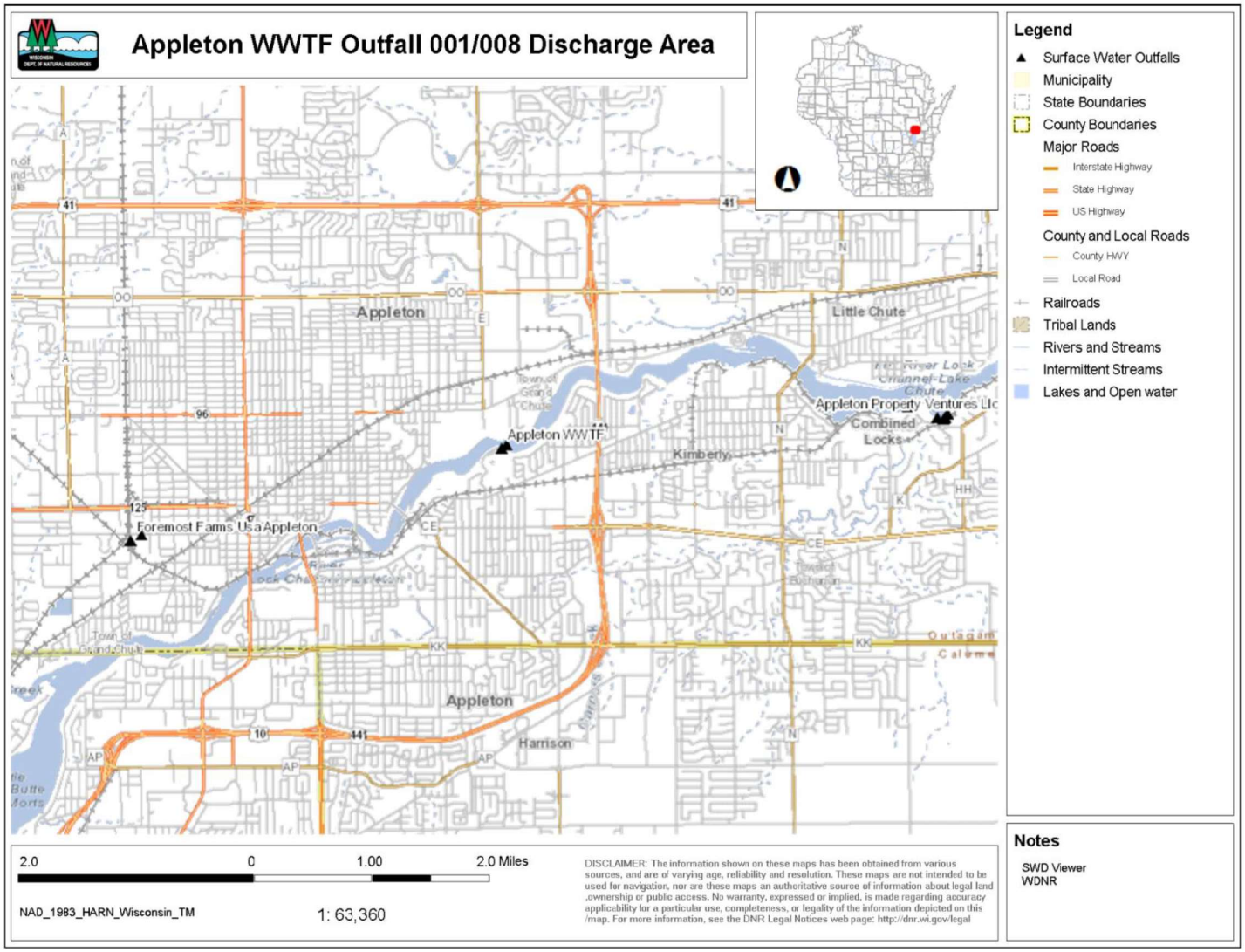
	Acute	Chronic
Effluent Variability	Little variability, no violations or upsets, consistent WWTF operations. **0 Points**	Same as acute. **0 Points**
Receiving Water Classification	WWSF community. **5 Points**	Same as acute. **5 Points**
Chemical-Specific Data	Reasonable potential for limits for chlorine based on ATC; Ammonia nitrogen limit carried over from the current permit. Multiple substances with ATC detected. Multiple additional compounds of concern detected. **10 Points**	No reasonable potential limits based on CTC; Ammonia nitrogen limit carried over from the current permit. Multiple substances with CTC detected. Multiple additional compounds of concern detected. **5 Points**
Additives	One biocide and three water quality conditioners added. Permittee has proper P chemical SOPs in place: No. **21 Points**	All additives used more than once per 4 days. **21 Points**
Discharge Category	Seven industrial contributors. **11 Points**	Same as acute. **11 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		Annual chronic tests during permit term.
TRE Recommended? (from Checklist)	No	No

- After consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, **2x/yr acute and annual chronic WET tests are recommended in the reissued permit.** Tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).

- According to the requirements specified in s. NR 106.08, Wis. Adm. Code, an acute and chronic WET limit are required. **The acute WET limit shall be expressed as 1.0 TUa as a daily maximum and the chronic WET limit shall be expressed as 11 TUc as a monthly average in the effluent limits table of the permit.**

- **If a satisfactory phosphorus chemical SOP is established and implemented at the facility prior to permit reissuance, then WET testing can be reduced to annual acute and chronic tests in the reissued permit.** A minimum of annual acute and chronic monitoring is required because both acute and chronic WET limits are required. Federal regulations in 40 CFR Part 122.44(i) require that monitoring occur at least once per year when a limit is present.

Attachment #2



CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: December 8, 2021

TO: Phillip Spranger – SCR/Fitchburg Service Center

FROM: Michael Polkinghorn – NOR/Rhinelander Service Center

SUBJECT: Water Quality-Based Effluent Limitations for the Appleton Wastewater Treatment Facility WPDES Permit No. WI-0023221-09-0

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 Appleton Wastewater Treatment Facility in Outagamie County. This municipal wastewater treatment facility (WWTF) discharges to the Fox River, located in the Fox River/Appleton Watershed in the Lower Fox River Basin. This discharge is included in the Lower Fox River Basin (LFRB) Total Maximum Daily Load (TMDL) as approved by EPA on May 18, 2012. 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
Flow River May – October						1, 2
River Temp May – October						1, 2
$CBOD_5$ Year round May – October	Variable		40 mg/L	25 mg/L		1, 3
TSS			45 mg/L 2,434 lbs/day	30 mg/L 1,322 lbs/day		1, 4
pH	9.0 s.u.	6.0 s.u.				1
E. coli May – September				126 #/100 mL geometric mean		5
Residual Chlorine	38 µg/L		**38 µg/L**	**38 µg/L**		1, 6
Ammonia Nitrogen Year round January – March April May June – September October – December	29 mg/L		 28 mg/L 29 mg/L **29 mg/L** 11 mg/L **29 mg/L**	 10 mg/L 11 mg/L 11 mg/L 4.4 mg/L 18 mg/L		6
Phosphorus						1, 4, 7
Interim				1.0 mg/L		
Final				69 lbs/day	23 lbs/day	
Mercury			**1.3 ng/L**	1.3 ng/L 0.00017 lbs/day 0.00026 lbs/day		6, 8

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Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Cadmium (Total Recoverable)						9
Chromium (Total Recoverable)						9
Copper (Total Recoverable)						9
Lead (Total Recoverable)						9
Nickel (Total Recoverable)						9
Zinc (Total Recoverable)						9
TKN, Nitrate+Nitrite, and Total Nitrogen						10
Acute WET	1.0 TUa					11
Chronic WET				11 TUc		12

Footnotes:

1. No changes from the current permit.
2. Monitoring performed at Sample Point 601.
3. Compliance with the daily maximum limits is determined at Sample Point (Outfall) 008. The $CBOD_5$ WLA tables from the current permit should be retained in the reissued permit.
4. The total suspended solids (TSS) and phosphorus mass limits are based on the LFRB TMDL to address TSS and phosphorus water quality impairments within the TMDL area.
5. Additional final limit: No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 count/100 mL.
6. 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.
7. The monthly average phosphorus concentration limit is a technology-based effluent limit (TBEL) which also functions as an interim limit for the phosphorus compliance schedule. A compliance schedule is in the current permit to meet the final WQBELs by 01/01/2023.
8. These are the WQBELs for mercury. An alternative effluent limitation of 3.4 ng/L, equal to the 1-day P_{99} of representative data, as a daily maximum may be included in the permit in place of the WQBELs if a mercury variance application is submitted and approved by EPA. The monthly average limit of 0.00026 lbs/day is an alternative wet weather mass limit as described in s. NR 106.07(9), Wis. Adm. Code. This limit applies when the monthly average mass limit of 0.00017 lbs/day is exceeded and the facility demonstrates to the Department the exceedance is caused by and occurs during a wet weather event.
9. Continued monitoring for total recoverable cadmium, chromium, copper, lead, nickel and zinc is also required because Appleton WWTF operates a local pretreatment program for the many industries that discharge to the treatment facility.
10. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, quarterly total nitrogen monitoring is recommended for all major municipal permittees. Total Nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), and total Kjeldahl nitrogen (TKN) (all expressed as N).
11. The acute WET limit of 1.0 TUa and annual 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. The chronic WET limit of 11 TUc and annual chronic WET tests are recommended during the reissued permit term. The Instream Waste Concentration (IWC) to assess chronic test results is 9%. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 30%, 10%, 3% & 1% and the dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the Fox River upstream of Outfall 001. 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).

