Date: February 2020

DECISION DOCUMENT FOR THE APPROVAL OF THE UPPER FOX WOLF BASIN WISCONSIN TMDL

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. Part 130 describe the statutory and regulatory requirements for approvable TMDLs. Additional information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable. These TMDL review guidelines are not themselves regulations. They are an attempt to summarize and provide guidance regarding currently effective statutory and regulatory requirements relating to TMDLs. Any differences between these guidelines and EPA's TMDL regulations should be resolved in favor of the regulations themselves.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal should identify the waterbody as it appears on the State's/Tribe's 303(d) list. The waterbody should be identified/georeferenced using the National Hydrography Dataset (NHD), and the TMDL should clearly identify the pollutant for which the TMDL is being established. In addition, the TMDL should identify the priority ranking of the waterbody and specify the link between the pollutant of concern and the water quality standard (see section 2 below).

The TMDL submittal should include an identification of the point and nonpoint sources of the pollutant of concern, including location of the source(s) and the quantity of the loading, e.g., lbs/per day. The TMDL should provide the identification numbers of the NPDES permits within the waterbody. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of the natural background. This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

(1) the spatial extent of the watershed in which the impaired waterbody is located;
(2) the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;
(4) present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and

(5) an explanation and analytical basis for expressing the TMDL through *surrogate measures*, if applicable. *Surrogate measures* are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

Comment:
Location Description/Spatial Extent: The Wisconsin Department of Natural Resources (WDNR) has submitted TMDLs for the Upper Fox Wolf River Basin (UFWB). The entire watershed covers 5,900 sq. mi. in Fond du Lac, Outagamie, Waupaca, Green Lake, Shawano, Waushara, Marquette, Winnebago, Dodge, Calumet, Columbia, Langlade, Oneida, Marquette, Portage, and Adams Counties, approximately 10% of the area of Wisconsin. There are many appendices also submitted with the main report.

There were 89 subbasins delineated for calculation of the TMDLs, including six subbasins on five Tribal lands (Menominee Reservation, Sokaogon Chippewa Community, Stockbridge Munsee Community, Forest County Potawatomi Community, and Ho-Chunk Nation) which are presented for illustrative purposes only since they are not under State TMDL jurisdiction, as shown in Table 2 of the TMDL with an asterisk (*). Of the 89 total locations, there are 22 lake segments (including the four chain of lakes (Poygan, Winneconne, Butte des Morts, and Winnebago) and 67 creek and river segments that comprise the areal extent of this TMDL. Subtracting the six Tribal subbasins from the total of 89, there are 83 total phosphorus (TP) and 83 total suspended solids (TSS) allocations for the creeks, rivers and lakes in the UFWB.

The TMDL tables at the end of this document shows creeks, rivers, tributaries and lake allocations. Section 1.3 of the TMDL submittal includes the locations in Wisconsin's 2016 Integrated Report in Tables 1 and 2 in the TMDL document, incorporated by reference, including their identification numbers, river miles, pollutants (TP or TSS), and impairments. Impairment indicators include degraded habitat, degraded biological community, excess algal growth, low Dissolved Oxygen (DO), water quality use restrictions, and eutrophication. As further discussed in Section 3 of this Decision Document, the modeling effort determined allocations for all waters in the subbasins, including non-impaired waterbodies. These allocations are considered protection strategies as described in "A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program".

Wolf River - Section 1.2 of the TMDL states that the Wolf River is located in east central Wisconsin and extends from the headwaters of the Wolf River in the north, flows southward toward the chain of lakes (Poygan, Winneconne, Butte des Morts, and Winnebago) where the Wolf River joins Lake Poygan which is the furthest west in the chain within the Wolf River Basin, then continues southeastward into Lake Winneconne. From Lake Winneconne, the River flows south to the inlet in the north portion of Lake Butte des Morts. The drainage boundary of the Wolf River includes the first two lakes and the northern portion of Lake Butte des Morts.

The Upper Fox River – The Upper Fox River is located south of the Wolf River Basin and extends from the headwaters in the southwest of the basin and flows generally northeastward to the inlet in the northwestern margin of Lake Butte des Morts, at in inlet slightly south of the Wolf River Basin inlet. The outlet from Lake Butte des Morts is at the eastern margin of Lake

Butte des Morts in Oshkosh; the River flows through Oshkosh then continues southeastward to the inlet of Lake Winnebago on its western shore. Most of the drainage area around Lake Winnebago is in the Upper Fox Basin, and drains to Lake Winnebago, except the northern portion of the Lake where the Lower Fox Basin begins.

The Fond du Lac River watershed drainage is part of the Upper Fox River drainage, located in the southernmost portion of the study area of the Upper Fox Basin. It flows generally eastward then north into the Lake Winnebago after flowing through the town of Fond du Lac.

Land use: Section 3.1 of the TMDL lists the current land uses as 30% forest, 22% cropland, 17% pasture/grassland, 20% wetland, 6% open water, 4% non-regulated urban, and 1% regulated urban for the entire basin. Table 4 and Figure 4 of the TMDL provide further refinement of the land use. The basin lies within seven ecological landscapes (Section 3.3 of the TMDL); they are the North Central Forest, Forest Transition, Northeast Sands, Northern Lake Michigan Coastal, Central Lake Michigan Coastal, Southeast Glacial Plains, and Central Sand Hills. Though there is variety in the landscapes, they were all greatly influenced by glaciation. The soils are predominantly tills, outwash sands and gravels, silt loams, and glacial drift. Glacial landforms are also varied over the large areal extent of the watershed, including moraines, drumlins, eskers, kames, outwash plains, beach ridges, terraces, kettles, boulder fields and tunnel channels.

Ground cover varies and includes forests, peatlands, wetlands, agricultural, pastures, and urban. Forested areas are predominant in the northern portion of the Wolf River watershed, and agricultural land use predominates further south in the lower portion of the Wolf River and Upper Fox watersheds. Both the soil type and vegetative cover have an impact on runoff of contaminants into the streams and lakes.

Problem Identification: Section 1.2 of the TMDL discusses that the rivers and lakes are impaired due to excess phosphorus and sediment, resulting in water use restrictions. The numerous impairment indicators include nuisance algal growth, oxygen depletion, reduced aquatic vegetation, reduced water clarity, degraded biological community, degraded habitat, elevated pH, and elevated water temperature. Excess phosphorus results in eutrophication of the lakes, altering the ecology of the lakes and rivers and degrading their uses for swimming, fishing, recreational uses, and supplies of clean drinking water; it can also result in algal blooms/scums and when they die, decomposition reduces the dissolved oxygen in the water, making it difficult for fish and aquatic life to survive. Algal blooms and surface scums, or cyanobacteria, also produce toxins which are harmful and pose health risks to humans.

Excess sediment reduces water clarity and light needed for aquatic vegetation. Vegetation provides oxygenation, food, and habitat, and stabilizes bottom sediments. However, when vegetation dies, the decomposition and eutrophication processes reduce available oxygen for other aquatic life. Too much sedimentation also smothers larvae and eggs in the substrate, clogs fish and invertebrate gills, increases water temperature, degrades habitat and reduces the sheltered habitat of aquatic organisms. Fish and waterfowl cannot see and catch food as well due to the turbidity.

TSS is also a concern because of its ability to transport TP to a waterbody, as further discussed in Section 2.5.2 of the TMDL. When anthropogenic sources of phosphorus are delivered to a stream the ratio of dissolved phosphorus immediately available to algae may be high relative to particulate forms of phosphorus (e.g., attached to soil particles; Robinson et al. 1992)[1]. Total phosphorus consists of both dissolved phosphorus (DP), which is mostly orthophosphate, and particulate phosphorus (PP), including both inorganic and organic forms (Sharpley et al. 1994)[2]. Runoff from conventional tillage is generally dominated by PP; however, the proportion of TP as DP increases where erosion is comparatively low in locations with no-till fields or pasture (Sharpley et al. 1994)[3]. Streams with low gradients and morphology that enhances deposition of sediments in the low flow channel (e.g., channelized streams) may continually release dissolved phosphorus from sediments. Six lakes are listed as impaired for both TSS and TP; TSS TMDLs are not explicitly developed for these six lakes but through the close linkage of TSS with TP, the phosphorus reductions are expected by WDNR to result in TSS reduction (for Lake Butte des Morts, Lake Winnebago, Park Lake, Lake Poygan, Lake Puckaway, and Lake Winneconne) (Section 5.2.2 of the TMDL).

Pollutant of Concern: The pollutants of concern are phosphorus and sediment.

Other relevant issues: Because of the large scope of this project, there are several relevant issues that had an influence on the development of this TMDL, described below.

Discharges related to Trading - Appendix H and Appendix I of the TMDL present wasteload allocations by facility needed to meet local water quality in the subbasin into which the facility discharges. The wasteload allocation must also meet downstream water quality. Section 6.4.1 in the TMDL states that allocations for municipal and industrial wastewater have been completed in this manner to help facilitate water quality trading, since the geographic extent in which trades can occur is based on the point of standards application as outlined in the "Guidance for Implementing Water Quality Trading in WPDES Permits", 08/21/2013. A copy of the guidance can be found at: http://dnr.wi.gov/topic/SurfaceWater/documents/WQT_guidance_Aug_21_2013signed.pdf or by searching for "water quality trading" at http://dnr.wi.gov/.

Appendix K of the TMDL is developed with WLA as well as Adaptive Management (AM) targets and estimated maximum downstream credits and will greatly assist in quantification of reductions or trading potential. Trading is further discussed in the Section 10 of this Decision Document (Implementation Section below). This TMDL Decision Document does not opine upon the discussions and calculations in Appendix K regarding water quality trading and adaptive management and ***are not approved or disapproved*** as part of this decision.

[1] Robinson, J.S., A.N. Sharpley, and S. J. Smith. Development of a method to determine bioavailable phosphorus loss in agricultural runoff. *Agriculture, Ecosystems and Environment*. 47: 1994. pp. 287-297. https://pubag.nal.usda.gov/download/18697/PDF

[2] Sharpley, A. N., Chapra, S. C., Wedepohl, R., Sim, J. T., Daniel, T. C. and K. R. Reddy. 1994. Managing agricultural phosphorus for protection of surface waters: Issues and options. *Journal of Environmental Quality*. 23: 437-451. https://dl.sciencesocieties.org/publications/jeq/abstracts/23/3/JEQ0230030437

[3] Ibid.

Core Study (Appendix F of the TMDL) - Lake Winnebago is an important source of drinking water for over 250,000 people in the larger communities of Oshkosh and Fond du Lac, as well as its use for recreation and sport fishing. To ensure that the target for Lake Winnebago is a reasonable objective, Section 2.4.1 of the TMDL submittal reviews the bottom sediment coring and analysis of the Lake that was completed in 2016 and 2017, specifically performed for this project to further understand the paleoecology and its use as a reference TP concentration for the Lake. Results will be further discussed in this document in the Standards Section 2 below. The full report is titled *Preliminary Report of Lake Winnebago Paleoecological Study* by Onterra, LLC (2017).

In-lake Macrophyte Study - Another project was completed by the WDNR in early 2018 during the process of developing this TMDL. Disturbances, stressors, and indicator responses in the Winnebago chain of lakes (called the Upper Pool Lakes in the 2018 project) were analyzed in the study. The primary disturbances recognized by WDNR are water level changes, increased nutrient loading, wind and wave action, benthivorous fish activity disturbing the rooted plants, and other activity such as motorboats and snowmobiles. Rather than watershed contaminant reduction, the project reviewed scenarios for internal phosphorus reduction in Lake Winnebago, as well as disturbance reduction. In-lake macrophyte development was studied for its role in increasing phosphorus uptake from the water column in the lake, and in stabilizing the bottom sediments to reduce phosphorus availability and turbidity (as TSS) from wind and benthic fish disturbance, as described in the report, *Winnebago Pool Lakes Nutrient Technical Support* (2018).[4]

USGS Study (Appendix E of the TMDL) – there was an additional BATHTUB lake modeling project for the four Chain of Lakes and published in a separate draft that will be discussed in Section 3 below in this Decision Document. It was completed in 2018 specifically for this project titled: *Water-Quality Response to Changes in Phosphorus Loading of the Winnebago Pool Lakes, Wisconsin, with Special Emphasis on the Effects of Internal Loading in a Chain of Shallow Lakes.*[5]

Past TMDL for Parsons Creek – Parsons Creek is in one of the segments modeled for this UFWB TMDL. A TMDL was completed by Wisconsin and approved by EPA in 2007 for TSS/sediment, TP, and ammonia as described in Sections 2.6.1, 2.6.2, and 2.6.3, respectively, of the UFWB TMDL submittal. The 2007 TMDL allocations for TSS/sediment and TP for Parsons Creek will be replaced by this TMDL approval. The new calculations for this TMDL increase the necessary reductions for Parsons Creek. The increase is due to several factors.

- In the original TMDL, values used for calculations of TSS as detailed in Section 2.6.1 of the UFWB TMDL, were varied flow and a variable concentration target, based on various flow regimes. The UFWB used one concentration target. Further, the flow record

[4] WDNR. 2018. Winnebago Pool Lakes Nutrient Technical Support. http://fwwa.org/new/wp-content/uploads/2018/06/Lake-Winnebago_Final-Report-02-28-2018.pdf

[5] Robertson, D.M., Siebers, B.J., Diebel, M.W., and Somor, A.J., 2018. Water-quality response to changes in phosphorus loading of the Winnebago Pool Lakes, Wisconsin, with special emphasis on the effects of internal loading in a chain of shallow lakes: *U.S. Geological Survey Scientific Investigations Report 2018–5099*, 58 p. https://doi.org/10.3133/sir20185099

was longer for this TMDL, which resulted in higher maximum daily flow than the original 1997-2001 timeframe.

- In Section 2.6.2, the UFWB states that the original Parsons Creek TP TMDL in 2007 did not have promulgated water quality standards (WQS) in the state of Wisconsin, so the targets were higher, allowing for less reduction from current conditions. Further, there is additional focus that downstream waters must meet WQS.
- The ammonia calculations and TMDL from 2007 will remain as they are currently, since this TMDL did not address ammonia (Section 2.6.3 of the TMDL).

Source Identification

Point Sources - Section 4.1.1 of the TMDL lists the following point source contributors.

- Publicly Owned Treatment Works (POTWs) and industrial dischargers with individual Wisconsin Pollutant Discharge Elimination Systems (WPDES) permits that generate wastewater (78 facilities in Appendix H of the TMDL, Table 1 for TP and Table 2 for TSS, incorporated by reference.)
- Municipal Separate Storm Sewer Systems (MS4) stormwater permits. Stormwater is collected in urban areas serving over 10,000 persons (28 municipalities, Table 10 below taken from the TMDL submittal).
- Concentrated Animal Feeding Operations (CAFOs) covered under the WPDES general CAFO permit, set to zero (32 locations, Table 11 below taken from the TMDL submittal).
- General WPDES permits for stormwater discharges from construction sites or industrial facilities located outside of a permitted MS4.

Point sources also contribute significant amounts of phosphorus and sediment to the Upper Fox Wolf River basin. As noted above, individual permittees, MS4s, CAFOs, and other discharges covered under general permits are present in the watershed and contribute pollutants. Section 4.2.2 of the TMDL submittal lists the WDNR MS4 permittees (Table 10 below taken from the TMDL). CAFOs are also present in the basin, listed below in Table 11. Because CAFOs must comply with no discharge permit requirements, they are provided zero (0) allocation in the TMDL.

Table 10. List of permitted MS4s within the Upper Fox-Wolf Basins.

Permittee	County	TMDL Subbasin	Area (acres)
Town of Algoma	Winnebago	30	97
		73	1,012
		74	6
		75	66
City of Appleton	Outagamie, Calumet, Winnebago	52	0.4
		75	174
Town of Black Wolf	Winnebago	75	207
Calumet County	Calumet	-	-
Village of Eden	Fond du Lac	39	165
Town of Empire	Fond du Lac	39	63
		75	61
City of Fond du Lac	Fond du Lac	43	2,505
		44	1,115
		75	3,069
		88	1,128
Town of Fond du Lac	Fond du Lac	34	13
		39	1.8
		43	79
		44	57
		75	411

Permittee	County	TMDL Subbasin	Area (acres)
		88	88
Fond du Lac County	Fond du Lac	-	-
Village of Fox Crossing	Winnebago	75	4.2
Town of Friendship	Adams	33	101
		34	130
		75	144
Town of Grand Chute	Outagamie	52	25
Town of Greenville	Outagamie	50	100
		52	967
Town & Village of Harrison	Calumet	75	431
City of Menasha	Winnebago	75	91
City of Neenah	Winnebago	75	71
Town of Neenah	Winnebago	75	185
Town of Nekimi	Winnebago	75	176
Village of North Fond du Lac	Fond du Lac	33	43
		34	745
		75	183
Town of Omro	Winnebago	73	42
City of Oshkosh	Winnebago	30	1,800
		73	984
		74	3,406
		75	4,917
Town of Oshkosh	Winnebago	73	243
		75	316
City of Portage	Columbia	4	43
		7	930
Village of Sherwood	Calumet	75	358
Town of Taycheedah	Fond du Lac County	75	262
University of Wisconsin Oshkosh	Winnebago	-	-
Town of Vinland	Winnebago	75	11
Winnebago County	Winnebago	-	-

Table 1. List of permitted CAFOs in the Upper Fox-Wolf Basins.

