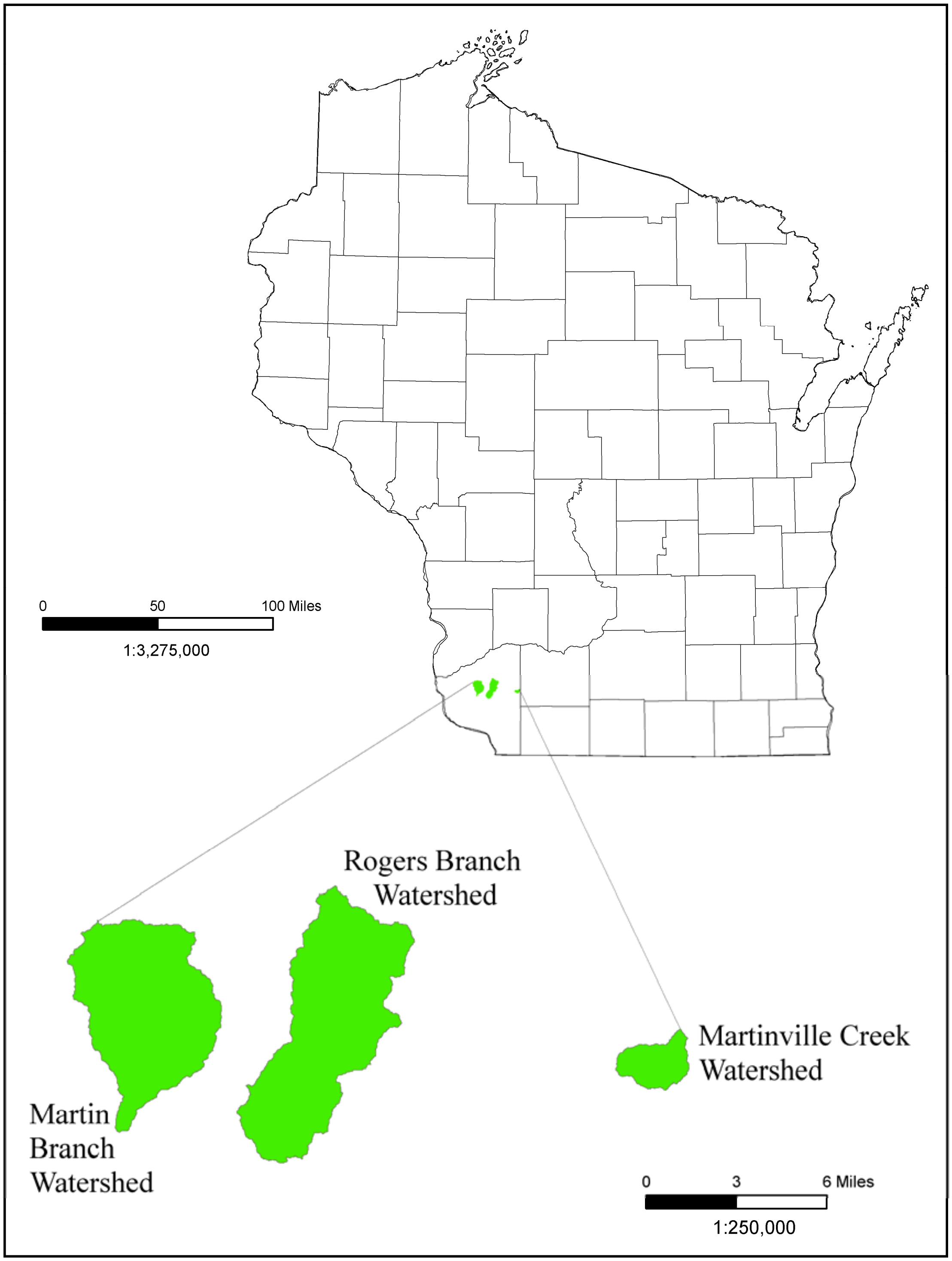
Total Maximum Daily Loads: Martin Branch, Martinville Creek, and Rogers Branch Grant County, Wisconsin

Rogers Branch, Grant County, WI

Figure 1. Martin Branch, Martinville Creek, and Rogers Branch Watershed Locations in Wisconsin.



INTRODUCTION

Martin Branch, Martinville Creek, and Rogers Branch are impaired streams in the Grant-Platte River Basin in southwestern Wisconsin (Figure 1). The Wisconsin Department of Natural Resources (WDNR) placed the following stream segments on the Wisconsin 303(d) impaired waters list as high priority due to degraded habitat caused by excessive sedimentation (the deposition of sediment) and low dissolved oxygen caused by high phosphorus concentrations (Table 1).

In cooperation with the U.S Geological Service (USGS), continuous stream flow was measured at various sites on each stream. Water chemistry parameters including total phosphorus (TP) and total suspended solids (TSS) were recorded at each site on a monthly basis from Spring 2005 until Fall 2006.

Table 1. Martin Branch, Martinville Creek, and Rogers Branch Use Designations

Waterbody Name	WBIC	TMDL ID	Impaired Stream Miles	Existing* Use	Codified* Use	Pollutant	Impairment
Martin Branch	963400	268	0-1.5	Unknown (Cold)	Default (Cold)	Sediment	Degraded Habitat
Martin Branch	963400		1.5-3.5	Cold	Default (Cold)	Sediment	Degraded Habitat
Martin Branch	963400		3.5-9.4	WWFF	Default (Cold)	Sediment	Degraded Habitat
Martinville Creek	955100	269	2.6-3.0	WWFF	Default (Warm)	Sediment	Degraded Habitat
Martinville Creek	955100		3.0-5.0	WWFF-LFF	Default (Warm)	Sediment	Degraded Habitat
Rogers Branch	964300	403	0-0.8	Cold	Cold	Phosphorus Sediment	DO; Degraded Habitat
Rogers Branch	964300	404	0.8-4.7	WWFF	Cold	Phosphorus Sediment	DO; Degraded Habitat
Rogers Branch	964300		4.7-5.6	WWFF	Cold	Phosphorus Sediment	DO; Degraded Habitat
Rogers Branch	964300		5.6-8.0	WWFF	Cold	Phosphorus Sediment	DO; Degraded Habitat
Rogers Branch	964300		8.0-12.0	WWFF	Default (Cold)	Phosphorus Sediment	DO; Degraded Habitat

*See Appendix A.

The Clean Water Act and United State Environmental Protection Agency (US EPA) regulations require that each state develop Total Maximum Daily Loads (TMDLs) for waters on the Section 303(d) list. The purpose of these TMDLs is to identify load allocations and management actions that will help restore the biological integrity of these streams. These TMDLs address each stream and pollutant individually, but are grouped together because they are located in the same river basin, share the same watershed characteristics, soils, types of land use, and available conservation programs.

PROBLEM STATEMENT

Due to excessive sedimentation in Martin Branch, Martinville Creek, and Rogers Branch and excessive phosphorus in Rogers Branch, these waterbodies are not currently meeting applicable narrative water quality criterion as defined in NR 102.04 (1); Wisconsin Administrative Code:

“To preserve and enhance the quality of waters, standards are established to govern water management decisions. Practices attributable to municipal, industrial, commercial, domestic, agricultural, land development, or other activities shall be controlled so that all waters including mixing zone and effluent channels meet the following conditions at all times and under all flow conditions:

(a) Substances that will cause objectionable deposits on the shore or in the bed of a water, shall not be present in such amounts as to interfere with public rights in waters of the state.
(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.”

In addition, Martin Branch, Martinville Creek, and Rogers Branch are not meeting their codified fisheries uses. The designated uses applicable to these streams are as follows:

S. NR 102.04 (3) intro, (a), (b), (c), (4) (a), and (e2) Wisconsin Administrative Code:

“FISH AND OTHER AQUATIC LIFE USES. The department shall classify all surface waters into one of the fish and other aquatic life subcategories described in this subsection. Only those use subcategories identified in pars. (a) to (c) shall be considered suitable for the protection and propagation of a balanced fish and other aquatic life community as provided in federal water pollution control act amendments of 1972, P.L. 92-500; 33 USC 1251 et. seq.“

“(a) Cold water communities. This subcategory includes surface waters capable of supporting a community of cold water fish and aquatic life, or serving as a spawning area for cold water fish species. This subcategory includes, but it not restricted to, surface waters identified as trout waters by the department of natural resources (Wisconsin Trout Streams, publication 6-6300(80)).”

“(b) Warm water sport fish communities. This subcategory includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sport fish.”

“(c) Warm water forage fish communities. This subcategory includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.”

The descriptions of fish community classifications are presented in Appendix A.

“STANDARDS FOR FISH AND AQUATIC LIFE. Except for natural conditions, all waters classified for fish and aquatic life shall meet the following criteria:

“(a) Dissolved Oxygen. Except as provided in par. (e) and s. NR 104.02 (3), the dissolved oxygen content in surface waters may not be lowered to less than 5 mg/L at any time.”

“(e) Temperature and dissolved oxygen for cold waters. Streams classified as trout waters by the department of natural resources (Wisconsin Trout Streams, publication 6-3600 (80)) or as great lakes or cold water communities may not be altered from natural background temperature and dissolved oxygen levels to such an extent that trout populations are adversely affected.