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Michael Polkinghorn at (715) 360-3379 or Michael.Polkinghorn@wisconsin.gov and Diane Figiel at Diane.Figiel@wisconsin.gov.

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

PREPARED BY: Michael A. Polkinghorn, E.I.T. – Water Resources Engineer

E-cc: Barti Oumarou, Wastewater Engineer – NER/Oshkosh Service Center
Heidi Schmitt-Marquez, Regional Wastewater Supervisor – NER/Green Bay Service Center
Diane Figiel, P.E., Water Resources Engineer – WY/3
Kari Fleming, Environmental Toxicologist – WY/3

Attachment #1

Water Quality-Based Effluent Limitations for
Appleton Wastewater Treatment Facility

WPDES Permit No. WI-0023221-09-0

Prepared by: Michael A. Polkinghorn, E.I.T.

PART 1 – BACKGROUND INFORMATION

Facility Description

The City of Appleton owns and operates an advanced, secondary, biological activated sludge wastewater treatment facility. Treatment processes consist of: screening, grit removal, primary clarification, activated sludge-contact stabilization, and final clarification. Seasonal disinfection is achieved with liquid sodium hypochlorite addition in 2 chlorine contact chambers. Dechlorination is accomplished by the addition of liquid sodium bisulfite. Phosphorus is precipitated chemically, with the addition of ferric chloride and/or ferrous sulfate. During typical operating conditions, effluent is discharged on a continuous basis by gravity via Outfall 001 (60" diffuser) to the south bank of the Fox River, approximately 0.75 mi east of the College Ave./Highway 125 bridge. However, during periods when high river flows prevent gravity discharge, three effluent screw pumps at pump station #1, convey effluent to the outfall chamber. This then flows by gravity to the 60" diffuser. If flows continue to be excessive, the outfall chamber surcharges into the outfall relief structure. That effluent volume discharges by gravity to the River, through a separate 48" outfall main, adjacent to the diffuser. If flows are still unmanageable for the first two outfall pipes, three centrifugal pumps at pump station #2, draw from the effluent end of chlorine contact tank #2. These discharge to the River through a 36" outfall main. This pipe is situated 400 feet upstream from station #1.

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

Existing Permit Limitations

The current permit, expiring on 03/31/2022, includes the following effluent limitations and monitoring requirements.

Outfall 001

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
Flow Rate						1
$CBOD_5$			40 mg/L	25 mg/L		2
TSS			45 mg/L 2,434 lbs/day	30 mg/L 1,322 lbs/day		2, 3
pH	9.0 s.u.	6.0 s.u.				2
Fecal Coliform May – September			**656#/100 mL** **geometric mean**	400#/100 mL geometric mean		4
Residual Chlorine	38 µg/L		**38 µg/L**	**38 µg/L**		4
Ammonia Nitrogen Year round	29 mg/L					5

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Six-Month Average	Footnotes
January – March			28 mg/L	10 mg/L		
April			29 mg/L	11 mg/L		
May				11 mg/L		
June – September			11 mg/L	4.4 mg/L		
October – December				18 mg/L		
Phosphorus						
Interim				1.0 mg/L		3, 6
Final				69 lbs/day	23 lbs/day	
Mercury						
Interim	3.4 ng/L					7
Final				1.3 ng/L		
Cadmium (Total Recoverable)						8
Chromium (Total Recoverable)						8
Copper (Total Recoverable)						8
Lead (Total Recoverable)						8
Nickel (Total Recoverable)						8
Zinc (Total Recoverable)						8
Acute WET	1.0 TU_a					9
Chronic WET						9

Footnotes:

1. Monitoring only.
2. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
3. The total suspended solids (TSS) and phosphorus mass limits are based on the LFRB TMDL to address TSS and phosphorus water quality impairments within the TMDL area.
4. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.
5. The weekly and monthly average limits are based on multiple discharges to this section of the Fox River, including the Appleton WWTF, Grand Chute Menasha West SC WWTF, Heart of the Valley MSD WWTF, and the Neenah Menasha SC WWTF.
6. The monthly average phosphorus concentration limit is a technology-based effluent limit (TBEL) which also functions as an interim limit for the phosphorus compliance schedule. A compliance schedule is in the current permit to meet the final WQBELs by 01/01/2023.
7. The interim limit is an alternative mercury effluent limit based on the variance granted by EPA as described in s. NR 106.145(4), Wis. Adm. Code, for the current permit term. This limit is based on the 1-day P_{99} of effluent data and includes implementation of a pollutant minimization plan.

8. Continued monitoring for total recoverable cadmium, chromium, copper, lead, nickel and zinc is also required because Appleton WWTF operates a local pretreatment program for the many industries that discharge to the treatment facility.
9. The current permit required annual acute and chronic whole effluent toxicity (WET) tests in order to collect seasonal information about the discharge.

Sample Point 601

Parameter	Footnotes
Flow River May – October	1
River Temp May – October	1

Sample Point (Outfall) 008

Parameter	Daily Maximum	Footnotes
$CBOD_5$ May – October	Variable	2, 3, 4

Footnotes:

1. Monitoring only.
2. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
3. Variable $CBOD_5$ daily maximum mass WQBELs are required for any point source discharge to the Lower Fox River (river miles 0 – 40.0) as described in s. 212.40, Wis. Adm. Code. The tables below, based on Table 1b of ch. NR 212, Wis. Adm. Code, for each respective month provide the receiving water temperature and flow conditions where the resulting mass limit shall apply on a daily basis, such that the actual discharge may not exceed 120.0% of the mass limit for that day.
4. Additional Limit: The sum of the actual daily discharges for any 7-consecutive-day-period may not exceed the sum of the daily mass limit values for the same 7-consectutive-day-period based on the tables below.

Daily Max $CBOD_5$ Limits (lbs/day): May – June

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
86 OR MORE	2471	2583	2793	3041	3307	3575	3836	4080	4341	4599	5010	5598	6453	8085	9301
82 TO 85	2457	2585	2810	3086	3373	3655	3926	4175	4456	4810	5263	5902	6806	8605	10076
78 TO 81	2423	2582	2850	3168	3487	3791	4109	4483	4903	5222	5676	6461	7491	9511	11553
74 TO 77	2387	2578	2905	3261	3600	4027	4470	4902	5251	5597	6172	6996	8064	10632	12724
70 TO 73	2361	2588	2969	3366	3856	4361	4847	5215	5616	6032	6667	7665	8677	12032	12724

66 TO 69	2363	2644	3070	3619	4189	4753	5178	5611	6107	6576	7292	8310	9537	12724	12724
62 TO 65	2410	2735	3339	3990	4652	5151	5670	6222	6759	7302	8219	9176	10822	12724	12724
58 TO 61	2521	3017	3776	4568	5178	5823	6486	7083	7783	8482	9303	10646	12724	12724	12724
54 TO 57	2852	3500	4483	5250	6081	6863	7668	8573	9249	9997	11220	12724	12724	12724	12724
50 TO 53	3431	4324	5346	6437	7426	8576	9536	10501	11574	12724	12724	12724	12724	12724	12724
46 TO 49	4451	5402	6797	8227	9770	11068	12517	12724	12724	12724	12724	12724	12724	12724	12724
42 TO 45	5852	7153	9231	11401	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724
41 OR LESS	8092	10298	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724

Daily Max $CBOD_5$ Limits (lbs/day): July

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
86 OR MORE	2456	2558	2783	3035	3253	3311	3413	3565	3699	3767	3964	4322	4867	6437	7520
82 TO 85	2476	2598	2807	3074	3325	3476	3585	3680	3778	3988	4290	4668	5415	7041	8380
78 TO 81	2458	2619	2860	3136	3394	3619	3809	4017	4271	4492	4809	5444	6255	8155	9995
74 TO 77	2462	2617	2903	3194	3460	3783	4181	4480	4749	5006	5515	6172	6987	9425	11842
70 TO 73	2438	2639	2936	3247	3661	4156	4644	4952	5284	5664	6190	6833	7779	10938	12724
66 TO 69	2433	2671	2997	3465	4039	4616	5053	5501	5945	6349	6820	7555	8776	12724	12724
62 TO 65	2467	2729	3222	3874	4571	5095	5633	6209	6620	6991	7601	8563	10155	12724	12724
61 OR LESS	2548	2946	3692	4533	5177	5859	6527	6961	7444	7961	8810	10126	12323	12724	12724

