

Sediment TMDL for Jug Creek in Vernon County, Wisconsin

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Introduction

Jug Creek, a 3.6 miles long stream located in Vernon County is listed as impaired on the 1998 Wisconsin 303(d). Jug Creek is located in the driftless area of southwestern Wisconsin about 25 miles east of the Mississippi. Jug Creek flows in a westerly direction and spills into the Kickapoo River inside the Army Corps of Engineers land just south of the village of Rockton. It has a high gradient of 71 feet per mile. Land use in the 5.2 square mile Jug Creek Watershed is 27% agricultural, 62% woodland, and 11% grassland, roads, quarries, and wetland. The agricultural land is located either along the stream or on ridge tops; typical of the “two-story” farming in the coulee area. Jug Creek was listed as a medium priority for TMDL development.

Jug Creek is specifically listed as impaired due to the lack of trout or other sport fish in the stream. Minnows and other species dominate the fish community in Jug Creek. The 1990 fish survey found 14 species of minnow and other forage species, but the species are generally “pollution tolerant” species. The temperatures of the stream are adequate to support a coldwater fishery. Based on the Hilsenhoff Biotic Index (HBI) of 4.28 – indicating “slight organic pollution” – dissolved oxygen is unlikely to be a concern. Water clarity is good.

The stream habitat is rated as “good”. The stream bottom is generally coarse or fine gravel with some sand. Near the mouth of Jug Creek the stream bottom is 40% silt. However, at a mid-stream location, only 10% of the stream bottom is covered with silt. The runs and riffle are clean of silt and one pool shows about 0.1 feet of deposited sediment. The typical embeddedness is less than 5%. There is no aquatic vegetation and instream cover is generally scarce and limited to non-woody debris. However, the overall stream habitat shows a tendency to be unstable. This situation compares very closely to the habitat of Reads Creek a similarly sized class I trout stream tributary to the Kickapoo River north of Jug Creek. Reads Creek, however, has more in-stream cover.

Given the high gradient coupled with the unstable habitat and scarce in-stream woody cover, it appears the lack of sport fish is due to the very “flashy” conditions of the stream. This is likely to include coarse-grained sediment that is carried (flushed) through the stream during runoff events. At a minimum, the coarse-grained sediment is adding to the instability of the stream banks and may effect the fishery directly. These coarse-grained sediments cause abrasion of the fish gills and other physical and biological impacts, forcing fish to move from Jug Creek. Control of these coarse-grained sediments should result in the return of trout to Jug Creek. Thus, the critical condition for the stream is runoff events and not related to any particular season of the year.

For more information on the topography, soils and geology of Jug Creek’s watershed please see Chapter 2 of the **Nonpoint Source Control Plan for the Middle Kickapoo Priority Watershed Project**.

Water Quality Standards

Jug Creek was placed on the 303(d) list due to not meeting its potential use as a coldwater fishery. The current use classification of Jug Creek is Warm Water Forage Fishery (WWFF), but the potential use is a Cold Water Community. The specific potential use of the stream has not been codified. The portion of Wisconsin’s water quality standards relating to the applicable potential use is as follows:

- NR 102.04 (3) intro and (a), Wis. Adm. Code:

(3) 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 the 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 other aquatic life, or serving as a spawning area for cold water fish species. This subcategory includes, but is not restricted to, surface waters identified as trout water by the department of natural resources (Wisconsin Trout Streams, publication 6-3600 (80)).

Table 1 below summarizes the description of all fish and aquatic life designated uses contained in s. NR 102.04(3), Wisconsin Administrative Code.

Table 1. Definitions of use classifications

Definitions of use classifications: (from s. NR 102.04(3), Wis. Adm. Code)
<p>Cold: Cold Water Communities; capable of supporting a community of cold water fish and other aquatic life. This classification includes all the streams referenced in <i>Wisconsin Trout Streams</i>.</p> <p>Class I: high-quality streams where populations are sustained by natural reproduction.</p> <p>Class II: streams with some natural reproduction but need stocking to maintain a desirable fishery.</p> <p>Class III: streams that sustain no natural reproduction and require annual stocking of legal-size fish for sport fishing.</p>
<p>WWSF: Warm Water Sport Fish Communities; capable of supporting a community of warm water sport fish or of serving as a spawning area for warm water sport fish.</p>
<p>WWFF: Warm Water Forage Fish Communities; capable of supporting an abundant diverse community of forage fish and other aquatic life.</p>
<p>LFF: Limited Forage Fish Communities; are communities capable of supporting only a limited community of forage fish and aquatic life.</p>

LAL: Limited Aquatic Life; capable of supporting only a limited community of aquatic life.