Name	County
Abel Dairy Farms LLC	Fond du Lac
Crailoo Dairy Farm LLC	Fond du Lac
Lake Breeze Dairy LLC	Fond du Lac
Murph-ko Farms Inc	Fond du Lac
Redtail Ridge Dairy	Fond du Lac
Rickert Bros. LLC	Fond du Lac
Rosendale Dairy LLC	Fond du Lac
Ruedinger Farms Inc	Fond du Lac
Vir-Clar Farms LLC	Fond du Lac
Pride View Dairy LLC	Green Lake
MAM Farms	Green Lake
Trillium Hill Farm Inc	Green Lake
Slowey Farms Inc	Marquette
Omro Dairy LLC	Winnebago
Thistle Dairy LLC	Winnebago
Ostrowski Farm	Marathon
Schairer Farms	Marathon
Birlings Bovines LLC	Outagamie
Rohan Dairy Farms LLC	Outagamie
Sugar Creek Farm LLC	Outagamie
Gordondale Farms	Portage
Betley Farms LLC	Shawano
Krueger Dairy LLC	Shawano
Matsche Farms Inc	Shawano
Schimdt's Ponderosa LLC	Shawano
Strassburg Creek Dairy LLC	Shawano
Tauchen Harmony Valley Inc	Shawano
Egan Bros. Partnership	Waupaca
Friendship Valley Dairy LLC	Waupaca
Quantum Dairy LLC	Waupaca
Krentz Family Dairy Inc	Waushara
Pine Breeze Dairy LLC	Waushara
Cross Farms LLC	Winnebago

Nonpoint Sources - The watershed is dominated by nonpoint sources of agriculture. Section 4.1.2 of the TMDL lists the following nonpoint source contributions.

- Agricultural runoff, including chemical fertilizer or animal manure, runoff from smaller animal feeding operations, fertilizer attached to soil particles, and dissolved phosphorus. Runoff comes from both cropland and pasture.
- Nonregulated runoff from roads and paved areas, rooftops, disturbed soil from construction sites, golf courses and lawns with little vegetative cover.
- Septic systems for domestic sewage that are not working properly.
- Background sources from natural occurrences such as rocks, plant material, soils, and wildlife waste. This includes potential air deposition onto large bodies of open waters and groundwater.
- Stream channels and lake shores can be disturbed by channel morphology changes, human activity such as tree removal, boating, etc. Erosion and deposition occur as the stream tries to reach equilibrium after disturbance, which could take years to stabilize.
- Internal loading from bottom sediments loads phosphorus into the water column under various conditions. Legacy phosphorus can be released from aerobic and anaerobic decomposition of organic sediments, release of iron-bound phosphorus, simple diffusion, or resuspension of sediments.

There are also waterbodies and impairment listings on the WDNR 2016 303(d) list that require further evaluation to determine if the allocations presented in the TMDL report will be sufficient to achieve water quality criteria. The waterbodies are in Appendix B of the TMDL and include Crane Lake, Lake Butte des Morts, Park Lake, Pine Lake, Poygan Lake, Puckaway Lake, Tree Lake and Winneconne Lake.

Priority Ranking: Section 1.2 of the TMDL submittal states that the WDNR has ranked numerous waters in this basin as high priority for the development of TMDLs to address the impairments caused by excess phosphorus and sediment loading.

Future growth: WDNR calculated a reserve capacity for each subbasin that can be utilized for future or increased discharges in the subbasin. Section 6.7 of the TMDL provides details for future new or expanding dischargers. The WDNR will use information provided by a permittee to maintain the overall loading capacity for each reach. A permittee may use some of the reserve capacity, or a TMDL may also be re-evaluated for its assimilative capacity, and a modification, revocation or reissuance may occur under chapter 283, Wis. Stats. Allocations may also be recalculated for potential trading if the loading exceeds reserve capacity.

Surrogate measures: The phosphorus and sediment reductions calculated for this TMDL will not only address the phosphorus and sediment impairments. Phosphorus and TSS reductions are expected to address the list of impairments in Table 1 of the TMDL, including low DO, excess algal growth, degraded biological community, and habitat degradation.

EPA finds that the TMDL document submitted by the WDNR satisfies all requirements concerning this first element.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy. (40 C.F.R. §130.7(c)(1)). EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

The TMDL submittal must identify a numeric water quality target(s) – a quantitative value used to measure whether or not the applicable water quality standard is attained. Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. The TMDL expresses the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target. Occasionally, the pollutant of concern is different from the pollutant that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as Dissolved Oxygen (DO) criteria). In such cases, the TMDL submittal should explain the linkage between the pollutant of concern and the chosen numeric water quality target.

Comment:
Designated Uses: Section 2.3 of the TMDL submittal states the Upper Fox Wolf River Basin designated uses, as defined in Chapter NR 102 of Wisconsin Administrative Code. The following designated uses apply to all waters of the state: Fish and Aquatic Life; Recreation; Wildlife; and Public Health and Welfare. Wisconsin water quality standards establish criteria for water quality that correspond to attainment of these designated uses. WDNR applied the criteria discussed below to both the impaired waters and the waters addressed by protection strategies.

The Fish and Aquatic Life use also includes the numeric criteria for phosphorus described in Section 2.2 of the TMDL report. Section NR 102.04(3) of the Wisconsin Administrative Code defines the Fish and Aquatic Life use and identifies five fish and aquatic life subcategories for surface water classification (cold water communities; warm water sport fish communities; warm water forage fish communities; limited forage fish communities; limited aquatic life). All fish and aquatic life subcategories are subject to attainment of numeric phosphorus criteria except for waters with limited aquatic life designation.

Standards for Phosphorus: There are both narrative and numeric criteria established to preserve and enhance water quality. Section 2.1 of the TMDL states that Wisconsin has determined that due to the excessive phosphorus and sediment loading, the following narrative criteria are not met in Wisconsin.

Section NR 102.04(1): (a) Substances that will cause objectionable deposits on the shore or in the bed of a body of water, shall not be present in such amounts as to interfere with public rights in waters of the state, (b) Floating or submerged debris, oil, scum or other material shall not be present in such amounts as to interfere with public rights in waters of the states, (c) Materials producing color, odor, taste or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the state.

The TMDL states: "Excess phosphorus loading causes algal blooms, which may be characterized as floating scum, producing a green color, a strong odor, and an unsightly condition. Sometimes these algal blooms contain toxins which limit recreational uses of the water bodies. Excessive sediments are considered objectionable deposits." Table 1 in the TMDL submittal lists the TP and TSS criterion for each waterbody and is incorporated by reference. Table 3 below is a summary of criteria based on waterbody type, taken from Section 2.2 of the TMDL.

Phosphorus Standards in Streams - Numeric criteria for phosphorus are found in NR 102.06 and were developed based on the size of the stream: **0.100 mg/L TP** for non-wadeable, larger streams; **0.075 mg/L TP** for wadeable, smaller streams (NR 102.06(3) criteria for rivers and streams).

Table 3. Wisconsin numeric total phosphorus (TP) criteria defined in Section NR 102.06 of the Wisconsin Administrative Code. Note that reservoirs (impounded rivers and streams) with hydraulic residence time less than 14 days are assigned applicable river or stream criteria.

Water Type	TP Criteria
Large Rivers	100 µg/L
Other Rivers and Streams	75 µg/L
Non-Stratified Reservoirs (hydraulic residence time ≥ 14 days)	30 µg/L
Stratified Reservoirs (hydraulic residence time ≥ 14 days)	40 µg/L
Stratified, Two-Story Fishery Lakes	15 µg/L
Stratified Seepage Lakes	20 µg/L
Stratified Drainage Lakes	30 µg/L
Non-Stratified Lakes	40 µg/L

Phosphorus Standards in Lakes and Reservoirs – There are individual lake and reservoir standards TP standards, depending on the characteristics of the waterbody, found in Section 5.1.2 in the TMDL (NR 102.06(4) criteria for lakes and reservoirs). Most of the lakes in this TMDL submittal have a **30 – 40 µg/L TP** standard. The four Winnebago Pool Lakes used the 40 µg/L standard, and the remaining lakes used the standards in Table 17 below.

Table 17. Total phosphorus loading capacity of the additional lakes and reservoirs addressed in this TMDL report.

Lake Name	TMDL Subbasin	TP Water Quality Target (µg/L)	TP Loading Capacity (lbs/yr)
Big Twin Lake	83	30	327
Black Otter Lake	82	40	1,749
Buffalo Lake	9	40	13,694
Collins Lake	65	20	359
Green Lake	20	15	9,319
Lake Emily	84	40	207
Little Green Lake	11	40	134
Long Lake	57	30	812
Mason Lake	3	40	1,312
Old Taylor Lake	85	20	8
Park Lake	5	40	3,316
Puckaway Lake	16	40	27,594
School Section Lake	62	30	297
Shawano Lake	56	40	5,619
Spring Lake	86	15	622
Swan Lake	6	30	11,402
Upper Post Lake	77	40	5,485
White Clay Lake	54	30	319

Phosphorus Target in Lake Winnebago - WDNR further investigated the existing criterion applicable to Lake Winnebago to determine if the criterion was both protective of the water and reasonable when compared with past lake conditions (Section 2.4.1 of the TMDL). Diatom communities (microscopic algae) were measured in the top and bottom of sediment cores at the north and south ends of the lake to estimate water column TP and sedimentation rates. The cores compared recently deposited samples to historical deposition in the lower sediments. Information from the lower sediments was used to determine that at least 150 years ago or more, the north basin of the lake measured TP at 40µg/L and the south basin measured 47µg/L. The WDNR determined therefore that the current criterion for TP for Lake Winnebago (40 µg/L) was appropriate.

Target in Streams for TSS: Section 2.5.2 of the TMDL submittal states that the **target for TSS is 12 mg/l** for all the waterbodies and is derived from the narrative standard of "no objectionable deposits", expressed as the median of monthly samples collected during the growing season between May and October.[6] This target represents strong correlation between suspended sediment concentration (SSC) and several biotic indices, including macroinvertebrate species, fish species, fish index biotic integrity, and others. Breakpoint values (changes in the curve) served as the basis of selecting the numeric TSS target of 12 mg/L for TMDL development. SSC concentrations were identified by WDNR which best represented thresholds between reference and degraded conditions, using breakpoints that ranged from 3.5 to 22.25 mg/L and averaged 13.5 mg/L. TSS and SSC procedures vary slightly in the lab, with TSS methods tending to underestimate sediment concentration relative to SSC.

Target development is closely linked with the TSS association with phosphorus in general and in this watershed. The TMDL explains that sediment loads are linked to particulate phosphorus loads because much of the phosphorus that is delivered to streams is bound to sediment, especially from nonpoint sources. Phosphorus reduction will often result in sediment reduction because many pollutant reduction strategies will address both simultaneously. By reducing phosphorus and TSS, many stressors, such as low DO and eutrophication, will also be addressed.

EPA finds that the TMDL document submitted by the WDNR satisfies all requirements concerning this second element.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

A TMDL must identify the loading capacity of a waterbody for the applicable pollutant. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)). The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). If the TMDL is expressed in terms other than a daily load, e.g., an annual load, the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen. The

[6] Robertson, D.M., Weigel, B.M., and Graczyk, D.J., 2008, Nutrient concentrations and their relations to the biotic integrity of nonwadeable rivers in Wisconsin: *U.S. Geological Survey Professional Paper 1754*, 81 p. https://pubs.usgs.gov/pp/1754/pdf/pp1754.pdf

TMDL submittal should describe the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

The TMDL submittal should contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling. EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation. TMDLs must take into account *critical conditions* for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable *critical conditions* and describe their approach to estimating both point and nonpoint source loadings under such *critical conditions*. In particular, the TMDL should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

Comment:
Loading capacity: The loading capacities for each impaired waterbody and protection strategy watershed for TP and TSS are shown in Appendices H and I of the TMDL, respectively, and are found at the end of this document. Allocations represent both daily and annual values, recommended Tribal allocations (though not part of this TMDL approval), percent reductions, and allowable discharges for individual permittees.

Method for determining cause and effect: The calculation of loading capacity for the Upper Fox Wolf River covers a large areal extent which includes a large variability in stream sizes (wadeable and non-wadeable, requiring the use of several water quality standards), including a spectrum of stream flows over time (flood through drought conditions), lakes and reservoirs, and the chain of lakes. Several methodologies were used and linked to determine loading capacities in the watershed. In addition to the TMDL submittal, reports from several models developed for the Upper Fox Wolf River included detailed methodology and results.

Soil and Water Assessment Tool (SWAT) (Appendix C of the TMDL) and Source Loading and Management Model (SLAMM) - The UFWB SWAT model discussed in Section 4.2.2 of the TMDL is a watershed loading model that uses information on land cover, soils, slope, and land management practices. Calibration and validation are performed for crop yield/plant growth, stream flow, sediment, and TP. It then provides estimates of average annual streamflow, average annual nonpoint source loads (for TP and sediment), and the magnitude of point and nonpoint phosphorus and sediment loads from the major land cover types. These annual water volumes and loads from the watersheds are then inputs into the impaired lakes to calibrate lake response models, not used to directly simulate lakes or reservoirs. The reports also reviewed several locations where calibration and validation results did not meet performance criteria, but the model is valid on a basinwide scale.

In Section 6.4.1 of the TMDL, the TSS wasteload allocations contained in the TMDL will be expressed as a mass limit. In many cases, dischargers will also receive a concentration limit for TSS, based on the Technology Based Effluent Limit (TBEL) requirements in ch. NR 210, Wis. Adm. Code, or applicable effluent limit guidelines for industrial discharges.

In Section 4.2.2 of the TMDL, there are 29 permitted MS4s within the UFWB that receive wasteload allocations, determined from the SWAT model. SLAMM is an urban runoff model used for stormwater management planning and results in overall percent reduction rather than wasteload allocations. Model results were adjusted for defining baseline conditions to reflect a 20% TSS reduction, consistent with requirements in ch. NR 216 and NR 151, Wis. Admin. Code, and a corresponding 15% reduction in TP. The corresponding 15% TP reduction is calculated in SLAMM by applying BMPs to obtain the 20% TSS reduction. TP and TSS reductions do not have a 1:1 ratio because of the portioning determined between phosphorus attached to sediment and the soluble phosphorus in the urban runoff.

Mass Balance is a simple difference between the P load exported from the lakes via outflow and that enter the lake from external sources from May through September.

BATHTUB is a lake and reservoir model using a mass balance and estimates water column TP concentrations (Section 5.1.2 of the TMDL). The internal load in each pool lake is significant and is estimated as the additional load exported beyond what has been imported into the lake. In the modeling done in BATHTUB for this project: "…internal loading of phosphorus is significant in Lake Winnebago during the growing season and contributes to high summer water column phosphorus concentrations. For example, the estimated internal load during the growing season accounted for 56% of the total growing season phosphorus load to Lake Winnebago during 2009 through 2011 compared to 15% for Lake Poygan, 14% for Lake Butte des Morts, and 3% for Lake Winneconne… The high rate of internal phosphorus loading in Lake Winnebago during the growing season is likely due to physical resuspension of phosphorus-rich bottom sediment into the water column from wind and wave energy, including boat wakes, and physical disturbance by aquatic species rather than by chemical diffusion of phosphorus into the water column." (Section 4.2.9, pp. 66-67 of the TMDL).

Two scenarios of BATHTUB were run, the first with changes in internal loading proportional to external loading changes. The second was run with a 25% greater internal load reduction compared to an external load reduction, to reflect growing season internal load reduction when simulating targeted management to promote macrophyte growth and reduce wind-driven sediment suspension. Results overall were that the first scenario required a 73% reduction in loading from existing external TP, and the second scenario required a 67% reduction that included a 25% internal TP loading reduction (Section 5.1.3 of the TMDL). The loading capacities in Appendix H and I of the TMDL were calculated using the second BATHTUB scenario, which includes a 25% reduction in internal loading (Section 5.1.3 of the TMDL). WNDR determined that internal loading reductions could be attained by improvements in rooted macrophytes, and the installation of breakwaters/islands in the lake.

Jensen[7] – This lake response model was also used on the four chain of lakes to determine internal sediment loading using a method different from the BATHTUB model, to further confirm and understand the internal loading dynamics of the lake, using different parameters aside from the

[7] Jensen, J. P., Pedersen, A. R., Jeppesen, E., & Søndergaard, M. (2006). An empirical model describing the seasonal dynamics of phosphorus in 16 shallow eutrophic lakes after external loading reduction. *Limnology and Oceanography*, 51(1, Part 2), 791-800. https://aslopubs.onlinelibrary.wiley.com/doi/epdf/10.4319/lo.2006.51.1_part_2.0791

import/export of TP in and out of the lake (Section 5.1.2 of the TMDL). The release of internal lake phosphorus is determined by equations that calculate phosphorus sedimentation and release as a function of concentration and temperature.