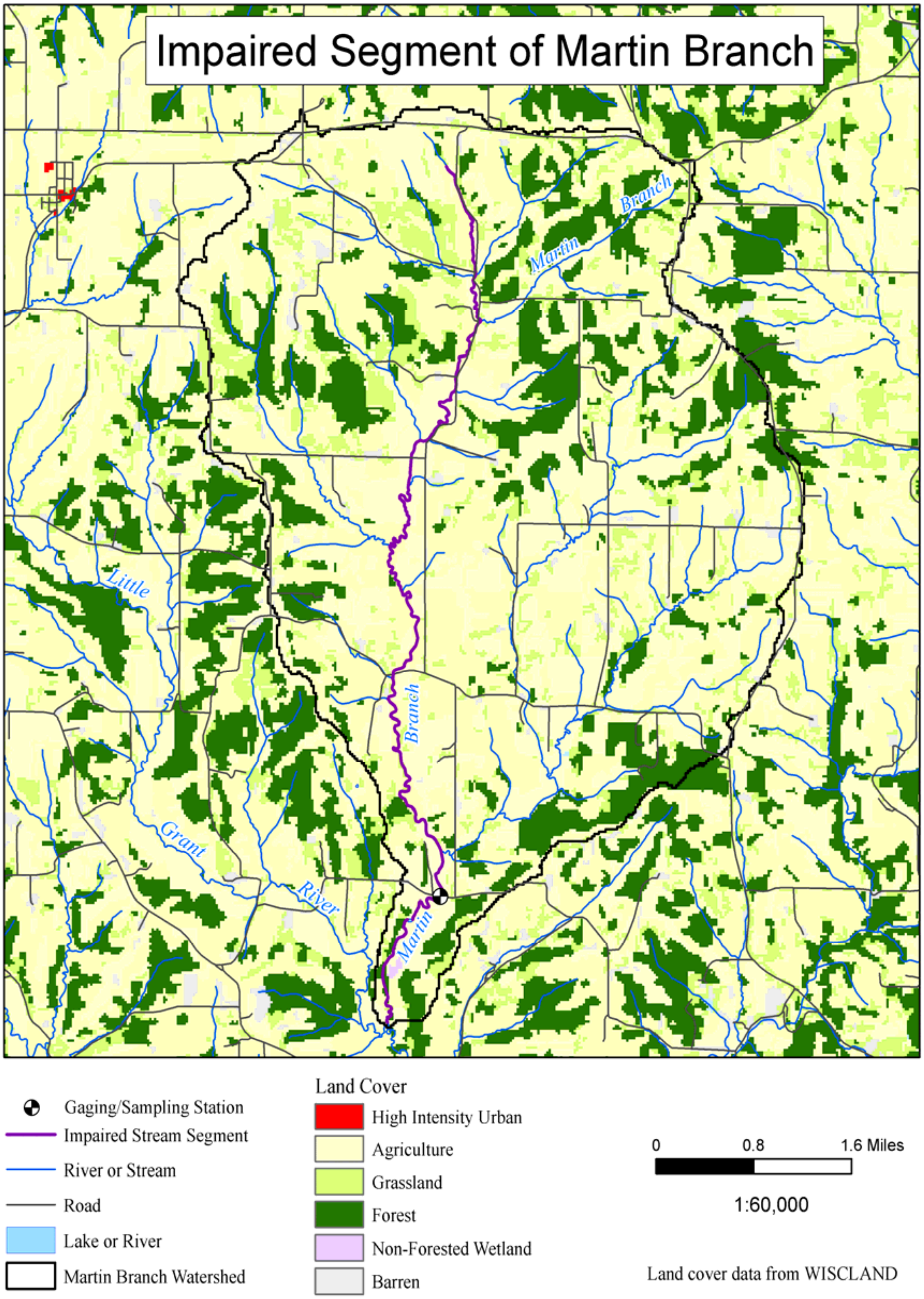
2. Dissolved oxygen in classified trout streams shall not be artificially lowered to less than 6.0 mg/L at any time, nor shall the dissolved oxygen be lowered to less than 7 mg/L during the spawning season.”

Martin Branch

Martin Branch is a ten-mile tributary that is spring fed from miles 0-4 and intermittent flow for the remainder of the stream. The stream flows south before reaching the Little Grant River near Lancaster, Wisconsin. It has a moderate to high gradient of about 32 feet per mile and drains an area of approximately 13 square miles. Martin Branch codified uses and existing uses are as described in Table 1.

Land use in the watershed is dominated by the agricultural practices of row cropping and pasturing (Table 2). Along many stretches of the impaired segment of Martin Branch, row cropping occurs adjacent to the stream banks without sufficient stream buffering allowing excessive non-point source sediment runoff to the stream. This is especially evident during high precipitation and/or snowmelt events.

Figure 2. Martin Branch Watershed Land Use and Sampling Location for TMDL Development



WDNR staff conducted a habitat survey (WDNR, 2002) in May 2006 within the 1.5 - 3.5 stream mile segment at Govier Road on Martin Branch. Using the current habitat assessment tool for wadeable streams, this section of the stream is considered having "good" habitat.

Table 2. Martin Branch Land Use, WISCLAND, 1992.

Land Use in Martin Branch Watershed	Percent Cover
Agriculture	66
Forest	19.8
Grassland	12.7
Barren	1.5
Water	<1.5

Despite finding multiple sizes/year classes of trout at Govier Road, the result of the fish assessment scored this site as having "very poor" cold water fish assemblages (cold water IBI = 0). This is likely due to the lack of other cold water indicator species and a predominance of eurythermal, warm water forage fish. Since no coldwater species were found at the Badger Road site, a warm water index of biotic integrity was calculated for this specific site. The warm water IBI score was "poor" (warm water IBI = 22). The result of the macroinvertebrate assessments scored both sites as having "fair" macroinvertebrates assemblages (macroinvertebrate IBI = 3.1).

Water chemistry data were collected by WDNR at Govier Road during 2005 and 2006. Water samples were analyzed for TSS and the results were used for modeling the existing sediment load to Martin Branch and establishing the sediment TMDL as described later in this report.

While the upper 6 miles of Martin Branch watershed is impacted by excessive grazing, the stream itself also suffers from low flow and may become intermittent during certain times of the year. Intermittent pools often become isolated, resulting in low dissolved oxygen levels and higher water temperatures in these pools until they can be replenished during rain or runoff events. However fish surveys indicate that certain species can tolerate these conditions for a period of time.

Further downstream at Govier Road, streamflow is good and much more uniform because of the spring flow and contributing tributaries. Multiple year classes of brown trout, along with a few young-of-the-year trout were found, indicating some level of natural reproduction. While the habitat scores were "fair", there was a significant amount of siltation outside the thalweg in this section of stream. This silt provided a base for heavy growth of macrophytes, especially curlyleaf pondweed, in certain sections of the stream. These macrophytes could lead to diurnal fluctuations of dissolved oxygen, but generally not to critical levels. The riparian corridor in this section of stream does contain row crops, but generally the stream has a buffer from 5 to 30 meters in width.

Martinville Creek

Figure 3. Martinville Creek Watershed Land Use and Sampling Location for TMDL Development

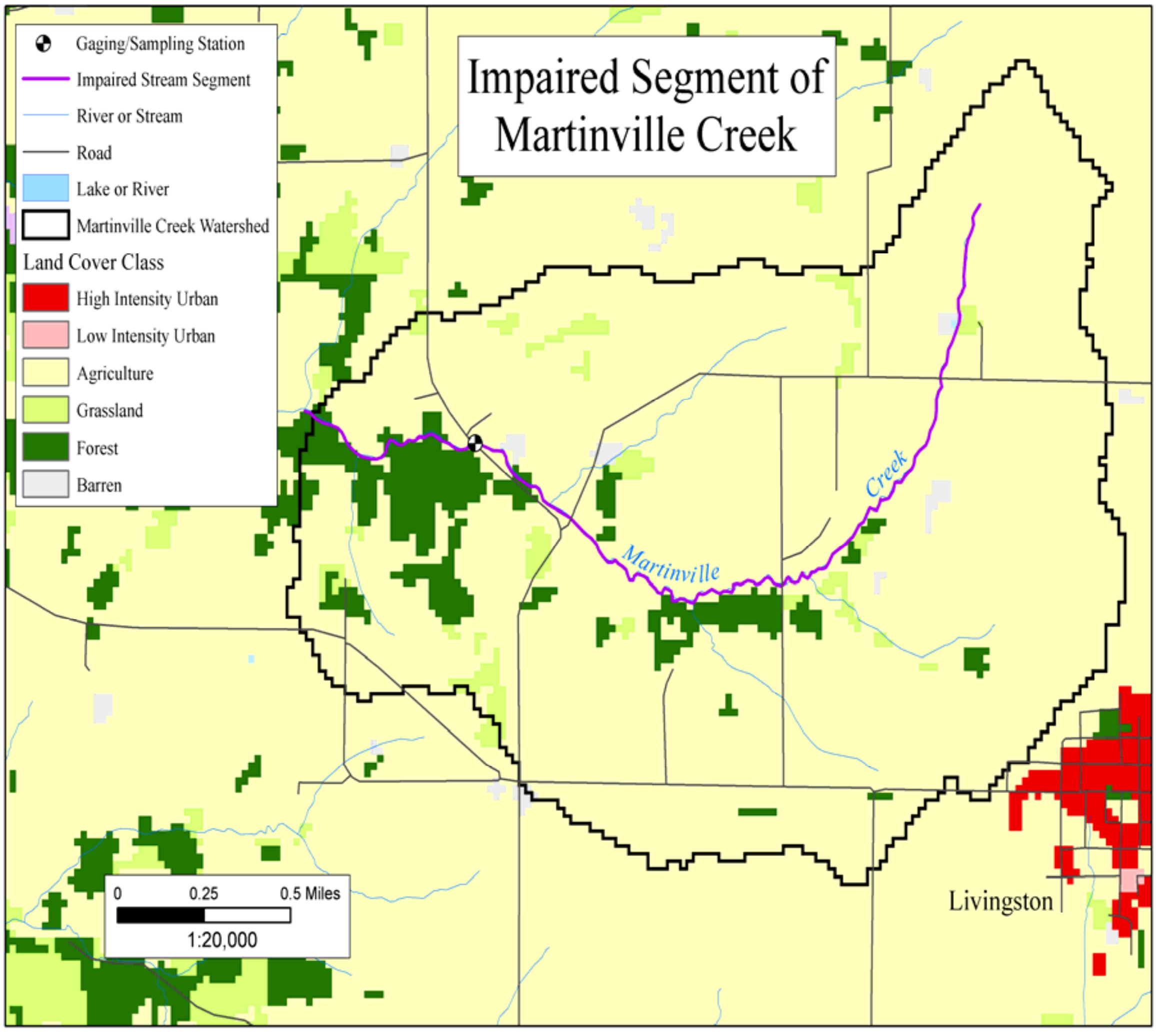


Table 3. Martinville Creek Land Use, WISCLAND, 1992.

Land Use in Martinville Creek Watershed	Percent Cover
Agriculture	90.2
Forest	6.6
Grassland	2.7
Barren	0.6
Water	<0.1

Martinville Creek is a five-mile stream in northeastern Grant County that flows west before reaching the Platte River near Annaton, Wisconsin. It has a moderate to high gradient of 43 feet per mile and drains an area of approximately seven square miles. Martinville Creek codified and existing uses are as described in Table 1. Heavy grazing and row cropping predominate the headwaters area of this watershed. Agriculture constitutes the main land use of the watershed (Table 3). The stream is small and has low flow for the upper 2 miles until it is augmented by spring flow. Downstream from Martinville Road, spring flow and the subsequent cooler water temperatures make the stream habitable for trout. Row cropping is generally limited to the high ground in the surrounding area. Land use in the narrow valley which covers the lower 2 miles is generally meadow and provides a good buffer to the stream.