Daily Max $CBOD_5$ Limits (lbs/day): August

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
86 OR MORE	2163	2254	2473	2740	3005	3242	3447	3626	3789	3938	4141	4327	4750	6066	6947
82 TO 85	2163	2275	2509	2790	3056	3299	3513	3695	3875	4020	4304	4568	5265	6666	7736
78 TO 81	2163	2309	2567	2864	3148	3401	3626	3827	4132	4438	4701	5297	5981	7640	9264
74 TO 77	2163	2332	2624	2940	3237	3506	3841	4241	4559	4857	5342	5913	6687	8808	11001
70 TO 73	2163	2356	2681	3013	3334	3808	4257	4611	4971	5354	5909	6548	7369	10252	12724
66 TO 69	2165	2414	2765	3159	3707	4237	4657	5067	5533	6031	6542	7201	8298	12011	12724
62 TO 65	2221	2499	2938	3566	4198	4697	5202	5740	6362	6704	7250	8126	9616	12724	12724
61 OR LESS	2319	2685	3402	4161	4778	5425	6110	6690	7125	7596	8370	9611	11684	12724	12724

Attachment #1

Daily Max $CBOD_5$ Limits (lbs/day): September

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
86 OR MORE	2163	2163	2163	2397	2692	2964	3218	3452	3674	3877	4146	4420	4845	6093	6986
82 TO 85	2163	2163	2163	2458	2759	3037	3288	3518	3754	3965	4136	4557	5279	6649	7740
78 TO 81	2163	2163	2229	2558	2872	3165	3433	3675	3894	4069	4463	5167	5888	7548	9264
74 TO 77	2163	2163	2309	2652	2978	3282	3560	3836	4156	4471	4981	5751	6549	8691	10992
70 TO 73	2163	2163	2385	2744	3079	3480	3829	4176	4556	4936	5612	6363	7169	10133	12724
66 TO 69	2163	2163	2491	2867	3377	3804	4217	4642	5105	5611	6310	6977	8059	11902	12724
62 TO 65	2163	2216	2623	3237	3759	4249	4764	5294	5927	6457	6990	7864	9387	12724	12724
58 TO 61	2163	2367	3067	3709	4315	4962	5642	6386	6844	7301	8064	9322	11429	12724	12724
54 TO 57	2240	2834	3638	4405	5236	6142	6863	7427	8064	8771	9925	11751	12724	12724	12724
50 TO 53	2784	3506	4494	5607	6740	7542	8350	9271	10289	11387	12724	12724	12724	12724	12724
46 TO 49	3584	4519	6027	7494	8573	9802	11180	12708	12724	12724	12724	12724	12724	12724	12724
42 TO 45	4900	6390	8415	10088	12004	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724
41 OR LESS	7203	9360	12179	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724

Daily Max $CBOD_5$ Limits (lbs/day): October

River Temperature (previous day average in °F)	Flow at Appleton Lutz Park (previous four-day average in cfs)														
	750 OR LESS	751 TO 1000	1001 TO 1250	1251 TO 1500	1501 TO 1750	1751 TO 2000	2001 TO 2250	2251 TO 2500	2501 TO 2750	2751 TO 3000	3001 TO 3500	3501 TO 4000	4001 TO 5000	5001 TO 8000	8001 OR MORE
66 OR MORE	2163	2163	2195	2576	2919	3298	3712	4152	4633	5164	6084	6844	8033	12165	12724
62 TO 65	2163	2163	2313	2800	3250	3737	4268	4804	5465	6181	6805	7735	9340	12724	12724
58 TO 61	2163	2163	2645	3189	3786	4442	5130	5902	6613	7078	7870	9183	11414	12724	12724
54 TO 57	2163	2395	3094	3846	4681	5587	6546	7153	7801	8519	9711	11619	12724	12724	12724
50 TO 53	2300	2924	3890	4995	6219	7210	8021	8942	9979	11099	12724	12724	12724	12724	12724
46 TO 49	2943	3846	5331	6910	8153	9383	10767	12303	12724	12724	12724	12724	12724	12724	12724
42 TO 45	4127	5585	7698	9549	11449	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724
41 OR LESS	6394	8457	11476	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724	12724

Receiving Water Information

- Name: Fox River
- Waterbody Identification Code (WBIC): 117900
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply. Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.

- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q_{10} and 7-Q_2 values are from USGS for the Fox River at Wrightstown.
  7-Q_{10} = 970 cubic feet per second (cfs)
  7-Q_2 = 1,380 cfs
  90-Q_{10} = 1,330 cfs
  Harmonic Mean Flow = 3,280 cfs using a drainage area of 6,010 mi^2.
  It should be noted that the low-flow location is approximately 13 miles downstream of Outfalls 001. Typically, low-flows should be estimated upstream of the confluence of the receiving water with the discharge, so the discharge does not influence the measured flow. Additional low flow data is available from USGS for the Fox River at Appleton WI, where the drainage area was determined to be 5,950 mi^2. This is a difference of 60 mi^2 or 1% between the two positions on the Fox River. In this case, the resulting change in the low-flows is not significant and the original USGS low-flows will be used in this evaluation.
- Hardness = 170 mg/L as $CaCO_3$. This value represents the geometric mean of WET test data (n = 5) from May 2017 – June 2021.
- % 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: Chromium data is taken from the Fox River at De Pere, WI. Chloride data is taken from the Fox River at Appleton, WI. Other metals data are from the Wolf River at New London, WI due to the limited availability of background data for the Fox River upstream of Outfall 001. The Wolf River is within the same ecological landscape so ambient water quality characteristics are expected to be similar. The numerical values are shown in the tables in Part 2 of this evaluation, in the columns titled "MEAN BACK-GRD.". If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations. Background data for calculating effluent limitations for ammonia nitrogen is described later.
- Multiple dischargers: Multiple dischargers were integrated in the weekly and monthly average ammonia nitrogen limits for the Appleton WWTF along with 3 other facilities in this section of the Fox River. Otherwise, the effects of multiple dischargers were not historically considered for other parameters due to not being in the immediate vicinity and the belief mixing zones are not overlapping. Therefore, the other dischargers do not impact this evaluation.
- Impaired water status: The Fox River is on the CWA Section 303(d) list and is impaired by phosphorus and polychlorinated biphenyls (PCBs). It is included in the LFRB TMDL area for phosphorus and TSS.

Effluent Information

- Design flow rate(s):
  Annual average = 15.5 Million Gallons per Day (MGD)
  Maximum monthly = 24.2 MGD
  For reference, the actual average flow from April 2017 – September 2021 was 12.5 MGD.
- Hardness = 598 mg/L as $CaCO_3$. This value represents the geometric mean of data (n = 4) required in the permit application from March 2021 – June 2021.
- 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 7 industrial contributors.
- Water supply: Appleton Water Plant (Lake Winnebago) and 2 industrial wells.
- Total Phosphorus Wasteload Allocation: 7,556 lbs/year, 20.69 lbs/day (See page 83 of the *Total Maximum Daily Load and Watershed Management Plan for Total Phosphorus and Total Suspended*

Solids in the Lower Fox River Basin and Lower Green Bay Report, March 2012).

- Total Suspended Solids Wasteload Allocation: 169,857 lbs/year, 465 lbs/day (See page 84 of the *Total Maximum Daily Load and Watershed Management Plan for Total Phosphorus and Total Suspended Solids in the Lower Fox River Basin and Lower Green Bay Report*, March 2012).
- Additives: The Appleton WWTF uses 4 additives in their process and are listed below:
    - Sodium hypochlorite – chlorination
    - Sodium bisulfite – dechlorination
    - Ferric chloride – chemical phosphorus removal
    - Ferrous sulfate – chemical phosphorus removal
- Effluent characterization: This facility is categorized as a major municipal, so the permit application required effluent sample analyses for all the "priority pollutants" except for the Dioxins and Furans as specified in s. NR 200.065, Table 1, Wis. Adm. Code. The permit-required monitoring effluent data for Cd, Cr, Cu, Pb, Ni, Hg and Zn from April 2017 – September 2021 are used in this evaluation.
- 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 chromium (+6) sample provided in the permit application (7.7 µg/L, 04/01/2021) is greater than the value recorded for total recoverable chromium/(+3) (1.70 µg/L) on the same date. In addition, the available total recoverable chromium/(+3) effluent dataset further suggests the chromium (+6) concentration in the effluent is not as high as 7.7 µg/L given the highest available total recoverable chromium/(+3) sample is 2.4 µg/L. Due to the apparent sampling error, the statistical values calculated for total recoverable chromium/(+3) will also be used in the limit evaluation for chromium (+6).
- Mercury field blanks indicated contamination was present from either sample transportation or environmental sources via 4 detects on the 7/1/2017, 7/1/2018, 8/1/2021, and 9/1/2021 samples respectively. Therefore, the effluent samples associated with those blanks are not used in this evaluation.