Jensen showed the greatest improvement in Lake Winnebago would occur in the first 20-30 years of external reduction, requiring a 75% reduction from existing conditions, and it would take 65-70 years to achieve the 40 µg/L TP target. At a rate of 69% reduction it would take 100-105 years to reach the target.

Wisconsin Lake Modeling Suite (WiLMS) (Appendix D) - The WiLMS models (Section 5.1.2 of the TMDL) provide estimates of in-lake phosphorus concentrations using information on lake morphology, water inflows, and phosphorus loading. A lake is represented as a completely-mixed body of water with no horizontal or vertical variability in water quality and is modeled on an annual time step. TP predictions are growing season averages; this model was used on 18 lakes that are separate from the four chain of lakes. Inputs to the model from SWAT do not include explicit phosphorus loading to lakes from onsite wastewater treatment septic systems, so WiLMS calculates loading from septic systems using an equation that includes: 1) annual loading from septic systems, 2) septic tank phosphorus (P) export rate, 3) population using septic systems (number of persons), and 4) P retention coefficient. These values were included to estimate septic P loading for each lake. The observed P concentrations were acquired from the Wisconsin database (Surface Water Integrated Monitoring System – (SWIMS)).

The Canfield-Bachmann model is a lake response model equation, quantifying the relationship between P loading and in-lake P concentrations. The equation was used within the WiLMS process to determine the lake response of the lakes in the watersheds (not including the four in the chain of lakes), originally derived using relationships of 723 natural lakes and reservoirs in the United States, Canada and northern Europe. The equations were developed for both natural lakes and artificial lakes, then applied to the lakes and reservoirs in the TMDL. It had worked well in the past in natural Wisconsin lakes (Appendix E of the TMDL).

Annual Flow Weighted Mean / Growing Season Median (FWM / GSM) ratios - The FWM is the mean annual load / mean annual flow volume. The FWM / GSM (growing season May through October) ratio uses two types of loads, one annual and the other only during the growing season, for both TP and TSS (Section 5.1.1 of the TMDL).

The calculation of this ratio is performed to convert the annual loading to values during the growing season to coincide with target values, using a conversion ratio. The ratios of FWM/GSM change, depending on whether there a is greater or smaller seasonal variation. Section 5.1.1 of the TMDL states: “A stream’s annual FWM concentration is generally higher than its GSM concentration in streams where TP concentration increases with discharge and where there is little seasonal variation. In contrast, the GSM concentration may be higher than the annual FWM concentration in streams where TP exhibits a strong seasonal pattern that peaks in summer and is independent of discharge.” The ratios were calculated using USGS flow gages at six sites.

After determining appropriate FWM / GSM ratios, the phosphorus loading capacity was initially calculated for headwater TMDL subbasins as:

$$Loading\ Capacity = Q_{mean} * TP_{crit} * FWM / GSM$$

where *Q mean* is the mean annual flow in the subbasin, *TP crit* is the total phosphorus criterion for the subbasin (75 µg/L for headwater subbasins), and *FWM/GSM* is the conversion factor described above. The phosphorus loading capacity for non-headwater subbasins was then calculated using the above equation minus the loading capacity of all upstream subbasins (Section 5.1.1 of the TMDL).

The equation was also used for the calculation of TSS.

$$Loading\ Capacity = Q_{mean} * TSS_{crit} * FWM / GSM$$

where *Q mean* is the mean annual flow in the subbasin, *TSS crit* is the numeric concentration target for the subbasin (12 µg/L for headwater subbasins) (Section 5.2.1 of the TMDL).

Model results - To summarize the methods on a project regional scale, the models and calculations were completed to simulate the best possible interpretation of the processes in the watershed. The SWAT (Appendix C) outputs are inputs to the lakes (BATHTUB and Jensen) as well as inputs to the lake model WiLMS (Appendix D) that includes additional septic tank phosphorus, the population using septic systems, and a P retention coefficient. The SWAT model was used to simulate the watershed loads running off the different land uses and into the lakes.

The loads were first calculated for the headwater basins, and then each subsequent subbasin had a loading calculation developed, based upon flow and appropriate criteria. The upstream load was subtracted from each basin, so the subbasin loading capacity is based upon the individual subbasin (i.e., is not a cumulative number). To determine the TMDL reach-specific load, the upstream load was subtracted from the overall load. Once the load capacities were calculated based upon the river criteria, the SWAT model was re-run to include the results from the lake modeling (BATHTUB and the Jensen Model) to determine the load capacities based upon any downstream lake criteria.

The large influence of the four Chain of Lakes draining to each other and from the watershed, especially Poygan, Winneconne and Butte des Morts on Lake Winnebago, was recognized and addressed by running separate lake models (BATHTUB and Jensen) for the Chain of Lakes. Multiple models help ensure that any bias implicit in a singular method was identified and generally quantified to better calculate the reductions needed. External loading and in-lake loading are also important factors that influence the lake calculations and addressed by the Canfield-Bachmann equation. The equation relationships were established from studying hundreds of other lakes, as stated above.

Headwater inputs and influences were accounted for using FWM / GWM ratios as inputs to the lake model BATHTUB. The importance of seasonal loading derived from the annual loading was addressed by studying the growing season mean (May through October) loading and flow weighted mean (annual) loading ratios to compare the influence of seasonal variation on annual loading.

Critical Conditions: In Section 5.3 in the TMDL, the WDNR states that critical conditions for both pollutant loadings are predominantly during high flows in the growing season in streams (May through October), while the critical condition for water quality impacts are during the summer when higher temperature and longer days causes an increase in excessive plant growth in the lakes when temperature, flow and sunlight causes excess algal growth (June through September 15). The influx of phosphorus can happen at any time of year and contribute to impairment.

EPA finds the WDNR's approach for calculating the loading capacity to be reasonable and consistent with EPA guidance. EPA finds that the TMDL document submitted by the WDNR satisfies all requirements concerning this third element.

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity attributed to existing and future nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, load allocations should be described separately for natural background and nonpoint sources.

Comment:
LAs for TP and TSS were determined by the WDNR for natural background, agricultural nonpoint source, and non-regulated urban stormwater (Section 6.2 of the TMDL) shown in Appendices H and I, respectively, of the TMDL. Natural background includes nonpoint sources from forests, wetlands, and atmospheric and direct groundwater inflow to the Winnebago Pool Lakes. The nonpoint sources are described in Section 1 above, and include leaking septic systems, erosion and internal sediment loading or resuspension of sediments. Appendix C of the TMDL describes the detailed process used by WDNR to determine the load allocations for each subbasin.

EPA finds the WDNR's approach for calculating the LA to be reasonable and consistent with EPA guidance. EPA finds that the TMDL document submitted by the WDNR satisfies all requirements concerning this fourth element.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit.

The individual WLAs may take the form of uniform percentage reductions or individual mass based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. These individual WLAs may be adjusted during the NPDES

permitting process. If the WLAs are adjusted, the individual effluent limits for each permit issued to a discharger on the impaired water must be consistent with the assumptions and requirements of the adjusted WLAs in the TMDL. If the WLAs are not adjusted, effluent limits contained in the permit must be consistent with the individual WLAs specified in the TMDL. If a draft permit provides for a higher load for a discharger than the corresponding individual WLA in the TMDL, the State/Tribe must demonstrate that the total WLA in the TMDL will be achieved through reductions in the remaining individual WLAs and that localized impairments will not result. All permittees should be notified of any deviations from the initial individual WLAs contained in the TMDL. EPA does not require the establishment of a new TMDL to reflect these revised allocations as long as the total WLA, as expressed in the TMDL, remains the same or decreases, and there is no reallocation between the total WLA and the total LA.

Comment:
The WLAs for TP and TSS TMDLs and protection strategies included general permits, regulated Wisconsin Pollutant Discharge Elimination System (WPDES) permits, MS4 permits in Appendix H and shown below. Note that Table 4 of this Decision Document is a recommended WLA and was calculated for modeling simulation continuity within the watershed but is not mandatory for the Tribes represented in the table and are not considered "approved" WLAs pursuant to 40 CFR 130.7. The allocations are in six subbasins for five Tribal areas.

Permitted and Industrial Wastewater Discharges - WDNR calculated WLAs for WPDES permits. The individual WLAs are in Table 3 below for TP (Appendix H) and Table 3 for TSS (Appendix I) later in this Section, taken from the TMDL submittal.

The baseline load for each facility was calculated based upon the technology-based effluent limit for phosphorus of 1.0 mg/L multiplied by either the average annual design flow (for the municipal facilities) or the highest average flow over five years (for industrial dischargers). Some facilities have a lower effluent concentration limit already in their permit, in which case the lower limit was used (Section 4.2.1 of the TMDL). The facilities were given an individual WLA based upon the reduction needed to attain WQSs in each modeled reach (Section 6.2 of the TMDL). For example, if a facility contributed 15% of the baseline load in a modeled reach, then the facility received 15% of the controllable load based upon the loading capacity. The controllable load is defined by WDNR as the point source, MS4, and the nonpoint source loads for each modeled reach. Some reaches do not have reductions, as the modeled reach is attaining current WQSs.

WDNR noted that many facilities discharge upstream of impaired segments, and therefore WLAs need to be determined to ensure downstream uses are protected. The WDNR calculated WLAs for NPDES permits on Tribal lands shown in Table 4 for TP and Table 4 for TSS below. Since they are not on State lands the allocations are recommended but not part of this EPA TMDL approval.

TP WLA by point source

Table 3. Annual total phosphorus wasteload allocations for dischargers with individual Wisconsin Pollutant Discharge Elimination System (WPDES) permits.

Facility Name	Permit Number	TMDL Subbasin	TP Wasteload Allocation (lbs./year)	TP Wasteload Allocation (lbs./day)
AGROPUR INC WEYAUWEGA PLANT	0001449	66	80	0.2
AMHERST WASTEWATER TREATMENT FACILITY	0023213	66	93	0.3
ARTESIAN TROUT FARM	PENDING	8	104	0.3
BEAR CREEK WASTEWATER TREATMENT FACILITY	0028061	64	52	0.1
BERLIN WASTEWATER TREATMENT FACILITY	0021229	28	779	2.1
BIRNAMWOOD WASTEWATER TREATMENT FACILITY	0022691	58	57	0.2
BLACK CREEK WASTEWATER TREATMENT FACILITY	0021041	89	174	0.5
BONDUELLE USA - FAIRWATER	0002666	12	4	0.01
BOWLER WASTEWATER TREATMENT FACILITY	0021237	59	17	0.05
BUTTE DES MORTS CONSOLIDATED SD 1	0032492	73	40	0.1
CAROLINE SD 1 WASTEWATER TREATMENT FACILITY	0022829	58	9	0.03
CLINTONVILLE WASTEWATER TREATMENT FACILITY	0021466	60	330	0.9
DALE SANITARY DISTRICT NO 1 WWTF	0030830	49	31	0.1
DARLING INTERNATIONAL INC	0038083	26	19	0.1
EDEN WASTEWATER TREATMENT FACILITY	0030716	39	96	0.3
EMBARRASS CLOVERLEAF LAKES SD LAGOON SYSTEM	0023949	59	88	0.2
FAIRWATER WASTEWATER TREATMENT FACILITY	0021440	12	27	0.1
FOND DU LAC WATER POLLUTION CONTROL PLANT	0023990	75	5,763	15.8
FREMONT ORIHULA WOLF RIVER JOINT S C	0026158	71	104	0.3
FRIESLAND WASTEWATER TREATMENT FACILITY	0031780	13	14	0.04
GREAT LAKES KRAUT	0050407	70	5	0.01
GREEN LAKE SANITARY DISTRICT	0036846	24	50	0.1
GREEN LAKE WASTEWATER TREATMENT FACILITY	0021776	25	260	0.7
GRESHAM WASTEWATER TREATMENT FACILITY	0022781	55	55	0.2
HILLSHIRE BRANDS (a.k.a. SARA LEE FOODS - NEW LONDON)	0023094	71	411	1.1
HORTONVILLE WASTEWATER TREATMENT FACILITY	0022896	69	260	0.7
IOLA WASTEWATER TREATMENT FACILITY	0021717	81	93	0.3
KINGSTON WASTEWATER TREATMENT FACILITY	0036421	14	10	0.03
LARSEN WINCHESTER SD WWTF	0031925	51	25	0.1
LEACH FARMS - AURORAVILLE	0052809	48	5	0.01
LITTLE RAPIDS CORP SHAWANO SPECIALTY PAPERS	0001341	67	1,038	2.8
MANAWA WASTEWATER TREATMENT FACILITY	0020869	81	106	0.3
SHAWANO COUNTY UTILITIES	0029718	57	79	0.2
MARION WASTEWATER TREATMENT FACILITY	0020770	60	208	0.6
MARKESAN WASTEWATER TREATMENT FACILITY	0024619	12	189	0.5
MONTELLO WASTEWATER TREATMENT FACILITY	0024813	16	157	0.4
NESHKORO WASTEWATER TREATMENT FACILITY	0060666	23	23	0.1
NEW LONDON WASTEWATER TREATMENT FACILITY	0024929	71	1,038	2.8
NICHOLS WASTEWATER TREATMENT FACILITY	0020508	53	16	0.04
NORTH LAKE POYGAN S D WWTF	0036251	72	27	0.1
OAKFIELD WASTEWATER TREATMENT FACILITY	0024988	37	138	0.4
OMRO WASTEWATER TREATMENT FACILITY	0025011	29	350	1.0
OSHKOSH WASTEWATER TREATMENT PLANT	0025038	74	10,384	28.4
OXFORD WASTEWATER TREATMENT FACILITY	0032077	1	23	0.1
PACKWAUKEE SANITARY DISTRICT NO 1	0060933	9	20	0.1
POWER PACKAGING INC	0069965	35	13	0.04
POY SIPPI SD WASTEWATER TREATMENT FACILITY	0031691	47	24	0.1
POYGAN POYSIPPI SD 1 WWTF	0035513	72	40	0.1
PRINCETON WASTEWATER TREATMENT FACILITY	0022055	24	135	0.4
REDGRANITE WASTEWATER TREATMENT FACILITY	0020729	48	167	0.5
RIPON WASTEWATER TREATMENT FACILITY	0021032	87	1,301	3.6
ROSENDALE WASTEWATER TREATMENT FACILITY	0028428	35	112	0.3
SAPUTO CHEESE USA FOND DU LAC (SCOTT ST)[1]	0056120	75	12	0.03
SEYMOUR WASTEWATER TREATMENT FACILITY	0021768	89	300	0.8
SHIOCTON WASTEWATER TREATMENT FACILITY	0028100	68	78	0.2
SILVER LAKE SANITARY DISTRICT	0061301	22	532	1.5
SILVER MOON SPRINGS	0064548	55	604	1.7
STEPHENSVILLE SANITARY DISTRICT NO 1	0032531	52	12	0.03
STOCKBRIDGE WASTEWATER TREATMENT FACILITY	0021393	46	59	0.2
TIGERTON WASTEWATER TREATMENT FACILITY	0022349	58	58	0.2
WAUPACA FOUNDRY PLANT 1	0026379	66	37	0.1
WAUPACA WASTEWATER TREATMENT FACILITY	0030490	66	779	2.1
WESTFIELD WASTEWATER TREATMENT FACILITY	0022250	8	130	0.4
WEYAUWEGA STAR DAIRY	0039527	66	13	0.04
WEYAUWEGA WASTEWATER TREATMENT FACILITY	0020923	66	439	1.2
WI DNR WILD ROSE FISH HATCHERY	0022756	47	446	1.2
WILD ROSE WASTEWATER TREATMENT FACILITY	0060071	47	60	0.2
WINNECONNE WASTEWATER TREATMENT FACILITY	0021938	73	403	1.1
WISCONSIN VENEER AND PLYWOOD INC	0047929	55	23	0.1
WITTENBERG WASTEWATER TREATMENT FACILITY	0028444	58	170	0.5
WOLF TREATMENT PLANT	0028452	67	1,366	3.7

Table 4. Recommended annual total phosphorus loads for tribal dischargers with individual National Pollutant Discharge Elimination System (NPDES) permits.

Facility Name	Permit Number	TMDL Subbasin	TP Load (lbs./year)	TP Load (lbs./day)
KESHENA WASTEWATER TREATMENT FACILITY	0071315	55	173	0.5
MENOMINEE TRIBAL ENTERPRISES	0046868	55	7	0.02
SOKAOGON CHIPPEWA COMMUNITY WASTEWATER TREATMENT SYSTEM	0071501	80	186	0.5
STOCKBRIDGE-MUNSEE COMMUNITY WASTEWATER PONDS	0036188	55	36	0.1
WOLF RIVER RANCH WASTEWATER TREATMENT FACILITY	0071307	55	34	0.1

MS4s: There are 47 allocations calculated for 29 cities, villages, and towns within the basin regulated under MS4 permits (Table 5 for TP below and Table 5 for TSS later in this document, taken from Appendix H and I of the TMDL submittal, respectively). The Town of Clayton has its MS4 regulated area outside of the UFWB and is not included in this TMDL (Section 4.2.2 of the TMDL submittal).