WDNR staff conducted a habitat survey in May of 2006 using the current habitat assessment tool for wadeable streams for two locations within the listed impaired segment on Martinville Creek. At the Hickory Grove Road stream crossing, the habitat assessment indicated that this section of stream is considered “fair” habitat for streams less than 10 meters wide. The habitat assessment done at the Rock Church Road crossing indicates that this section of the stream is considered having “excellent” habitat for streams less than 10 meters wide.

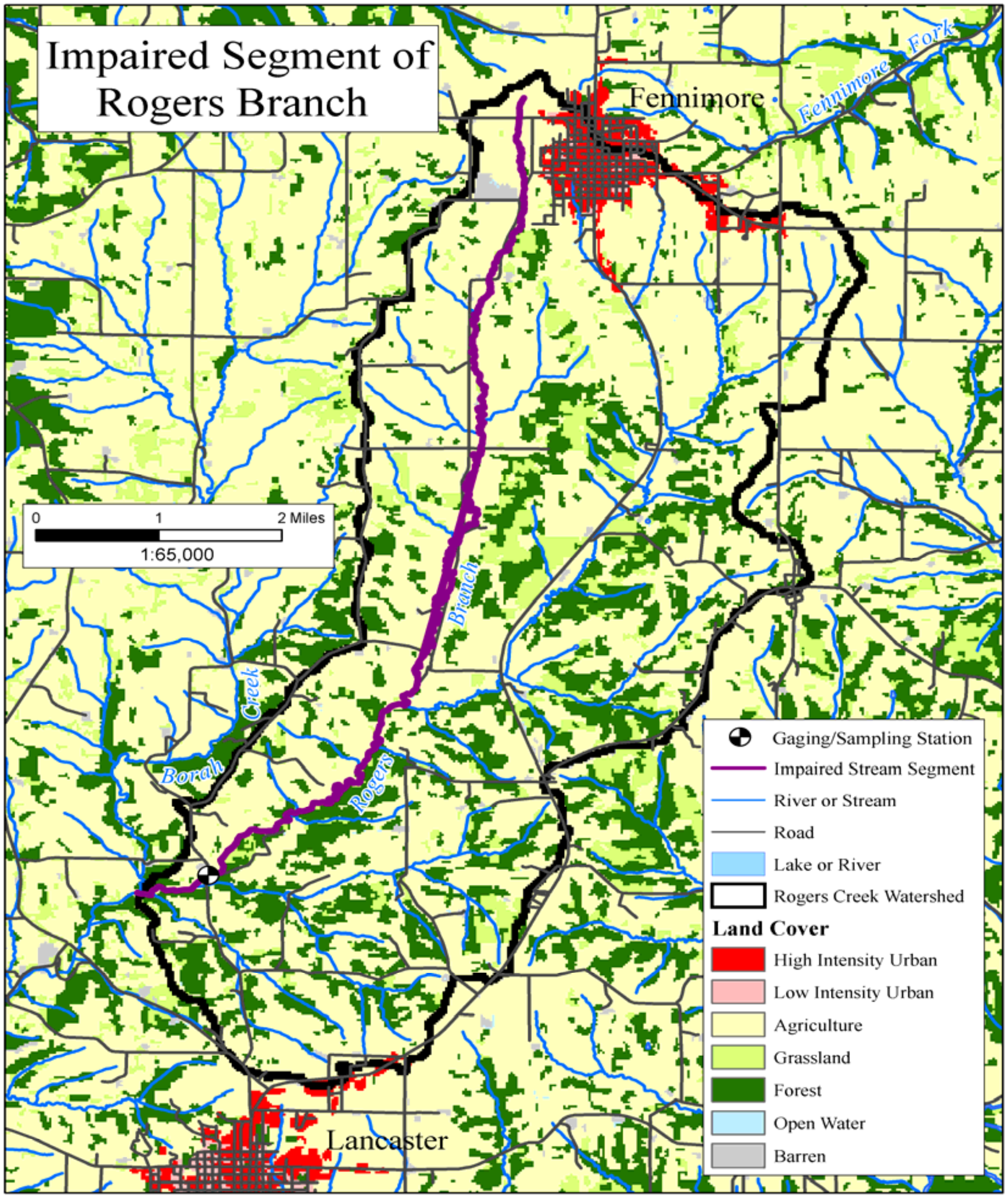
Fish and macroinvertebrate assessments were conducted in 2005 and 2006 at Hickory Grove Road, Rock Church Road, and at site on the lower stream on private property. The fish assessment showed a “fair” score at the private property site. While the result of the fish assessment at Rock Church Road scored “very poor” for cold water fish assemblages (cold water IBI = 0), there was evidence of natural reproduction of trout at Rock Church Road as indicated by the number of young-of-the-year trout found at this site. There were not enough fish collected at the Hickory Grove Road site to calculate an IBI. The water was very turbid and the area heavily grazed. The result of the macroinvertebrate assessments scored both sites as having “fair” macroinvertebrate assemblages (macroinvertebrate IBI = 3.1).

Water chemistry data were collected by WDNR at Rock Church Road during 2005 and 2006. Water samples were analyzed for TSS and the results were used for modeling the existing sediment load to Martinville Creek and establishing the sediment TMDL as described later in this report. In cooperation with the United States Geological Survey (USGS), continuous stream flow was measured at Rock Church Road during 2005 and 2006.

Better land use practices, including managed grazing and buffering of the stream in the headwaters areas would help reduce loads to the lower stream.

Rogers Branch

Figure 4. Rogers Branch Watershed Land Use and Sampling Location for TMDL Development



Rogers Branch is a twelve-mile stream in northcentral Grant County that has its origin near the village of Fennimore and flows south and joins with Borah Branch to form the Grant River near Lancaster, Wisconsin. It has a moderate to high gradient of 31 feet per mile and drains an area of approximately 14 square miles. The land use is characterized mostly as agriculture and forest (Table 4).

The stream is fairly small (less than 2 meters wide) for the upper 7 miles of stream. Downstream from Link Road, it gains in size until just upstream from Borah Road, where a large spring instantaneously adds approximately 5 cubic feet per second of cold water (10˚C) flow to the stream. The stream is classified as a Class II trout water for the lower 8 miles of stream (below Town Line Road) (Appendix A), and default for the upper 4 miles (Table 1).

A fisheries survey conducted between Borah Road and the spring showed the presence of 261 brown trout in a 250 meter stretch of stream. Despite this, the coldwater IBI was still poor (Cold Water IBI = 20). This was due to the lack of other coldwater indicator species and a predominance of eurythermal warmwater forage species. A fisheries survey conducted immediately upstream from the spring showed the presence of only 2 brown trout, but a variety of eurythermal warmwater forage species. The coldwater IBI for this section was 10 (poor), but the warmwater IBI was 49 (fair).

At Link Road, the stream is considerably smaller (less than 2 meters wide) and contained only eurythermal warmwater forage species. The warmwater IBI for this site was 92 (excellent).

Table 4. Rogers Branch Land Use, WISCLAND, 1992.

Land Use in Rogers Branch Watershed	Percent Cover
Agriculture	67.9
Forest	20.7
Grassland	7.5
Urban	2.5
Barren	1.1
Golf Course	0.2
Water	0.1

WDNR staff conducted a habitat survey in May of 2006 using the current habitat assessment tool for wadeable streams at three locations on Rogers Branch. The assessments conducted at Borah Road, upstream of the spring at Borah Road, and at Link Road all indicated that these are areas of “good” habitat.

Macroinvertebrate assessments were also conducted in 2005 and 2006 at Borah Road, upstream of the spring at Borah Road, and at Link Road. The result of the macroinvertebrate assessments scored all three sites as having “poor” macroinvertebrate assemblages (macroinvertebrate IBI at Borah Road = 1.1, macroinvertebrate IBI above spring at Borah Road = 1.4, and macroinvertebrate IBI at Link Road = 1.5).

Water chemistry data were collected by WDNR at Borah Road during the 2005 and 2006. Water samples were analyzed for TSS and TP, and the results were used for modeling the existing sediment and phosphorus load to Rogers Branch.

In cooperation with the United States Geological Survey (USGS), continuous stream flow was measured at Borah Road during 2005 and 2006. WDNR staff measured dissolved oxygen at Link Road and Borah Road in July 2006. A seven day measurement of the diurnal fluctuations in dissolved oxygen at Link Road indicated that the dissolved oxygen fluctuates above and below the 6 mg/L DO standard for trout waters ranging between 5.15 mg/L and 6.70 mg/L. At Borah Road, the dissolved oxygen concentration never dropped below the 6 mg/L standard for trout waters.

While the stream is managed as a trout fishery for the lower 8 miles, trout populations upstream from the spring at Borah Road can be marginal due to seasonal low flows and warm temperatures.

SOURCE ASSESSMENT

Point Sources

There are no point sources located on or discharging to any of the impaired waters included in this TMDL report.

Nonpoint Sources

Agricultural runoff and bank erosion during rain and snowmelt events is the suspected cause of excessive sedimentation in Martin Branch, Martinville Creek, and Rogers Branch and excessive phosphorus loading to Rogers Branch. To investigate potential sources of the pollutant for the TMDL, a TSS load duration curve was developed for each stream and a TP load duration curve was developed for Rogers Branch based on methods outlined by Cleland (2002) and the Nevada Division of Environmental Protection (2003). To calculate the flow duration curves, continuous daily stream flow from USGS gage stations located at the furthest downstream crossing of the impaired segment of each stream was collected (Martin Branch at Govier Road, Martinville Creek at Rock Church Road, and Rogers Branch at Borah Road). Monthly TSS data were collected at each gaging site and monthly TP was collected from Rogers Branch at the gaging site by WDNR staff between 2005 and 2006 to provide the data necessary to build the load duration analysis for each stream (Appendix B). Load duration curves for Martin Branch, Martinville Creek, and Rogers Branch indicate high TSS and TP (Rogers Branch) during high flow periods in the watershed.