Toxic Substances Effluent Data

Statistics	Chromium (+3) (µg/L)	Copper (µg/L)
1-day P_{99}	2.44	17.18
4-day P_{99}	1.72	11.73
30-day P_{99}	0.97	8.91
Mean	0.58	7.53
Std	0.43	3.02
Sample size	54	54
Range	<1.3 - 2.4	2.7 - 19

Statistics	Nickel (µg/L)	Mercury (ng/L)	Zn (µg/L)
1-day P_{99}	16.08	4.05	50.23
4-day P_{99}	11.15	2.39	40.32
30-day P_{99}	8.59	1.53	30.59
Mean	7.33	1.15	25.85
Std	2.78	0.80	7.73
Sample size	54	50	54

Range	1.9 - 16	<0.36 - 3.6	<10 - 46

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

Cadmium Effluent Data

Sample Date	µg/L
06/01/2017	0.17
12/01/2018	0.30
03/01/2019	0.30
07/01/2019	0.40
08/01/2019	0.30
07/01/2020	0.20
03/01/2021	0.20
09/01/2021	0.30
Sample size	54
Mean	0.04

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

Lead Effluent Data

Sample Date	µg/L
06/01/2017	1.10
09/01/2017	0.66
02/01/2019	5.00
04/01/2019	5.80
07/01/2019	3.30
11/01/2019	4.50
05/01/2020	3.60
Sample size	54
Mean	0.44

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

Chloride Effluent Data

Sample Date	mg/L
03/29/2021	209
04/21/2021	230
05/20/2021	174
06/23/2021	220
Mean	208

The following table presents the average concentrations and loadings at Outfall 001 and 008 from April 2017 – September 2021 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6), Wis. Adm. Code:

Attachment #1

Parameter Averages with Limits

	Average Measurement*	Average Mass Discharged
$CBOD_5$	5.7 mg/L	500 lbs/day
TSS	3 mg/L	371 lbs/day
pH field	7.17 s.u.	
Fecal coliform	14 #/100 mL	
Chlorine	0.140 µg/L	
Ammonia Nitrogen	2.79 mg/L	
Phosphorus	0.24 mg/L	
Mercury	1.15 ng/L	

*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 not the case for Appleton WWTF 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 for all the detected substances. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L) and mercury (ng/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 776 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.
Cadmium	457	58.9	117.8	23.6	0.04		0.40
Chromium (+3)	301	4,446	8,891.7			2.44	2.4
Chromium (+6)		16.0	32.0			2.44	2.4
Copper	495	70.2	140.4			17.18	19
Lead	356	365	729.3	145.9	0.44		5.80
Mercury (ng/L)		830	1,660.0			4.05	3.6
Nickel	268	1,080	2,160.6			16.08	16
Zinc	333	345	689.4			50.23	46
Chloride (mg/L)		757	1,514.0	303	208		230
Toluene***		2,107.59	2,107.59	421.52	0.73		0.73

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

** The 2 × ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q_{10} 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 using the 2 × ATC or 1-Q_{10} methods as described in s. NR 106.06(3)(b)2, and s. NR 105.05(2)(f)6), Wis. Adm Codes.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)

RECEIVING WATER FLOW = 243 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	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Cadmium	170	3.73	0.133	40.10	8	0.04	
Chromium (+3)	170	203.89	0.781	2,258			1.72
Chromium (+6)		10.98		122.0			1.72
Copper	170	16.29	1.06	170.3			11.73
Lead	170	46.73	0.247	516.7	103.3	0.44	
Mercury (ng/L)		440		440			2.39
Nickel	170	81.71		908			11.15
Zinc	170	191.32	1.8	2,108			40.32

Attachment #1

SUBSTANCE	REF. HARD. mg/L	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Chloride (mg/L)		395	17.2	4215	843.0	208	
Selenium		5.00		55.56	11.11	1.0	
Toluene*		117.08		1,300.93	260.19	0.73	

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

Monthly Average Limits based on Wildlife Criteria (WC)

RECEIVING WATER FLOW = 333 cfs (¼ of the 90-Q_{10}), as specified in s. NR 106.06(4), Wis. Adm. Code

SUBSTANCE	WC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P_{99}
Mercury (ng/L)	1.3		**1.3**			**1.53**

Monthly Average Limits based on Human Threshold Criteria (HTC)

RECEIVING WATER FLOW = 820 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	30-day P_{99}
Antimony	373		13,126	2,625.3	0.44	
Cadmium	370	0.133	13,016	2,603.3	0.04	
Chromium (+3)	3,818,000	0.781	134,360,566			0.97
Chromium (+6)	7,636		268,721			0.97
Lead	140	0.247	4,918	983.7	0.44	
Mercury (ng/L)	1.5		**1.5**			**1.53**
Nickel	43,000		1,513,228			8.59
Selenium	2,600		91,498	18,300	1.0	
Toluene	15,359		540,504	108,101	0.73	

Monthly Average Limits based on Human Cancer Criteria (HCC)

RECEIVING WATER FLOW = 820 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HCC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Chloroform	1,960		68,975	13,795	0.95

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 needed for mercury.** The need for additional ammonia nitrogen limits will be evaluated later in this evaluation. Limits and/or monitoring recommendations are made in the following paragraphs below:

Total Residual Chlorine – Because chlorine is added as a disinfectant, effluent limitations are recommended to assure proper operation of the de-chlorination system. Section NR 210.06(2)(b), Wis. Adm. Code, states, "When chlorine is used for disinfection, the daily maximum total residual chlorine concentration of the discharge may not exceed 0.10 mg/L." Because the WQBELs are more restrictive, they are recommended instead. **Therefore, 38 µg/L as a daily maximum is recommended during the reissued permit term.**

The current permit has the weekly and monthly average limits of 38 µg/L to meet the requirements in s. NR 106.07, Wis. Adm Code. Because the daily maximum limit has not changed, **the weekly and monthly average limits of 38 µg/L should remain unchanged and continued during the reissued permit term.**

Mercury – A review of data from April 2017 – September 2021 indicates the 30-day P_{99} is 1.53 ng/L, which is above the wildlife criterion of 1.3 ng/L. Therefore, **1.3 ng/L as a monthly average is required for the Appleton WWTF.**

When an effluent limit based on WC for toxic substances is needed, a mass limit and an alternative wet weather mass limit are required as described in s. NR 106.07, Wis. Adm. Code. The mass limit is based on the annual average design flow and the alternative wet weather mass limit is based on the maximum monthly average design flow. The mass limitation of **0.00017 lbs/day as a monthly average** is based on the concentration limit and the annual average design flow rate of 15.5 MGD (1.3 ng/L * 15.5 MGD * $8.34/10^6$) in accordance with s. NR 106.07(2)(c), Wis. Adm. Code. In addition, the wet weather mass limit of **0.00026 lbs/day as a monthly average** is required using the maximum monthly design flow of 24.2 MGD (1.3 ng/L * 24.2 MGD * $8.34/10^6$) based on s. NR 106.07(9), Wis. Adm. Code.

Additional limits to meet the expression of limits requirements of s. NR 106.07, Wis. Adm. Code, will be evaluated in Part 8 of this evaluation.

Section NR 106.145(4), Wis. Adm. Code, allows for eligibility for an alternative mercury effluent limitation if the permittee applies for an alternative mercury limit, which includes the submittal of a pollutant minimization plan. Section NR 106.145(5), Wis. Adm. Code, specifies that an alternative limitation shall equal the 1-day P_{99} of the effluent data and shall be expressed as a daily maximum concentration. The 1-day P_{99} of effluent mercury data is 4.05 ng/L, however, the mercury interim limit in the current permit is 3.4 ng/L and the Department cannot increase the interim limit as the facility must show progress towards meeting the mercury WQBELs as part of the EPA variance approval process for water quality standards. **Therefore, if a variance is granted and approved by US Environmental Protection Agency, then an alternative mercury limitation of 3.4 ng/L as a daily maximum would be recommended during the reissued permit term for Appleton WWTF.**

Appleton WWTF has indicated in the permit application that they do not wish to reapply for the mercury variance. **In the absence of a mercury variance, the prior stated limits and additional concentration limits to meet the expression of limits requirements in s. NR 106.07, Wis. Adm. Code, would be required during the reissued permit term.**

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. 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.
- Section NR 106.07(3), Wis. Adm. Code requires weekly and monthly average limits for municipal treatment plants.

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

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

Where:

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

The effluent pH data was examined as part of this evaluation. A total of 1,644 sample results were reported from April 2017 – September 2021. The maximum reported value was 8.14 s.u. (Standard pH Units). The effluent pH was 7.63 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 7.70 s.u. The mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 7.69 s.u. Therefore, a value of 7.70 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 7.70 s.u. into the equation above yields an ATC = 14.35 mg/L.

