Cottonwood River Fecal Coliform

Total Maximum Daily Load

Report

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For Submission to:

U.S. Environmental Protection Agency
Region 5
Chicago, Illinois

Submitted by:

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Location	The Cottonwood River Watershed is located in Southwestern Minnesota and is a tributary to the Minnesota River Basin. The Cottonwood River originates in Lyon County and flows to the East through Redwood County before entering the Minnesota River in Brown County. Tributaries to the Cottonwood River flow in from Murray and Cottonwood counties.	9, 10
303(d) Listing Information	The MPCA's projected schedule for TMDL completions, as indicated on Minnesota's 303(d) impaired waters list, implicitly reflects Minnesota's priority ranking of this TMDL. The project is scheduled to begin in 2009 and be completed in 2012. All listings are for Fecal Coliform impairment and include; Cottonwood River from JD30 to the Minnesota River (listed 1994), Cottonwood River from Coal Mine Creek to Sleepy Eye Creek (2006), Sleepy Eye Creek from headwaters to Cottonwood River (2006), Cottonwood River from Plum Creek to Dutch Charley Creek (2006), Dutch Charley Creek from Highwater Creek to Cottonwood River (2006), Plum Creek from headwaters to Cottonwood River (2006), Lone Tree Creek from T109 R39W S7, westline to Cottonwood River and Meadow Creek from headwaters to Cottonwood River (not listed, but data indicates impairment)	4, 5

Impairment / TMDL Pollutant(s) of Concern	Impaired for Aquatic Recreation by Fecal Coliform	5, 6
Impaired Beneficial Use(s)	The applicable water body classifications and water quality standards are specified in Minnesota Rules Chapter 7050. Minnesota Rules Chapter 7050.0407 lists water body classifications and Chapter 7050.2222 subp. 5 lists applicable water quality standards for the impaired reaches for Aquatic Recreation.	5, 16
Applicable Water Quality Standards/ Numeric Targets	Minnesota Rules Chapter 7050 provides the water quality standards for Minnesota waters. The rules are as follows for Class 2B surface waters for fecal coliform bacteria: The quality of Class 2B surface waters shall be such as to permit the propagation and maintenance of a healthy community of cool or warm water sport or commercial fish and associated aquatic life, and their habitats. These waters shall be suitable for aquatic recreation of all kinds, including bathing, for which the waters may be usable. Fecal coliform organism not to exceed 200 organisms per 100 milliliters as a geometric mean of not less than five samples in any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 2000 organisms per 100 milliliters. The standard applies only between April 1 and October 31.	5,6, 17, 18,
Loading Capacity (expressed as daily load)	Flow regimes were determined for high, moist, mid-range, dry and low flow conditions. The mid-range flow value for each flow regime was then used to calculate the total monthly loading capacity (TMLC). Thus, for the "high flow" regime, the loading capacity is based on the monthly flow value at the 5th percentile. The flow used to determine daily loading capacity for each flow regime was multiplied by a conversion factor of 4,892,279,040. Fecal coliform TMDLs are expressed in both monthly and maximum daily terms. This is to ensure that both the monthly geometric mean and upper tenth percentile portions of the water quality standard are addressed. All maximum daily loading capacity and allocation values are set at a third the monthly loading capacity. In conceptual terms, three days of bacteria loads that approach the maximum daily capacities will "use up" most of the monthly capacity. A greater percentage of days would be considered dry; however the majority of bacterial loading to streams occurs during wet conditions.	39, 40

Wasteload Allocation Fecal Coliform Cottonwood River: JD30 to Minnesota River (07020008-501)				49, 50
	Source	**Permit #**	**Individual WLA***	
	CAFOs			
	Gilland Feedlot Inc.	127-50088	0	
	Mark Schwartz Farm	015-50008	0	
	Tim Schieffert Farm	015-50002	0	
	Mark Schwartz Farm	015-82452	0	
	Tim Schieffert Farm	015-71684	0	
		Total =		
	Source	**Permit #**	**Individual WLA***	
	MS4			
	New Ulm	MS400228	Flow Dependant	
		Total =	See Page 47	
	Source	**Permit #**	**Individual WLA***	
	WWTF			
	Sleepy Eye	MNG580041	5.3	
		Total =	5.3	
	Source	**Permit #**	**Individual WLA***	
	Straight-Pipe-Septics			
	Illegal Discharges	N/A	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Reserve Capacity			
	N/A	N/A	N/A	
		Total =	0	
Wasteload Allocation Fecal Coliform Cottonwood River: Coal Mine Creek to Sleepy Eye Creek (07020008-508)	**Source**	**Permit #**	**Individual WLA***	53, 54
	CAFOs			
	Sandy Rivers Hutterian Brethren	127-65964	0	
	Cory Huiras	015-50005	0	
	Four Seasons Dairy	015-95051	0	
	Schwartz Brothers Farm	015-71727	0	
	Glen Graff Farm	033-50011	0	
	Dry Creek Ranch	033-98098	0	
		Total =	0	
	Source	**Permit #**	**Individual**	

			WLA*	
	MS4			
	N/A	N/A	N/A	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	WWTF			
	Sanborn	MN0024805	0.424	
	Springfield	MN0024953	5.905	
		Total =	6.329	
	Source	**Permit #**	**Individual WLA***	
	Straight-Pipe-Septics			
	Illegal Discharges	N/A	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Reserve Capacity			
	N/A	N/A	N/A	
		Total =	0	
Wasteload Allocation Fecal Coliform Sleepy Eye Creek: Headwaters to Cottonwood River Fecal Coliform 07020008-512	**Source**	**Permit #**	**Individual WLA***	57, 58
	CAFOs			
	Andrew Schiller Farm	127-50051	0	
	Brian Timm Farm	127-50091	0	
	Kodet Farms	127-50042	0	
	Paul Meidl Farm	127-50047	0	
	Kurt Kratz Farm	015-82460	0	
	Lindeman & Wells Inc.	015-50013	0	
	Lindeman & Wells Inc.	015-72338	0	
	Richard Trebesch Farm	015-50009	0	
	Richard Trebesch Farm	015-71783	0	
	Scott Helget Farm	015-71726	0	
	Tom Anderson Farm	015-60703	0	
	Trent Moe	015-71671	0	
	Tom Anderson Farm	015-71688	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	MS4			

	N/A	N/A	N/A	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	WWTF			
	Clements	MN0023043	0.189	
	Lucan	MN0031348	0.212	
	Wabasso	MN0025151	0.852	
	Wanda	MN0020524	0.126	
		Total =	1.379	
	Source	**Permit #**	**Individual WLA***	
	Straight-Pipe-Septics			
	Illegal Discharges	N/A	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Reserve Capacity			
	N/A	N/A	N/A	
		Total =	0	
Wasteload Allocation Fecal Coliform Cottonwood River: Plum Creek to Dutch Charley Creek 07020008-504	**Source**	**Permit #**	**Individual WLA***	61, 62
	CAFOs			
	Randy Tholen Farm	083-80220	0	
	Ronald Scott Farm	083-50029	0	
	Sanmarbo Farms Inc.	083-50003	0	
	Gregory Lanoue Farm	083-50002	0	
	Richard Vroman Farm	083-50030	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	MS4			
	N/A	N/A	N/A	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	WWTF			
	Balaton	MN0020559	0.93	
	Garvin	MNG580101	1.63	
	Revere	MNG580114	0.14	
	Walnut Grove	MN0021776	1.51	
		Total =	4.21	
	Source	**Permit #**	**Individual WLA***	

	Straight-Pipe-Septics			
	Illegal Discharges	N/A	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Reserve Capacity			
	N/A	N/A	N/A	
		Total =	0	
Wasteload Allocation Fecal Coliform Dutch Charley Creek: Highwater Creek to Cottonwood River 07020008-517	**Source**	**Permit #**	**Individual WLA***	65, 66
	CAFOs			
	Reid Miller Farm	033-50001	0	
	Fox Feedlot Inc.	033-60187	0	
	W S Feeders Inc.	033-97997	0	
	Great Plains Family Farms Inc.	101-50005	0	
	Shetek 5 & 6 Farm	101-88989	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	MS4			
	N/A	N/A	N/A	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	WWTF			
	Lamberton	MN0023922	1.514	
	Storden	MN0052248	0.397	
	Westbrook	MN0025232	1.136	
		Total =	3.047	
	Source	**Permit #**	**Individual WLA***	
	Straight-Pipe-Septics			
	Illegal Discharges	N/A	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Reserve Capacity			
	N/A	N/A	N/A	
		Total =	0	
Wasteload Allocation Fecal Coliform	**Source**	**Permit #**	**Individual WLA***	69, 70
	CAFOs			
	Port Transitions Inc.	083-50007	0	

Plum Creek: Headwaters to Cottonwood River 07020008-516		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	MS4			
	N/A	N/A	N/A	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	WWTF			
	N/A	N/A	N/A	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Straight-Pipe-Septics			
	Illegal Discharges	N/A	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Reserve Capacity			
	N/A	N/A	N/A	
		Total =	0	
Wasteload Allocation Fecal Coliform Lone Tree Creek: T109 R39W S7, westline to Cottonwood River 07020008-524	**Source**	**Permit #**	**Individual WLA***	73, 74
	CAFOs			
	Generation Pork Inc.	127-50063	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	MS4			
	N/A	N/A	N/A	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	WWTF			
	Tracy	MN0049654	2.271	
		Total =	2.271	
	Source	**Permit #**	**Individual WLA***	
	Straight-Pipe-Septics			
	Illegal Discharges	N/A	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Reserve Capacity			

	N/A	N/A	N/A	
		Total =	0	
Wasteload Allocation Fecal Coliform Meadow Creek: Headwaters to Cottonwood River 07020008-515	**Source**	**Permit #**	**Individual WLA***	77, 78
	CAFOs			
	Virgil M. Johnson Farm	083-50024	0	
	Donald J. Delanghe Farm 1	083-87103	0	
	Donald J. Delanghe Farm 2	083-87104	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	MS4			
	Marshall	MS400241	Flow Dependent	
		Total =	See Page 78	
	Source	**Permit #**	**Individual WLA***	
	WWTF			
	N/A	N/A	N/A	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Straight-Pipe-Septics			
	Illegal Discharges	N/A	0	
		Total =	0	
	Source	**Permit #**	**Individual WLA***	
	Reserve Capacity			
	N/A	N/A	N/A	
		Total =	0	

Load Allocation Fecal Coliform Cottonwood River: JD30 to Minnesota River (07020008-501)	**Flow Regime**	**Individual LA***	**Page #**
	High	6319.5	50
	Moist	1304.6	
	Mid	524.0	
	Dry	89.9	
	Low		

Load Allocation Fecal Coliform Cottonwood River: Coal Mine Creek to Sleepy Eye Creek (07020008-508)	**Flow Regime**	**Individual LA***	54
	High	4260.0	
	Moist	878.9	
	Mid	352.7	
	Dry	59.9	
	Low		
Load Allocation Fecal Coliform Sleepy Eye Creek: Headwaters to Cottonwood River 07020008-512	**Flow Regime**	**Individual LA***	56
	High	1322.4	
	Moist	275.6	
	Mid	112.7	
	Dry	22.0	
	Low		
Load Allocation Fecal Coliform Cottonwood River: Plum Creek to Dutch Charley Creek 07020008-504	**Flow Regime**	**Individual LA***	62
	High	2163.1	
	Moist	447.5	
	Mid	180.4	
	Dry	31.9	
	Low		
Load Allocation Fecal Coliform Dutch Charley Creek: Highwater Creek to Cottonwood River 07020008-517	**Flow Regime**	**Individual LA***	66
	High	1003.2	
	Moist	207.5	
	Mid	83.8	
	Dry	14.9	
	Low		
Load Allocation Fecal Coliform Plum Creek: Headwaters to Cottonwood River 07020008-516	**Flow Regime**	**Individual LA***	70
	High	430.0	
	Moist	90.0	
	Mid	37.0	
	Dry	7.6	
	Low	0.3	
Load Allocation Fecal Coliform Lone Tree Creek: T109 R39W S7, westline to Cottonwood River 07020008-524	**Flow Regime**	**Individual LA***	74
	High	591.3	
	Moist	121.9	
	Mid	48.9	
	Dry	8.2	
	Low		
Load Allocation Fecal Coliform Meadow Creek: Headwaters to Cottonwood River 07020008-515	**Flow Regime**	**Individual LA***	78
	High	470.5	
	Moist	98.4	
	Mid	40.5	
	Dry	8.3	
	Low	0.3	

Margin of Safety	Because the allocations are a direct function of monthly flow, accounting for potential flow variability is the appropriate way to address the MOS explicitly for the fecal coliform and turbidity impairments. This is done within each of five flow zones. The MOS was determined as the difference between the median flow and minimum flow in each zone.	43, 80
Seasonal Variation	Monitoring data show an apparent relationship between season and fecal coliform bacteria concentrations. Typically the highest bacterial concentrations are found in the summer and early fall. In the spring, concentrations are typically lower, despite the fact that significant manure application occurs during this time and that fields have little crop canopy to protect against water erosion.	80
Reasonable Assurance	The source reduction strategies detailed in the implementation plan section have been shown to be effective in reducing pathogen transport/survival. Many of the goals outlined in this TMDL study run parallel to objectives outlined in the local Water Plans. Various program and funding sources will be used to implement measures that will be detailed in an implementation plan to be completed. Through existing permit programs, fecal coliform impairments are being addressed and monitored. In the future, it can be assumed that this will continue.	87
Monitoring	A detailed monitoring plan will be included in the Implementation Plan to be completed. Currently, there are monitoring efforts in the watershed.	82
Implementation	A summary of potential management measures was included. More detail will be provided in the implementation plan.	82
Public Participation	A group of local state and federal official have been meeting periodically to receive TMDL updates and will be contributing to the development of the implementation plan. There have been news releases and website updates regarding this project.	88
	Public Comment period: April 25-May 25, 2011	

	Meeting location: Redwood Falls	
	Comments received? Yes	

* All WLA and LA values are in billions of organisms per day.

Fecal Coliform Total Maximum Daily Load Assessment Report
Cottonwood River Watershed, Minnesota

Executive Summary

There are currently two impaired uses on the Cottonwood River (HUC-07020008): Aquatic Recreation and Aquatic Life, due to fecal coliform bacteria, turbidity, and impaired biota. The Cottonwood River from Judicial Ditch 30 to Minnesota River was listed in 1994 as impaired for aquatic recreation due to fecal coliform bacteria and impaired for aquatic life due to turbidity in 2002 under Section 303(d) of the Clean Water Act by the Minnesota Pollution Control Agency (MPCA). Sleepy Eye Creek, Dutch Charley Creek, Plum Creek, and two reaches of the Cottonwood River were listed for fecal coliform on the 2006 303(d) list due to ongoing monitoring. There are other impairments due to turbidity and impaired biota but they are not addressed directly by this plan. This Total Maximum Daily Load (TMDL) report (Report) describes the magnitude of the problem and provides direction for improving water quality at the listed reaches, as well as reaches not formally assessed but believed to exhibit similar water quality conditions. This Report evaluates the fecal coliform concentrations and load reductions needed for eight reaches in the Cottonwood River to meet Minnesota's water quality standards.

The Cottonwood River originates near Balaton in southwest Lyon County, Minnesota and flows about 150 miles east to the Minnesota River near New Ulm. The dominant land use in the Cottonwood River Watershed is cultivated agricultural land. The largest cities within the watershed include Tracy, Sleepy Eye, Springfield, and New Ulm. The Cottonwood River watershed is approximately 840,000 acres or 1,313 square miles. The Redwood-Cottonwood Rivers Control Area (RCRCA) monitors the watershed at five sampling stations on a regular basis. The focus of this Report is to better identify fecal coliform bacteria levels, probable sources, and estimate load reduction needs to meet water quality goals for the Cottonwood River. Sub-watershed bacterial loading allocation methods were used to assess the magnitude of point and non-point sources and determine a cause-effect linkage of loading sources and their contributions to stream concentrations. The TMDL was also calculated for spring, summer, and fall conditions.

The majority of water quality monitoring data used in this Report was collected from 1997 to 2006 by MPCA and RCRCA staff. Findings based on these tests results showed that several reaches of the Cottonwood River watershed were impaired due to excess fecal coliform bacteria, as well as other pollutants. Analyses of samples taken through the past ten years suggest that none of the sites were above the impaired status in the spring (through May), but that all sites in June and July were considered impaired. All reaches, apart from PLC001 (STORET# S001-918), were impaired through August and all are technically impaired in September.

The Report describes several contributing sources of fecal coliform bacteria. The identified contributing sources are wastewater treatment facilities, urban and rural area stormwater, unsewered communities, straight pipe septic systems, wildlife, pets, and livestock manure. Livestock manure and untreated human waste appear to be the primary sources of fecal coliform contamination based on source inventory assessments and water quality testing. While there is considerable uncertainty about the actual magnitude of these sources, these are the areas where increased focus would seem to have the most potential for water quality improvements.

Livestock manure represents more than 98% of the fecal matter produced in the watershed. Nearly all manure is either incorporated or surface applied to farm fields. As such, the majority of fecal material that is produced in the basin is land applied manure. Land application of this manure has three potential pathways to reach surface waters; 1) overland runoff, 2) open tile intakes and 3) macropores/preferential flow. The majority of livestock producers in the watersheds are most likely handling their manure and conducting land application consistent with current rules, guidelines, and University recommendations. These practices, however, do not typically result in total containment of manure under all conditions. Even if less than 1% of the land applied manure enters surface waters through one or more of the pathways mentioned, it could account for violations of the bacterial water quality standard.

It is important to note that livestock manure has environmental and economic benefits that must be taken into account and weighed against potential bacteria impacts. Livestock manure reduces commercial fertilizer demand, while adding organic matter to the soil. Soil rich in organic matter is less prone to erosion. There are also significant numbers of beef and dairy cattle in the watersheds. The pasture and hay land supported by these ruminants may result in further soil erosion reduction, particularly if it is located on steeper lands.

Potential sources of fecal coliform contamination during low flows appear to be pastured livestock with access to waterways, wildlife, “straight pipe” septic systems and unsewered communities that discharge untreated sewage directly or through tile drainage to surface waters. There are five unsewered communities and an estimated 761 ”straight pipe” septic systems in the Cottonwood River watershed. Direct discharge of these systems to surface waters during low flow periods can be a major contributor of fecal coliform contamination. The potential sources of fecal colifrom contamination during rain events that produce runoff associated with high flows could be from feedlots with no runoff controls, improper land applied manure, untreated human waste, and stormwater containing wildlife and pet waste.

The document also describes conditions when bacterial concentrations are highest in the Cottonwood River and tributaries. Monitoring data show bacterial concentrations appear to increase as water temperature increases. During both wet and dry periods, it appears that a portion of fecal coliform contamination from human and animal sources may stay in the stream channel sediments as a reservoir. Increases in flow during storm runoff can cause re-suspension of sediments that are high in fecal coliform bacteria. In some situations, exceedances of water quality standards during low flow periods may also partially be attributed to release of fecal coliform bacteria from streambed sediments.

This Report used a flow duration curve approach to determine the fecal coliform loading capacity at the impaired reaches under varying flow regimes. The Report focuses on fecal coliform loading capacity and general allocations necessary to meet water quality standards at individual impaired river or stream reaches, rather than on precise loading reductions that may be required from specific sources.

Fecal coliform loading capacities were calculated for each individual impaired reach, and those capacities are allocated among point sources (wasteload allocation), nonpoint sources (load allocation), and a margin of safety. A loading capacity is the product of stream flow at each impaired reach and the fecal coliform water quality standard. Five flow zones, ranging from low flow to high flow are utilized, so that the entire range of conditions is accounted for in the Report. The loading capacity and allocation vary by impaired reach, and by flow zone for a given reach. A description of the duration curve approach is in Appendix A.

The Report describes the above sources and dynamics in more detail. The Report also describes applicable water quality standards for fecal coliform bacteria, population and source inventories, TMDL allocations, a monitoring plan and suggested implementation strategies.

1.0 Introduction

1.1 Purpose

Section 303(d) of the Clean Water Act (CWA) provides authority for completing Total Maximum Daily Loads (TMDLs) to achieve state water quality standards and/or their designated uses. The TMDL process establishes the allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reductions necessary from both point and nonpoint sources to restore and maintain the quality of their water resources.

A TMDL or Total Maximum Daily Load (TMDL) is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. Section 303(d) of the Clean Water Act (CWA) and its implementing regulations (40 C.F.R. § 130.7) require states to identify waters that do not or will not meet applicable water quality standards and to establish TMDLs for pollutants that are causing non-attainment of water quality standards.

Water quality standards are set by States, Territories, and Tribes. They identify the uses for each water body; for example, drinking water supply, contact recreation (swimming), aquatic life support (fishing), and the scientific criteria to support that use.

A TMDL needs to account for seasonal variation and must include a margin of safety (MOS). The MOS is a safety factor that accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality. Also, a TMDL must specify pollutant load allocations among sources. The total of all allocations, including wasteload allocations (WLA) for point sources, load allocations (LA) for nonpoint sources (including natural background), and the MOS (if explicitly defined) cannot exceed the maximum allowable pollutant load:

TMDL =sum**WLAs +** sum**LAs + MOS + RC***

* The MPCA also requires that “Reserve Capacity” (RC) which is an allocation for future growth be addressed in the TMDL.

A TMDL study identifies all sources of the pollutant and determines how much each source must reduce its contribution in order to meet the quality standard. The sum of all contributions must be less than the maximum daily load.

Sources that are part of the waste load allocation, with the exception of “straight-pipe” septic systems, are largely controlled through National Pollutant Discharge Elimination System (NPDES) permits. Load allocation sources are controlled through a variety of regulatory and non-regulatory efforts at the local, state, and federal level.

The state agency responsible for assessing, listing, and reporting impaired waters is the Minnesota Pollution Control Agency (MPCA). In 1994, the MPCA identified one reach impaired for fecal coliform bacteria in the Cottonwood River watershed. In 2006, the MPCA listed five additional reaches impaired for fecal coliform bacteria. Data shows that two other reaches also meet the impairment thresholds and are included in this report, but they are not yet on the 303(d) list. Table 1.01 summarizes the listings, sites and data collected at each of the impaired reaches.

The MPCA's projected schedule for TMDL completions, as indicated on Minnesota's 303(d) impaired waters list, implicitly reflects Minnesota's priority ranking of this TMDL. The project was scheduled to begin in 2009 and be completed in 2012. Ranking criteria for scheduling TMDL projects include, but are not limited to: impairment impacts on public health and aquatic life; public value of the impaired water resource; likelihood of completing the TMDL in an expedient manner, including a strong base of existing data and restorability of the waterbody; technical capability and willingness, locally, to assist with the TMDL; and appropriate sequencing of TMDLs within a watershed or basin.

Table 1.01: Cottonwood River Watershed Impaired Reaches Descriptions and Assessment Summaries

Reach	Description	Year listed	River Assessment Unit ID	(STORET ID#) Monitoring Stations Used for Assessment	% of data >200 cfu	Years of Data
Cottonwood River	Judicial Ditch 30 to Minnesota R	94	07020008-501	S000-139; S001-918	50%	67-06
Cottonwood River	Coal Mine Cr to Sleepy Eye Cr	06	07020008-508	S001-920	41%	97-06
Sleepy Eye Creek	Headwaters to Cottonwood R	06	07020008-512	S001-919	67%	97-06
Cottonwood River	Plum Cr to Dutch Charley Cr	06	07020008-504	S002-247	62%	00-06
Dutch Charley Creek	Highwater Cr to Cottonwood R	06	07020008-517	S001-915	69%	97-99
Plum Creek	Headwaters to Cottonwood R	06	07020008-516	S001-913	70%	97-06
Lone Tree Creek*	T109 R39W S7, westline to Cottonwood R	Not Listed	07020008-524	S001-914	60%*	97
Meadow Creek	Headwaters to Cottonwood R	Not Listed	07020008-515	S001-917	60%	97

*Uses the Class 7: Limited Resource Value water quality standard of 1,000 cfu/100mL standard

The protocol for this assessment is outlined in MPCA "Listing Methodology" publications found at: http://www.pca.state.mn.us/water/tmdl/index.html#support. The applicable water body classifications and water quality standards are specified in Minnesota Rules Chapter 7050. Minn. R. ch. 7050.0222, subp. 5 lists applicable water quality standards for the impaired reaches and Minn. R. ch. 7050.0407 lists water body classifications. Assessment summary information for the eight reaches is listed in Table 1.01. The assessment protocol includes pooling of data by month over a 10-year period. Five reaches had more than two months with at least five fecal coliform samples that violated the geometric mean water quality standard of 200 colony forming units (cfu) /100ml. In addition, three sites that were sampled less than five times a month, exceeded the 2,000 cfu/100mL standard, and were considered in this report. See section 3.0 - 3.2 Applicable Water Quality Standards and Assessment Procedures for further explanation.

1.2 Project Background

The Cottonwood River Watershed Project (CRWP) was awarded a Clean Water Partnership (CWP) Phase I Diagnostic Study grant by the MPCA in 1997 to begin an intensive study of land use and water quality in the Cottonwood River Watershed. The CRWP was awarded a Phase II Implementation grant from the MPCA in 2000 to carry out the remediation strategies determined in the Phase I CWP. Subsequent grants were carried out to continue the implementation of Best Management Practices (BMPs) outlined in the CRWP Implementation Plan as well as continued monitoring of surface waters in the watershed. Most of the data used in this Report is a result of monitoring efforts through the CRWP.

The diagnostic study focused on monitoring the watershed to determine water quality and determine non-point sediment sources to the Cottonwood River corridor and tributaries to get a better grasp on the sediment delivery to the Minnesota River. The history of bacteria monitoring in the Cottonwood River Watershed began with the diagnostic study. Ten sites were sampled for Fecal Coliform Bacteria in 1997 throughout the Cottonwood River watershed through the sample season (April-September). Sites were sampled at a rate of 6-13 samples for the year. None of these sites were sampled at a frequency that would have listed them at the time but all sites with the exception of the two on Sleepy Eye Creek would have been listed for the acute standard. The quality assurance objective of the diagnostic study was as follows "… all reasonable actions to prevent erroneous data from being produced. In the event that did occur, they were identified and corrected; suspected data were not utilized as a basis for conclusions and subsequent actions."

Fecal coliform bacteria sampling post CWP Phase II by the CRWP was limited to one sample per month between April and September, starting in 2000, and stepped up to include storm events in 2005. Sampling during this period was limited to the five sites; three on the Cottonwood mainstem and one each near the mouth of tributaries Plum Creek and Sleepy Eye Creek. Given the scarcity of bacteria sampling in from the CWP phases in the Cottonwood River watershed, targeted implementation recommendations for bacteria reduction in surface streams were not made at the time. However, subsequent monitoring/sampling and placement of sampled reaches on the federal 303(d) list will allow the project to produce an implementation plan for targeted implementation.

2.0 Watershed Characteristics

2.1 Demographics

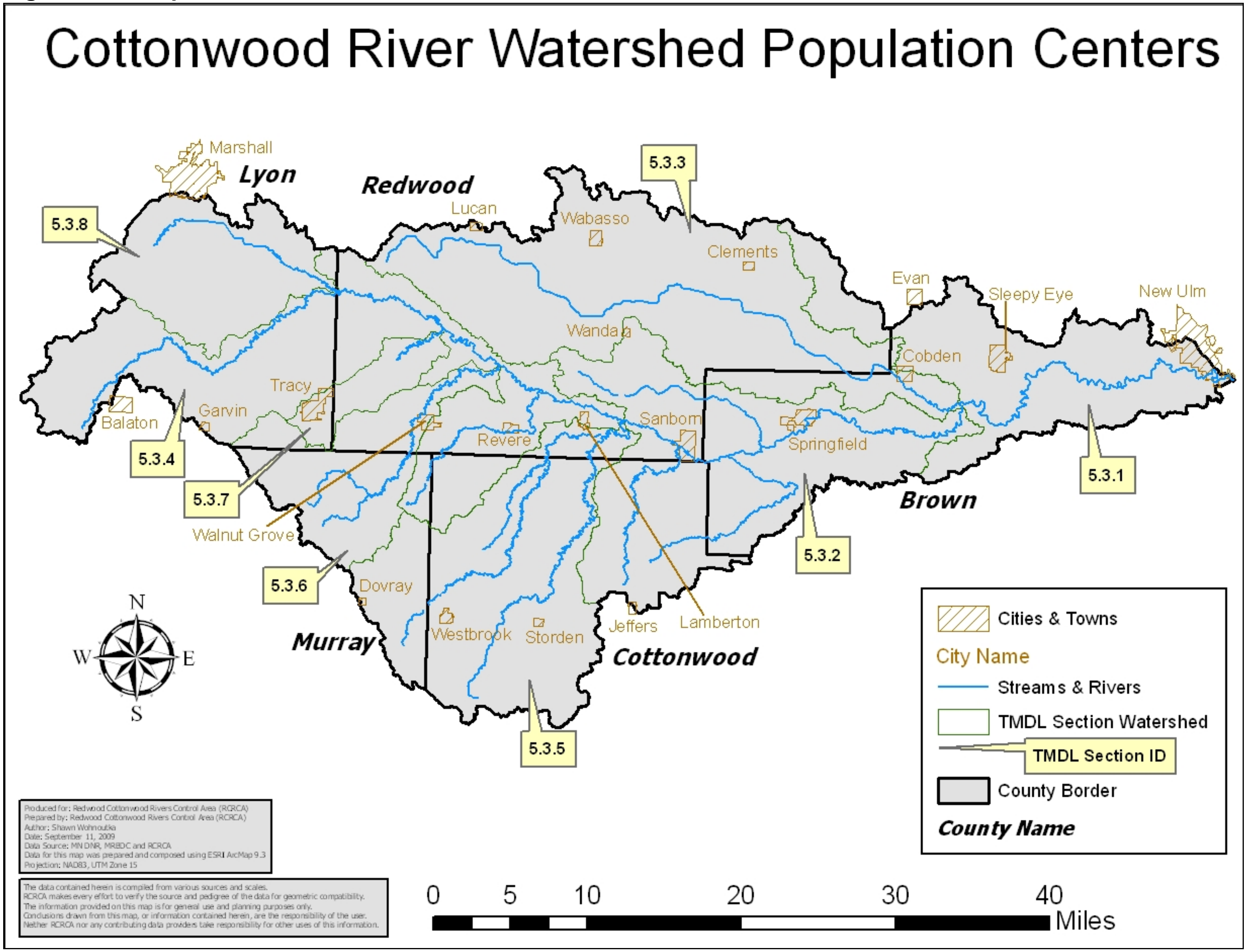
The Cottonwood River is a tributary to the Minnesota River located in southwestern Minnesota in the counties of Brown, Cottonwood, Lyon, Murray, and Redwood. There are fifteen incorporated communities in this watershed including Tracy, Sleepy Eye, Springfield, and New Ulm and there are seven unincorporated communities. Table 2.01 shows the townships and cities located in the watershed in each county.

Table 2.01: Local Units of Government in the Cottonwood River Watershed

County	Township	Cities
Brown	13	5
Murray	6	1
Cottonwood	9	3
Lyon	11	4
Redwood	17	7
Total	**56**	**20**

Southwestern Minnesota is predominantly rural with a relatively dispersed population. About 0.65 percent of the watershed is urban. Urban population for communities and cities with contributing waters to the Cottonwood River watershed is 12,978 according to the 2000 US Census. Portions of the city of New Ulm (est. pop 13,362) as well as a small portion of the city of Marshall (est. pop 12,432) are also in the watershed and affect the Cottonwood River through storm water runoff related to urban land uses and impervious surfaces. Rural population within the Cottonwood River watershed is approximately 10,136 based on number of full time and cluster septic systems reported to MPCA and multiplied by 2.57 persons per household. The total population is approximately 23,114 people. Figure 2.01 shows city locations in the watershed.

Figure 2.01: Population Centers in the Cottonwood River Watershed



2.2 Location and Topography

The watershed area is located roughly north of Latitude 43 57’ 00” and east of Longitude -96 00’ 00” covering an area of 1,313 square miles. The Cottonwood River Watershed is located in Southwestern Minnesota and is a tributary to the Minnesota River Basin. The Cottonwood River originates in Lyon County and flows to the East through Redwood County before entering the Minnesota River in Brown County. Tributaries to the Cottonwood River flow in from Murray and Cottonwood counties. Figure 2.02 shows the watershed location within the state.

The topography of the Cottonwood River watershed is that of a rolling upland area. Altitudes descend from west to east with the Coteau des Prairies serving as a watershed divide. Natural drainage patterns in the area were established by valleys formed from glacial meltwaters during the Pleistocene Epoch. End moraines, which were formed during the recession of the last glacier, are the most prominent features. They formed a series of morainic belts, generally running from north to south or northwest to southeast.

The Cottonwood River drops from an elevation of about 1,650 feet above sea level in southwestern Lyon County to 790 feet at its confluence with the Minnesota River in New Ulm, an average of about 7.5 feet per mile. The river slope varies, a little steeper in the western quarter and relatively gentle through the middle half of the watershed. Through New Ulm and its confluence with the Minnesota River, the river’s slope increases sharply before it levels out into the Minnesota River Valley floor.

The upland plain is characterized by parallel glacial moraines and glacial till superimposed on bedrock. Natural drainage of the plain is relatively poor, and there are many small marshes, ponds, and shallow lakes. Installation of widespread artificial drainage systems, however, has reduced today’s numbers to only a fraction of what once existed.

The lowland plain’s geologic composition is glacial till derived from ground moraines overlying bedrock. The land is gently rolling to flat. Row crop agriculture is the predominant land use which has been aided by use of extensive artificial drainage systems. An elevation map of the Cottonwood River Watershed is shown in Figure 2.03.

2.3 Land Use

The entire Cottonwood River watershed has approximately 88.0 percent (approximately 739,000 acres) of the land in cultivation, 5.8 percent of the land in grassland, 1.1 percent is wetlands or water, and just under 3.0 percent is still wooded. The remainder of the land is farmsteads, gravel pits, rural development, and other land uses. For detailed information by county and of the watershed as a whole, refer to Table 2.02, Table 2.03, and Table 2.04.

Figure 2.02: Location of Cottonwood River Watershed

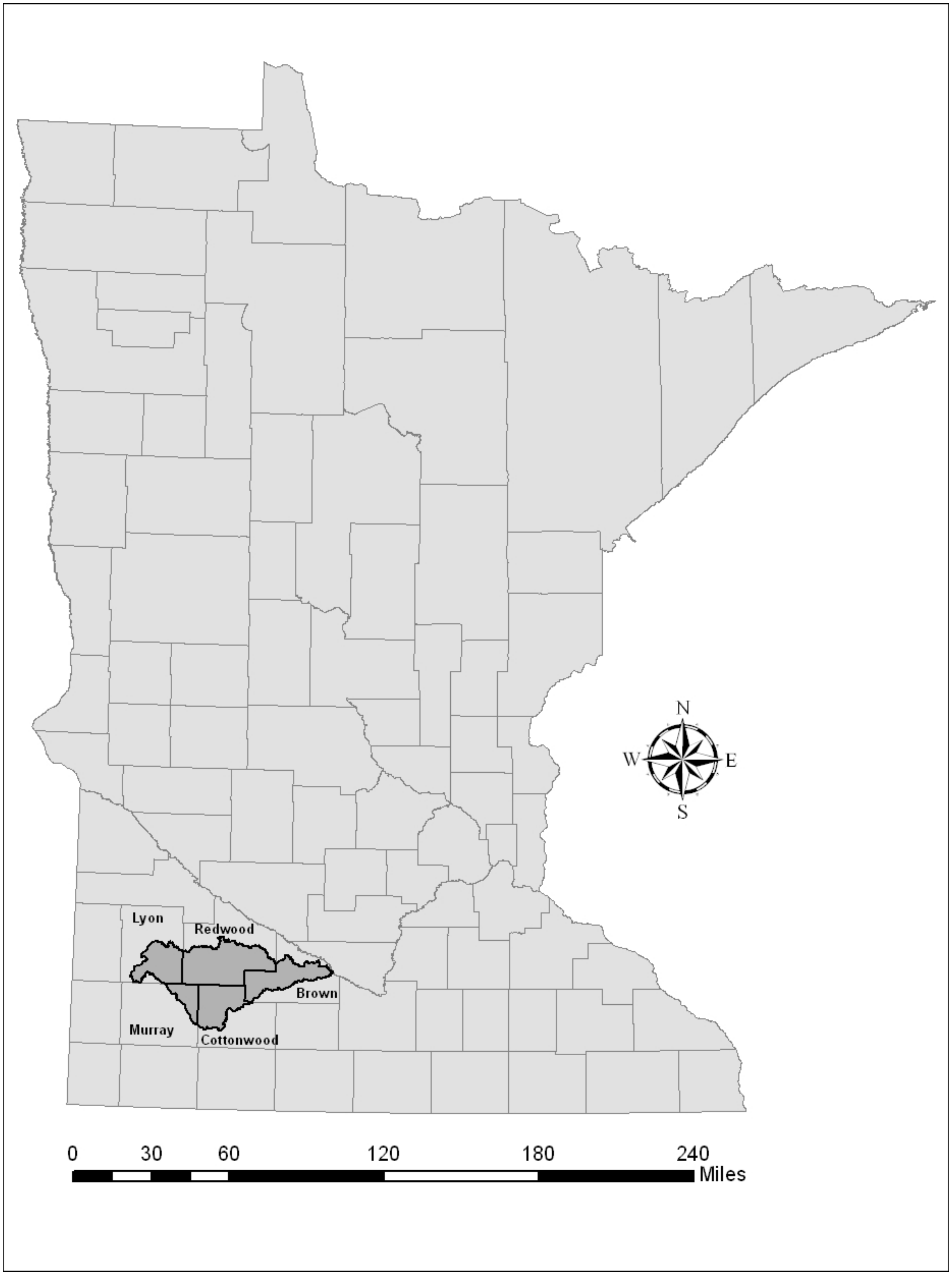

Lyon
Redwood
Brown
Murray
Cottonwood
N
W
E
S
0
30
60
120
180
240
Miles

Figure 2.03: Elevation of Cottonwood River Watershed

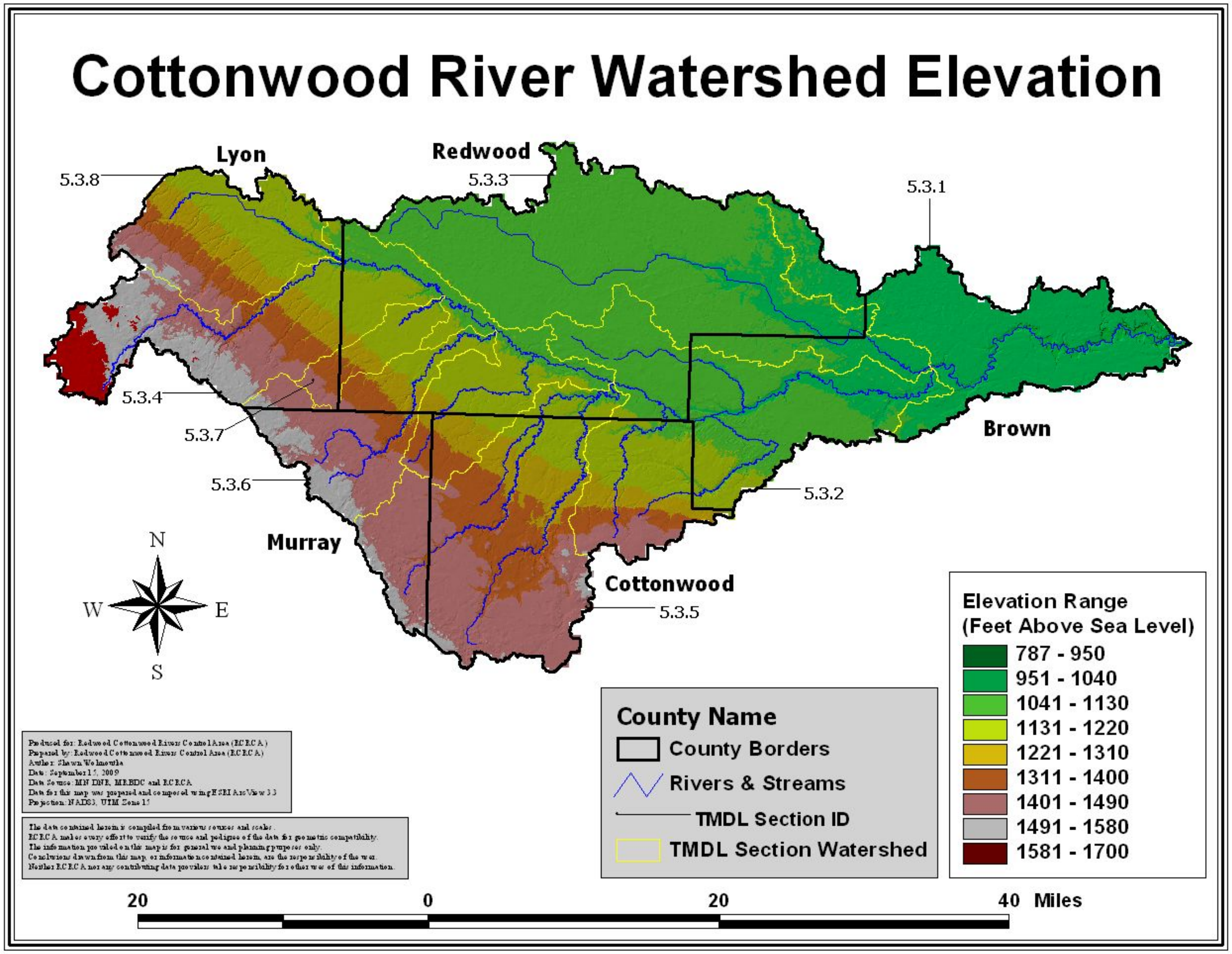


Table 2.02: Cottonwood River Watershed Land Use by County

Entire Watershed		Land Use	Brown		Cottonwood		Lyon		Murray		Redwood	
Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
738,911.72	87.95%	Cultivated Land	146,377.71	84.14%	138,836.95	88.40%	122,913.63	83.31%	56,158.67	88.19%	274,624.75	92.17%
24,935.13	2.97%	Deciduous Forest	9,606.37	5.52%	4,066.66	2.59%	3,880.61	2.63%	1,268.47	1.99%	6,113.03	2.05%
49,045.81	5.84%	Grassland *	9,657.42	5.55%	9,602.44	6.11%	14,736.28	9.99%	4,097.70	6.43%	10,951.96	3.68%
17,767.81	2.11%	Residential/Urban **	5,940.30	3.41%	2,596.61	1.65%	3,086.13	2.09%	972.06	1.53%	5,172.73	1.74%
9,194.52	1.09%	Water - Wetlands	2,200.36	1.26%	1,911.26	1.22%	2,879.78	1.95%	1,181.91	1.86%	1,021.20	0.34%
337.87	0.04%	Other ***	190.60	0.11%	42.06	0.03%	44.43	0.03%	3.05	0.00%	57.73	0.02%
840,192.86	**100.00%**	**Totals =**	**173,972.76**	**100.00%**	**157,055.98**	**100.00%**	**147,540.86**	**100.00%**	**63,681.86**	**100.00%**	**297,941.40**	**100.00%**