The applicable water quality standards criterion is as follows:

- NR 102.04 (1) intro and (a), Wis. Adm. Code.

"(1) GENERAL. 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 the mixing zone and the effluent channel 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 body of water, shall not be present in such amounts as to interfere with public rights in waters of the state."

Existing Sediment Loads

As stated above, the impairment in Jug Creek is one related to sediment; most likely carried through the stream during runoff events. It is likely that the coarse-grained sediment coupled with the high velocity of the stream during runoff events is causing the bank instability. Other nearby streams that support trout undoubtedly experience similar stream velocities, but may lack the abundance of coarse-grained sediment carried in the stream during runoff events. Therefore, stream velocity alone is unlikely to cause the impairment. Coarse-grained sediment is likely to come from eroding stream banks, from active gullies and from eroding cropped fields. The information below is for all sediment – regardless of grain size.

Upland erosion, primarily from eroding crop fields, accounts for 58% of the sediment reaching Jug Creek. Gully erosion accounts for the remaining 35% of sediment reaching Jug Creek. Most of the gullies occur in small drainage areas at the breaks of the ridges before the terrain turns to steep wooded hillsides. Stream bank erosion is very minor in the Jug Creek subwatershed, accounting for only 7% of the sedimentation. Only small sections of the creek are pastured.

The estimated sediment loads to Jug Creek are shown in Tables 2 and 3.

Table 2. Average Annual Sediment Loading Reaching Jug Creek (in tons/year) by source in Jug Creek. Source: Nonpoint Source Control Plan for the Middle Kickapoo Priority Watershed Project (1).

Upland erosion and sediment delivery was determined using the Wisconsin Nonpoint Source (WIN) Model (Baun & Snowden, 1987). EPA Region 5 has a user manual and other information on this model on file.

Stream bank erosion was determined using the NRCS volumetric approach (height,width and estimated rate of recession multiplied by the density of the soil).

Source	Sediment Load (tons/year)	Percent
Uplands	769	58%
Gullies	460	35%

Streambanks	97	7%
Total	1326	100%

Table 3. Sources of Upland Sediment Loading Reaching Jug Creek (in tons/year) in Jug Creek.

Source: Nonpoint Source Control Plan for the Middle Kickapoo Priority Watershed Project (1). Upland erosion and sediment delivery was determined using the Wisconsin Nonpoint Source (WIN) Model (Baun & Snowden, 1987).

Source	Sediment Load (tons/year)	Percent
Cropland	706	92%
Development	22	3%
Pasture	22	3%
Ungrazed Woodlot	10	1.3%
Woodlot Grazed	6	0.8%
Grassland	3	0.4%
Wetlands	0	0%
Total	769	100%

Total Load Capacity, Waste Load Allocation & Load Allocations

The objective of the Jug Creek TMDL is to improve conditions sufficient to upgrade the creek from a Warm Water Forage Fishery to a coldwater trout fishery. The measurable goal for this TMDL for Jug Creek is to achieve a coldwater fishery, as measured through fishery species and population metrics.

Total Load Capacity: Based on review of all the information and professional judgment of Department water quality staff, a total load capacity for sediment in Jug Creek of an average annual 575 tons per year has been determined. This represents a 57% reduction in average annual load and is consistent with load reductions and loading capacities called for in other streams in the same part of the state. Given that the runs and riffles are clear of sediment and many of the other nearby streams have higher amounts of silt on the bed the total load capacity may be conservative. The Department intends to monitor the stream and evaluate whether the load reductions are being achieved and whether the stream is responding as anticipated. If additional reduction is needed, the intent of the Department is to revise this TMDL and assign a lower load capacity. If the expected results are achieved with a lower sediment load reduction, the Department intends to pursue either “delisting” of Jug Creek and the need for the TMDL will be eliminated or revise this TMDL to assign a more appropriate total load capacity. The BMPs are designed to be particularly effective in addressing the critical high flow events?

Waste Load Allocation: There are no point sources that discharge Jug Creek and none that can be anticipated in the future. Therefore the waste load allocation is zero.

Load Allocation: Since there is no wasteload allocation, the load allocation equals the total load capacity – assuming the margin of safety is implicit. As shown in Table 4, the load allocation corresponds to a 57% reduction.

Table 4. Load Allocation for sediment from upland sources and streambank erosion for Jug Creek (Average Tons/Year).

Upland erosion and sediment delivery was determined using the Wisconsin Nonpoint Source (WIN) Model (Baun & Snowden, 1987). Details are on page A-5 of the Nonpoint Source Control Plan (1).