Potential Changes to Daily Maximum Ammonia Nitrogen Effluent Limitations
Subchapter IV of ch. NR 106, Wis. Adm. Code (effective September 1, 2016) specifies methods for the use of the 1-Q_{10} receiving water low flow to calculate daily maximum ammonia nitrogen limits 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

	Ammonia Nitrogen Limit mg/L
2×ATC	29
1-Q	480

The 2×ATC method yields the most stringent limits for Appleton 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 – WWSF

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
$6.0 \leq pH \leq 6.1$	108	$7.0 < pH \leq 7.1$	66	$8.0 < pH \leq 8.1$	14
$6.1 < pH \leq 6.2$	106	$7.1 < pH \leq 7.2$	59	$8.1 < pH \leq 8.2$	11
$6.2 < pH \leq 6.3$	104	$7.2 < pH \leq 7.3$	52	$8.2 < pH \leq 8.3$	9.4
$6.3 < pH \leq 6.4$	101	$7.3 < pH \leq 7.4$	46	$8.3 < pH \leq 8.4$	7.8
$6.4 < pH \leq 6.5$	98	$7.4 < pH \leq 7.5$	40	$8.4 < pH \leq 8.5$	6.4
$6.5 < pH \leq 6.6$	94	$7.5 < pH \leq 7.6$	34	$8.5 < pH \leq 8.6$	5.3
$6.6 < pH \leq 6.7$	89	$7.6 < pH \leq 7.7$	29	$8.6 < pH \leq 8.7$	4.4
$6.7 < pH \leq 6.8$	84	$7.7 < pH \leq 7.8$	24	$8.7 < pH \leq 8.8$	3.7
$6.8 < pH \leq 6.9$	78	$7.8 < pH \leq 7.9$	20	$8.8 < pH \leq 8.9$	3.1
$6.9 < pH \leq 7.0$	72	$7.9 < pH \leq 8.0$	17	$8.9 < pH \leq 9.0$	2.6

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

The weekly and monthly average limits in the current permit are based on multiple discharges to this section of the Fox River, including the Appleton WWTF, Grand Chute Menasha West SC WWTF, Heart of the Valley MSD WWTF, and the Neenah Menasha SC WWTF. The Department does not plan to revise these limits for these facilities at this time but may do so in the future dependent on expanded monitoring programs which can potentially lead to more detailed modeling of the Fox River. The calculations are explained in further detail in the Department memorandum dated October 2009 and the final applicable limits for Appleton WWTF are included in the table below:

Weekly and Monthly Average Ammonia Nitrogen Limits

Months Applicable	Weekly Average (mg/L)	Monthly Average (mg/L)
January – March	28	10
April – May	29	11
June – September	11	4.4
October – December	47	18

Section NR 106.33(2), Wis. Adm. Code, was updated effective September 1, 2016. As a result, seasonal 20 and 40 mg/L thresholds for including ammonia limits in municipal discharge permits are no longer applicable under current rules. Section NR 106.33(1), Wis. Adm. Code, enables the Department to determine the need to include ammonia limits in municipal discharge permits based on the statistical comparisons in s. NR 106.05, Wis. Adm. Code.

Effluent Data

The following table evaluates the statistics based upon ammonia data reported from April 2017 – September 2021, with those results being compared to the calculated limits to determine the need to include ammonia limits in the Appleton 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. In addition, the daily maximum values are compared to the daily maximum limit.

Ammonia Nitrogen Effluent Data

Statistics mg/L	January – March	April	May	June - September	October - December
1-day P_{99}	28.18	18.31	13.09	5.93	12.36
4-day P_{99}	15.50	10.00	7.08	3.21	6.71
30-day P_{99}	8.80	5.54	3.73	1.71	3.63
Mean*	5.96	3.66	2.35	1.09	2.34
Std	5.72	3.74	2.71	1.22	2.54
Sample size	361	150	155	609	368
Range	<0.082 - 25.3	<0.082 - 18.9	<0.082 - 17	<0.082 - 7.13	<0.082 - 14

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

Based on this comparison, there is no reasonable potential for the discharge to exceed any of the calculated ammonia nitrogen limits.

The current permit has daily maximum and monthly average limits year-round. There are also weekly average limits from January – April and June – September. Where there are existing ammonia nitrogen limits in the permit, the limits must be retained regardless of reasonable potential, consistent with s. NR 106.33(1)(b), Wis. Adm. Code:

> (b) If a permittee is subject to an ammonia limitation in an existing permit, the limitation shall be included in any reissued permit. Ammonia limitations shall be included in the permit if the permitted facility will be providing treatment for ammonia discharges.

Conclusions and Recommendations

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

Final Ammonia Nitrogen Limits

	Daily Maximum (mg/L)	Weekly Average (mg/L)	Monthly Average (mg/L)
January – March	29	28	10
April	29	29	11
May	29		11
June – September	29	11	4.4
October – December	29		18

Additional limits to meet the expression of limits requirements of s. NR 106.33, Wis. Adm. Code, will be evaluated in Part 8 of this evaluation.

PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR BACTERIA

On May 1, 2020, revisions to chs. NR 102 and NR 210, Wis. Adm. Codes, became effective which replace fecal coliform limits with new *Escherichia coli* (*E. coli*) limits for protection of recreational uses. Section NR 210.06(2)(a)1, Wis. Adm. Code, includes two limits which must be included in permits for facilities which are required to disinfect:

1. The geometric mean of *E. coli* bacteria in effluent samples collected in any calendar month may not exceed 126 counts/100 mL.
2. No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 counts/100 mL.

E. coli monitoring is recommended at the same frequency that fecal coliform monitoring is required in the current permit. Because the Appleton WWTF's permit requires weekly monitoring, the 410 counts/100 mL limit will effectively function as a daily maximum limit unless the facility performs additional monitoring. Any additional monitoring beyond what is required by the permit must also be reported on the DMR as required in the standard requirements section of the permit. For informational purposes the Appleton WWTF has been monitoring for fecal coliform at a frequency of 3 times/week.

These limits are required during May – September. No changes are recommended to the current recreational period and the required disinfection season.

Effluent Data

The Appleton WWTF has monitored effluent *E. coli* from May 2019 – September 2019 using both multiple well and membrane filtration analytical methods. The Appleton WWTF plans to use the multiple well analytical method in the future for limit compliance. Using the multiple well method, the geometric mean of 126 counts/100 mL was not exceeded during the 2019 disinfection season, with a maximum monthly geometric mean of 30 counts/100 mL. Effluent data has not exceeded 410 counts/100 mL, with a maximum reported value of 271 counts/100 mL. Using the membrane filtration method, the geometric mean of 126 counts/100 mL was exceeded once during the 2019 disinfection season, with a maximum monthly geometric mean of 154 counts/100 mL. Effluent data has exceeded 410 counts/100 mL once, with a maximum reported value of 1,110 counts/100 mL.

Based on this effluent data it appears that the facility can meet the new *E. coli* limits and a compliance schedule is not needed in the reissued permit.

PART 5 – PHOSPHORUS & TSS

Technology-Based Effluent Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit. Because the Appleton 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 concentration-based WQBEL is given.** In addition, the need for a WQBEL for phosphorus must be considered.

Water Quality-Based Effluent Limits (WQBEL)

Revisions to the administrative rules for phosphorus discharges took effect on December 1, 2010. These rule revisions include additions to ch. NR 102 (s. NR 102.05, Wis. Adm. Code), which establish phosphorus standards for surface waters. Revisions to ch. NR 217 (s. NR 217, Subchapter III, Wis. Adm. Code) establish procedures for determining water quality based effluent limits for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

Section NR 217.16, Wis. Adm. Code, states that the Department may include a TMDL-derived WQBEL for phosphorus in addition to, or in lieu of, a s. NR 217.13 WQBEL in a WPDES permit. Because the discharge is to the Fox River, which is an impaired segment covered under an approved TMDL, the TMDL-based limit is protective of the immediate receiving water as well as downstream waters and can be included in the WPDES permit absent the s. NR 217.13 WQBEL. This limit should be expressed in a manner consistent with the wasteload allocation and assumptions of the TMDL. If after two permit terms, the Department determines the nonpoint source load allocation has not been substantially reduced, the Department may include the s. NR 217.13 WQBEL unless these reductions are likely to occur.

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 is found in page 83 *of the Total Maximum Daily Load and Watershed Management Plan for Total Phosphorus and Total Suspended Solids in the Lower Fox River Basin and Lower Green Bay Report (March 2012)* and is expressed as maximum annual loads (lbs/year). For the Appleton WWTF, this WLA is 7,556 lbs/year and is equal to 20.69 lbs/day.

The monthly average limit of 69 lbs/day and the six-month average limit of 23 lbs/day were determined in the previous WQBEL addendum (September 2016). The six-month average multiplier of 1.10 was chosen as described in the Department TMDL Implementation guidance using a coefficient of variation (CV) of 0.58 and a daily effluent monitoring frequency. For informational purposes the Appleton WWTF has been monitoring for phosphorus daily where the current permit requires a frequency of 5 times/week.