***Grassland** includes: “Grassland”, “Grassland-Shrub-Tree” and “Transitional Ag. Land”

** **Residential/Urban** includes: “Urban & Industrial”, “Farmsteads & Rural Residences”, “Rural Residential Development” and “Other Rural Developments”

*****Other** includes: “Gravel Pits and Open Mines” and “Exposed Soil, Sandbars & Sand Dunes”

Table 2.03: Cottonwood River Land Use by Individual TMDL Section

Reaches	TMDL Section #	Drainage Area (mi^2)	Land Use Percentages					
			Cultivated	Grass*	Forest	Water/ Wetland	Residential/ Urban**	Other***
Lower Cottonwood River	**5.3.1**	154.37	83.2%	3.9%	7.0%	1.8%	4.0%	0.11%
Middle Cottonwood River	**5.3.2**	227.24	87.7%	7.0%	2.7%	0.4%	2.2%	0.06%
Sleepy Eye Creek	**5.3.3**	274.07	95.3%	1.2%	1.4%	0.4%	1.6%	0.00%
Upper Cottonwood River	**5.3.4**	231.77	84.6%	9.1%	3.1%	1.3%	1.7%	0.03%
Dutch Charley/ Highwater Creek	**5.3.5**	208.81	87.7%	5.7%	3.0%	1.8%	1.8%	0.04%
Plum Creek	**5.3.6**	90.83	87.1%	7.2%	2.9%	1.2%	1.5%	0.01%
Lone Tree Creek	**5.3.7**	28.17	85.0%	7.6%	1.6%	0.3%	5.6%	0.00%
Meadow Creek	**5.3.8**	97.54	85.3%	9.9%	1.6%	1.6%	1.6%	0.06%

(Percentages may not add to100% due to rounding)

Table 2.04: Cottonwood River Cumulative Land Use by TMDL Section

Sections contributing	TMDL Section #	Drainage Area (mi^2)	Cumulative Land Use Percentages					
			Cultivated	Grass*	Forest	Water/ Wetland	Residential/ Urban**	Other***
All Sections Contribute	**5.3.1**	1312.80	88.0%	5.8%	3.0%	1.1%	2.1%	0.04%
5.3.2, 5.3.4, 5.3.5, 5.3.6, 5.3.7, 5.3.8	**5.3.2**	884.37	86.5%	7.6%	2.7%	1.2%	1.9%	0.04%
5.3.3	**5.3.3**	274.07	95.3%	1.2%	1.4%	0.4%	1.6%	0.00%
5.3.4, 5.3.6, 5.3.7, 5.3.8	**5.3.4**	448.32	85.3%	8.8%	2.7%	1.3%	1.9%	0.03%
5.3.5	**5.3.5**	208.81	87.7%	5.7%	3.0%	1.8%	1.8%	0.04%
5.3.6	**5.3.6**	90.83	87.1%	7.2%	2.9%	1.2%	1.5%	0.01%
5.3.7	**5.3.7**	28.17	85.0%	7.6%	1.6%	0.3%	5.6%	0.00%
5.3.8	**5.3.8**	97.54	85.3%	9.9%	1.6%	1.6%	1.6%	0.06%

(Percentages may not add to100% due to rounding)

***Grass** includes: “Grassland”, “Grassland-Shrub-Tree” and “Transitional Ag. Land”

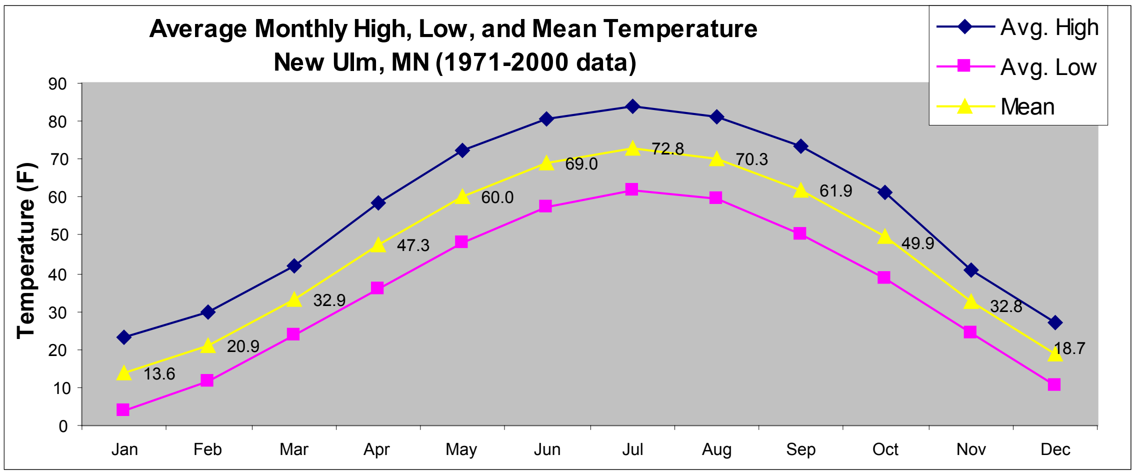
** **Residential/Urban** includes: “Urban & Industrial”, “Farmsteads & Rural Residences”, “Rural Residential Development” and “Other Rural Developments”

*****Other** includes: “Gravel Pits and Open Mines” and “Exposed Soil, Sandbars & Sand Dunes”

2.4 Temperature

Figure 2.04 presents the average monthly high, low, and mean temperatures at New Ulm, MN. Ice-out conditions in the Cottonwood River typically occur in late March or early April with smaller tributaries usually following. Warmest air temperatures reach their peak in July, while the warmest water temperatures are usually in late July and August. Monitoring data indicates that temperature relates to bacteria levels in surface waters. Warmer waters tend to have higher bacteria levels.

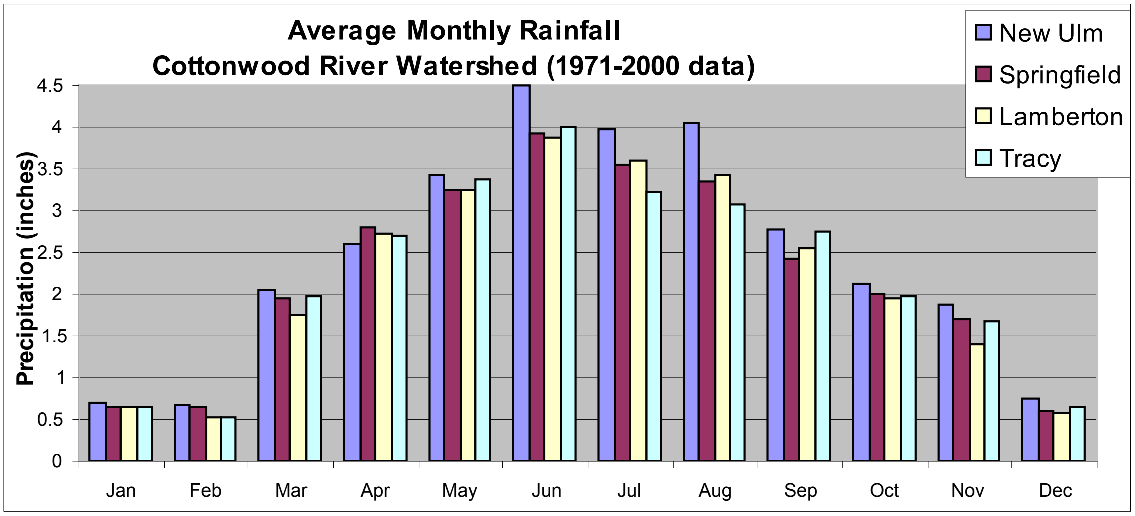
Figure 2.04: Average Monthly Temperatures



2.5 Precipitation

The Cottonwood River watershed averages 27.3 inches annually. 79.9 percent of precipitation occurs within the months of April and October. Figure 2.05 presents the average monthly precipitation values for towns across the Cottonwood watershed. Communities are shown in order from outlet to Minnesota River (New Ulm) to upper watershed (Tracy). Notice that precipitation typically decreases from east to west.

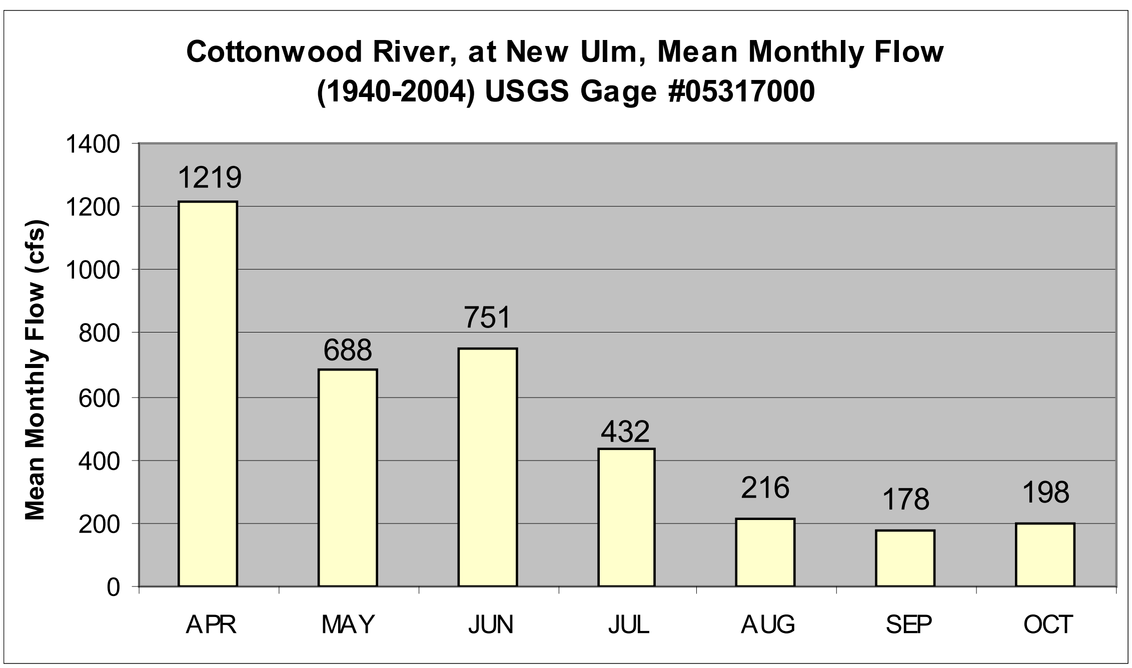
Figure 2.05: Average Monthly Rainfall



2.6 Stream Flow Dynamics

Figure 2.06 displays the mean monthly flow for the Cottonwood River in New Ulm (PLC001, STORET# S001-918, USGS gage #05317000) for the months of April through October. These are the months in which a majority of the flow occurs and the months that are used in the assessment for fecal bacteria. April has higher flows, on average due to snowmelt and overland runoff while June, having the most precipitation, has the second highest mean monthly flow. Flow is measured in cubic feet per second (cfs).

Figure 2.06: Mean Monthly Flow; Cottonwood River at New Ulm (1940-2004)



3.0 Description of Applicable Water Quality Standards and Assessment Procedures

3.1 Classification and Beneficial Uses

The TMDL evaluation is a method of addressing and assessing the waters that exceed the state water quality standard for fecal coliform bacteria. All waters of Minnesota are assigned classes, based on their suitability for the following beneficial uses (Minn. Rules part 7050.0200):

Class 1 – Domestic consumption
Class 2 – Aquatic life and recreation
Class 3 – Industrial consumption
Class 4 – Agriculture and wildlife
Class 5 – Aesthetic enjoyment and navigation
Class 6 – Other uses
Class 7 – Limited resource value

All surface waters of the state that are not specifically listed in Chapter 7050 and are not wetlands, which include most lakes and streams in Minnesota, are classified as Class 2B, 4A, 5 and 6 waters (Minn. R. ch. 7050.0430).

According to Minn. R. ch. 7050.0220-0227, the designated beneficial use for the different use classes is as follows:

<u>Class1B</u>: For domestic consumption following approved disinfection, such as simple chlorination or its equivalent.

<u>Class 2A</u>: Aquatic life support refers to cold water sport or commercial fish and associated aquatic life, and their habitats. Recreation support refers to aquatic recreation of all kinds, including bathing, for which the waters may be usable. Class 2A also is protected as a source of drinking water.

<u>Class 2B</u>: Aquatic life support refers to cool or warm water sport and commercial fish and associated aquatic life. Recreation support refers to aquatic recreation of all kinds, including bathing.

<u>Class 2C</u>: Aquatic life support and recreation includes boating and other forms of recreation for which the water may be suitable (i.e., swimming). Class 2C waters may also support indigenous aquatic life, but not necessarily sport or commercial fish.

<u>Class 3B</u>: General industrial purposes, except for food processing, with only a moderate degree of treatment. Similar to Class 1D waters of the state used for domestic consumption.

Relative to the fecal coliform standard, all of the waters covered in this report are either Class 2B, 3B, 2C, or 7. All class 3B waters here are also classified as 2B or 2C and are required to meet the more stringent requirements of a class 2B or 2C water so there is no explanation of 3B requirements as they would not be applicable for these waters.

3.2 Applicable Minnesota Water Quality Standards

Minn. R. ch. 7050.0222 subp. 4 and 5, *Escherichia (E.) coli* water quality standard for Class 2B and 2C waters states that *E. coli* shall not exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions within any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31.

Minn. R. ch. 7050.0227 subp. 2, *Escherichia (E.) coli* water quality standard for Class 7 waters states that *E. coli* shall not exceed 630 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions within any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31. MPCA did not list or assess Class 7 waters, but will in 2010.

The *E. coli* standards as described in the Minnesota Rules chapter 7050.0222 and 7050.0227, above, replaced the standards for fecal coliform bacteria during the crafting of this report. Fecal coliform standards have an equivalent value of 200 fecal coliforming organisms per 126 *E. coli* organisms;1,000 fecal coliforming organisms per 630 *E. coli* organisms for class 7 streams; 2,000 fecal coliforming organisms per 1,260 *E. coli* organisms in the case of the acute standard based on studies done by the MPCA as described in section 3.4. The *E. coli* standards were set accordingly. This Report uses the fecal coliform standards to derive load values and allocations because river reaches listed in this Report (Table 1.01) were based on fecal coliform sampling. Another reason for sticking with the fecal coliform standards is to avoid converting a majority of the sample data in this Report from fecal coliform to *E. coli* values and perhaps losing accuracy in the conversion.

This Report focuses on 200 organisms per 100 ml monthly geometric mean as an environmental goal for impaired reaches. Establishing TMDLs to meet the geometric mean of 200 organisms/100ml rather than not exceeding 2,000 organisms per 100 ml in more than 10 percent of single samples is consistent with EPA's recent promulgation of water quality criteria for coastal recreational waters. The preamble of the coastal recreational water rule states: *"the geometric mean is the more relevant value for ensuring that appropriate actions are taken to protect and improve water quality because it is a more reliable measure, being less subject to random variation"* (EPA, 2004). The same source-reduction measures that are required to attain compliance with the "chronic" standard also will lead to attainment of compliance with the "acute" standard of 2,000 organisms/100ml cited above. This Report requires compliance with both parts of the standard.

3.3 Impaired Assessment

Impairment assessment is based on the procedures found at:
http://www.pca.state.mn.us/water/tmdl/index.html#support

For support of swimming and recreation, the fecal coliform methodology (303(d) listing) is as follows: Data is aggregated over a ten-year period by month and by reach. If the geometric mean for at least five samples for each appropriate month (all years combined) exceeded 200 organisms per 100ml, the reach will be placed on the 303(d) list. In addition, if at least 10 percent of the entire data set for a reach during the ten-year period exceeded 2,000 organisms per 100ml, then that reach will also placed on the list. Class 7 streams had not been assessed in this manner but will be in 2010.

The MPCA and RCRCA monitored the Cottonwood River and its tributaries for fecal coliform at the locations identified in Figure 3.01. Table 1.01, as well as Table 3.03, provides summary information of the data used to determine the impairment status of the eight stream reaches included in this Report.

Table 3.01 and Table 3.02 display the data collected from 1967-2006 for the impaired reaches. Table 3.01 lists the data collected at CWR-1 (STORET# S000-139). This site is located at State Highway 15/68 bridge about .75 miles downstream of the USGS station in New Ulm and has been monitored since 1967. All reaches exceeded water quality standards at least once during the ten years of sampling used in this report. Figure 3.03 shows the geometric mean for each month at each site with adequate data (five samples/ month).

Figure 3.01: Cottonwood River Watershed Sampling Sites

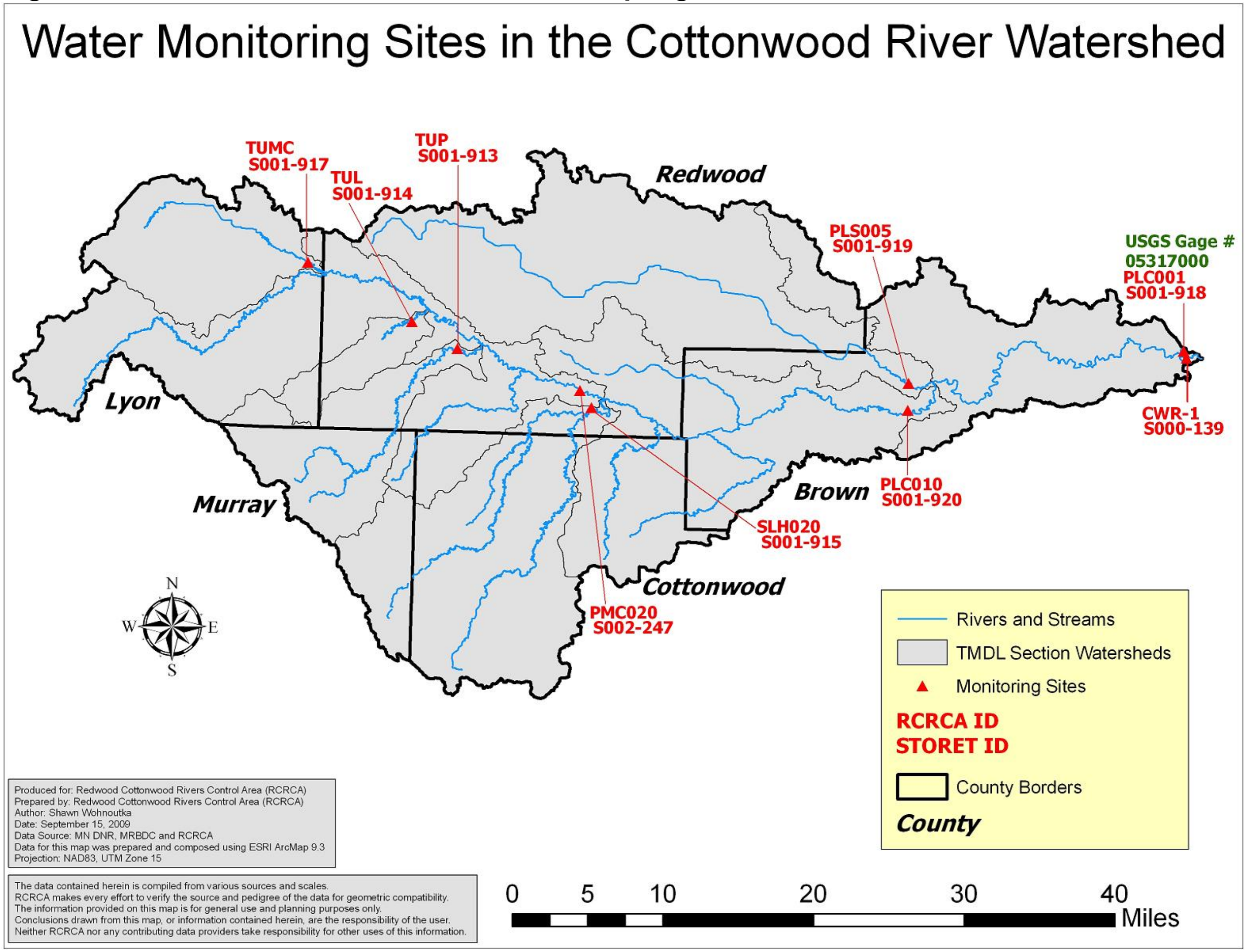


Table 3.01: CWR-1 (S000-139) Site: 1967-2006 Fecal Coliform (cfu/100ml) Sampling by Month

RCRCA Site ID	CWR-1												
STORET ID	S000-139												
Date	Value	Date	Value	Date	Value	Date	Value	Date	Value	Date	Value	Date	Value
4/25/1968	1100	5/18/1971	50	6/20/1968	140	7/13/1967	200	8/30/1967	1300	9/18/1968	4900	10/26/1967	330
4/6/1970	490	5/3/1972	2300	6/8/1970	1700	7/19/1968	790	8/15/1968	110	9/9/1970	700	10/10/1968	17000
4/20/1971	50	5/21/1973	220	6/15/1971	790	7/14/1970	79000	8/12/1970	7900	9/13/1971	1100	10/6/1970	330
4/10/1972	70	5/6/1974	20	6/29/1972	23000	7/21/1971	1700	8/17/1971	490	9/8/1972	230	10/5/1971	330
4/24/1973	50	5/21/1975	50	6/20/1973	7900	7/11/1972	700	8/2/1972	230	9/28/1973	490	10/27/1972	700
4/11/1974	80	5/26/1976	170	6/5/1974	40	7/31/1973	50	8/27/1973	11000	9/5/1974	330	10/30/1973	130
4/16/1975	790	5/18/1977	3500	6/18/1975	1300	7/3/1974	230	8/7/1974	220	9/24/1975	20	10/3/1974	330
4/28/1976	20	5/6/1981	60	6/23/1976	490	7/16/1975	490	8/27/1975	170	9/29/1976	330	10/22/1975	130
4/20/1977	700	5/25/1982	330	6/22/1977	2400	7/22/1976	230	8/18/1976	330	9/21/1977	1300	10/27/1976	140
4/8/1981	20	5/4/1983	490	6/11/1981	790	7/20/1977	230	8/17/1977	490	9/1/1981	790	10/1/1980	20
4/27/1982	20	5/9/1984	790	6/22/1982	490	7/8/1981	140	8/5/1981	3000	9/20/1982	330	10/5/1981	170
4/6/1983	230	5/7/1985	185*^	6/8/1983	20	7/27/1982	1300	8/24/1982	3500	9/6/1983	1400	10/6/1982	9200
4/10/1984	1300	5/5/1987	8	6/5/1984	1800	7/7/1983	790	8/1/1983	80	9/11/1984	50	10/5/1983	20
4/9/1985	10*^	5/24/1988	140	6/4/1985	694*^	7/10/1984	35000	8/7/1984	940	9/4/1985	1315*^	10/9/1985	401*^
4/29/1987	8	5/2/1989	16	6/2/1987	40	7/9/1985	76*^	8/7/1985	133*^	9/10/1986	150000	10/7/1986	180
4/5/1988	120	5/9/1990	210	6/7/1988	130	7/8/1986	4000	8/6/1986	470	9/9/1987	150	10/6/1987	16
4/5/1989	16	5/13/1991	12	6/6/1989	28	7/7/1987	200	8/4/1987	92	9/7/1988	200	10/5/1988	44
4/26/1990	12	5/21/1992	36	6/12/1990	92	7/7/1988	68	8/9/1988	76	9/6/1989	140	10/5/1989	56
4/17/1991	560	5/12/1993	160	6/10/1991	280	7/11/1989	880	8/2/1989	36	9/5/1990	90	10/22/1990	8
4/13/1992	12	5/12/1994	76	6/28/1993	470	7/10/1990	250	8/5/1991	60	9/11/1991	2700	10/9/1991	63
4/7/1993	72	5/11/1998	36	6/16/1994	200	7/31/1990	1600	8/25/1992	1200	9/15/1992	100	10/12/1992	360
4/27/1994	20000	5/13/1998	12	6/4/1998	46	7/24/1991	120	8/17/1993	8000	9/28/1993	320	10/27/1993	9
4/22/2001	501*^	5/19/1998	52	6/9/1998	44	7/2/1992	6000	8/22/1994	180	9/26/1994	280	10/29/2000	37*^
4/4/2006	380^	5/21/1998	52	6/16/1998	290	7/27/1992	340	8/7/1997	1700	9/29/1997	72	10/27/2003	4*^
4/12/2006	49^	5/26/1998	160	6/23/1998	360	7/29/1993	1300	8/5/1998	67	9/25/2001	5355*^	10/27/2003	72*^
		5/28/1998	64	6/30/1998	1300	7/25/1994	150	8/6/2001	191*^	9/14/2004	715*^	10/5/2005	1006^
		5/23/2001	481*^	6/3/2001	25*^	7/24/1997	3100	8/12/2004	19*^	9/19/2006	70^	10/5/2006	40^
		5/3/2004	4*^	6/30/2004	4*^	7/7/1998	580	8/16/2006	18^	9/21/2006	95^		
		5/3/2004	8*^	6/30/2004	137*^	7/14/1998	1	8/23/2006	47^				
		5/12/2004	79*^	6/6/2006	91^	7/22/1998	3300						
		5/2/2006	1899^	6/14/2006	972^	7/28/1998	700						
		5/31/2006	37^			7/19/2004	289*^						
						7/13/2006	36^						
						7/16/2006	27^						
GEOMEAN	**112**		**91**		**271**		**451**		**318**		**434**		**125**

*Averaged Duplicates, ^At least one value figured from *E. coli*

Table 3.02: Cottonwood River Watershed 1997-2006 Fecal Coliform (cfu/100ml) Sampling (RCRCA Sites)

RCRCA Site ID	**PLC001**	**PLC010**	**PLS005**	**PMC020**	**SLH020**	**TUP**	**TUL**	**TUMC**
STORET ID	**S001-918**	**S001-920**	**S001-919**	**S002-247**	**S001-915**	**S001-913**	**S001-914**	**S001-917**
4/14/1997		33	30		8	82	23	22
4/13/1999		381	150					
4/14/1999						137		
4/19/1999					67			
4/14/2004						10		
4/15/2004	<1	60	82	80				
4/26/2005	110	90	20	150				
GEOMEAN								
5/12/1997		16	194		46	8	12	142
5/18/1998		46	42		42	88		
5/24/1999		170	66		122	203		
5/1/2000		50	146	33		71		
5/30/2001		200	200	120		60		
5/27/2003	70	140	150					
5/28/2003				400		300		
5/5/2004	560	10	330	520		300		
5/24/2005	200	150	91	290		200		
5/15/2006						120*^		
5/16/2006	190*^	910*^	1400*^	200*^				
5/30/2006	11^	9^	3^	4^		4^		
GEOMEAN	**199**	**63**	**128**	**189**		**101**		
6/24/1997		2600			8900			
6/16/1998		125	102		410	703		
6/22/1999		490	380		994	890		
6/26/2000		1700	1600	460		1700		
6/29/2001		3600	4600	8500		8000		
6/26/2003	1000	6000	1500	2000		6000		
6/29/2004	800	600	800	600				
6/30/2004						1100		
6/8/2005	6000		6000					
6/27/2005	2020*^		900*^					
6/28/2005		550*^		400*^		870*^		
6/27/2006	1070^	760^	1070^	<1^		1560^		
GEOMEAN	**1597**	**1043**	**1079**	**351**		**1719**		
7/14/1997		3880	1560		2240	7840	4880	5080
7/13/1998		105	180		240	380		
7/30/1999		420	310		710	560		
7/27/2000		150	230	140		2000		
7/18/2001		2000	600	5000				
7/19/2001						2000		
7/31/2003	2800	4000	1700	700		1700		
7/27/2004				420		800		
7/28/2004	300	1100	1400					
7/28/2004	700							
7/5/2005	560		1100					
7/29/2005	640	400	220	640		1700		
7/10/2006	<1^	100^	220^	100^		400^		
7/27/2006	27^	89^	89^	34^		180^		
GEOMEAN	**178**	**740**	**575**	**667**		**1408**		

*Averaged Duplicates, ^At least one value figured from *E. coli*

RCRCA Site ID STORET ID	**PLC001** **S001-918**	**PLC010** **S001-920**	**PLS005** **S001-919**	**PMC020** **S002-247**	**SLH020** **S001-915**	**TUP** **S001-913**	**TUL** **S001-914**	**TUMC** **S001-917**
8/11/1997		1040	600		1080	1280	5000	2480
8/10/1998		105	145		340	440		
8/30/1999		95	1230		645	2580		
8/16/2000		150	8000	180		250		
8/14/2001				8000		500		
8/5/2002				2300				
8/13/2003	300	200	3200	1300		1500		
8/23/2004				800		1100		
8/25/2004	60	2000	1400					
8/17/2005						270		
8/24/2005	300	550	3000	450				
8/29/2006	22^	110^	82^	87^		1070^		
GEOMEAN		**320**	**1418**	**1076**		**730**		
9/15/1997		50	205		410	390	5300	490
9/14/1998		140	540		1050			
9/23/1999		130	590		122	140		
9/28/2000		70	220	80		260		
9/26/2001		170	230	110		80		
9/4/2002				2000				
9/27/2002				50				
9/25/2003	400	2700	600	400		370		
9/29/2004				1400		520		
9/14/2005				6000		14000		
9/16/2005	4700	2100	14000					
9/12/2006	16^	1070^	720^	340^		1230^		
9/26/2006	<1^	73^	1340^	220^		120^		
GEOMEAN		**327**	**717**	**435**		**446**		
10/22/2003	110							
10/17/2005				210		200		
10/18/2005	110	120	91					

*Averaged Duplicates
^At least one value figured from *E.Coli*

Table 3.03: Cottonwood River Watershed Assessment Site Descriptors

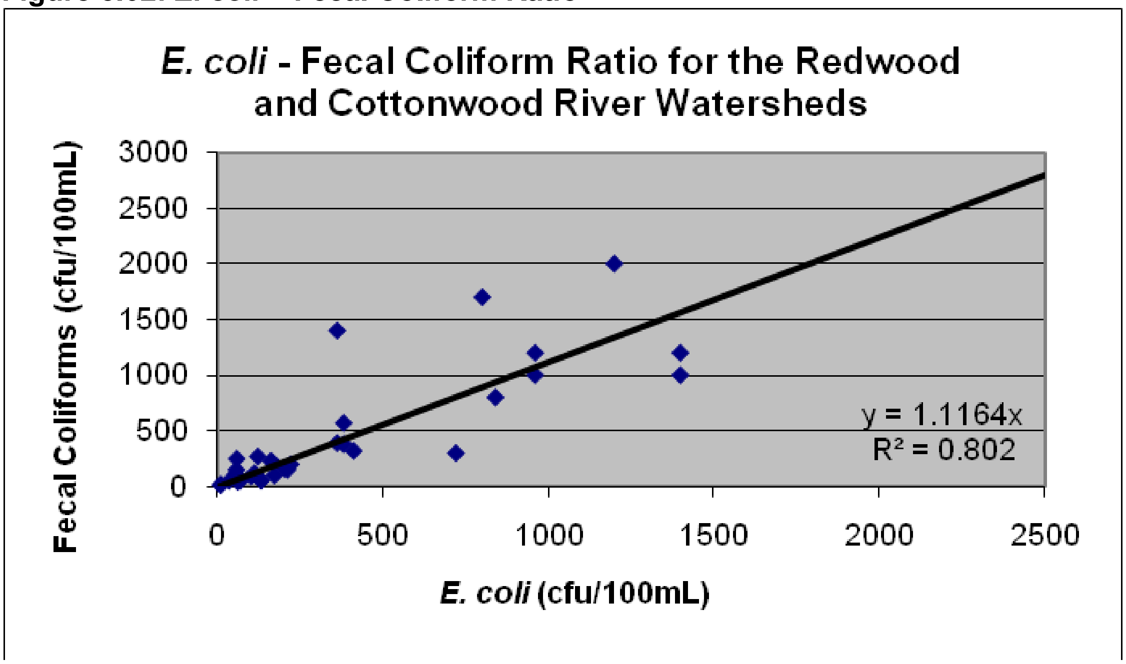
Sample Site Name	TMDL Section #	Reach	Description	River Assessment Unit ID	STORET ID Site Used for Assessment	Years of Data
CWR-1	-	Cottonwood River	Judicial Ditch 30 to Minnesota R	07020008-501	S000-139	67-06
PLC001	5.3.1	Cottonwood River	Judicial Ditch 30 to Minnesota R	07020008-501	S001-918	97-06
PLC010	5.3.2	Cottonwood River	Coal Mine Cr to Sleepy Eye Cr	07020008-508	S001-920	97-06
PLS005	5.3.3	Sleepy Eye Creek	Headwaters to Cottonwood R	07020008-512	S001-919	97-06
PMC020	5.3.4	Cottonwood River	Plum Cr to Dutch Charley Cr	07020008-504	S002-247	00-06
SLH020	5.3.5	Dutch Charley Creek	Highwater Cr to Cottonwood R	07020008-517	S001-915	97-99
TUP	5.3.6	Plum Creek	Headwaters to Cottonwood R	07020008-516	S001-913	97-06
TUL	5.3.7	Lone Tree Creek*	T109 R39W S7, westline to Cottonwood R	07020008-524	S001-914	97
TUMC	5.3.8	Meadow Creek	Headwaters to Cottonwood R	07020008-515	S001-917	97

3.4 Fecal Coliform and *E. coli* Standards

As the writing of this report began, the MPCA was proposing to change the bacterial water quality standard from fecal coliform to *E. coli* bacteria. Paired comparison studies conducted by MPCA have shown on average that 63 percent of fecal coliform tested to be *E. coli* bacteria. This means that the 200 org/100 ml fecal coliform standard would be equivalent to 126 *E. coli* bacteria per 100ml. This *E.coli* standard has replaced the fecal coliform standard by the completion of this report. Because the vast majority of data collected is based on fecal coliform, both data sources are used and existing *E. coli* data was converted to the equivalent fecal coliform values."

Values noted as derived from *E. coli* samples in this report were converted using a factor of 179 *E. coli* units = 200 fecal coliform units. Though this varies with the proposed 126 *E. coli* units to 200 fecal coliform units conversion, we substantiate this using 35 *E.coli*/fecal coliform sample pairs from the Redwood and Cottonwood River Watersheds from 1985-2006. Values are charted in Figure 3.02.

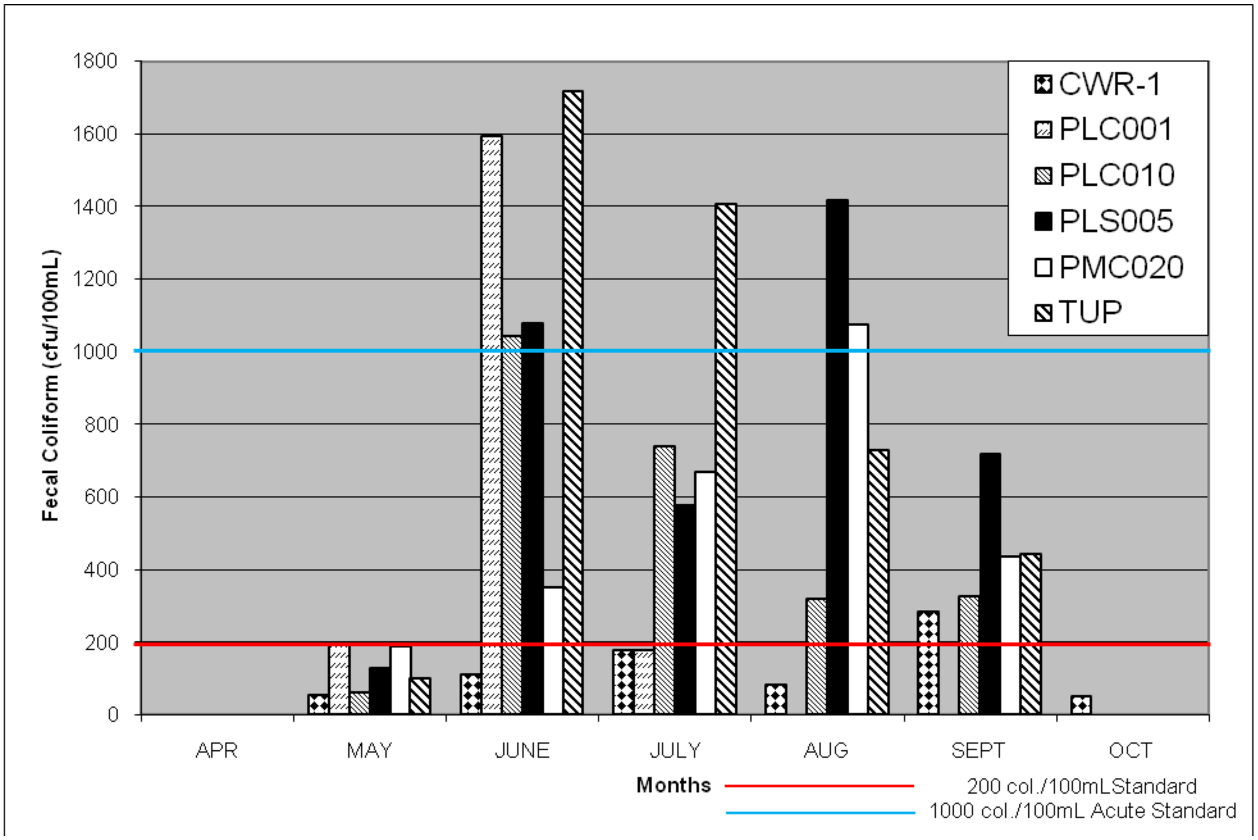
Figure 3.02: *E. coli* – Fecal Coliform Ratio



3.5 Monthly Fecal Coliform Concentrations in the Cottonwood River

The criteria used for determining fecal coliform impairments are described in Section 3.2. The procedure involves calculating monthly geometric means from April through October. Figure 3.03 displays the monthly geometric means from April through October.

Figure 3.03: 1997-2006 Cottonwood River Watershed Fecal Coliform, Geometric Mean by Site



3.6 MPCA Non-degradation Policy

Non-degradation is an important component of water quality standards in Minnesota. MPCA policy distinguishes non-degradation for all waters from non-degradation for Outstanding Resource Value Waters (ORVW), as follows:

Minn. R. ch 7050.0185, subp. 1. Non-degradation for All Waters. The potential capacity of the water to assimilate additional wastes and the beneficial uses inherent in water resources are valuable public resources. It is the policy of the state of Minnesota to protect all waters from significant degradation from point and nonpoint sources and wetland alterations, and to maintain existing water uses, aquatic and wetland habitats, and the level of water quality necessary to protect these uses.

3.7 Trends in Fecal Coliform Surface Water Quality

Figure 3.04 and Figure 3.05 track long-term fecal coliform geometric means by decade at the site in New Ulm (CWR-1; STORET# S000-139), based on 206 samples. The data indicates a general downward trend in bacterial concentration over the past five decades.