The MS4 WLAs were based upon the land area under the jurisdiction of the MS4 permit as well as the SLAMM model as discussed in Section 3 of this Decision Document and in Section 4.2.2 of the TMDL. The SLAMM model was used to determine the baseline loads for the MS4 entities and considered the Wisconsin runoff management performance standards requiring a 20% reduction in annual average TSS loads from existing development constructed prior to October 1, 2004 pursuant to Wisconsin NR 216 and NR 151 rules (Section 4.2.2 of the TMDL). The WDNR "*TMDL Guidance for MS4 Permits: Planning, Implementation, and Modeling Guidance*" (WDNR, 2014) determined that the TSS reduction of 20% is equivalent to a 15% reduction in phosphorus loads as stated above in Section 3 of this document. The WLAs for each MS4 are in Table 5 for TP and Table 5 for TSS below in this Decision Document. The WLAs are calculated for each municipality and includes identification of the subbasin and acreage.

Calumet County, Fond du Lac County, Winnebago County, and the University of Wisconsin-Oshkosh are covered by a WPDES permit but will not receive individual allocations because they are covered by their respective MS4 permits. They are expected to achieve the applicable reduction. WDNR noted that the MS4 permits require permittees to map out their stormwater system, and this process is currently underway.

A separate MS4 load was not calculated for the Wisconsin Department of Transportation (WisDOT). WDNR noted that at this time, WisDOT has a WPDES permit called a TS4 that includes a Memorandum of Understanding with the WDNR for WisDOT to implement the TMDL requirements for discharges and comply with the TMDL allocation (Section 6.4.3 of the TMDL).

For both MS4s and individual dischargers, WDNR also calculated percent reductions (Appendices H and I) in several ways to assist stakeholders in reduction from baseline. WDNR gives details for: 1) percent reduction to protect local (within the subbasin) water quality; 2) reduction for downstream water quality; and 3) total percent reduction, that is, local and downstream. WDNR explained that this portioning is important when determining where and how water quality trading or adaptive management activities occur. This will ensure guidance is followed and is compatible with the geographic extent of trading. WDNR noted that it is important that trades occur within the same watersheds, and to ensure local water quality is not

ignored (Section 6.4.1 of the TMDL). Appendix K of the TMDL discusses how water quality trading and adaptive management can be used in the Upper Fox Wolf Basin to implement the allocations.

CAFOs: These point sources must comply with all WPDES permit conditions and the runoff from CAFO land application is considered a nonpoint source when applied in agronomic amounts. For production areas, CAFOs may not discharge manure or process wastewater pollutants to navigable waters except under extraordinary circumstances (as noted in Section 6.4.4 of the TMDL); from ancillary or storage areas, CAFOs may discharge stormwater provided they comply with surface water and groundwater standards (Section 6.4.4 of the TMDL). For this TMDL effort, WDNR has determined a WLA = 0 for manure management facilities (Section 6.4.4 of the TMDL).

Table 5. Annual total phosphorus wasteload allocations for permitted MS4s.

Municipality	TMDL Subbasin	Regulated Area (acres)	TP Wasteload Allocation (lbs./year)	TP Reduction from Baseline			TP Wasteload Allocation (lbs../day)
				Local Reduction (%)	Downstream Reduction (%)	Total Reduction (%)	
Algoma (Town)	30	97	1.4	0%	83%	83%	0.004
Algoma (Town)	73	1,012	15	0%	83%	83%	0.04
Algoma (Town)	74	6	0.04	0%	83%	83%	0.0001
Algoma (Town)	75	66	0.9	0%	83%	83%	0.002
Appleton (City)	52	0.4	0.01	51%	32%	83%	0.00002
Appleton (City)	75	174	1.9	0%	83%	83%	0.005
Black Wolf (Town)	75	207	2.8	0%	83%	83%	0.008
Eden (Village)	39	165	1.8	44%	39%	83%	0.005
Empire (Town)	39	63	0.7	44%	39%	83%	0.002
Empire (Town)	75	61	0.8	0%	83%	83%	0.002
Fond du Lac (City)	43	2,505	32	63%	20%	83%	0.09
Fond du Lac (City)	44	1,115	16	70%	13%	83%	0.04
Fond du Lac (City)	75	3,069	34	0%	83%	83%	0.09
Fond du Lac (City)	88	1,128	6.1	0%	83%	83%	0.02
Fond du Lac (Town)	34	13	0.1	0%	83%	83%	0.0002
Fond du Lac (Town)	39	2	0.02	44%	39%	83%	0.00005
Fond du Lac (Town)	43	79	1.1	63%	20%	83%	0.003
Fond du Lac (Town)	44	57	0.9	70%	13%	83%	0.003
Fond du Lac (Town)	75	411	5.0	0%	83%	83%	0.01
Fond du Lac (Town)	88	88	0.5	0%	83%	83%	0.001
Fox Crossing (Village)	75	4	0.1	0%	83%	83%	0.0001
Friendship (Town)	33	101	0.9	0%	83%	83%	0.003
Friendship (Town)	34	130	1.0	0%	83%	83%	0.003
Friendship (Town)	75	144	1.9	0%	83%	83%	0.005
Grand Chute (Town)	52	25	0.7	51%	32%	83%	0.002
Greenville (Town)	50	100	3.8	1%	82%	83%	0.01
Greenville (Town)	52	967	15	51%	32%	83%	0.04
Harrison (Town & Village)	75	431	5.4	0%	83%	83%	0.01
Menasha (City)	75	91	1.1	0%	83%	83%	0.003
Neenah (City)	75	71	0.8	0%	83%	83%	0.002
Neenah (Town)	75	185	2.5	0%	83%	83%	0.007
Nekimi (Town)	75	176	2.1	0%	83%	83%	0.006
North Fond du Lac (Village)	33	43	0.4	0%	83%	83%	0.001
North Fond du Lac (Village)	34	745	5.0	0%	83%	83%	0.01
North Fond du Lac (Village)	75	183	1.9	0%	83%	83%	0.005
Omro (Town)	73	42	0.7	0%	83%	83%	0.002
Oshkosh (City)	30	1,800	23	0%	83%	83%	0.06
Oshkosh (City)	73	984	12	0%	83%	83%	0.03
Oshkosh (City)	74	3,406	19	0%	83%	83%	0.05
Oshkosh (City)	75	4,917	50	0%	83%	83%	0.14
Oshkosh (Town)	73	243	2.9	0%	83%	83%	0.008
Oshkosh (Town)	75	316	3.7	0%	83%	83%	0.01
Portage (City)	4	43	1.6	0%	88%	88%	0.004
Portage (City)	7	930	21	0%	88%	88%	0.06
Sherwood (Village)	75	358	5.0	0%	83%	83%	0.01
Taycheedah (Town)	75	262	3.4	0%	83%	83%	0.009
Vinland (Town)	75	11	0.1	0%	83%	83%	0.0004

TSS WLA by point source

Table 3. Annual sediment wasteload allocations (as total suspended solids, TSS) for dischargers with individual Wisconsin Pollutant Discharge Elimination System (WPDES) permits.

Facility Name	Permit Number	TMDL Subbasin	TSS Wasteload Allocation (lbs/year)	TSS Wasteload Allocation (lbs/day)
AGROPUR INC WEYAUWEGA PLANT	0001449	66	3,819	10
AMHERST WASTEWATER TREATMENT FACILITY	0023213	66	10,653	29
ARTESIAN TROUT FARM	PENDING	8	15,232	42
BEAR CREEK WASTEWATER TREATMENT FACILITY	0028061	64	3,946	11
BERLIN WASTEWATER TREATMENT FACILITY	0021229	28	80,749	221
BIRNAMWOOD WASTEWATER TREATMENT FACILITY	0022691	58	4,340	12
BLACK CREEK WASTEWATER TREATMENT FACILITY	0021041	89	13,218	36
BONDUELLE USA - FAIRWATER	0002666	12	62	0.2
BOWLER WASTEWATER TREATMENT FACILITY	0021237	59	1,989	5
BUTTE DES MORTS CONSOLIDATED SD 1	0032492	73	14,257	39
CAROLINE SD 1 WASTEWATER TREATMENT FACILITY	0022829	58	2,131	6
CLINTONVILLE WASTEWATER TREATMENT FACILITY	0021466	60	33,878	93
DALE SANITARY DISTRICT NO 1 WWTF	0030830	49	3,214	9
DARLING INTERNATIONAL INC	0038083	26	7,866	22
EDEN WASTEWATER TREATMENT FACILITY	0030716	39	6,726	18
EMBARRASS CLOVERLEAF LAKES SD LAGOON SYSTEM	0023949	59	10,062	28
FAIRWATER WASTEWATER TREATMENT FACILITY	0021440	12	1,864	5
FOND DU LAC WATER POLLUTION CONTROL PLANT	0023990	75	1,014,454	2,777
FREMONT ORIHULA WOLF RIVER JOINT S C	0026158	71	11,837	32
FRIESLAND WASTEWATER TREATMENT FACILITY	0031780	13	1,114	3
GREAT LAKES KRAUT	0050407	70	64	0.2
GREEN LAKE SANITARY DISTRICT	0036846	24	9,357	26
GREEN LAKE WASTEWATER TREATMENT FACILITY	0021776	25	26,916	74
GRESHAM WASTEWATER TREATMENT FACILITY	0022781	55	6,260	17
HILLSHIRE BRANDS (a.k.a. SARA LEE FOODS - NEW LONDON)	0023094	71	31,237	86
HORTONVILLE WASTEWATER TREATMENT FACILITY	0022896	69	29,594	81
IOLA WASTEWATER TREATMENT FACILITY	0021717	81	8,722	24
KINGSTON WASTEWATER TREATMENT FACILITY	0036421	14	1,949	5
LARSEN WINCHESTER SD WWTF	0031925	51	2,940	8
LEACH FARMS - AURORAVILLE	0052809	48	1,219	3
LITTLE RAPIDS CORP SHAWANO SPECIALTY PAPERS	0001341	67	239,078	655
MANAWA WASTEWATER TREATMENT FACILITY	0020869	81	9,940	27
SHAWANO COUNTY UTILITIES	0029718	57	1,499	4
MARION WASTEWATER TREATMENT FACILITY	0020770	60	14,623	40
MARKESAN WASTEWATER TREATMENT FACILITY	0024619	12	13,234	36
MONTELLO WASTEWATER TREATMENT FACILITY	0024813	16	14,620	40
NESHKORO WASTEWATER TREATMENT FACILITY	0060666	23	2,422	7
NEW LONDON WASTEWATER TREATMENT FACILITY	0024929	71	118,374	324
NICHOLS WASTEWATER TREATMENT FACILITY	0020508	53	1,564	4
NORTH LAKE POYGAN S D WWTF	0036251	72	9,651	26
OAKFIELD WASTEWATER TREATMENT FACILITY	0024988	37	11,150	31
OMRO WASTEWATER TREATMENT FACILITY	0025011	29	43,422	119
OSHKOSH WASTEWATER TREATMENT PLANT	0025038	74	1,827,844	5,004
OXFORD WASTEWATER TREATMENT FACILITY	0032077	1	3,119	9
PACKWAUKEE SANITARY DISTRICT NO 1	0060933	9	2,011	6
POWER PACKAGING INC	0069965	35	2,803	8
POY SIPPI SD WASTEWATER TREATMENT FACILITY	0031691	47	8,774	24
POYGAN POYSIPPI SD 1 WWTF	0035513	72	7,129	20
PRINCETON WASTEWATER TREATMENT FACILITY	0022055	24	12,671	35
REDGRANITE WASTEWATER TREATMENT FACILITY	0020729	48	29,428	81
RIPON WASTEWATER TREATMENT FACILITY	0021032	87	54,835	150
ROSENDALE WASTEWATER TREATMENT FACILITY	0028428	35	7,896	22
SAPUTO CHEESE USA FOND DU LAC (SCOTT ST)[1]	0056120	75	1,196	3
SEYMOUR WASTEWATER TREATMENT FACILITY	0021768	89	22,807	62
SHIOCTON WASTEWATER TREATMENT FACILITY	0028100	68	8,937	24
SILVER LAKE SANITARY DISTRICT	0061301	22	55,179	151
SILVER MOON SPRINGS	0064548	55	123,166	337
STEPHENSVILLE SANITARY DISTRICT NO 1	0032531	52	877	2
STOCKBRIDGE WASTEWATER TREATMENT FACILITY	0021393	46	4,167	11
TIGERTON WASTEWATER TREATMENT FACILITY	0022349	58	6,611	18
WAUPACA FOUNDRY PLANT 1	0026379	66	6,062	17
WAUPACA WASTEWATER TREATMENT FACILITY	0030490	66	88,777	243
WESTFIELD WASTEWATER TREATMENT FACILITY	0022250	8	12,174	33
WEYAUWEGA STAR DAIRY	0039527	66	183	1
WEYAUWEGA WASTEWATER TREATMENT FACILITY	0020923	66	50,070	137
WI DNR WILD ROSE FISH HATCHERY	0022756	47	142,267	390
WILD ROSE WASTEWATER TREATMENT FACILITY	0060071	47	21,386	59
WINNECONNE WASTEWATER TREATMENT FACILITY	0021938	73	71,012	194
WISCONSIN VENEER AND PLYWOOD INC	0047929	55	5,066	14
WITTENBERG WASTEWATER TREATMENT FACILITY	0028444	58	19,413	53
WOLF TREATMENT PLANT	0028452	67	155,662	426

Table 4. Recommended annual sediment loads (as total suspended solids, TSS) for tribal dischargers with individual National Pollutant Discharge Elimination System (NPDES) permits.

Facility Name	Permit Number	TMDL Subbasin	TSS Load (lbs/year)	TSS Load (lbs/day)
KESHENA WASTEWATER TREATMENT FACILITY	0071315	55	19,783	54
MENOMINEE TRIBAL ENTERPRISES	0046868	55	2,263	6
SOKAOGON CHIPPEWA COMMUNITY WASTEWATER TREATMENT SYSTEM	0071501	80	3,551	10
STOCKBRIDGE-MUNSEE COMMUNITY WASTEWATER PONDS	0036188	55	4,606	13
WOLF RIVER RANCH WASTEWATER TREATMENT FACILITY	0071307	55	2,559	7

Table 5. Annual sediment wasteload allocations (as total suspended solids, TSS) for permitted MS4s.
Note: Municipalities with a 0% TSS reduction from baseline under this TMDL (marked with an asterisk, *) are still required to meet the TSS performance standard for existing development (20% reduction) defined under chapters NR 216 and NR 151 of Wisconsin Administrative Code.

Municipality	TMDL Subbasin	Regulated Area (acres)	TSS Wasteload Allocation (lbs/year)	TSS Reduction from Baseline			TSS Wasteload Allocation (lbs/day)
				Local Reduction (%)	Downstream Reduction (%)	Total Reduction (%)	
Algoma (Town)	30	97	178	48%	0%	48%	0.5
Algoma (Town)	73	1,012	2,414	0%	0%	0%*	7
Algoma (Town)	74	6	24	0%	0%	0%*	0.1
Algoma (Town)	75	66	104	0%	0%	0%*	0.3
Appleton (City)	52	0.4	0.5	80%	0%	80%	0.001
Appleton (City)	75	174	349	0%	0%	0%*	1
Black Wolf (Town)	75	207	338	0%	0%	0%*	1
Eden (Village)	39	165	1,505	65%	0%	65%	4
Empire (Town)	39	63	286	65%	0%	65%	1
Empire (Town)	75	61	107	0%	0%	0%*	0.3
Fond du Lac (City)	43	2,505	12,077	43%	0%	43%	33
Fond du Lac (City)	44	1,115	3,697	70%	0%	70%	10
Fond du Lac (City)	75	3,069	6,610	0%	0%	0%*	18
Fond du Lac (City)	88	1,128	11,741	0%	0%	0%*	32
Fond du Lac (Town)	34	13	45	16%	0%	16%	0.1
Fond du Lac (Town)	39	2	7.3	65%	0%	65%	0.02
Fond du Lac (Town)	43	79	371	43%	0%	43%	1
Fond du Lac (Town)	44	57	134	70%	0%	70%	0.4
Fond du Lac (Town)	75	411	809	0%	0%	0%*	2
Fond du Lac (Town)	88	88	770	0%	0%	0%*	2
Fox Crossing (Village)	75	4	7.8	0%	0%	0%*	0.02
Friendship (Town)	33	101	450	44%	0%	44%	1
Friendship (Town)	34	130	607	16%	0%	16%	2
Friendship (Town)	75	144	245	0%	0%	0%*	1
Grand Chute (Town)	52	25	210	80%	0%	80%	1
Greenville (Town)	50	100	1,036	0%	0%	0%*	3
Greenville (Town)	52	967	2,082	80%	0%	80%	6
Harrison (Town & Village)	75	431	743	0%	0%	0%*	2
Menasha (City)	75	91	187	0%	0%	0%*	1
Neenah (City)	75	71	131	0%	0%	0%*	0.4
Neenah (Town)	75	185	293	0%	0%	0%*	1
Nekimi (Town)	75	176	363	0%	0%	0%*	1
North Fond du Lac (Village)	33	43	359	44%	0%	44%	1
North Fond du Lac (Village)	34	745	3,696	16%	0%	16%	10
North Fond du Lac (Village)	75	183	458	0%	0%	0%*	1
Omro (Town)	73	42	74	0%	0%	0%*	0.2
Oshkosh (City)	30	1,800	4,513	48%	0%	48%	12
Oshkosh (City)	73	984	4,431	0%	0%	0%*	12
Oshkosh (City)	74	3,406	15,425	0%	0%	0%*	42
Oshkosh (City)	75	4,917	12,478	0%	0%	0%*	34
Oshkosh (Town)	73	243	939	0%	0%	0%*	3
Oshkosh (Town)	75	316	700	0%	0%	0%*	2
Portage (City)	4	43	1,792	6%	41%	47%	5
Portage (City)	7	930	4,289	0%	47%	47%	12
Sherwood (Village)	75	358	489	0%	0%	0%*	1
Taycheedah (Town)	75	262	436	0%	0%	0%*	1
Vinland (Town)	75	11	20	0%	0%	0%*	0.1

EPA finds the WDNR's approach for calculating the WLA to be reasonable and consistent with EPA guidance. EPA finds that the TMDL document submitted by the WDNR satisfies all requirements concerning this fifth element.

6. Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

Comment:
The WDNR used an implicit MOS for the Upper Fox Wolf River TMDL for both TP and TSS (Section 6.6 of the TMDL). The WDNR states that conservative estimates in the methodologies were used for three waterbody types, the streams and rivers, lakes and reservoirs, and the chain of lakes.

Streams and rivers used conservative assumptions for the development of the TP and TSS TMDLs; numeric targets for both TSS and TP are developed in Wisconsin by using annual flow weighted mean concentrations, which includes the higher flows during growing season. The lakes and reservoirs phosphorus loading capacity analysis used lake response models to estimate water column TP concentrations, using flow volume and external phosphorus loading (Section 5.1.2 of the TMDL). In the modeling efforts, the water volumes were set to existing averages from 2009-2013, which are less than baseline flows used for calculating loading capacities. Loading capacity calculations used design flows of POTWs, or maximum annual observed flow for industrial dischargers. Within the models, less flow brings in less load; therefore, using averages and not maximum values was a conservative assumption for phosphorus and sediment loading capacity calculation.

In the Winnebago Pool Lakes, the TP loads from direct groundwater discharge (Section 4.2.7 of the TMDL) are assigned to the background source category, with no reductions applied to baseline loads, though baseline groundwater TP loading may be higher due to human activity. Reductions in TP loading from direct groundwater discharge to the Winnebago Pool may occur as land management activities are implemented to reduce TP in surface water, and therefore the groundwater loading values represent a conservative assumption. Lake Winnebago also used two lake response models to estimate the loading, and water column TP but resulted in similar estimates, used to provide confidence in the models and implicit margin of safety due to the resultant relative agreement of the two models.

Further, the WDNR states in Section 6.6 of the TMDL: "The phosphorus loading capacity of Lake Winnebago requires load reductions from most TMDL subbasins that are beyond what would be needed to meet local stream and river targets for phosphorus. The difference between these two levels of load reductions represents an implicit MOS for subbasins with phosphorus allocations determined by Lake Winnebago."

EPA finds the WDNR's approach for calculating the MOS to be reasonable and consistent with EPA guidance. EPA finds that the TMDL document submitted by the WDNR satisfies all requirements concerning this sixth element.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variations. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Comment:
Seasonal variation was considered as described in Section 6.8 of the TMDL. Loading capacity and allocations were calculated acknowledging the various source influences at different times of the year. The spring and summer months are conducive to transportation of TP and TSS, and plant growth occurs when excess phosphorus is available, as well as the loading and transport of TSS with precipitation events. TSS critical conditions occur during wet weather events that may add runoff during storm events, scour from channel beds, or streambank erosion. Timeframes outside of the spring and summer months can also contribute to high sediment concentrations as sediments may be deposited in streambeds in the spring or summer but transported at a later time in the year.

EPA finds that the TMDL document submitted by WDNR satisfies all requirements concerning this seventh element.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by point sources only, the issuance of a National Pollutant Discharge Elimination System (NPDES) permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an approved TMDL.

When a TMDL is developed for waters impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement water quality standards.

EPA's August 1997 TMDL Guidance also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by nonpoint sources. However, EPA cannot disapprove a TMDL for nonpoint source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

Comment:
Section 7.2 and 7.3 of the TMDL consider reasonable assurance for both point and nonpoint sources, respectively. Numeric criteria for phosphorus were established in 2010 under Section NR 102.06 of the Wisconsin Administrative Code (Wis. Adm. Code).

Point sources - have permits issued for wastewater from municipalities and industry, and stormwater from certain MS4s, industries and construction sites, under Chapter (ch.) NR 217. Wisconsin used Technology Based Effluent Limit requirements in ch. NR 217, Wis. Adm. Code for phosphorus, and ch. NR 210 Wis. Adm. Code for TSS limits. For point source reductions, the individual, municipal and industrial wastewater dischargers will acquire discharge limits consistent with the TMDL. General permit discharges will be evaluated to ensure they are consistent with the TMDL as well.

Nonpoint sources - Sections 7.3.1 through 7.3.11 describe the many incentives and programs that demonstrate the reasonable assurance is a very strong, coordinated, and ongoing effort related to improvement of the Upper Fox Wolf River Basin, both in the internal state planning and programs, and the extensive citizen and stakeholder involvement. The Section reviews many financial, regulatory, and implementation activities over the course of many years to help ensure that the TMDLs will be implemented through many initiatives in many organizations and agencies.

- NR 151 of the Wis. Adm. Code – NR 151 includes NPS performance standards and manure management prohibitions. Methods include using a tillage setback, the use of the Phosphorus Index to limit amount of phosphorus runoff from croplands and pastures, executing the prohibition against excess process wastewater handling, achieving TMDLs, meeting tolerable soil erosion rates for sheet, rill and wind erosion, and maintaining manure storage facilities.
- WDNR cost sharing grant programs – Wisconsin lists six entities that provide support grants: the Targeted Runoff Management (TRM) Grant Program, the Notice of Discharge (NOD) Grant Program, the Urban Nonpoint Source & Storm Water Management Grant Program, the Lake Planning Grant Program, the Lake Protection Grant Program, and the River Planning and Protection Grant Program.
- Targeted Runoff Management (TRM) Grant Program – grants are available to local units of government for both urban and agricultural sites, based on the need for compliance with standards, the existence of impaired waters, outstanding or exceptional resource waters, threats to public health, animal feeding operations receiving an NOD, the existence of water quality concerns of national or statewide importance, projects consistent with priorities of the WDNR, or consistent with approved county land and water resource management plans.
- NOD Grants - grants to provide cost sharing to farmers who must install agricultural BMPs to comply with NOD requirements.
- Lake Management Planning Grants – to assist lake groups in gathering data, describe land use on shorelines and watersheds, evaluate zoning and sanitations, assess fish and wildlife habitats, and evaluate different courses of action
- Lake and River Protection Grants – to purchase land, restore wetlands and shorelands, develop local regulations to protect lakes, and to develop lake management implementation

plans. River grants are similar but also include a range of actions from potential dam removal to increased local understanding.

- Department of Agriculture, Trade, and Consumer Protection (DATCP) Soil & Water Resource Management Program – the counties' Land and Water Conservation Departments develop plans to identify conservation needs.
- DATCP Producer Led Watershed Protection Grants Program – its first round of grants was in 2016, to give financial support to farmers to lead conservation efforts in their own watersheds.
- Federal Programs – Wisconsin named the Environmental Quality Incentive Program (EQIP) is a federal cost-share program administered by the Natural Resources Conservation Service (NRCS) for assisting in BMPs. The Conservation Reserve Program (CRP) is a voluntary program available to agricultural producers to help them safeguard environmentally sensitive land. Conservation Reserve Enhancement Program (CREP) provides funding to take land out of production near surface water or sinkholes. The Regional Conservation Partnership Program (RCPP) promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners.
- Water Quality Trading (WQT) and AM – available to eligible municipal and industrial wastewater dischargers to demonstrate compliance with TMDL WLAs. These options provide a watershed-based opportunity to reduce pollutant loading through point and nonpoint source collaboration.
- Phosphorus Multi-discharger Variance – variances were developed to assist in extending the timeline to wastewater dischargers. In exchange, point sources commit to assist in reduction from NPS loading.

EPA finds that the TMDL document submitted by the WDNR satisfies all the requirements concerning this eighth element.

9. Monitoring Plan to Track TMDL Effectiveness

EPA's 1991 document, *Guidance for Water Quality-Based Decisions: The TMDL Process* (EPA 440/4-91-001), recommends a monitoring plan to track the effectiveness of a TMDL, particularly when a TMDL involves both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur. Such a TMDL should provide assurances that nonpoint source controls will achieve expected load reductions and, such TMDL should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring and leading to attainment of water quality standards.

Comment:
Section 7.4 of the TMDL states that the basin sites will be monitored, especially where grant money was used for BMPs. Monitoring will occur as staff and money allow, and where locations may have changed as they reach applicable water quality standards. Sites will be assessed on the statewide rotational monitoring basis, as well as using metrics for habitat and biota. WDNR will

also work with citizen monitoring groups to assist and supplement WDNR data. A website portal is under development to track implementation of NPS locations, and access will be available for those outside of the agency.

EPA finds that the TMDL document submitted by the WDNR satisfies all the requirements concerning this ninth element.

10. Implementation

EPA policy encourages Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired by nonpoint sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that nonpoint source LAs established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. In addition, EPA policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

Comment:
Section 7.1 of the TMDL states that water quality implementation details are included in the Reasonable Assurance Section above. The stakeholders have access to many programs and grants to assist in the implementation activities, which helps ensure that the implementation will occur. Many phases of implementation (planning, money, collaborative efforts) from multiple sectors (PS, NPS and potential trading) are addressed. Targeting of implementation steps may occur both in an urban and agricultural setting, for nonpermitted entities, general permits, and individual permits, and ensure consistency with the TMDL.

Wisconsin provided Appendix G in the TMDL which includes baseline loads per source type. These values will be very helpful to operators or stakeholders in determining reductions in several source categories: background, agricultural nonpoint, non-regulated urban, general permits, regulated MS4 urban, and individual permits.

Wisconsin has also provided Appendix K with the TMDL which assists the operators of facilities with numerical goals for trading and adaptive management options for point sources. The discussion includes the end goals of each program, monitoring, timing, quantification of reductions, and eligibility requirements. The facilities are identified by name, permit number, TMDL number of subbasin, WLAs, credits, identifies the downstream waterbodies as well as the adaptive management target.

EPA reviews, but does not approve, implementation plans. EPA finds that this criterion has been adequately addressed.

11. Public Participation

EPA policy is that there should be full and meaningful public participation in the TMDL development process. The TMDL regulations require that each State/Tribe must subject calculations to establish TMDLs to public review consistent with its own continuing planning process (40 C.F.R. §130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval should describe the State's/Tribe's public participation process, including a summary of significant comments and the State's/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. §130.7(d)(2)).

Provision of inadequate public participation may be a basis for disapproving a TMDL. If EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

Comment:
This TMDL effort follows upon the TMDL project for the Lower Fox River Watershed, which was developed by WDNR and approved by EPA on May 18, 2012. The Lower Fox River TMDL addressed phosphorus and sediment loads in the Lower Fox River and noted that additional reductions in phosphorus loading would be needed from Upper Fox/Wolf River watershed and Lake Winnebago (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. WDNR, March 2012).

The public was extensively involved in the development process of this TMDL.

- September 2014 - introduction of the TMDL project, description of the proposed watershed and lake modeling approaches, and presentation of the data to be used for the project;
- June 2016 - presentation of initial watershed modeling and lake inputs, methods, and results;
- August 2017 - presentation of updated watershed modeling and lake results and allocation methods for TMDL development;
- July 2018 - presentation of updated watershed modeling and lake results.

WDNR held several technical advisory group meetings over the course of several years, to assist in the understanding of the approaches and processes in developing the TMDL. Finally, the TMDL was public noticed by WDNR from November 30, 2018 to January 18, 2019. A public meeting was held on December 12, 2018, at the Coughlin Building in Oshkosh, with extensive community participation. Copies of the draft TMDL were made available upon request and on the Internet web site: https://dnr.wi.gov/topic/tmdls/foxwolf/

Several entities and individuals provided comments to the WDNR during the public comment period. The comments were from various stakeholders, including several environmental/ watershed groups, wastewater dischargers, consultants for municipalities, municipalities,

individual citizens, and several trade groups representing permitted dischargers. A summary of the major issues and WDNR responses is below.

The comments were adequately addressed by WDNR and are included with the final TMDL submittal Response to Comments. WDNR also adequately addressed EPA comments throughout the course of TMDL development. The comments are addressed within the text as appropriate, within tables in appendices, and in responses to comments included in the final TMDL.

Development of Allocations and Reductions for Nonpoint Sources

The greatest number of comments requested that the allocations have a less restrictive TP limit for point sources, and that nonpoint sources should take more measures to reduce their loading. These commenters stated that point sources have an unfair burden to reduce, even as they do not contribute as much to the impairment as the nonpoint sources. WDNR stated that each discharger has distinct allocations and reductions, and that if associated cost savings occurs for one source (with less restrictive limits), that action might increase costs at another location. All entities should continue to use the TMDL allocations, as calculated, to meet regulatory standards. Further, the reasonable assurance for nonpoint sources would be less likely to be achieved if the point sources changed to put more restrictions on the nonpoint locations. The suggestions from the public regarding a phased approach for more flexibility in achieving reductions still requires meeting standards.

WDNR explained that the modeling and TMDL development process was designed to provide stakeholders with sufficient information to identify where the nonpoint source reductions would be most critical. The use of multiple models included SWAT, WiLMs, Jensen, BATHTUB and FWMC as described in the methods section above enables operators to make appropriate decisions to address the sources of contamination.

Questions arose from commenters related to Water Quality Based Effluent Limits (WQBELs) using WDNR's NR 217 (rather than technology-based limits which would be higher), utilizing TMDL-based limits for a few permit cycles. These commenters have a concern about whether the limits could be further reduced after several cycles if there are not significant reductions from nonpoint sources within that timespan. WDNR responded that because the TMDL was very comprehensive and developed with appropriate allocations to meet standards, including detailed modeling and calculations, it does not believe it is likely that the point sources would be given lower targets at a later date.

Lake Winnebago: Macrophyte Restoration

The establishment of macrophyte communities to reduce phosphorus in the lake aquatic vegetation in Lake Winnebago was modeled in 2018 separately from this TMDL. The interaction of macrophytes (aquatic plants), chlorophyll and mussels were studied to determine possible remediation of the eutrophication of the Lake. Stakeholders suggested the removal of phosphorus

or the reduction of sediment disturbance due to the stabilization of sediment would be very useful and could potentially be used for trading credits. WDNR has stated that the TMDL is not designed to make quantitative trading decisions and that trading would need to be addressed through the trading mechanisms and guidance. Though the project was designed to support WDNR with nutrient reduction and implementation planning to reduce harmful algal blooms, there are many variables and drivers discussed within the macrophyte document, such as the influence of benthic fish, water level changes, changes in fish species, etc., that make a direct quantitative amount or trading ratio not viable at this time.

WDNR examined mussel interactions in the lake ecosystem and found that the zebra mussels could have both negative and positive effects: there may be decreasing chlorophyll, increasing water clarity and thus macrophyte growth due to removal of phytoplankton, but also decreasing water quality by adding total phosphorus to the water column. Mussels may also attach to plants and inhibit their growth.

Paleoecology and Target Development

WDNR and the USGS reviewed the currently approved phosphorus criteria to determine if it was appropriate for Lake Winnebago and the Upper Pool Lakes. The study was completed in 2018 interpreting the paleoecology from sediment cores to determine the pre-settlement conditions of Lake Winnebago to assist in determining the Water Quality Criteria (WQC). Phosphorus and chlorophyll relationships were established using three different areas of the lake (north, middle and south) resulting in range of values from 32 – 59µg/l (the pre-settlement lake TP). BATHTUB modeling (Robertson et al., 2018) found 32µg/l TP summer average concentration was needed to attain WQS a pre-settlement TP value in Lake Winnebago.[8]

With the current WDNR criterion of 40µg/l for phosphorus determined to be appropriate and achievable, the external total phosphorus requires a 67% reduction to attain WQS in Lake Winnebago. This attains the 40% boundary condition TP load reduction determined in the Lower Fox River TMDL). The values do not require tributary phosphorus loads to be less than the natural background loads estimated to attain the chlorophyll-a target set at 20µg/l. WDNR also stated that Lake Winnebago could take 75 years to achieve these goals, but explained that these are implementation issues, and do not address the technical adequacy of the criterion. Stakeholders were concerned that the target value of chlorophyll-a at 20 µg/l would also affect the permit limits of the point sources and would be lowered further in the next few permit terms. WDNR responded that the TMDL assigns reductions proportional to their mass contribution and not disproportionately raise reductions for point sources. Any higher targets would not support the recreational designated use.