This TMDL-based WQBEL will be re-evaluated if the annual WLA is not being met as described in the prior stated guidance. This is done by comparing each rolling sum of 12 consecutive months of total monthly mass discharges over the current permit term directly against the annual WLA. In this case, the Appleton WWTF has not been compliant meeting the annual WLA of 7,556 lbs/yr during April 2018 – December 2020, and more recently from April 2021 – September 2021. This is 27 of the 43 available rolling sums during April 2017 – September 2021. The facility has also demonstrated compliance with the annual WLA, particularly during January 2020 – March 2021, and represents 16 of the 43 available rolling sums during April 2017 – September 2021. This compliance time period corresponds to when the facility began chemical phosphorus treatment activities in approximately April 2019 when a significant decrease in effluent phosphorus concentrations is noted. This trend continues to decrease through June 2020 until effluent phosphorus concentrations increased through September 2021, where exceedances with the annual WLA started again in April 2021. This is most likely caused by experimentation with the phosphorus removal chemicals first achieving compliance with the annual WLA followed by chemical feed optimization to produce monthly phosphorus mass yields closer to the annual WLA. Although the facility has been noncompliant with the annual WLA the majority of the current permit term, the rolling sums later in the current permit term demonstrate the facility can readily meet the annual WLA once the correct optimization is achieved. The Appleton WWTF is considered to be meeting their annual WLA and

the TMDL-based phosphorus WQBELs will not be reevaluated at this time. **Therefore, the monthly and six-month average limits of 69 and 23 lbs/day respectively will remain unchanged during the reissued permit term.**

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 TBEL of 1.0 mg/L as a monthly average is recommended to continue as the interim limit during the reissued permit term.** Although the facility has demonstrated to consistently achieve lower concentration levels than 1.0 mg/L, the TBEL would still be applicable once the mass phosphorus WQBELs becomes effective. The following table lists the statistics for concentration and mass effluent phosphorus levels (April 2017 – September 2021) for informational purposes.

Phosphorus Effluent Data

Statistics	mg/L	lbs/day
1-day P_{99}	0.84	122
4-day P_{99}	0.50	66
30-day P_{99}	0.32	37
Mean	0.24	24
Std	0.17	25
Sample Size	1644	1644
Range	<0.061 - 1.24	<0.061 - 452.1

TMDL Limits – TSS
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)* and are based on the annual TSS WLA given in pounds per year. This WLA found in page 84 *of the Total Maximum Daily Load and Watershed Management Plan for Total Phosphorus and Total Suspended Solids in the Lower Fox River Basin and Lower Green Bay Report (March 2012)* and is expressed as maximum annual loads (lbs/year). For the Appleton WWTF, this WLA is 169,857 lbs/year and is equal to 465 lbs/day.

The weekly average limit of 2,434 lbs/day and the monthly average limit of 1,322 lbs/day were determined in the previous WQBEL addendum (May 2016). The weekly average multiplier of 5.23 and the monthly average multiplier of 2.84 were chosen as described in the Department TMDL Implementation guidance using a standard deviation value 2.84 and a daily effluent monitoring frequency. For informational purposes the Appleton WWTF has been monitoring for TSS daily where the current permit requires a frequency of 5 times/week.

The standard deviation value of 2.84 was calculated by taking the facility-specific CV of 1.22 and multiplying by 2.327, which is the amount of standard deviations from the mean to find the 99th percentile in a normally distributed dataset. This method is inconsistent with the Department TMDL Implementation guidance such that only the unaltered CV is used to calculate a multiplier.

This TMDL-based WQBEL will be re-evaluated if the annual WLA is not being met as described in the prior stated guidance. This is done by comparing each rolling sum of 12 consecutive months of total monthly mass discharges over the current permit term directly against the annual WLA. In this case, the Appleton WWTF has been 74% compliant meeting the annual WLA of 169,857 lbs/yr, or 11 of the 43 available rolling sums have exceeded the annual WLA during April 2017 – September 2021. These exceedances occurred from February 2019 – December 2019. The facility has since been compliant more recently with the annual WLA from January 2020 – September 2021, and also historically from March 2018 – January 2019. The Appleton WWTF is considered to be meeting their annual WLA and the TMDL-based TSS WQBELs will not be reevaluated at this time. **Therefore, the weekly and monthly average limits of 2,434 and 1,322 lbs/day respectively will remain unchanged 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 April 2017 – September 2021.

The Appleton WWTF was not required to monitor temperature during the current permit term. Historic effluent temperature data from July 2014 – June 2015 is used to determine the need for temperature limits. The table below summarizes those maximum temperatures along with the calculated limits. The complete thermal table used for the limit calculation is included as attachment #3.

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	55	56	NA	120
FEB	54	55	NA	120
MAR	55	55	NA	120
APR	55	57	78	120
MAY	59	60	78	120
JUN	56	60	99	120

Attachment #1

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)
JUL	60	64	111	120
AUG	63	65	108	120
SEP	65	66	102	120
OCT	64	66	106	120
NOV	62	62	115	120
DEC	58	59	NA	120

* NA denotes "not applicable" when the calculated weekly average limit is greater than or equal to 120 °F.

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 comparison between available effluent data and the calculated limits, the discharge does not have reasonable potential to exceed the calculated limits. **Therefore, temperature limits or monitoring are not recommended during the reissued permit term.**

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 (October 29, 2019).*

- 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 9% 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 = 15.5 MGD = 24.0 cfs
f = fraction of the Q_e withdrawn from the receiving water = 0
Q_s = ¼ of the 7-Q_{10} = 970 cfs ÷ 4 = 243 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. In addition, the Department 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, available WET data after March 31, 2011 is shown in the table below:

WET Data History

Date Test Initiated	Acute Results LC_{50} % (% survival in 100% effluent)				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?	
08/09/2011	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
05/01/2012	>100	>100	Pass	Yes					
10/16/2012	>100	>100	Pass	Yes	NA	NA	NA	No	1

11/06/2012	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
03/06/2013	>100	>100	Pass	Yes					
08/20/2013	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
05/20/2014	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
11/18/2014	75.2	>100	Fail	Yes					
12/16/2014	>100	>100	Pass	Yes					
01/27/2015	>100	>100	Pass	Yes					
08/18/2015	>100	>100	Pass	Yes					
05/16/2017	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
07/17/2018	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
10/08/2019	>100	>100	Pass	Yes	>100	>100	Pass	Yes	
02/25/2020	>100	>100	Pass	Yes					
04/28/2020	>100	>100	Pass	Yes	59.6	52	Pass	Yes	
06/29/2021	>100	>100	Pass	Yes	>100	>100	Pass	Yes	

Footnotes:
1. *Qualified or Inconclusive Data.* Data quality concerns were noted during testing which calls into question the reliability of the test results.

- 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)]
  Chronic Reasonable Potential = [(TUc effluent) (B)(IWC)]

  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 = [(TU_a effluent) (B)]

Acute WET Limit Parameters

TUa (maximum) $100/LC_{50}$	**B** (multiplication factor from s. NR 106.08(5)(c), Wis. Adm. Code, Table 4)
100/75.2 = 1.33	6.2 Based on 1 detect

[(TUa effluent) (B)(AMZ)] = 8.2 > 1.0

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

Attachment #1

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
100/52 = 1.9	6.2 Based on 1 detect	9%

[(TUc effluent) (B)(IWC)] = 1.1 > 1.0

Therefore, reasonable potential is shown for both acute and chronic WET limits using the procedures in s. NR 106.08(6), Wis. Adm. Code, and representative data from August 2011 – June 2021.

Expression of WET limits

Acute WET limit = **1.0 TU_a expressed as a daily maximum**

Chronic WET limit = [100/IWC] TU_c = **11 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 = 9%. **0 Points**
Historical Data	Sixteen tests used to calculate RP. No tests failed. **0 Points**	Nine tests used to calculate RP. One tests failed. **0 Points**
Effluent Variability	Little variability, no violations or upsets, consistent WWTF operations. **0 Points**	Same as acute. **0 Points**
Receiving Water Classification	WWSF community. **5 Points**	Same as acute. **5 Points**
Chemical-Specific Data	Reasonable potential for limits for chlorine based on ATC; Ammonia nitrogen limit carried over from the current permit. Multiple substances with ATC detected. Multiple additional compounds of concern detected. **10 Points**	No reasonable potential limits based on CTC; Ammonia nitrogen limit carried over from the current permit. Multiple substances with CTC detected. Multiple additional compounds of concern detected. **5 Points**

Attachment #1

	Acute	Chronic
Additives	One biocide and three Water Quality Conditioners added. P treatment chemical other than Ferric Chloride (FeCl), Ferrous Sulfate ($FeSO_4$), or alum used: No. **6 Points**	All additives used more than once per 4 days. **6 Points**
Discharge Category	Seven industrial contributors. **11 Points**	Same as acute. **11 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**
Total Checklist Points:	**32 Points**	**27 Points**
Recommended Monitoring Frequency (from Checklist):	Three tests during permit term (year 1, 3, 5, etc.)	Three tests during permit term (year 1, 3, 5, etc.)
Limit Required?	Limit = 1.0 TU_a	Limit = 11 TU_c
TRE Recommended? (from Checklist)	No	No

- According to the requirements specified in s. NR 106.08, Wis. Adm. Code, an acute and chronic WET limit are required. **The acute WET limit shall be expressed as 1.0 TUa as a daily maximum and the chronic WET limit shall be expressed as 11 TUc as a monthly average in the effluent limits table of the permit. A minimum of annual acute and chronic monitoring is required because both acute and chronic WET limits are required.** Federal regulations in 40 CFR Part 122.44(i) require that monitoring occur at least once per year when a limit is present.