Figure 3.04: Fecal Coliform Geometric Mean Trend by Decade

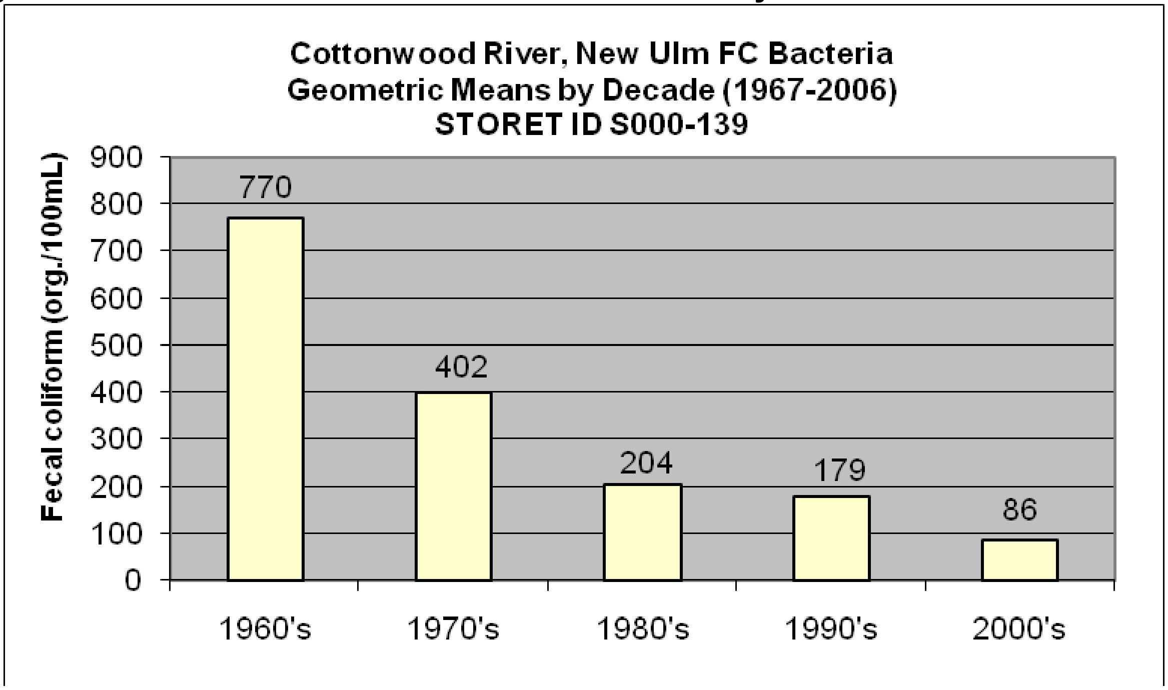
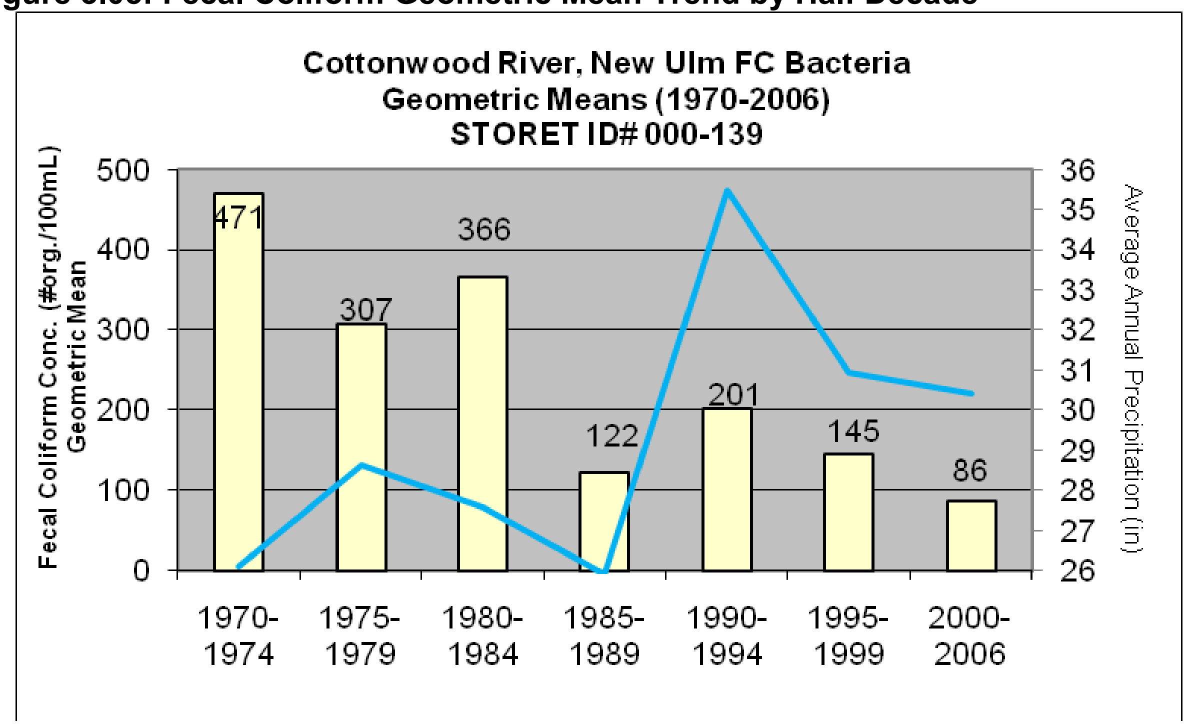


Figure 3.05 uses the same data as Figure 3.04 coupled with precipitation data for the same area from the daily cooperative records at the Minnesota State Climatology Office, broken down a little bit more. The bacteria concentrations appear, in part, to have a relationship to the dry years in the mid 1970's, the drought of 1988-89, and the wet years of the early 1980's and 1990's.

Figure 3.05: Fecal Coliform Geometric Mean Trend by Half Decade



4.0 Description of Fecal Coliform Bacteria and Its Sources

4.1 Fecal Coliform Bacteria Description

Fecal coliform bacteria represent a group of several genera found in the intestines of warm-blood animals and is always associated with fecal matter. Certain strains of the fecal coliform bacteria group, e.g. *Escherichia coli* are extremely pathogenic. Public health uses fecal coliform as an indicator of the presence of pathogens, due to the similarity between their habitats and the characteristics of pathogenic organisms. Excessive fecal coliform concentrations in water bodies (e.g. lakes, rivers and streams) can pose a public health threat when humans come in contact with the water.

The assessment of fecal coliform sources within a watershed and establishing the cause-effect relationship between the sources, the transport mechanisms, and the subsequent stream loading is complex and difficult to quantify. The survival rate of fecal coliform in terrestrial and aquatic environments is poorly understood and further exacerbates efforts to track sources.

Once fecal coliform bacteria have reached streams and rivers, it can survive in streambed sediments. One thing that is often overlooked is that fecal coliform bacteria can be re-suspended with the streambed sediments. Several studies have reported significantly increased concentrations of water column fecal coliform density after disturbance of the surface sediments. Weiskel et al. (1996) reported greatly increased values of fecal coliform density after artificial disturbance of the surface 2 cm of sediments in Buttermilk Bay, Massachusetts. The Water Resources Center reported (2006) a study conducted in southern Minnesota, which found that physical raking of streambed sediments resulted in bacteria concentrations several factors higher than the water column values before re-suspension. Jolley et al. (2004) reported bottom sediment reservoirs of indicator bacteria in surface water increase surface water levels at base flow and should be considered sources of surface water contamination. Davis et al. (2005) reported that in stream observations in Arkansas indicated it is possible for *E. coli* to survive in certain streambed sediments for at least four months with no fresh external inputs. As runoff during a storm event begins, the discharge and velocity increase, in turn scouring bacteria from the benthic areas of the stream (Yagow and Shanholtz, 1998). This scouring causes increased levels of bacteria in the water column and decreased levels in stream sediments. It must be noted, however, that though the mechanisms cited above have a possible effect on the values of pollutant calculated in this Report, but are not quantifiable at this time.

Two Minnesota studies describe the presence and growth of “naturalized” or “indigenous” strains of *E. coli* in watershed soils (Ishii et al., 2006) and ditch sediment and water (Sadowsky et al., 2010). The latter study, supported with Clean Water Land and Legacy funding, was conducted in the Seven Mile Creek watershed, an agricultural landscape approximately 30 miles to the east of the mouth of the Cottonwood River. DNA fingerprinting of *E. coli* from sediment and water samples collected in Seven Mile

Creek from 2008-2010 resulted in the identification of 1568 isolates comprised of 452 different *E. coli* strains. Of these strains, 63.5% were represented by a single isolate, suggesting new or transient sources of *E. coli*. The remaining 36.5% of strains were represented by multiple isolates, suggesting persistence of specific *E. coli*. Discussions with the primary author of the Seven Mile Creek study suggest that while 36% might be used as a rough indicator of "background" levels of bacteria at this site during the study period, this percentage is not directly transferable to the concentration and count data of *E. coli* used in water quality standards and TMDLs. Additionally, because the study is not definitive as to the ultimate origins of this bacteria, it would not be appropriate to consider it as "natural" background. Finally, the author cautioned about extrapolating results from the Seven Mile Creek watershed to other watersheds without further studies. From a pragmatic standpoint, this study suggests that there is a fraction of bacteria that may exist regardless of most traditional implementation strategies that are employed to control the sources of *E. coli*."

Despite the complexity of the relationship between sources and in-stream concentrations of fecal coliform, the following can be considered major source categories:

4.2 Fecal Coliform Bacteria Sources

4.2.1 Human Sources

Wastewater Treatment Facilities

There are sixteen municipal wastewater treatment facilities in the watershed servicing approximately 13,000 people in fifteen communities (Table 4.01). As of 2006, the sixteen facilities included thirteen pond systems and three continuous discharge plants in the Cottonwood River watershed. According to state rule, each facility is required to meet a discharge limit of 200 cfu/100ml fecal coliform or *E. coli* equivalent concentration as a monthly geometric mean. This is accomplished through disinfection of the wastewater at the final treatment stage, through chlorination or equivalent processes.

All permitted facilities are required to monitor their effluent to ensure that concentrations of specific pollutants remain within levels specified in the discharge permit. The MPCA regularly reviews the Discharge Monitoring Reports to determine if violations have occurred.

Pond system permits allow for two discharge windows between April 1 and June 30 and between September 1 and December 15. In general these windows coincide with either high flow periods or low recreational value periods, which help minimize the risk to humans.

Municipal bypasses are emergency discharges of partially or untreated human sewage from waste water treatment facilities. Municipal wastewater facilities shall not allow an anticipated bypass to occur unless the bypass is unavoidable to prevent loss of life, personal injury, or severe damage to the facility or private property. Municipal bypasses sometimes occur during periods of heavy precipitation, when treatment facilities become hydraulically overloaded. Conditions for bypasses are detailed in the facility's NPDES permit and Minn. R. 7001.1090.

Table 4.01: Cottonwood River Watershed Permitted WWTF

WWTF	System Type	Permit No.	Sub-watershed	County	(2000-2006) Mean FC Discharge (org/day)[1]	Load at Standard (org/day)	Population[2]
BALATON WWTP	Pond	MN0020559	Upper Cottonwood	Lyon	5.98E+07	7.33E+08	637
CLEMENTS WWTP	Pond	MN0023043	Sleepy Eye Creek	Redwood	2.49E+08	6.37E+07	191
GARVIN WWTP[#]	Pond	MNG580101	Upper Cottonwood	Lyon	1.76E+06	1.34E+08	159
LAMBERTON WWTP	Pond	MN0023922	Dutch Charley Creek	Redwood	5.80E+06	2.86E+08	859
LUCAN WWTP	Pond	MN0031348	Sleepy Eye Creek	Redwood	2.58E+07	9.11E+07	226
REVERE WWTP[$]	Pond	MNG580114	Upper Cottonwood	Redwood	1.56E+07	9.30E+07	100
SANBORN WWTP	Pond	MN0024805	Middle Cottonwood	Redwood	4.82E+07	1.48E+08	434
SLEEPY EYE WWTP	Pond	MNG580041	Lower Cottonwood	Brown	8.80E+08	2.93E+09	3,515
SPRINGFIELD WWTP	Cont. Discharge	MN0024953	Middle Cottonwood	Brown	5.04E+08	2.60E+09	2,215
STORDEN WWTP[%]	Pond/C.D. [%]	MN0052248	Dutch Charley Creek	Cottonwood	6.66E+07	2.44E+08	274
TRACY WWTP - N	Pond	MN0021725	Lone Tree Creek	Lyon	1.42E+08	7.91E+08	2,268
TRACY WWTP - S	Pond	MN0021725	Lone Tree Creek	Lyon	1.02E+08	9.08E+08	-
WABASSO WWTP[^]	Cont. Discharge	MN0025151	Sleepy Eye Creek	Redwood	1.02E+08	1.99E+08	643
WANDA WWTP	Pond	MN0020524	Sleepy Eye Creek	Redwood	6.43E+06	3.11E+07	103
WESTBROOK WWTP[*]	Pond	MN0025232	Dutch Charley Creek	Cottonwood	1.43E+08	6.45E+08	755
WALNUT GROVE WWTP[^,*]	Cont. Discharge	MN0021776	Upper Cottonwood	Redwood	6.34E+08	9.45E+08	599
					2.99E+09	1.08E+10	12,978

[1]MPCA 2000-2006 Daily Monitoring Report Data
[2]United States Census 2000
[$]Operation began in 2005
[#]Operation began in 2006
[%]Switched from mechanical to pond system in 2005
[^]No Reports for April
[*]Reported from 2001 to 2006

The seven-year average discharge from the sixteen WWTFs with available data is 2.99E+09 organisms per day. The seven year load equivalent at the allowable standard is 1.08E+10 organisms per day.

It should be noted that:
-**Clements (MN0023043)** discharged over 200 orgs/100mL, on average, in April, May, and June of 2001, in April and May of 2002, and in June of 2004.
-**Sleepy Eye (MNG580041)** discharged over 200 orgs/100mL, on average, in September of 2000 and September of 2005.
-**Storden (MN0052248)** discharged over 200 orgs/100mL, on average, in July of 2000, June of 2001, June of 2002, and July of 2003.
-**Wabasso (MN0025151)** discharged over 200 orgs/100mL, on average, in May of 2001. -Walnut Grove (MN0021776) discharged over 200 orgs/100mL, on average, in May of 2001, June of 2001, July of 2002, August of 2002, May of 2004, June of 2004, and July of 2004.

-**Westbrook (MN0025232)** discharged over 200 orgs/100mL, on average, in June of 2001 and October of 2002.

With these violations, MPCA oversees and takes action through enforcement. For the most part, these violations were isolated and non-repeat offenses that were rectified with improved handling methods. In the case of Storden, since the continuous discharge plant was reverted to a pond system, there have not been any reported discharge violations. In the case of Clements, extensive handling procedure changes seem to have worked. Walnut Grove's system went through a complete overhaul and has been in compliance.

Unsewered Communities

The population in the unsewered communities in the Cottonwood River watershed is approximately 210 people (Table 4.02). Most of the small hamlets on this list are not incorporated or have been deemed low priority. Recently, the cities of Cobden and Dovray have upgraded to cluster systems known as Midsize Subsurface Sewage Treatment System (MSTS) and are operating through county permits. An MSTS is essentially a larger SSTS that handles the wastewater needs of multiple residents or an individual SSTS in excess of 5,000 gallons per day and less than 10,000 gallons per day. These systems do not require a NPDES permit and therefore are considered in the load allocation portion of a TMDL as "0".

Table 4.02: Cottonwood River "Unsewered" Communities

CITY	COUNTY	REACH	POPULATION
AMIRET[1]	Lyon	Meadow Creek	100
DOTSON[1]	Brown	Middle Cottonwood	10
DUDLEY[1]	Lyon	Meadow Creek	10
LEAVENWORTH[1]	Brown	Lower Cottonwood	70
ROWENA[1]	Redwood	Sleepy Eye Creek	20

[1]Estimated Population

[2]United States Census 2000

Urban Stormwater and Rural Areas

Several of the unsewered communities are combined sewer and stormwater systems. Other than humans, sources of fecal coliform in urban stormwater and rural areas include pet and wildlife waste. Pet and wildlife waste can be directly deposited to streams and rivers or from runoff via impervious surfaces to storm sewer systems and overland flow. Untreated pet and wildlife waste in stormwater from cities, small towns, and rural areas can be a source for many pollutants including fecal coliform bacteria and associated pathogens. Fecal coliform concentrations in urban runoff can be as great as or greater than those found in cropland runoff and feedlot runoff (USEPA 2001). Newer urban development often includes stormwater treatment such as sedimentation basins, infiltration areas, and vegetated filter strips. Marshall and New Ulm are the two cities in the watershed, which are required to have a Municipal Separate Storm Sewer System (MS4) permit. The MS4 permit requires a range of actions that will ultimately reduce the impact of stormwater from the community to downstream water bodies. Smaller communities or even rural residences not covered under MS4 permits may still need to take action to reduce stormwater and associated bacteria runoff.

Subsurface Sewage Treatment Systems

The number of failing (includes imminent threats to public health) Subsurface Sewage Treatment Systems (SSTS) was determined from using the actual number of SSTS reported by each county to MPCA (2006 data set). The number of SSTS attributed to the Cottonwood River watershed was generated by multiplying the percentage of the county in the watershed by the number of SSTS in the county. This was done for each reach in the watershed. Each county had varying levels of "failing" systems, and this was taken into account for each county within a reach. Using MPCA records and the analysis method described above, it was determined there were 3,944 SSTS (includes unsewered communities) in the Cottonwood River watershed (including seasonal and non-residential), of which, 1,852 were designated as failing. Of those 1,852 failing systems, 761 were estimated to be imminent threats to public health (ITPH). For the purpose of this report, a straight-pipe system, a system that directly discharges into surface waters, is considered an imminent health threat as defined below.

A SSTS that fails to protect groundwater is defined as "failing". At a minimum, a system that is failing to protect groundwater is a system that is a seepage pit, cesspool, drywell, leaching pit, or other pit; a system with less than the required vertical separation distance (between the system and groundwater level) or a system not abandoned in accordance with state law (Rule: 7080.2500)

A SSTS system that is not protective of public health and safety is defined as imminent threats to public health (ITPH). At a minimum, a system that is an imminent threat to public health of safety is a system with a discharge of sewage or sewage effluent to the ground surface, drainage systems, ditches, storm water drains or directly to surface water; systems that cause a reoccurring sewage backup into a dwelling or other establishment; systems with electrical hazards; or sewage tanks with unsecured, damages, or weak maintenance hole covers.

4.2.2 Livestock Sources

Livestock manure represents more than 98% of the fecal matter produced in the watershed. Nearly all manure is either incorporated or surface applied to farm fields. As such, the majority of fecal material that is produced in the basin is land applied manure. Land application of this manure has three potential pathways to reach surface waters; 1) overland runoff, 2) open tile intakes and 3) macropores/preferential flow. The majority of livestock producers in the watersheds are most likely handling their manure and conducting land application consistent with current rules, guidelines, and University recommendations. These practices, however, do not typically result in total containment of manure under all conditions. Even if less than 1% of the land applied manure enters surface waters through one or more of the pathways mentioned, it could account for violations of the bacterial water quality standard.

It is important to note that livestock manure has environmental and economic benefits that must be taken into account and weighed against potential bacteria impacts. Livestock manure reduces commercial fertilizer demand, while adding organic matter to the soil. Soil rich in organic matter is less prone to erosion. There are also significant numbers of beef and dairy cattle in the watersheds. The pasture and hay land supported by these ruminants may result in further soil erosion reduction, particularly if it is located on steeper lands

Livestock facilities with NPDES Permits
A feedlot designated as a Concentrated Animal Feeding Operation (CAFO) is required to operate in accordance with a National Pollutant Discharge Elimination System (NPDES) permit. The feedlot meets the definition of a CAFO as defined in Federal Regulations (40 CFR: 122.23(b)(4)); or the feedlot is capable of holding 1,000 or more animal units (AU) (as defined under Minn. R. 7020.0300, subp.5) or the manure storage area is capable of storing the manure generated by 1,000 AU or more.

According to the MPCA Feedlot database, there are thirty-nine NPDES-permitted facilities in the watershed. The NPDES permittees are listed in Section 5.0. Thirteen facilities are located in the Sleepy Eye Creek reach and six in the Middle Cottonwood River reach. There are five facilities in each of the following reaches; Lower Cottonwood River, Upper Cottonwood River and Highwater/Dutch Charley Creek. Three facilities are in the Meadow Creek reach and one each in the Lone Tree Creek and Plum Creek reaches. These thirty-nine permitted facilities represent 31,622 Swine animal units (AUs), 21,982 Beef AUs, 910 Dairy AUs, 248 Poultry AUs, 5 Sheep AUs and 2 Horse AUs throughout the Cottonwood River watershed (Table 4.03).

Livestock facilities without NPDES Permits
Runoff from livestock feedlots, pastures, and land application areas has the potential to be a significant source of fecal coliform bacteria and other pollutants. There is considerable spatial variation in the type and density of livestock across the watershed (Table 4.03).

The MPCA feedlot database of facilities lists just over 134,000 animal units (AUs) at locations without NPDES permits in the watershed mainly representing dairy, beef, swine, sheep and turkey (MPCA, 2003). Other animals include horse, chicken, buffalo, goat, rabbit, donkey, bulls and dogs. The type and number of AUs in each reach is listed in Table 4.03.

Feedlot proximity to water has an effect on potential fecal coliform sources, delivery assumptions and for determining target areas for BMP implementation. Figure 4.01 shows feedlot locations and proximity in the Cottonwood River Watershed. Table 4.04 includes a breakdown of animal units (AU) by proximity to surface water. More information related to surface water proximity is in Appendix C of this Report.

For the entire watershed, Swine AUs represented over 49 percent of all Animal Units and Beef were over 40 percent. Dairy made up 7.5 percent, Poultry was just over 2 percent and Sheep about .5 percent. Horse and “Other” combined for just .28 percent of all AUs in the Cottonwood River watershed.

Table 4.03: Cottonwood River Watershed Feedlot Inventory

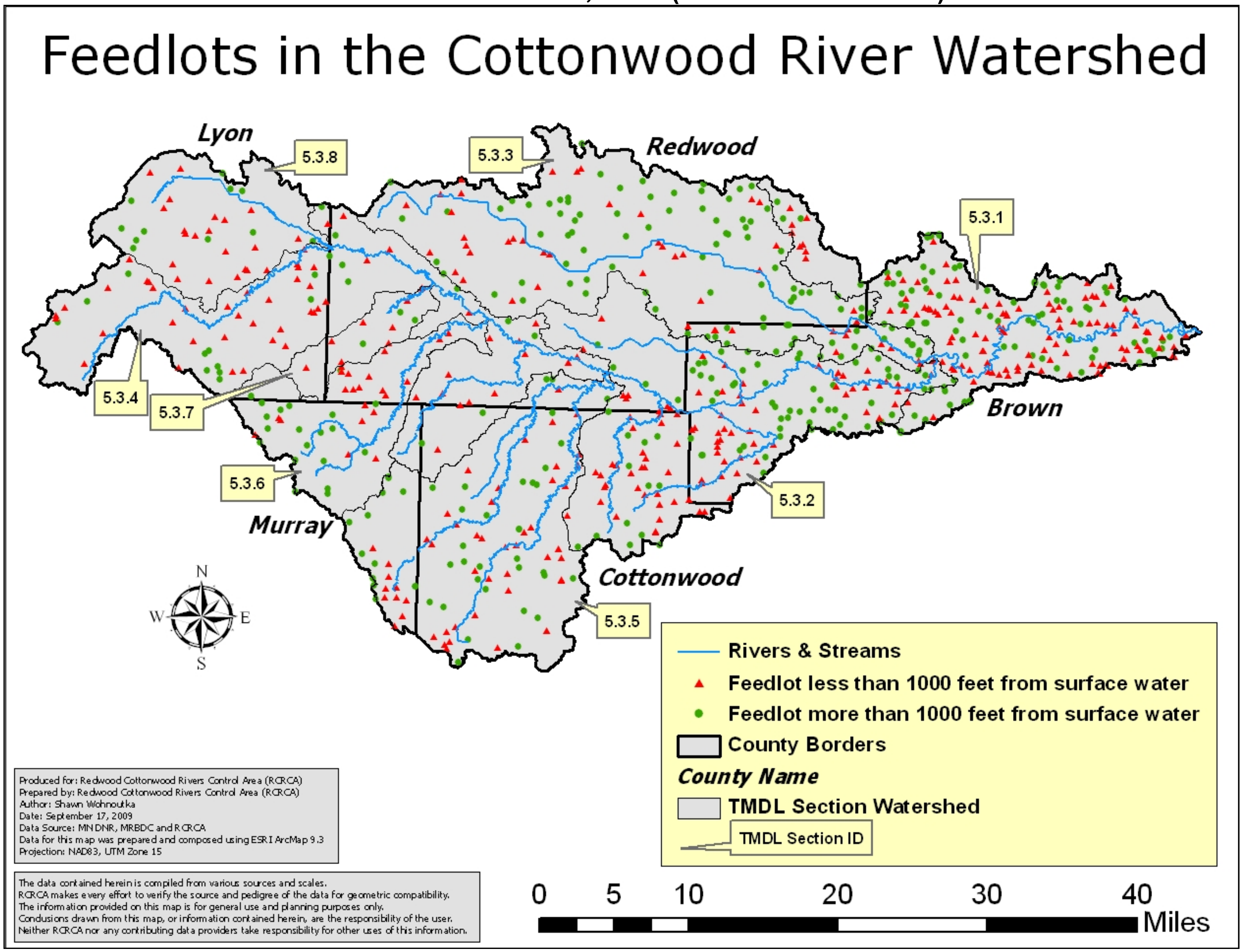
Reach Name Sample Site ID Report Section # Animal Unit Density	Source	With NPDES Permits AU	Without NPDES Permits AU	Total AU
Meadow Creek TUMC Section 5.3.8 138.51 AU/mi^2	Dairy		580	580
	Beef	3,390	4,185	7,575
	Swine	1,152	4,183	5,335
	Poultry			
	Sheep			
	Horse		19	19
	Other*		1	1
Lone Tree Creek TUL Section 5.3.7 115.39 AU/mi^2	Dairy		7	7
	Beef		925	925
	Swine	1,440	870	2,310
	Poultry			
	Sheep		4	4
	Horse		5	5
	Other*			
Plum Creek TUP Section 5.3.6 118.10 AU/mi^2	Dairy		7	7
	Beef		2,444	2,444
	Swine	2,520	5,546	8,066
	Poultry		184	184
	Sheep		24	24
	Horse		2	2
	Other*			
Highwater/ Dutch Charley SLH020 Section 5.3.5 109.43 AU/mi^2	Dairy	910	642	1,552
	Beef	840	6,248	7,088
	Swine	4,457	9,176	13,633
	Poultry		2	2
	Sheep		520	520
	Horse		55	55
	Other*			
Upper Cottonwood River PMC020 Section 5.3.4 102.98 AU/mi^2	Dairy		358	358
	Beef	2,560	10,892	13,452
	Swine	2,982	6,312	9,294
	Poultry	243	91	334
	Sheep		307	307
	Horse		24	24
	Other*		100	100

Table 4.03 (Continued): Cottonwood River Watershed Feedlot Inventory

Reach Name Sample Site ID Report Section # Animal Unit Density	Source	With NPDES Permits AU	Without NPDES Permits AU	Total AU
Sleepy Eye Creek PLS005 Section 5.3.3 141.65 AU/mi^2	Dairy		2,770	2,770
	Beef	2,816	7,613	10,429
	Swine	11,857	12,625	24,482
	Poultry		1,017	1,017
	Sheep	5	73	78
	Horse		14	14
	Other*		30	30
Middle Cottonwood River PLC010 Section 5.3.2 181.90 AU/mi^2	Dairy		2,425	2,425
	Beef	9,976	16,588	26,564
	Swine	1,382	9,346	10,728
	Poultry	5	1,352	1,357
	Sheep		10	10
	Horse	2	8	10
	Other*		240	240
Lower Cottonwood River PLC001 Section 5.3.1 223.99 AU/mi^2	Dairy		6,501	6,501
	Beef	2,400	5,392	7,792
	Swine	5,832	12,929	18,761
	Poultry		1,442	1,442
	Sheep		52	52
	Horse		29	29
	Other*			
Total Animal Units for the Cottonwood River Watershed CT29 143.92 AU/mi^2	Dairy	910	13,290	14,200
	Beef	21,982	54,286	76,268
	Swine	31,622	60,987	92,609
	Poultry	248	4,088	4,336
	Sheep	5	990	995
	Horse	2	156	158
	Other*	0	370	370
Totals =		**54,769**	**134,167**	**188,936**
As a percentage =		**28.99%**	**71.01%**	**100.00%**

Animal Unit values have been rounded to nearest whole number.
Animal Unit Density is for Total Animal Units
* Other includes: Donkey, Buffalo, Rabbits, Bulls, Dogs and Goats

Figure 4.01: Feedlots in the Cottonwood River Watershed, 2003 (Listed in Table 4.03)



4.2.3 Pet Sources

Pet numbers are calculated using information gathered from a 2007 study by the American Veterinary Medical Association (AVMA) and human census data from the United States 2006-2007 Census estimates. These numbers generate a value of .2387 dogs for every person and .2709 cats for every person. The urban and rural populations were multiplied by the values above to determine number of dogs and cats. Typically, urban households have fewer dogs and more cats and rural households are more likely to have more cats and more dogs. These numbers reflect national averages and may not reflect ownership accurately.

4.2.4 Wildlife/Natural Background Sources

Wildlife populations were determined by multiplying the animal density for each animal by the area of land in each watershed. The animal density numbers for the Cottonwood River Watershed were provided from the Minnesota Department of Natural Resources' Farmland Wildlife Population and Research Group (deer, pheasants & turkeys). Duck and geese estimates were obtained from the U.S. Fish and Wildlife Wetland Management District.

Section 4.1 discusses the potential of "naturalized" or "indigenous" bacteria in soils, ditch sediment, and water as an additional source. However, the studies cited are not definitive as to the magnitude of this contribution. Additionally, the studies are not definitive as to the ultimate origins of this bacteria, so it may not be appropriate to consider it as "natural" background.

4.3 Summary of Sources

Table 4.04 summarizes the primary sources of fecal coliform in the Cottonwood River watershed. It is recognized that there is some uncertainty regarding the numbers in the table. That being said, the data compiled for Table 4.04 is the best-known data possible. The feedlot numbers and livestock animal units were derived from county feedlot inventory records and MPCA. The rural population with inadequate subsurface sewage treatment systems (SSTSs) is based on county reports of malfunctioning SSTSs to the Minnesota Pollution Control Agency. The SSTS data is proportional to the area of the watershed included in each county. The 2006 Census estimates there is an average of 2.57 people/household; the SSTS figures were multiplied by 2.57 to estimate the rural population. The urban population was obtained from the 2000 Census.

Table 4.04: Inventory of Fecal Coliform Producers

		Animal Units or individuals		
Category	**Source**	**Within 1000' surface water**	**Not within 1000' surface water**	**Total**
With NPDES Permits	Dairy	910 AU		910 AU
	Beef	9,305 AU	12,677 AU	21,982 AU
	Swine	10,489 AU	21,133 AU	31,622 AU
	Poultry	243 AU	5 AU	248 AU
	Sheep		5 AU	5 AU
	Horse	2 AU		2 AU
	Other/Misc **			0 AU
Without NPDES Permits	Dairy	7,656.5 AU	5,633.3 AU	13,289.8 AU
	Beef	31,055.3 AU	23,230.2 AU	54,285.5 AU
	Swine	31,184 AU	29,803 AU	60,987 AU
	Poultry	2,505.4 AU	1,582.4 AU	4,087.8 AU
	Sheep	565 AU	425 AU	990 AU
	Horse	96 AU	60 AU	156 AU
	Other/Misc **	354.1 AU	16.3 AU	370.4 AU
Human	Population with inadequate septic systems	4,760 People		4,760 People
	Population with adequate septic systems	5,376 People		5,376 People
	WWTP	12,978 People		
Wildlife*	Deer	6,565 Deer		6,565 Deer
	Pheasants	126,048 Pheasants		126,048 Pheasants
	Turkeys	105 Turkeys		105 Turkeys
	Ducks	24,807 Ducks		24,807 Ducks
	Geese	1,759 Geese		1,759 Geese
	Other wildlife	6,565***		6,565***
Pets*	Dogs and Cats	11,545 Individuals		11,545 Individuals

*Pet and wildlife population numbers are explained in the paragraphs above this table.
** Other/Misc sources include: Other animals include buffalo, goat, rabbit, donkey, bulls and dogs
***Used Total Fecal Coliform Produced by Deer Population as Equivalent to unknown "Other Wildlife" population

5.0 TMDL development for the Cottonwood River Watershed

5.1 Approach to Allocations Needed to Satisfy the TMDLs

The TMDLs developed for the eight reaches in this Report consists of four main components: Load Allocations (LA), Wasteload Allocations (WLA), Margins of Safety (MOS), and Reserve Capacity (RC) as defined in Section 1.0. The WLA includes four sub-categories: Permitted wastewater treatment facilities, communities subject to Stormwater MS4 NPDES permit requirements, livestock facilities requiring NPDES permits, and "straight pipe" septic systems. *As additional data become available after US EPA approval of this TMDL, WLAs for individual permitted sources may be modified, provided the overall WLA does not change. Modifications in individual WLAs will be public noticed.* The LA, reported as a single category, includes manure runoff from farm fields, pastures, and smaller non-NPDES permitted feedlots, runoff from smaller non-permitted MS4 communities, and fecal coliform contributions from pets and wildlife. The LA includes land-applied manure from livestock facilities requiring NPDES permits, provided the manure is applied in accordance with the permit. The third component, MOS, is the part of the allocation that accounts for uncertainty that the allocations will result in attainment of water quality standards. Lastly, RC is the portion of the total load used to account for growth in the area.

The four components (WLA, LA, MOS, and RC) were calculated as average total daily load of fecal organisms (with the average being met over a calendar month). The daily number of fecal coliform organisms was calculated for each of a series of five flow zones ranging from low flow to high flow. Partitioning the daily fecal coliform loads between five flow regimes is referred to as the duration curve approach in this Report and is the methodology created by Bruce Cleland (Cleland, 2002; MPCA, 2006)

TMDLs can be developed using a variety of approaches. In Minnesota, the MPCA recommends the use of the "Duration Curve" approach for developing TMDLs. Steps used in the development of this TMDL are found in Appendix A.

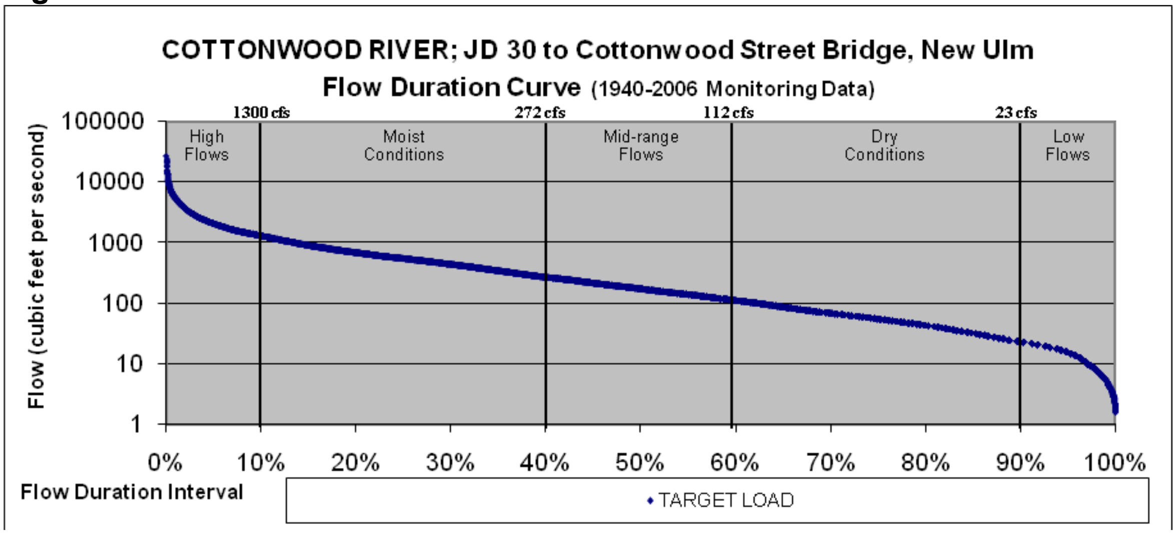
The duration curve approach involved using long-term (1940-2006) flow monitoring data from a U.S. Geological Survey gage station (USGS Station #05317000). The site is located near the outlet of the Cottonwood River in New Ulm, MN. Daily mean flow values were obtained for April through October, from 1940 through 2006. The April through October period was selected as this corresponds with the fecal coliform standard.

Data at the site has been very consistent and contains a good record of historical data. The site was originally established in 1909 and daily data is available for a period during open water periods until 1913 and re-established in 1931 with daily flows during open water periods. The site reported daily flow values from mid-1938 on.

The daily flow values were sorted by flow volume, from highest to lowest to develop a flow duration curve. Figure 5.01 displays the flow duration curve for the USGS gage site which is also the Cottonwood River outlet monitoring site (PLC001, STORET# S001-

918). The chart depicts the percentage of time any particular flow is exceeded. For example, during the flow record, 1,300 CFS was exceeded by 10 percent of daily flow values, and thus represents “high flow” conditions. A value of 23 CFS was exceeded by 90 percent of flow values and represents “low flow” conditions.

Figure 5.01: Cottonwood River Flow Duration Curve



Flow regimes were determined for high flow, moist, mid-range, dry, and low flow conditions. The mid-range flow value for each flow regime was then used to calculate the total monthly loading capacity (TMLC). Thus, for the “high flow” regime, the loading capacity is based on the monthly flow value at the fifth percentile. At this flow value, the mean monthly flow would be exceeded by five percent of all flow values in the dataset. Table 5.01 presents the flow regimes that were determined for the Cottonwood River gaging site, along with the flow value used to calculate the TDLC.

Table 5.01: Flow Categories for the Cottonwood River at USGS Station #05317000 in New Ulm

Flow Condition	Flow Duration Interval	Flow Range	Flow Value Used to Calculate Daily Load Capacity
High	0-10%	>1,300	2,077
Moist	10-40%	273-1,300	554
Mid	40-60%	113-272	175
Dry	60-90%	24-112	55
Low	90-100%	<24	15

Allocations in the duration curve approach for each impaired stream reach are developed for the full range of flows experienced during the April 1 – October 31 period of the fecal coliform standard. By adjusting the wasteload allocation, load allocation, and margin of safety to a range of five discrete flow intervals at each reach, a closer correspondence is obtained between the (flow-specific) loading capacity and the TMDL components (WLA + LA + MOS + RC), at the range of flow conditions experienced historically at each site. This approach also makes it possible to relate fecal coliform sources to allocations more specifically. For example, continuous discharges such as SSTS that are imminent health threats will be more prominent at lower flows, and manure runoff will be more prominent at higher flows.

Table 5.02 shows the conversion of flow from cubic feet per second (cfs) to million gallons per day (MGD), and loads from colony forming units (cfu)/ 100ml to organisms per day and vice versa. This Report states flow in MGD, concentrations in cfu/100mLand load in organisms per day.

Table 5.02: Conversion Equations

Flow: cubic feet/second (cfs) and Millions gallons per day (MGD); 1 cfs = 0.646 MGD	
To change cfu/100ml to organisms/day using flow in cfs or MGD	
Flow in cfs	cfu/100mL x cfs x 28,317 mL/ ft^3 x 86,400 seconds/day = orgs/day
Flow in MGD	cfu/100mL x 3,785 ml/gallon x 1E+6 gal/1MG x MGD = orgs/day
To change organisms/day to cfu/100ml using flow in cfs or MGD	
Flow in cfs	Orgs/day x 1/cfs x 1/28,317ml/ft^3 x 1/86,400sec/day x 100 = cfu/100ml
Flow in MGD	Orgs/day x 1/MGD x 1MG/1E+6 gal. x gal./3,785 mL x 100 = cfu/100ml

*cfu (colony forming units) is equivalent to organisms

5.2 Components of TMDL Allocations

Each impaired reach in this Report is associated with a stream reach within the entire watershed and were listed to the 303(d) list based on sampling data. When allocating the total daily loading capacity in the Cottonwood River watershed, the sum of all reaches contributing to the reach that was listed as impaired would be included as part of the summation of that impaired reaches loading capacity. For instance, to determine the loading capacity the site PMC020, the entire area of the watershed above that point is considered in the total daily loading capacity. This would mean that the components (WLA, LA, MOS, and RC) for the impaired reaches associated with TUP, TUL, and TUMC would also be included in the impaired reach associated with PMC020, yet components of TUP, TUL, and TUMC are independent of each other in their own right. Furthermore, the impaired reaches of TUP, TUL, and TUMC would also be part of the components of the load capacities in the reaches associated with sites, PLC010, PLC001, and CWR-1 but would not be included in the reaches at PLS005 or SLH020 (see sites, STORET#s and how they relate to each other in Figure 3.01).

For each impaired reach and flow condition, the total daily loading capacity or total maximum daily load (TMDL) was divided into its component wasteload allocation, load allocation, reserve capacity, and margin of safety. The process was as follows:

5.2.1 Wasteload Allocation

<u>Wastewater Treatment Facilities (WWTF)</u>

- Continuous discharge (mechanical) WWTF allocations were calculated by multiplying wet-weather design flows for all facilities in an impaired reach watershed by the permitted discharge limit (200 organisms per 100mL). Since wet-weather design flows represent a “maximum” flow for a mechanical treatment (continuous discharge) facility, the WWTF allocations are conservative in that they are substantially greater than what is actually being discharged. This builds the case for an implicit margin of safety for these facilities. Consequently, the WWTF design flows for both of the mainstem sites exceed the stream flow at the low flow zone. Of course, actual WWTF flow can never exceed stream flow as it is a component of stream flow.