Phosphorus attached to sediment particles that move into the stream from agricultural runoff and snowmelt events is the suspected cause of excessive phosphorus concentrations in Rogers Branch. Total phosphorus loads in Rogers Branch were estimated by multiplying the sampled TP concentration by the flow at the time of the sample. Based on a recent USGS/WDNR study of wadeable streams in Wisconsin which evaluated biological responses to in-stream concentrations of TP, 0.075 mg/l TP was selected as a target value for this TMDL analysis. Total phosphorus loads in Rogers Branch were estimated by multiplying the sampled TP concentration by the flow at the time of the sample. These points were then plotted against the target value of 0.075 mg/l TP. The resulting TP load duration curve for Rogers Branch indicate TP concentrations are greater than the 0.075 mg/L target throughout the majority of flow conditions, however the greatest exceedence of the target occurs during high flow conditions.

LINKAGE ANALYSIS

Establishing the link between watershed characteristics and resulting water quality is a crucial step in TMDL development. By striving to return watershed characteristics closer to natural conditions, improvements in overall stream health can be achieved. However, determining natural conditions of the stream is challenging due to lack of historical information to represent conditions prior to human disturbance.

Sedimentation from stream bank erosion and runoff from agricultural practices within the watersheds are the suspected cause of habitat degradation in Martinville Creek, Martin Branch, and Rogers Branch. Fine sediments covering the stream substrate reduce suitable habitat for fish and other biological communities by filling in pools and reducing available cover for juvenile and adult fish. Sedimentation of riffle areas compromises reproductive success of fish communities by covering gravel substrate necessary for spawning conditions. The filling in of riffle areas also affects the fish communities' food source, macroinvertebrates, which have difficulty thriving in areas with predominately sand and silt substrate as opposed to a substrate composed of gravel, cobble/rubble, and sand mixture. In addition, sedimentation can increase turbidity in the water column, causing reduced light penetration necessary for photosynthesis in aquatic plants, reduced feeding capacity of aquatic macroinvertebrates due to clogged gilled surfaces, and reduce the visibility of predator fish species to find prey. Also, other pollutants (i.e phosphorus) are bound to soil particles and delivered to the stream through runoff and stream bank erosion, increasing the concentration levels of these pollutants in the water column. Sedimentation can impact the physical attributes of the stream and act as a transport mechanism for other pollutants that will impact the water chemistry.

Phosphorus enters the stream mainly bound to soil particles that transport it during runoff from overgrazed pastures adjacent to the stream channel, and nutrient rich manure spread within close proximity (e.g. 30 feet) of the stream. Phosphorus loading in water bodies can cause eutrophication of streams and reservoirs, and is characterized by excessive plant growth, dense algal growth, and higher fluctuations of DO levels due to algal oxygen production during photosynthesis, consumption of oxygen during respiration at night, and bacterial consumption of oxygen in the decaying process of dead algae and plant material.

Severe dissolved oxygen fluctuations stress fish and aquatic insects. Depleted dissolved oxygen levels that fall below 6 mg/l are not suitable for the survival of salmonids and other cold water fish species.

TMDL DEVELOPMENT

A TMDL is a quantative analysis of the amount of a particular pollutant a stream or lake can receive before exceeding water quality standards. As part of a TMDL, the amount of pollutant that the water can tolerate and still meet water quality standards must be identified. Martinville Creek, Martin Branch, and Rogers Branch have been impaired by a combination of flashy flow conditions during runoff events, bank erosion, runoff from agricultural practices, and excessive sedimentation of the stream substrate. The goal of this TMDL is to reduce sediment loads throughout Martinville Creek, Martin Branch, and Rogers Branch watersheds and reduce phosphorus loading throughout Rogers Branch watershed to a level that narrative water quality standards and defined numerical targets will be met, and the streams' biological communities will be restored to their listed potential.

In addition to identification of pollutant loading, a TMDL also identifies critical environmental conditions used when defining allowable pollutant levels. A critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other important conditions. Although sediment is considered a "conservative" pollutant and does not degrade over time or during critical periods of the year, we define the critical condition for TSS and phosphorus loading in these TMDLs as occurring after heavy rainfall events (>0.5 inches) and snowmelt events when flows are high (approximately > 1.5 cfs for Martinville Creek, > 9 cfs for Martin Branch, and > 19 cfs for Rogers Branch). At high flow rates the sediment and phosphorus attached to the sediment moves into the streams from agricultural activities and erosion in the watershed. Existing sediment in the streams can be re-suspended and transported downstream. Additionally, high flows in the stream channel may erode the stream bank adding sediment to the stream.

TMDL MODELING

Wisconsin Department of Natural Resources staff collected field data over a period of 2 years from spring 2005 through fall 2006. During this time, WDNR staff collected monthly and high flow event samples that were analyzed for TSS and TP concentrations, to represent pollutant concentrations during normal baseflow conditions and high flow event conditions. Continuous flow was recorded throughout the monitoring period using USGS flow gauges. Based on the amount of data and limited options for models suitable for the size of this data set, it was determined that load duration curves would be the most appropriate method to model the sediment and nutrient loads in Martin Branch, Martinville Creek, and Rogers Branch.

By using TSS concentration as an indicator of soil particles entering the stream, the load duration curves indicate that the majority of soil particles are entering the stream during high flow conditions when the top 10% of flow was recorded over the 2 year monitoring period. High TSS concentrations during high flow conditions is related to increased soil loading to the stream from bank erosion and runoff and re-suspension of existing sediment on the stream bed.

By using TP concentration as an indicator of phosphorus loading to the stream, the load duration curves indicate that the majority of phosphorus is also entering the stream during high flow conditions when the top 10% of flow was recorded over the 2 year monitoring period. Phosphorus has a tendency to bind to soil particles, and as soil moves into the stream from soil erosion and runoff from the watershed, the phosphorus releases from the soil into the water column.

ALLOCATIONS

The total annual loading capacity for sediment and phosphorus is the sum of the wasteload allocations for permitted sources, the load allocations for nonpoint sources, and the margin of safety, as generally expressed in the following equation:

TMDL Load Capacity = WLA + LA+ MOS

WLA = Wasteload Allocation
LA = Load Allocation
MOS = Margin of Safety

WLA

Since there are no point sources in the watershed, the wasteload allocation is zero pounds/day. If a point discharge were proposed, one of the following would need to occur:

- An effluent limit of zero sediment and phosphorus would be included in the WPDES permit.
- An offset would need to be created through some means, such as pollutant trading.
- A re-allocation of sediment load would need to be developed and approved by EPA.

LA

The load allocation (LA) component defines the load capacity for a pollutant that is related to nonpoint source pollution. To achieve the TSS LA, sediment load reductions are necessary in the agriculture land use areas of these watersheds. The LA is based on a reduction of wet-weather runoff event sediment loads with a goal of a median stream concentration of 10 mg/L for Martin Branch, Martinville Creek, and Rogers Branch. It is important to note that these values target high flow periods that occur during 10% of the flow regime. For 90% of the time, TSS concentrations are typically less than 10 mg/L in Martin Branch, Martinville Creek, and Rogers Branch. See Tables 5 – 7 below for the load allocations for Martin Branch, Martinville Creek, and Rogers Branch as determined by the load duration curves in Appendix B.

To achieve the total phosphorus LA for Rogers Branch, phosphorus reductions are necessary in the agriculture land-use of the watershed. The percent reductions at different flow conditions in the LA is based on a reduction of wet-weather runoff event TP loads with a goal of the daily target stream concentration of 0.075 mg/l. See Table 8 below for the LA for Rogers Branch as determined by the load duration curve in Appendix B.

MOS

The margin of safety (MOS) accounts for the uncertainty about the relationship between the pollutant of concern and the response in the waterbody. For the Martin Branch, Martinville Creek, and Rogers Branch TMDLs, an explicit MOS is provided for each of the flow periods of the TSS and TP load duration curves. In this TMDL, the MOS was calculated based on the difference between the loading capacity as calculated at the mid-point of each flow zone and the loading capacity calculated at the minimum flow of each zone. The MOS assures that load allocations will not exceed the load associated with the minimum flow in each zone. See Tables 5 – 8 for the MOS in Martin Branch, Martinville Creek, and Rogers Branch.

TOTAL LOAD CAPACITY

The total loading capacity was captured for these TMDLs using water quality duration curves (see Appendix B for Load Duration Curves). For Martin Branch, Martinville Creek, and Rogers Branch, it is evident that TSS and TP (Rogers Branch) concentrations are highest during event flows as a result of runoff from agriculture fields, stream bank erosion, and factors such as re-suspension of sediment from channel scour.

Based on the understanding that the majority of sediment loading to these streams is occurring during rain and snowmelt events, the sediment loading capacity for Martin Branch, Martinville Creek, and Rogers Branch was established as (1) an amount less than the estimated median observed load during high flow periods (2) is not exceeded during the rest of the flow regime (3) and is consistent throughout the watersheds. For these waterbodies, it was decided that the target TSS concentration during all flow conditions in Martin Branch, Martinville Creek, and Rogers Branch is 10 mg/L. WDNR is confident that 10 mg/L TSS will not lead to excessive sedimentation of these streams, and over time as these streams scour existing sediment during high flows, habitat such as gravel and cobble substrate will be exposed and available for fish and macroinvertebrate communities. TSS loading throughout all of the flow conditions was estimated using the continuous flow data and the 10 mg/L target concentration. The TMDL for TSS is the allowable load calculated at the median flow for the respective flow zone for each stream. The loading capacity and TMDLs for Martin Branch, Martinville Creek, and Rogers Branch are listed in Tables 5, 6, and 7 respectively.