Another concern from stakeholders was that in one scenario the modeled phosphorus target was set to 20µg/l and set to zero for anthropogenic sources. WDNR explained that the values were for

[8] Robertson et al., Op. cit., p. 1.

modeling purposes only, to better understand the ecosystem response and develop a reference condition (pre-settlement, pre-anthropogenic loading) scenario. The scenario is not intended to be the target or that the anthropogenic sources would be eliminated.

MS4s

Several MS4s permittees were concerned that their contribution to the impairment is much smaller than other sources and therefore they should not be required to make any reductions; WDNR stated the MS4s do contribute the pollutants of concern but can achieve compliance over multiple permit terms. The stakeholders believe the EPA guidance for MS4s (#3800-2014-04) is contrary to Wisconsin statutes and that permittees cannot be required to achieve reductions as required by the MS4 TMDL wasteload allocations. The WDNR states the guidance is secondary to following the Clean Water Act, stating that all permits issued after an approved TMDL must be consistent with wasteload allocations contained in the TMDL. Implementation of the TMDL occurs through the permit with the guidance providing supplemental information. Before permit issuance, there is an opportunity for public comment.

CAFOs

Stakeholders suggested that CAFOs should receive a part of the point source allocation. WDNR explained that CAFO permits do not allow discharges except under extraordinary conditions. Even under these conditions, discharges must not cause or contribute to a water quality exceedance. Stakeholders communicated that they don't feel the CAFOs are properly accounted for in the calculations. WDNR stated that increasing WLA in the equation for CAFOs would then decrease the WLA available for other point sources.

Trading and Adaptive Management

Some stakeholders strongly recommended the use of water quality trading and adaptive management for point sources to reach water quality goals, enabling sources to have more flexibility in achieving goals. WDNR noted that the TMDL was developed with trading and adaptive management in mind (Appendix K of the TMDL). WDNR explained that many of the processes are within programs that are set forth in State statutes, rules and guidance, and any change in existing State Statutes and rules would need to go through legislative processes to be implemented. The requirement for any program is to be sure that the purchase of credits or other methods would not cause other WQC exceedance either locally or downstream. WDNR also clarified that adaptive management or phased approaches still must meet WQS but be executed in a phased manner after monitoring occurs to measure and quantify reductions.

Uncontrollable Sources

Regarding uncontrollable sources of phosphorus or contaminants, there are stakeholder suggestions that the wetlands and gullies in the watershed may be used for calculating credits in

the watershed and modified as contributors to the background load reduction, not only the current focus on streams. Suggestions include dredging sediments from wetlands and harvesting wetland plants, and gully correction. WDNR stated the costs and credits for these actions or controls have not been calculated and the benefits are not clear when considering migration, breeding, spawning and other habitat needs of the fish and wildlife. WDNR states that current, viable existing practices are gully and streambank stabilization.

The EPA carefully reviewed the comments submitted during the public notice period, as well as the responses from WDNR. The EPA agrees that WDNR appropriately addressed the comments and revised the TMDL document as appropriate. The EPA finds that the TMDL document submitted by the WDNR satisfies the requirements of this eleventh element.

12. Submittal Letter

A submittal letter should be included with the TMDL submittal, and should specify whether the TMDL is being submitted for a *technical review* or *final review and approval*. Each final TMDL submitted to EPA should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final review and approval, should contain such identifying information as the name and location of the waterbody, and the pollutant(s) of concern.

Comment:
The EPA received the final Upper Fox Wolf River TMDL on January 29, 2020, accompanied by a submittal letter dated January 21, 2020. In the submittal letter, WDNR stated that the submission includes the final TMDLs and supporting Appendices (with TP and TSS allocations).

EPA finds that the TMDL document submitted by WDNR satisfies all requirements concerning this twelfth element.

13. Conclusion

After a full and complete review, EPA finds that the phosphorus and TSS TMDLs for the 89 impaired subbasins (83 on State land, six on Tribal lands), including river reaches and creeks, and 22 lakes including the chain of lakes Poygan, Winneconne, Butte des Morts, and Winnebago, satisfy all the elements of an approvable TMDL document. This submittal approves 83 TMDLs for TP and 83 for TSS in the state of Wisconsin. These TMDLs address degraded habitat, low DO, eutrophication, and turbidity impairments.

EPA also agrees that the protection measures outlined in the TMDL document for the remaining segments in the Upper Fox/Wolf River Basin are sufficient to maintain the existing water quality in the waterbodies. EPA agrees these measures are appropriate for consideration as "protection strategies" as described in the "A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program".

EPA's approval of this TMDL does not extend to those waters that are within Indian Country, as defined in 18 U.S.C. Section 1151. EPA is taking no action to approve or disapprove TMDLs for those waters at this time. EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under the CWA Section 303(d) for those waters.

EPA sent letters to the Forest County Potawatomi, the Ho-Chunk Nation, the Menominee, the Sokaogon Chippewa Community, and the Stockbridge-Munsee Community in Wisconsin. In the letters, EPA offered the Tribal representatives the opportunity to consult with the EPA regarding these TMDLs. The Menominee Tribe informally consulted with EPA and is satisfied with the Wisconsin TMDLs and had no further comments on the TMDLs. The other Tribes had no response.

Table 1. Allocations of total phosphorus loads by source for each TMDL subbasin. Allocations for TMDL subbasins 55, 56, 58, 59, 80, and 81 (marked with an asterisk, *) do not include loads from point and nonpoint sources on tribal lands in each subbasin. Recommended loads for sources on tribal lands are reported separately in Table 2. Note that individual loads may not sum to reported totals due to rounding.

TMDL Subbasin ID & Name	Units	Total Load (LA+WLA+RC)	Load Allocation (LA)	Background	Agricultural Nonpoint	Non-Regulated Urban	Wasteload Allocation (WLA)	General Permit	Regulated MS4 Urban	Individual Permits	Reserve Capacity (RC)
1 Upper Neenah Creek	Lbs./yr.	1,639	1,568	1,085	458	25	44	21	0	23	27
	lbs./day	4.5	4.3	3.0	1.3	0.1	0.1	0.06	0.0	0.06	0.1
2 Tributary to Mason Lake	lbs./yr.	364	353	181	168	4	2	2	0	0	9
	lbs./day	1.0	1.0	0.5	0.46	0.01	0.01	0.01	0	0	0.02
3 Mason Lake	lbs./yr.	948	898	202	668	28	13	13	0	0	37
	lbs./day	2.6	2.5	0.6	1.8	0.1	0.04	0.04	0	0	0.1
4 Neenah Creek	lb./yr.	1,996	1,909	1,039	824	46	41	39	2	0	46
	lbs./day	5.5	5.2	2.8	2.3	0.1	0.1	0.1	0.01	0	0.1
5 Park Lake	lbs./yr.	3,316	3,149	522	2,550	77	29	29	0	0	138
	lbs./day	9.1	8.6	1.4	7.0	0.2	0.1	0.1	0	0	0.4
6 Swan Lake	lbs./yr.	334	306	172	109	25	21	21	0	0	7
	lbs./day	0.9	0.8	0.5	0.3	0.1	0.1	0.1	0	0	0.02
7 Buffalo Lake Inflow	lbs./yr.	3,252	3,113	1,901	1,149	63	74	53	21	0	65
	lbs./day	8.9	8.5	5.2	3.2	0.2	0.2	0.2	0.1	0	0.2
8 Westfield Creek	lbs./yr.	2,187	1,869	1,111	704	54	266	32	0	234	52
	lbs./day	6.0	5.1	3.0	1.9	0.2	0.7	0.1	0	0.6	0.1
9 Buffalo Lake	lbs./yr.	1,847	1,723	1,083	559	81	89	69	0	20	35
	lbs./day	5.1	4.7	3.0	1.5	0.2	0.2	0.2	0	0.1	0.1
10 Montello River	lbs./yr.	3,586	3,440	1,882	1,449	109	64	64	0	0	82
	lbs./day	9.8	9.4	5.2	4.0	0.3	0.2	0.2	0	0	0.2
11 Little Green Lake	lbs./yr.	134	119	6	89	24	9	9	0	0	6
	lbs./day	0.4	0.3	0.02	0.2	0.1	0.02	0.02	0	0	0.02
12 Upper Grand River	lbs./yr.	1,891	1,570	25	1,531	14	228	8	0	220	93
	lbs./day	5.2	4.3	0.1	4.2	0.04	0.6	0.02	0	0.6	0.3
13 Tributary to Grand River	lbs./yr.	817	760	51	700	9	19	5	0	14	38
	lbs./day	2.2	2.1	0.1	1.9	0.02	0.1	0.01	0	0.04	0.1
14 Middle Grand River	lbs./yr.	876	825	220	590	15	19	9	0	10	32
	lbs./day	2.4	2.3	0.6	1.6	0.04	0.1	0.02	0	0.03	0.1
15 Lower Grand River	lbs./yr.	2,556	2,456	1,092	1,316	48	28	28	0	0	72
	lbs./day	7.0	6.7	3.0	3.6	0.1	0.1	0.1	0	0	0.2
16 Lake Puckaway	lbs./yr.	1,646	1,390	682	617	91	210	53	0	157	46
	lbs./day	4.5	3.8	1.9	1.7	0.3	0.6	0.2	0	0.4	0.1
17 Roy Creek	lbs./yr.	327	311	13	297	1	0.4	0.4	0	0	16
	lbs./day	0.9	0.9	0.04	0.8	0.003	0.001	0.001	0	0	0.04
18 Wuerches Creek	lbs./yr.	768	729	10	714	5	1	1	0	0	38
	lbs./day	2.1	2.0	0.03	2.0	0.01	0.003	0.003	0	0	0.1
19 Silver Creek - Below South Koro Road	lbs./yr.	646	614	35	568	11	2	2	0	0	30
	lbs./day	1.8	1.7	0.1	1.6	0.03	0.01	0.01	0	0	0.1
20 Green Lake	lbs./yr.	2,106	1,988	133	1,652	203	20	20	0	0	98
	lbs./day	5.8	5.4	0.4	4.5	0.6	0.1	0.1	0	0	0.3
21 Mecan River	lbs./yr.	6,989	6,707	3,643	2,858	206	121	121	0	0	161
	lbs./day	19.1	18.4	10.0	7.8	0.6	0.3	0.3	0	0	0.4
22 Upper White River	lbs./yr.	2,543	1,895	1,204	603	88	584	52	0	532	64
	lbs./day	7.0	5.2	3.3	1.7	0.2	1.6	0.1	0	1.5	0.2
23 Lower White River	lbs./yr.	2,588	2,443	1,437	891	115	91	68	0	23	54
	lbs./day	7.1	6.7	3.9	2.4	0.3	0.3	0.2	0	0.1	0.2
24 Fox River - Downstream Lake Puckaway	lbs./yr.	2,491	2,194	1,143	970	81	232	47	0	185	65
	lbs./day	6.8	6.0	3.1	2.7	0.2	0.6	0.1	0	0.5	0.2
25 Puchyan River	lbs./yr.	724	428	165	248	15	269	9	0	260	27
	lbs./day	2.0	1.2	0.5	0.7	0.04	0.7	0.02	0	0.7	0.1
26 Harrington Creek	lbs./yr.	149	122	22	96	4	21	2	0	19	6
	lbs./day	0.4	0.3	0.1	0.3	0.01	0.1	0.01	0	0.1	0.02
27 Waukau Creek	lbs./yr.	1,846	1,753	262	1,465	26	15	15	0	0	78
	lbs./day	5.1	4.8	0.7	4.0	0.1	0.04	0.04	0	0	0.2
28 Fox River - White River to Omro	lbs./yr.	4,032	3,067	1,286	1,695	86	830	51	0	779	135
	lbs./day	11.0	8.4	3.5	4.6	0.2	2.3	0.1	0	2.1	0.4
29 Fox River - Omro to Lake Butte des Morts	lbs./yr.	619	232	36	183	13	358	8	0	350	29
	lbs./day	1.7	0.6	0.1	0.5	0.04	1.0	0.02	0	1.0	0.1
30 Sawyer Creek	lbs./yr.	310	267	0	260	7	28	4	24	0	15

TMDL Subbasin ID & Name	Units	Total Load (LA+WLA+RC)	Load Allocation (LA)	Background	Agricultural Nonpoint	Non-Regulated Urban	Wasteload Allocation (WLA)	General Permit	Regulated MS4 Urban	Individual Permits	Reserve Capacity (RC)
	lbs./day	0.9	0.7	0	0.7	0.02	0.1	0.01	0.1	0	0.04
31 Spring Brook	lbs./yr.	520	490	16	465	9	5	5	0	0	25
	lbs./day	1.4	1.3	0.04	1.3	0.02	0.01	0.01	0	0	0.1
32 Van Dyne Creek	lbs./yr.	213	201	19	178	4	2	2	0	0	10
	lbs./day	0.6	0.6	0.1	0.5	0.01	0.01	0.01	0	0	0.03
33 Anderson Creek	lbs./yr.	89	83	0	81	2	2	1	1	0	4
	lbs./day	0.2	0.2	0	0.2	0.01	0.01	0.003	0.003	0	0.01
34 Mosher Creek	lbs./yr.	48	39	0	38	1	7	1	6	0	2
	lbs./day	0.1	0.1	0	0.1	0.003	0.02	0.003	0.02	0	0.01
35 Tributary to West Branch Fond du Lac River	lbs./yr.	551	396	14	377	5	128	3	0	125	27
	lbs./day	1.5	1.1	0.04	1.0	0.01	0.4	0.01	0	0.3	0.1
36 Sevenmile Creek	lbs./yr.	1,152	1,095	62	1,027	6	3	3	0	0	54
	lbs./day	3.2	3.0	0.2	2.8	0.02	0.01	0.01	0	0	0.2
37 Campground Creek	lbs./yr.	742	565	24	537	4	141	3	0	138	36
	lbs./day	2.0	1.6	0.1	1.5	0.01	0.4	0.01	0	0.4	0.1
38 De Neveu Creek	lbs./yr.	11	10	0	10	0.2	0.1	0.1	0	0	1
	lbs./day	0.03	0.03	0	0.03	0.001	0.0003	0.0003	0	0	0.003
39 Tributary to De Neveu Creek	lbs./yr.	255	144	25	116	3	100	2	2	96	11
	lbs./day	0.7	0.4	0.1	0.3	0.01	0.3	0.01	0.01	0.3	0.03
40 Tributary to Parsons Creek	lbs./yr.	106	100	3	95	2	1	1	0	0	5
	lbs./day	0.3	0.3	0.01	0.3	0.01	0.003	0.003	0	0	0.01
41 Upper Parsons Creek	lbs./yr.	211	200	9	190	1	1	1	0	0	10
	lbs./day	0.6	0.6	0.02	0.5	0.003	0.003	0.003	0	0	0.03
42 Parsons Creek	lbs./yr.	152	144	8	135	1	1	1	0	0	7
	lbs./day	0.4	0.4	0.02	0.4	0.003	0.003	0.003	0	0	0.02
43 East Branch Fond du Lac River	lbs./yr.	2,037	1,898	72	1,812	14	41	8	33	0	98
	lbs./day	5.6	5.2	0.2	5.0	0.04	0.1	0.02	0.1	0	0.3
44 West Branch Fond du Lac River	lbs./yr.	5,241	4,964	396	4,535	33	36	19	17	0	241
	lbs./day	14.4	13.6	1.1	12.4	0.1	0.1	0.1	0.1	0	0.7
45 Carpenter Creek	lbs./yr.	343	331	199	123	9	5	5	0	0	7
	lbs./day	0.9	0.9	0.5	0.3	0.02	0.01	0.01	0	0	0.02
46 Mud Creek	lbs./yr.	306	231	17	211	3	61	2	0	59	14
	lbs./day	0.8	0.6	0.1	0.6	0.01	0.2	0.01	0	0.2	0.04
47 Pine River	lbs./yr.	4,123	3,444	2,610	706	128	607	77	0	530	72
	lbs./day	11.3	9.4	7.2	1.9	0.4	1.7	0.2	0	1.5	0.2
48 Willow Creek	lbs./yr.	4,224	3,881	2,091	1,674	116	240	68	0	172	103
	lbs./day	11.6	10.6	5.7	4.6	0.3	0.7	0.2	0	0.5	0.3
49 Tributary to Rat River	lbs./yr.	669	607	153	446	8	36	5	0	31	26
	lbs./day	1.8	1.7	0.4	1.2	0.02	0.1	0.01	0	0.1	0.1
50 Rat River	lbs./yr.	2,212	2,103	672	1,382	49	33	29	4	0	76
	lbs./day	6.1	5.8	1.8	3.8	0.1	0.1	0.1	0.01	0	0.2
51 Arrowhead River	lbs./yr.	893	818	35	769	14	33	8	0	25	42
	lbs./day	2.4	2.2	0.1	2.1	0.04	0.1	0.02	0	0.1	0.1
52 Bear Creek (Wolf)	lbs./yr.	3,000	2,825	286	2,518	21	40	12	16	12	135
	lbs./day	8.2	7.7	0.8	6.9	0.1	0.1	0.03	0.04	0.03	0.4
53 Shioc River	lbs./yr.	3,695	3,520	1,189	2,271	60	51	35	0	16	124
	lbs./day	10.1	9.6	3.3	6.2	0.2	0.1	0.1	0	0.04	0.3
54 White Clay Lake	lbs./yr.	319	303	20	274	9	1	1	0	0	15
	lbs./day	0.9	0.8	0.1	0.8	0.02	0.003	0.003	0	0	0.04
55* Upper Wolf River	lbs./yr.	19,607	17,894	13,052	3,706	1,136	1,350	669	0	681	363
	lbs./day	53.7	49.0	35.7	10.2	3.1	3.7	1.8	0	1.9	1.0
56* Shawano Lake	lbs./yr.	4,854	4,589	714	3,433	442	55	55	0	0	210
	lbs./day	13.3	12.6	2.0	9.4	1.2	0.2	0.2	0	0	0.6
57 Long Lake	lbs./yr.	813	694	96	573	25	83	4	0	79	36
	lbs./day	2.2	1.9	0.3	1.6	0.1	0.2	0.01	0	0.2	0.1
58* Upper Embarrass River	lbs./yr.	10,048	9,390	5,143	4,036	211	418	123	0	295	240
	lbs./day	27.5	25.7	14.1	11.1	0.6	1.1	0.3	0	0.8	0.7
59* Middle Embarrass River	lbs./yr.	6,584	6,222	3,061	3,018	143	190	84	0	106	172
	lbs./day	18.0	17.0	8.4	8.3	0.4	0.5	0.2	0	0.3	0.5
60 Pigeon River	lbs./yr.	4,183	3,458	1,466	1,900	92	592	54	0	538	133
	lbs./day	11.5	9.5	4.0	5.2	0.3	1.6	0.2	0	1.5	0.4
61 Lower Little Wolf River	lbs./yr.	1,343	1,284	289	982	13	7	7	0	0	52

