Evaluation of the Grand River for Impair Waters Listing

Sue Larson
Wisconsin Department of Natural Resources

Background

The Upper Grand River Watershed is located in Fond du Lac and Green Lake counties. It is 39,651 acres in size and contains 85 miles of rivers and streams, 41 acres of lake and 2,973 acres of wetlands. The watershed is dominated by agriculture (76%) and grasslands (8%) and is ranked high for nonpoint source issues affecting groundwater and medium for nonpoint source issues affecting streams. The Lower Grand River Watershed is located primarily in Green Lake County, but also in Marquette, Columbia and Dodge counties. It is 70,011 acres in size and includes 185 miles of streams and rivers, 1,264 acres of lakes and 13,715 acres of wetlands. The watershed is dominated by agriculture (44%), wetlands (19%), forest (17%) and grassland (14%) and is ranked high for nonpoint source issues affecting groundwater. (http://dnr.wi.gov/water/watersheddetail)

This objective of this project was to monitor and assess the impacts of point and non-point discharges to the Grand River (WBIC 159300) and determine if the river meets the requirements for 303(d) listing. Samples collected in 2012 for WPDES phosphorus limits calculations (Project Id WCR_13_CMP13), and historic water quality data, indicates that Total Phosphorous (TP) well exceeds the listing threshold of 0.075 mg/L upstream of the Grand River Marsh. Samples were found to contain concentrations of TP between 0.1 to 0.9 mg/L. Historical TP data for the stretch of stream below the Grand River Marsh and upstream of the Fox River also averaged above the listing threshold. TP concentrations were found to be between 0.04 and 0.327 mg/L.

Methods

Water quality samples and biological assessments were accomplished in this project, for both stretches of stream, to complete WisCALM requirements for impaired water identification. Sampling included two TP samples collected in May and June 2013, macroinvertebrate sampling during November of 2013, and fish survey during the summer of 2013 at Fairwater (Station ID 10022781), Markesan (Station ID 10037822), and Kingston (Station ID 10037823). Previous WPDES phosphorus limits sampling efforts, in 2012, collected 4 monthly samples at sampling locations upstream of Fairwater (Station ID 10037821), Markesan (Station ID 10037822), and Kingston (Station ID 10037823) WWTFs. This project completed collection of the 6 samples required and biological assessment needed for impaired waters listing. An additional site was located downstream of Grand River Marsh near the Fox River (Station ID 10033618) to determine if the downstream stretch of the river also meets impaired water criteria. This site had 6 monthly TP samples collected previous sampling efforts, by the Lake Puckaway Plan Implementation Project, in 2011 and 2012. To complete the biological

assessment needed for impaired water listing, macroinvertebrate sampling was conducted during November of 2013, and fish survey during the summer of 2013. In addition to phosphorus and biological sample collection, sonde (temp, spec cond, pH, DO), turbidity, and flow data were also collected.

