Fecal Coliform TMDL Assessment for 21 Impaired Streams in the Blue Earth River Basin

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TABLE OF CONTENTS

FIGURES

TABLES

Appendices

Acronyms

AU – Animal Unit
BERB – Blue Earth River Basin
BERBA – Blue Earth River Basin Alliance
BMP – Best Management Practice
CFS – Cubic Feet Per Second
CFU – Colony Forming Unit
CWP – Clean Water Partnership
DNR – Department of Natural Resources
FC – Fecal Coliform
ISTS – Individual Sewage Treatment System
IWMI – Interagency Watershed Monitoring Initiative
LA – Load Allocation
MOS – Margin of Safety
MPCA – Minnesota Pollution Control Agency
MS4 – Municipal Separate Storm Sewer Permit
NPDES – National Pollutant Discharge Elimination System
NRCS – Natural Resources Conservation Service
QAQC – Quality Assurance Quality Control
TMDL – Total Maximum Daily Load
TSS – Total Suspended Solids
USDA – United States Department of Agriculture
USEPA – United States Environmental Protection Agency
WLA – Waste Load Allocation
WWTP – Wastewater Treatment Plant

Executive Summary

The Blue Earth River Basin (BERB) is located across portions of 14 counties in south-central Minnesota and Northern Iowa. The basin includes three major watersheds, the Blue Earth, Le Sueur and Watonwan. The BERB contains 3,364 miles of streams and rivers and 3,374 miles of public drainage (719 miles of public open ditch and 2,665 miles of public tile). The 3,540 square mile BERB includes all or portions of 51 municipalities, the largest being Fairmont, St. James, Blue Earth and Mankato. The estimated human population is 92,202, with 60% living in cities and 40% in rural areas. Agricultural landuse comprises approximately 88% of the landscape, with corn and soybeans the primary crop types. The BERB has just over 2,300 feedlot facilities, with swine as the major livestock type. It is estimated that over 2.2 million swine are raised in the basin.

As part of larger, long-term efforts to improve Minnesota River water quality, the BERB is the focal point of this report. As compared to other Minnesota River major watersheds, the Blue Earth, LeSueur, and to a lesser extent, Watonwan rivers, have been shown to contribute disproportionately high pollutant loads to the Minnesota River. Even with the serious water quality concerns, the Blue Earth River system is quite popular for fishing, canoeing, and even swimming. The water quality concerns and recreational interest have led to solid local policy and technical organizations capable of addressing these issues through TMDLs and other means. For these reasons, initiating this TMDL was a priority at both the local and state level.

The BERB contains 17 stream reaches that are on the 303(d) list as impaired for fecal coliform bacteria. Testing conducted during the TMDL project indicated another four stream reaches potentially qualifying to be listed as impaired. Data review of over 1,250 water quality samples collected between 1995 through 2004 indicated that 100% of stream reaches with adequate monitoring data in the BERB qualify to be listed as impaired waters. The majority of these streams will need an 80%-90% reduction in fecal coliform levels to meet surface water quality standards. Fecal coliform levels are typically highest during the summer months of June, July and August.

The document describes the likely major contributors of fecal coliform contamination. Applied manure and inadequately functioning septic systems 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. The following statements from the Minnesota Generic Environmental Impact Statement on Animal Agriculture (2001) supports attention on land application of manure – "Thus, from a policy perspective, the primary water quality impact of animal manure is from land applied manure. Non-compliant feedlot runoff or seepage, and illegal spills have a negligible overall impact on regional water quality patterns. Without considering this, there is the real potential that the federal, state, and local governments will spend millions of dollars fixing noncompliant feedlots, without the prospect of making much difference in regional water quality problems." While there is state and local regulatory authority related to septic systems, addressing land application will be primarily through research, education, and the promotion of voluntary BMPs.

Livestock manure represents over 99% of the fecal matter produced in the BERB. The majority (>98%) of livestock manure is either surface applied to, or incorporated into farm fields as a fertilizer and soil amendment. As such, the majority of fecal material that is produced in the basin is distributed on the land. Land application of this manure can be a major source of fecal coliform bacteria contamination. There are three potential pathways to waterways of fecal coliform from fields with applied manure; 1) overland runoff, 2) open tile intakes and 3) preferential flow through soil macropores. While all three pathways generally require precipitation or snowmelt runoff, poorly timed or improper application also could lead to surface water contamination.

The majority of livestock producers in the BERB are probably 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 and livestock manure have 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. While swine are the dominant livestock in the BERB, there are significant numbers of beef and dairy cattle. The pasture and hay land supported by these ruminants may result in further soil erosion reduction, particularly if it is located on steeper lands.

During low flow conditions the primary sources appear to be individual straight pipe septic systems, as well as unsewered communities. An estimated 39% of individual sewage treatment systems in the BERB are allowing inadequately treated wastewater into waterways. This equates to an estimated 5,500 individual sewage treatment systems. Another potential source of fecal coliform contamination, during both wet and dry conditions appears to be the stream channel itself. A portion of fecal coliform contamination from human and animal sources may persist in the stream channel sediments for a period of time. Increases in flow during storm runoff can cause resuspension of these sediments. Even in low flow periods fecal bacteria may be released from streambed sediments.

A significant correlation is seen between fecal coliform bacteria concentrations and stream temperature. Bacterial concentrations on average increase as stream temperature increases. A positive correlation is also seen between suspended sediment and bacterial concentrations. High total suspended solids concentrations in water usually correlate with elevated bacterial concentrations. The data indicate that strategies used to reduce erosion from agricultural fields may be effective in reducing bacterial contamination during wet periods.

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.

Section 1.0 – Introduction

1.1 Overview

The Blue Earth River Basin (BERB) is located in southern Minnesota and northern Iowa and includes three major watersheds, the Blue Earth, Le Sueur and Watonwan. The basin covers 3,540 square miles (2.26 million acres) and includes 51 municipalities. The basin has an estimated population of 92,202, with 60% living in cities and 40% rural areas. Approximately 88% of the basin is used for agricultural purpose, dominated by corn and soybean production. Swine and cattle feedlots are also prevalent with over 2,300 facilities. Based on 2003 county feedlot inventories there are over 2.2 million swine in the basin.

As of 2006, 17 stream reaches in the BERB were listed as impaired on the 303(d) list for recreational use based on violations of water quality standards for fecal coliform bacteria. Review of water quality data collected as part of the BERB Total Maximum Daily Load (TMDL) study revealed another four reaches as potentially qualifying to be listed as impaired. The data assessment process revealed that 100% of stream reaches with adequate monitoring data in the basin qualify to be listed as impaired waters. Listed below are the 17 officially listed stream segments in the basin.

Table 1.1 - Fecal Coliform Bacteria Impaired Stream Reaches in the BE River Basin

Stream Name	Description	Year Listed	MPCA River Assessment Unit ID
Blue Earth River Watershed			
Blue Earth River	W Br Blue Earth R to Coon Cr	1994	07020009-504
Blue Earth River	Le Sueur R to Minnesota R	1994	07020009-501
Cedar Creek	T104 R33W S6 west line to Cedar Lk	2006	07020009-560
Cedar Creek	Cedar Lk to Elm Cr	2006	07020009-521
Center Creek	George Lk to Lily Cr	2006	07020009-526
Center Creek	Lily Cr to Blue Earth R	1996	07020009-503
Dutch Creek	Headwaters to Hall Lk	2006	07020009-527
Elm Creek	S Fk Elm Cr to Cedar Cr	2006	07020009-522
Elm Creek	Cedar Cr to Blue Earth R	1996	07020009-502
Judicial Ditch 3	Headwaters to Elm Cr	2006	07020009-505
Lily Creek	Headwaters to Center Cr	2006	07020009-525
Le Sueur River Watershed			
Little Beauford Ditch	Headwaters to Cobb R	2004	07020011-503
Watonwan River Watershed			
Watonwan River	Headwaters to N Fk Watonwan R	2006	07020010-514
Watonwan River	N Fk Watonwan R to Butterfield Cr	2006	07020010-512
Watonwan River	Butterfield Cr to S Fk Watonwan R	2006	07020010-511
Watonwan River	Perch Cr to Blue Earth R	1994	07020010-501
Watonwan River, South Fork	Willow Cr to Watonwan R	2006	07020010-517

1.2 Purpose

Section 303(d) of the federal Clean Water Act and US Environmental Protection Agency's (EPA's) Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies which are violating water quality standards.

A TMDL represents the maximum amount of pollutant a waterbody can receive and still meet water quality standards and designated uses. The TMDL process establishes the allowable loading of pollutants for a waterbody based on the relationship between pollution sources and in-stream water quality conditions.

The EPA specifies that in order for a TMDL to be considered complete and approvable, it must include the following eight elements:

1. It must be designed to meet applicable water quality standards;
2. It must include a total allowable load as well as individual waste load allocations and load allocations;
3. It must consider the impacts of background pollutant contributions, such as wildlife;
4. It must consider critical environmental conditions, such as stream flow, precipitation, temperature, etc;
5. It must consider seasonal environmental variations;
6. It must include an implicit or explicit margin of safety to account for uncertainties inherent to the TMDL development process;
7. It must provide opportunity for public participation; and
8. It should consider reasonable assurance in the attainment of allocations.

In general, the TMDL is developed according to the following relationship:

TMDL = WLA + LA + MOS

Where (for fecal coliform TMDLs):

WLA = Waste Load Allocation, which is the sum of all point sources, including:
- Permitted Wastewater Treatment Facilities
- Communities Subject to MS4 NPDES Requirements
- Livestock Facilities Requiring NPDES Permits
- "Straight Pipe" Septic Systems

LA = Load Allocation, which is the sum of all nonpoint sources, including;
- Runoff from fields receiving manure application
- Runoff from feedlots without runoff controls
- Overgrazed pastures near streams and waterways
- Urban Stormwater
- Wildlife

MOS = Margin of Safety (may be implicit and factored into conservative WLA or LA, or explicit.)

This document provides the information used to develop TMDLs for 17 impaired streams in the BERB. These stream reaches are listed as impaired for failure to meet their swimming designated beneficial uses due to excessive fecal coliform concentrations. TMDL assessment information is also provided for four streams in the Basin that are not currently listed, but that will qualify for listing in 2008. Figure 1.2 displays the location of all impaired and potentially impaired streams in the basin. (potentially impaired streams are defined as those qualifying for the 2008 impaired waters list).

The criteria used for determining stream reach impairments is outlined in the Minnesota Pollution Control Agency (MPCA) document, Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment – 305(b) Report and 303(d) List), January 2003. 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.