- Non–continuous (stabilization ponds) discharge WWTF allocations were calculated by multiplying the maximum flow volumes (all discharge periods) by the permitted discharge limit requirement (200 organisms per 100mL). Pond systems typically discharge over a 1-2 week period in the spring and in the fall. In the event they need to discharge outside of the spring or fall window, the WWTF wasteload allocation assumed that these facilities could discharge for an entire month under any flow conditions. As long as WWTFs discharge at or below their permit limit, they will not cause violations of the fecal coliform water quality standard. See Section 4.2.1 for more information.
- The total daily loading capacities in the low flow zone are very small and the calculated margins of safety are relatively large. This is due to the occurrence of zero to near-zero flows in the long-term flow records used for these sites. In the case of the USGS sites at Marshall, the calculated MOS takes up nearly all of the remaining allocation capacity after assigning wasteload allocation values. To account for these situations, the wasteload and load allocations are expressed as an equation rather than an absolute number. That equation is simply:

  Allocation = (flow contribution from a given source) x (200 cfu/100 ml)

  In essence, this amounts to assigning a concentration-based limit to the MS4 community and nonpoint source load allocation sources for this low flow zone. While this might be seen as quite stringent, these sources tend not to be significant contributors under the low flow zone conditions. The contribution of fecal coliform from straight-pipe septic systems could be substantial under these conditions; however, these systems are still assigned a zero allocation.

<u>Straight-Pipe Septic Systems</u>
Straight-pipe septic systems are illegal and un-permitted, and as such are assigned a zero wasteload allocation.

<u>Stormwater NPDES Permits</u>
To account for permitted Municipal Separate Storm Sewer Systems (MS4) communities, the WWTF allocation and MOS were subtracted from the total loading capacity. The remaining capacity was divided between municipal separate storm sewer system (MS4) permits (wasteload allocations) and all nonpoint sources (load allocation) based on the percentage of land in an

impaired reach watershed covered by MS4 permits. For example, if 10 percent of an impaired reach watershed is covered by a MS4 permit, 10 percent of the remaining capacity is allocated to that permit. The same land area would factor into all reaches downstream of the reach that holds the MS4 permit as a percentage of the total area of the watershed to that point. Let us continue with the example above: Let's say the area of the watershed to the impaired reach is 100 square miles. The area of the city in the watershed with the MS4 permit is 10 square miles so we allocate 10 percent of the Load Allocation to the permit for this impaired reach. Now let's say there is an impaired reach downstream of the first reach in which the watershed to that point is 400 square miles and includes the city with the MS4 permit 10 square miles of the entire 400 square mile area so we allocate 2.5 percent of the Load Allocation to the permit for this impaired reach. In addition to being a practical way to allocate between MS4 permits and all other nonpoint sources, it is also equitable from the standpoint of rural and urban fecal coliform sources being held to the same "standard".

Livestock Facilities Requiring NPDES Permits

Livestock facilities that have been issued NPDES permits are assigned a zero wasteload allocation. This is consistent with the conditions of the permit, which allow no pollutant discharge from the livestock housing facilities and associated sties. Discharge of fecal coliform from fields where manure has been land applied may occur at times. Such discharges are covered under the load allocation portion of the TMDLs, provided the manure is applied in accordance with the permit.

5.2.2 Load Allocations

Once the WLA and MOS were determined for a given reach and flow zone, the remaining loading capacity was considered load allocation. The load allocation includes nonpoint pollution sources that are not subject to NPDES permit requirements with exception to land application of manure. The nonpoint pollution sources are largely related to livestock production, inadequate human wastewater treatment, non-permitted municipal stormwater systems, pets and "natural background" sources such as wildlife.

5.2.3 Margin of Safety

- The purpose of the MOS is to account for uncertainty that the allocations will result in attainment of water quality standards. Because the allocations are a direct function of daily flows, accounting for potential flow variability is the appropriate way to address the MOS. This is done within each of the five flow zones.
- The margin of safety was calculated based on the difference between the median flow and minimum flow in each zone. For example, the MOS for the low flow zone is the 100th percentile flow value subtracted from the 95th percentile flow value. The resulting value was converted to a load and used as the MOS.

For the low flow zone, this reflects the lowest daily flow observed over the period of record at the specific flow gage site.

- For the impaired reach in which the allocation for the dry and low flow zones required use of an alternative method of calculation, i.e., a concentration-based limit, an implicit MOS was used. An implicit MOS means that conservative assumptions were built in to the TMDL and/or allocations. In this instance the listed section is expected to meet the TMDL because the permitted point source dischargers are limited to discharge concentrations below the impairment target, thereby providing additional capacity. In addition, the creek flow itself is primarily being fed by ground water at these low flows, which is believed to convey very little of the impairment.

5.2.4 Reserve Capacity

Reserve capacity is a portion of total allocation that shall accommodate future growth. A reserve capacity in this watershed was considered, but in light of the decrease in population and relative stagnancy in animal numbers, it was decided that the LA would not be held to reserve capacity. For the MS4 permits however, the land area of the city in the watershed was increased by 10 percent of the footprint of the city to account for development, though the populations of these cities have been decreasing per US Census estimates. This would also mean that current permitted volumes for WWTFs could serve the functions they were designed for and would probably not need to change significantly.

The overall population growth in the past decade for the Cottonwood River watershed averaged a loss of about 4 percent. Changes in the human population should not change the load allocations provided in this Report. There is no clear trend in livestock numbers in the watershed; however livestock numbers appear to be concentrated in fewer operations.

<u>Straight Pipe Septic Systems</u>
The number of straight pipe septic systems, will decrease over time, as a result of the implementation of state and local rules, ordinances, and programs. Because these systems constitute illegal discharges, they are not provided a wasteload allocation for the impaired reaches in this Report. As such, other elements of the TMDL allocation will not change as these systems are eliminated.

<u>Wastewater Treatment Facilities</u>
Flows at some wastewater treatment facilities are not likely to change greatly over time with negligible changes in the populations they serve. As long as current fecal coliform discharge limits are met at these facilities, the flows most likely will not impact the allocation given to other sources. The population is expected to decline; currently there is adequate treatment such that fecal coliform will not increase. Municipal WWTF currently represent a small proportion

of the watershed loads and are regulated through NPDES permits. Under these permits, WWTFs must discharge below the standard of 200 cfu/100ml.

Municipal Separate Storm Sewer Systems
Expansion of the current MS4 community in the watershed is not likely to take place, because of the declining population trend in the counties. That being said, values used to account for MS4 permitting in this study have been purposefully over estimated to account for development though the populations of these cities appear to be decreasing.

Livestock
The other major source of fecal coliform in the watershed, besides human, is livestock. While there have been changes in the sizes and types of feedlots, there do not appear to be clear trends in overall livestock numbers. With changes in facility size and type, a continuing shift in focus from the feedlots themselves to land application practices may be warranted in the future. If growth in livestock does occur, newer regulations for facility location and construction, manure storage design, and land application practices should help mitigate potential increases in fecal coliform loading to the streams and rivers in the watershed.

For the above reasons, no explicit adjustments were made to the wasteload or load allocations to account for human or livestock population growth. The MPCA will monitor population growth, urban expansion, and changes in agriculture, and reopen the TMDLs covered in this report if and when adjustments to allocations may be required.

Table 5.03 presents the resulting TMDL (WLA+LA) and MOS for the Cottonwood River impaired reach based on the five flow regimes. The values expressed are in total organisms per day. For each of the five flow regimes, the monthly flow volume was multiplied by the water quality standard of 200 organisms/100 ml.

Table 5.03: TDLC for the Cottonwood River at USGS Station #05317000 in New Ulm

Flow Condition	Allocation*	MOS*	TDLC*
High	6360.1	3801.4	10161.4
Moist	1330.7	1377.2	2707.9
Mid	547.9	308.2	856.2
Dry	112.5	156.6	269.1
Low	4.4	69.0	73.4

*Values expressed in billions of organisms per day

Several of the fecal coliform impaired reaches did not have sufficient flow monitoring data. To estimate flow at the ends of the listed reaches it was assumed that the flow at those reaches was proportional to the USGS gage station in New Ulm based on respective drainage areas represented. For example, the Plum Creek impaired stream reach is 6.76 percent of the watershed area monitored by the New Ulm USGS gaging station. To determine flow zones for the Plum Creek site, mean monthly flows were assumed to be 6.76 percent of the flow volumes at the New Ulm gauging station. Calculated flows were then checked against 7 years of measured flow data for the small stream. This check showed that the magnitudes were generally similar between the actual vs. proportionally-calculated flows; however, there were some discrepancies in timing of peak flows following significant rain events. This approach represents a valid method of determining flow values for ungaged areas of the watershed. Table 5.04 lists the ungaged sites and watershed area.

Table 5.04: Cottonwood River Watershed Impaired Reaches Descriptions and Watershed Areas

Reach	Description	Year listed	River Assessment Unit ID	STORET # Used for Assessment	Area of sub-watershed (sq. miles)	Percentage of Watershed Area/Area at USGS Site#	Area of Cottonwood River Watershed
Cottonwood River	Judicial Ditch 30 to Minnesota R	94	07020008-501	S000-139; S001-918	1,304.1	100%	99.3%
Cottonwood River	Coal Mine Cr to Sleepy Eye Cr	06	07020008-508	S001-920	884.4	67.8%	67.4%
Sleepy Eye Creek	Headwaters to Cottonwood R	06	07020008-512	S001-919	274.1	21.0%	20.9%
Cottonwood River	Plum Cr to Dutch Charley Cr	06	07020008-504	S002-247	448.3	34.4%	34.1%
Dutch Charley Creek	Highwater Cr to Cottonwood R	06	07020008-517	S001-915	208.8	16.0%	15.9%
Plum Creek	Headwaters to Cottonwood R	06	07020008-516	S001-913	90.8	6.96%	6.92%
Lone Tree Creek*	T109 R39W S7, westline to Cottonwood R	Not Listed	07020008-524	S001-914	28.2	2.16%	2.15%
Meadow Creek	Headwaters to Cottonwood R	Not Listed	07020008-515	S001-917	97.5	7.48%	7.43%

Total Area of Cottonwood River Watershed is 1,312.8 sq. miles
*Uses the Class 7: Limited Resource Value water quality standard of 1,000 cfu/100mL standard
#Uses the USGS site above at Cottonwood Street in New Ulm (Site #05317000)

5.3 TMDL Allocations for Individual Impaired Reaches

In Sections 5.3.1 through 5.3.8 below, TMDL allocations are provided for the individual impaired reaches. Please note the following explanations and clarifications for portions of presented information in these sections:

- Tables showing permitted wastewater treatment facilities, livestock facilities, and MS4 communities that are unique to the sub-watershed described in the section. These values along with any values upstream of the sub-watershed to calculate waste load allocations for the impaired reach of the sub-watershed.

- Calculations for the TMDL, (WLA, LA, and MOS) consider the total drainage area represented by the end of each listed reach. As such, listed reaches lower in the watershed will have allocations for the same sources covered in listed reaches upstream. In terms of actual load contributions, some upstream sources may not be as significant as those sources within or close to the downstream listed reaches due to the potential for die-off of bacteria as waters travel downstream in the watershed.

- Tables showing the fecal coliform loading capacities and allocations are provided and illustrate the TMDL, (WLA, LA and MOS) for the midpoints of five flow zones. (Due to rounding the (WLA, LA, and MOS) may not exactly add up to the loading capacities for some flow zones.)

- An estimated reduction percentage is provided for each listed reach (where sufficient data are available) to indicate how much of a decrease from geometric means are needed to meet the water quality standard (i.e., 200 organisms/100 ml). The calculation is as follows:

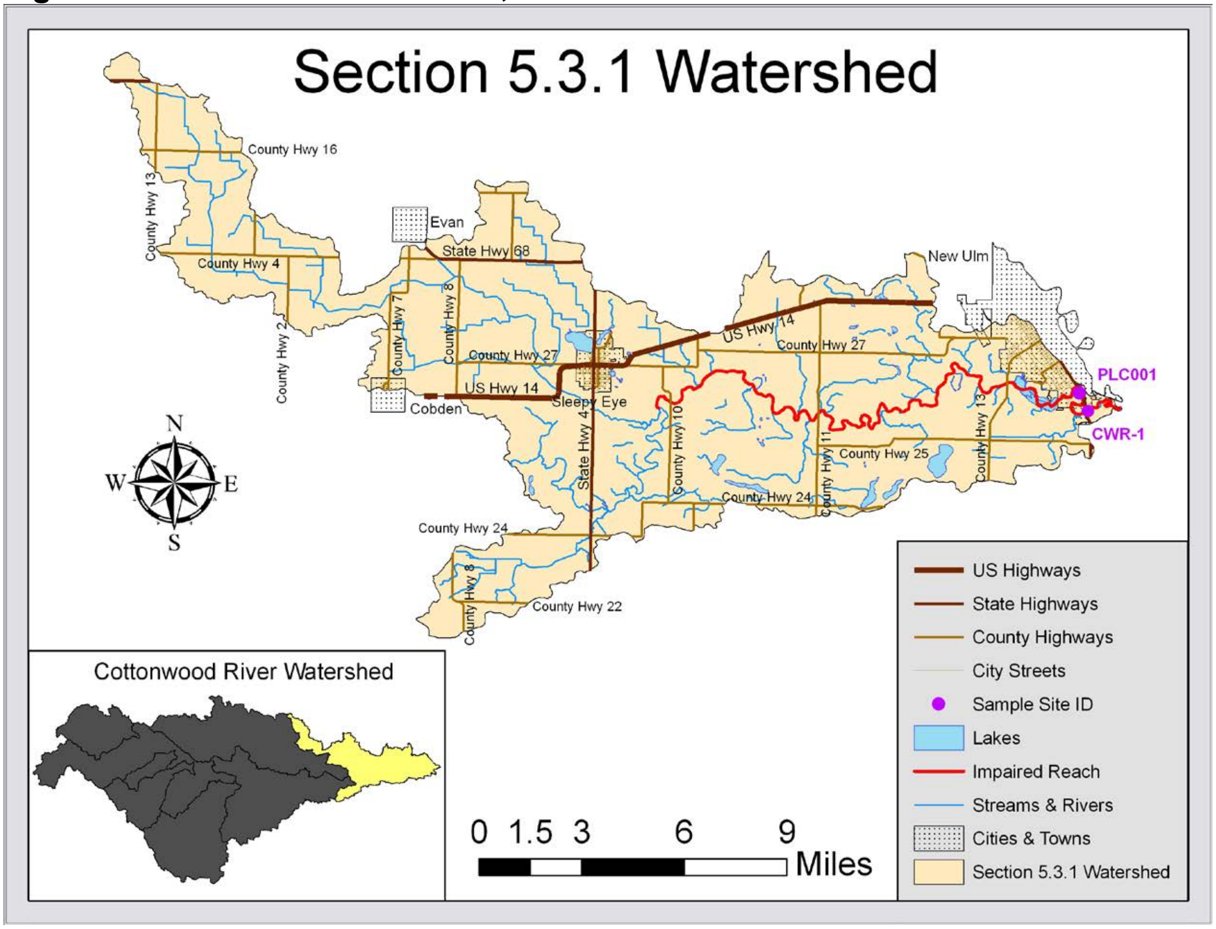
  (geometric mean – 200) / geometric mean)

  The resulting reduction percentage is only intended as a rough approximation, as it does not account for flow and since bacterial data is inherently highly variable. Sample sizes are low and vary. This contributes uncertainty in the percent reduction calculations. Reduction percentages are not a required element of a TMDL (and do not supersede the allocations provided), but are included here to provide a starting point to assess the magnitude of the effort needed in the watershed to achieve the standard.

5.3.1 Cottonwood River; JD 30 to Minnesota River (AUID: 07020008-501)

This reach of the Cottonwood River from Judicial Ditch 30 to the Minnesota River (Figure 5.3.1A) was added to the Section 303(d) Clean Water Act impaired waters list in 1994. The primary source of data that led to this listing was the MPCA long-term monitoring program. The sampling sites are CWR-1 (STORET# S000-139) and PLC001 (STORET# S001-918). The drainage area to the sampling station of this impaired reach is 1,304 square miles.

Figure 5.3.1A: Cottonwood River; JD30 to Minnesota River



Land use in this reach of the impairment is 83.2 percent cultivated, 3.9 percent grass, 7.0 percent forest, 1.8 percent water/wetlands, and 4.0 percent urban. One community, Sleepy Eye is serviced by a WWTF in this area (Table 5.3.1A). A portion of New Ulm is in this sub-watershed of the Cottonwood River watershed. Their permitted wastewater treatment facility does not enter the Cottonwood River system. New Ulm has a MS4 NPDES stormwater permit (Table 5.3.1B). The MS4 permit covers approximately 3.48 square miles, or .29 percent of the entire watershed to this point, and allows for growth. There are an estimated 604 SSTS systems in this reach, of which, 255 are failing. There are five NPDES permitted livestock facilities in the reach (Table 5.3.1C). The number of animal units at locations without NPDES permits for swine, dairy, beef, poultry, sheep and horses in the reach are 12,929; 6,501; 5,392; 1,442; 52; and 29 respectively. Animal units (AUs) without NPDES permits account for 76.2% of all AUs and NPDES permitted facilities have 23.8% of all AUs in this reach.

Table 5.3.1D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margin of safety. The loading capacities for five flow zones were developed using flow data from the USGS gage site (USGS# 05317000) on the Cottonwood River at New Ulm. Substantial reductions in fecal coliform loading from straight-pipe septic systems and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in Appendix B.

Table 5.3.1A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Sleepy Eye	MNG580041	0.7	5.3

Table 5.3.1B: Permitted Municipal Separate Storm Sewer System (MS4) Communities

Community	Permit Number	Population Estimate	Category
New Ulm	#MS400228	13,362	Designated by rule: >5,000 population and within ½ mile of an impaired water. 3.48 square miles of the watershed

Table 5.3.1C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Gilland Feedlot Inc.	127-50088	2,300 Other Cattle – 2,300 AU
Mark Schwartz Farm	015-50008	4,000 Swine, 55 lbs. or more – 1,200 AU
Tim Schieffert Farm	015-50002	6,400 Swine, 55 lbs. or more – 1,920 AU
Mark Schwartz Farm	015-82452	3,840 Swine, 55 lbs. or more – 1,252 AU
Tim Schieffert Farm	015-71684	5,200 Swine, 55 lbs. or more – 1,560 AU

Table 5.3.1D: Daily Fecal Coliform Loading Capacities and Allocations – Cottonwood River; JD 30 to Minnesota River (AUID: 07020008-501)

Drainage area for listed reach (sq mi): 1304.1
Flow gage used: Cottonwood River at Cottonwood Street, New Ulm USGS #05317000
Land Area MS4 Urban (%): 0.287
Total WWTF Flow (mgd): 2.9592

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY LOADING CAPACITY	10161.4	2707.9	856.2	269.1	73.4
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	22.4	22.4	22.4	22.4	22.4
Communities Subject to MS4 NPDES Requirements	18.2	3.8	1.5	0.3	*
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	6319.5	1304.6	524.0	89.9	*
Margin of Safety	3801.4	1377.2	308.2	156.6	*Implicit*
	Percent of total daily loading capacity				
TOTAL DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.2%	0.8%	2.6%	8.3%	30.5%
Communities Subject to MS4 NPDES Requirements	0.2%	0.1%	0.2%	0.1%	*
Livestock Facilities Requiring NPDES Permits	0.0%	0.0%	0.0%	0.0%	0.0%
"Straight Pipe" Septic Systems	0.0%	0.0%	0.0%	0.0%	0.0%
Load Allocation	62.2%	48.2%	61.2%	33.4%	*
Margin of Safety	37.4%	50.9%	36.0%	58.2%	*Implicit*

* See Section 5.2

Reductions Needed by Month

Monitoring Conducted by: Redwood-Cottonwood River Control Area/MPCA
Years Monitored: 1997 through 2006
Samples Collected: 78 (includes two sites)

The following reduction represents the percentage reduction in bacterial concentration (Figure 5.3.1B and Figure 5.3.1C) that would be required to meet the 200 cfu/100 ml water quality standard. This reduction percentage is only intended as a rough approximation, as it does not account for flow. It serves to provide a starting point based on recent water quality data for assessing the magnitude of the reduction needed in the watershed to achieve the surface water standard. This reduction percentage does not supersede the allocations provided for the TMDL. See also Table 3.02 for sampling data and Section 9.2 for locally targeted implementation plan.

CWR-1 (S000-139)

Month	Required Reduction
April	Inadequate Data
May	None Required
June	None Required
July	None Required
August	None Required
September	29.58%
October	None Required

PLC001 (S001-918)

Month	Required Reduction
April	Inadequate Data
May	None Required
June	87.48%
July	None Required
August	Inadequate Data
September	Inadequate Data
October	Inadequate Data

Figure 5.3.1B: (CWR-1) Monthly Geometric Mean Fecal Coliform Concentrations (1997-2006)

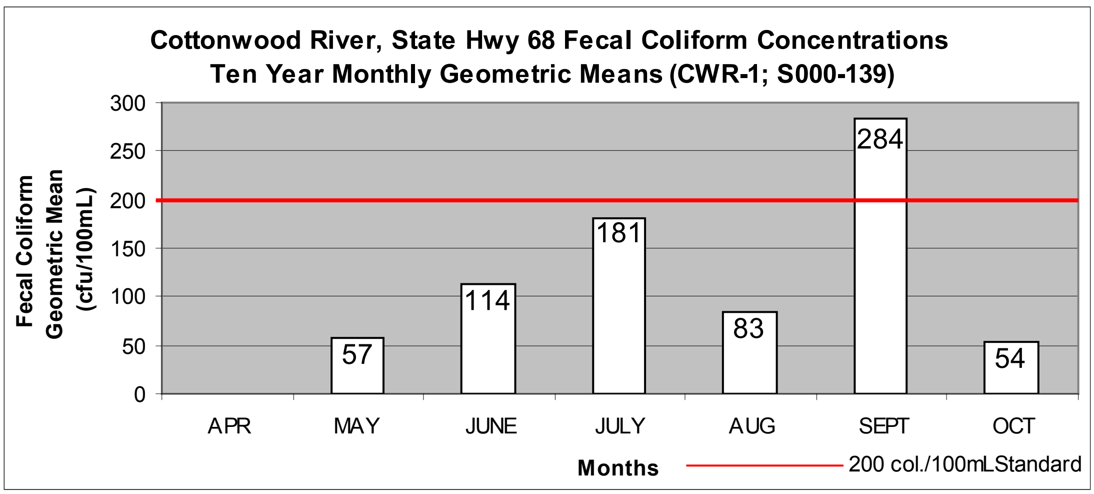
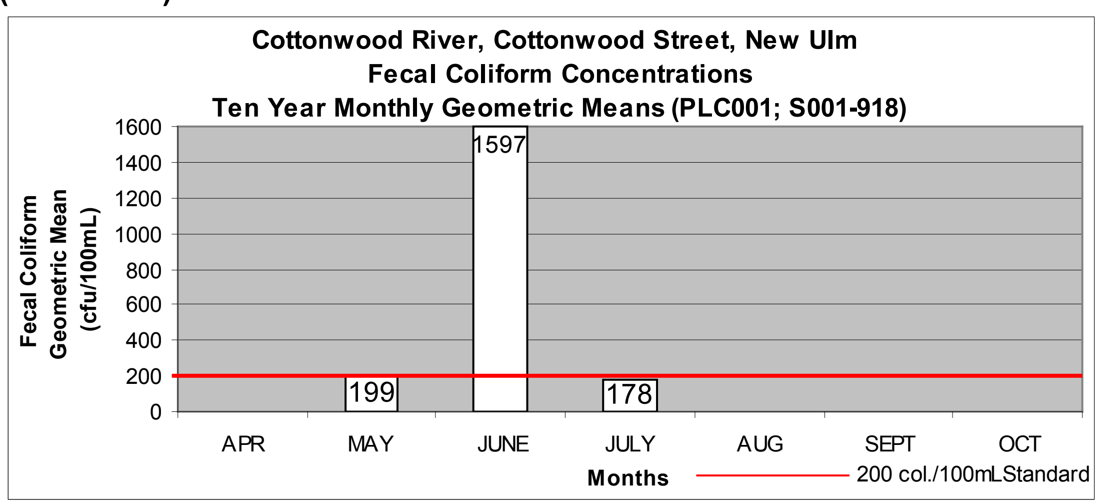


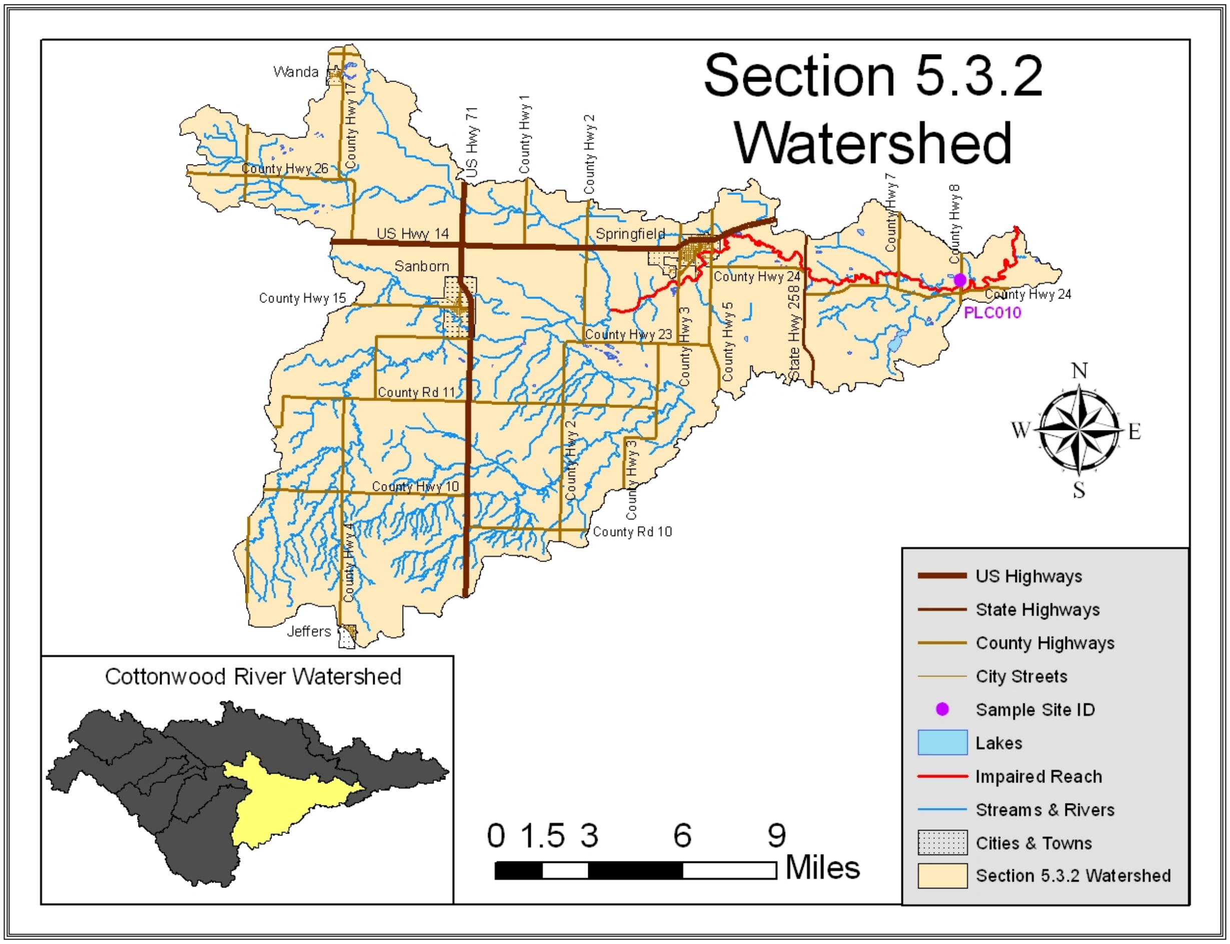
Figure 5.3.1C: (PLC001) Monthly Geometric Mean Fecal Coliform Concentrations (1997-2006)



5.3.2 Cottonwood River; Coal Mine Creek to Sleepy Eye Creek (AUID: 07020008-508)

The Cottonwood River reach from Coal Mine Creek to Sleepy Eye Creek (Figure 5.3.2A) was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the monitoring efforts of the RCRCA. The sampling site is PLC010 (STORET# S001-920). The drainage area to the sampling station of this impaired reach is 876.75 square miles.

Figure 5.3.2A: Cottonwood River; Coal Mine Creek to Sleepy Eye Creek



Land use in the reach of the impairment is 87.7 percent cultivated land, 7.0 percent grass, 2.7 percent forest, 0.4 percent water/wetlands, and 2.2 percent urban. The reach contains two communities, Springfield and Sanborn, served by permitted wastewater treatment facilities (Table 5.3.2A), and there are no communities requiring MS4 permits (Table 5.3.2B). There are an estimated 760 SSTS systems in this reach, of which, 314 are failing. There are six NPDES permitted livestock facilities in the reach (Table 5.3.2C). The number of animal units at locations without NPDES permits for beef, swine, dairy, poultry, buffalo, sheep and horses in the reach are 16,588; 9,346; 2,425; 1,352; 240; 10; and 8 respectively. Animal units (AUs) without NPDES permits account for 72.5% of all AUs and NPDES permitted facilities have 27.5% of all AUs in this reach.

Table 5.3.2D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from Cottonwood River USGS site in New Ulm. Substantial reductions in fecal coliform loading from straight-pipe septic systems and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in Appendix B.

Table 5.3.2A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Springfield	MN0024953	0.78	5.905
Sanborn	MN0024805	0.056	0.424

Table 5.3.2B: Permitted Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
none		

Table 5.3.2C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Sandy Rivers Hutterian Brethren	127-65964	600 Swine, 55 lbs or more – 286.7 AU 2134 Swine, < 55 lbs.
Cory Huiras Farm	015-50005	6500 Cattle, 1950 Chickens – 7805.85 AU
Four Seasons Dairy	015-95051	230 Other Cattle – 211 AU
Schwartz Brothers Farm	015-71727	1920 Swine, 55 lbs. or more – 916 AU 6800 Swine, < 55 lbs.
Glen Graff Farm	033-50011	1200 Cattle, 600 Swine 55 lbs. or more – 1382 AU
Dry Creek Ranch	033-98098	900 Other Cattle – 765 AU

Table 5.3.2D: Daily Fecal Coliform Loading Capacities and Allocations – Cottonwood River; Coal Mine Creek to Sleepy Eye Creek (AUID: 07020008-508)

Drainage area for listed reach (sq mi): 876.8
Flow gage used: Cottonwood River at Cottonwood Street, New Ulm USGS #05317000
Land Area MS4 Urban (%): 0.03
Total WWTF Flow (mgd): 2.077

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY LOADING CAPACITY	6831.55	1820.5	575.60	180.90	49.34
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	15.7	15.7	15.7	15.7	15.7
Communities Subject to MS4 NPDES Requirements	1.3	0.3	0.1	<0.1	*
Livestock Facilities Requiring NPDES Permits	0.0	0.0	0.0	0.0	0.0
"Straight Pipe" Septic Systems	0.0	0.0	0.0	0.0	0.0
Load Allocation	4260.0	878.9	352.7	59.9	*
Margin of Safety	2555.7	925.9	207.2	105.3	*Implicit*
	Percent of total daily loading capacity				
TOTAL DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.2%	0.9%	2.7%	8.7%	31.9%
Communities Subject to MS4 NPDES Requirements	<0.1%	<0.1%	<0.1%	<0.1%	*
Livestock Facilities Requiring NPDES Permits	0.0%	0.0%	0.0%	0.0%	0.0%
"Straight Pipe" Septic Systems	0.0%	0.0%	0.0%	0.0%	0.0%
Load Allocation	62.4%	48.3%	61.3%	33.1%	*
Margin of Safety	37.4%	50.9%	36.0%	58.2%	*Implicit*

* See Section 5.2

Potential Sources and Reductions Needed

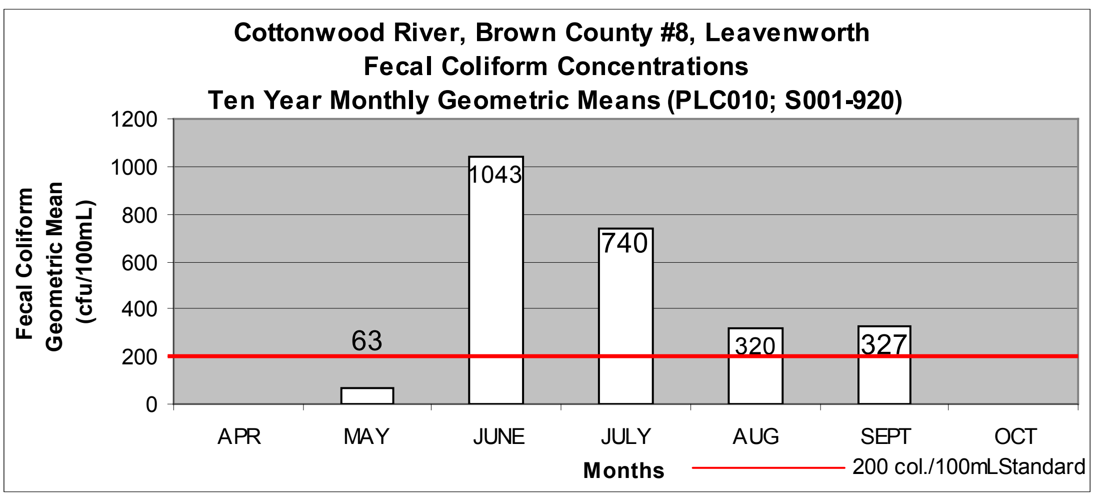
Monitoring Conducted by: Redwood-Cottonwood River Control Area
Years Monitored: 1997 through 2006
Samples Collected: 51

The following reduction represents the percentage reduction in bacterial concentration (Figure 5.3.2B) that would be required to meet the 200 cfu/100 ml water quality standard. This reduction percentage is only intended as a rough approximation, as it does not account for flow. It serves to provide a starting point based on recent water quality data for assessing the magnitude of the reduction needed in the watershed to achieve the surface water standard. This reduction percentage does not supersede the allocations provided for the TMDL. See also Table 3.02 for sampling data and Section 9.2 for locally targeted implementation plan.

PLC010 (S001-920)

Month	Required Reduction
April	Inadequate Data
May	None Required
June	80.82%
July	72.97%
August	37.50%
September	38.84%
October	Inadequate Data

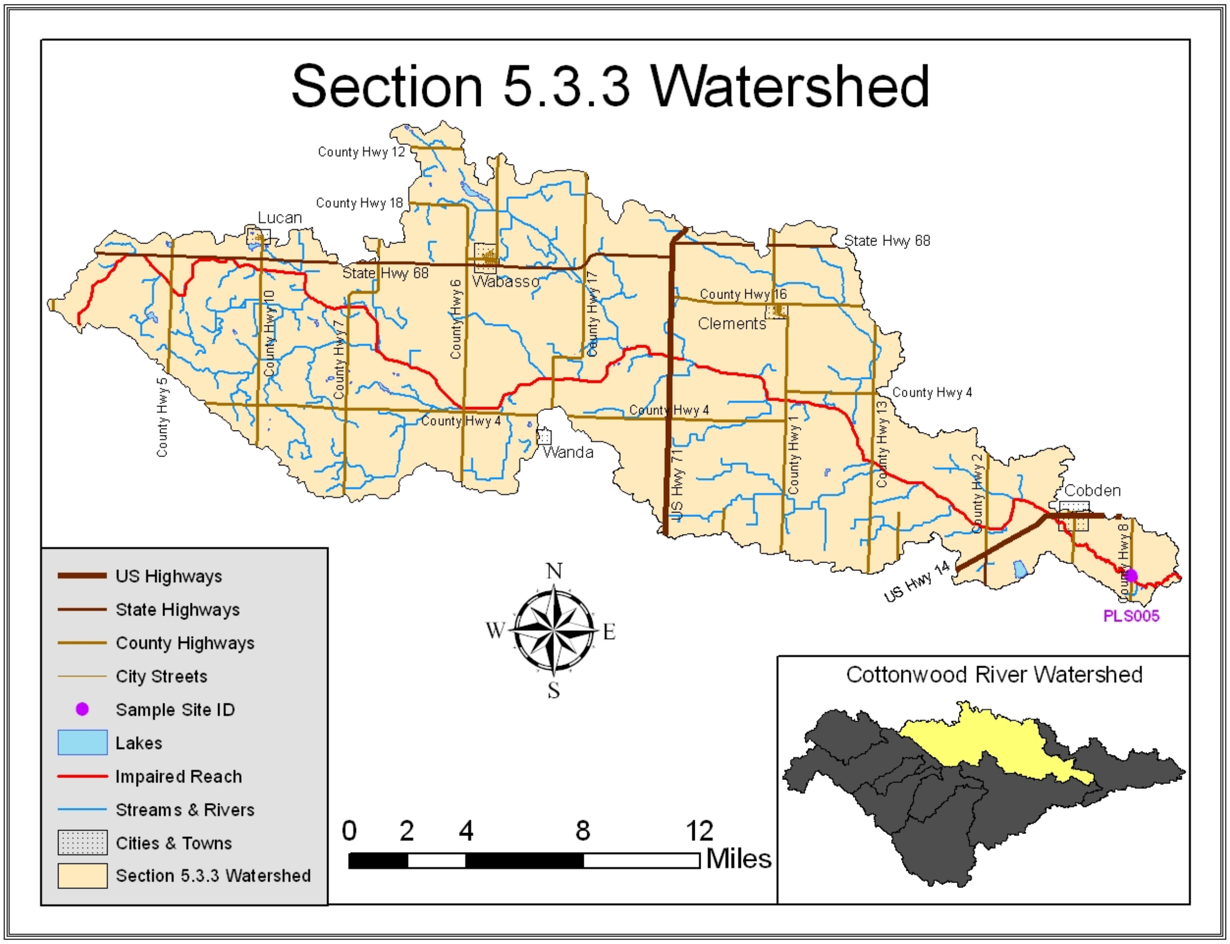
Figure 5.3.2B: (PLC010) Monthly Geometric Mean Fecal Coliform Concentrations (1997-2006)



5.3.3 Sleepy Eye Creek, Headwaters to Cottonwood River (AUID: 07020008-512)

Sleepy Eye Creek from its headwaters to the Cottonwood River (Figure 5.3.3A) was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data is from the sampling efforts of RCRCA. The sampling site is PLS005 (STORET# S001-919). The drainage area to the sampling station of this reach is 271.44 square miles.

Figure 5.3.3A: Sleepy Eye Creek, Headwaters to Cottonwood River



Land use in the reach includes 95.3 percent cultivated, 1.2 percent grass, 1.4 percent forest, 0.4 percent water/wetlands, and 1.6 percent urban. There are four wastewater treatment facilities in the reach (Table 5.3.3A) servicing the community of Lucan, Wanda, Wabasso, and Clements. None of these communities require a MS4 Stormwater permit (Table 5.3.3B). There are an estimated 806 SSTS systems in this reach, of which, 592 are failing. There are thirteen NPDES permitted livestock facilities in the reach (Table 5.3.3C). The number of animal units at locations without NPDES permits for swine, beef, dairy, poultry, sheep, horse and other (dogs, goats and bulls) in the reach are 12,625; 7,613; 2,770; 1,017; 73; 14; and 30 respectively. Animal units

(AUs) without NPDES permits account for 62.2% of all AUs and NPDES permitted facilities have 37.8% of all AUs in this reach.

Table 5.3.3D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the USGS gage site on the Cottonwood River in New Ulm. Substantial reductions in fecal coliform loading from straight-pipe septic systems and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in Appendix B.