TMDL Subbasin ID & Name	Units	Total Load (LA+WLA+RC)	Load Allocation (LA)	Background	Agricultural Nonpoint	Non-Regulated Urban	Wasteload Allocation (WLA)	General Permit	Regulated MS4 Urban	Individual Permits	Reserve Capacity (RC)
	lbs./day	3.7	3.5	0.8	2.7	0.04	0.02	0.02	0	0	0.1
62 School Section Lake	lbs./yr.	297	282	14	261	7	1	1	0	0	14
	lbs./day	0.8	0.8	0.04	0.7	0.02	0.003	0.003	0	0	0.04
63 Tree Lake	lbs./yr.	160	154	99	50	5	3	3	0	0	3
	lbs./day	0.4	0.4	0.3	0.1	0.01	0.01	0.01	0	0	0.01
64 Bear Creek (Embarrass)	lbs./yr.	635	553	122	422	9	57	5	0	52	25
	lbs./day	1.7	1.5	0.3	1.2	0.02	0.2	0.01	0	0.1	0.1
65 Collins Lake	lbs./yr.	358	341	36	298	7	1	1	0	0	16
	lbs./day	1.0	0.9	0.1	0.8	0.02	0.003	0.003	0	0	0.04
66 Waupaca River	lbs./yr.	10,479	8,565	3,778	4,540	247	1,586	145	0	1,441	328
	lbs./day	28.7	23.5	10.3	12.4	0.7	4.3	0.4	0	4.0	0.9
67 Wolf River – Shawano to Shioc River	lbs./yr.	8,222	5,432	2,144	3,141	147	2,490	86	0	2,404	300
	lbs./day	22.5	14.9	5.9	8.6	0.4	6.8	0.2	0	6.6	0.8
68 Wolf River - Shioc River to Bear Creek	lbs./yr.	2,157	1,973	350	1,597	26	94	16	0	78	90
	lbs./day	5.9	5.4	1.0	4.4	0.1	0.3	0.04	0	0.2	0.3
69 Wolf River - Bear Creek to Embarrass River	lbs./yr.	1,250	921	215	676	30	278	18	0	260	51
	lbs./day	3.4	2.5	0.6	1.9	0.1	0.8	0.1	0	0.7	0.1
70 Lower Embarrass River	lbs./yr.	3,865	3,685	860	2,780	45	31	26	0	5	149
	lbs./day	10.6	10.1	2.4	7.6	0.1	0.1	0.1	0	0.01	0.4
71 Wolf River - Embarrass River to Lake Poygan	lbs./yr.	7,859	5,958	2,856	2,926	176	1,656	103	0	1,553	245
	lbs./day	21.5	16.3	7.8	8.0	0.5	4.5	0.3	0	4.3	0.7
72 Lake Poygan and Lake Winneconne	lbs./yr.	8,386	8,183	6,535	1,571	77	113	45	0	68	90
	lbs./day	23.0	22.4	17.9	4.3	0.2	0.3	0.1	0	0.2	0.3
73 Lake Butte des Morts	lbs./yr.	4,036	3,485	2,855	597	33	493	19	30	444	58
	lbs./day	11.1	9.5	7.8	1.6	0.1	1.4	0.1	0.1	1.2	0.2
74 Fox River - Lake Butte de Morts to Lake Winnebago	lbs./yr.	10,955	3	0	3	0.3	10,403	0.2	19	10,384	548
	lbs./day	30.0	0.01	0	0.01	0.001	28.5	0.001	0.1	28.4	1.5
75 Lake Winnebago	lbs./yr.	46,237	39,865	38,074	1,673	118	5,967	69	123	5,775	405
	lbs./day	126.6	109.1	104.2	4.6	0.3	16.3	0.2	0.3	15.8	1.1
76 Crane Lake	lbs./yr.	167	157	142	0	15	9	9	0	0	1
	lbs./day	0.5	0.4	0.4	0	0.04	0.02	0.02	0	0	0.003
77 Upper Post Lake	lbs./yr.	4,363	4,073	1,777	1,176	1,120	169	169	0	0	121
	lbs./day	12.0	11.2	4.9	3.2	3.1	0.5	0.5	0	0	0.3
78 Pine Lake	lbs./yr.	1,123	1,049	450	321	278	42	42	0	0	32
	lbs./day	3.1	2.9	1.2	0.9	0.8	0.1	0.1	0	0	0.1
79 Hill Creek	lbs./yr.	115	109	3	105	1	0.3	0.3	0	0	6
	lbs./day	0.3	0.3	0.01	0.3	0.003	0.001	0.001	0	0	0.02
80* Wolf River - Upper Post Lake to Hunting River	lbs./yr.	6,121	5,719	4,697	452	570	335	335	0	0	67
	lbs./day	16.8	15.7	12.9	1.2	1.6	0.9	0.9	0	0	0.2
81* Upper Little Wolf River	lbs./yr.	17,068	16,260	8,865	7,039	356	408	209	0	199	400
	lbs./day	46.7	44.5	24.3	19.3	1.0	1.1	0.6	0	0.5	1.1
82 Black Otter Lake	lbs./yr.	1,749	1,660	81	1,560	19	6	6	0	0	83
	lbs./day	4.8	4.5	0.2	4.3	0.1	0.02	0.02	0	0	0.2
83 Big Twin Lake	lbs./yr.	327	310	9	294	7	1	1	0	0	16
	lbs./day	0.9	0.9	0.02	0.8	0.02	0.003	0.003	0	0	0.04
84 Lake Emily	lbs./yr.	208	195	7	176	12	3	3	0	0	10
	lbs./day	0.6	0.5	0.02	0.5	0.03	0.01	0.01	0	0	0.03
85 Old Taylor Lake	lbs./yr.	8	7	5	1	1	1	1	0	0	0.1
	lbs./day	0.02	0.02	0.01	0.003	0.003	0.003	0.003	0	0	0.0003
86 Spring Lake	lbs./yr.	621	592	93	484	15	3	3	0	0	26
	lbs./day	1.7	1.6	0.3	1.3	0.04	0.01	0.01	0	0	0.1
87 Silver Creek - Above South Koro Road	lbs./yr.	2,329	903	41	836	26	1,312	11	0	1,301	114
	lbs./day	6.4	2.5	0.1	2.3	0.1	3.6	0.03	0	3.6	0.3
88 Fond du Lac River	lbs./yr.	13	5	0	5	0	7	0	7	0	1
	lbs./day	0.04	0.01	0	0.01	0	0.02	0	0.02	0	0.003
89 Black Creek	lbs./yr.	1,594	1,031	181	817	33	493	19	0	474	70
	lbs./day	4.4	2.8	0.5	2.2	0.1	1.4	0.1	0	1.3	0.2

Table 2. Recommended total phosphorus loads for sources on tribal lands in TMDL subbasins 55, 56, 58, 59, 80, and 81. Note that individual loads may not sum to reported totals due to rounding.

TMDL	Subbasin ID & Name	Tribal Area	Units	Total Load (NPS+PS)	Total Nonpoint Source (NPS)	Background	Agricultural Nonpoint	Non-Regulated Urban	Total Point Source (PS)	General Permit	Regulated MS4 Urban	Individual Permits
55	Upper Wolf River	Menominee Reservation	lbs./yr.	10,655	10,074	9,058	336	680	581	401	0	180
			lbs./day	29.2	27.6	24.8	0.9	1.9	1.6	1.1	0	0.5
		Menominee Off-Reservation Trust Land	lbs./yr.	125	85	34	43	8	40	4	0	36
			lbs./day	0.3	0.2	0.1	0.1	0.02	0.1	0.01	0	0.1
		Stockbridge Munsee Community	lbs./yr.	819	768	712	28	28	51	17	0	34
			lbs./day	2.2	2.1	2.0	0.1	0.1	0.1	0.05	0	0.1
56	Shawano Lake	Menominee Reservation	lbs./yr.	448	440	333	46	61	8	8	0	0
			lbs./day	1.2	1.2	0.9	0.1	0.2	0.02	0.02	0	0
58	Upper Embarrass River	Ho-Chunk Nation Off-Reservation Trust Land	lbs./yr.	44	43	19	23	1	1	1	0	0
			lbs./day	0.1	0.1	0.1	0.1	0.003	0.003	0.003	0	0
59	Middle Embarrass River	Stockbridge Munsee Community	lbs./yr.	100	99	96	1	2	1	1	0	0
			lbs./day	0.3	0.3	0.3	0.003	0.01	0.003	0.003	0	0
80	Wolf River - Upper Post Lake to Hunting River	Forest County Potawatomi Community	lbs./yr.	111	103	84	5	14	8	8	0	0
			lbs./day	0.3	0.3	0.2	0.01	0.04	0.02	0.02	0	0
		Forest County Potawatomi Off-Reservation Trust Land	lbs./yr.	187	1	1	0	0	186	0	0	186
			lbs./day	0.5	0.003	0.003	0	0	0.5	0	0	0.5
		Sokaogon Chippewa Community	lbs./yr.	122	115	85	18	12	7	7	0	0
			lbs./day	0.3	0.3	0.2	0.1	0.03	0.02	0.02	0	0
		Sokaogon Chippewa Off-Reservation Trust Land	lbs./yr.	70	69	60	7	2	1	1	0	0
			lbs./day	0.2	0.2	0.2	0.02	0.01	0.003	0.003	0	0
81	Upper Little Wolf River	Ho-Chunk Nation Off-Reservation Trust Land	lbs./yr.	8	8	7	1	0	0	0	0	0
			lbs./day	0.02	0.02	0.02	0.003	0	0	0	0	0

Table 1. Allocations of sediment loads (as total suspended solids, TSS) by source for each TMDL subbasin. Allocations for TMDL subbasins 55, 56, 58, 59, 80, and 81 (marked with an asterisk, *) do not include loads from point and nonpoint sources on tribal lands in each subbasin. Recommended loads for source on tribal lands are reported separately in Table 2. Note that individual loads may not sum to reported totals due to rounding.

TMDL Subbasin ID & Name		Units	Total Load (LA+WLA+RC)	Load Allocation (LA)	Background	Agricultural Nonpoint	Non-Regulated Urban	Wasteload Allocation (WLA)	General Permit	Regulated MS4 Urban	Individual Permits	Reserve Capacity (RC)
1	Upper Neenah Creek	lbs/yr	654,741	618,843	30,920	579,010	8,913	4,791	1,672	0	3,119	31,107
		lbs/day	1,793	1,694	85	1,585	24	13	5	0	9	85
2	Tributary to Mason Lake	lbs/yr	187,334	178,224	9,113	167,999	1,112	209	209	0	0	8,901
		lbs/day	513	488	25	460	3	1	1	0	0	24
3	Mason Lake	lbs/yr	442,064	420,270	24,853	393,361	2,056	983	983	0	0	20,811
		lbs/day	1,210	1,151	68	1,077	6	3	3	0	0	57
4	Neenah Creek	lbs/yr	987,048	935,677	35,926	888,400	11,351	3,921	2,129	1,792	0	47,450
		lbs/day	2,702	2,562	98	2,432	31	11	6	5	0	130
5	Park Lake	lbs/yr	1,235,077	1,174,673	55,176	1,114,087	5,410	1,483	1,483	0	0	58,921
		lbs/day	3,381	3,216	151	3,050	15	4	4	0	0	161
6	Swan Lake	lbs/yr	117,273	111,508	12,330	96,274	2,904	545	545	0	0	5,220
		lbs/day	321	305	34	264	8	1	1	0	0	14
7	Buffalo Lake Inflow	lbs/yr	625,217	592,809	90,007	495,176	7,626	5,719	1,430	4,289	0	26,689
		lbs/day	1,712	1,623	246	1,356	21	16	4	12	0	73
8	Westfield Creek	lbs/yr	611,302	554,909	95,857	441,020	18,032	30,790	3,384	0	27,406	25,603
		lbs/day	1,674	1,519	262	1,207	49	84	9	0	75	70
9	Buffalo Lake	lbs/yr	1,973,037	1,871,234	56,110	1,792,976	22,148	6,164	4,153	0	2,011	95,639
		lbs/day	5,402	5,123	154	4,909	61	17	11	0	6	262
10	Montello River	lbs/yr	922,358	875,953	84,502	766,120	25,331	4,750	4,750	0	0	41,655
		lbs/day	2,525	2,398	231	2,098	69	13	13	0	0	114
11	Little Green Lake	lbs/yr	56,850	54,006	2,678	50,666	662	143	143	0	0	2,701
		lbs/day	156	148	7	139	2	0.4	0.4	0	0	7
12	Upper Grand River	lbs/yr	557,473	513,376	1,727	509,925	1,724	16,370	1,210	0	15,160	27,727
		lbs/day	1,526	1,406	5	1,396	5	45	3	0	42	76
13	Tributary to Grand River	lbs/yr	365,911	346,471	6,966	338,594	911	1,513	399	0	1,114	17,927
		lbs/day	1,002	949	19	927	2	4	1	0	3	49
14	Middle Grand River	lbs/yr	252,442	237,451	1,312	233,417	2,722	2,460	511	0	1,949	12,531
		lbs/day	691	650	4	639	7	7	1	0	5	34
15	Lower Grand River	lbs/yr	791,280	753,539	61,955	684,427	7,157	1,342	1,342	0	0	36,399
		lbs/day	2,166	2,063	170	1,874	20	4	4	0	0	100
16	Lake Puckaway	lbs/yr	309,139	277,499	10,160	255,715	11,624	16,800	2,180	0	14,620	14,840
		lbs/day	846	760	28	700	32	46	6	0	40	41
17	Roy Creek	lbs/yr	55,745	53,276	7,431	45,771	74	56	56	0	0	2,413
		lbs/day	153	146	20	125	0.2	0.2	0.2	0	0	7
18	Wuerches Creek	lbs/yr	130,682	124,426	8,135	116,048	243	135	135	0	0	6,121
		lbs/day	358	341	22	318	1	0.4	0.4	0	0	17
19	Silver Creek - Below South Koro Road	lbs/yr	119,007	113,002	4,606	107,548	848	300	300	0	0	5,705
		lbs/day	326	309	13	294	2	1	1	0	0	16
20	Green Lake	lbs/yr	215,991	205,020	9,726	191,218	4,076	692	692	0	0	10,279
		lbs/day	591	561	27	524	11	2	2	0	0	28
21	Mecan River	lbs/yr	634,668	600,860	26,259	555,585	19,016	3,566	3,566	0	0	30,242
		lbs/day	1,738	1,645	72	1,521	52	10	10	0	0	83
22	Upper White River	lbs/yr	259,165	190,926	37,642	140,984	12,300	57,267	2,088	0	55,179	10,972
		lbs/day	710	523	103	386	34	157	6	0	151	30
23	Lower White River	lbs/yr	64,714	58,392	2,247	51,335	4,810	3,239	817	0	2,422	3,083
		lbs/day	177	160	6	141	13	9	2	0	7	8
24	Fox River - Downstream Lake Puckaway	lbs/yr	280,729	243,122	1,972	231,936	9,214	23,756	1,728	0	22,028	13,851
		lbs/day	769	666	5	635	25	65	5	0	60	38
25	Puchyan River	lbs/yr	147,559	112,745	3,647	104,745	4,353	27,655	739	0	26,916	7,159
		lbs/day	404	309	10	287	12	76	2	0	74	20
26	Harrington Creek	lbs/yr	57,088	46,051	578	43,336	2,137	8,230	364	0	7,866	2,807
		lbs/day	156	126	2	119	6	23	1	0	22	8
27	Waukau Creek	lbs/yr	1,263,433	1,199,050	9,373	1,182,231	7,446	1,768	1,768	0	0	62,615
		lbs/day	3,459	3,283	26	3,237	20	5	5	0	0	171
28	Fox River - White River to Omro	lbs/yr	1,148,411	1,009,069	31,761	960,189	17,119	83,655	2,906	0	80,749	55,687
		lbs/day	3,144	2,763	87	2,629	47	229	8	0	221	152
29	Fox River - Omro to Lake Butte de Morts	lbs/yr	153,427	101,657	684	95,697	5,276	44,170	748	0	43,422	7,600
		lbs/day	420	278	2	262	14	121	2	0	119	21
30	Sawyer Creek	lbs/yr	322,290	301,152	0	299,346	1,806	5,041	349	4,692	0	16,097