The assessment protocol includes pooling of data by month over a 10-year period. A geometric mean is then calculated for each month, April through October, with a minimum of five samples used for each monthly calculation.

There are two scenarios when a stream reach will qualify to be listed as impaired. If any monthly geometric mean value exceeds 200 organisms per 100 ml the stream qualifies to be listed as impaired. The other scenario involves combining the entire ten year data set and assessing the percent of samples that exceed 2000 organisms per 100 ml. If more than 10% of the samples exceed 2000 org/100ml, the stream qualifies as listing as impaired.

Table 3.3 represents the analysis of nearly 1200 fecal coliform bacteria samples collected at 24 monitoring sites in the basin from 1995 through 2004. These samples were collected by various county and watershed groups including;

- Watonwan County Environmental Services
  - Watonwan River Clean Water Partnership Project
- Blue Earth Soil and Water Conservation District
  - Maple River Clean Water Partnership Project
- Martin & Faribault Soil and Water Conservation Districts
  - Blue Earth River Clean Water Partnership Project
- Water Resources Center – Minnesota State University, Mankato
  - Blue Earth Basin Implementation Framework Project
  - Le Sueur River Watershed Implementation Framework Project
  - Beauford Ditch Watershed Project
- Minnesota Pollution Control Agency
- United States Geological Survey

The above groups practiced MPCA standard quality assurance/quality control (QAQC) procedures in collection of samples, which includes collection of samples in sterilized bottles, shipping samples at 4 degrees C and delivery of samples to a certified laboratory within a 24 hour holding period. Nearly all fecal coliform samples collected in the basin during the assessment period (1995-2004) have been analyzed at Minnesota Valley Testing Laboratory in New Ulm, the Environmental Services Laboratory at Minnesota State University, Mankato or the Minnesota Department of Health Laboratory in St. Paul.

Monitoring data from these groups show frequent violations of the monthly fecal coliform standard. The magnitude of these violations, especially during the summer months, suggest serious water quality impairments that will require substantial bacterial reductions in waterbodies.

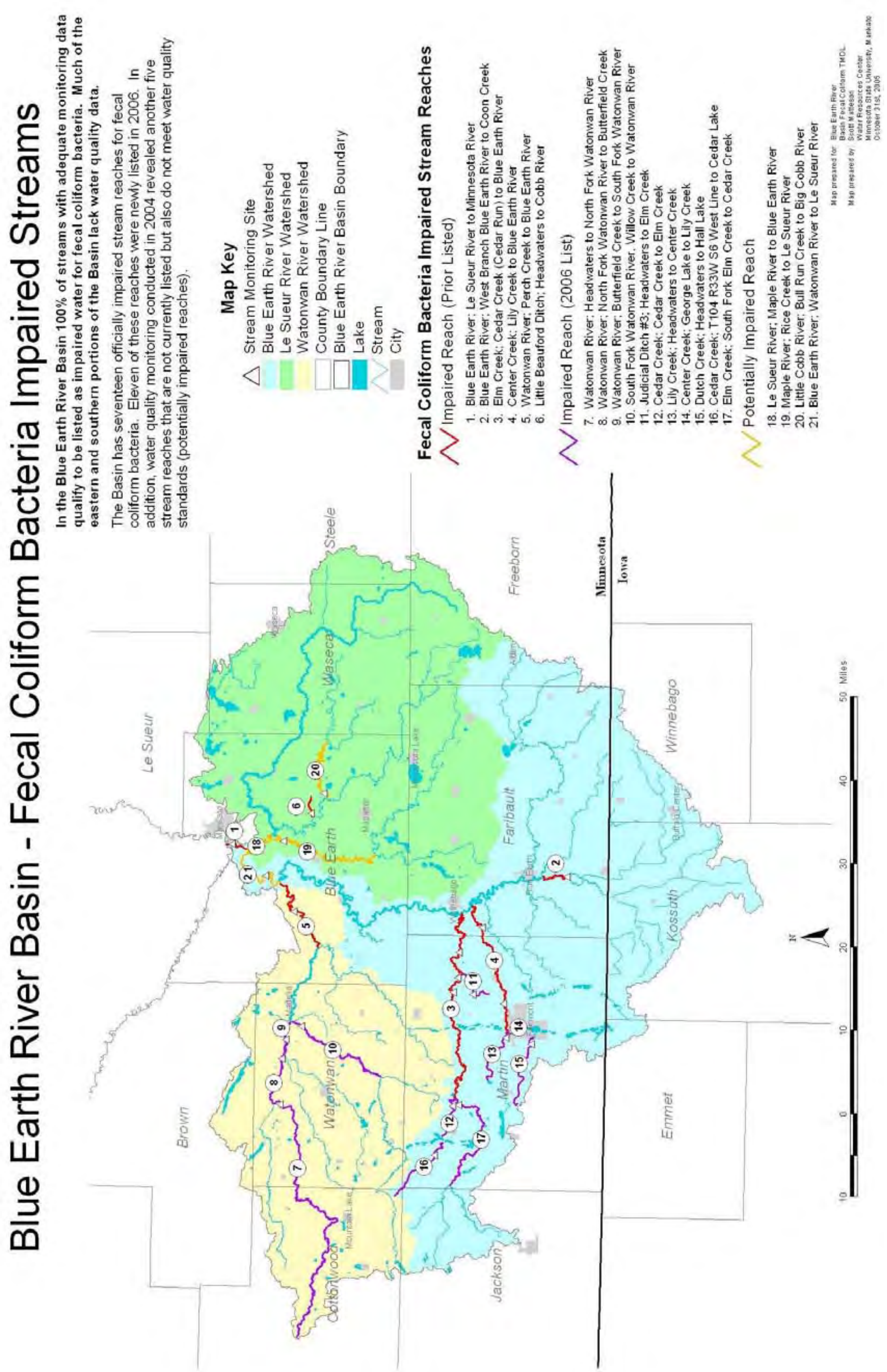


Figure 1.2 – Blue Earth River Basin Fecal Coliform Bacteria Impaired Streams

Section 2.0 - Background Information

2.1 Study Area Overview

The Blue Earth River Basin (BERB) covers approximately 2.26 million acres and includes parts of 11 South Central Minnesota counties and three Iowa counties. The BERB includes three major watersheds, the Blue Earth River Watershed, Le Sueur River Watershed and Watonwan River Watershed. The Le Sueur and Watonwan Rivers flow into the Blue Earth River upstream of its confluence with the Minnesota River at Mankato. The BERB contains 3,364 miles of streams and rivers (1,651 miles of perennial streams and 1,802 miles of intermittent streams), and 3,374 miles of public drainage (719 miles of public open ditch and 2,665 miles of public tile).

The BERB is a region of gently rolling prairie and glacial moraine with river valleys and ravines cut into the landscape. Pre-settlement vegetation was deciduous woods in the northern part of the Basin. South of the hardwoods were flat plains and tall grass prairies. Some stream banks have steep slopes and are often cut by the fast flowing rivers. The climate includes extreme cold and heat and precipitation rates are typically 30 inches per year. The soil is poorly drained clay and silt/clay soils, requiring extensive tiling and ditching for crop production. Approximately 88% of the Basin is used for agriculture, dominated by corn and soybean production. Feedlots are common, as a large percentage of hogs and cattle in the state of Minnesota are raised within the southeastern portion of the Minnesota River Basin. (Water Resources Center, 2000).

2.2 Land Use and Cover (1990)

General land use data are presented in table 2.2 based on 1990 statistics. The BERB is dominated by cultivated land, which accounts for 88% of the land use. Grasslands, which comprise of pastures, CRP, set-aside, and roadside ditches constitute approximately 5% of the land use. Wetland and forested areas each cover 3% of the Basin. Rural residences and urban areas each represent about 1% of the Basin. It is important to note that some changes in land use have occurred since 1990, particularly an increase in agricultural lands enrolled in easement programs, such as the Conservation Reserve Enhancement Program (CREP). Since 2000 there are an estimated 19,000 acres of CREP easements in the BERB, which represents 0.8% of the total landscape (Minnesota Easement GIS data layer).

Sections 6.0 and 7.0 of this report provide land use maps and statistics for each of the impaired and potentially impaired reach watersheds.

Table 2.2 – Blue Earth River Basin Land Use and Cover (1990)

	Blue Earth Watershed		Le Sueur Watershed		Watonwan Watershed		Blue Earth River Basin	
Landuse Category	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Cultivated Land	874,260	88.2%	616,390	86.6%	502,118	89.4%	1,992,767	88.0%
Grass/Shrub/Tree	906	0.1%	586.8	0.1%	352	0.1%	1844.8	0.1%
Grassland	47,429	4.8%	25,331	3.6%	21,833	3.9%	94,593	4.2%
Gravel Pit/Rock/Sand	713	0.1%	277.6	0.0%	114	0.0%	1104.1	0.0%
Urban/Rural Development	19,859	2.0%	16,892	2.4%	12,746	2.3%	49,497	2.2%
Water	12,974	1.3%	10,889	1.5%	6,730	1.2%	30,593	1.4%
Wetlands	2,844	0.3%	9534.7	1.3%	2449.4	0.4%	14828.2	0.7%
Woodland/Forest	32,648	3.3%	31,912	4.5%	15,277	2.7%	79,837	3.5%
Unclassified							429	0.0%
Total Acres	**991,631**		**711,813**		**561,619**		**2,265,492**	

2.3 Temperature

Figure 2.3 presents the average monthly temperatures in the BERB during the monitoring season months of April through October. Ice out conditions in the basin typically occur between the end of March and early April. Temperatures reach peak levels during July/August and then gradually decline. Monitoring data indicate that temperature does seem to have an association with bacterial concentrations in surface waters. Monitoring data indicate that very cold stream water during early spring often is below surface water standards for fecal coliform bacteria.