Table 5.3.3A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Clements	MN0023043	0.025	0.189
Lucan	MN0031348	0.028	0.212
Wabasso	MN0025151	0.1125	0.852
Wanda	MN0020524	0.0167	0.126

Table 5.3.3B: Permitted Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.3.3C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Andrew Schiller Farm	127-50051	6,240 Swine, 55 lbs. or more – 1,872 AU
Brian Timm Farm	127-50091	3,120 Swine, 55 lbs. or more – 936 AU
Kodet Farms	127-50042	2,700 Swine, 55 lbs. or more – 855 AU 900 Swine, < 55 lbs.
Paul Meidl Farm	127-50047	2,880 Swine, 55 lbs. or more – 879 AU 200 Swine, < 55 lbs. & 50 Sheep
Kurt Kratz Farm	015-82460	2,600 Swine, 55 lbs. or more – 780 AU
Lindeman & Wells Inc.	015-50013	3,840 Swine, 55 lbs. or more – 1,152 AU
Lindeman & Wells Inc.	015-72338	3,840 Swine, 55 lbs. or more – 1,152 AU
Richard Trebesch Farm	015-50009	3,840 Swine, 55 lbs. or more – 1,180 AU 40 Cattle
Richard Trebesch Farm	015-71783	3,840 Swine, 55 lbs. or more – 1,180 AU 40 Cattle
Scott Helget Farm	015-71726	2,000 Swine, 55 lbs. or more – 600 AU
Tom Anderson Farm	015-60703	2,000 Cattle – 1640 AU
Trent Moe Farm	015-71671	4,440 Swine, 55 lbs. or more – 1,332 AU
Tom Anderson Farm	015-71688	1,600 Cattle – 1120 AU

Table 5.3.3D: Daily Fecal Coliform Loading Capacities and Allocations – Sleepy Eye Creek, Headwaters to Cottonwood River (AUID: 07020008-512)

Drainage area for listed reach (sq mi): 271.4
Flow gage used: Cottonwood River at Cottonwood Street, New Ulm USGS #05317000
Land Area MS4 Urban (%): 0
Total WWTF Flow (mgd): 0.1822

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY LOADING CAPACITY	2115.0	563.6	178.2	56.0	15.3
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	1.4	1.4	1.4	1.4	1.4
Communities Subject to MS4 NPDES Requirements	0	0	0	0	*
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	1322.4	275.6	112.7	22.0	*
Margin of Safety	791.2	286.7	64.2	32.6	*Implicit*
	Percent of total daily loading capacity				
TOTAL DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.1%	0.2%	0.8%	2.5%	9.0%
Communities Subject to MS4 NPDES Requirements	0.0%	0.0%	0.0%	0.0%	*
Livestock Facilities Requiring NPDES Permits	0.0%	0.0%	0.0%	0.0%	0.0%
"Straight Pipe" Septic Systems	0.0%	0.0%	0.0%	0.0%	0.0%
Load Allocation	62.5%	48.9%	63.2%	39.4%	*
Margin of Safety	37.4%	50.9%	36.0%	58.2%	*Implicit*

* See Section 5.2

Potential Sources and Reductions Needed

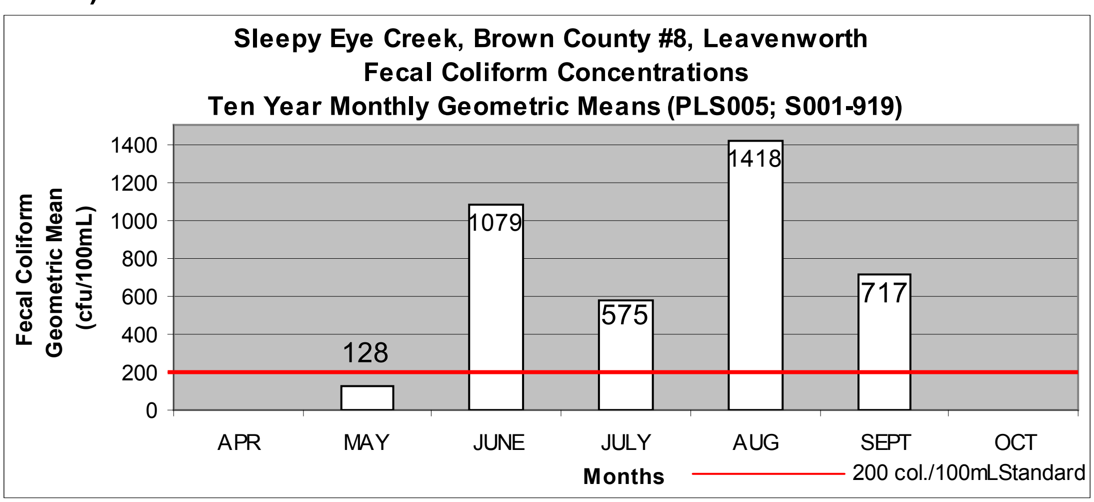
Monitoring Conducted by: Redwood-Cottonwood River Control Area
Years Monitored: 1997 through 2006
Samples Collected: 52

The following reduction represents the percentage reduction in bacterial concentration (Figure 5.3.3B) that would be required to meet the 200 cfu/100 ml water quality standard. This reduction percentage is only intended as a rough approximation, as it does not account for flow. It serves to provide a starting point based on recent water quality data for assessing the magnitude of the reduction needed in the watershed to achieve the surface water standard. This reduction percentage does not supersede the allocations provided for the TMDL. See also Table 3.02 for sampling data and Section 9.2 for locally targeted implementation plan.

PLS005 (S001-919)

Month	Required Reduction
April	Inadequate Data
May	None Required
June	81.46%
July	65.22%
August	85.90%
September	72.11%
October	Inadequate Data

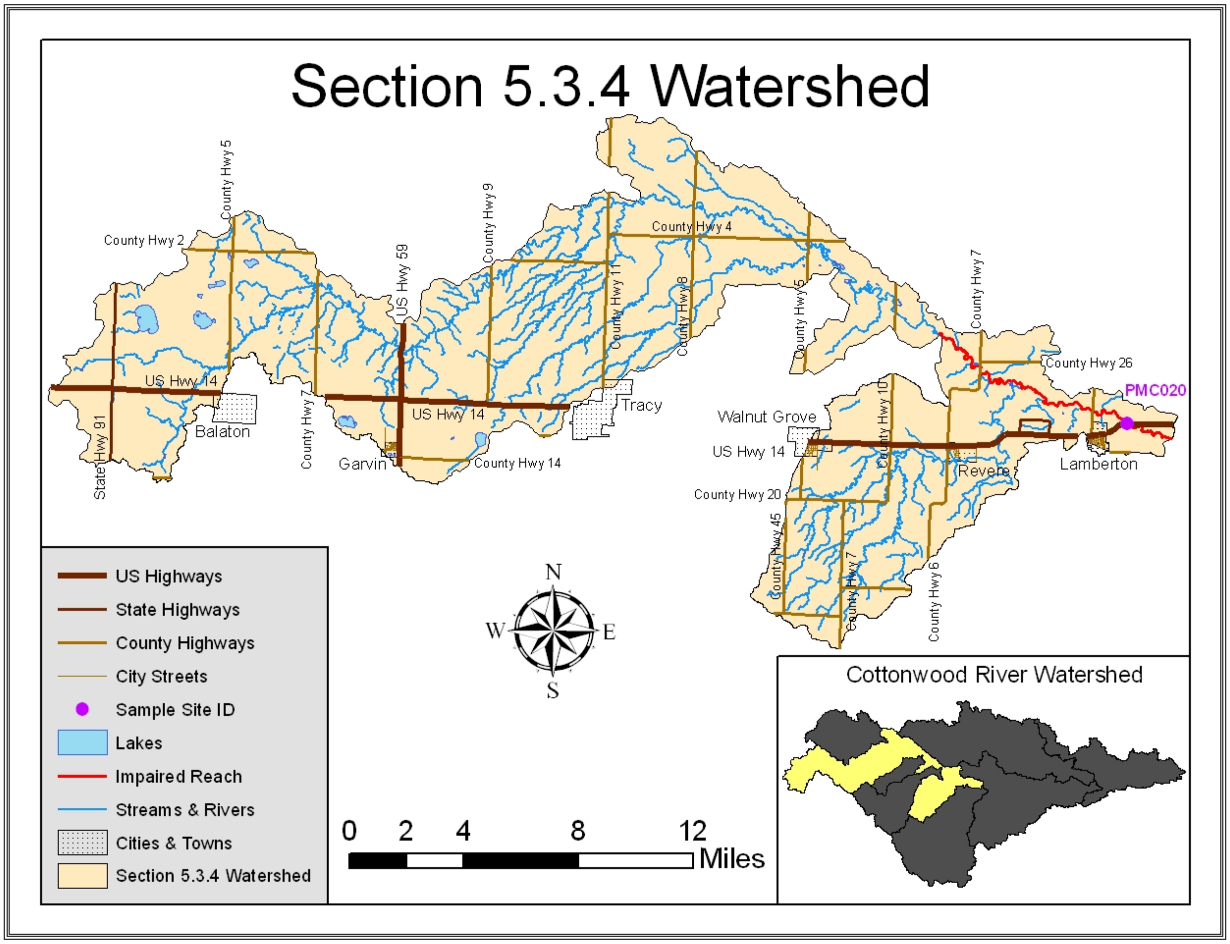
Figure 5.3.3B: (PLS005) Monthly Geometric Mean Fecal Coliform Concentrations (1997-2006)



5.3.4 Cottonwood River, Plum Creek to Dutch Charley Creek (AUID: 07020008-504)

Cottonwood River from Plum Creek to Dutch Charley Creek (Figure 5.3.4A) was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The sampling site is PMC020 (STORET# S002-247). The drainage area to the sampling station of this reach is 445.12 square miles.

Figure 5.3.4A: Cottonwood River, Plum Creek to Dutch Charley Creek



Land use in the reach is approximately 84.6 percent cultivated, 9.1 percent grass, 3.1 percent forest, 1.3 percent water/wetlands and 1.7 percent urban. There are four wastewater treatment facilities in the reach (Table 5.3.4A) servicing the communities of Balaton, Garvin, Revere, and Walnut Grove (Table 5.3.4B). There are an estimated 645 SSTS systems in this reach, of which, 344 are failing. There are five NPDES permitted livestock facilities in the reach (Table 5.3.4C). The number of animal units at locations without NPDES permits for beef, swine, dairy, sheep, poultry, horse and other (buffalo and rabbits) in the reach are 10,892; 6,312; 358; 307; 91; 24; and 100 respectively. Animal units (AUs) without NPDES permits account for 75.8% of all AUs and NPDES permitted facilities have 24.2% of all AUs in this reach.

Table 5.3.4D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the Cottonwood River USGS site off Cottonwood Street in New Ulm. Substantial reductions in fecal coliform loading from straight-pipe septic systems and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in Appendix B.

Table 5.3.4A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Balaton	MN0020559	0.123	0.93
Garvin	MNG580101	0.215	1.63
Revere	MNG580114	0.018	0.14
Walnut Grove	MN0021776	0.200	1.51

Table 5.3.4B: Permitted Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.3.4C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Randy Tholen Farm	083-80220	800 Cattle – 800 AU
Ronald Scott Farm	083-50029	4,000 Swine, 55 lbs. or more – 1,200 AU
Sanmarbo Farms Inc.	083-50003	4,800 Swine, 55 lbs. or more – 1,440 AU
Gregory Lanoue Farm	083-50002	900 Cattle, 200 Swine, < 55lbs. – 1,113 AU 81,000 Chickens
Richard Vroman Farm	083-50030	950 Cattle, 880 Swine, 55 lbs. or more – 1,232 AU 200 Swine, < 55 lbs.

Table 5.3.4D: Daily Fecal Coliform Loading Capacities and Allocations – Cottonwood River, Plum Creek to Dutch Charley Creek (AUID: 07020008-504)

Drainage area for listed reach (sq mi): 445.1
Flow gage used: Cottonwood River at Cottonwood Street, New Ulm USGS #05317000
Land Area MS4 Urban (%): 0.058
Total WWTF Flow (mgd): 0.856

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY LOADING CAPACITY	3468.3	924.3	292.2	91.8	25.0
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	6.5	6.5	6.5	6.5	6.5
Communities Subject to MS4 NPDES Requirements	1.3	0.3	0.1	<0.1	*
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	2163.1	447.5	180.4	31.9	*
Margin of Safety	1297.5	470.1	105.2	53.4	*Implicit*
	Percent of total daily loading capacity				
TOTAL DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.1%	0.5%	1.4%	4.6%	16.8%
Communities Subject to MS4 NPDES Requirements	<0.1%	<0.1%	<0.1%	<0.1%	*
Livestock Facilities Requiring NPDES Permits	0.0%	0.0%	0.0%	0.0%	0.0%
"Straight Pipe" Septic Systems	0.0%	0.0%	0.0%	0.0%	0.0%
Load Allocation	62.4%	48.4%	61.7%	34.7%	*
Margin of Safety	37.4%	50.9%	36.0%	58.2%	*Implicit*

* See Section 5.2

Potential Sources and Reductions Needed

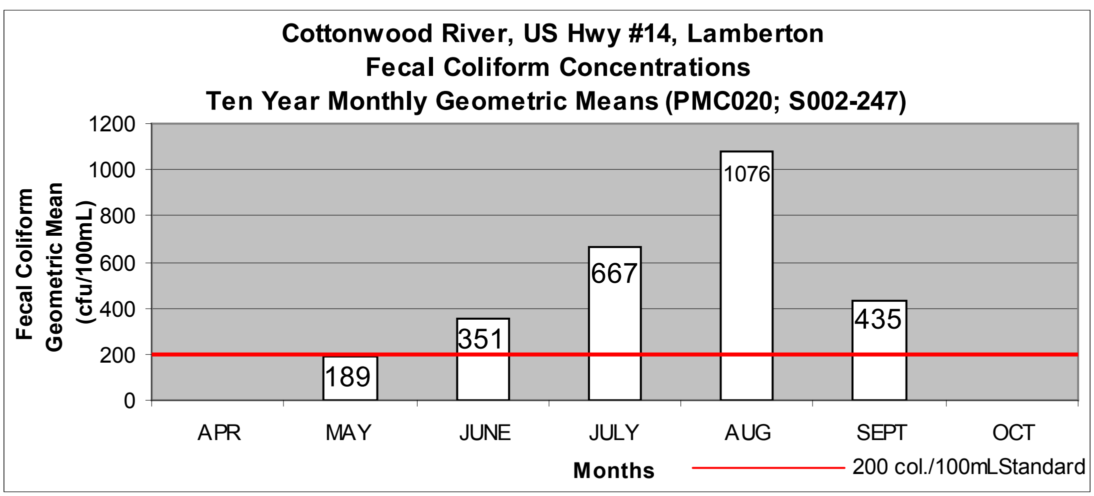
Monitoring Conducted by: Redwood-Cottonwood River Control Area
Years Monitored: 2000 through 2006
Samples Collected: 33

The following reduction represents the percentage reduction in bacterial concentration (Figure 5.3.4B) that would be required to meet the 200 cfu/100 ml water quality standard. This reduction percentage is only intended as a rough approximation, as it does not account for flow. It serves to provide a starting point based on recent water quality data for assessing the magnitude of the reduction needed in the watershed to achieve the surface water standard. This reduction percentage does not supersede the allocations provided for the TMDL. See also Table 3.02 for sampling data and Section 9.2 for locally targeted implementation plan.

PMC020 (S002-247)

Month	Required Reduction
April	Inadequate Data
May	None Required
June	43.02%
July	70.01%
August	81.41%
September	54.02%
October	Inadequate Data

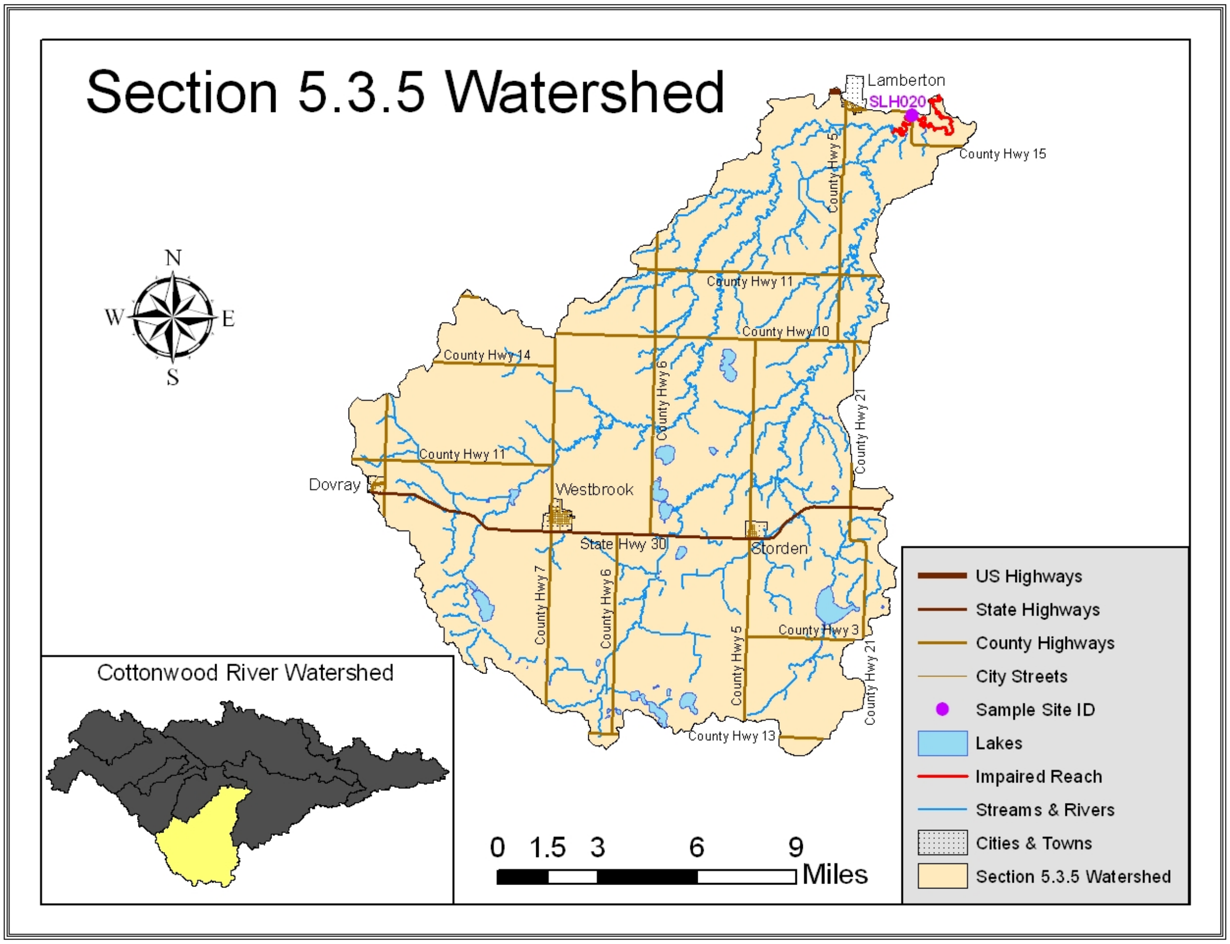
Figure 5.3.4B: (PMC020) Monthly Geometric Mean Fecal Coliform Concentrations (1997-2006)



5.3.5 Dutch Charley Creek; Highwater Creek to Cottonwood River (AUID: 07020008-517)

The small stretch of Dutch Charley Creek from Highwater Creek to Cottonwood River (Figure 5.3.5A) was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The sampling site is SLH020 (STORET# S001-915). The drainage area of the Highwater-Dutch Charley Creek complex to the sampling site is 206.3 square miles.

Figure 5.3.5A: Dutch Charley Creek; Highwater Creek to Cottonwood River



Land use in the reach is approximately 87.7 percent cultivated, 5.7 percent grass, 3.0 percent forest, 1.8 percent water/wetlands and 1.8 percent urban. The drainage area contains the cities of Lamberton, Storden, and Westbrook which are served by permitted wastewater treatment facilities (Table 5.3.5A). There are no communities that require an MS4 permit (Table 5.3.5B). There are an estimated 535 SSTS systems in this reach, of which, 109 are failing. There are five NPDES permitted livestock facilities in the reach (Table 5.3.5C). The number of animal units at locations without NPDES permits for swine, beef, dairy, sheep, horse and poultry in the reach are 9,176; 6,248; 642; 520; 55; and 2 respectively. Animal units (AUs) without NPDES permits account for 72.8% of all AUs and NPDES permitted facilities have 27.2% of all AUs in this reach.

Table 5.3.5D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the Cottonwood River USGS flow gage in New Ulm. Substantial reductions in fecal coliform loading from straight-pipe septic systems and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in Appendix B.

Table 5.3.5A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Lamberton	MN0023922	0.2	1.514
Storden	MN0052248	0.035	0.397
Westbrook	MN0025232	0.15	1.136

Table 5.3.5B: Permitted Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.3.5C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Reid Miller Farm	033-50001	3,840 Swine, 55 lbs. or more – 1,177 AU 500 Swine, under 55 lbs.
Fox Feedlot Inc.	033-60187	1,300 Dairy & 1,200 Other Cattle – 1,750 AU
W S Feeders Inc.	033-97997	3,300 Swine, 55 lbs. or more – 990 AU
Great Plains Family Farms Inc.	101-50005	2,688 Swine, 55 lbs. or more – 1,135.2 AU 200 Swine, under 55 lbs.
Shetek 5 & 6 Farm	101-88989	2,888 Swine, 55 lbs. or more – 1,155.2 AU

Table 5.3.5D: Daily Fecal Coliform Loading Capacities and Allocations – Dutch Charley Creek; Highwater Creek to Cottonwood R. (AUID: 07020008-517)

Drainage area for listed reach (sq mi): 206.3
Flow gage used: Cottonwood River at Cottonwood Street, New Ulm USGS #05317000
Land Area MS4 Urban (%): 0
Total WWTF Flow (mgd): 0.4025

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY LOADING CAPACITY	1607.5	428.4	135.4	42.6	11.6
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	2.9	2.9	2.9	2.9	2.9
Communities Subject to MS4 NPDES Requirements	0	0	0	0	*
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	1003.2	207.6	83.8	14.9	*
Margin of Safety	601.3	217.9	48.8	24.8	*Implicit*
	Percent of total daily loading capacity				
TOTAL DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.2%	0.7%	2.2%	6.8%	25.1%
Communities Subject to MS4 NPDES Requirements	0.0%	0.0%	0.0%	0.0%	*
Livestock Facilities Requiring NPDES Permits	0.0%	0.0%	0.0%	0.0%	0.0%
"Straight Pipe" Septic Systems	0.0%	0.0%	0.0%	0.0%	0.0%
Load Allocation	62.4%	48.4%	61.8%	35.0%	*
Margin of Safety	37.4%	50.9%	36.0%	58.2%	*Implicit*

* See Section 5.2

Potential Sources and Reductions Needed

Monitoring Conducted by: Redwood-Cottonwood River Control Area
Years Monitored: 1997 through 1999; 2007
Samples Collected: 55

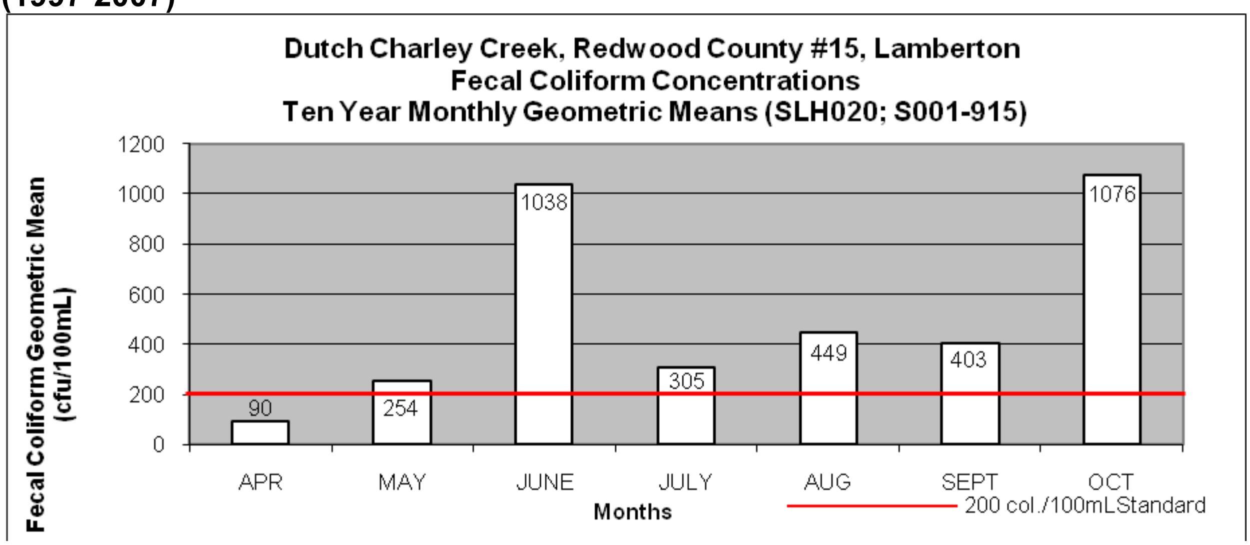
The following reduction represents the percentage reduction in bacterial concentration (Figure 5.3.5B) that would be required to meet the 200 cfu/100 ml water quality standard. This reduction percentage is only intended as a rough approximation, as it does not account for flow. It serves to provide a starting point based on recent water quality data for assessing the magnitude of the reduction needed in the watershed to achieve the surface water standard. This reduction percentage does not supersede the allocations provided for the TMDL. See also Table 3.02 for sampling data and Section 9.2 for locally targeted implementation plan.

SLH020 (S001-915)

Month	**Required Reduction**
April	None Required
May	21.26%
June	80.73%
July	34.43%
August	55.46%
September	50.37%
October	81.41%

This site was listed based on exceedences of the 2,000 organisms/100mL (at least 10 percent of the samples in a month) water quality standard. Five samples per month were taken in 2007 and results show this reach continues to exceed the standard.

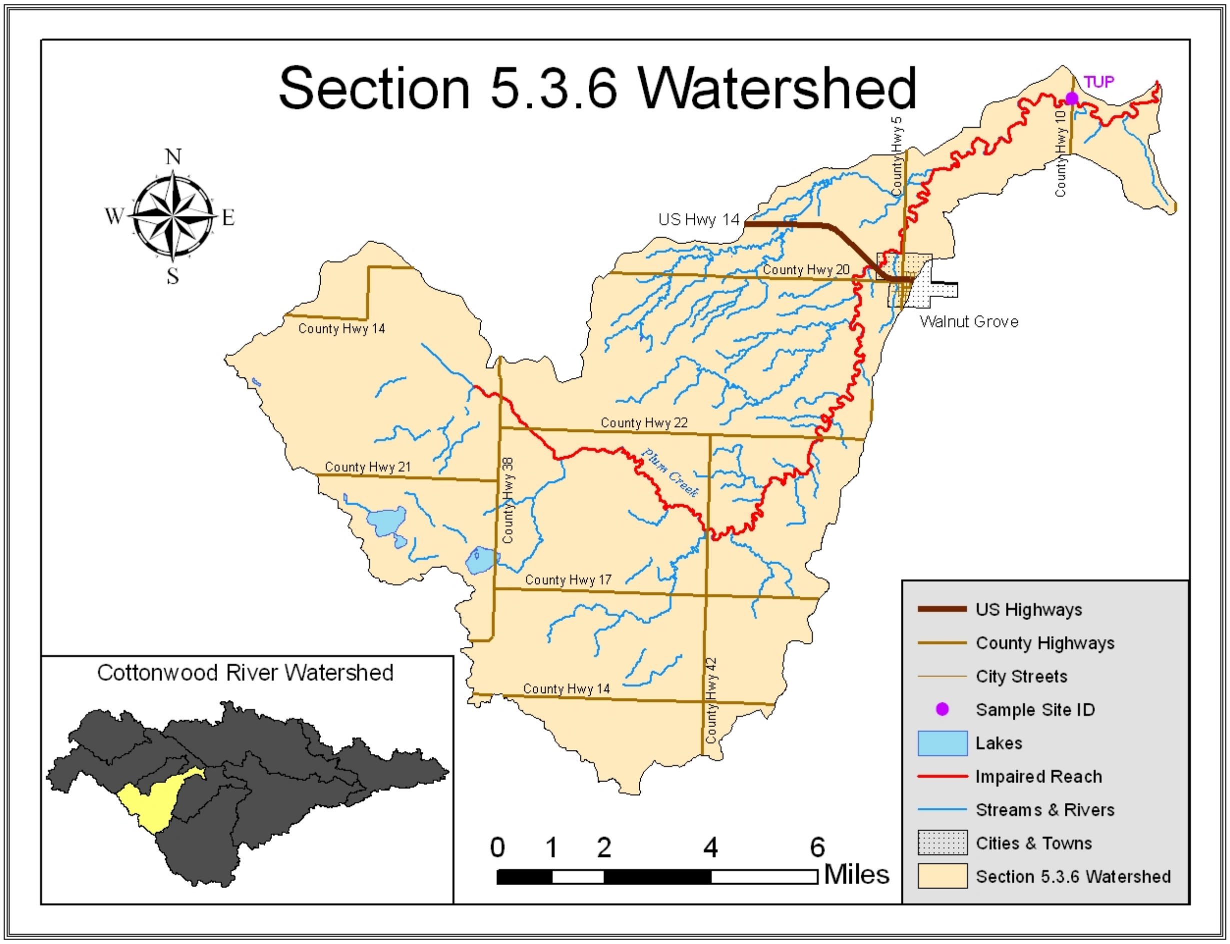
Figure 5.3.5B: (SLH020) Monthly Geometric Mean Fecal Coliform Concentrations (1997-2007)



5.3.6 Plum Creek, Headwaters to Cottonwood River (AUID: 07020008-516)

Plum Creek, Headwaters to Cottonwood River (Figure 5.3.6A) was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the sampling efforts of RCRCA. The sampling site is TUP (STORET# S001-913). The drainage area to the sampling station of this impaired reach is 88.17 square miles.

Figure 5.3.6A: Plum Creek, Headwaters to Cottonwood River



Land use in the reach is approximately 87.1 percent cultivated, 7.2 percent grass, 2.9 percent forest, 1.2 percent water/wetlands and 1.5 percent urban. The drainage area contains no cities served by a permitted wastewater treatment facility (Table 5.3.6A), and there are no communities requiring MS4 permits (Table 5.3.6B). There are an estimated 239 SSTS systems in this reach, of which, 73 are failing. There is one NPDES permitted livestock facility in the reach (Table 5.3.6C). The number of animal units at locations without NPDES permits for swine, beef, poultry, sheep, dairy and horse in the reach are 5,546; 2,444; 184; 24; 7; and 2 respectively. Animal units (AUs) without NPDES permits account for 76.5% of all AUs and NPDES permitted facilities have 23.5% of all AUs in this reach.

Table 5.3.6D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the USGS Cottonwood River flow gage near the Cottonwood Street Bridge in New Ulm. Substantial reductions in fecal coliform loading from straight-pipe septic systems and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in Appendix B.

Table 5.3.6A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
None			

Table 5.3.6B: Permitted Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.3.6C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Pork Transitions Inc.	083-50007	8,400 Swine, 55 lbs. or more – 2,520 AU

Table 5.3.6D: Daily Fecal Coliform Loading Capacities and Allocations – Plum Creek, Headwaters to Cottonwood River (AUID: 07020008-516)

Drainage area for listed reach (sq mi): 88.2
Flow gage used: Cottonwood River at Cottonwood Street, New Ulm USGS #05317000
Land Area MS4 Urban (%): 0
Total WWTF Flow (mgd): 0

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY LOADING CAPACITY	687.0	183.1	57.9	18.2	5.0
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0	0	0	0	0
Communities Subject to MS4 NPDES Requirements	0	0	0	0	0
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	430.0	90.0	37.0	7.6	0.3
Margin of Safety	257.0	93.1	20.8	10.6	4.7
	Percent of total daily loading capacity				
TOTAL DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.0%	0.0%	0.0%	0.0%	0.0%
Communities Subject to MS4 NPDES Requirements	0.0%	0.0%	0.0%	0.0%	0.0%
Livestock Facilities Requiring NPDES Permits	0.0%	0.0%	0.0%	0.0%	0.0%
"Straight Pipe" Septic Systems	0.0%	0.0%	0.0%	0.0%	0.0%
Load Allocation	62.6%	49.1%	64.0%	41.8%	6.0%
Margin of Safety	37.4%	50.9%	36.0%	58.2%	94.0%

Potential Sources and Reductions Needed

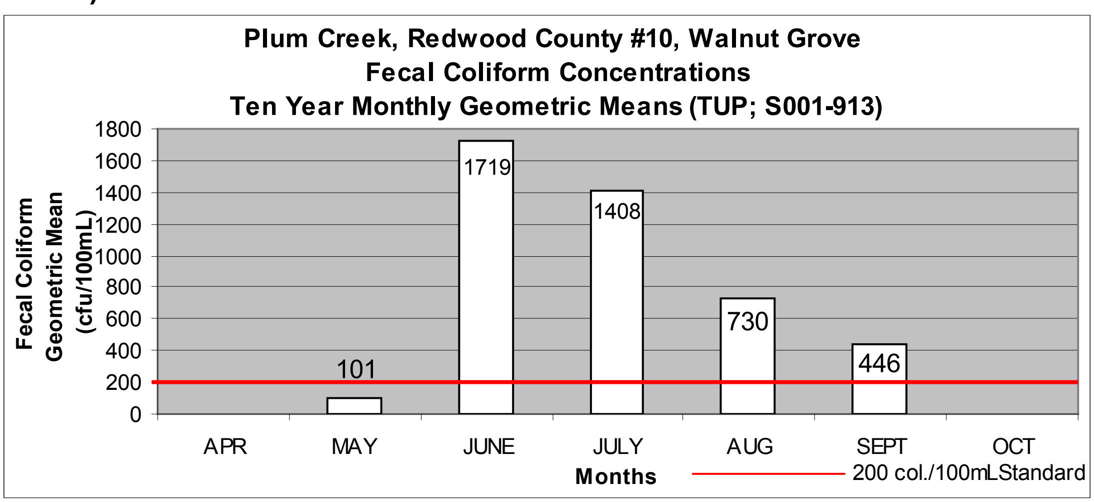
Monitoring Conducted by: Redwood-Cottonwood River Control Area
Years Monitored: 1997 through 2006
Samples Collected: 50

The following reduction represents the percentage reduction in bacterial concentration (Figure 5.3.6B) that would be required to meet the 200 cfu/100 ml water quality standard. This reduction percentage is only intended as a rough approximation, as it does not account for flow. It serves to provide a starting point based on recent water quality data for assessing the magnitude of the reduction needed in the watershed to achieve the surface water standard. This reduction percentage does not supersede the allocations provided for the TMDL. See also Table 3.02 for sampling data and Section 9.2 for locally targeted implementation plan.

TUP (S001-913)

Month	Required Reduction
April	Inadequate Data
May	None Required
June	88.37%
July	85.80%
August	72.60%
September	55.16%
October	Inadequate Data

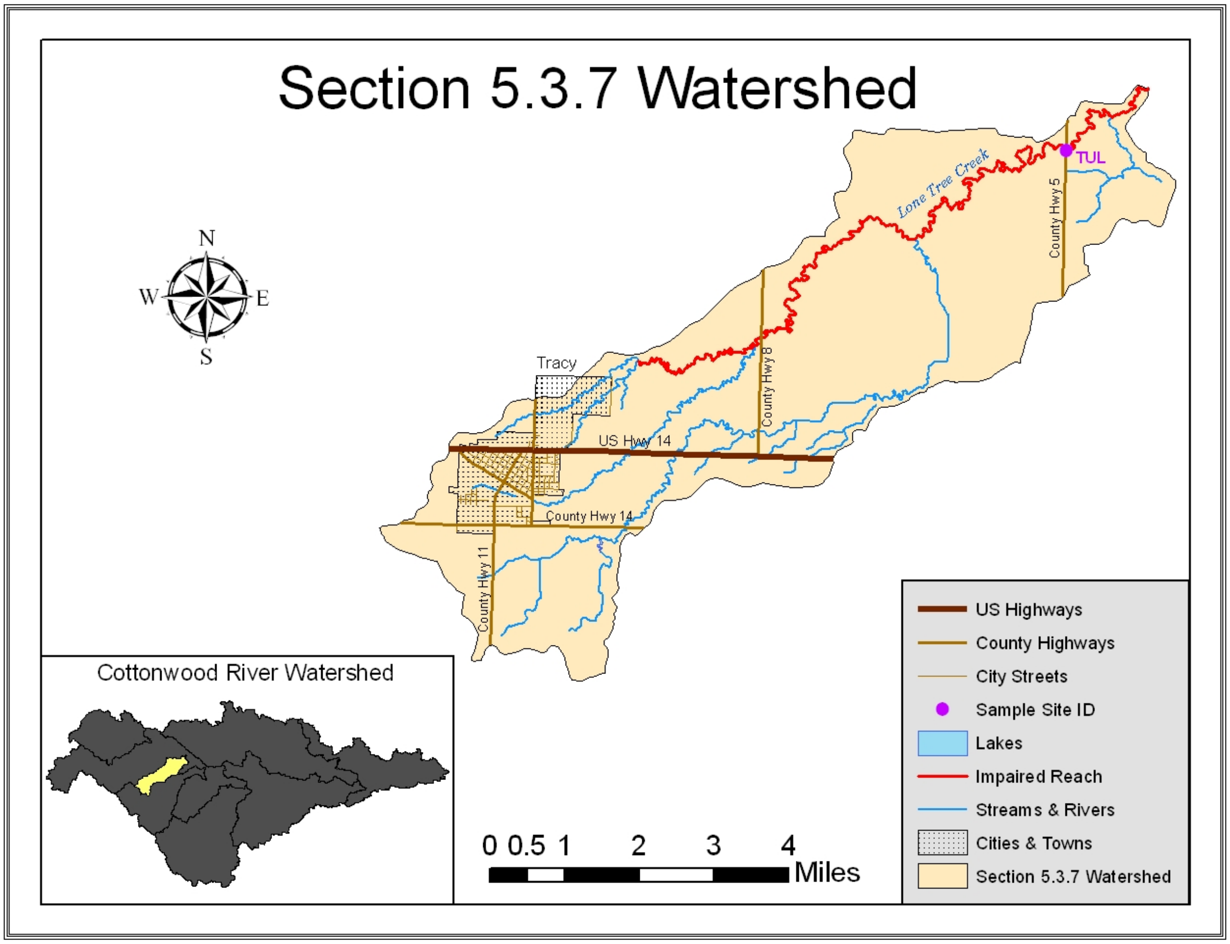
Figure 5.3.6B: (TUP) Monthly Geometric Mean Fecal Coliform Concentrations (1997-2006)



5.3.7 Lone Tree Creek, T109 R39W S7, westline to Cottonwood River (AUID: 07020008-524)

Lone Tree Creek (Figure 5.3.7A) is not currently listed on the Section 303(d) Clean Water Act impaired waters list. Sampling data shows that this reach is impaired. The primary source of this data is due to the efforts of RCRCA. These waters have been assessed as "Class 7" and are held to the 1000 orgs/ 100mL and the allocations for these waters are calculated as such. The sampling site is TUL (STORET# S001-914). The drainage area to the sampling station of this impaired reach is 24.34 square miles.

Figure 5.3.7A: Lone Tree Creek, T109 R39W S7, Westline to Cottonwood River



Land use in the reach is approximately 85.0 percent cultivated, 7.6 percent grass, 1.6 percent forest, 0.3 percent water/wetlands and 5.6 percent urban. The drainage area contains the city of Tracy, which is served by a permitted wastewater treatment facility (Table 5.3.7A). There are no communities in this reach requiring MS4 permits (Table 5.3.7B). There are an estimated 79 SSTS systems in this reach, of which, 55 are failing. There is one NPDES permitted livestock facility in the reach (Table 5.3.7C). The number of animal units at locations without NPDES permits for beef, swine, dairy, horse and sheep in the reach are 925, 870, 7, 5 and 4 respectively. Animal units (AUs) without

NPDES permits account for 55.7% of all AUs and NPDES permitted facilities have 44.3% of all AUs in this reach.

Table 5.3.7D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the Cottonwood River USGS gauging site in New Ulm. Substantial reductions in fecal coliform loading from straight-pipe septic systems and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in Appendix B.

Table 5.3.7A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Tracy	MN0049654	0.3	2.271

Table 5.3.7B: Permitted Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.3.7C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Generation Pork Inc.	127-50063	4,800 Swine, 55 lbs. or more – 1,440 AU

Table 5.3.7D: Daily Fecal Coliform Loading Capacities and Allocations – Lone Tree Creek, T109 R39W S7, westline to Cottonwood River (AUID: 07020008-524)

Drainage area for listed reach (sq mi): 24.3
Flow gage used: Cottonwood River at Cottonwood Street, New Ulm USGS #05317000
Land Area MS4 Urban (%): 0
Total WWTF Flow (mgd): 0.3

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY LOADING CAPACITY	948.3	252.7	79.9	25.1	6.8
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	2.3	2.3	2.3	2.3	2.3
Communities Subject to MS4 NPDES Requirements	0	0	0	0	*
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	591.3	121.9	48.9	8.2	*
Margin of Safety	354.7	128.5	28.8	14.6	*Implicit*
	Percent of total daily loading capacity				
TOTAL DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.2%	0.9%	2.8%	9.0%	33.2%
Communities Subject to MS4 NPDES Requirements	0.0%	0.0%	0.0%	0.0%	*
Livestock Facilities Requiring NPDES Permits	0.0%	0.0%	0.0%	0.0%	0.0%
"Straight Pipe" Septic Systems	0.0%	0.0%	0.0%	0.0%	0.0%
Load Allocation	62.4%	48.2%	61.2%	32.8%	*
Margin of Safety	37.4%	50.9%	36.0%	58.2%	*Implicit*

* See Section 5.2
Note: These are "CLASS 7" waters and are held to a 1000fcu's / 100mL standard.
Loads are calculated as such. MPCA did not assess or list Class 7 waters in 2006 but proposes to in 2010.

