Justification for 4a Listing of the Yahara Lakes and Their Inclusion in the Rock River TMDL

Prepared By:
Wisconsin Department of Natural Resources
Matt Diebel, PhD and Kevin Kirsch, PE

Background:
The Yahara Lakes (Mendota, Monona, Waubesa, and Kegonsa) are a chain of lakes along the Yahara River, which is part of the Rock River Basin. The Rock River TMDL, which was approved by EPA in September 2008, established total phosphorus (TP) and total suspended sediment (TSS) allocations for impaired stream reaches and lakes in the basin. At the time, the Yahara Lakes were not listed as impaired for TP or TSS so the TMDL analyses did not include explicit allocations for the lakes. Because of their proximity to UW-Madison, the Yahara Lakes have been extensively studied; and at the time the TMDL was written, DNR believed that the allocations contained in the TMDL would meet water quality goals for the lakes. DNR did not want to have a TMDL approved and explain allocations to stakeholders only to have to assign potentially more stringent allocations in the near future to meet lake water quality goals.

In 2008 when the TMDL was approved, EPA did not assign explicit allocations to waters that were not impaired nor did DNR have a comprehensive report available at the time summarizing historical lake data to support explicit allocations. However, separate analyses conducted and published for the Yahara CLEAN report (Lathrop and Carpenter 2011) were able to be adapted to answer the adequacy of the TMDL allocations in meeting the water quality criteria for the Yahara Lakes.

Water Quality Targets for Yahara Lakes:
In 2010, the DNR promulgate statewide nutrient criteria for total phosphorus for streams, rivers, and lakes. Lakes are assigned criteria values based on their natural community classification. The upper lakes (Mendota and Monona) are classified as deep lowland lakes, and have summer mean TP criteria of 0.03 mg/L. The lower lakes (Waubesa and Kegonsa) are classified as shallow lowland lakes, and have summer mean TP criteria of 0.04 mg/L.

Lathrop and Carpenter's (2011; Figure 6) analyses show that all four lakes met these criteria during the drought period of 1988-89. Unlike other TMDL analysis that are often based exclusively on computer simulations, actual lake monitoring data and loading data representing the desired water quality condition could be used. Because actual external TP loads to the lakes during this period (Table 2, load goal) produced concentrations meeting water quality criteria the loads can be considered sufficient to meet TP criteria.

Supporting Analysis:
To compare the TMDL load allocations to these load goals, Matt Diebel (originally part of the EPA consultant team that developed the Rock River TMDL and current DNR researcher) conducted a three-step analysis. First, Matt assumed that the TP allocations to reaches 64 and 66 (Table 1) would be split between the lakes in approximate proportion to their relative direct drainage areas (Table 2, % of lumped allocation). Second, Matt added TP from atmospheric and

groundwater to the allocated load. And third, Matt used Lathrop and Carpenter's "pass-through" factors for each lake (outflow/inflow TP load) to simulate how loads to the upper lakes would move down the chain of lakes.

The results of this analysis show that the TMDL allocations are well below the load goals for Mendota, Monona, and Waubesa (Table 2), which means those three lakes would likely have even lower summer TP concentrations than during the 1988-89 drought. The TMDL allocation is 16% more than the observed load to Lake Kegonsa during the drought, but the TP concentration in Kegonsa during the drought was approximately 25% less than the criterion, so meeting the allocation would result in meeting the criterion.

Margin of Safety:
In addition to the margin of safety already contained in the Rock River TMDL analysis, the analysis conducted above includes additional safety factors through the inclusion of both atmospheric and groundwater contributions of total phosphorus to the Yahara Lakes.

Reasonable Assurance:
Since the completion of the Rock River TMDL additional implementation planning and activities have been occurring in the Yahara River Basin including Madison Metropolitan Sewerage District's adaptive management plan to reduce phosphorus loads in the basin through a combination of point and nonpoint sources reductions and Yahara Clean Initiative (A CLEAN Future for the Yahara Lakes: Solutions for Tomorrow, Starting Today; September 2010). The report identified 70 actions to help clean up the lakes and have them meet nutrient criteria targets. The actions include recommendations for reducing sediment and nutrient input into the lakes from rural areas and farmlands and urban areas, and for improving beach water quality through stormwater management and waterfowl control measures.

In November 2012, an additional two years of work focused in on specific management options and targeting and was summarized in the "Yahara CLEAN Strategic Action Plan". The plan includes a list of 14 actions, with phosphorus reductions calculated for each action based on models, assumptions, and more than 30 years of monitoring data. The combination of actions is tailored for each lake in the Yahara River chain and focuses on reductions in the direct drainage sources of phosphorus to each lake. The actions are further divided into rural and urban actions.

As with any TMDL, if after implementation of these practices it is found that water quality goals are not being achieved, the TMDL will be re-visited and allocations adjusted accordingly. DNR does not yet have a timetable for when approved TMDLs are re-visited; however, at that time newly listed water previously not addressed in the Rock River TMDL will be added and the implicit allocations for the Yahara Lakes can be explicitly clarified within the TMDL.

Lathrop, R.C. and S.R. Carpenter. 2011. Phosphorus Loading and Lake Response Analyses for the Yahara Lakes. Unpublished report prepared for the Yahara CLEAN project.

Table 1.

Lake	TMDL Reach	TP Allocation (lb)	TP Allocation (kg)
Mendota (Pheasant Branch)	62	969	439
Mendota (Dorn Creek)	63	866	392
Mendota and Monona	64	17,331	7,846
Waubesa (Nine Springs Creek)	65	1,469	665
Waubesa and Kegonsa	66	7,177	3,249

Table 2.

Lake	TP pass through factor[1]	Other TP sources (atmospheric and groundwater, kg)[1]	% of Lumped Allocation	Load goal (kg)[1]	Projected load with TMDL implemented (kg)[2]	Difference between projected load and load goal
Mendota	26.5%	3,800	90%	17,400	11,692	-33%
Monona	58.6%	1,100	10%	11,700	4,983	-57%
Waubesa	93.5%	700	40%	6,800	5,584	-18%
Kegonsa	77.9%	1,100	60%	7,100	8,271	+16%

[1]From Lathrop and Carpenter (2011, Table 1)

[2]Projected load with TMDL implemented for lake A =
projected load with TMDL implemented for next upstream lake × TP pass through factor for next upstream lake
+ other TP sources to lake A
+ TP allocation to lake A only from table 1
+ lumped TP allocation to lake A and another lake from table 1 × % of lumped allocation to lake A