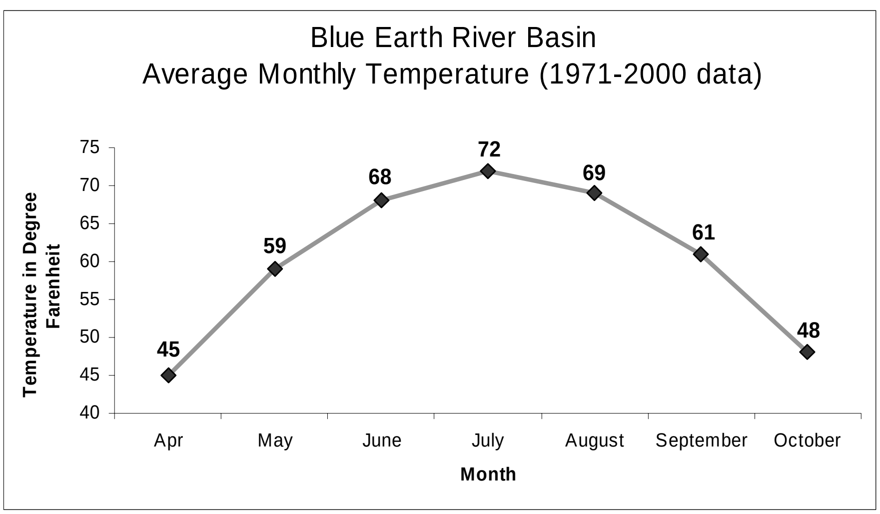


Figure 2.3 – Average Monthly Temperature by Month

2.4 Precipitation

The BERB averages 27 to 33 inches of precipitation annually, increasing from west to east. The monitoring season months of April through October see average precipitation totals of 22 to 26 inches of precipitation. In a typical year, the western portion of the basin receives less precipitation than the east. Table 2.4 presents the average monthly precipitation values for five locations across the BERB.

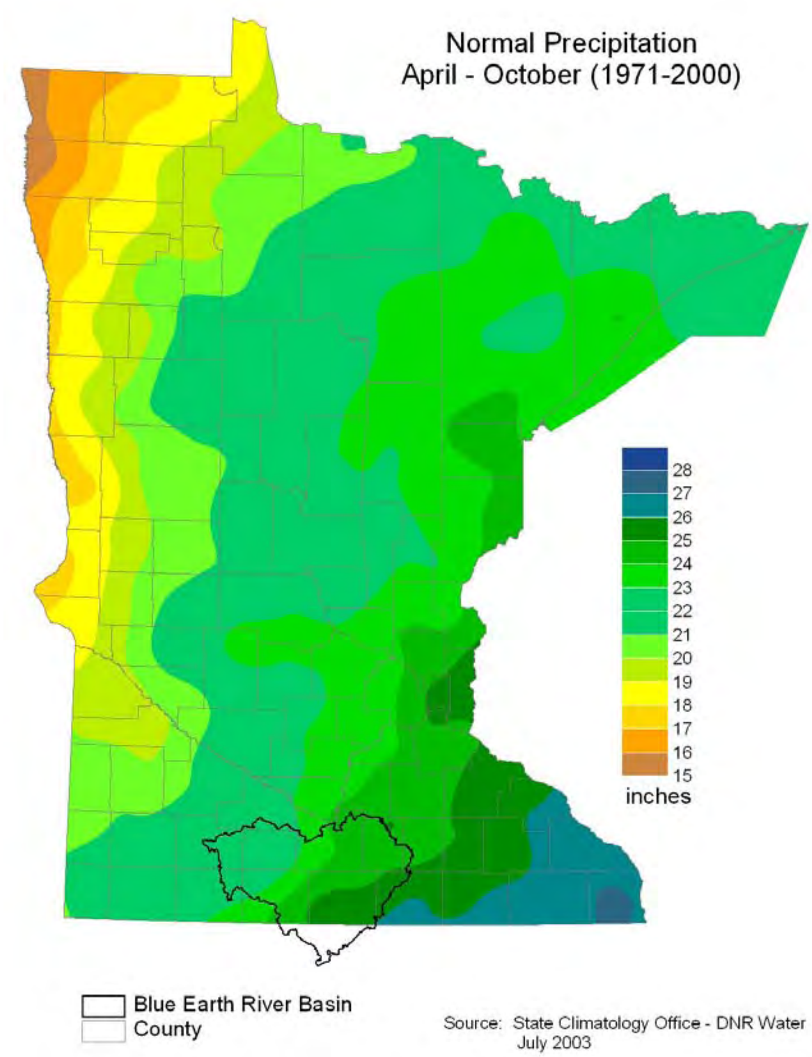


Figure 2.4 – Map of Average Precipitation for Minnesota

Table 2.4 – Precipitation Data for Major Cities in Blue Earth River Basin

Site Location	Average Monthly Precipitation (inches)												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
St. James	0.5	0.4	1.8	2.7	3.5	4.5	3.8	3.6	2.7	2.1	1.5	0.7	27.7
Blue Earth	0.7	0.6	1.6	3.0	3.8	5.1	4.3	4.6	2.6	2.3	1.8	0.9	31.3
Fairmont	0.8	0.7	1.9	3.2	3.9	4.5	4.2	4.2	2.6	2.3	2.0	1.0	31.4
Mankato	1.1	0.6	2.1	3.1	3.6	5.6	4.4	4.4	3.1	2.5	2.0	1.0	33.4
Waseca	1.4	1.0	2.5	3.2	4.0	4.2	4.5	4.6	3.2	2.5	2.3	1.4	34.7
Average	**0.9**	**0.7**	**2.0**	**3.0**	**3.7**	**4.8**	**4.2**	**4.3**	**2.8**	**2.3**	**1.9**	**1.0**	**31.7**

Source: 1971-2000 National Climatic Data Center

Review of monitoring data collected from monitoring stations across the Basin show a strong relationship between fecal coliform bacteria concentration and rainfall intensity. The highest bacterial concentrations of any particular year are usually associated with the highest intensity rain events. This is especially true during the spring when farm fields are not protected by crop canopy. Crop canopy significantly reduces rainfall runoff and associated soil erosion and pollutant movement.

2.5 Stream Flow Characteristics

The surface water standard for fecal coliform bacteria applies to the months of April through October. On average, the month with the highest flow volume is April, due to the combination of snowmelt runoff and runoff of precipitation. June, the month with the greatest precipitation totals has the second highest mean monthly flow.

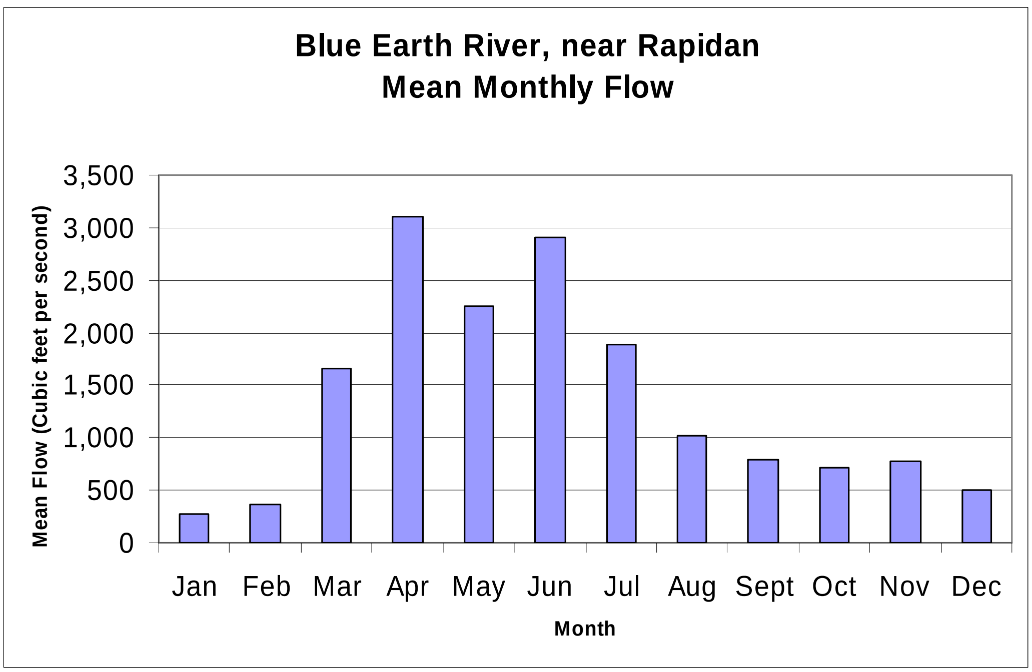


Figure 2.5 – Mean Monthly Flow for Blue Earth River, Near Rapidan (1976-2004)

2.6 Streambed Sediments

A potential source of fecal coliform bacteria in streams/rivers that is often overlooked is resuspension of 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. Ewert (2005) in a study conducted in southern Minnesota, found that physical raking of streambed sediments resulted in bacteria concentrations several factors higher than the water column values before resuspension. Jolley et al. (2004) reported bottom sediment reservoirs of indicator bacteria in surface water increase surface water bacteria levels at base flow and should be considered sources of surface water contamination. Davis et al. (2005) reported that 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. Yagow and Shanholtz (1998) reported that as runoff during a storm event begins, the discharge and velocity increase, in turn scouring bacteria from the benthic areas of the stream. This scouring causes increased levels of bacteria in the water column and decreased levels in stream sediments.

In 2005, preliminary monitoring of stream sediments in the BERB revealed similar elevated bacteria concentrations in streambed sediments. On 16 occasions in 2005, sediment and water column fecal coliform and e. coli bacteria samples were collected from three monitoring stations in the Blue Earth County, Minnesota. The results revealed bacterial concentrations to be tens to hundreds times higher in the sediment samples than the water column samples. The data indicated that in some situations, exceedances of water quality standards during low flow periods may be primarily attributed to release of fecal bacteria from streambed sediments, and not directly from wildlife or discharge of sewage as previously thought.

Section 3.0 – Applicable Water Quality Standards and Water Quality Numeric Targets

3.1 Description of Fecal Coliform Bacteria

Fecal coliform bacteria are a bacteria group that are found in the intestines of warm blooded animals. Some bacteria in this group are harmful; however fecal coliforms are typically considered an indicator of the presence of other disease causing bacteria, viruses, and/or protozoans.

Fecal coliform bacteria are passed through the fecal excrement of humans, livestock and wildlife. These bacteria can enter streams and ditches through direct discharge of waste from mammals and birds, from agricultural and urban stormwater runoff and from poorly or untreated human sewage. Agricultural practices such as spreading manure during wet periods and allowing livestock uncontrolled access to streams can contribute to high levels of fecal coliform bacteria. Wildlife can also be a contributor of fecal coliform bacteria, especially during low flow conditions.

In addition to bacteria and other pathogens, human and animal waste contains high levels of other pollutants such as phosphorus, nitrogen, and oxygen demanding organic material. Additionally, some of the same soil erosion processes and delivery pathways that lead to sediment pollution of streams and rivers also contribute to human and animal waste entering the water. As such, efforts to contain sewage and animal waste, and to control soil erosion and sedimentation, result in better overall water quality.