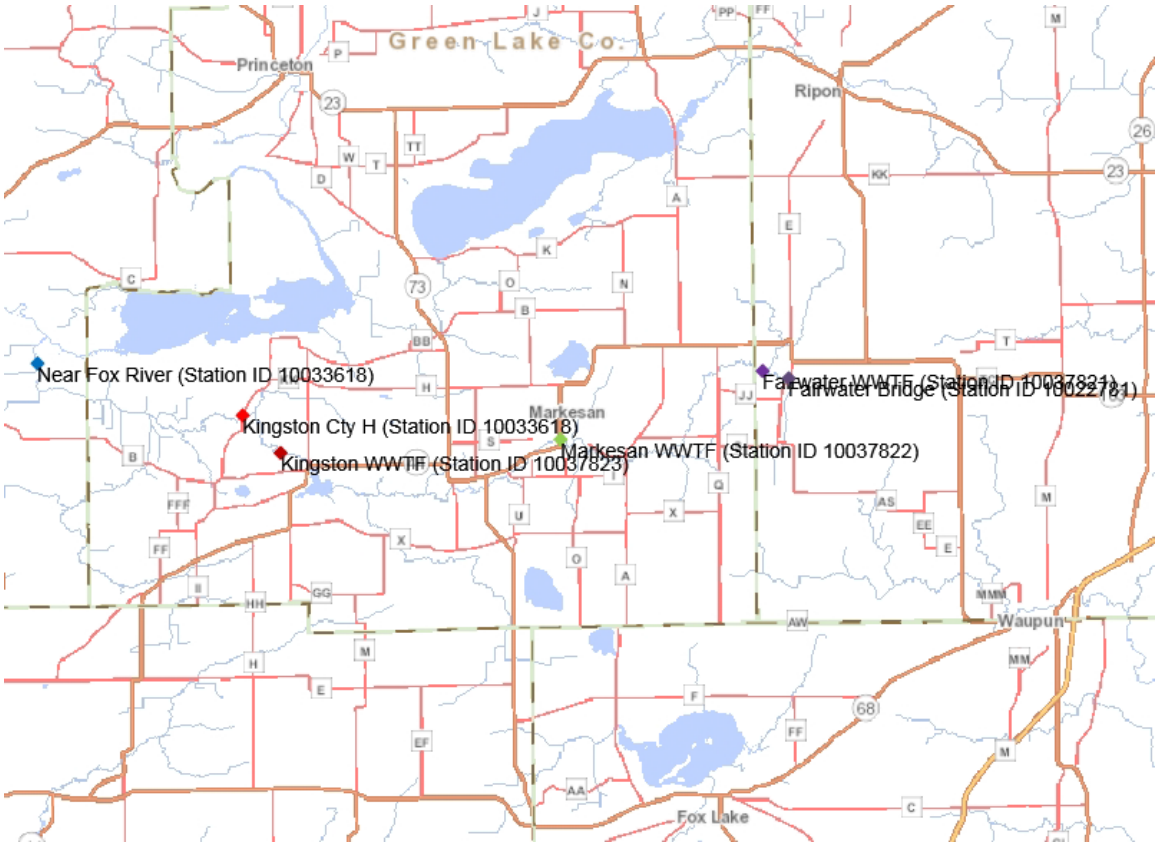
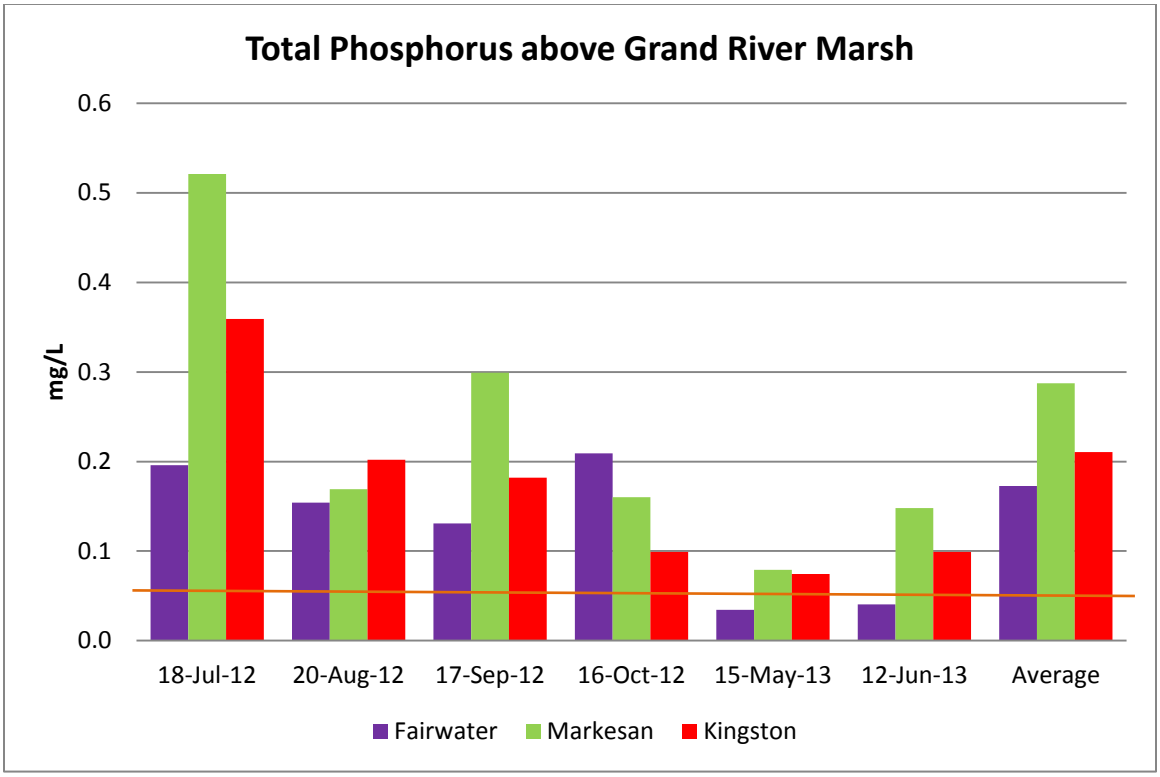