Table 5. TMDL Summary for TSS in Martin Branch

TMDL Component	High	Moist	Mid	Dry	Low
Current Load (lbs/day)	1515.4	118.1	141.8	103.1	85.7
TMDL = LA + WLA + MOS	404.2	312.1	286.0	265.3	242.8
LA (lbs/day)	362.1	294.7	276.2	252.9	185.5
WLA (lbs/day)	0	0	0	0	0
MOS (lbs/day)	42.1	17.4	9.8	12.4	57.4

Table 6. TMDL Summary for TSS in Martinville Creek

TMDL Component	High	Moist	Mid	Dry	Low
Current Load (lbs/day)	229.3	89.0	24.9	14.6	No Data
TMDL = LA + WLA + MOS	97.1	54.0	41.6	31.3	22.1
LA (lbs/day)	80.9	45.9	37.2	25.4	17.3
WLA (lbs/day)	0	0	0	0	0
MOS (lbs/day)	16.2	8.1	4.3	5.9	4.9

Table 7. TMDL Summary for TSS in Rogers Branch

TMDL Component	High	Moist	Mid	Dry	Low
Current Load (lbs/day)	3437.3	378.9	237.2	117.8	No Data
TMDL = LA + WLA + MOS	804.1	534.2	432.4	392.1	330.2
LA (lbs/day)	682.8	467.2	415.5	355.4	284.7
WLA (lbs/day)	0	0	0	0	0
MOS (lbs/day)	121.3	67.0	16.9	36.7	45.5

The TP loading capacity to Rogers Branch was also determined by building a load duration curve using a 2-year set of continuous flow data with monthly water quality data, supplemented by several event samples, and a TP concentration target of 0.075 mg/L. The TP concentration target was established by averaging the measured TP concentration in streams where a recognized biologic response of several biotic indices correlated to phosphorus concentrations occurred (Robertson *et. al*., 2006)[1]. In Rogers Branch, it is during the high flow periods when there are higher concentrations of TP as a result of runoff from adjacent agricultural land use and re-suspension of phosphorus bound to sediment from channel scour. However, the majority of the water samples analyzed for TP in Rogers Branch through all of the flow conditions are exceeding the TP concentration target. The TP loading capacity and TMDL for Rogers Branch is listed in Table 8 below.

Table 8. TMDL Summary for TP in Rogers Branch

TMDL Component	High	Moist	Mid	Dry	Low
Current Load (lbs/day)	28.97	7.42	4.96	4.29	No Data
TMDL = LA + WLA + MOS	6.03	4.01	3.25	2.94	2.48
LA (lbs/day)	5.05	3.48	3.12	2.63	2.14
WLA (lbs/day)	0	0	0	0	0
MOS (lbs/day)	0.98	0.53	0.13	0.31	0.34

CRITICAL CONDITIONS

Although sediment as a pollutant reaches Martin Branch, Martinville Creek, and Rogers Branch under high flow events such as storms and runoff, there is no seasonal variation in the sedimentation of these streams. The impairment that excessive sediment causes in streams exists in all seasons. Under some flow regimes, sediment is deposited, and at other times, sediment is scoured and transported downstream. Sediment is considered a "conservative" pollutant and does not degrade over time. Sedimentation is a year round situation in which the depth of sediment on the stream bed varies under response of flood flows in the stream. Much of the sediment in these systems remains within the confines of the stream until major floods scour some of the accumulated sediment. Over time, the net result has been an accumulation of sediments in and along the stream under the current amounts of sediment reaching the stream.

Increased TP loads in Rogers Branch are dependant on varying flow conditions rather than one specific season (e.g. summer). Rogers Branch may display eutrophic conditions during low flow conditions in summer as a result of phosphorus actively being consumed by aquatic plants and algae, causing

[1] Biotic indices and the data used to develop the TP target for Wisconsin wadeable streams can be found in Table 23 of Robertson *et.al*., 2006.

diurnal fluctuations in dissolved oxygen. Increased TP loading may also occur in summer as a result of heavy rainfall events. However, in late spring and early winter, when plant cover is lacking and soil is exposed, Rogers Branch is most susceptible to TP loading due to snow melt and heavy rain events.

SEASONALITY

Seasonal variations in flow were captured by 2 years of continuous flow monitoring from spring 2005 until fall 2006. Also, seasonal variations in TP concentrations were measured by monthly sampling for 2 years and during high flow events. The seasonal variations in measured TP concentrations are accounted for in the TP load duration curve for Rogers Branch by evaluating allowable loads on a daily basis over the entire range of measured flows.

POST MANAGEMENT PRACTICE IMPLEMENTATION MONITORING

The WDNR intends to monitor Martin Branch, Martinville Creek, and Rogers Branch based on the implementation of the TMDLs. Monitoring for TSS and TP will continue until it is deemed that the streams have responded to the point where they are meeting their potential uses or until funding for these studies are discontinued. In addition, the streams will be monitored on a five to six year interval as a part of a baseline monitoring strategy to assess temporary conditions and note trends in overall stream quality. The monitoring will consist of metrics contained in WDNR's baseline protocol for wadeable streams, such as the Index of Biotic Integrity (IBI), the Hilsenhoff Biotic Index (HBI), the current habitat assessment tool, and sampling of water quality parameters at a subset of sites. Instantaneous flow will be measured at the time of each sample so it will be known during which flow conditions the sample was collected. Samples collected after management practices are installed will be added to the flow duration curve and compared to the existing data.

IMPLEMENTATION MEASURES

Modeling results and load durations curves developed for Martin Branch, Martinville Creek, and Rogers Branch indicate that TSS and TP concentrations are highest in the stream during high-flow conditions. To reach the TMDLs in these watersheds, best management practices (BMPs), such as riparian buffers and conservation tillage, are encouraged in agricultural areas to reduce loading during these events.

REASONABLE ASSURANCE

To ensure the reduction goals of this TMDL are attained, BMPs must be implemented and maintained to control sediment and nutrient loadings from nonpoint source pollution. (There are currently no point sources discharging sediment or nutrients to Martin Branch, Martinville Creek, and Rogers Branch). Many of these measures require local participation to properly implement.

The WDNR and Grant County Land & Water Conservation Department (LWCD) will implement the agricultural and non-agricultural performance standards and manure management prohibitions listed in ch. NR 151, Wisconsin Administrative Code., to address sediment and nutrient loadings in the Martin Branch, Martinville Creek, and Rogers Branch watersheds. Many landowners voluntarily install BMPs to help improve water quality and comply with the performance standards. Cost sharing is available for many of these BMPs. In most cases, farmers cannot be required to comply with the agricultural performance standards and prohibitions, unless they are offered at least 70% cost sharing.

The *Grant County Land & Water Resource Management Plan* workplan for 2004-2008 includes goals that address reductions for sedimentation and nutrient loadings. The county's Land & Water Resource Management Plan also includes a strategy to implement the NR 151 performance standards and prohibitions.

The Grant County LWCD and other local units of government may apply for Targeted Runoff Management (TRM) Grants through the WDNR. The TRM Grant Program provides competitive cost-sharing grants to support small-scale, 2-year projects to reduce nonpoint source pollution. TRM Grants fund up to 70% of eligible project costs, with the grant amount capped at $150,000. Since 1999, the Grant County LWCD received four TRM grants, totaling nearly $600,000 for BMP implementation.

In addition to the implementation of state performance standards and WDNR cost-sharing programs, there are several federal and local programs that may assist in implementing these TMDLs:

Federal Land Conservation Programs

The Environmental Quality Incentive Program (EQIP) provides a voluntary conservation program for farmers and ranchers, that promotes agricultural production and environmental quality as compatible national goals. Farmers may receive up to 75% reimbursement for installing and implementing runoff management practices. Eligible projects can include: terraces, waterways, diversions, and contour strips to manage agricultural waste, promote stream buffers, and control erosion on agricultural lands.

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners. Through CRP, you can receive annual rental payments and cost-share assistance to establish long-term, resource conserving covers on eligible farmland. The Commodity Credit Corporation makes annual rental payments based on the agriculture rental value of the land, and it provides cost-share assistance for up to 50 percent of the participant's costs in establishing approved conservation practices. Participants enroll in CRP contracts for 10 or 15 years.

The Conservation Reserve Enhancement Program (CREP) is an enhancement of the USDA/NRCS CRP. This is a continuous sign-up program for high priority conservation practices. Participants receive annual rental payments based on agricultural rental value of the land and receive cost-share assistance in an amount equal to not more than 50 percent of the cost in establishing the approved practice. The contract duration is either 10 or 15 years or the landowner could opt for a perpetual easement. The establishment of buffers along the waterbody reduces the phosphorus, nitrogen, and sediment entering the streams and rivers. Grant County was given $1,850,000 to allocate in the CREP. As of fall 2003, Grant County had 696 acres of cropland and 615 acres of pasture set aside in CREP.

The Grassland Reserve Program (GRP) is a voluntary program to help protect valuable grass and hay lands, which are threatened by development or from conversion to more intensive cropping systems which can cause serious soil erosion. Landowners may sign 10, 15, 20, or 30-year contracts. The U.S. Department of Agriculture (USDA) pays 75 percent of the grazing value in annual payments for the length of the agreement.

The Wildlife Habitat Incentives Program (WHIP) is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Through WHIP, the NRCS provides both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from 5 to 10 years from the date the agreement is signed.

Grant County Land Conservation Programs

The Grant County Board approves $20,000 each year for county cost sharing. Forestry practices take $3,500 of that allotment to cost share on fencing and tree protectors. The remainder is used in different ways. One use is the "piggybacking" with other cost-sharing programs for installation of expensive conservation/water quality practices such as manure storage and barnyard runoff systems. The other method is to cost share on low-cost, stand-alone practices, such as well abandonment, crop management practices, grassed waterways and special practices.

Each year the Wisconsin Department of Agriculture Trade and Consumer Protection (DATCP) allocates a certain amount of funds to provide cost sharing in Grant County. Since the dollar amount of the grant is relatively small in comparison to the amount of cost share requests, the Land and Water Conservation Committee (LWCC) has set a limit of 70% cost sharing up to $5000. If the estimated cost is over $10,000, the individual may request additional funds from the Grant County Cost-Share Program. Cost sharing is available for a variety of the traditional conservation practices used in Grant County.

The Farmland Preservation Program (FPP) is designed to help preserve farmland through local planning and zoning, promote soil and water conservation and provide tax relief to participating landowners. Landowners qualify if their land is in an exclusively agricultural zoning district of if they sign an agreement to use their land exclusively for agricultural purposes. For 2002, the average tax incentive generated $747 per participant, and brought in $568,144 for Grant County as property tax relief.

PUBLIC PARTICIPATION

This TMDL was subject for public review from July 24, 2007 through August 22, 2007. On July 24, 2007 a news release was sent out to the media to inform the public about the comment period and how to obtain copies of the public notice and the draft TMDL. The news release, public notice, and draft TMDL were also placed on the WDNR's website. No comments were received form the public.

REFERENCES

Cleland, 2003. TMDL Development from the "Bottom-Up" – Part III: Duration Curves and Wet-Weather Assessments.

Nevada Division of Environmental Protection, 2003. Load Duration Curve Methodology for Assessment and TMDL Development.

Robertson, D.M., Graczyk, D.J., Garrison, P.J., Wang, Lizhu, Laliberte, Gina, and Bannerman, R., 2006. Nutrient Concentrations and Their Relationships to the Biotic Integrity of Wadeable Streams in Wisconsin. US Geological Survey Professional Paper 1722.