3.2 Applicable Minnesota Water Quality Standards

Minnesota Rules Chapter 7050 provides the water quality standards for bacterial concentrations in Minnesota waters. The rules are as follows for class 2B surface waters, which include all of the impaired reaches covered in this report.

3.2.1 Class 2B waters

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 organisms 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.

Table 3.2.1 summarizes the fecal coliform bacteria standards for other classes of waters, some of which occur in the BERB.

Table #3.2.1 – Minnesota Surface Water Standards for Fecal Coliform Bacteria

Use Class	Standard No. of Organisms Per 100 mL of Water		Applicable Season	Use
	Monthly Geometric Mean*	10% of Samples Maximum**		Body Contact
2A, trout streams and lakes	200	400	April 1 - October 31	Primary
2Bd, 2B, 2C, non-trout (warm) waters	200	2000	April 1 - October 31	Primary
2D, wetlands	200	2000	April 1 - October 31	Primary, if the use is suitable
7, limited resource value waters	1000	2000	May 1 - October 31	Secondary

* Not to be exceeded as the geometric mean of not less than 5 samples in a calendar month.

** Not to be exceeded by 10% of all samples taken in a calendar month, individually.

Source: Guidance Manual for Assessing the Quality of Minnesota Surface Waters: For the Determination of Impairment. 305(b) Report and 303(d) List

3.3 Impairment Assessment: Fecal Coliform Impairments

Monitoring of fecal coliform bacteria in the BERB has largely been done in association with a few watershed-scale projects, including the Watonwan River, Blue Earth Watershed and the Maple River Clean Water Partnership Projects (CWP's). These projects were all initiated within the last ten years. Before that time very little fecal coliform bacteria monitoring was conducted in the BERB. Even now large portions of the basin have no bacterial monitoring data.

While limited data were collected before 1995, a significant number of samples have been collected since that time. An estimated 1,250 samples have been collected at 24 monitoring sites from 1995 through 2004. Figure 3.3 and table 3.3 provide the description of monitoring sites in the basin, location, and months of impairment.

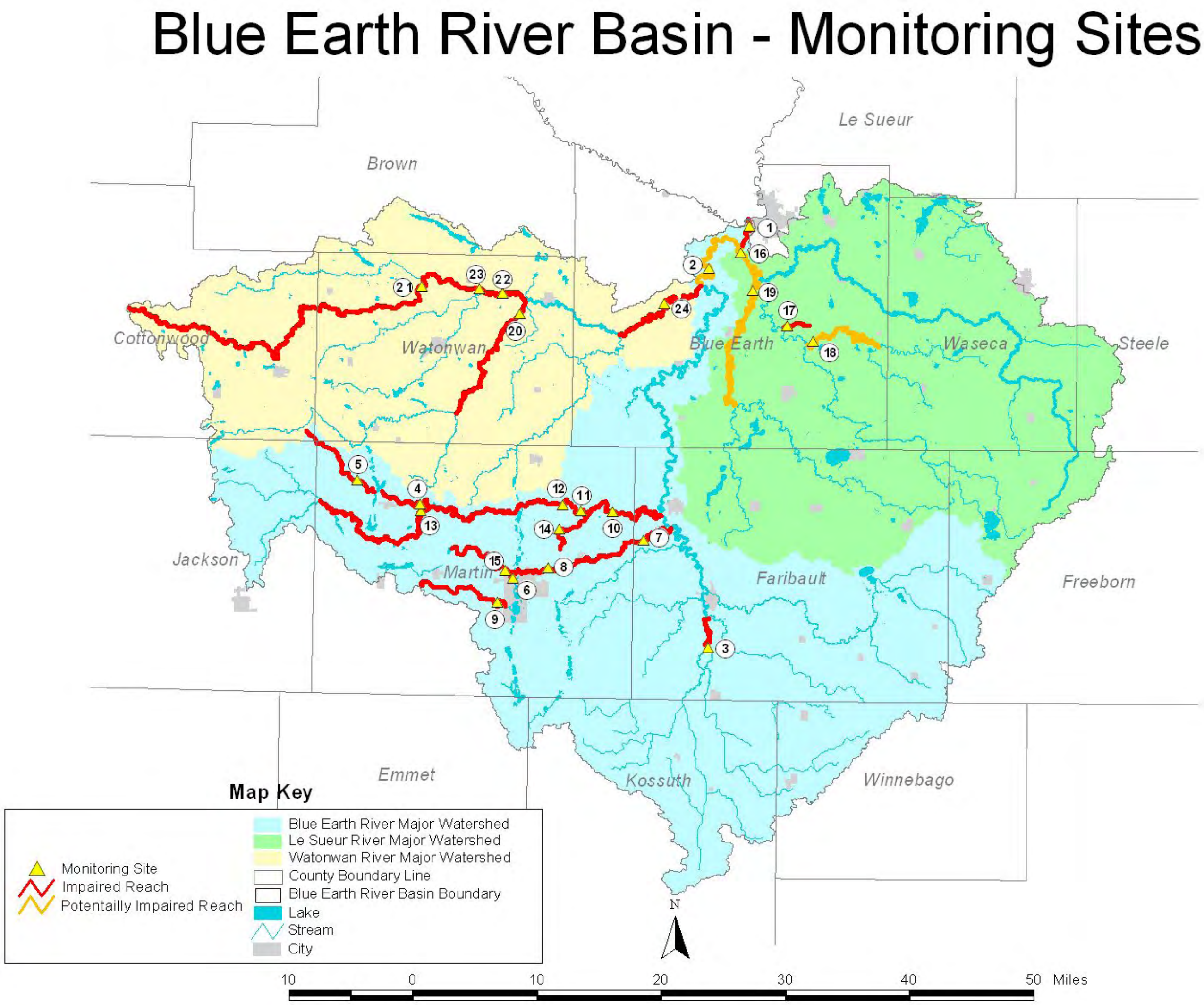


Figure 3.3 – Fecal Coliform Bacteria Monitoring Sites in the Blue Earth River Basin

Monitoring data used for assessment of streams in the Basin show 17 impaired segments. Monitoring data collected in 2004 and 2005 as part of the BERB Fecal Coliform TMDL study show another four segments that will qualify for listing on the 2008 impaired waters list.

Table 3.3 – Stream Monitoring Sites and Impairment Assessment Data

Blue Earth Watershed

Site Number	Impaired Reach	Site Used for Assessment	Agency/Group	# of Samples	# Smpls. >2000	% Smpls. >2000	Apr. GM	May GM	Jun. GM	Jul. GM	Aug. GM	Sep. GM	Oct. GM	Years of Data
1	Blue Earth River; Le Sueur River to Minnesota River	Blue Earth River, Mankato	MPCA Milestone Monitoring Program	45	1	2.2%	-	111	412	188	145	244	-	95,96,97,98,00,01,03,04
2	Blue Earth River; Watonwan River to Le Sueur River	Blue Earth River, Rapidan	Water Resources Center, MN State University, Mankato	24	0	0.0%	9	50	195	1006	84	-	-	04
3	Blue Earth River; West Branch Blue Earth River to Coon Cr.	Blue Earth River, CSAH 4	MPCA Milestone Monitoring Program	17	0	0.0%	-	295	-	-	-	-	-	97,98
4	Cedar Creek; Cedar Creek to Elm Creek	Cedar Run, S34/35	Center-Lily, Blue Earth River CWP	40	18	45.0%	-	-	596	2390	2383	-	-	00,01,02
5	Cedar Creek; T104 R33W S6 West Line to Cedar Lake	Cedar Run, CSAH 9	Center-Lily, Blue Earth River CWP	28	8	28.6%	-	-	252	1604	1991	-	-	00,01,02
6	Center Creek; George Lake to Lily Creek	Center Creek, George Lake	Center-Lily, Blue Earth River CWP	24	2	8.3%	-	-	86	184	558	-	-	00,01
7	Center Creek; Lily Creek to Blue Earth River	Center Creek, 315 Ave.	Center-Lily, Blue Earth River CWP	67	14	20.9%	41	191	640	1274	1549	-	-	02,03,04
8	Center Creek; Lily Creek to Blue Earth River	Center Creek, S34/35	Center-Lily, Blue Earth River CWP	34	9	26.5%	-	-	1841	492	401	-	-	00,01,03,04
9	Dutch Creek; Headwaters to Hall Lake	Dutch Creek, 100th St.	Center-Lily, Blue Earth River CWP	55	19	34.5%	-	-	425	1410	1331	-	-	00,01,02,04
10	Elm Creek; Cedar Creek to Blue Earth River	Elm Creek, 290th Ave.	Center-Lily, Blue Earth River CWP	65	10	15.4%	52	67	343	476	989	-	-	02,03,04
11	Elm Creek; Cedar Creek to Blue Earth River	Elm Creek, 260th Ave.	Center-Lily, Blue Earth River CWP	25	6	24.0%	-	-	669	584	737	-	-	00,01
12	Elm Creek; Cedar Creek to Blue Earth River	Elm Creek, CSAH 149	Center-Lily, Blue Earth River CWP	11	1	9.1%	-	-	-	376	340	-	-	00,01
13	Elm Creek; South Fork Elm Creek to Cedar Creek	Elm Creek, 185th St.	Center-Lily, Blue Earth River CWP	40	14	35.0%	-	-	691	1058	1013	-	-	00,01,02
14	Judicial Ditch #3; Headwater to Elm Creek	Judicial Ditch #3	Center-Lily, Blue Earth River CWP	39	14	35.9%	-	-	372	914	2874	-	-	00,01,02
15	Lily Creek; Headwaters to Center Creek	Lily Creek, Hunt Farm	Center-Lily, Blue Earth River CWP	41	15	36.6%	-	-	882	928	2213	-	-	00,01,02

Does not Qualify for Listing as Impaired Waterbody

Qualifies for Listing as Impaired Waterbody

Table 3.3 continued – Stream Monitoring Sites and Impairment Assessment Data

Le Sueur Watershed

Site Number	Impaired Reach	Site Used for Assessment	Agency/Group	# of Samples	# Smpls. >2000	% Smpls. >2000	Apr. GM	May GM	Jun. GM	Jul. GM	Aug. GM	Sep. GM	Oct. GM	Years of Data
16	Le Sueur River; Maple River to Blue Earth River	Le Sueur, Near Rapidan #1	Water Resources Center, MN State University, Mankato	24	2	8.3%	18	228	159	696	1357	-	-	04
17	Little Beauford Ditch; Headwater to Cobb River	Beauford Ditch	Water Resources Center, MN State University, Mankato	142	19	13.4%	96	181	399	741	1360	244	225	95,96,97,98,00,04
18	Little Cobb River; Blue Run Creek to Big Cobb River	Little Cobb River	Water Resources Center, MN State University, Mankato	24	3	12.5%	56	251	167	556	1451	-	-	04
19	Maple River; Rice Creek to Le Sueur River	Maple River CSAH 35	Maple River CWP	86	23	26.7%	37	239	1822	2041	409	902	-	96,03,04