Figure 1. Grand River Stations

Results

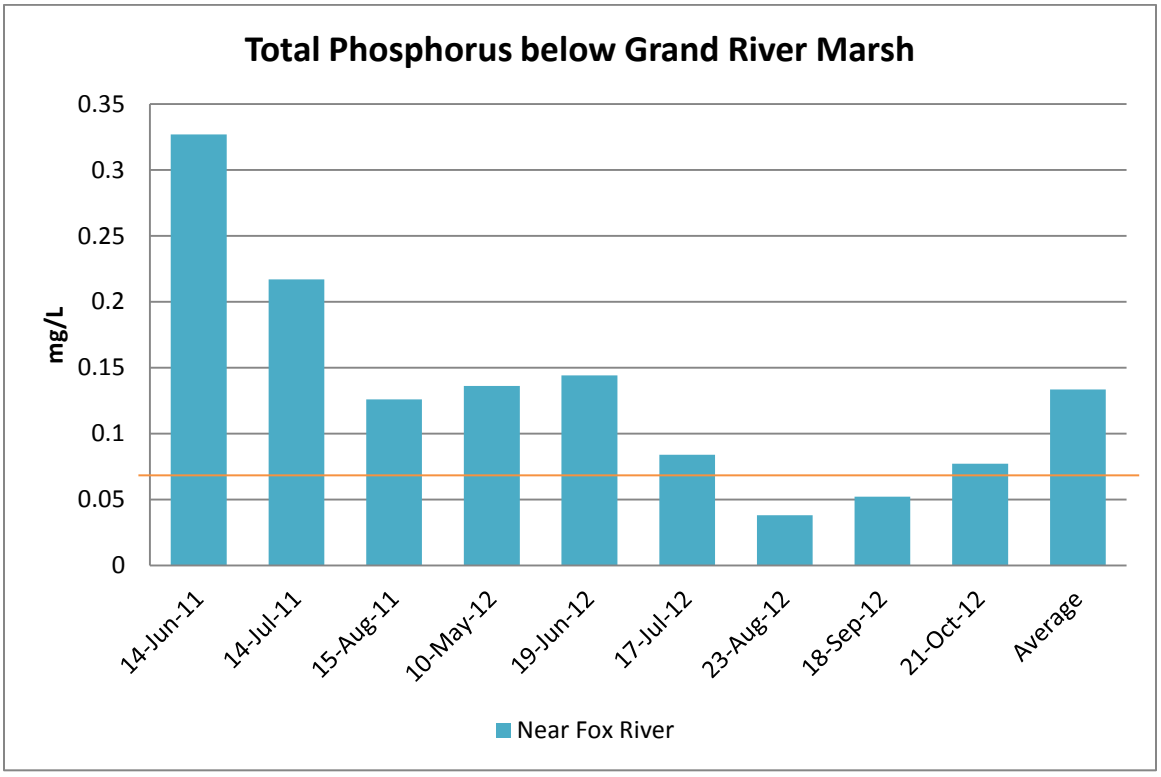
Total Phosphorus (mg/L) above Grand River Marsh

	Fairwater	Markesan	Kingston
18-Jul-12	0.196	0.521	0.359
20-Aug-12	0.154	0.169	0.202
17-Sep-12	0.131	0.299	0.182
16-Oct-12	0.209	0.160	0.099
15-May-13	0.034	0.079	0.074
12-Jun-13	0.040	0.148	0.099
Average	0.173	0.287	0.211
L90%	0.063	0.130	0.102
U90%	0.166	0.283	0.208