WDNR, 2002. Guidelines for Evaluating Habitat of Wadeable Streams. Wisconsin Department of Natural Resources, Bureau of Fisheries Management. June 2002.

APPENDIX A: STREAM CLASSIFICATION AND DESCRIPTION

Wisconsin Stream Use Classifications

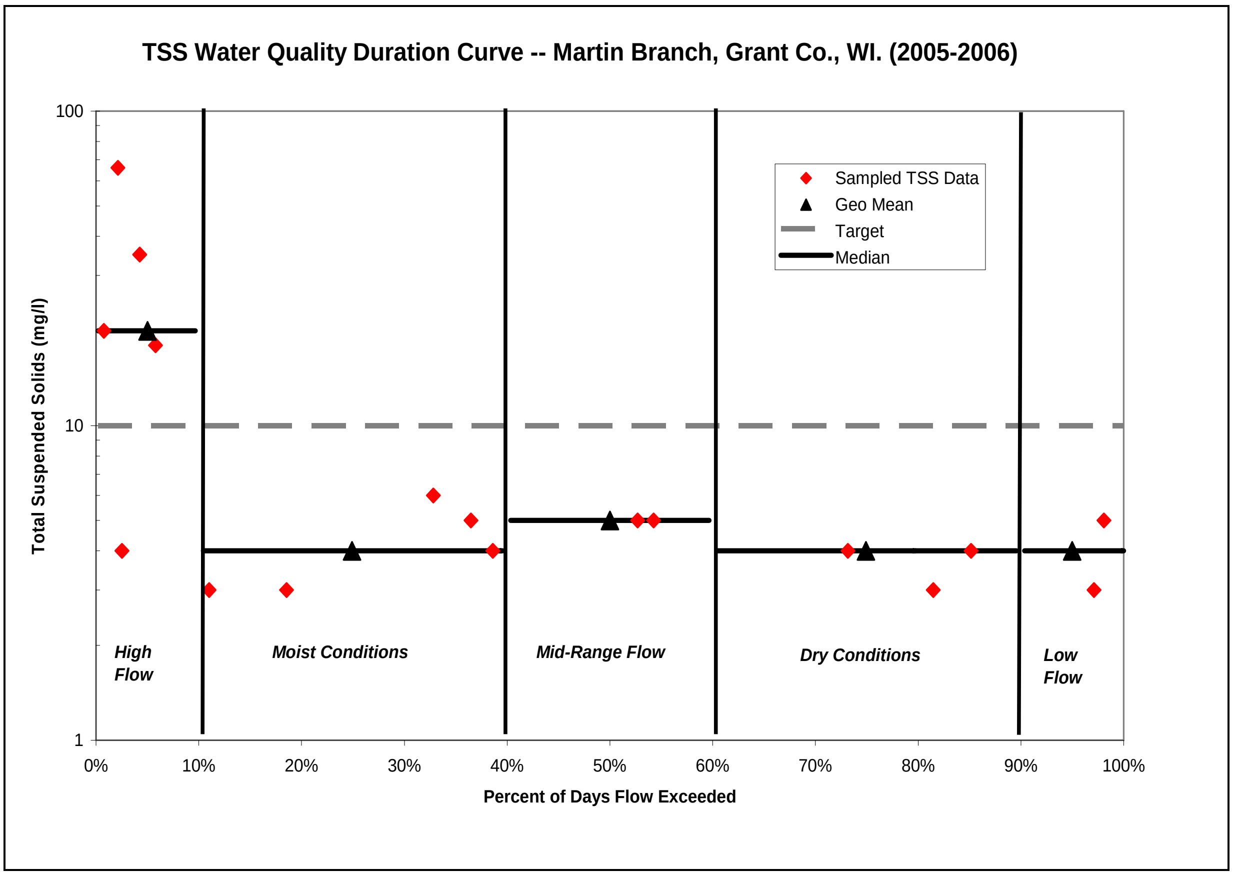
Stream Use Classification	Description
Cold	Cold water community; includes surface waters that are capable of supporting a cold water fishery and other aquatic life and serving as a spawning area for cold water species. This includes three levels of cold water classification (Class I, II, or III).
WWSF	Warm water sport fish communities; includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning or nursery for warm water sport fish.
WWFF	Warm water forage fish communities; includes surface waters capable of supporting an abundant and diverse community of forage fish and other aquatic life.
LFF	Limited forage fishery; (intermediate surface waters (INT-D) includes surface water of limited capacity because of low stream flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of tolerant forage fish and aquatic life.
Default	Water bodies with no reference are considered to be "default" waters and are assumed to support either a coldwater community, warmwater sportfish community, or a warmwater forage fish community depending on water body-specific temperature and habitat limitations.

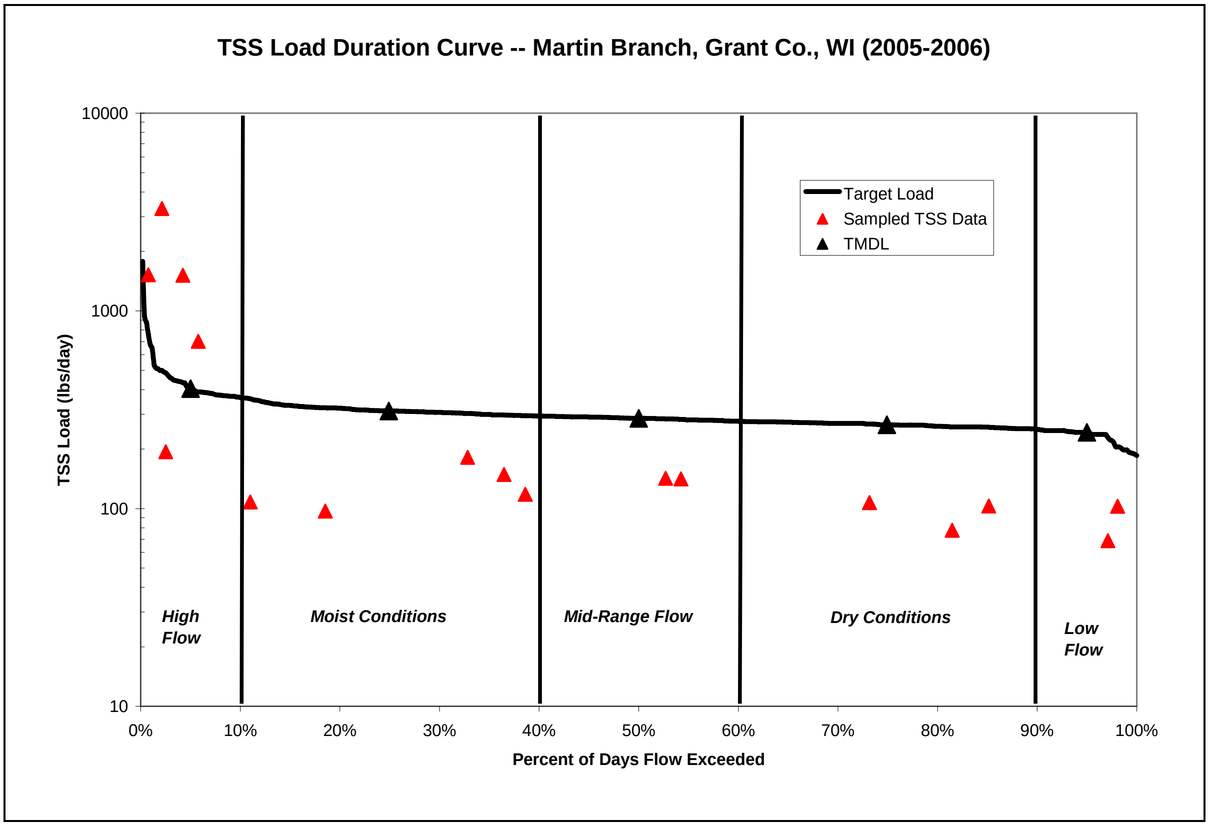
Wisconsin Trout Stream Classifications

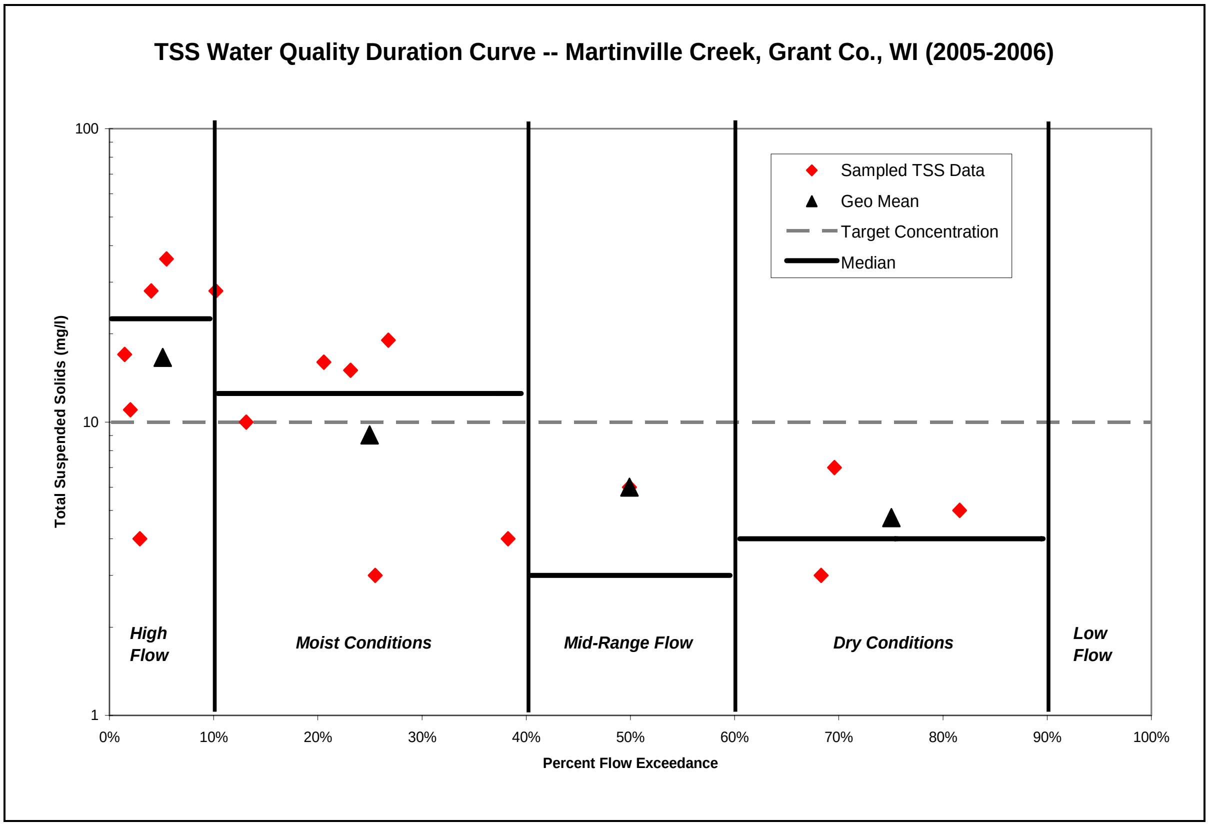
Trout Stream Classification	Description
Class I	These are high quality trout waters, having sufficient natural reproduction to sustain populations of wild trout at or near carrying capacity. Consequently, streams in this category require no stocking of hatchery trout. These streams or stream sections are often small and may contain small or slow-growing trout, especially in the headwaters.
Class II	Streams having this classification may have some natural reproduction but not enough to utilize available food and space. Therefore, stocking is sometimes required to maintain a desirable sport fishery. These streams show good survival and carryover of adult trout often producing some fish of better than average size.
Class III	These waters are marginal trout habitat with no natural reproduction occurring. They require annual stocking of legal-size fish to provide trout fishing. Generally, there is no carryover of trout from one year to the next.