Watonwan Watershed

Site Number	Impaired Reach	Site Used for Assessment	Agency/Group	# of Samples	# Smpls. >2000	% Smpls. >2000	Apr. GM	May GM	Jun. GM	Jul. GM	Aug. GM	Sep. GM	Oct. GM	Years of Data
20	South Fork Watonwan River; Willow Creek to Watonwan R.	Watonwan River, Madelia	Watonwan River CWP	59	14	23.7%	191	406	837	762	2416	-	-	00,01,02
21	Watonwan River, Headwaters to North Fork Watonwan River	Watonwan River, CSAH 4	Watonwan River CWP	59	15	25.4%	144	361	869	1362	980	-	-	00,01,02
22	Watonwan River; Butterfield Creek to South Fk Watonwan R.	Watonwan River, CR 6	Watonwan River CWP	68	19	27.9%	217	315	1044	2593	2200	769	-	96,00,01,02
23	Watonwan River; North Fork Watonwan R. to Butterfield Cr.	Watonwan River, CR 16	Watonwan River CWP	58	15	25.9%	283	338	841	1772	3225	-	-	00,01,02
24	Watonwan River; Perch Creek to Blue Earth River	Watonwan River, Garden City	Watonwan River CWP	173	28	16.2%	62	188	1048	803	251	209	-	96,97,98,01,02,03,04

Does not Qualify for Listing as Impaired Waterbody

Qualifies for Listing as Impaired Waterbody

3.4 Geographic Scope of Impairment

Every site in the BERB with adequate monitoring data qualifies to be listed as an impaired stream reach. Furthermore, these sites greatly exceed recommended water quality standards during the summer and fall months. Monitoring data from the BERB are concentrated from streams in the north and western portions of the BERB; however samples collected at streams in the eastern and southern portions of the BERB also show elevated bacterial concentrations. While there are insufficient data from these portions of the BERB for assessment purposes, the data that do exist reveal similar bacteria levels as those found in the north and west portions of the BERB. These data point to elevated fecal coliform throughout the BERB.

3.5 Seasonality

Monitoring data show a clear relationship between season and fecal coliform bacteria concentration. The highest monthly geometric mean at all monitored sites in the basin occurred in June, July or August. Figure 3.5a presents the fecal coliform bacteria concentration for each month, based on the average monthly geometric mean values from 24 monitoring sites in the Basin. April is typically the monitoring month with the lowest bacteria concentration, despite the fact that some manure application occurs during this time and that fields have little crop canopy to protect against water erosion.

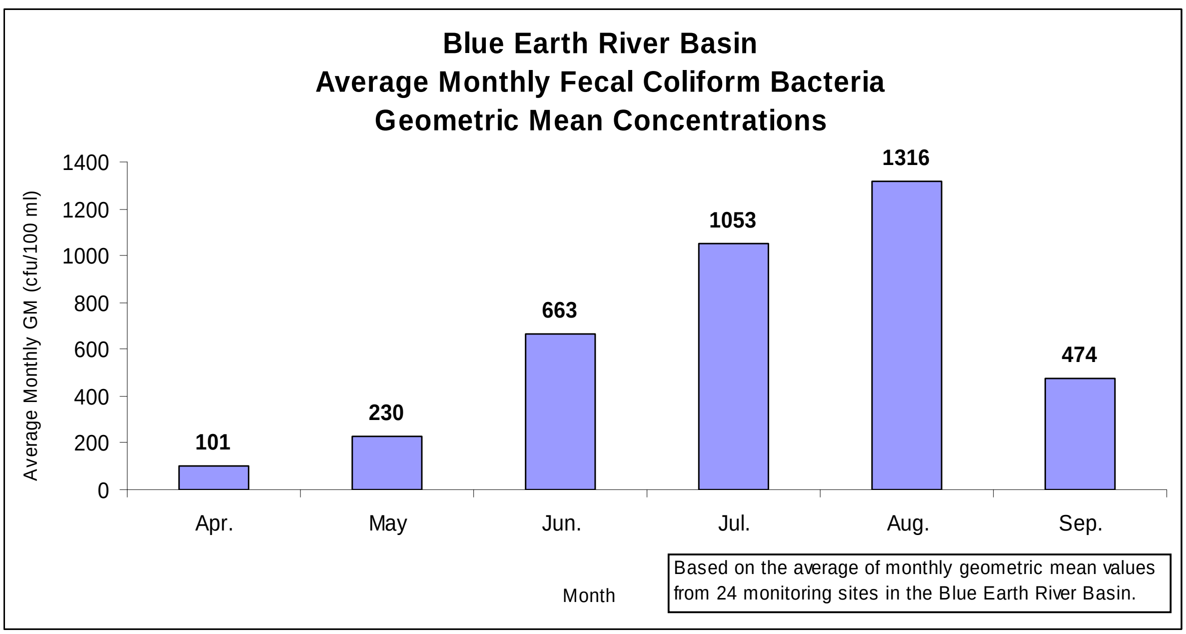


Figure 3.5a – Basinwide Monthly Fecal Coliform Bacteria Geometric Means

The apparent seasonality of fecal coliform bacteria concentrations appears to be most strongly correlated with water temperature. Fecal coliform bacteria are the most productive at temperatures similar to their origination environment in animal intestines in animal intestines. Therefore fecal coliform are at their highest concentrations during warmer temperatures, possibly due to reproduction in numbers. However, at lower temperatures it is probable the metabolism of organisms slow, therefore prolonging their survival (Chapelle, 2001; Cullimore, 1993). Thus, while bacterial concentrations may be lower during colder periods, survival rates are increased.

Figure 3.5b provides an example of the association between bacterial concentrations and stream temperature at Beauford Creek, one of the more frequently monitored streams in the BERB. The chart displays the percentage of baseflow samples that exceeded the surface water standard of 200 cfu/100 ml based on stream temperature classification. The data set includes 76 samples collected during the 2000, 2004, and 2005 monitoring seasons and excludes all samples collected within 48 hours of greater than 0.5 inches of precipitation. These data show a significant association between stream temperature and fecal coliform bacteria concentration; however, the higher bacterial concentrations during the warm summer/fall months may also be associated with greater nutrient and algae concentrations at that time of year. Nutrients and algae may support bacterial growth and therefore temperature may be a secondary factor.

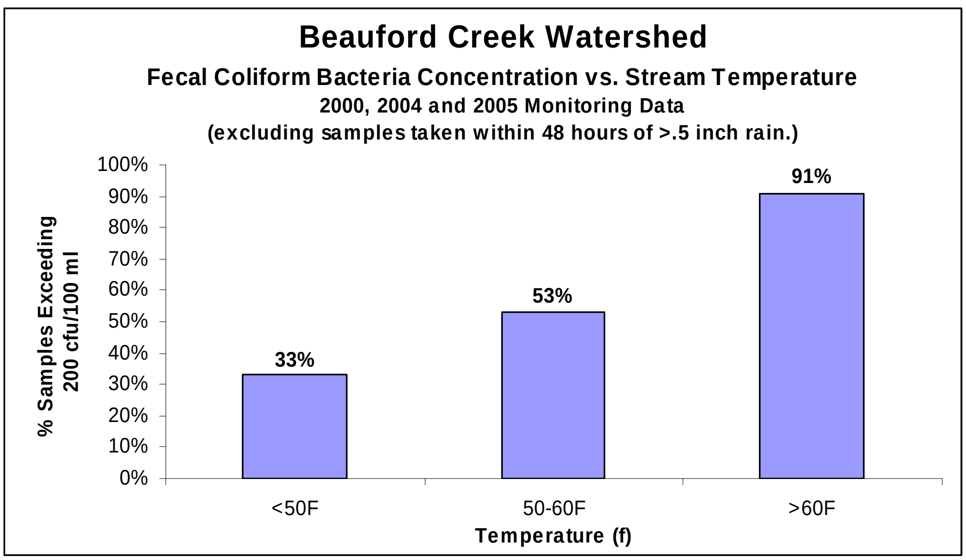


Figure 3.5b – Beauford Creek – Fecal Coliform vs. Stream Temperature

Figure 3.5c highlights the monthly geometric mean at the Beauford monitoring station along with average, min and max monthly stream temperature. These data also show the apparent association between temperature and bacterial concentration

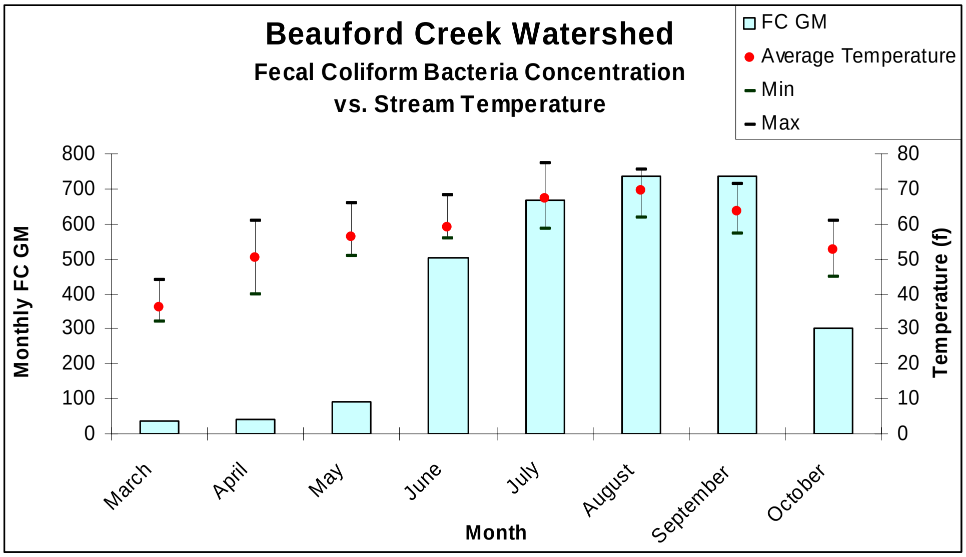


Figure 3.5c - Beauford Creek – Fecal Coliform and Stream Temperature by Month

3.6 Relationship of Flow and Fecal Coliform Concentration

Streams with sufficient monitoring data in the BERB show a positive relationship between flow and fecal coliform concentration. The highest bacterial concentrations are frequently observed during high flow periods. An example of this relationship is shown in table and figure 3.6 for the Watonwan River, near Garden City. This site has been monitored for 30 years, with 262 samples collected from 1976 through 2004. The data reveal a steady increase in geometric mean fecal coliform concentration as flows increase.