PART 8 – EXPRESSION OF LIMITS

Revisions to chs. NR 106 and 205, Wis. Adm. Code, align Wisconsin's WQBELs with 40 CFR 122.45(d), which requires WPDES permits 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.

Appleton WWTF is a municipal treatment facility and is therefore subject to weekly average and monthly average limitations whenever limitations are determined to be necessary.

This evaluation provides additional limitations necessary to comply with the expression of limits in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Code. Pollutants already compliant with these rules or that have an approved impracticability demonstration, are excluded from this evaluation including water-quality based effluent limitations for phosphorus, temperature, pH, and *E. coli* among other parameters. Mass limitations are not subject to the limit expression requirements if concentrations limits are given.

Method for Calculation

The methods for calculating limitations for continuous discharges subject to ch. NR 210 to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(3), Wis. Adm. Code, and are as follows:

1. 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.
   - Ammonia Nitrogen: Weekly average limits are needed for the months of May and October – December. For both month ranges the daily maximum limit is the most stringent limit when compared to the calculated weekly average WQBELs and the limits based on the monthly average limit calculation procedure. **Therefore, the weekly average limits of 29 mg/L for May and October – December respectively, are recommended during the reissued permit term.**

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

3. Whenever a monthly average limitation is determined necessary to protect water quality, a weekly average limit shall be calculated using the following procedure and included in the permit unless a more restrictive limit is already determined necessary to protect water quality:

   Weekly Average Limitation = (Monthly Average Limitation × MF)

   Where:

   MF= Multiplication factor as defined in Table 1

   CV= coefficient of variation (CV) as calculated in s. NR 106.07(5m), Wis. Adm. Code.

   n= the number of samples per month required in the permit

s. NR 106.07(3)(e)4, Table 1, Wis. Adm. Code — Multiplication Factor

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.7	1.00	1.34	1.55	1.71	2.08	2.28	2.41	2.51	2.58	2.67

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

- Mercury – The CV of mercury effluent data (April 2017 – September 2021) is 0.7 and the monitoring frequency expected in the reissued permit is monthly. This yields a MF of 1.00. **Therefore, the weekly average limit of 1.3 ng/L is recommended during the reissued permit term.**

Summary of Additional Limitations:

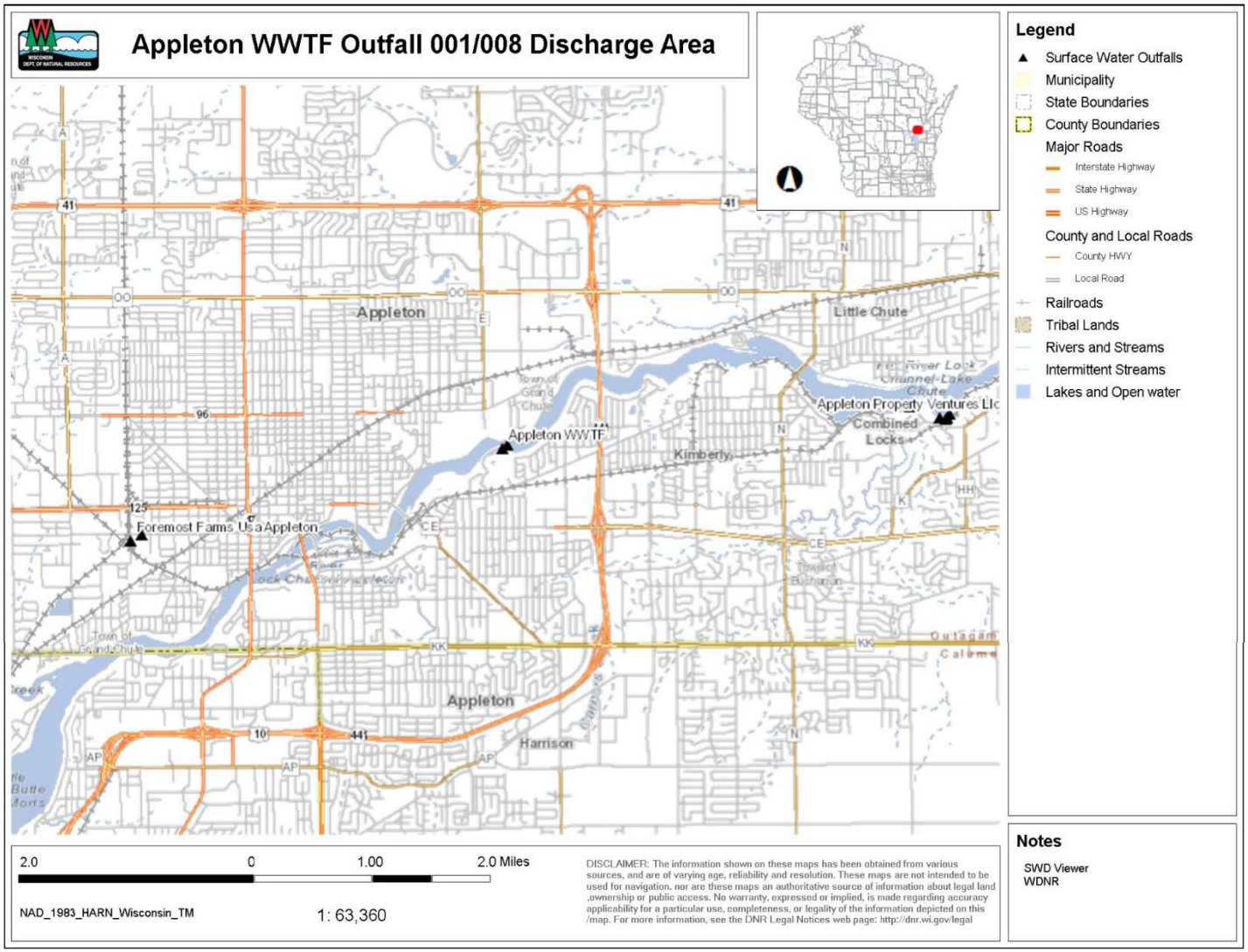
In conclusion, the following additional limitations are required to comply with ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes are included in bold:

Expression of Limits Summary

Parameter	Daily Maximum	Weekly Average	Monthly Average	Multiplication Factor (CV)	Assumed Monitoring Frequency (n)
Ammonia Nitrogen	29 mg/L	**29 mg/L**	11 mg/L		

May October – December	29 mg/L	**29 mg/L**	18 mg/L		
Mercury		**1.3 ng/L**	1.3 ng/L	1.00 (0.7)	1

Attachment #2



Attachment #3

Temperature Limits for Receiving Waters with Unidirectional Flow

(calculation using default ambient temperature data)

						Temp Dates	Flow Dates
Facility:	Appleton WWTF	**7-Q_{10}:**	970	cfs			
Outfall(s):	001	**Dilution:**	25%		**Start:**	07/01/14	04/01/17
Date Prepared:	11/4/2021	**f:**	0		**End:**	06/30/15	09/30/21
Design Flow (Qe):	15.5 MGD	**Stream type:**	Lower Fox River				
Storm Sewer Dist.	0 ft	**Qs:Qe ratio:**	10	: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	35	49	76	970	18.4	25.6	0	55	56	NA	120
FEB	35	50	76	970	11.6	14.7	0	54	55	NA	120
MAR	38	52	77	970	27.7	53.2	0	55	55	NA	120
APR	50	55	80	970	34.3	40.0	0	55	57	78	120
MAY	62	65	83	970	35.0	67.3	0	59	60	78	120
JUN	73	76	85	970	20.2	30.5	0	56	60	99	120
JUL	77	81	87	970	20.8	42.1	0	60	64	111	120
AUG	76	80	86	970	22.8	39.3	0	63	65	108	120
SEP	68	73	85	970	27.4	60.9	0	65	66	102	120
OCT	53	61	80	970	27.6	41.0	0	64	66	106	120
NOV	42	50	78	970	19.4	29.4	0	62	62	115	120
DEC	35	49	76	970	18.2	30.5	0	58	59	NA	120

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: November 13, 2025

TO: Ashley Clark – NER/Green Bay Service Center

FROM: Michael Polkinghorn – NOR/Rhinelander Service Center

SUBJECT: Mercury Water Quality-Based Effluent Limitations for the Appleton Wastewater Treatment Facility
WPDES Permit No. WI-0023221-09-0

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 Appleton Wastewater Treatment Facility in Outagamie County. This municipal wastewater treatment facility (WWTF) discharges to the Fox River, located in the Fox River/Appleton Watershed in the Lower Fox River Basin. This discharge is included in the Lower Fox River Basin (LFRB) Total Maximum Daily Load (TMDL) as approved by EPA on May 18, 2012. The evaluation of the permit recommendations is discussed in more detail in the attached report.