Potential Sources and Reductions Needed

Monitoring Conducted by: Redwood-Cottonwood River Control Area
Years Monitored: 1997; 2007
Samples Collected: 38

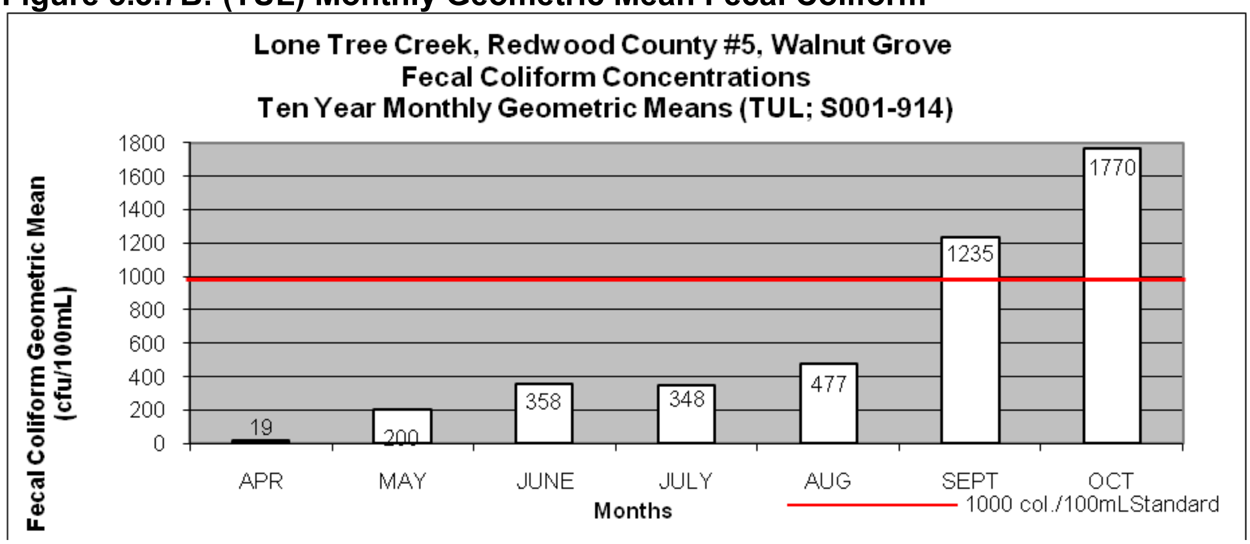
The following reduction represents the percentage reduction in bacterial concentration (Figure 5.3.7B) that would be required to meet the 1000 cfu/100 ml water quality standard. This reduction percentage is only intended as a rough approximation, as it does not account for flow. It serves to provide a starting point based on recent water quality data for assessing the magnitude of the reduction needed in the watershed to achieve the surface water standard. This reduction percentage does not supersede the allocations provided for the TMDL. See also Table 3.02 for sampling data and Section 9.2 for locally targeted implementation plan.

TUL (S001-914)

Month	Required Reduction
April	None Required
May	None Required
June	None Required
July	None Required
August	None Required
September	19.02%
October	43.50%

This site is not included on the 2008 TMDL list as they are “Class 7” water. “Class 7” waters will be assessed by MPCA starting in 2010. Five samples per month were taken in 2007 and would exceed the chronic standard. This site will be listed for 2010.

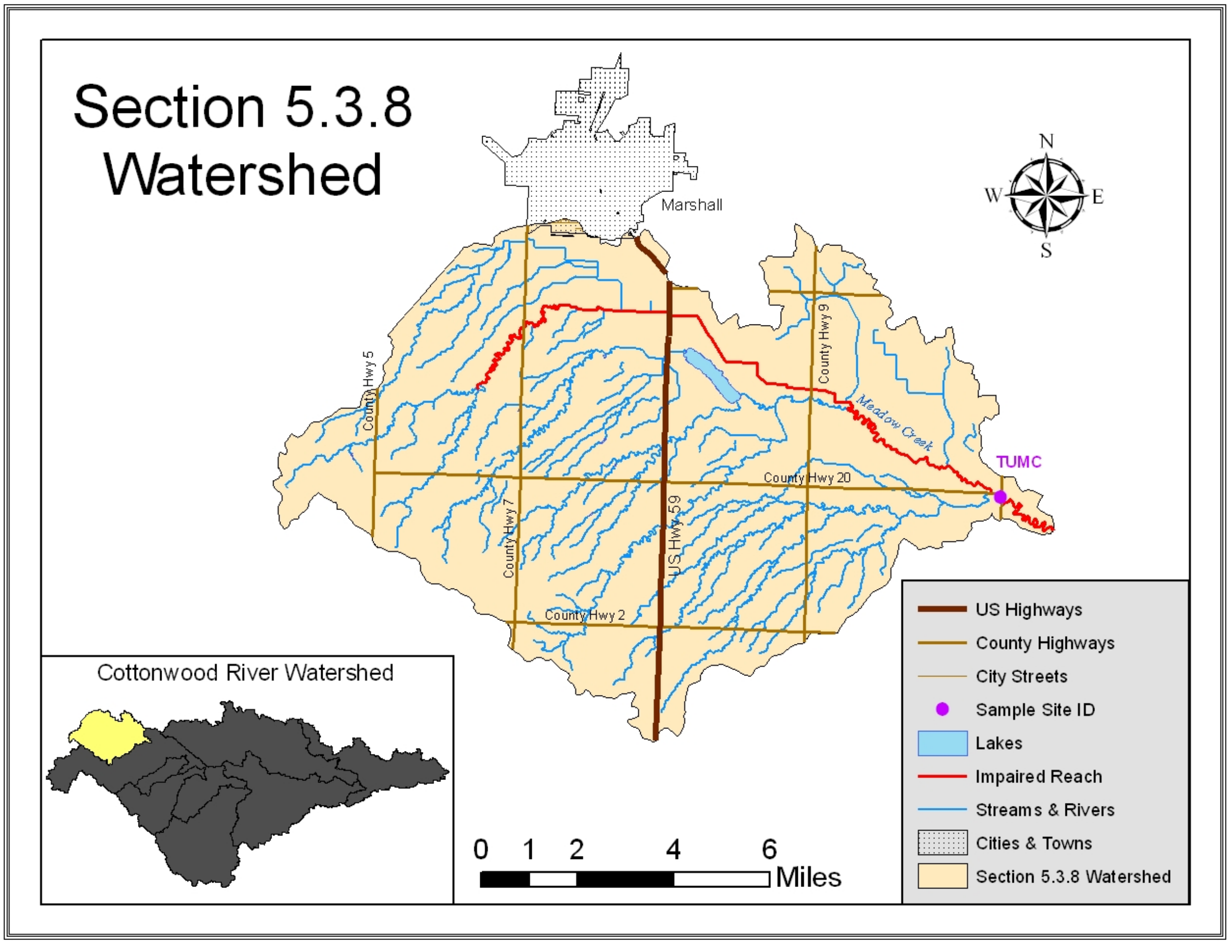
Figure 5.3.7B: (TUL) Monthly Geometric Mean Fecal Coliform



5.3.8 Meadow Creek, Headwaters to Cottonwood River (AUID: 07020008-515)

Meadow Creek, Headwaters to Cottonwood River (Figure 5.3.8A) has not yet been added to the Section 303(d) Clean Water Act impaired waters list. The primary source of data was the sampling efforts of RCRCA. The sampling site is TUMC (STORET# S001-917). The drainage area to the sampling station of this impaired reach is 96.74 square miles.

Figure 5.3.8A: Meadow Creek, Headwaters to Cottonwood River



Land use in the reach is approximately 85.3 percent cultivated, 9.9 percent grass, 1.6 percent forest, 1.6 percent water/wetlands and 1.6 percent urban. There are no wastewater treatment facilities in the reach (Table 5.3.8A). A portion of Marshall is in the reach which requires a MS4 Stormwater permit (Table 5.3.8B). There are an estimated 276 SSTS systems in this reach, of which, 110 are failing. There are three NPDES permitted livestock facilities in the reach (Table 5.3.8C). The number of animal units at locations without NPDES permits for beef, swine, dairy, horse and donkey in the reach are 4,185; 4,183; 580; 19; and 1 respectively. Animal units (AUs) without NPDES permits account for 66.4% of all AUs and NPDES permitted facilities have 33.6% of all AUs in this reach.

Table 5.3.8D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the USGS gauging site in New Ulm. Substantial reductions in fecal coliform loading from straight-pipe septic systems and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in Appendix B.

Table 5.3.8A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
None			

Table 5.3.8B: Permitted Municipal Separate Storm Sewer System (MS4) Communities

Community	Permit Number	Population Estimate	Category
Marshall	#MS400241	12,464	Designated by rule: Over 10,000 people. 0.26 square miles of the watershed.

Table 5.3.8C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Virgil M. Johnson Farm	083-50024	3,840 Swine, 55 lbs. or more – 1,152 AU
Donald J. Delanghe Farm1	083-87103	2,500 Cattle – 1,750 AU
Donald J. Delanghe Farm2	083-87104	2,450 Cattle – 1,640 AU

Table 5.3.8D: Daily Fecal Coliform Loading Capacities and Allocations – Meadow Creek, Headwaters to Cottonwood River (AUID: 07020008-515)

Drainage area for listed reach (sq mi): 96.74
Flow gage used: Cottonwood River at Cottonwood Street, New Ulm USGS #05317000
Land Area MS4 Urban (%): 0.269
Total WWTF Flow (mgd): 0

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY LOADING CAPACITY	753.8	200.9	63.5	20.0	5.4
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0	0	0	0	0
Communities Subject to MS4 NPDES Requirements	1.3	0.3	0.1	<0.1	<0.1
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	470.5	98.4	40.5	8.3	0.3
Margin of Safety	282.0	102.2	22.9	11.6	5.1
	Percent of total daily loading capacity				
TOTAL DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.0%	0.0%	0.0%	0.0%	0.0%
Communities Subject to MS4 NPDES Requirements	0.2%	0.1%	0.2%	0.1%	<0.1%
Livestock Facilities Requiring NPDES Permits	0.0%	0.0%	0.0%	0.0%	0.0%
"Straight Pipe" Septic Systems	0.0%	0.0%	0.0%	0.0%	0.0%
Load Allocation	62.4%	49.0%	63.8%	41.7%	6.0%
Margin of Safety	37.4%	50.9%	36.0%	58.2%	94.0%

Potential Sources and Reductions Needed

Monitoring Conducted by: Redwood-Cottonwood River Control Area
Years Monitored: 1997; 2007
Samples Collected: 43

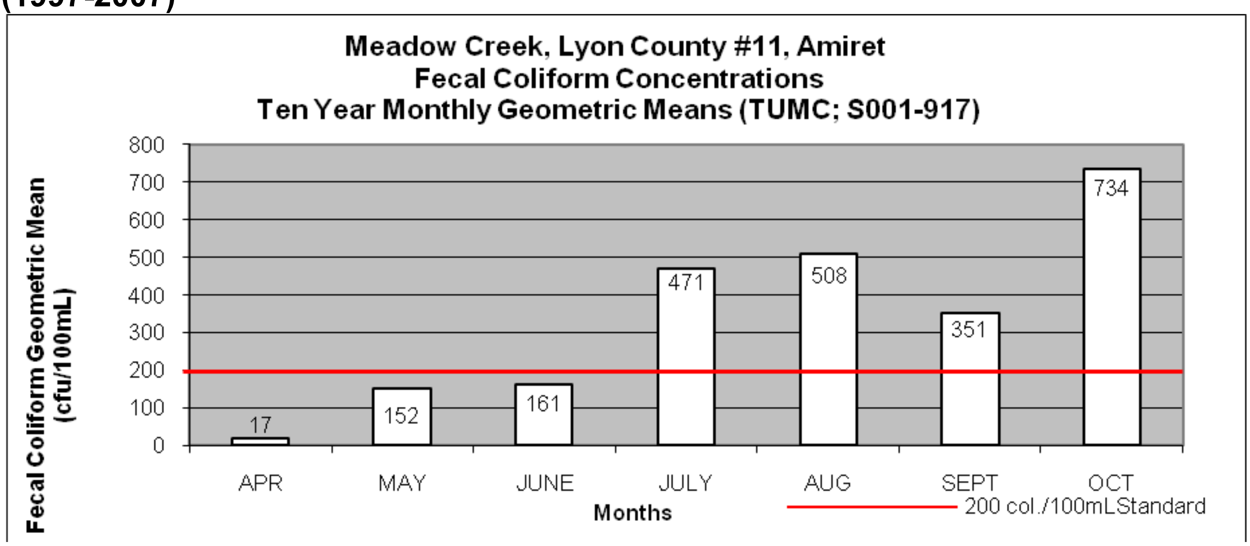
The following reduction represents the percentage reduction in bacterial concentration (Figure 5.3.8B) that would be required to meet the 200 cfu/100 ml water quality standard. This reduction percentage is only intended as a rough approximation, as it does not account for flow. It serves to provide a starting point based on recent water quality data for assessing the magnitude of the reduction needed in the watershed to achieve the surface water standard. This reduction percentage does not supersede the allocations provided for the TMDL. See also Table 3.02 for sampling data and Section 9.2 for locally targeted implementation plan.

TUMC (S001-917)

Month	Required Reduction
April	None Required
May	None Required
June	None Required
July	57.54%
August	60.63%
September	43.02%
October	72.75%

This site was listed based on violations of the acute standard, exceeding 2,000 organisms/100mL at least 10 percent of the samples in a month. Five samples per month were taken in 2007 and would exceed the chronic standard as well. As this report was written based on the 2006 303(d) list, it was not yet on the list based on 2007 data, but was proposed for 2008.

Figure 5.3.8B: (TUMC) Monthly Geometric Mean Fecal Coliform Concentrations (1997-2007)



6.0 Margin of Safety

Under Section 303(d) of the Clean Water Act, a MOS is required as part of a TMDL report. The purpose of the MOS is to account for uncertainty that the allocations will result in attainment of water quality standards. For the eight impaired reaches covered in this Report, an explicit margin of safety is provided for each of the flow periods for each impaired reach. As described in Section 5 and Appendix A of this document, the MOS is based on the difference between the loading capacity as calculated at the mid-point of each of the five flow ranges, and the loading capacity calculated at the minimum flow in each zone. Given that the loading capacity is typically much less at the minimum flow of a zone as compared to the mid-point, a substantial MOS is provided. The MOS ensures that allocations will not exceed the load associated with the minimum flow in each zone. Because the allocations are a direct function of daily flow, accounting for potential flow variability is the appropriate way to address the MOS. The minimum daily flows over long periods of record dictate the MOS for the low flow zone. For the impaired reach in which the allocation for the dry and low flow zones required use of an alternative method of calculation, i.e., a concentration-based limit, an implicit MOS was used. An implicit MOS means that conservative assumptions were built in to the TMDL and/or allocations. In this instance the listed section is expected to meet the TMDL because the permitted point source dischargers are limited to discharge concentrations below the impairment target, thereby providing additional capacity. In addition, the creek flow itself is primarily being fed by ground water at these low flows, which is believed to convey very little of the impairment.

7.0 Seasonal Variation

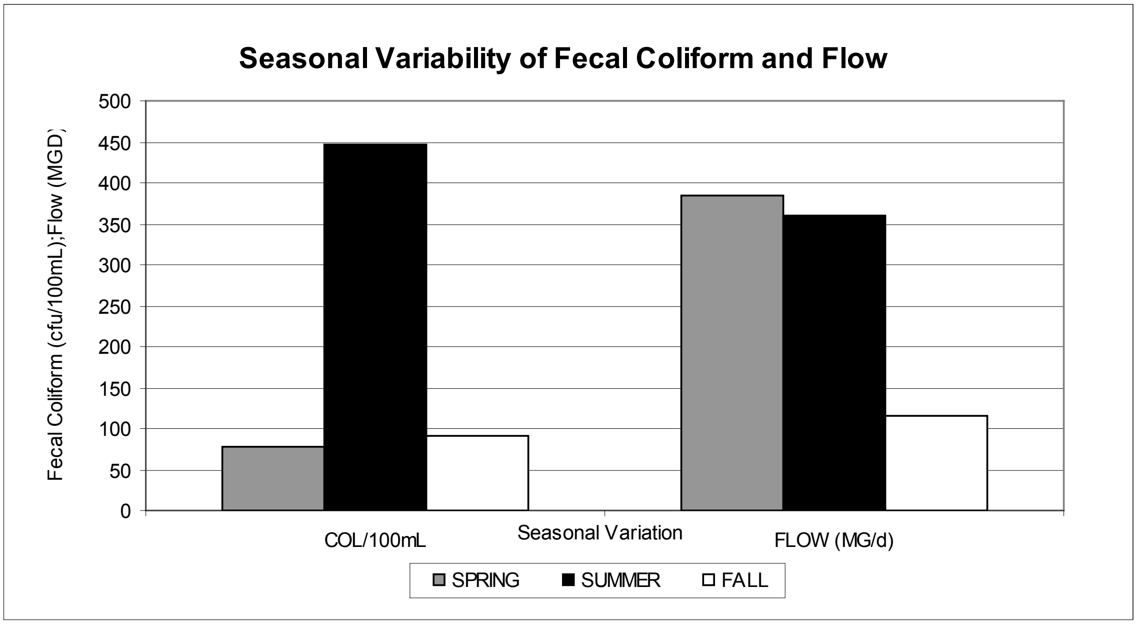
The flow duration approach utilized in this Report captures the full range of flow conditions over the April-October period when the fecal coliform water quality standard applies. Seasonal variation in flow is a key part of TMDL development. Daily loads are directly proportional to flows.

Fecal coliform samples and flow measurements were conducted over the spring, summer, and fall months (April-October). The results indicated a wide range of flows and fecal coliform concentrations. The large flows associated with snow melt events in the spring did not exceed the impaired levels. Generally, land application of manure occurs October-March. The summer period from June through August is the critical period when fecal coliform levels exceeded the level of impairment. The summer impairment seems to be driven by storm events.

PLC001 (STORET# S001-918) in the Lower reach illustrates the variation in fecal coliform concentrations and flows by season (Table 7.01 and Figure 7.01).

The EPA requires that TMDLs take into account “critical conditions for stream flow, loading, and water quality parameters.” This requirement is fulfilled through the analysis and discussion of seasonality, and effects of weather and streamflow, contained in Sections 3.2, 4.0, and Appendix A of this Report. While there is some variability among the impaired reaches addressed in this Report, critical conditions include storm events, and summer (June-September).

Figure 7.01: Seasonal Variation of Fecal Coliform cfu/100ml & Flow MGD at site PLC001 (STORET# S001-918)



Duration curve zones can be used to reflect seasonal variation. Table 7.01 uses duration curve zones to identify loading capacity information. Loading capacities are organized in a way that reflects actual flow conditions for any given month.

Table 7.01: Flow Duration Curve Loading by Months

	Duration Curve Zone (Loading Capacity expressed as billion organisms per day)				
	Flood	**Moist**	**Mid**	**Dry**	**Drought**
Cottonwood River @ New Ulm PLC001	10161.419	2707.918	856.162	269.079	73.385
Seasonal Considerations [most likely zone(s) by month]	**April** **May** **June** **July** **August** **September** **October**				

8.0 Monitoring Plan

The goal of the monitoring plan is to assess if the reduction strategies are effective in attaining water quality standards and designated uses.
RCRCA plans to continue their annual condition monitoring efforts in the Cottonwood River Watershed. In an effort to maintain a contiguous monitoring database, the subsequent implementation plan will include a monitoring plan and quality assurance project plan. Further effectiveness monitoring sites may be added upon recommendations from the stakeholder technical advisory committee. Implementation activities supported by an approved implementation plan will be evaluated every five years and modified as needed. Annual results will be included in the yearly Cottonwood River Watershed Monitoring Summary. Five samples per month/geometric mean *E.coli* monitoring will be conducted every five years to be conterminous with the implementation plan evaluation and to assess the implementation plan's effectiveness in delisting the impaired reaches.

The majority of bacteria monitoring collected over the past ten years is attributed to the Cottonwood River Clean Water Partnership (CWP) project in the basin. The diagnostic and implementation phases of this CWP are complete and provided funding for this watershed through 2007. RCRCA is maintaining the contiguous monitoring through the use of CWA 319 and general fund dollars for 2008. Monitoring after 2008 will depend on the approval of this TMDL and implementation plan to maintain the sampling database and evaluate effectiveness.

9.0 Implementation Strategy

9.1 Implementation through Source Reduction Strategies

RCRCA has proposed a watershed-wide approach to achieving water quality standards for fecal coliform bacteria within ten years. Methods in the implementation plan set forth in the original Cottonwood River diagnostic study, a plan which has been in place since 1999, will be used as a template for the implementation plan for this TMDL project. The final TMDL implementation plan will be developed within a year of the final approval of the Report by the EPA. The implementation plan developed by the stakeholder advisory committee will spell out what type of best management practice (BMP) to use and where they will be applied in the sub-watersheds of the impaired reaches and will project the cost and funding sources for their application.

Table 9.01 below brings the main potential sources (municipal wastewater, septic systems, grazing livestock, urban stormwater, feedlots, and field-applied manure) into the analysis. In this table, these sources are portrayed in terms of "implementation opportunities" and are associated with the likely flow zones in which they would be effective. Using this table, in conjunction with the load duration curve, local stakeholder knowledge and other information, a project team can start to rule in or out some sources and potentially rank them from most significant to least significant as well as point towards some implementation strategies.

Table 9.01: Implementation Opportunities for the Different Flows Regimes

<table>
<tr><th rowspan="2"></th><th colspan="5">Duration Curve Zone</th></tr>
<tr><th>Flood</th><th>Moist</th><th>Mid</th><th>Dry</th><th>Drought</th></tr>
<tr><td rowspan="6">Implementation Opportunities</td><td colspan="2">Wastewater bypass elimination</td><td></td><td colspan="2">WWTF</td></tr>
<tr><td></td><td colspan="4">SSTS</td></tr>
<tr><td></td><td colspan="4">Pasture management & riparian protection</td></tr>
<tr><td colspan="3">Urban stormwater management</td><td colspan="2"></td></tr>
<tr><td colspan="3">Feedlots</td><td colspan="2"></td></tr>
<tr><td colspan="2">Manure management</td><td colspan="3"></td></tr>
</table>

Adapted from Revised SE Regional Fecal Coliform TMDL, Appendix A.

Appendix B includes load duration curves for each sub-watershed in an attempt to target areas for reducing bacteria concentrations. A preliminary strategy for bacteria source load inventory is described in Appendix C.

RCRCA received a 319 grant in 2001 and in 2004 to implement best management practices for improving water quality. The BMPs include: CRP buffers, alternative tile intakes, grassed waterways, livestock exclusion, sediment basins, nutrient management plans, wetland restorations, and streambank stabilization. Some of these activities can directly affect bacteria concentrations by reducing availability of direct conveyance to surface water and some of these methods can reduce surface water bacteria by reducing bacteria transport through erosion reduction mechanisms. Some of these activities are listed below.

- <u>Pasture Management/Livestock Exclusion Plans</u> – Many pastured animals use nearby surface waters for drinking water when they are pastured. Unfortunately, the activity in or near surface waters allows for direct transport of fecal bacteria into surface waters. Livestock exclusion, by fencing off areas where livestock activity exists and replacing the surface water sources with an alternate watering system will exclude livestock from waters and with proper buffering, can reduce the conveyance of fecal bacteria associated with runoff. Another way to ensure better coverage in pastures and pasture health is through rotational grazing. Rotational grazing is a method of grazing where pastures are divided into sections with the goal of allowing pasture grass time to grow back after being grazed. Other pasture activities to ensure that pastures aren't overgrazed include proper grazing timing and grazing the proper amount of animals per acre.

- <u>Manure/Nutrient Management Plans</u> – State rules dictate that feedlots larger than 300 animal units are required to develop manure management plans. Manure management plans serve to account for the storage and application of manure to ensure that there is enough land to accommodate the amount of manure produced by a livestock operation. Manure management is one of the integral parts of a nutrient management plan. Both serve to plan nutrient/manure application according to the need of the land. Rates of application consider the crop, soil type, previous crops, history of fertilizer/manure application and incorporation/application methods. Proper application rates, placement, and timing of fertilizer and manure application can reduce the movement and availability of bacteria to surface water sources.

- Feedlot Runoff Controls – Runoff from feedlots can be diverted into holding areas and stored with adequate buffers from surface water to be land applied at a later time or simply buffered from water sources using adequate vegetation. Clean water can be diverted away from feedlots so as not to pick up pollutants including fecal coliform bacteria which may be incorporated in surface water systems. Smaller feedlots would be the focus of manure managing practices as larger feedlots, subject to permitting, are required to do such activities under their NPDES Permits.

Estimations based on EQIP payment history and the number of locations without NPDES permitted animal units listed in this Report estimate that the cost to put animal agricultural activities under manure management and feedlot runoff mitigation plans would cost around $47,000,000. This figure would include storage structures, runoff controls, nutrient management plans, and pasture management programs. The cost would roughly be $350 per animal unit.

- Sediment Reduction Practices – Some fecal bacteria reduction could occur through efforts where sediment reduction was a primary factor. BMPs designed to intercept runoff or filter sediments out of sheet flows before entering surface water systems would also serve to reduce manure and other nutrient rates in the watershed.

- Waste Water Treatment Facilities – Counties, Regional Development Commissions and MPCA staff will work with WWTFs to ensure continued compliance as part of their permits.

- Unsewered Communities – Counties, Regional Development Commissions and MPCA staff will work with unsewered areas to bring them into compliance. The five unsewered areas in this Report are listed in Table 4.02.

- Subsurface Septic Treatment Systems – Three percent low interest loan dollars are available to aid landowners in upgrading their SSTS. An approximate number of SSTS needs can be inferred from the estimation of non-compliant septic systems. With a cost estimated at about $7,500, the 1,852 failing systems would cost on the order of $13,890,000 to replace failing systems in the Cottonwood river watershed.

9.2 Locally Targeted Implementation

The eight impaired reaches can be used as priority areas in the implementation plan. Smaller watershed area will ensure targeted BMP implementation. RCRCAs goal is to help make these changes happen through education, training, and monetary incentives. Below are implementation plan ideas by subwatershed. Most of the proposed practices relate to agricultural BMPs, but SSTS and unsewered communities will also be addressed.

- The Lower Cottonwood Watershed (PLC001, STORET# S001-918): The Cottonwood River from JD 30 to the Minnesota River (Assessment reach ID #07020008-501) was first identified a priority area in the watershed in 1994 due to elevated levels of sediment, nutrients, and bacteria. As this reach is the lower end of the Cottonwood River, it reflects all tributaries to the river as well as areas immediate to the reach itself. Based on sampling and the load duration curve, this reach tends to exceed the standard during "moist" conditions. Implementation of projects such as manure management plans, and pasture management regiments are a few plans that should help to realize the improvement needed to bring this reach below the standard.

- The Middle Cottonwood Watershed (PLC010, STORET# S001-920): The Cottonwood River from Coal Mine Creek to Sleepy Eye Creek (Assessment reach ID #07020008-508) was first identified a priority area in the watershed in 2006 due to elevated levels of sediment, bacteria and nutrients. As this reach is a section of the main stem of the Cottonwood River, it reflects tributaries to the lower end of this section as well as areas immediate to the reach itself. Based on sampling and the load duration curve, this reach tends to exceed the standard during "moist" and "flood" flow conditions. Implementation of projects such as manure management plans, and pasture management regiments are a few actions that should help to realize the improvement needed to bring this reach below the standard.

- The Upper Cottonwood Watershed (PMC020, STORET# S002-247): The Cottonwood River from Plum Creek to Dutch Charley Creek (Assessment reach ID #07020008-504) was first identified a priority area in the watershed in 2006 due to elevated levels of sediment, bacteria and nutrients. As this reach is a section of the main stem of the Cottonwood River, it reflects tributaries to the lower end of this section as well as areas immediate to the reach itself. Based on sampling and the load duration curve, this reach tends to exceed the standard during "moist", "average", and "dry" flow conditions. Implementation of projects such as manure management plans, and pasture management regiments would be prudent for the higher flows. Municipal discharge management, animal exclusion, pasture management, and replacement of failing Subsurface Sewage Treatment Systems would better serve the reach during the dry periods. These are a few actions that should help to realize the improvement needed to bring this reach below the standard.

- Sleepy Eye Creek (PLS005, STORET# S001-919): Sleepy Eye Creek from its headwaters to the Cottonwood River (Assessment reach ID #07020008-512) was first identified a priority area in the watershed in 2004 due to elevated levels of sediment and 2006 for bacteria. The Sleepy Eye Creek sub-watershed reflects the whole of the reach itself. Based on sampling and the load duration curve, this reach tends to exceed the standard during “moist”, “average”, and “dry” flow conditions. Implementation of projects such as manure management plans, and pasture management regiments would be prudent for higher flows. Municipal discharge management, animal exclusion, pasture management, and replacement of failing Subsurface Sewage Treatment Systems would better serve the reach during the dry periods. These are but a few actions that should help to realize the improvement needed to bring this reach below the standard.

- Plum Creek (TUP, STORET# S001-913): Plum Creek from its headwaters to the Cottonwood River (Assessment reach ID #07020008-516) was first identified a priority area in the watershed in 2006 due to elevated levels of sediment and bacteria. Plum Creek reach reflects the whole of the sub-watershed itself. Based on sampling and the load duration curve, this reach tends to exceed the standard during “moist”, “average”, and “dry” flow conditions. Implementation of projects such as manure management plans, and pasture management regiments would be prudent for the higher flows. Animal exclusion, pasture management, and replacement of failing Subsurface Sewage Treatment Systems would better serve the reach during the dry periods. These are a few actions that should help to realize the improvement needed to bring this reach below the standard.

- Highwater-Dutch Charley Creek (SLH020, STORET# S001-915), Dutch Charley Creek from Highwater Creek to the Cottonwood River (Assessment reach ID #07020008-517) was first identified a priority area in the watershed in 2006 due to elevated levels of sediment and bacteria. The Highwater-Dutch Charley Creek subwatershed reflects the whole of the reach itself. Based on sampling and the load duration curve, this reach tends to exceed the standard during “moist”, “average”, and “dry” flow conditions. Implementation of projects such as manure management plans, and pasture management regiments would be prudent for the higher flows. Municipal discharge management, animal exclusion, pasture management, and replacement of failing Subsurface Sewage Treatment Systems would better serve the reach during the dry periods. These are but a few actions that should help to realize the improvement needed to bring this reach below the standard.

- Meadow Creek (TUMC, STORET# S001-917): Meadow Creek from its headwaters to the Cottonwood River (Assessment reach ID #07020008-515) was sampled in 1997 and again in 2007 and was found to have levels of bacteria exceeding the standard. Meadow Creek subwatershed reflects the whole of the reach itself. Based on sampling and the load duration curve, this reach tends to exceed the standard during “moist” flow conditions. Implementation of projects such as manure management plans and pasture management regiments would be prudent for the higher flows. Animal exclusion, pasture management, and replacement of failing Subsurface Sewage Treatment Systems would better serve the reach during the dry periods. These are a few actions that should help to realize the improvement needed to bring this reach below the standard.

- <u>Lone Tree Creek (TUL, STORET# S001-914)</u>: Lone Tree Creek from Tracy to the Cottonwood River (Assessment reach ID #07020008-524) was sampled in 1997 and again in 2007 and was found to have elevated levels of bacteria. Lone Tree Creek is a Class 7 water and was not assessed by MPCA, however, it will be assessed in 2010 According to the data this creek will be listed as levels of bacteria were found to be over the standard. Remedial actions in this reach should help the watershed as a whole. Based on sampling and the load duration curve, this reach tends to exceed the standard during “moist” flow conditions. Implementation of projects such as manure management plans and pasture management regiments would be prudent for the higher flows. Animal exclusion, pasture management, and replacement of failing Subsurface Sewage Treatment Systems would better serve the reach during the dry periods. These are a few actions that should help to realize the improvement needed to bring this reach below the standard.

10. Reasonable Assurance

10.1 Evidence of BMP Implementability

The source reduction strategies listed are shown to be successful in reducing pathogen transport and survival and to be capable of widespread adoption by land owners and local resource managers. Many of the BMPs listed below are part of the original Cottonwood River Clean Water Project’s implementation plan. RCRCA will apply for available grants and loans to continue implementation of these BMPs. RCRCA has a proven history backed with an extensive database, a long-term monitoring program, and an organizational structure that remains supportive and flexible to ensure that projects such as the Redwood River Clean Water Project and the Cottonwood River Restoration Project are successful. This success can be viewed in the 2001 Final Report, “Evolution of Watershed Restoration”, which can also be found at our website. Continued best management projects concentrated in priority areas of the watershed have helped the Cottonwood River Watershed realize a reduction and stabilization in sediment and nutrient loads. In the same way, acheivements in *E. coli* bacteria reductions will be effective if the methods and efforts listed below are tailored to priority areas but more importantly, in such a way that will be effective at priority times of the year in these areas.

- Feedlot runoff controls – these are evaluated by professional engineers using the Minnesota Feedlot Annualized Runoff Model referenced in Minn. R. ch. 7020.

These rules are implemented by the MPCA staff and by local staff of counties via a delegation agreement with the Agency.

- Subsurface Sewage Treatment Systems –SSTS with proper drain fields provide virtually complete treatment of fecal coliform bacteria. Acceptable designs are described in Minn. R. ch. 7080. All counties in the watershed are delegated to implement these rules, which require conformance with state standards for new construction and disclosure of the state of the system when property transfers ownership.
- Municipal Wastewater Disinfection – Disinfection with chlorine or ultraviolet radiation is required of all NPDES permitted facilities.
- Land Application of Manure – Buffer strips, immediate incorporation, and maintenance of surface residue have been demonstrated to reduce manure and pathogen runoff (EQB, 1999). The state feedlot rules (Minn. Rules part 7020) require manure application record-keeping and manure management planning, with requirements differing according to operation size, and manure application pollution risk based on method, time and place of application.
- Erosion Control and Sediment Reduction – Conservation tillage and riparian buffer strips have been shown to be effective in reducing sediment delivery to streams. Since embedded sediment can serve as a substrate for fecal coliform survival, reduction of sediment sources is considered an effective measure for controlling fecal coliform bacteria in streams.
- Planned Rotational Grazing – Sovell, et.al., 2000, demonstrated that rotational grazing, in contrast to conventional grazing, significantly reduces both sedimentation and fecal coliform concentrations in water downstream of study sites in southeastern Minnesota.
- Urban Stormwater Management – Practices such as runoff detention, infiltration, and street sweeping have been shown to be effective in reducing urban runoff and associated pollutant.

10.2 Non-regulatory, Regulatory, and Incentive-Based Approaches

The lead for implementation will be sponsored by the Redwood-Cottonwood Rivers Control Area. The local work group of the RCRCA is composed of RCRCA technical staff, county representatives and personnel from Soil and Water Conservation Districts, Board of Soil and Water Resources, Department of Natural Resources, Minnesota Pollution Control Agency, and the Natural Resources and Conservation Services. The local work group will monitor and evaluate the implementation strategies, and will advise and make recommendations on the progress of the strategies to the RCRCA Board.

11.0 Public Participation

The Redwood-Cottonwood Rivers Control Area (RCRCA) conducted four public meetings in Redwood Falls. The meetings were held February 20, 2008, April 7, 2008, May 28, 2008 and June 25, 2008, to solicit feedback from the technical committee and stakeholders. These meetings also provided information to citizens on the impact of the fecal coliform TMDL on the Cottonwood River. Invitations were mailed or emailed to citizens and interested parties in the watershed, and notices of the meetings were put on the RCRCA website. Invitations, agendas and meeting minutes are found in Appendix D. This Report was also discussed at RCRCA annual meetings (December 8, 2007 and December 9, 2006) and as part of the educational efforts at the RCRCA annual Golf Tournament (September 13, 2007 and September 14, 2006) and canoe paddles on various dates in the last four years.

The draft TMDL report is available to the public via the MPCA web site at http://www.pca.state.mn.us/water/tmdl/index.html as well as on the RCRCA web site at http://www.rcrca.com/TMDL_info.htm

Many local, state, and federal agencies have been involved in the public participation process including, but not limited to, representatives from the Soil and Water Conservation Districts and Natural Resources Conservation Services, County Boards, County Environmental Services, Cities of Redwood Falls and Marshall, MN Department of Natural Resources, MN Pollution Control Agency, Board of Soil and Water Resources, County Extension Service, MN Soybean Growers Association, MN Corn Growers Association, MN State Cattlemen's Association, MN Farm Bureau and Pork Producer Organizations. These agencies, in cooperation with the local residents, landowners, and farm operators, have contributed to the understanding of the political, economic, and natural resource aspects of the report and ultimately the implementation plan.

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Appendix A:
Cottonwood River Fecal Coliform TMDL: Methodology for TMDL Equations and Load Duration Curves

The loading capacity determination used for this report is based on the process outlined in the MPCA report, "Bacteria Protocols and Submittal Requirements" (Dec 2006). This process is known as the "Duration Curve" method.

Loading capacities for fecal coliform bacteria are related directly to flow volume. As flows increase, the loading capacity of the stream will also increase. Thus, it is necessary to determine loading capacities for a variety of flow zones.

For this approach, daily flow values for each site are sorted by flow volume, from highest to lowest and a percentile scale is then created (where a flow at the X^{th} percentile means X percent of all measured flows equal or exceed that flow). Five flow zones are used in this approach: "high" (0-10^{th} percentile), "moist" (10^{th}- 40^{th} percentile), "mid-range" (40^{th}-60^{th} percentile), "dry" (60^{th}-90^{th} percentile) and "low" (90^{th}-100^{th} percentile). The flows at the mid-points of each of these zones (i.e., 5^{th}, 25^{th}, 50^{th}, 75^{th} and 95^{th} percentiles) are multiplied by the fecal coliform standard (200 org/100 mL) except for Class 7 waters which is 1,000 org/100 mL. A conversion factor reports the allowable maximum loads in units of billions of organisms per day. For example, if the "mid-range" (50^{th} percentile) flow is 100 cubic feet per second (cfs), the loading capacity or TMDL would be:

100 cfs x 200 orgs/100 mL x 28,312 mL/cubic ft x 86,400 sec/day ÷ 1 billion = 489 billion organisms per day

The flow monitoring data used in this project was from the U.S. Geological Survey gage station in New Ulm. Sixty-eight years of flow data from the USGS stations were used for the Cottonwood River calculations (1940-2006).

Flow data for the sites was estimated by normalizing data from the U.S. Geological Survey gage stations. For example, the Plum Creek impaired reach drainage area is 6.76 percent (88.17/1304.08) of the drainage area monitored by the PLC001 USGS gaging station. Calculated flows were then checked against 7 years of available flow data for the small stream which showed a reasonable degree of alignment.

It was decided to use USGS data for all sites in the Cottonwood River watershed to better reflect the range of hydrologic conditions in the watershed by having a wider variety of conditions to use for the duration curve. It should also be noted that only flow data from April through October was used in the duration curve as these are the only flows/months used in assessing for bacteria TMDL's.

TMDLs were calculated for the five flow zones for the eight impaired reaches. The TMDLs were then divided into a Margin of Safety (MOS), Wasteload Allocations (WLAs), Load Allocation (LA), and Reserve Capacity (RC).

The MOS accounts for uncertainty in the TMDL allocation process. The MOS was established so that the load associated with the minimum flow for each zone would not be exceeded. For each zone, the MOS is the difference between the central and lowest flow value for each zone. For example, to determine the MOS for the high flow zone, the 10^{th} percentile flow value was subtracted from the 5^{th} percentile flow value. The resulting value was converted to a load and used as the MOS. The final available load and wasteload allocation is the TMDL minus the MOS.

The final step in the process was determining the portion of the load that needs to be allocated for wastewater treatment facilities (WWTFs) and the two permitted stormwater municipal separate storm sewer system (MS4) communities in the watershed (Marshall and New Ulm). A 10 percent increase of land area in the MS4 communities was use to account for Reserve Capacity in the Waste Load Allocation.

The allowable wasteload allocated to WWTFs was determined by totaling the potential daily discharge for all upstream facilities. For continuous discharge facilities, the average wet weather design flow was used; for facilities with pond systems, the effluent volume equivalent to six inches per day drawdown from their pond was used. The resulting daily volumes of effluent were converted to a load using the permitted concentration limit (200 organisms/100 ml) and a conversion factor to arrive at a load in billions of organisms per day. The wasteload allocation for a given WWTF will be the same under all flow zones since its allocation is based on the volume it is permitted to discharge. Example WLA calculation for a WWTF discharging 3,000,000 gallons of effluent per day:

$$3{,}000{,}000 \text{ gallons/day} \times 200 \text{ orgs/100ml} \times 3785 \text{ ml/gallon} \div 1 \text{ billion}$$
$$= 23 \text{ billion organisms per day}$$

The WWTF allocation and MOS were subtracted from the total loading capacity. The remaining capacity was divided between MS4 permitted stormwater and all nonpoint sources (load allocation) based on the percentage of land in an impaired reach watershed covered by MS4 permits. In the case of the Lower Cottonwood USGS site (PLC001) watershed, the percentage of land area covered by Marshall and New Ulm was 0.287 percent of the watershed, so 0.287 percent of the remaining capacity was allocated to that permit. In addition to being a practical way to allocate between MS4 permits and all other nonpoint sources, it is also equitable from the standpoint of rural and urban fecal coliform sources being held to the same “standard.” (Note: The land area percentage used for municipalities subject to MS4 permits was 110 percent of the actual municipal boundary found in the GIS layer to account for future growth in the short term)

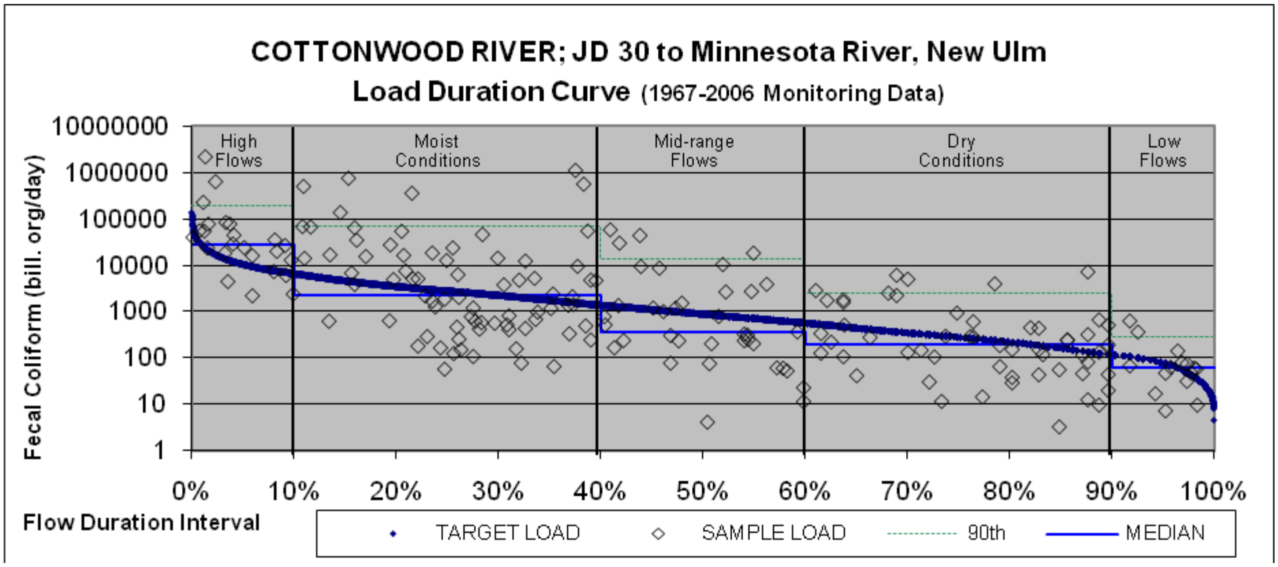
Load duration curves used the flow duration data and factored in the fecal coliform standard to determine and display the allowable load for each flow percentile. The loads represented by grab samples were calculated and plotted.