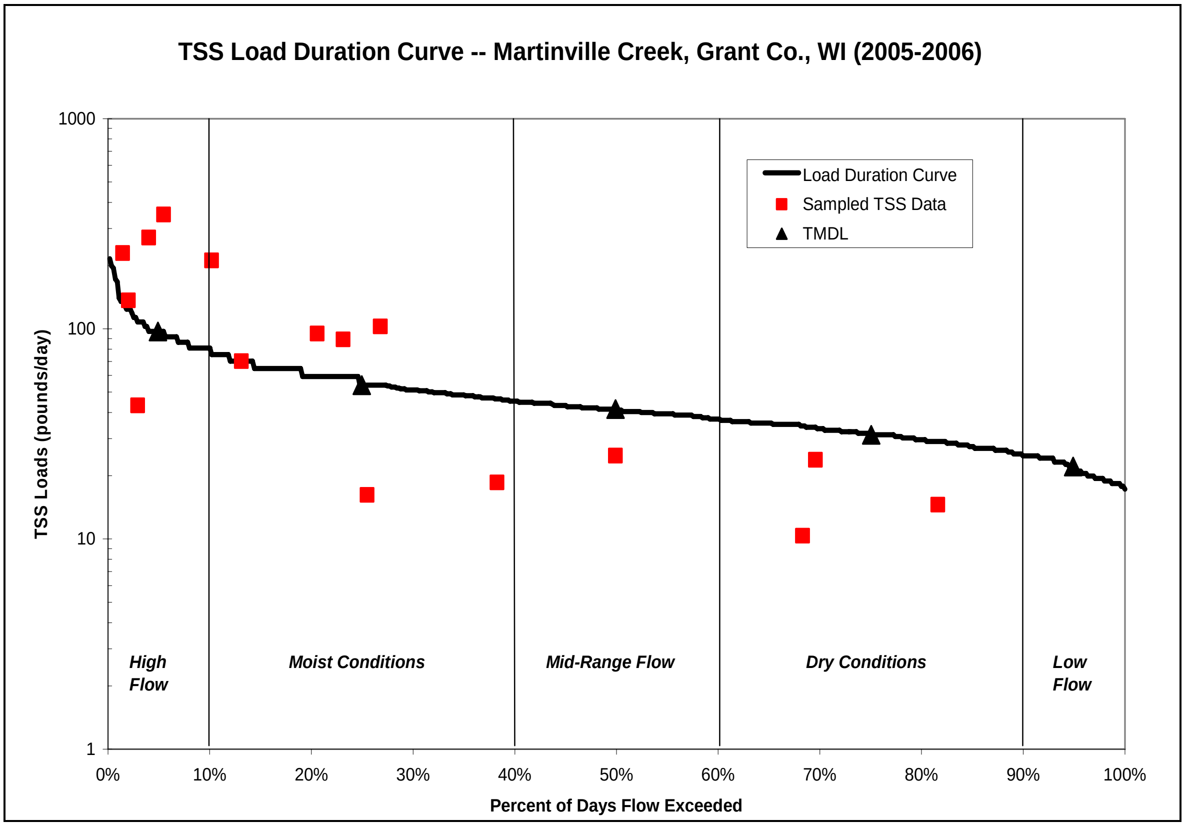
APPENDIX B: Load Duration Curves

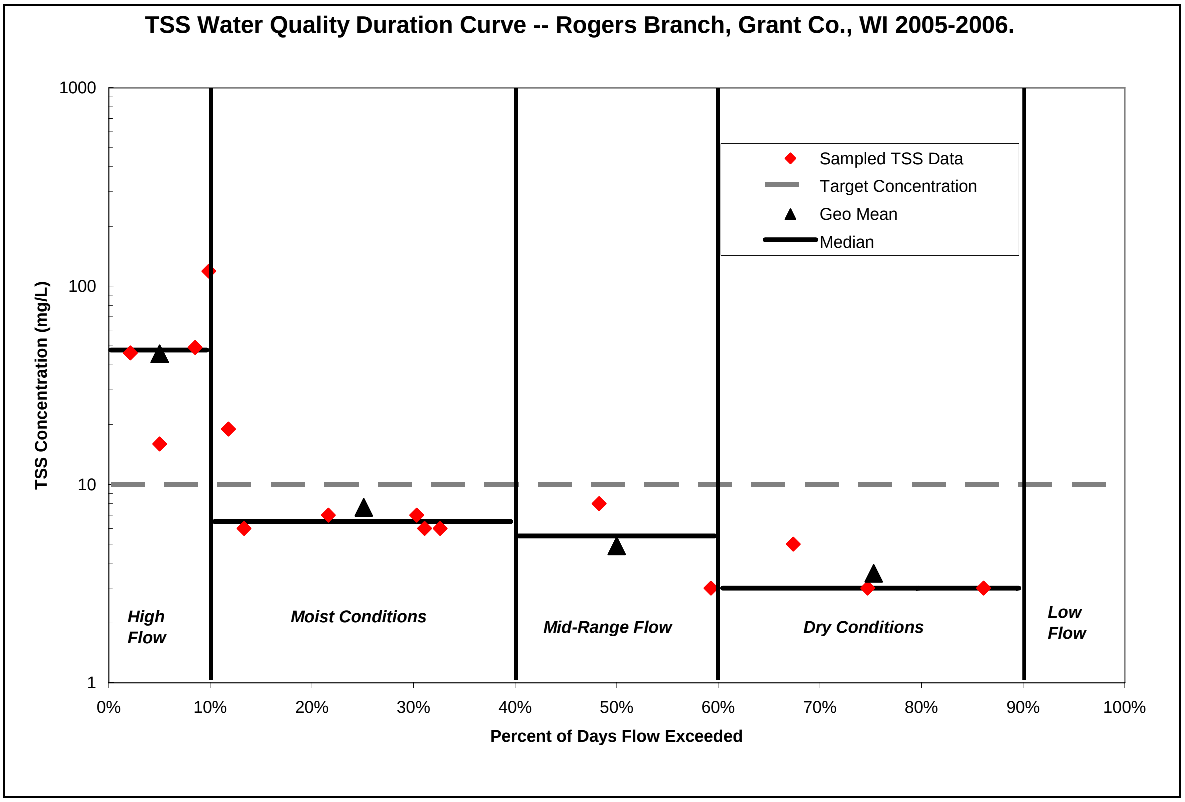
Flow duration curves display the cumulative frequency of the distribution of the daily flow for the period of record. Flow duration curves are transformed into load duration curves by multiplying the flow values along the curve by the respective pollutant water quality target and appropriate conversion factors. The x-axis represents the flow recurrence interval and the y-axis represents the allowable load for the water quality parameter. The measured pollutant loading points that are plotted above the target line on the load duration curve exceed the pollutant water quality target level; those that fall below the line meet the pollutant water quality target. The flow duration interval (%) is derived from a set of average daily flow data, and indicates the percent of days where flow was exceeded (0% indicates the highest flow periods or "flood conditions", and 100% indicates the lowest flow periods or "dry conditions").