In general, the primary sources of fecal coliform contamination to waterways will vary by flow condition. During low flow periods, inputs for illegally discharging septic systems and wildlife are likely the major contributors to waterways. During high flow conditions, when much of the flow in waterways is delivered off of agricultural fields and through tile drainage, land applied manure a larger contributor.

As detailed in section 2.6 (page 9), resuspension of streambed sediments during high flow periods can also act as a source of fecal coliform loading.

Table 3.6 – FC Statistics by Flow Category for the Watonwan River, near Garden City

Flow Condition	Flow Percentile	Flow Range (cfs)	# Samples	% Samples >200	% Samples >2000	Fecal Coliform Geometric Mean
Low Flows	90 -100%	0-13	17	23.5%	0.0%	62
Dry Conditions	80 - 90%	14-29	15	26.7%	0.0%	68
	70 - 80%	30-51	12	16.7%	0.0%	30
Mid Range Flows	60 - 70%	52-81	19	36.8%	5.3%	72
	50 - 60%	82-135	20	30.0%	0.0%	115
	40 -50%	136-222	29	55.2%	0.0%	205
	30 - 40%	223-369	32	50.0%	9.4%	225
Moist Conditions	20 - 30%	369-577	49	63.3%	10.2%	379
	10 - 20%	577-1080	31	80.6%	29.0%	781
Flood Flows	0 - 10%	>1,080	38	78.9%	36.8%	816

Analysis based on 262 samples collected from 1976 through 2004.

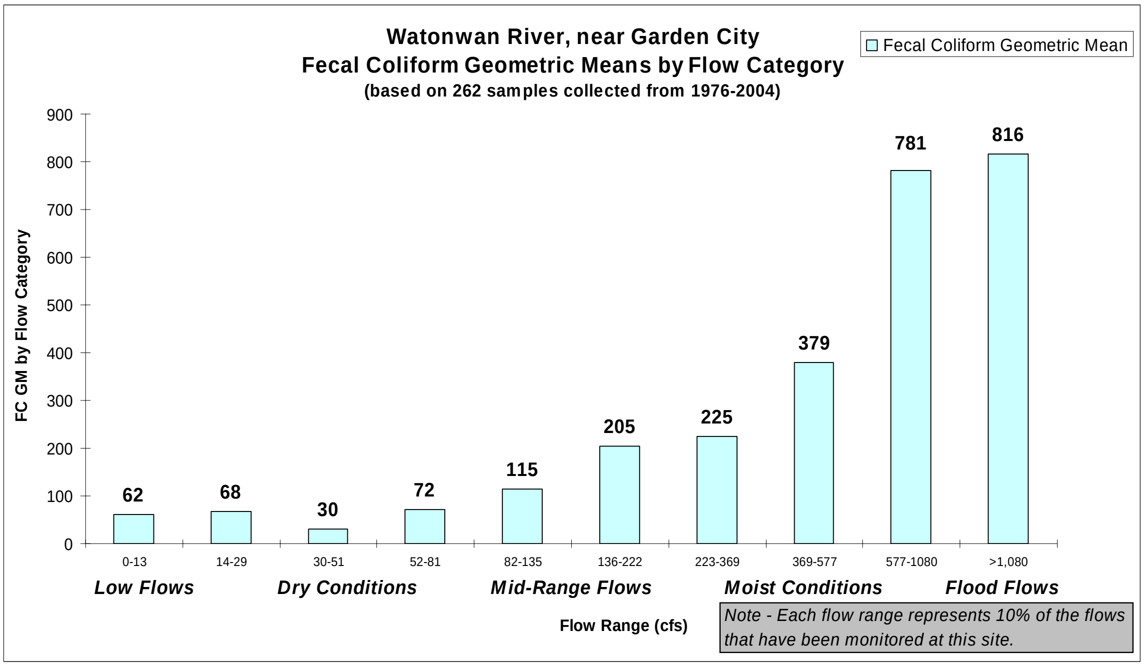


Figure 3.6 – FC GM's by Flow Category for the Watonwan River, near Garden City

3.7 Relationship of Total Suspended Solids and Fecal Coliform Concentration

Total suspended solids (TSS) are the measurement of the amount of sediment and organic material in a water sample. Typically 80-90% of TSS are sediment, with 10-20% being organic material.

Monitoring data from streams in the BERB show a positive correlation between TSS and fecal coliform concentration. Figure 3.7 presents a comparison of TSS and fecal coliform concentration for the Watonwan River near Garden City and Blue Earth River near Rapidan. The charts shows the average TSS concentration for four fecal coliform groupings at both sites. FC samples were grouped together into the following stratifications:

- 0 to 99 org/100 ml
- 101 to 200 org/100 ml
- 201 to 1000 org/100 ml
- Greater than 1000 org/100 ml

The average TSS concentration was then calculated for each of these four groups. Note that using these averages, the recommended standard for TSS (which is around 66 mg/L) corresponds with the 200 org/100 ml standard for fecal coliform bacteria. The data suggest that efforts to reduce soil erosion would also help lower FC concentrations in streams and waterways.

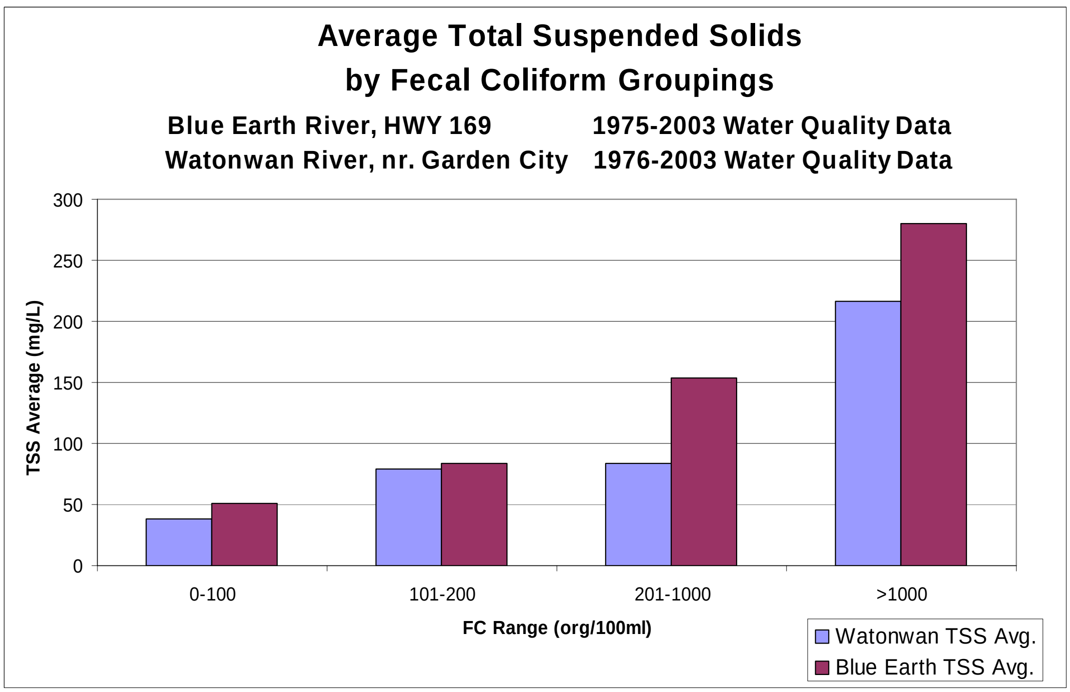


Figure 3.7a – TSS Averages by FC Groupings

The relationship of TSS and fecal coliform bacteria can also be examined by stratification of TSS samples. In this scenario TSS samples were grouped together in stratifications of:

- 0 to 32 mg/L
- 33 to 66 mg/L
- 67 to 150 mg/L
- Greater than 150 mg/L

A FC geometric mean for each TSS range was then calculated. Note that at TSS concentrations above 150 mg/L, FC levels dramatically increase at both monitoring sites.

This analysis also suggests that implementation of BMP's that reduce TSS levels may also reduce FC levels.

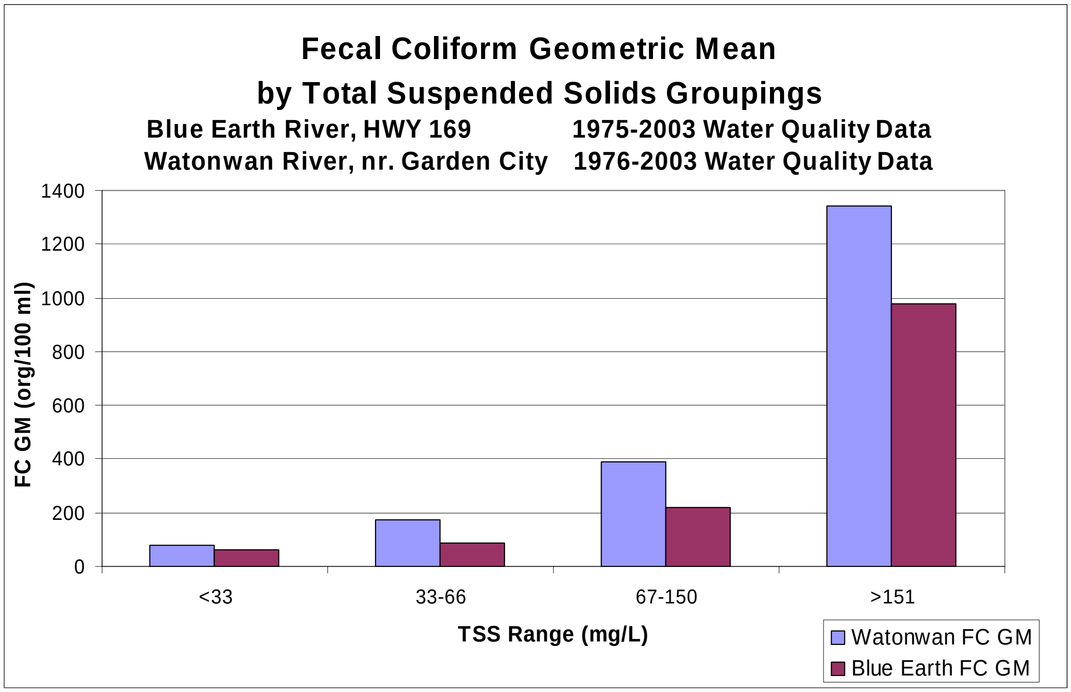


Figure 3.7b – FC GM's by TSS Groupings

3.8 Trends in Fecal Coliform Surface Water Quality

Three streams in the basin have long term bacterial monitoring data. These streams have been monitored periodically over the past several decades as part of the MPCA Minnesota River Milestone Monitoring Program. The program is described in greater detail in section 9.0.