Total Phosphorus (mg/L) below Grand River Marsh

	Near Fox R.
14-Jun-11	0.327
14-Jul-11	0.217
15-Aug-11	0.126
10-May-12	0.136
19-Jun-12	0.144
17-Jul-12	0.084
23-Aug-12	0.038
18-Sep-12	0.052
21-Oct-12	0.077
Average	0.133
L90%	0.118
U90%	0.208



Site	Site ID	F-IBI Score	Condition Category	M-IBI Score	Condition Category
Fairwater	10022781	30	Fair	3.78	Fair
Markesan	10037822	70	Excellent	4.29	Fair
Kingston	243029	47	Fair	3.37	Fair
Near Fox R.	10033618	65	Good	none	none

Discussion and Recommendations

Total Phosphorus sampling data for the Grand River showed exceedances of listing criteria at nearly all sampling locations. The exception was Fairwater, at which the Lower 90% confidence interval of the sample median was found to be 0.063 mg/L, which is lower than the listing threshold. The difference may be attributable to sample location. The May and June 2013 sampling events took place upstream of the Fairwater millpond and bridge (Station ID 10037821) in the headwaters of the Grand River rather than directly upstream of the Fairwater WWTF (Station ID 10037821) as in the four previous sampling events in 2012. The change in location was necessary for collecting biological data as the location upstream of the WWTF contained very humic, mucky sediment. However, the change of location may have skewed the phosphorus results -the two 2013 samples taken in the fast flowing headwater location were below the listing threshold, while the 2012 samples in the slower flowing, potentially phosphorus rich sediment area, just upstream of the Fairwater WWTF, were above the threshold. The remaining three sites (Markesan, Kingston, and Near Fox River) had lower 90% confidence interval sample medians above the listing threshold indicating impairment.

According to WisCALM 2014, "If the LCL of the phosphorus dataset from a particular stream site exceeds the applicable criterion, and those data were representative of normal weather and hydrology, then the corresponding stream segment is considered to be exceeding the TP criteria." But also, "If the LCL exceeds the Wisconsin Department of Natural Resources 55 applicable TP criterion by two-fold (i.e., "overwhelming exceedance"), then biological confirmation of impairment is not required. However, if the LCL exceeds the criterion less than two-fold (under normal weather and hydrologic conditions), a F-IBI or M-IBI score indicating 'poor' biological condition sufficiently corroborates the FAL use impairment." This is problematic as total phosphorus sample data exceed 2014 WisCALM listing criteria for the Fish and Aquatic Life use, however, available biological data do not indicate impairment (i.e. no macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the "poor" condition category). The sites which had LCL exceedances did not have two-fold exceedances at which level biological confirmation can be discounted.

WISCALM 2014

Table 11. Condition category thresholds for wadeable stream macroinvertebrate index of biotic integrity.

Wadeable Stream M-IBI Thresholds	*Condition Category*
> 7.5	Excellent
5.0-7.4	Good
2.5-4.9	Fair
< 2.5	Poor

Table 10. Condition category thresholds for applicable fish indices of biotic integrity (IBI).

Natural Community	Fish IBI Type	Fish IBI	Condition Category
Coldwater	Coldwater Fish	81-100	Excellent
		51-80	Good
		21-50	Fair
		0-20	Poor
Cool-Cold or Cool-Warm Headwater	Small-Stream (Intermittent) Fish	91-100	Excellent
		61-90	Good
		31-60	Fair
		0-30	Poor
Cool-Cold Mainstem	Cool-Cold Transition Fish	61-100	Excellent
		41-60	Good
		21-40	Fair
		0-20	Poor
Cool-Warm Mainstem	Cool-Warm Transition Fish	61-100	Excellent
		41-60	Good
		21-40	Fair
		0-20	Poor
Warm Headwater	Small-Stream (Intermittent) Fish	91-100	Excellent
		61-90	Good
		31-60	Fair
		0-30	Poor
Warm Mainstem	Warmwater Fish	66-100	Excellent
		51-65	Good
		31-50	Fair
		0-30	Poor
Large River	River Fish	81-100	Excellent
		61-80	Good
		41-60	Fair
		0-40	Poor