The previous WQBEL addendum (October 2024) for the 9th issuance of Appleton WWTF's permit with respect to mercury is being reevaluated due to multiple holds to the reissued permit. This WQBEL addendum will reevaluate the need for mercury WQBELs from the results of the most recent five years of effluent mercury data.

Receiving Water Information

- Name: Fox River
- Waterbody Identification Code (WBIC): 117900
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply. Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.
- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q_{10} and 7-Q_2 values are from USGS for the Fox River at Wrightstown.
  7-Q_{10} = 970 cubic feet per second (cfs)
  7-Q_2 = 1,380 cfs
  90-Q_{10} = 1,330 cfs
  Harmonic Mean Flow = 3,280 cfs using a drainage area of 6,010 mi^2.
  It should be noted that the low-flow location is approx. 13 miles downstream of Outfalls 001. Typically, low flows should be estimated upstream of the confluence of the receiving water with the discharge, so the discharge does not influence the measured flow. Additional low flow data is available from USGS for the Fox River at Appleton WI, where the drainage area was determined to be 5,950 mi^2. This is a difference of 60 mi^2 or 1% between the two positions on the Fox River. In this case, the resulting change in the low-flows is not significant and the original USGS low-flows will be used in this evaluation.
- Multiple dischargers: Multiple dischargers were integrated in the weekly and monthly average ammonia nitrogen limits for the Appleton WWTF along with 3 other facilities in this section of the Fox River. Otherwise, the effects of multiple dischargers were not historically considered for other parameters due to not being in the immediate vicinity and the belief mixing zones are not overlapping. Therefore, the other dischargers do not impact this

evaluation.

- Impaired water status: The Fox River is on the CWA Section 303(d) list and is impaired by phosphorus and polychlorinated biphenyls (PCBs). It is included in the LFRB TMDL area for phosphorus and TSS.

Effluent Information

- Design flow rate(s):
  Annual average = 15.5 million gallons per day (MGD)
  Peak monthly average = 24.2 MGD
  For reference, the actual average flow from October 2020 – September 2025 was 11.8 MGD.
- 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 7 industrial contributors.
- Water supply: Appleton Water Plant (Lake Winnebago) and 2 industrial wells.
- Additives: The Appleton WWTF uses 4 additives in their process and are listed below:
  - Sodium hypochlorite – chlorination
  - Sodium bisulfite – dechlorination
  - Ferric chloride – chemical phosphorus removal
  - Ferrous sulfate – chemical phosphorus removal
- Mercury field blanks (Sample Point 111) indicated contamination was present from either sample transportation or environmental sources via 11 detects. Therefore, the effluent mercury samples associated with those blanks are not used in this evaluation. The field blanks and effluent samples in question are shown in the table below:

Detectable Mercury Field Blanks & Effluent Data

Sample Date	SP 111 (ng/L)	Outfall 001 (ng/L)
08/01/2021	0.38	1.6
09/01/2021	0.19	1.2
04/01/2022	0.22	0.64
12/01/2022	0.28	0.87
03/01/2023	0.39	1.1
04/01/2023	0.22	0.62
07/01/2023	0.21	2.4
04/01/2024	0.19	1.0
07/01/2024	0.25	1.2
11/01/2024	0.19	2.5
05/01/2025	0.25	1.8

Mercury Effluent Data

Statistics	Conc. (ng/L)
1-day P_{99}	2.8
4-day P_{99}	1.8
30-day P_{99}	1.3
Mean	1.1
Std	0.53
Sample size	49
Range	0.38 - 3.2

MERCURY WATER QUALITY-BASED EFFLUENT LIMITATIONS

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 not the case for Appleton WWTF 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 for all the detected substances.

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 776 cfs, (1-Q_{10} (estimated as 80% of 7-Q_{10})), as specified in s. NR 106.06(3)(bm), Wis. Adm. Code.

SUBSTANCE	ATC	MAX. EFFL. LIMIT*	1-day P_{99}	1-day MAX. CONC.
Mercury (ng/L)	830	1,660	2.8	3.2

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

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)
RECEIVING WATER FLOW = 243 cfs (¼ of the 7-Q_{10}), as specified in s. NR 106.06(4)(c), Wis. Adm. Code

SUBSTANCE	CTC	WEEKLY AVE. LIMIT	4-day P_{99}
Mercury (ng/L)	440	440	1.8

Monthly Average Limits based on Wildlife Criteria (WC)
RECEIVING WATER FLOW = 333 cfs (¼ of the 90-Q_{10}), as specified in s. NR 106.06(4), Wis. Adm. Code

SUBSTANCE	WC	MO'LY AVE. LIMIT	30-day P_{99}
Mercury (ng/L)	1.3	**1.3**	**1.308**

Monthly Average Limits based on Human Threshold Criteria (HTC)
RECEIVING WATER FLOW = 820 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06(4), Wis. Adm. Code.

SUBSTANCE	HTC	MO'LY AVE. LIMIT	30-day P_{99}
Mercury (ng/L)	1.5	1.5	1.308

Conclusions and Recommendations
Limits and/or monitoring recommendations are made in the paragraphs below:

Mercury – Considering available effluent data from the current permit term (n = 49, October 2020 – September 2025), the 1-day, 4-day, and 30-day P_{99} values are 2.8, 1.8, and 1.308 ng/L respectively. The 30-day P_{99} concentration is slightly above the calculated mercury WQBEL based on WC; **therefore, the monthly average limit of 1.3 is recommended during the reissued permit term. Monthly monitoring and PMP efforts are recommended to continue during the reissued permit term to maintain effluent quality at or below current levels.**

The monthly average mass limit of 0.00017 lbs/day is based on the concentration limit and the design annual average flow rate of 15.5 MGD (1.3 ng/L × 15.5 MGD × $8.34/10^6$) in accordance with s. NR 106.07(2)(c), Wis. Adm. Code. **An alternative wet weather monthly average mass limit of 0.00026 lbs/day** (1.3 ng/L × 24.2 MGD × $8.34/10^6$) **should also be included** in accordance with s. NR 106.07(9), Wis. Adm. Code. The peak monthly design flow was used to calculate the wet weather mass limit. The wet weather mass limit applies when the dry weather mass limit is exceeded and the facility demonstrates to the Department the exceedance occurred during a wet weather event.

Revisions to chs. NR 106 and 205, Wis. Adm. Code, align Wisconsin's WQBELs with 40 CFR 122.45(d), which requires WPDES permits 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.

Appleton WWTF is a municipal treatment facility and is therefore subject to weekly average and monthly average limitations whenever limitations are determined to be necessary. The methods for calculating limitations for continuous discharges subject to ch. NR 210 to conform to 40 CFR 122.45(d) are specified in s. NR 106.07(3), Wis. Adm. Code. Whenever a monthly average limitation is determined necessary to protect water quality, a weekly average limit shall be calculated using the following procedure and included in the permit unless a more restrictive limit is already determined necessary to protect water quality:

Weekly Average Limitation = (Monthly Average Limitation × MF)

Where:

MF= Multiplication factor as defined in Table 1

CV= coefficient of variation (CV) as calculated in s. NR 106.07(5m), Wis. Adm. Code.

n= the number of samples per month required in the permit

s. NR 106.07(3)e4, Table 1, Wis. Adm. Code — Multiplication Factor

CV	n=1	n=2	n=3	n=4	n=8	n=12	n=16	n=20	n=24	n=30
0.5	**1.00**	1.28	1.45	1.56	1.81	1.94	2.02	2.08	2.13	2.18

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

The weekly average multiplier is 1.00 based on a monthly monitoring frequency and a CV of 0.5 based on effluent mercury data during October 2020 – September 2025. **Therefore, the weekly average limit of 1.3 ng/L is required during the reissued permit term.**

Interim Limit

Because the updated effluent mercury data has caused reasonable potential with the calculated mercury WQBEL by a slight margin, a compliance schedule is more appropriate to comply with the limit instead of continuing the existing mercury variance. An interim limit is required 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 2.8 ng/L as a daily maximum.** This value is based on the 1-day P_{99} of effluent mercury data during October 2020 – September 2025. The facility would have been compliant with the interim limit approx. 98% of the time during the same time period or only 1 monthly sample would have exceeded the interim limit. A daily maximum averaging period was chosen for the interim limit during the compliance schedule because the mercury variance limit in the current permit is a daily maximum limit.

Conclusions

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

- **Monthly average limits of 1.3 ng/L, 0.00017 lbs/day, and 0.00026 lbs/day**
- **Weekly average limit of 1.3 ng/L**

- **Daily maximum interim limit of 2.8 ng/L**

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.

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