Long term monitoring of these three sites has shown reductions in fecal coliform bacteria. The most substantial decrease occurred around the early 1970's, the same period the Clean Water Act (1972) was enacted. This was the period when many wastewater treatment facilities across the United States were upgraded. The data do not show a substantial trend in bacteria concentration during the past two decades. Table 3.6 displays a summary of fecal coliform data from these three sites.

Table 3.8 – Fecal Coliform Bacterial Concentrations by Decade

	Fecal Coliform (geomean in cfu/100 ml) by Decade				
Minneosota River Milestone Monitoring Program Site ID	1960s	1970s	1980s	1990s	overall trend
Blue Earth River in Sibley Park at Mankato (BE-0)	1,629	245	137	171	decrease
Center Creek between S34/35, 1 Mile NE of Fairmont (CEC-23.2)	---	628	347	154	decrease
Watonwan River at Br on CSAH-13, 1 Mi W of Garden City (WA-6)	661	201	137	172	decrease

Data obtained from MRMMP website at *http://www.pca.state.mn.us/water/milestone-maps.html*

3.9 TMDL Endpoints

TMDL endpoints will meet the 200 organism/100 ml "chronic" standard and 2000 "acute" standard for fecal coliform bacteria. Section 5.0 outlines the process used to determine monthly and daily TMDL allocations for each of the impaired streams. This process involved using long term flow data from three USGS flow gauging stations and incorporating the two numeric water quality standards for fecal coliform bacteria.

The first numerical standard is that streams will have a monthly geometric mean below 200 org/100 ml. This standard was incorporated to calculate the monthly loading capacity and allocations. The second numerical standard is that no more than 10% of samples may exceed 2000 org/100 ml and was used to calculate the daily loading capacity and allocations. Daily loading capacity and allocations were determined as 1/3rd the monthly loading capacity and allocations. This relates to the 2000 numerical standard being a factor of 10 times the 200 numerical standard. Neither the monthly or daily loading capacities (nor individual allocations) may be exceeded.

Section 4.0 –Source Pollutant Assessment

4.1 Humans

Human waste can be a significant source of fecal coliform contamination during low flow periods. Individual sewage treatment systems that are not functioning properly can allow untreated or partially treated sewage into waterways. Emergency bypasses from wastewater treatment facilities are an occasional source of bacteria and other pollutants. A high priority should be placed on preventing human waste from entering waterways, as human pathogens are often found to be highly communicable.

4.1.1 Human Populations

The 2000 census data indicate that the BERB has an estimated human population of 92,202. The urban population is 55,370 (60%) and the rural population is 36,832 (40%). Figure 4.1.1a presents the location of all incorporated communities in the Basin. Population breakdown by major watershed is the following:

Watershed	Urban Population	Rural Population	Total Population
Blue Earth	24,593	14,280	38,873
Le Sueur	18,747	14,291	33,038
Watonwan	12,030	8,261	20,291
Totals	**55,370**	**36,832**	**92,202**

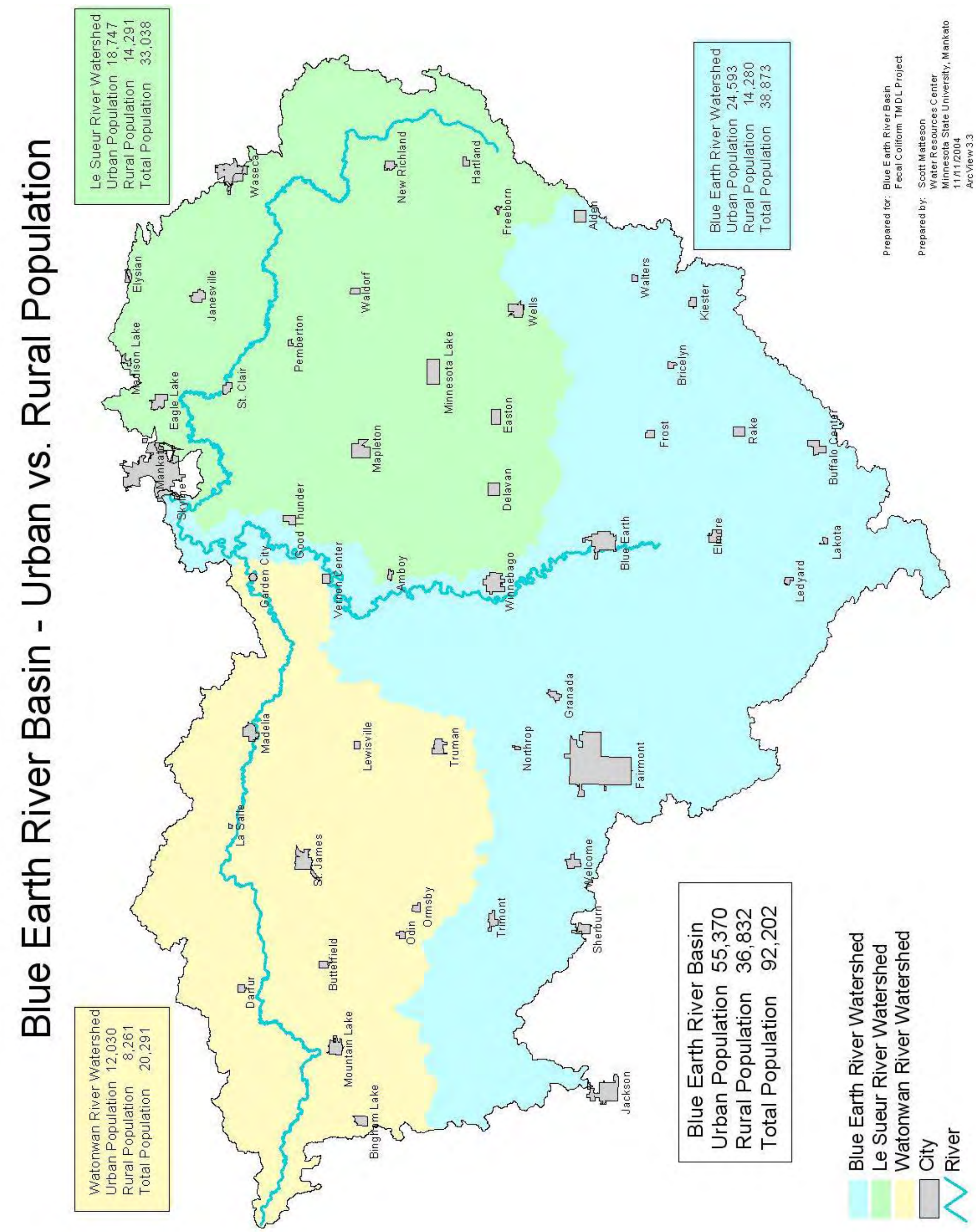


Figure 4.1.1a - Cities in the Blue Earth River Basin by Major Watershed

Table 4.1.1 presents the population of all cities/towns located in the basin. Certain cities, such as Mankato, lie only partially in the basin. To determine population for these areas, the percent of the city area in the basin was multiplied by the city's total population.

Table 4.1.1 - Urban Population Estimates for the Blue Earth River Basin (2000 Census)

City	Total Population	City	Total Population	City	Total Population
Fairmont	10,889	Trimont	754	Frost	251
St. James	4,695	Elmore	735	Elysian*	250
Blue Earth	3,621	Welcome	721	Pemberton	246
Mankato*	3,560	Minnesota Lake	681	Waldorf	242
Wells	2,494	Alden	652	Rake	227
Madelia	2,340	Good Thunder	592	Delavan	223
Waseca*	2,274	Amboy	575	Easton	214
Janesville	2,109	Butterfield	564	Skyline*	208
Mountain Lake	2,082	Kiester	540	Sherburn*	185
Eagle Lake	1,787	Bricelyn	379	Bingham Lake	167
Mapleton	1,678	Vernon Center	359	Ormsby	154
Winnebago	1,487	Granada	317	Ledyard	147
Truman	1,259	Freeborn	305	Darfur	137
New Richland	1,197	Hartland	288	Odin	125
Buffalo Center	963	Lewisville	274	La Salle	90
Madison Lake*	837	Northrop	262	Walters	88
St. Clair	827	Lakota	255	Jackson*	64

Total Urban Population 55,370

** Partial Population Estimate Based on Percentage of City in Basin*

In the BERB there is an average of 10.4 persons per square mile living in rural areas. The highest population densities are in the Le Sueur River Watershed, around the communities of Mankato and Waseca. Figure 4.1.1b presents the rural population density by township for the BERB.