Table A. Cottonwood River Fecal Coliform TMDL general reach information

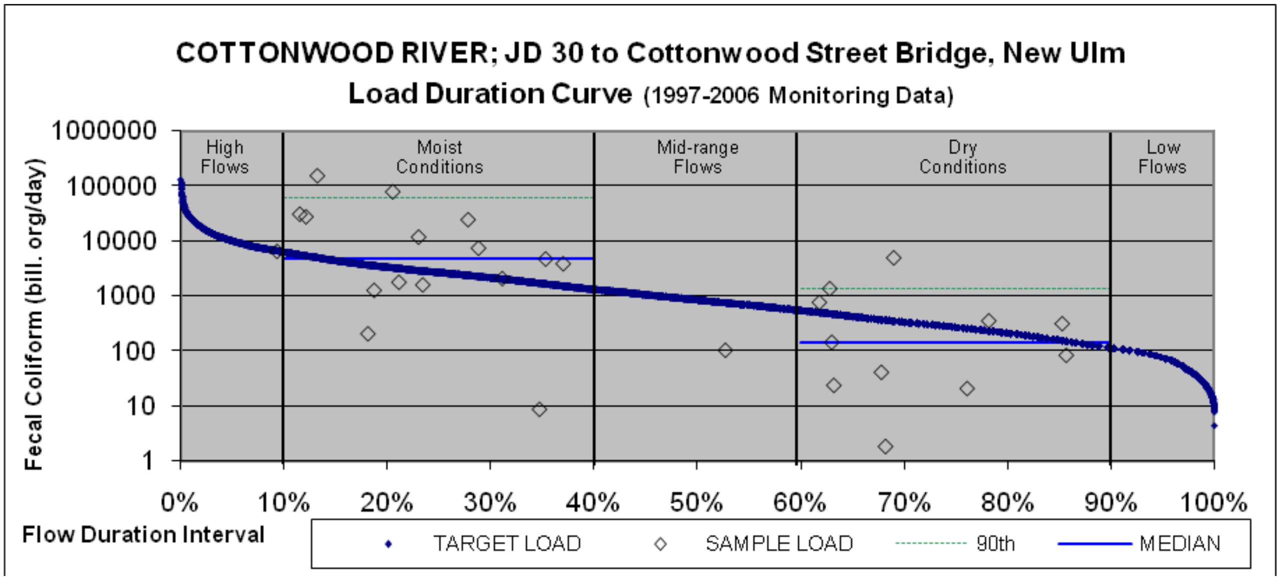
Reach	Description	Assessment Unit ID	STORET #	CWRP MPCA Site #	Sub-watershed	Flow Data source (years)	Area* (sq. miles)
Cottonwood River	Judicial Ditch 30 to Minnesota R	07020008-501	S001-918	PLC001	Lower	USGS 05317000 (40-06)	1312.80
Cottonwood River	Coal Mine Cr to Sleepy Eye Cr	07020008-508	S001-920	PLC010	Middle	USGS 05317000 (40-06)	884.37
Sleepy Eye Creek	Headwaters to Cottonwood R	07020008-512	S001-919	PLS005	Sleepy Eye Creek	USGS 05317000 (40-06)	274.07
Cottonwood River	Plum Cr to Dutch Charley Cr	07020008-504	S002-247	PMC020	Upper	USGS 05317000 (40-06)	448.32
Dutch Charley Creek	Highwater Cr to Cottonwood R	07020008-517	S001-915	SLH020	Dutch Charley Creek	USGS 05317000 (40-06)	208.81
Plum Creek	Headwaters to Cottonwood R	07020008-516	S001-913	TUP	Plum Creek	USGS 05317000 (40-06)	90.83
Lone Tree Creek	T109 R39W S7, westline to Cottonwood R	07020008-524	S001-914	TUL	Lone Tree Creek	USGS 05317000 (40-06)	28.17
Meadow Creek	Headwaters to Cottonwood R	07020008-515	S001-917	TUMC	Meadow Creek	USGS 05317000 (40-06)	97.54

* Drainage areas were generated using Arc View to determine drainage areas. The datum and projection that this was done in is NAD 1983, UTM 15N.

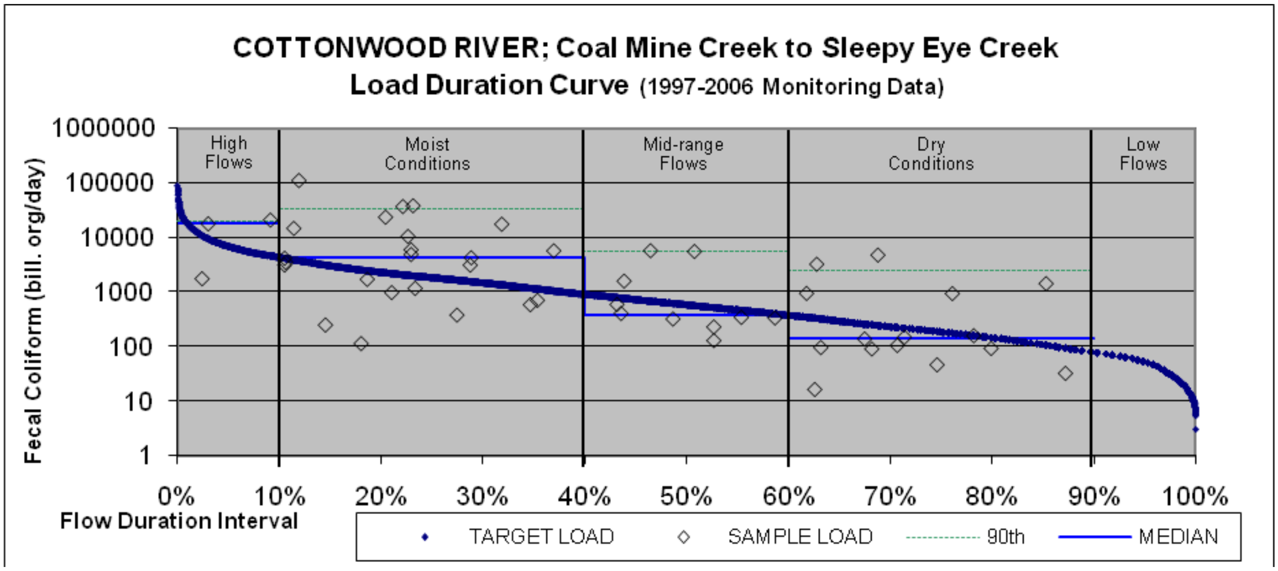
Appendix B: Load Duration Curves for the Impaired Reaches



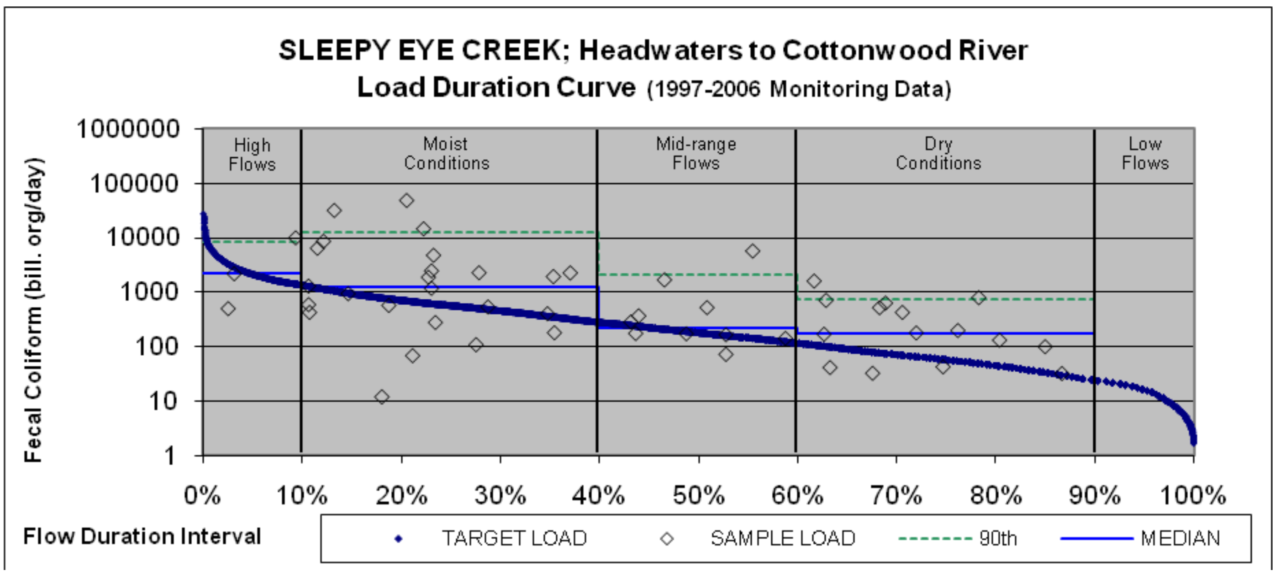
Site: CWR-1, Flow Data: USGS (estimated based on area), Area: 1313 square miles



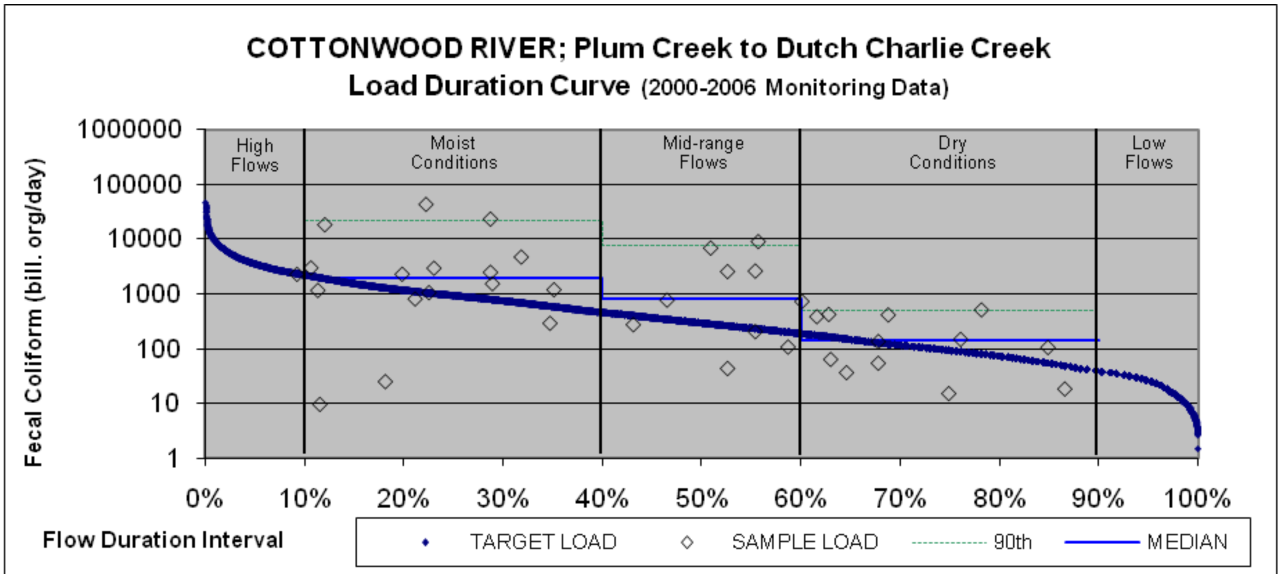
Site: PLC001, Flow Data: USGS, Area: 1304.08 square miles



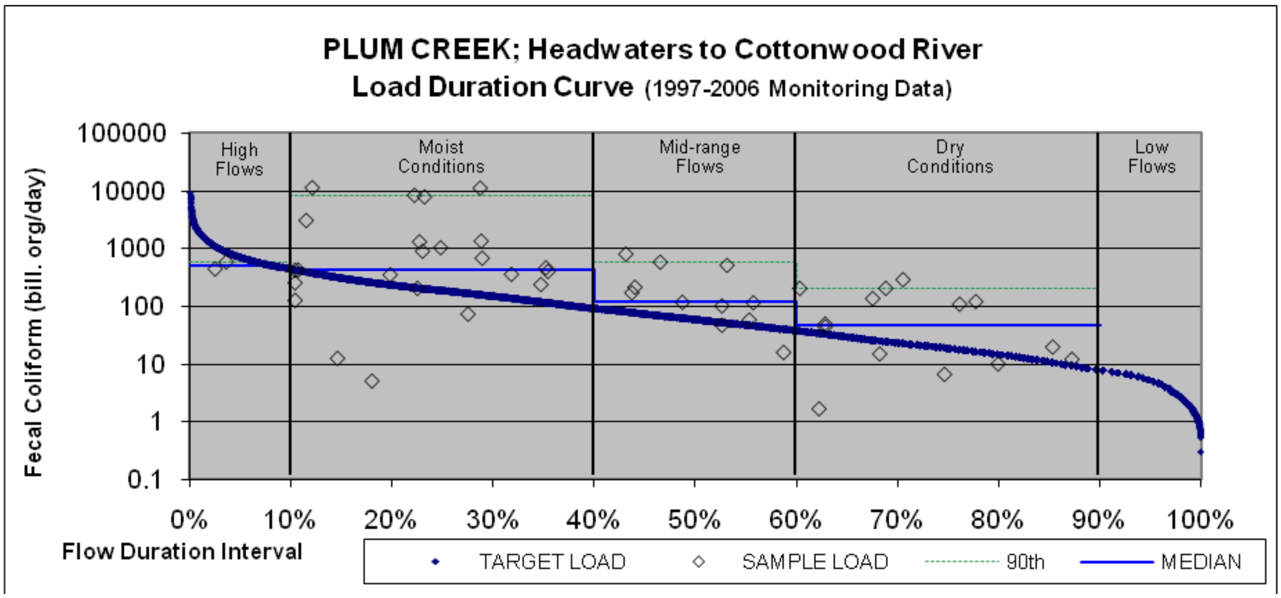
Site: PLC010, Flow Data: USGS (estimated based on area), Area: 876.75 square miles



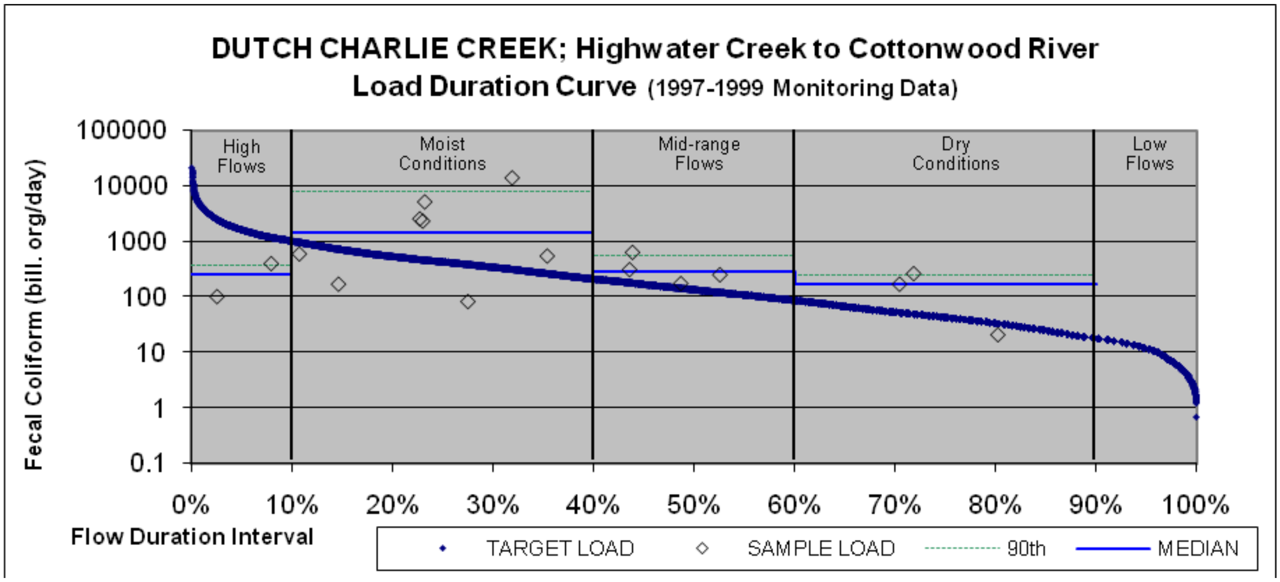
Site: PLS005, Flow Data: USGS (estimated based on area), Area: 271.44 square miles



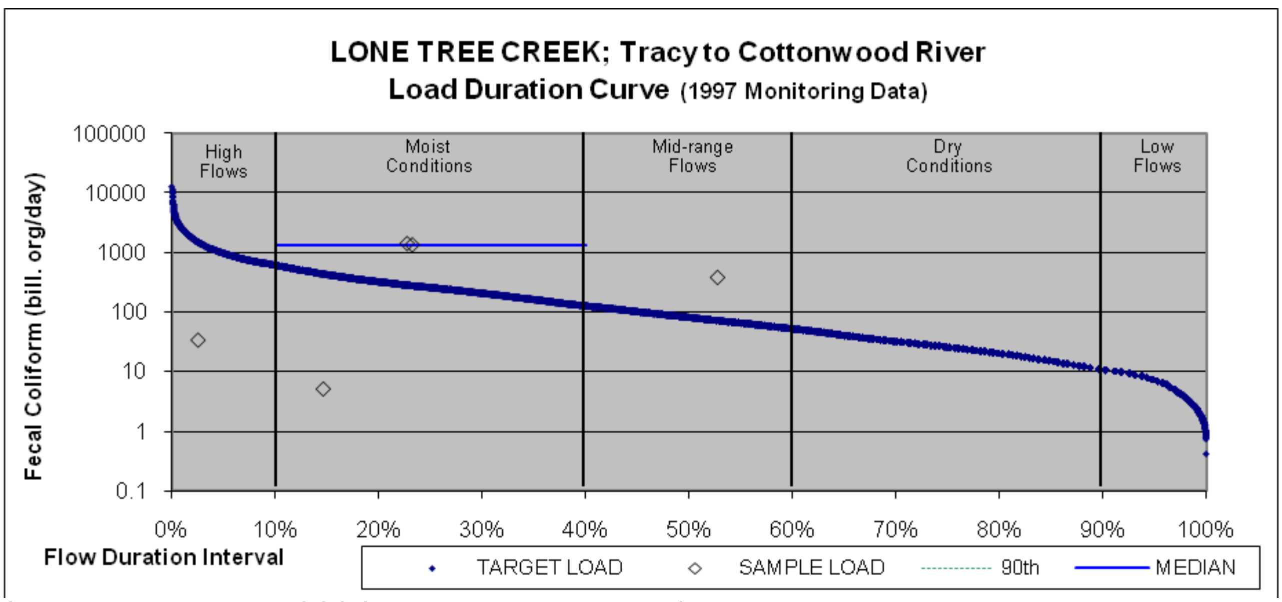
Site: PMC020, Flow Data: USGS (estimated based on area), Area: 445.12 square miles



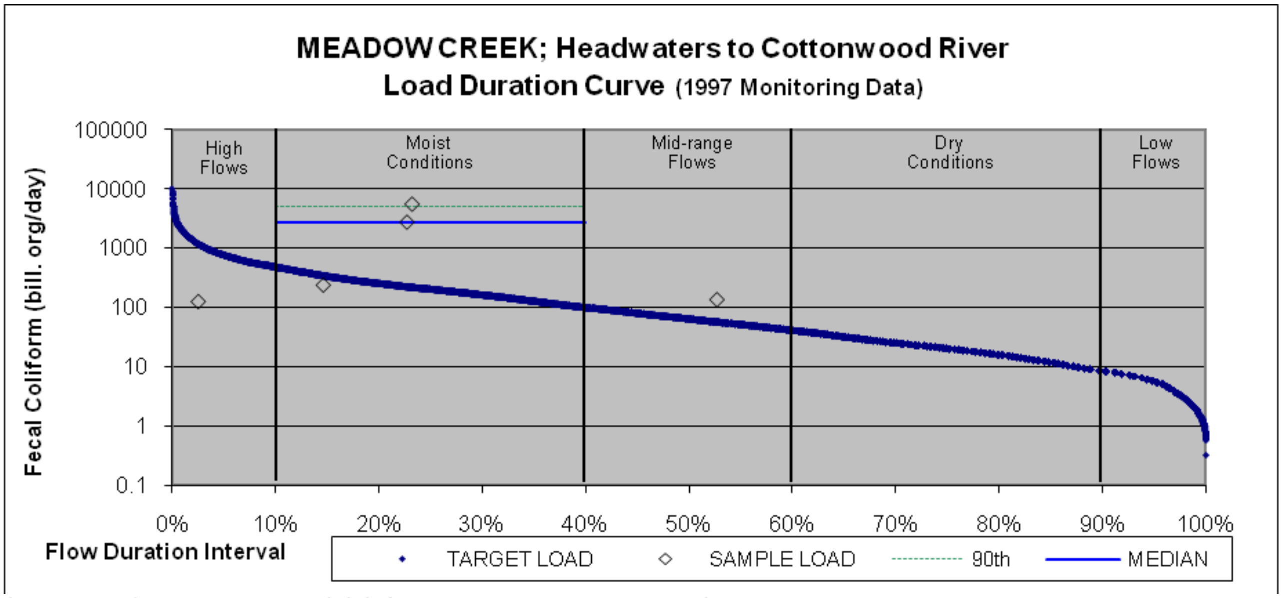
Site: TUP, Flow Data: USGS (estimated based on area), Area: 88.17 square miles



Site: SLH020, Flow Data: USGS (estimated based on area), Area: 206.3 square miles



Site: TUL, Flow Data: USGS (estimated based on area), Area: 24.34 square miles
NOTE: The target load of this reach is 1000 org/100 mL as these are "Class 7" waters, they were not assessed by MPCA in 2006, but will be in 2010.



Site: TUMC, Flow Data: USGS (estimated based on area), Area: 96.74 square miles

Appendix C: Fecal Coliform Current Loading by Source: Methodology and Estimates of Relative Contribution

This Appendix serves to outline the process that was used for each impaired stream reach to estimate the primary sources of fecal coliform contamination. These are approximations because neither river flow nor the dynamics of fecal coliform growth and die-off cycle were factored in. Also, availability and delivery percentages rely on professional judgment as opposed to research derived estimates. This procedure has no bearing on TMDL allocations and has no regulatory implications. The entire Cottonwood River Watershed is used as an example

The first step to estimating bacteria contribution was compiling population estimates and fecal coliform produced by each animal type in the Watershed. Table 1 displays the fecal coliform (FC) producers, amount of FC per producer and the source of the information. Figure 1 displays the FC produced by each of the four major sources; livestock produces about 98 percent of the FC in the watershed. Figure 2 breaks out the FC source by type where swine and cattle produce 90 percent of the FC. The amount of fecal coliform produced daily by each animal type was obtained from a variety of sources, which are all recommended in the Environmental Protection Agency's (EPA) guidance document *Protocol for Developing Pathogen TMDLs*. Total FC produced by each animal type is calculated by multiplying the population figure by the daily FC produced per individual or animal unit. Note that the below table and graphs represent the total FC available, not the amount delivered to surface waters.

Table 1: Population and Total Estimated Potential Fecal Coliform Produced by Animal Type

Animal Type	Animal Units	Individuals	FC Produced per Individual or AU Per Day	Total FC Available	Source (FC Produced per Day)
Dairy	14,200		7.14E+10	1.01E+15	ASAE*,1998
Beef	76,268		1.00E+11	7.63E+15	ASAE*,1998
Swine	92,609		7.11E+10	6.58E+15	ASAE*,1998; Metcalf and Eddy, 1991
Poultry**	4,336		1.50E+10	6.50E+13	ASAE*,1998; Metcalf and Eddy, 1991
Sheep	995		1.50E+11	1.49E+14	ASAE*,1998; Metcalf and Eddy, 1991
Horses	158		4.20E+08	6.64E+10	ASAE*,1998
Other	370		1.00E+11	3.70E+13	Used Beef (Mostly Buffalo)
Human (all)		23,114	2.00E+09	4.62E+13	Metcalf and Eddy, 1991
Deer		6,565	2.00E+08	1.31E+12	Metcalf and Eddy, 1991
Geese		1,759	1.04E+07	1.83E+10	Alderiso and DeLuca, 1999
Pheasants		126,048	1.90E+08	2.39E+13	Used Chickens
Ducks		24,807	4.54E+09	1.13E+14	ASAE*,1998; Metcalf and Eddy, 1991; Roll and Fujioka, 1997
Wild Turkey		105	1.13E+08	1.19E+10	Used Turkey
Other wildlife				1.31E+12	Used Value Equivalent to Deer
Dogs and Cats		11,779	5.00E+09	5.89E+13	Horsley and Witten, 1996

*American Society of Agricultural Engineers
** Used Chickens and Turkeys

Figure 1: Estimated Fecal Coliform Produced by Source Category

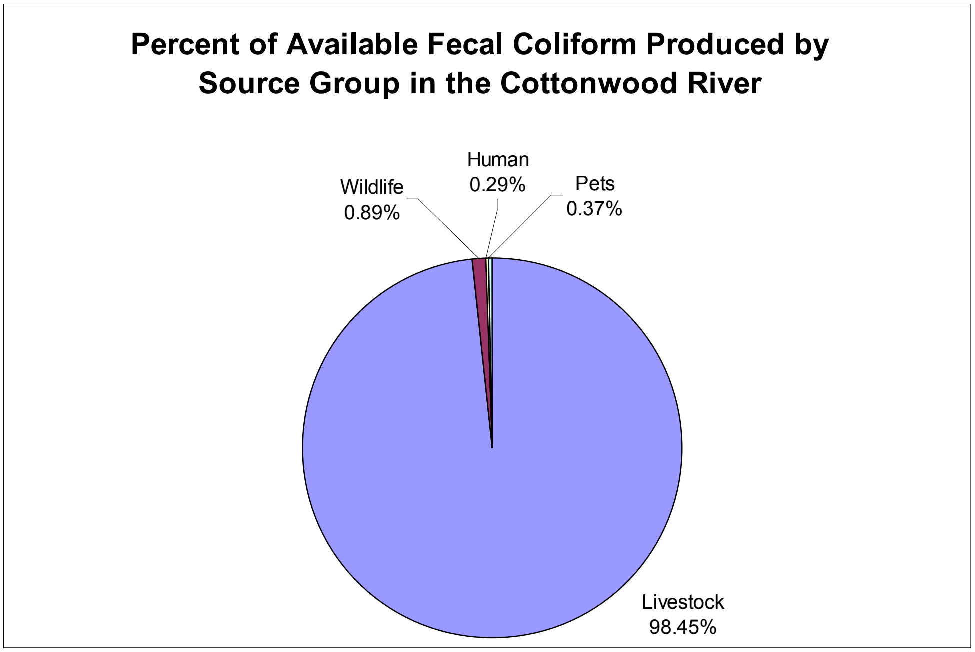
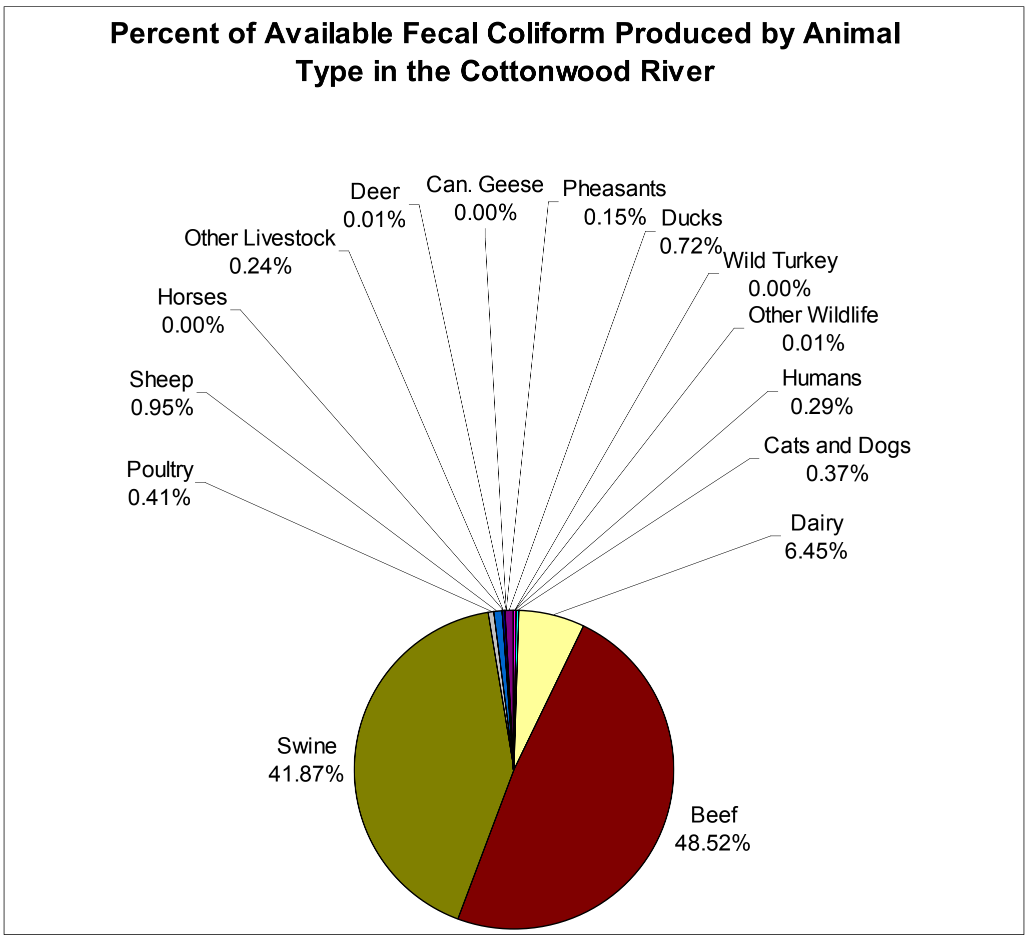


Figure 2: Estimated Fecal Coliform Bacteria Produced by Source



Potential Fecal Coliform Sources by Application Type/Method

The total potential fecal coliform produced in the Cottonwood River Watershed was further dissected. For the human population, the number of people that have adequately and inadequately treated wastewater systems were counted in both rural and urban areas. For livestock, assumptions were made regarding the method of manure application and animal type. The ratio of potential manure sources based on application/source method was based on assumptions derived from the Generic Environmental Impact Statement (GEIS) on Animal Agriculture, prepared by the Minnesota Environmental Quality Board. The document provides general guidelines on how and where livestock manure is applied to land in Minnesota. Like other projects in Minnesota, the assumptions of manure were modified to portrayed activities in the watershed. The GEIS states that 80 percent of swine manure is incorporated and 20 percent is land applied. Based on trends in the application of swine manure from surface applied to incorporated we elected to assume 95 percent of swine manure is incorporated, five percent surface applied. Table 2 provides the assumptions used and their resulting categories for the entire Cottonwood River watershed.

Table 2: Assumptions for Calculating FC by Source/Application Method

Category	Source	Assumptions*	Animal Units or Individuals
Livestock	Pastures within 1000' of Streams and Waterways	20% Dairy Manure 47% Beef Manure 1% Horse Manure 1% Sheep Manure	2,840 Dairy AU 35,846 Beef AU 2 Horse AU 10 Sheep AU
	Pastures Greater than 1000' from Streams and Waterways	5% Dairy Manure 13% Beef Manure	710 Dairy AU 9,915 Beef AU
	Feedlots and Stockpiles without Runoff Controls	1% Dairy Manure 5% Beef Manure 1% Turkey Manure	142 Dairy AU 3,813 Beef AU 43 Poultry AU
	Surface Applied Manure	37% Dairy Manure 17.5% Beef Manure 5% Swine Manure 49.5% Horse Manure 49.5% Sheep Manure 49.5% Turkey Manure 50% Other Livestock	5,254 Dairy AU 13,347 Beef AU 4,630 Swine AU 78 Horse AU 493 Sheep AU 2,146 Poultry AU 185 Other Livestock AU
	Incorperated Manure	37% Dairy Manure 17.5% Beef Manure 95% Swine Manure 49.5% Horse Manure 49.5% Sheep Manure 49.5% Turkey Manure 50% Other Livestock	5,254 Dairy AU 13,347 Beef AU 87,979 Swine AU 78 Horse AU 493 Sheep AU 2,146 Poultry AU 185 Other Livestock AU
Human	Inadquately Treated Wastewater Adequately Treated Rural Wastewater Municipal Wastewater Treatment Facilities	20.59% of Human Waste 23.26% of Human Waste 56.15% of Human Waste	4,760 People 5,376 People 12,978 People
Wildlife	Wildlife	100% of Deer 100% of Geese 100% of Pheasants 100% of Ducks 100% of Wild Turkeys 100% of Other Wildlife	6,565 Deer 1,759 Geese 126,048 Pheasants 24,807 Ducks 105 Wild Turkeys 6,565 Other Wildlife
Pets	Pets	100% of Dogs and Cats	11,779 Cats and Dogs

*Assumptions used for livestock were derived from information contained in the Generic Environmental Impact Statement on Animal Agriculture, prepared by the Minnesota Environmental Quality Board.

Delivery Assumptions

To estimate the primary sources of fecal coliform bacteria contamination in the Cottonwood River watershed, the delivery ratios presented in Table 3 were used. These figures were derived from Appendix C of the Regional TMDL Evaluation of Fecal Coliform Bacteria Impairments in the Lower Mississippi River Basin in Minnesota, 2002 (revised 2006). The delivery ratios are based on expert opinions and should be taken in relative rather than absolute terms.

Table 3: Delivery Assumptions

Category	Source	Wet Conditions	Dry Conditions
Livestock	Pastures within 1000' of Streams and Waterways	1.0%	0.1%
	Pastures Greater than 1000' from Streams and Waterways	0.1%	0.0%
	Feedlots and Stockpiles without Runoff Controls	4.0%	0.0%
	Surface Applied Manure	1.0%	0.0%
	Incorporated Manure	0.1%	0.0%
Human	Inadequately Treated Wastewater	8.0%	8.0%
Wildlife	Wildlife	0.5%	0.0%
Pets	Pets	4.0%	1.0%

Target Areas for Fecal Coliform Bacteria

The amount of fecal material delivered from any one source will vary depending on many factors. Because of this uncertainty, it is difficult to accurately breakdown the percent of bacterial contamination from each source. Instead, categories were used to list the sources of bacterial contamination in the impaired reaches. Table 4 presents the likely major sources of bacterial loading in the Cottonwood River watershed, during wet and dry conditions. Wet conditions are defined as those during and following precipitation events that cause overland flow. Dry conditions are when overland flow is not occurring. A greater percentage of days are considered dry; however the majority of bacterial loading to streams occurs during wet conditions. Categories were defined as less than five percent being a low contributor, five to twenty percent a moderate contributor and greater than twenty percent a high contributor.

Table 4: Target Areas for FC Reduction in the Cottonwood River

Category	Source	Wet Conditions	Dry Conditions
Livestock	Pastures within 1000' of Streams and Waterways	High Contributor	High Contributor
	Pastures Greater than 1000' from Streams and Waterways	Low Contributor	Low Contributor
	Feedlots and Stockpiles without Runoff Controls	Moderate Contributor	Low Contributor
	Surface Applied Manure	High Contributor	Low Contributor
	Incorporated Manure	Moderate Contributor	Low Contributor
Human	Inadequately Treated Wastewater	Low Contributor	Moderate Contributor
Wildlife	Wildlife	Moderate Contributor	High Contributor
Pets	Pets	Low Contributor	Low Contributor

Appendix D: Agendas, Presentations, and Handouts

Redwood and Cottonwood River Watershed Fecal Coliform Stakeholder and Technical Advisory Group 1st Meeting on Implementation Summary

Agenda:

10:00 Start- Welcome/Introductions

10:30 TMDL Overview/RCRCA's Goals and Objective as a Third Party Vendor

10:45 Responsibilities of a Technical Committee

11:00 Summary TMDLs/Watershed Characteristics/Load Equation (WLA, LA, MOS, RC and Resulting Duration Curves -Doug

Noon: Lunch

1:00 Presentation on Developing Accurate Animal Unit Numbers and Sources for both Production Ag and Wildlife -Shawn

1:30 Questions/Comments/Set Date for next month-Adjourn

2:00 Other business – available cost-share

Minutes of the February 20th Technical Advisory/Enhanced Stakeholder Meeting Concerning the Redwood and Cottonwood River Fecal TMDL Rough Drafts.

Attendees: Marilyn Bernhardson, Redwood County SWCD; Bob Jahn, City of Marshall; LouAnn Nagel, Yellow Medicine SWCD; Desiree Hoenstein, Brown County; Cheryl Isder, NRCS DC Yellow Med; Howard Konkel, Murray County SWCD; Randy Kraus, Lincoln SWCD; Dennis Johnson, NRCS DC Lincoln; Jon Mitchell, Redwood County PZ; Tom Maher, Brown County SWCD; Chris Hansen, Murray County Environmental; Dave Voigt, NRCS Soil Con Tech, Lyon Co.; Beth Stueven, Redwood County PZ; Lance Otto, Redwood County Landowner-C/SB growers; Kelly Heather, NRCS DC, Redwood Co.
Staff: Jim Doering, RCRCA Executive Director; Doug Goodrich, Watershed Technician; Shawn Wohnoutka, RCRCA Education/GIS Technician.

Agenda Items:

Welcome/Meet and Greet
TMDL overview
RCRCA's Goals and Objectives and Role as a third party vendor
Doug Goodrich's presentation on TMDLs, watershed characteristics, WLA, LA, MOS, RC and resulting flow duration curves.
Lunch
Shawn Wohnoutka's presentation on developing accurate animal unit numbers and sources for both production ag and wildlife.
Set next meeting/Adjourn

Concerns/Comments raised during the meeting:

1. Purpose of the meeting and its relation to a stakeholder meeting? Jim Doering explained that this is a technical advisory meeting and the stakeholder meetings will happen after these working sessions. Doering explained that RCRCA has taken the data it has generated since 1990 to present and used that to develop the draft TMDLs. The format has been set based on currently approved fecal TMDLs and RCRCA has added it's information into the same format and produced a tangible working product to review and revise if needed.
2. Various questions were raised on how the WLA, LA, MOS, and RC values were generated with no major concerns.
3. Comments were made they wish there were more local landowners present.
4. Doering closed with the instructions for the committee to review the TMDLs and send comments and concerns via e-mail to be addressed at the next meeting.
5. Doering also stated that RCRCA will add the implementation summary to the TMDLs for the next meeting and the committee is to be prepared to revise them according to other water quality plans in order to remain consistent and to develop implementation strategies that will satisfy these TMDLs and existing plans.

The group set the next meeting for April 7th with the location TBA

Redwood and Cottonwood River Watershed Fecal Coliform Stakeholder and Technical Advisory Group 2nd Meeting on Implementation Summary

Agenda:

10:00 Start- Welcome

10:15 Review- TMDL report so far- question and answers

11:15 Summary Implementation Plan-Doug

Noon: Lunch

1:00 Current plans addressing Fecal Coliform

1:30 BMP selection by reach –Current and Premier Suggestions

2:00 Set Date for next month-Adjourn

Minutes of the April 7th Technical Advisory/Enhanced Stakeholder Meeting Concerning the Redwood and Cottonwood River Fecal TMDL Rough Drafts.