TMDL Subbasin ID & Name	Units	Total Load (LA+WLA+RC)	Load Allocation (LA)	Background	Agricultural Nonpoint	Non-Regulated Urban	Wasteload Allocation (WLA)	General Permit	Regulated MS4 Urban	Individual Permits	Reserve Capacity (RC)
	lbs/day	882	825	0	820	5	14	1	13	0	44
31 Spring Brook	lbs/yr	427,411	405,655	494	403,229	1,932	432	432	0	0	21,324
	lbs/day	1,170	1,111	1	1,104	5	1	1	0	0	58
32 Van Dyne Creek	lbs/yr	182,250	172,904	476	171,113	1,315	271	271	0	0	9,075
	lbs/day	499	473	1	468	4	1	1	0	0	25
33 Anderson Creek	lbs/yr	92,398	86,732	0	85,325	1,407	1,059	250	809	0	4,607
	lbs/day	253	237	0	234	4	3	1	2	0	13
34 Mosher Creek	lbs/yr	62,682	54,972	0	52,939	2,033	4,588	241	4,347	0	3,122
	lbs/day	172	151	0	145	6	13	1	12	0	9
35 Tributary to West Branch Fond du Lac River	lbs/yr	111,135	94,401	1,209	91,903	1,289	11,266	567	0	10,699	5,468
	lbs/day	304	258	3	252	4	31	2	0	29	15
36 Sevenmile Creek	lbs/yr	202,318	192,137	9,232	182,051	854	554	554	0	0	9,627
	lbs/day	554	526	25	498	2	2	2	0	0	26
37 Campground Creek	lbs/yr	126,296	108,218	1,444	105,504	1,270	11,872	722	0	11,150	6,206
	lbs/day	346	296	4	289	3	33	2	0	31	17
38 De Neveu Creek	lbs/yr	11,881	11,243	0	10,897	346	46	46	0	0	592
	lbs/day	33	31	0	30	1	0.1	0.1	0	0	2
39 Tributary to De Neveu Creek	lbs/yr	131,693	116,274	6,748	107,174	2,352	9,206	682	1,798	6,726	6,213
	lbs/day	361	318	18	293	6	25	2	5	18	17
40 Tributary to Parsons Creek	lbs/yr	40,454	38,041	163	35,669	2,209	419	419	0	0	1,994
	lbs/day	111	104	0.5	98	6	1	1	0	0	5
41 Upper Parsons Creek	lbs/yr	46,076	43,645	578	42,646	421	164	164	0	0	2,267
	lbs/day	126	119	2	117	1	0.4	0.4	0	0	6
42 Parsons Creek	lbs/yr	70,604	66,817	377	64,041	2,399	290	290	0	0	3,497
	lbs/day	193	183	1	175	7	1	1	0	0	10
43 East Branch Fond du Lac River	lbs/yr	755,772	704,578	6,753	690,094	7,731	13,811	1,363	12,448	0	37,383
	lbs/day	2,069	1,929	18	1,889	21	38	4	34	0	102
44 West Branch Fond du Lac River	lbs/yr	1,565,051	1,480,895	8,488	1,464,621	7,786	6,459	2,628	3,831	0	77,697
	lbs/day	4,285	4,054	23	4,010	21	18	7	10	0	213
45 Carpenter Creek	lbs/yr	18,723	17,967	8,441	6,972	2,554	255	255	0	0	501
	lbs/day	51	49	23	19	7	1	1	0	0	1
46 Mud Creek	lbs/yr	132,344	121,408	3,524	117,351	533	4,512	345	0	4,167	6,424
	lbs/day	362	332	10	321	1	12	1	0	11	18
47 Pine River	lbs/yr	363,194	172,931	42,485	111,495	18,951	174,322	1,895	0	172,427	15,941
	lbs/day	994	473	116	305	52	477	5	0	472	44
48 Willow Creek	lbs/yr	1,326,142	1,228,064	44,023	1,149,041	35,000	34,147	3,500	0	30,647	63,931
	lbs/day	3,631	3,362	121	3,146	96	93	10	0	84	175
49 Tributary to Rat River	lbs/yr	252,462	235,794	1,056	232,014	2,724	4,144	930	0	3,214	12,524
	lbs/day	691	646	3	635	7	11	3	0	9	34
50 Rat River	lbs/yr	940,363	891,136	2,252	875,354	13,530	2,389	1,353	1,036	0	46,838
	lbs/day	2,575	2,440	6	2,397	37	7	4	3	0	128
51 Arrowhead River	lbs/yr	652,182	616,076	1,331	612,548	2,197	3,596	656	0	2,940	32,510
	lbs/day	1,786	1,687	4	1,677	6	10	2	0	8	89
52 Bear Creek (Wolf)	lbs/yr	1,382,282	1,307,949	1,692	1,301,717	4,540	5,416	2,247	2,292	877	68,917
	lbs/day	3,784	3,581	5	3,564	12	15	6	6	2	189
53 Shioc River	lbs/yr	1,920,864	1,818,712	12,939	1,770,380	35,393	7,029	5,465	0	1,564	95,123
	lbs/day	5,259	4,979	35	4,847	97	19	15	0	4	260
54 White Clay Lake	lbs/yr	47,336	44,829	683	42,956	1,190	184	184	0	0	2,323
	lbs/day	130	123	2	118	3	1	1	0	0	6
55* Upper Wolf River	lbs/yr	1,561,376	1,352,251	519,802	730,959	101,490	150,200	15,708	0	134,492	58,925
	lbs/day	4,275	3,702	1,423	2,001	278	411	43	0	368	161
56* Shawano Lake	lbs/yr	544,708	515,883	707	505,996	9,180	1,417	1,417	0	0	27,408
	lbs/day	1,491	1,412	2	1,385	25	4	4	0	0	75
57 Long Lake	lbs/yr	97,681	90,951	123	88,418	2,410	1,871	372	0	1,499	4,859
	lbs/day	267	249	0.3	242	7	5	1	0	4	13
58* Upper Embarrass River	lbs/yr	3,129,704	2,938,223	167,620	2,701,226	69,377	43,208	10,712	0	32,496	148,273
	lbs/day	8,569	8,044	459	7,396	190	118	29	0	89	406
59* Middle Embarrass River	lbs/yr	3,222,717	3,048,204	97,466	2,909,036	41,702	18,490	6,439	0	12,051	156,023
	lbs/day	8,823	8,346	267	7,965	114	51	18	0	33	427
60 Pigeon River	lbs/yr	1,841,073	1,698,039	41,309	1,628,913	27,817	53,285	4,784	0	48,501	89,749
	lbs/day	5,041	4,649	113	4,460	76	146	13	0	133	246
61 Lower Little Wolf River	lbs/yr	488,778	464,167	50,150	410,820	3,197	2,821	2,821	0	0	21,790

TMDL Subbasin ID & Name	Units	Total Load (LA+WLA+RC)	Load Allocation (LA)	Background	Agricultural Nonpoint	Non-Regulated Urban	Wasteload Allocation (WLA)	General Permit	Regulated MS4 Urban	Individual Permits	Reserve Capacity (RC)
	lbs/day	1,338	1,271	137	1,125	9	8	8	0	0	60
62 School Section Lake	lbs/yr	40,291	38,213	447	37,330	436	90	90	0	0	1,988
	lbs/day	110	105	1	102	1	0.2	0.2	0	0	5
63 Tree Lake	lbs/yr	10,876	10,340	1,570	8,292	478	74	74	0	0	462
	lbs/day	30	28	4	23	1	0.2	0.2	0	0	1
64 Bear Creek (Embarrass)	lbs/yr	322,604	301,828	709	296,109	5,010	4,720	774	0	3,946	16,056
	lbs/day	883	826	2	811	14	13	2	0	11	44
65 Collins Lake	lbs/yr	19,467	18,487	735	17,456	296	46	46	0	0	934
	lbs/day	53	51	2	48	1	0.1	0.1	0	0	3
66 Waupaca River	lbs/yr	5,172,228	4,750,478	261,137	4,375,968	113,373	177,071	17,507	0	159,564	244,679
	lbs/day	14,161	13,006	715	11,981	310	485	48	0	437	670
67 Wolf River – Shawano to Shioc River	lbs/yr	5,654,072	4,960,253	10,305	4,835,377	114,571	412,432	17,691	0	394,741	281,387
	lbs/day	15,480	13,580	28	13,239	314	1,129	48	0	1,081	770
68 Wolf River - Shioc River to Bear Creek	lbs/yr	1,097,084	1,031,104	1,903	1,013,631	15,570	11,341	2,404	0	8,937	54,639
	lbs/day	3,004	2,823	5	2,775	43	31	7	0	24	150
69 Wolf River - Bear Creek to Embarrass River	lbs/yr	1,353,700	1,253,328	9,913	1,218,950	24,465	33,372	3,778	0	29,594	67,000
	lbs/day	3,706	3,431	27	3,337	67	91	10	0	81	183
70 Lower Embarrass River	lbs/yr	1,729,388	1,639,591	17,834	1,610,269	11,488	4,438	4,374	0	64	85,359
	lbs/day	4,735	4,489	49	4,409	31	12	12	0	0.2	234
71 Wolf River - Embarrass River to Lake Poygan	lbs/yr	2,706,062	2,403,592	47,493	2,300,926	55,173	169,968	8,519	0	161,449	132,502
	lbs/day	7,409	6,581	130	6,300	151	465	23	0	442	363
72 Lake Poygan and Lake Winneconne	lbs/yr	792,993	736,001	5,935	721,028	9,038	17,684	904	0	16,780	39,308
	lbs/day	2,171	2,015	16	1,974	25	48	2	0	46	108
73 Lake Butte de Morts	lbs/yr	783,973	650,933	4,082	637,188	9,663	94,094	966	7,859	85,269	38,946
	lbs/day	2,146	1,782	11	1,745	26	258	3	22	233	107
74 Fox River - Lake Butte de Morts to Lake Winnebago	lbs/yr	1,947,412	6,613	0	5,173	1,440	1,843,436	144	15,448	1,827,844	97,363
	lbs/day	5,332	18	0	14	4	5,047	0.4	42	5,004	267
75 Lake Winnebago	lbs/yr	2,385,063	1,223,947	8,471	1,196,893	18,583	1,042,379	1,858	24,872	1,015,649	118,737
	lbs/day	6,530	3,351	23	3,277	51	2,854	5	68	2,781	325
76 Crane Lake	lbs/yr	5,787	5,471	3,945	0	1,526	236	236	0	0	80
	lbs/day	16	15	11	0	4	1	1	0	0	0.2
77 Upper Post Lake	lbs/yr	336,947	327,522	280,008	2,673	44,841	6,924	6,924	0	0	2,501
	lbs/day	923	897	767	7	123	19	19	0	0	7
78 Pine Lake	lbs/yr	19,559	18,680	14,277	212	4,191	647	647	0	0	232
	lbs/day	54	51	39	1	11	2	2	0	0	1
79 Hill Creek	lbs/yr	40,443	38,397	716	37,545	136	63	63	0	0	1,983
	lbs/day	111	105	2	103	0.4	0.2	0.2	0	0	5
80* Wolf River - Upper Post Lake to Hunting River	lbs/yr	663,103	641,890	540,167	1,982	99,741	15,402	15,402	0	0	5,811
	lbs/day	1,815	1,757	1,479	5	273	42	42	0	0	16
81* Upper Little Wolf River	lbs/yr	8,810,897	8,354,905	358,325	7,914,232	82,348	34,107	15,445	0	18,662	421,885
	lbs/day	24,123	22,874	981	21,668	225	93	42	0	51	1,155
82 Black Otter Lake	lbs/yr	344,290	325,556	1,101	321,327	3,128	1,657	1,657	0	0	17,077
	lbs/day	943	891	3	880	9	5	5	0	0	47
83 Big Twin Lake	lbs/yr	34,697	33,018	2,391	30,484	143	67	67	0	0	1,612
	lbs/day	95	90	7	83	0.4	0.2	0.2	0	0	4
84 Lake Emily	lbs/yr	35,291	33,511	892	32,463	156	63	63	0	0	1,717
	lbs/day	97	92	2	89	0.4	0.2	0.2	0	0	5
85 Old Taylor Lake	lbs/yr	648	612	96	457	59	9	9	0	0	27
	lbs/day	1.8	1.7	0.3	1	0.2	0.03	0.03	0	0	0.1
86 Spring Lake	lbs/yr	202,253	192,172	10,233	178,714	3,225	505	505	0	0	9,576
	lbs/day	554	526	28	489	9	1	1	0	0	26
87 Silver Creek - Above South Koro Road	lbs/yr	428,261	350,820	3,131	342,822	4,867	56,256	1,421	0	54,835	21,185
	lbs/day	1,173	960	9	939	13	154	4	0	150	58
88 Fond du Lac River	lbs/yr	18,593	5,123	0	4,826	297	12,542	30	12,512	0	928
	lbs/day	51	14	0	13	1	34	0.1	34	0	3
89 Black Creek	lbs/yr	606,732	537,644	1,566	516,961	19,117	38,977	2,952	0	36,025	30,111
	lbs/day	1,661	1,472	4	1,415	52	107	8	0	99	82

Table 2. Recommended sediment loads (as total suspended solids, TSS) for sources on tribal lands in TMDL subbasins 55, 56, 58, 59, 80, and 81. Note that individual loads may not sum to reported totals due to rounding.

TMDL	Subbasin ID & Name	Tribal Area	Units	Total Load (NPS+PS)	Total Nonpoint Source (NPS)	Background	Agricultural Nonpoint	Non-Regulated Urban	Total Point Source (PS)	General Permit	Regulated MS4 Urban	Individual Permits
55	Upper Wolf River	Menominee Reservation	lbs/yr	447,710	417,249	319,289	43,578	54,382	30,461	8,416	0	22,045
			lbs/day	1,226	1,142	874	119	149	83	23	0	60
		Menominee Off-Reservation Trust Land	lbs/yr	18,521	13,822	1,271	11,949	602	4,699	93	0	4,606
			lbs/day	51	38	3	33	2	13	0.3	0	13
		Stockbridge Munsee Community	lbs/yr	40,526	37,664	24,759	10,945	1,960	2,862	303	0	2,559
			lbs/day	111	103	68	30	5	8	1	0	7
56	Shawano Lake	Menominee Reservation	lbs/yr	5,953	5,870	285	5,051	534	83	83	0	0
			lbs/day	16	16	1	14	1	0.2	0.2	0	0
58	Upper Embarrass River	Ho-Chunk Nation Off-Reservation Trust Land	lbs/yr	14,802	14,768	685	13,865	218	34	34	0	0
			lbs/day	41	40	2	38	1	0.1	0.1	0	0
59	Middle Embarrass River	Stockbridge Munsee Community	lbs/yr	4,589	4,484	2,828	977	679	105	105	0	0
			lbs/day	13	12	8	3	2	0.3	0.3	0	0
80	Wolf River - Upper Post Lake to Hunting River	Forest County Potawatomi Community	lbs/yr	14,667	14,291	11,833	20	2,438	376	376	0	0
			lbs/day	40	39	32	0.1	7	1	1	0	0
		Sokaogon Chippewa Community	lbs/yr	3,679	128	128	0	0	3,551	0	0	3,551
			lbs/day	10	0.4	0.4	0	0	10	0	0	10
		Forest County Potawatomi Off-Reservation Trust Land	lbs/yr	10,513	10,181	7,959	74	2,148	332	332	0	0
			lbs/day	29	28	22	0.2	6	1	1	0	0
		Sokaogon Chippewa Off-Reservation Trust Land	lbs/yr	7,420	7,355	6,903	28	424	65	65	0	0
			lbs/day	20	20	19	0.1	1	0.2	0.2	0	0
81	Upper Little Wolf River	Ho-Chunk Nation Off-Reservation Trust Land	lbs/yr	872	871	289	576	6	1	1	0	0
			lbs/day	2	2	1	2	0.02	0.003	0.003	0	0