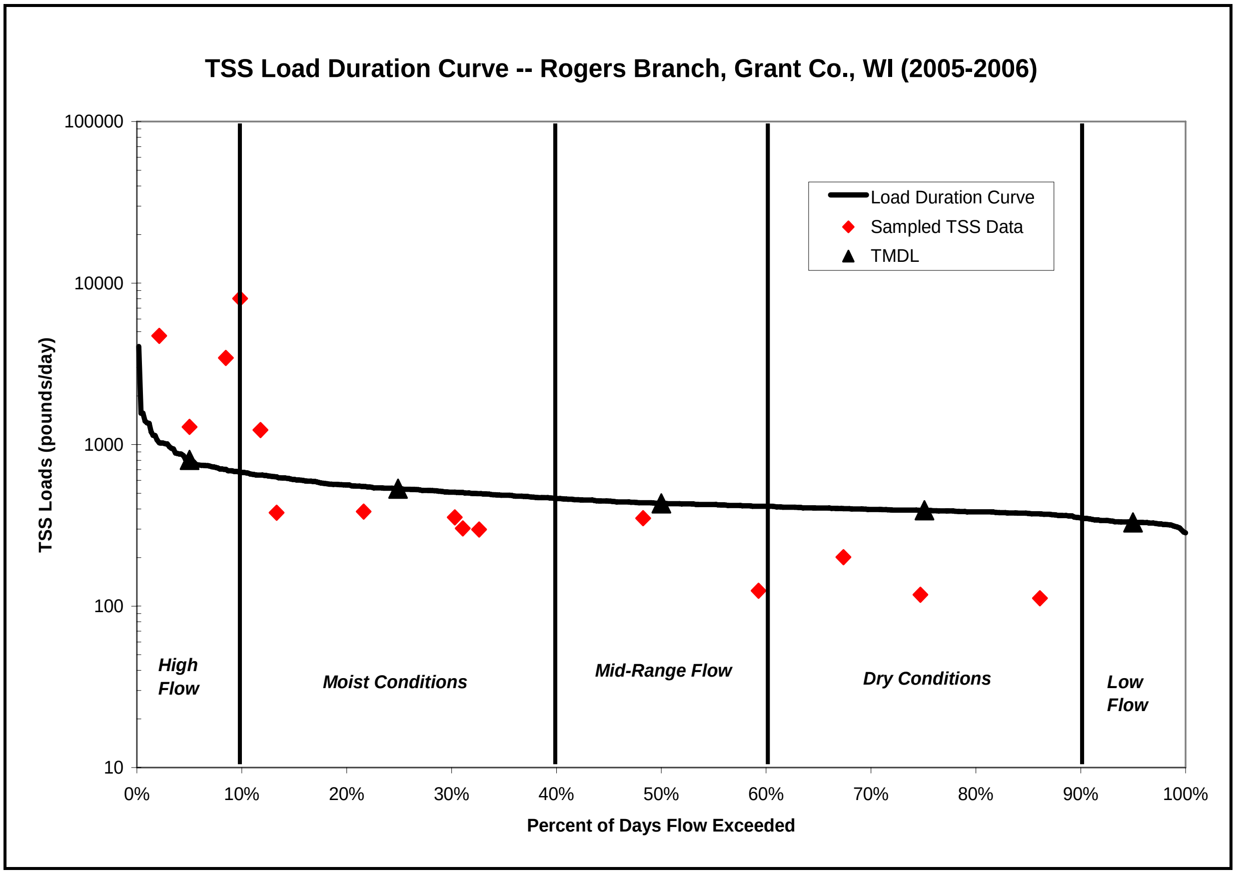


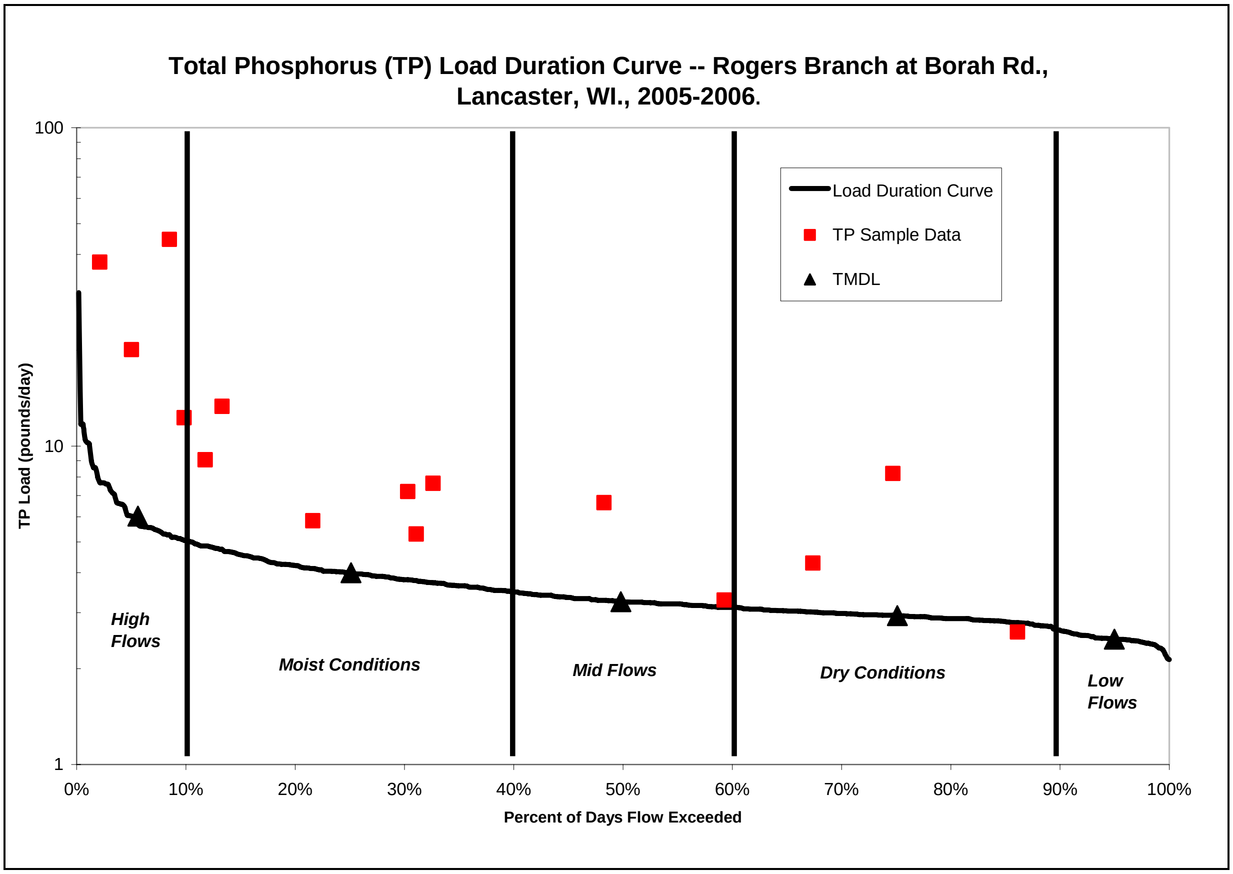

TSS Load Duration Curve -- Martin Branch, Grant Co., WI (2005-2006)
10000
1000
100
10
TSS Load (lbs/day)
Target Load
Sampled TSS Data
TMDL
High
Flow
Moist Conditions
Mid-Range Flow
Dry Conditions
Low
Flow
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Flow Exceeded


TSS Water Quality Duration Curve -- Martinville Creek, Grant Co., WI (2005-2006)
100
10
1
Total Suspended Solids (mg/l)
Sampled TSS Data
Geo Mean
Target Concentration
Median
High
Flow
Moist Conditions
Mid-Range Flow
Dry Conditions
Low
Flow
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Flow Exceedance


TSS Load Duration Curve -- Martinville Creek, Grant Co., WI (2005-2006)
TSS Loads (pounds/day)
1000
100
10
1
Load Duration Curve
Sampled TSS Data
TMDL
High Flow
Moist Conditions
Mid-Range Flow
Dry Conditions
Low Flow
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Flow Exceeded


TSS Water Quality Duration Curve -- Rogers Branch, Grant Co., WI 2005-2006.
TSS Concentration (mg/L)
1000
100
10
1
Sampled TSS Data
Target Concentration
Geo Mean
Median
High Flow
Moist Conditions
Mid-Range Flow
Dry Conditions
Low Flow
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Flow Exceeded


TSS Load Duration Curve -- Rogers Branch, Grant Co., WI (2005-2006)
TSS Loads (pounds/day)
100000
10000
1000
100
10
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Flow Exceeded
Load Duration Curve
Sampled TSS Data
TMDL
High Flow
Moist Conditions
Mid-Range Flow
Dry Conditions
Low Flow


Total Phosphorus (TP) Load Duration Curve -- Rogers Branch at Borah Rd., Lancaster, WI., 2005-2006.
TP Load (pounds/day)
100
10
1
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Days Flow Exceeded
Load Duration Curve
TP Sample Data
TMDL
High Flows
Moist Conditions
Mid Flows
Dry Conditions
Low Flows

APPENDIX C: EPA Comments

The WDNR provided EPA with a copy of the draft TMDL in late July 2007. On August 7, 2007 EPA provided comments to the WDNR regarding the Martin Branch, Martinville Creek, and Rogers Branch TMDL. Below are the comments EPA provided and a short description of how those comments were incorporated in the draft TMDL report.

Comments on the Martin Branch et al TMDL
Dave Werbach   8/3/07

1. **Page 3: Delete "coldwater" in "In addition, Martin Branch, Martinville Creek, and Rogers Branch are not meeting their codified uses as coldwater fisheries." Martinville Creek appears to be codified for WWSF**.

    - *WDNR incorporated this suggested change where appropriate.*

2. **Page 4: Table 3 is covering up part of the footnote at the bottom of the page. Also, is the WDNR habitat survey online? If not could I get a copy? I don't need it for the TMDL *per se*, but would like to add it to my library.**

    - *The formatting change was made to Table 3.*
    - *Copies of WDNR habitat survey were provided to Dave Werbach in mid-August, 2007.*

3. **Page 5, Rogers Branch: The 303d list shows DO is an impairment in this waterbody. Is it sill an issue? This could help link phosphorus to any impairments of the biotic community.**

    - *Language was added on page 11 that discusses DO monitoring in Rogers Branch.*

4. **Page 7-8: Good discussion of impacts TP and TSS have of the fish community. May want to add a final sentence to the TP section on how this impacts the fish – lowers the water quality, shift from specialist feeders (sportsfish, trout) to generalist/omnivores (forage fish)(sorry, not a biologist, inset correct terms here.)**

    - *Language was added to page 13 that discusses how TP can influence dissolved oxygen levels and the impact low dissolved oxygen has on fish and macroinvertebrates.*

5. **Page 8: A short description of how this TMDL for sediment was developed is needed. It should explain what process was chosen**

(load duration curve), why it was chosen, what data was used to develop it (where the flow data came from, where the sample data came from), and a brief summary of how to interpret it. I will look for a good example to send. There is a summary on page 22 that is a good start, but more info is needed in the TMDL.

- *A section titled "TMDL Modeling" was added on page 13 discuss how the TMDL was developed.*

6. **Page 9: Good inclusion of these bullets. I will likely pass this on to other states as an example.**

7. **Page 10, Total Load Capacity: More information is needed on the 10 mg/l target. We need to tie it better to the WQS/designated use more closely (e.g, that meeting 10 mg/l will ensure the fish community/designated use is met).**

   - *Language was added in the Total Load Capacity section on page 16 describing the relationship between reducing the TSS concentration to 10 mg/L and the resulting expected response from the stream.*

8. **Page 12, Seasonality: This is actually a good description of critical condition. Critical condition is defined as "Determinations of TMDLs shall take into account critical conditions for stream flow, loading, and water quality parameters." 40 130.7 (c)(1). This section explains the difference between loadings (during storms and run-off events), and water quality parameters (sediment impacts are year-round). The TP discussion is even more on critical condition. Suggest you change the heading to "Critical Condition", and add a section on Seasonality, stating that Seasonality is accounted for in the LDC process, where 2 years of flow data and sampling data account for variations in flow over the year.**

   - *Changes were made to these sections on pages 17 and 18 as suggested to better represent critical condition and seasonality.*