Source of Sediment	Prior Load	% Reduction BMP Installation	Reduced Load	Remaining Load	Load Allocation
Upland sources (cropland and other uplands)	769	55%	423	346	
Eroding stream banks	97	54%	52	45	
Eroding gullies	460	60%	276	184	
Total	1326	57%	751	575	575

Margin of Safety

A margin of safety is provided two ways. First, as explained under the total load capacity heading above the total load capacity may be conservative; building in a margin of safety. The second way is through implementation of additional best management practices in the watershed. For example, implementation of the Conservation Reserve Enhancement Program (CREP) in this watershed should result in establishment of riparian vegetative buffers, resulting in a greater control of sediment. The CREP program, which has been extended through 2007, uses financial incentives to encourage farmers to remove highly erodible cropland and wetlands from production in exchange for annual rental payments. About 27% of the watershed is in agricultural use. However, much of the agricultural land is along Jug Creek. Enrolling land in CREP should help stabilize the stream banks. And riparian buffers should provide 50 to 75% control of sediment carried in overland flow through the buffers.

Seasonal Variation

There is no seasonal variation in the sedimentation of Jug Creek. Sedimentation occurs primarily due to runoff during rainfall and snowmelt events, which occur throughout the year. The amount of sediment entering the streams increases during spring runoff and intense summer rainstorms. Over time, it appears that the net result has been a build-up of sediment in the pools. Much of the sediment tends to stay in the pools until major flood events occur and scour the pools. This is more of an episodic occurrence rather than a seasonal occurrence.

Reasonable Assurance

There are no point sources in the watershed. As such, the specific requirement to demonstrate “reasonable assurance” of nonpoint source load allocations is not entirely applicable. However, in the spirit of demonstrating implementation of the TMDLs, the following information is provided:

Wisconsin's section 319 Management Plan (approved by the EPA in 2000) describes the variety of financial, technical and educational programs in the state. In addition, it describes the "back-up" enforcement authorities for nonpoint source management in Wisconsin. The primary state program described in the 319 Management Plan is the Wisconsin Nonpoint Source Water Pollution Abatement Program (Section 281.65 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code). Implementation of these TMDLs is provided through implementation of Wisconsin's Nonpoint Source Water Pollution Abatement Program.

Specific to these TMDLs, these streams are part of a larger priority watershed project, The Middle Kickapoo Priority Watershed Project. The Middle Kickapoo Priority Watershed Plan was prepared through the cooperative efforts of the Wisconsin Department of Natural Resources, the Monroe, Richland and Vernon County Land Conservation Departments (LCD), the Middle Kickapoo River Watershed Citizens Advisory Committee and the Department of Agriculture, Trade and Consumer Protection (DATCP). The goal of the project is to reduce the amount of pollutants from nonpoint sources that reach surface water and groundwater within the watershed. Designation of this watershed as a "priority watershed" project enables special financial support to local governments and private landowners in the watershed to reduce nonpoint source pollution. The watershed plan will be used as a guide to implement measures to achieve desired water quality conditions. Signed cost-share agreements list the practices, costs, cost-share amounts and a schedule to install BMPs.

The DNR and DATCP review the progress of the counties and other implementing units of government, and provide assistance throughout the ten-year project. As part of a financing plan for the Priority Watershed and Priority Lake projects, long-term state cost sharing and local staff funding is committed to the Middle Kickapoo Priority Watershed Project. The watershed project is scheduled for completion in 2004. However, enforcement of nonpoint source performance standards will continue beyond that date.

Public Participation

Consistent with the Wisconsin DNR Continuing Planning Process and as required by Sections NR 120.08, Watershed Plans, and NR 121.07(1), Water Quality Management Plans, there was public participation on the Middle Kickapoo Priority watershed Project Plan. There were public meetings in the developmental stage of the plan and a public hearing was held on the Middle Kickapoo Priority Watershed Project Plan August 29, 1991. Public comments were incorporated into the final plan. Since the load allocation in this TMDL is consistent with the Middle Kickapoo Priority Watershed Plan the Department believes the public participation process used for the priority watershed project meets the intent of public participation requirements for a TMDL.

Final

Monitoring Plan

The Department of Natural Resources intends to re-monitor Jug Creek in 2004, if staff time and resources allow. If not, the monitoring will be re-scheduled for 2005. A series of baseline metrics will be using, including collecting fish population data, determining the Index of Biological Integrity (IBI) for a cold water fishery assessing the habitat using the Habitat Suitability Index.

Sources/Attachments

(1) Nonpoint Source Control Plan for the Middle Kickapoo Priority Watershed Project