Attendees: Steve Soderman, MNCGA; Marilyn Bernhardson, Redwood County SWCD; Matt Drewitz, BWSR; Bob Jahn, City of Marshall; LouAnn Nagel, Yellow Medicine SWCD; Desiree Hoenstein, Brown County; Cheryl Isder, NRCS DC Yellow Med; Howard Konkel, Murray County SWCD; Ron Madsen, Lincoln SWCD; Pauline VanOverbeck, Lincoln Co. SWCD; Tom Maher, Brown County SWCD; Lance Otto, Redwood County Landowner-C/SB growers; Kelly Heather, NRCS DC, Redwood Co.; Dave Englin, Comfrey Area; Brian Johnson, Redwood Co. Pork Producers; Greg Bartz, Farmers Union; Gorge Goblish, MSGA; Steven Commerford, Crop Consultant; Arland Roiger, Springfield Area; Butch Kerkhoff, Redwood Area; April Sullivan, NRCS DC, Cottonwood Co.; Dave Bucklin, Cottonwood Co. SWCD; Mark T. Hanson, MPCA; Kerry Netzke, AreaII;
Staff: Jim Doering, RCRCA Executive Director; Doug Goodrich, Watershed Technician; Shawn Wohnoutka, RCRCA Education/GIS Technician.

Agenda Items:
Welcome/Meet and Greet
TMDL overview
Lunch/Networking
TMDL overview cont.
Set next meeting/Adjourn

In light of the many new faces RCRCA followed reviewed the previous meetings agenda.
Concerns/Comments raised during the meeting:

1. Doering explained that RCRCA has taken the data it has generated since 1990 to present and used that to develop the draft TMDLs. The format has been set based on currently approved fecal TMDLs and RCRCA has added it’s information into the same format and produced a tangible working product to review and revise if needed.
2. Various questions were raised on how the WLA, LA, MOS, and RC values were figured. Questions and much discussion related to what specific groups were actually included in the LA portion of the equation and why the MOS was so large in some cases. Goodrich explained the equations in more detail and walked through examples of what groups could be included. Goodrich and Doering explained that no calculations in terms of LA values were done at this point in the load equations. Concerns that agricultural activities may not contribute a significant amount to the overall load equation were discussed at length. Some in the group put it to the staff to produce studies involving the actual reasoning behind pathogen standards used in these studies. Staff members acknowledged this request and others to explain bacteria life cycles and relation to sediment and natural conditions (temperature, moisture, etc.)
3. Comments were made they wish there were more local landowners present.
4. Discussions ran long at this meeting and the explanation of the TMDL process would need to finish at the next meeting.
5. Doering closed with the instructions for the committee to review the TMDLs and send comments and concerns via e-mail to be addressed at the next meeting. The group set the next meeting for May 28th with the located at the Redwood Area Community Center. Start time 10:00 a.m. until 2:00 p.m.

Redwood and Cottonwood River Watershed Fecal Coliform Stakeholder and Technical Advisory Group 3rd Meeting on Implementation Summary

Agenda:

10:00 Start- Welcome

10:15 Review- TMDL report so far- question and answers

11:15 Individual Reach Summary/Load Duration Curves/Implementation Techniques - Doug

Noon: Lunch

1:00 Pathogens in Water/Studies and Reasoning Behind FC Standard -Shawn

1:30 BMP selection by reach –Current and Premier Suggestions

2:00 Set Date for next month-Adjourn

Minutes of the May 28th Technical Advisory/Enhanced Stakeholder Meeting Concerning the Redwood and Cottonwood River Fecal TMDL Rough Drafts.

Attendees: LouAnn Nagel, Yellow Medicine SWCD; Desiree Hoenstein, Brown County; Pauline VanOverbeke, Lincoln Co. SWCD; Lance Otto, Redwood County Landowner-C/SB growers; Kelly Heather, NRCS DC, Redwood Co.; Brian Johnson, Redwood Co. Pork Producers; Steven Commerford, Crop Consultant; Butch Kerkhoff, Redwood Area; Mark T. Hanson, MPCA; Kerry Netzke, AreaII; Richard Trebesch, Landowner; Bob VanMoer, City of Marshall; Warren Formo, MN AgWater Resources Center; Jeremy Geske, Farm Bureau; Jeff Strock, University of Minnesota Southwest Research Center; Glenn Graff, Landowner; Howard Hamilton, Landowner; Mark Pankonin, MSCA Feedlot Council; Doug Albin, MCGA; Sam Ziegler, MSGA

Staff: Jim Doering, RCRCA Executive Director; Doug Goodrich, Watershed Technician; Shawn Wohnoutka, RCRCA Education/GIS Technician.

Agenda Items:
Welcome
Recap
Finish presentation on TMDL process
Lunch
Presentation information on surface water pathogens/Standards Reasoning
Set next meeting/Adjourn

Concerns/Comments raised during the meeting:

1. Comments that failing septic systems would be a major contributer in dry periods according to the loading curve. The staff agreed that failed septic system would have a greater impact during dryer periods and could possibly provide a large source of new bacteria as a percentage under the right conditions.
2. Other comments and discussion involving what types of activities would help reduce fecal bacteria movement during different flows. Comments were made on how it made sense to use the actual volume of the river was better to use than a temporal regime.
3. Much disagreement was expressed on whether standards made sense for rivers in southwestern Minnesota and that studies such as this one shouldn't be conducted until actual sources could be accounted for by species/specific source. Staff and agency staff expressed again that this study was undertaken because it is a requirement of the EPA and that the standards used were set by EPA and MPCA. Staff also expressed that this was not the forum to voice opposition to the standards and that the TMDL process serves to determine what reduction of pollutant would be needed to bring a water body to standards and that the TMDL equation and Stream Load Capacity needs to be part of that process.
4. Doering closed with the instructions for the committee to review the TMDLs and send comments and concerns via e-mail to be addressed at the next meeting.

The group set the next meeting for June 25th with the located at the Redwood Area Community Center. Start time 10:00 a.m. until 2:00 p.m.

Redwood and Cottonwood River Watershed Fecal Coliform Stakeholder and Technical Advisory Group 4th Meeting on Implementation Summary

Agenda:

10:00 Start- Welcome

10:15 RCRCA's Responsibility in the TMDL Process/Federal and State Requirements in Relation to the Clean Water Act -Doug

11:15 Load Duration Curves and Sampling Data/Inventory of Available Bacteria Load and Calculation of Bacteria Delivery per Source Based on Estimations of Professional Judgment -Doug

Noon: Lunch

1:00 BMP selection by reach –Current and Premier Suggestions

1:30 Group Selection/Suggestions for Bacteria Reduction for Each Reach and Flow Type

2:00 Adjourn- Discuss Future Correspondence

Minutes of the June 25th Technical Advisory/Enhanced Stakeholder Meeting Concerning the Redwood and Cottonwood River Fecal TMDL Rough Drafts.

Attendees: Steve Soderman, MNCGA; Marilyn Bernhardson, Redwood County SWCD; Steven Commerford, Crop Consultant; Mark T. Hanson, MPCA; Kerry Netzke, Area II; Paul Hagen, C-SB Growers; Glen Graff, Landowner; Harley Vogel, Landowner New Ulm Area; Warren Formo, MAWRC

Staff: Jim Doering, RCRCA Executive Director; Doug Goodrich, Director/Watershed Technician; Shawn Wohnoutka, RCRCA Education/GIS Technician.

Agenda Items:
Welcome
Recap
Presentation – Requirements of Various Agencies in the TMDL Process/Load Duration Curve and Sampling Analysis
Lunch
Presentation – Inventory of Available Bacteria Load and Calculation of Bacteria Delivery per Source Based on Estimations of Professional Judgment
Adjourn

Concerns/Comments raised during the meeting:

1. Goodrich explained the relationship of sampling data to load duration curve with no major concerns. A question was raised as to whether or not enough monitoring sites were being used. Discussion was pursued as to where agricultural activities fit into the "flow zones"
2. Discussion was revisited on whether or not the LA portion of the equation was overstating the amount of contribution due to agricultural activity. Staff explained that available pollutant and delivered pollutant are two different figures and quite possibly the delivery of agricultural manure, with proper handling, can have a low delivery rate. The fact of the matter is, that even with low delivery rate the available pollutant for agricultural practices far outweighs that of all other sources in terms of raw bacteria count. Much discussion followed. A breakdown of calculations step by step was performed by staff.
3. Doering closed with the instructions for the committee to review the TMDLs and send comments and concerns via e-mail due to the small turnout, and staff would answer concerns on a one to one basis.

Appendix E: Responses to Written Comments

Compilation of comments received for the Cottonwood River Fecal Coliform Total Maximum Daily Load (TMDL) and the Redwood River Fecal Coliform TMDL. (Responses apply to both TMDLs because identical comments were received for each.)

The following comments were received from the Minnesota Corn Growers Association's (MCGA):

Concern #1-
"The description of seasonal variation offers one perspective based on water monitoring trends ("Monitoring data show an apparent relationship between season and fecal coliform bacteria concentrations. Typically the highest bacterial concentrations are found in the summer and early fall. In the spring, concentrations are typically lower, despite the fact that significant manure application occurs during this time and that fields have little crop canopy to protect against water erosion"). We would suggest that this seasonality be explained more completely, especially the general link between lower flows and higher temperature and bacteria concentrations. The water monitoring data suggests that there is a minimal association between manure applications and bacteria concentrations, as the majority of manure applications occur in the October-November and April-May timeframes, both periods of lower bacteria concentrations."

MPCA response: The quotation cited is taken from the brief draft Cottonwood River Fecal Coliform and Redwood River Fecal Coliform TMDLs Summary Tables. More detail on the seasonality of bacteria is given in Section 7 (Seasonal Variation) of the draft Cottonwood River Fecal Coliform and Redwood River Fecal Coliform TMDLs.

Concern #2-
"The Executive Summary discussion of livestock manure suggests that a majority of livestock producers in the watersheds are "probably" handling manure and conducting land application consistent with current rules, guidelines, and University of Minnesota recommendations. A scientific assessment should not be based on "probably". Was there an effort to quantify or characterize the manure management practices of farmers in the watersheds? Further, this section also suggests that "even if less than 1% of the land applied manure enters surface waters, it could account for violations of water quality standards. Again, this statement appears to be based on conjecture, not science. What if the correct estimate is 0.1%, or 0.01%? Will similar use of conjecture be applied equally to all sources and to resulting 1oad allocations?"

MPCA response: There was not an effort to quantify or characterize manure management practices; rather the comment is intended to recognize the observation of local water quality professionals that in general, citizens of the watershed try to do the right thing.

The statement "even if less than 1% of the land applied manure enters surface waters, it could account for violations of water quality standards" was not based on conjecture. It was a calculation based on the animal units of land applied manure known, calculated bacteria content per animal unit type applied to the watershed, and actual calculated TMDLs of the systems. At the low flow rates equal to the 90th percentile, historic flows on the Cottonwood River would be exceeded if only 0.74% of all land applied manure reached the river; the Redwood River would be exceeded under the same flow conditions (90th percentile) by only 0.53% of available manure reaching the river.

Concern #3-
"Land use values provided in section 2.3 seem to overstate the area of cultivated cropland. The Redwood River watershed is listed at 85.5% cultivated land. The Cottonwood River watershed is listed at 88% cultivated lane. While it is a relatively small issue in these reports, it is important that methods and definitions be consistent. USDA data suggests that actual cultivated area is overstated by 6-8%. Please provide clarification of the data sources."

MPCA Response: Data from the Land Management Information Center (LMIC 1993) was used, which was obtained from the DNR's Minnesota Geospatial Data Office.

Concern #4-
"We are opposed to the wasteful use of taxpayer resources to addressing bacteria standards on Class 7 waters, which are highly unlikely to be used for aquatic recreation."

MPCA response: Class seven (7) waters often flow into other classes of waterbodies and thus can have direct impacts to water quality and aquatic recreation downstream. Water quality standards are reviewed every three years and public comments are welcomed during this process. The following MPCA website has more detailed information about the triennial review process:
http://www.pca.state.mn.us/iryp1405.

Concern #5-
"Section 4.1 of the draft reports provides an overview of fecal coliform sources, but does not include research conducted in the Minnesota River Basin by Dr. Michael Sadowsky, funded by the citizens of Minnesota through Clean Water Funds. This report, which is attached, reveals that fecal coliform bacteria may be living in and even reproducing outside of the intestines of warm blooded animals. This finding makes the TMDL statement "though the mechanisms cited above have a possible effect on the values of pollutant calculated in this report, they are not quantifiable at this time" even more ominous. The development of load allocations should be undertaken with great caution."

MPCA response: Upon receipt of comments during the public comment period, MPCA staff carefully reviewed and considered the Sadowsky study. In addition, MPCA staff discussed the Sadowsky study and specifically whether the natural background discussion contained within the proposed draft Cottonwood River and Redwood River Fecal Coliform TMDLs should be altered in light of the Sadowsky study's findings.

The MPCA staff also contacted and met with Dr. Sadowsky, the author of the study. The meeting focused entirely on the potential implications of Dr. Sadowsky's findings in light of the proposed draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

Dr. Sadowsky cautioned about translating the results of his work to load allocations, and about the extrapolation of the results from the Seven Mile Creek watershed to the Cottonwood River and Redwood River watersheds.

MPCA staff worked with Dr. Sadowsky and Dr. Adam Birr (former Minnesota Department Agriculture Research Coordinator) to develop language additions and changes which were drafted for the draft Cottonwood River Fecal Coliform TMDL, but also apply to the draft Redwood River Fecal Coliform TMDL.

The MPCA staff propose and the MPCA hereby incorporates the following language to Section 4.1 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs:

> "Two Minnesota studies describe the presence and growth of "naturalized" or "indigenous" strains of *E. coli* in watershed soils (Ishii et al., 2006) and ditch sediment and water (Sadowsky et al., 2010). The latter study, supported with Clean Water Land and Legacy funding, was conducted in the Seven Mile Creek watershed, an agricultural landscape approximately 30 miles to the east of the mouth of the Cottonwood River. DNA fingerprinting of *E. coli* from sediment and water samples collected in Seven Mile Creek from 2008-2010 resulted in the identification of 1568 isolates comprised of 452 different *E. coli* strains. Of these strains, 63.5% were represented by a single isolate, suggesting new or transient sources of *E. coli*. The remaining 36.5% of strains were represented by multiple isolates, suggesting persistence of specific *E. coli*. Discussions with the primary author of the Seven Mile Creek study suggest that while 36% might be used as a rough indicator of "background" levels of bacteria at this site during the study period, this percentage is not directly transferable to the concentration and count data of *E. coli* used in water quality standards and TMDLs. Additionally, because the study is not definitive as to the ultimate origins of this bacteria, it would not be appropriate to consider it as "natural" background. Finally, the author cautioned about extrapolating results from the Seven Mile Creek watershed to other watersheds without further studies."

The MPCA staff propose and the MPCA hereby incorporates the following language to Section 4.2.4 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs and changes the title of these sections from "Wildlife Sources" to "Wildlife/Natural Background Sources."

> "Section 4.1 discusses the potential of "naturalized" or "indigenous" bacteria in soils, ditch sediment, and water as an additional source. However, the studies cited are not definitive as to the magnitude of this contribution. Additionally, the

> studies are not definitive as to the ultimate origins of this bacteria, so it may not be appropriate to consider it as “natural” background.”

In addition to the changes as outlined immediately above, Dr. Adam Birr suggested MPCA include a statement of the pragmatic implications of the Sadowsky study:

> “From a pragmatic standpoint, this study suggests that there is a fraction of bacteria that may exist regardless of most traditional implementation strategies that are employed to control the sources of *E. coli*.”

The MPCA hereby incorporates the language contained above into Section 4 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

Concern #6-

“We find it curious that the discharge of partially or untreated human sewage would ever by described as "legal" (section 4.2.1).”

MPCA response: The word “legal” has been deleted and new language has been developed for this paragraph to clarify circumstances in which municipal wastewater bypasses occur. The new language is as follows:

> “Municipal bypasses are emergency discharges of partially or untreated human sewage from waste water treatment facilities. Municipal wastewater facilities shall not allow an anticipated bypass to occur unless the bypass is unavoidable to prevent loss of life, personal injury, or severe damage to the facility or private property. Municipal bypasses sometimes occur during periods of heavy precipitation, when treatment facilities become hydraulically overloaded. Conditions for bypasses are detailed in the facility’s NPDES permit and Minn. R. 7001.1090.”

Concern #7-

“The discussion of urban stormwater in section 4.2.1 states that "Fecal coliform concentrations in urban runoff can be as great as or greater than those found in cropland runoff and feedlot runoff' citing a 2001 USEPA source. Did the authors attempt to determine actual fecal coliform concentrations and/or loads from urban runoff? The permit for cities falling under stormwater regulation are required to perform "a range of actions that will ultimately reduce the impact of stormwater", but monitoring to determine effectiveness is rarely conducted and would be extremely useful in both source identification and evaluating implementation effectiveness.”

MPCA response: The authors of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs did not attempt to determine the actual loads from urban sources. Rather, estimates of urban loadings were taken from the Source Assessment section in the USEPAs 2001 Protocol for Developing Pathogen TMDLs, which is cited as a reference in Section 11 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

The comment about effectiveness monitoring is acknowledged.

Concern #8-
"Did the authors attempt to determine the extent of manure handling and land application methods in the watershed beyond the stated analysis that "the majority of livestock producers in the watersheds are most likely handling their manure and conducting land application consistent with current rules, guidelines, and University recommendations"? A scientific assessment should not be based on "most likely". Was there an effort to quantify or characterize the manure management practices of farmers in the watersheds? Further, this section also suggests that "even if less than 1% of the land applied manure enters surface waters, it could account for violations of water quality standards. Again, this statement appears to be based on conjecture, not science. What if the correct estimate is 0.1%, or 0.01%? Will similar use of conjecture be applied equally to all sources and to resulting 1oad allocations?"

MPCA response: There was not an effort to quantify or characterize manure management practices; rather the comment is intended to recognize the observation of local water quality professionals that in general citizens of the watershed try to do the right thing.

The statement "even if less than 1% of the land applied manure enters surface waters, it could account for violations of water quality standards" was not based on conjecture. It was a calculation based on the animal units of land applied manure known, calculated bacteria content per animal unit type applied to the watershed, and actual calculated TMDLs of the systems. At the low flow rates equal to the 90th percentile, historic flows on the Cottonwood River would be exceeded if only 0.74% of all land applied manure reached the river; the Redwood River would be exceeded under the same flow conditions (90th percentile) by only 0.53% of available manure reaching the river.

Concern #9-
"According to section 5.2.1 of the draft report, "As long as WWTFs discharge at or below their permit limit, they will not cause violations of the fecal coliform water quality standard." Is this always true, given that discharge could contain bacteria which settle into stream sediments, then be re-suspended by subsequent events? As stated in the report, under low flow conditions, waste water treatment facilities contribute as much as 1996%, of daily load capacity. Also as stated in the report, actual WWTF effluent concentration cannot exceed the stream concentration as stream flow must be at least 100% of WWTF discharge. However, this may allow for storage of excess bacteria in stream sediments."

MPCA response: The reference in the draft Redwood River Fecal Coliform TMDL to WWTF contributing 1996% has been clarified in all of the applicable loading capacity and allocation tables. The correct wasteload allocation for these low flow zones is calculated by multiplying the maximum daily flow of the WWTFs by 200 organisms per 100 mL.

The discharge of wastewater containing concentrations of fecal coliform bacteria that are less than or equal to 200 organisms/100 mL (or 126 *E. coli* organisms/100 mL) will not cause violations of the water quality standard. NPDES permit effluent limits for fecal coliform bacteria are based on the understanding that discharges in compliance with permit limits do not cause or contribute to violations of the applicable water quality standard. Also, wastewater effluent disinfection usually provides a nearly complete bacterial kill, particularly when chlorine is used and as a result effluent concentrations are usually well below the permitted effluent limitations. Questions relating to the deposition and re-suspension of viable fecal coliform or *E. coli* organisms in flowing waterbodies are the subject of ongoing research and discussion.
The load duration analysis does not address bacteria re-growth in sediments, die-off, and natural background levels. Sampling of bottom sediment is not done to determine impairments. Only samples of the water column are taken, and bottom sediment is not part of the water column. The current bacteria standard is written to protect human health while swimming in water. The margin of safety helps to account for the variability associated with these conditions.

Concern #10-
"The reserve capacity discussion in section 5.2.4 includes a comment suggesting that livestock numbers "appear to be concentrated in fewer operations." Are the authors suggesting a relationship between bacteria-related water impairments and the size of farm operations? If so, is the relationship direct or inverse? If the authors are not suggesting such a relationship, this sentence should be deleted."

MPCA response: The statement was not meant to imply a relationship between the bacteria-related water impairments and the size of farm operations. Rather it was a simple demographic observation. This comment is acknowledged but results in no changes to the draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

Concern #11-
"The Seasonal Variation discussion in section 7.0 states that summer is the peak season of "agriculture" and that soil is "presumably at peak seasonal load for fecal coliform by mid-summer". What assessment tools were used to define "agriculture's" peak season? Could this information be used elsewhere to assess manure management practices?"

MPCA response: The comment intended to make the point that most land application of manure occurs prior to crop growth in the spring. In the summer, then, the land has the most manure of the season when rainstorms can wash it away. The comment also intended to make the point that summer is the peak season of crop growth, not simply "agriculture." This paragraph has been removed from both draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

Concern #12-

“The implementation strategy outlined in section 9.1estimates that the cost to put "animal agricultural activities under manure management and feedlot runoff mitigation plans" at around $25 million. What is the basis for this estimate?”

MPCA response: As section 9.1 in the draft Cottonwood River and Redwood River Fecal Coliform TMDLs states, this estimation was based on EQIP payment history and the number of non-NPDES permitted animal units listed in the draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

The following comments were received from the Minnesota State Cattlemen’s Association (MSCA):

Comment MSCA #1:
“The Minnesota State Cattlemen’s Association (MSCA) requests the MPCA withdraw the current Total Maximum Daily Load (TMDL) plan for the Redwood and Cottonwood Rivers and re-engage local stakeholders to discuss monitoring, allocation and remediation issues related to bacteria.”

MPCA response: The MPCA declines the request to withdraw the draft Cottonwood River and Redwood River Fecal Coliform TMDLs. The draft Cottonwood River and Redwood River Fecal Coliform TMDL studies were conducted in a manner consistent with EPA guidance, MPCA protocol, and previous EPA approved bacteria TMDLs. A Stakeholder/Technical Advisory process was established and utilized in the development of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs. A collaboration of interest groups, organizations, and citizens were invited and participated in this process as well as local, state, and federal agencies to provide input in the development of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs. Stakeholder/Technical Advisory meetings were held February 2008, April 2008, May 2008 and June 2008 in Redwood Falls. An electronic mail message was sent August 2010 from RCRCA to the Stakeholder/Technical Advisory group to request review and provide comments on the final draft Cottonwood River and Redwood River Fecal Coliform TMDLs prior to the public notice comment period. No comments were received from the Stakeholder/Technical Advisory group. The draft Cottonwood River and Redwood River Fecal Coliform TMDLs were revised based on EPA comments and responses sent to EPA in November 2010.

Comment MSCA #2:
“Lack of local livestock stakeholder involvement and engagement
As you know, civic engagement and a formal stakeholder process are required under the Clean Water Legacy Act. Area cattle farmers do not feel they have had an adequate opportunity to provide input into this process nor had time to fully evaluate the ramifications. The MSCA also requests the MPCA clarify the consequences of the TMDL to current NPDES permitted cattle farms in the watershed.”

MPCA response: The public notice comment period for the draft Cottonwood River and Redwood River Fecal Coliform TMDLs was April 25, 2011 to May 25, 2011. The draft Cottonwood River and Redwood River Fecal Coliform TMDLs were posted on the

MPCA web site along with a press release and a copy of the mailing sent to interested parties. The timeline for this public comment period was consistent with the length of other TMDLs, and the MPCA feels that due diligence was fulfilled in making interested parties aware of the Cottonwood River and Redwood River Fecal TMDL development. Also, the stakeholder group included area cattle farmers.

As the draft Cottonwood River Fecal Coliform and Redwood River Fecal Coliform TMDLs states in section 5.2.1, "livestock facilities that have been issued NPDES permits are assigned a zero wasteload allocation. This is consistent with the conditions of the permit, which allow no pollutant discharge from the livestock housing facilities and associated sites. Discharge of fecal coliform from fields where manure has been land applied may occur at times. Such discharges are covered under the load allocation portion of the draft Cottonwood River Fecal Coliform and Redwood River Fecal Coliform TMDLs, provided the manure is applied in accordance with the permit". The draft Cottonwood River Fecal Coliform and Redwood River Fecal Coliform TMDLs will not change the requirements of the current NPDES permit for existing permitted cattle farms.

Comment MSCA #3:
"<u>Questions over designated use</u>
There is uncertainty over what is the actual designated use the Minnesota Pollution Control Agency (MPCA) is attempting to address through these TMDL plans. Clarification is needed whether this TMDL is focused on restoring aquatic recreation or aquatic life. As you know, the measures that must be taken to address the different designated uses will vary significantly.

If the designated use is aquatic recreation, the MSCA requests the MPCA to identify which recreation and swimming areas in the watershed are effected. If the designated use if aquatic life, the MSCA requests the MPCA to identify specific strategies that will address water temperature and tree plantings along riparian areas."

MPCA response: Impairments for fecal coliform bacteria, such as the ones in the draft Cottonwood River Fecal Coliform and Redwood River Fecal Coliform TMDLs, are impairments of the beneficial use of aquatic recreation.

All of the reaches identified in the draft Cottonwood River Fecal Coliform and Redwood River Fecal Coliform TMDLs are waters of the state. People are free to recreate (which includes but is not limited to swimming) in waters of the state wherever they wish.

Comment MSCA #4:
"<u>Questions over monitoring and correct accounting for sources of bacteria</u>
As you know, accounting for bacteria numbers and sources is a highly technical matter with evolving science. I would point out recent research by Dr. Sadowsky that suggests some strains of coliform bacteria are capable of surviving, being re-suspended and multiplying in soil or steam sediments. If this is the case, strategies to eliminate existing bacteria must be employed, rather than simply focusing on eliminating new sources.

We would also question the assumption that bacteria loadings are primarily caused by manure application. The MSCA requests additional information from the MPCA in terms of failing septic systems and municipal waste water discharges and their potential loadings to area watersheds. Furthermore, the MSCA requests that MPCA deliver genetic fingerprinting data that validates the sources of the bacteria."

MPCA response: Upon receipt of comments during the public comment period, MPCA staff carefully reviewed and considered the Sadowsky study. In addition, MPCA staff discussed the study and specifically whether the natural background discussion contained within the proposed draft Cottonwood River and Redwood River Fecal Coliform TMDLs should be altered in light of the Sadowsky study's findings.

The MPCA staff also contacted and met with Dr. Sadowsky, the author of the study. The meeting focused entirely on the potential implications of Dr. Sadowsky's findings in light of the proposed draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

Dr. Sadowsky cautioned about translating the results of his work to load allocations, and about the extrapolation of the results from the Seven Mile Creek watershed to the Cottonwood River and Redwood River watersheds.

MPCA staff worked with Dr. Sadowsky and Dr. Adam Birr (former Minnesota Department Agriculture Research Coordinator) to develop language additions and changes which were drafted for the draft Cottonwood River Fecal Coliform TMDL, but also apply to the draft Redwood River Fecal Coliform TMDL.

The MPCA staff propose and the MPCA hereby incorporates the following language to Section 4.1 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs:

> "Two Minnesota studies describe the presence and growth of "naturalized" or "indigenous" strains of *E. coli* in watershed soils (Ishii et al., 2006). and ditch sediment and water (Sadowsky et al., 2010). The latter study, supported with Clean Water Land and Legacy funding, was conducted in the Seven Mile Creek watershed, an agricultural landscape approximately 30 miles to the east of the mouth of the Cottonwood River. DNA fingerprinting of *E. coli* from sediment and water samples collected in Seven Mile Creek from 2008-2010 resulted in the identification of 1568 isolates comprised of 452 different *E. coli* strains. Of these strains, 63.5% were represented by a single isolate, suggesting new or transient sources of *E. coli*. The remaining 36.5% of strains were represented by multiple isolates, suggesting persistence of specific *E. coli*. Discussions with the primary author of the Seven Mile Creek study suggest that while 36% might be used as a rough indicator of "background" levels of bacteria at this site during the study period, this percentage is not directly transferable to the concentration and count data of *E. coli* used in water quality standards and TMDLs. Additionally, because the study is not definitive as to the ultimate origins of this bacteria, it would not be appropriate to consider it as "natural" background. Finally, the author cautioned about extrapolating results from the Seven Mile Creek watershed to other watersheds without further studies."

The MPCA staff propose and the MPCA hereby incorporates the following language to Section 4.2.4 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs and changes the title of these sections from “Wildlife Sources” to “Wildlife/Natural Background Sources.”

> “Section 4.1 discusses the potential of “naturalized” or “indigenous” bacteria in soils, ditch sediment, and water as an additional source. However, the studies cited are not definitive as to the magnitude of this contribution. Additionally, the studies are not definitive as to the ultimate origins of this bacteria, so it may not be appropriate to consider it as “natural” background.”

In addition to the changes as outlined immediately above, Dr. Adam Birr suggested MPCA include a statement of the pragmatic implications of the Sadowsky study:

> “From a pragmatic standpoint, this study suggests that there is a fraction of bacteria that may exist regardless of most traditional implementation strategies that are employed to control the sources of *E. coli*.”

The MPCA hereby incorporates the language contained above into Section 4.1 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

Information with respect to failing septic systems can be found in MPCA’s “2011 Annual Report Summary Minnesota Subsurface Sewage Treatment Systems” at: http://www.pca.state.mn.us/index.php/view-document.html?gid=17868

Information with respect to municipal waste water discharges can be found in section 5.3 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs. The wasteload allocations for permitted wastewater treatment facilities (WWTF’s) in the draft Cottonwood River and Redwood River Fecal Coliform TMDLs are the potential loadings to the Cottonwood and Redwood River watersheds. Further information regarding municipal waste water discharges for specific facilities can be obtained by making an information request to the MPCA DataDesk at datadesk.mpca@state.mn.us.

DNA fingerprinting of *E.coli* bacteria was not done as part of these TMDLs. At this time the MPCA does not plan to do this testing. The MPCA feels the protocols used to delineate sources and loadings in the TMDLs are sufficient to meet TMDL goals.

The following comments were received from the Minnesota Pork Producers Association (MPPA):

Comment MPPA#1:
“It is known that some strains of coliform bacteria are capable of multiplying in soil or steam sediments (Sadowsky). As indicated in section 4.1 of the report, survival of fecal coliform in terrestrial and aquatic environments is poorly understood, exacerbating efforts to track sources. The report also acknowledges that bacteria survival and reproduction in stream sediments, and subsequent re-suspension in the water column,

could have an effect on bacteria calculations, but that the magnitude of such processes cannot be quantified at this time.

If one accepts that notion that "pollution" is the result of human activity, should natural background also include naturalized populations of bacteria residing in sediments or soil?"

MPCA response: Upon receipt of comments during the public comment period, MPCA staff carefully reviewed and considered the Sadowsky study. In addition, MPCA staff discussed the study and specifically whether the natural background discussion contained within the proposed draft Cottonwood River and Redwood River Fecal Coliform TMDLs should be altered in light of the Sadowsky study's findings.

The MPCA staff also contacted and met with Dr. Sadowsky, the author of the study. The meeting focused entirely on the potential implications of Dr. Sadowsky's findings in light of the proposed draft Cottonwood River and Redwood Rivers Fecal Coliform TMDLs.

Dr. Sadowsky cautioned about translating the results of his work to load allocations, and about the extrapolation of the results from the Seven Mile Creek watershed to the Cottonwood and Redwood River watersheds.

MPCA staff worked with Dr. Sadowsky and Dr. Adam Birr (former Minnesota Department Agriculture Research Coordinator) to develop language additions and changes which were drafted for the draft Cottonwood River Fecal Coliform TMDL, but also apply to the draft Redwood River Fecal Coliform TMDL.

The MPCA staff propose and the MPCA hereby incorporates the following language to Section 4.1 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs:

> "Two Minnesota studies describe the presence and growth of "naturalized" or "indigenous" strains of *E. coli* in watershed soils (Ishii et al., 2006) and ditch sediment and water (Sadowsky et al., 2010). The latter study, supported with Clean Water Land and Legacy funding, was conducted in the Seven Mile Creek watershed, an agricultural landscape approximately 30 miles to the east of the mouth of the Cottonwood River. DNA fingerprinting of *E. coli* from sediment and water samples collected in Seven Mile Creek from 2008-2010 resulted in the identification of 1568 isolates comprised of 452 different *E. coli* strains. Of these strains, 63.5% were represented by a single isolate, suggesting new or transient sources of *E. coli*. The remaining 36.5% of strains were represented by multiple isolates, suggesting persistence of specific *E. coli*. Discussions with the primary author of the Seven Mile Creek study suggest that while 36% might be used as a rough indicator of "background" levels of bacteria at this site during the study period, this percentage is not directly transferable to the concentration and count data of *E. coli* used in water quality standards and TMDLs. Additionally, because the study is not definitive as to the ultimate origins of this bacteria, it would not be appropriate to consider it as "natural" background. Finally, the author cautioned about extrapolating results from the Seven Mile Creek watershed to other watersheds without further studies."

The MPCA staff propose and the MPCA hereby incorporates the following language to Section 4.2.4 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs and changes the title of these sections from “Wildlife Sources” to “Wildlife/Natural Background Sources.”

> “Section 4.1 discusses the potential of “naturalized” or “indigenous” bacteria in soils, ditch sediment, and water as an additional source. However, the studies cited are not definitive as to the magnitude of this contribution. Additionally, the studies are not definitive as to the ultimate origins of this bacteria, so it may not be appropriate to consider it as “natural” background.”

In addition to the changes as outlined immediately above, Dr. Adam Birr suggested MPCA include a statement of the pragmatic implications of the Sadowsky study:

> “From a pragmatic standpoint, this study suggests that there is a fraction of bacteria that may exist regardless of most traditional implementation strategies that are employed to control the sources of *E. coli*.”

The MPCA hereby incorporates the language contained above into Section 4.1 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

Comment MPPA #2:
“Did the authors attempt to quantify “legal emergency discharges of partially or untreated human sewage from waste water treatment facilities”? (section 4.2.1) Such discharges may not lead to immediate violations of water quality standards, due to dilution, but could settle in stream sediments and contribute to exceeding the standard in the future. “As long as WWTFs discharge at or below their permit limit, they will not cause violations of the fecal coliform water quality standard.” (Section 5.2.1)

Is this always true, given that discharge could contain bacteria which settle into stream sediments, then be re-suspended by subsequent events? As stated in the report, under low flow conditions, waste water treatment facilities contribute as much as 1996%, of daily load capacity. Also as stated in the report, actual WWTF effluent concentration cannot exceed the stream concentration as stream flow must be at least 100% of WWTF discharge. However, this may allow for storage of excess bacteria in stream sediments.”

MPCA response: The word “legal” has been deleted and new language has been developed for this paragraph to clarify circumstances in which municipal wastewater bypasses occur. The new language is as follows:

> “Municipal bypasses are emergency discharges of partially or untreated human sewage from waste water treatment facilities. Municipal wastewater facilities shall not allow an anticipated bypass to occur unless the bypass is unavoidable to prevent loss of life, personal injury, or severe damage to the facility or private property. Municipal bypasses sometimes occur during periods of heavy precipitation, when treatment facilities become hydraulically overloaded.

> Conditions for bypasses are detailed in the facility's NPDES permit and Minn. R. 7001.1090."

The reference in the draft Redwood River Fecal Coliform TMDL to WWTF contributing 1996% has been clarified in all of the applicable loading capacity and allocation tables. The correct wasteload allocation for these low flow zones is calculated by multiplying the maximum daily flow of the WWTFs by 200 organisms per 100 mL.

The discharge of wastewater containing concentrations of fecal coliform bacteria that are less than or equal to 200 organisms/100 mL (or 126 *E. coli* organisms/100 mL) will not cause violations of the water quality standard. NPDES permit effluent limits for fecal coliform bacteria are based on the understanding that discharges in compliance with permit limits do not cause or contribute to violations of the applicable water quality standard. Also, wastewater effluent disinfection usually provides a nearly complete bacterial kill, particularly when chlorine is used and as a result effluent concentrations are usually well below the permitted effluent limitations. Questions relating to the deposition and re-suspension of viable fecal coliform or *E. coli* organisms in flowing waterbodies are the subject of ongoing research and discussion.
The load duration analysis does not address bacteria re-growth in sediments, die-off, and natural background levels. Sampling of bottom sediment is not done to determine impairments. Only samples of the water column are taken, and bottom sediment is not part of the water column. The current bacteria standard is written to protect human health while swimming in water. The margin of safety helps to account for the variability associated with these conditions.

Comment MPPA #3:
"Did the authors attempt to determine actual fecal coliform concentrations and/or loads from urban runoff? (section 4.2.1) Permitted cities falling under stormwater regulation are required to perform "a range of actions that will ultimately reduce the impact of stormwater", but monitoring to determine effectiveness is rarely conducted."

MPCA response: The authors of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs did not attempt to determine the actual loads from urban sources. Rather, estimates of urban loadings were taken from the Source Assessment section in the USEPAs 2001 Protocol for Developing Pathogen TMDLs, which is cited as a reference in Section 11 of the draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

The comment about effectiveness monitoring is acknowledged.

Comment MPPA #4:
"The reserve capacity discussion (section 5.2.4) includes a comment suggesting that livestock numbers appear to be concentrated in fewer operations. Do the authors have data supporting a link between bacteria-related water impairments and the size of farm operations? It would be inaccurate to imply that larger farms are more likely to contribute to pollution problems. It appears that animal units are the only consideration, and that management activities have little or no influence on determining load

allocations. Proximity to surface waters (for all potential sources) does not seem to factor in to the load allocation. MPPA also takes issue with the statement: "Even if less than 1% of the land applied manure enters surface waters through one or more of the pathways mentioned, it could account for violations of the bacterial water quality standard." Do the authors have any data to support that comment?"

MPCA response: The statement was not meant to imply a relationship between the bacteria-related water impairments and the size of farm operations. Rather it was a simple demographic observation. This comment is acknowledged but results in no changes to the draft Cottonwood River and Redwood River Fecal Coliform TMDLs.

The statement "even if less than 1% of the land applied manure enters surface waters, it could account for violations of water quality standards" was not based on conjecture. It was a calculation based on the animal units of land applied manure known, calculated bacteria content per animal unit type applied to the watershed, and actual calculated TMDLs of the systems. At the low flow rates equal to the 90th percentile, historic flows on the Cottonwood River would be exceeded if only 0.74% of all land applied manure reached the river; the Redwood River would be exceeded under the same flow conditions (90th percentile) by only 0.53% of available manure reaching the river.

Comment MPPA #5:
"The fecal coliform bacteria standard is intended to protect the designated use of aquatic recreation, yet the report does not include any discussion on the extent of aquatic use of the designated stream reaches, particularly the presence of swimming beaches. The reports do cite low recreational value periods as justification for allowing wastewater treatment facilities utilizing pond systems to discharge prior to June 30 and after September 1 (section 4.2.1). The report also includes stream sections designated as class 7 waters (limited resource value). While we recognize the importance of working to protect surface waters, it seems that limited monitoring resources could be better utilized on increasing coverage of water bodies that are more likely to be used for aquatic recreation."

MPCA response: Class seven (7) waters often flow into other classes of waterbodies and thus can have direct impacts to water quality and aquatic recreation downstream. Water quality standards are reviewed every three years and public comments are welcomed during this process. The following MPCA website has more detailed information about the triennial review process: http://www.pca.state.mn.us/iryp1405.

Impairments for fecal coliform bacteria, such as the ones in the draft Cottonwood River and Redwood River Fecal Coliform TMDLs, are impairments of the beneficial use of aquatic recreation.

All of the reaches identified in the draft Cottonwood River and Redwood River Fecal Coliform TMDLs are waters of the state. People are free to recreate (which includes but is not limited to swimming) in waters of the state wherever they wish.

Comment MPPA #6
"In general, the draft Redwood River Fecal Coliform Total Maximum Daily Load Report is filled with too many assumptions and very little actual data in terms of accurate source load allocations. We realize that actual data can be very time consuming and expensive to obtain; however, when estimates can be off by wide margins, the potential to waste significant resources while having minimal impact on water quality is a huge concern."

MPCA response: Comment acknowledged.

Comment MPPA #7:
"MPPA is pleased to see MPCA acknowledge that the TMDL may need to be reopened if adjustments are required (section 5.2.4). Is this an indication that the "adaptive management" that has been heralded for several years might finally actually be used?"

MPCA response: Adaptive management is an important part of watershed management, and the intent is to evaluate and modify TMDL implementation using this technique.

The following comment was received from a citizen regarding the Cottonwood River Fecal Coliform TMDL:

"It is my belief that runoff from farming operations is a major contributor to the poor quality of many of our rivers within the state of MN. For the MPCA to essentially give them a pass and continue to increase the discharge regulations on cities is fundamentally flawed. Without addressing the non-point-source contamination, the water quality of our rivers will continue to degrade. Regulation of the farming industry is long overdue. It is an industry and should be treated as such! Fresh water seems abundant, until you don't have any. I urge you, the MPCA and the EPA to begin taking steps to curb the farm runoff contamination of our waterways."

MPCA response: MPCA's regulatory authority is limited by state statute. It is unclear what specific "steps to curb the farm runoff contamination of our waterways" the commenter would like the MPCA and the EPA to begin to take with respect to the draft Cottonwood River Fecal Coliform TMDL. The comment is acknowledged but results in no change to the draft Cottonwood River Fecal Coliform TMDL.