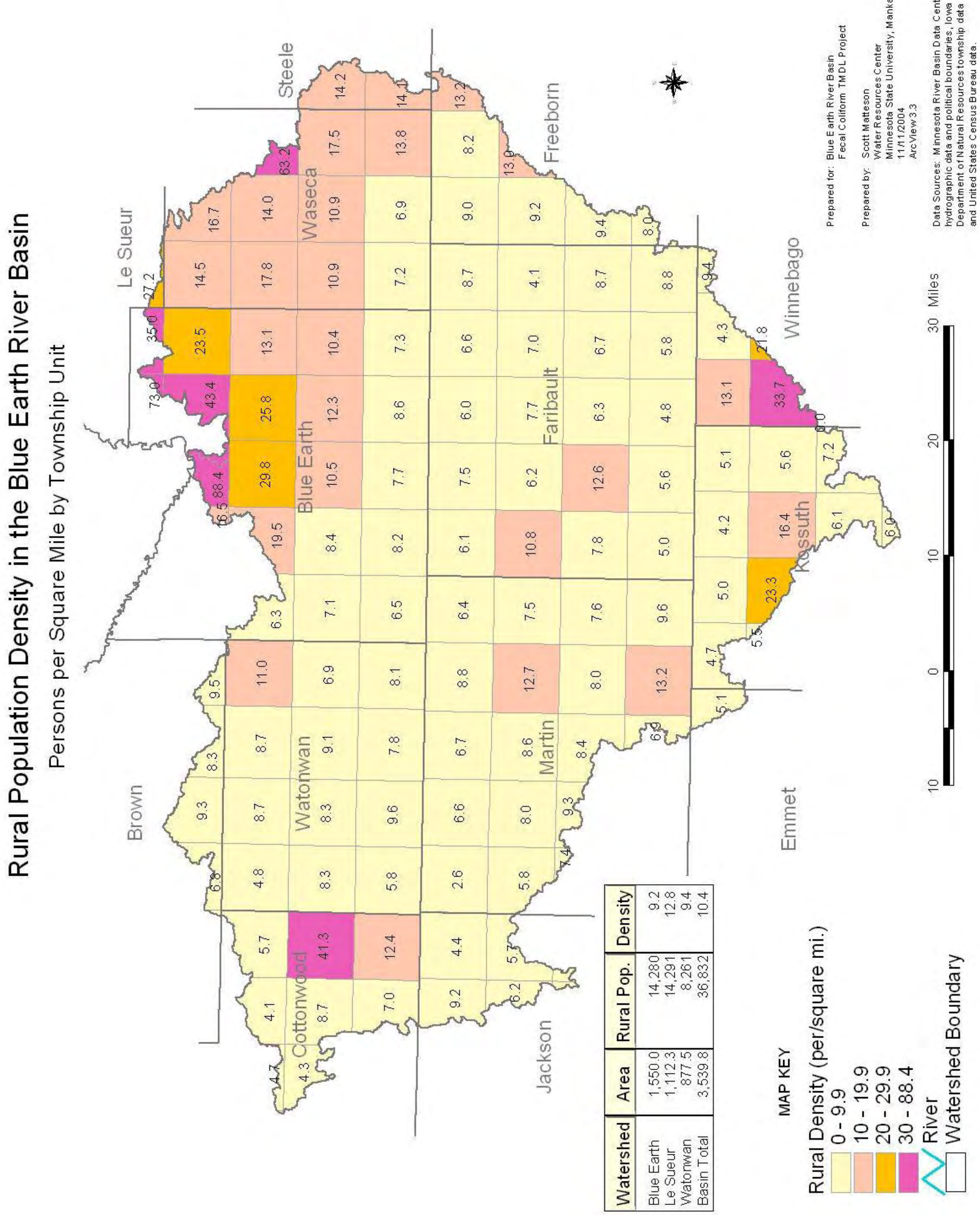


Figure 4.1.1b – Rural Population Density by Township for Blue Earth River Basin

4.1.2 Noncompliant Individual Sewage Treatment Systems (ISTS)

An estimated 39% of ISTS in the BERB are allowing inadequately treated wastewater into waterways. The systems that discharge inadequately treated wastewater via drainage tile directly into waterways are often termed "straight pipe" systems. Most "straight pipes" are tied to existing agricultural drainage tile.

There are an estimated 5,500 individual sewage treatment systems across the basin. These estimates are highly subjective however, as the method of inventorying varies from one county to the next. Estimates vary from 5% in Freeborn County to 75% in Jackson County. Sewage from these systems are estimated to be a major contributor to bacteria levels in streams, especially during low flow conditions. These systems are illegal, un-permitted systems pursuant to Minnesota Rules Chapter 7080.

In several communities there are homes which are not connected to wastewater treatment facilities. In some cases these systems are allowing partially or untreated sewage to waterways.

Systems that discharge partially or untreated sewage directly to surface water are often referred to as "straight pipe septic systems".

Straight pipe septic systems usually discharge to the nearest stream, ditch or lake.

4.1.3 Unsewered Communities

Unsewered communities can also be a significant contributor of fecal coliform pollution during low and moderate flows. In 1999, there were 2,013 individuals living in 10 unsewered incorporated communities in the basin. Since that time, the communities of Darfur, Delevan, Lewisville and Skyline have all become sewered. La Salle is scheduled to begin construction of a waste water treatment facility in 2006.

As of 2005, there were 938 individuals in six unsewered incorporated communities in the basin. In addition another 1,532 individuals lived in unsewered unincorporated communities in the Basin. It is assumed a similar 39% of septic systems in these communities have inadequate treatment of wastewater, equating to around 400 systems.

Table 4.1.3 – Incorporated and Unincorporated Unsewered Communities

Incorporated Community	County	Population	Unincorporated Community	County	Population
Walters*	Faribault	82	Rapidan Town	Blue Earth	250
Lasalle*	Watonwan	96	Garden City	Blue Earth	230
Ormsby	Watonwan	152	Guckeen	Faribault	36
Odin	Watonwan	95	Huntley*	Faribault	91
Ledyard	Kossuth	258	Bergen	Jackson	10
Lakota	Kossuth	255	Fish Lake	Jackson	115
Total Incorporated		938	Village Of East Chain	Martin	48
			Village Of Immogene	Martin	22
			Village Of Fox Lake	Martin	25
			Elk's Park/Lakeview Rst	Waseca	25
			Rolling Greens	Waseca	30
			Fairway Acres	Waseca	60
			Otisco	Waseca	45
			Smiths Mill	Waseca	31
			Alma City	Waseca	25
			Matawan	Waseca	48
			Reeds Lake	Waseca	65
			St. Olaf Lake	Waseca	53
			East Lake Elysian Subd.	Waseca	58
			Grogan	Watonwan	35
			South Branch	Watonwan	30
			Long Lake	Watonwan	200
			Total Unincorporated		1,532

Total Unsewered Incorporated and Unincorporated **2,470**

** In process of developing sewage treatment system*

4.1.4 MS4 Communities – Stormwater

Runoff of stormwater can adversely impact both water quality and quantity from urban areas. This runoff can affect our water resources physically, chemically and biologically.

Fecal coliform concentrations in stormwater runoff from urban areas can be as great or greater than those found in cropland runoff, grazed pasture runoff, and feedlot runoff (USEPA, 2001). Approximately 34,000 acres or 1.5% of the basin is urbanized.

The Clean Water Act Phase II Stormwater Program requires large communities to obtain Municipal Separate Storm Sewer System (MS4) General Permit. According to the MPCA, systems that serve a population of at least 10,000 and systems with a population of at least 5,000 and discharging to valuable or polluted waters may be required to obtain MS4 permits. Once designated, these M-4s have 18 months to apply for permit coverage. The BERB has three communities requiring a MS4 permits; Fairmont, Mankato and Waseca.

MS4 National Pollutant Discharge Elimination System (NPDES) regulated municipalities must develop stormwater pollution prevention plans to address their stormwater discharges. Each regulated party determines the appropriate pollution prevention practices or "best management practices" to minimize pollution to their specific site. Table 4.1.4 presents the MS4 communities in the Basin, along with size and population in the Basin.

Table 4.1.4 – MS4 Communities

MS4 Community	Acres in Basin	% of Basin	Estimated Population in Basin
Fairmont	10,573	0.47%	10,889
Mankato	921	0.04%	3,560
Waseca	622	0.03%	2,274

4.1.5 Municipal Waste Water Treatment Facility Bypasses

Municipal bypasses are emergency discharges of partially or untreated human sewage from waste water treatment facilities. Municipal bypasses usually occur during periods of heavy precipitation, when waste water treatment facilities become overloaded. Municipal bypasses typically last from a few hours to a few days.

There were 38 reported municipal bypasses in the basin from 2000 through 2004. Three cities had three or more bypasses during that period, Blue Earth (7), Winnebago (4) and Elmore (3). Bypasses from each of these three communities discharge directly into the Blue Earth River. Appendix D provides a summary of all reported bypasses in the Basin.

Table 4.1.5 – Number of Bypasses by Watershed and by Year (2000-2004)

Watershed	# Bypasses
Blue Earth	18
Le Sueur	16
Watonwan	4

Year	# Bypasses
2000	11
2001	15
2002	2
2003	2
2004	14

4.1.6 Municipal Wastewater Treatment Facility Violations

Municipal wastewater treatment facilities (WWTP) are required to test fecal coliform bacteria levels in effluent on a weekly basis. Facilities report a geometric mean fecal coliform level for each month, April through October. The geometric mean for all samples collected in a month must not exceed 200 cfu/100 ml fecal coliform bacteria. Exceedance of the 200 cfu/100 limit is considered a WWTP permit violation.

According to MPCA records, 23 wastewater treatment facility violations for fecal coliform bacteria were reported from 2000 through 2004. Fourteen of these violations occurred from three communities, Truman (7), Waldorf (5) and Mountain Lake (2). Appendix E provides a summary of all WWTP violations reported in the basin.

4.1.7 Application of Sewage Sludge to Agricultural Lands

WWTP and sewage disposal contractors are required to properly treat and disinfect sludge and septage through processing or lime stabilization. Treated sewage is then usually disposed of onto agricultural lands. The rules and procedures related to sewage handling and application are intended to insure pathogens have been destroyed.

4.2 Livestock

Based on population inventories and the assessment procedures outlined in section 4.5.1, nearly 99% of the fecal matter produced (not what may be delivered to waterways) in the BERB is from livestock manure. Of the fecal matter produced by livestock, 98% is applied to cropland as a fertilizer. The remaining 2% is estimated to be deposited in pasture area or lost from feedlots without runoff controls. Of the manure applied to cropland an estimated 71% is incorporated and 27% is surface applied without incorporation. Runoff from land application areas, pastures and livestock feedlots has the potential to be a significant source of fecal coliform bacteria and other pollutants.

Based on county feedlot inventories, there are an estimated 2,311 feedlots with 705,466 animal units in the basin. Swine is the dominant animal type in the basin, accounting for

78.2% of total livestock animal units. The other major livestock animal types are beef (13.3%), dairy (5.4%), turkey (1.8%) and chicken (1.1%).

Figure 4.2a displays the location of inventoried feedlots in the basin as well as animal unit density by minor watershed. The majority of these facilities are confined operations with little or no runoff to surface water. However, there are a number of open feedlots, some of which have pollution problems and pose a risk of fecal contamination. In certain areas of the BERB, runoff from these feedlots may be a significant source of fecal coliform contamination during periods of heavy precipitation. According to county feedlot officers and MPCA reports, most feedlots store and manage manure adequately to avoid runoff problems.

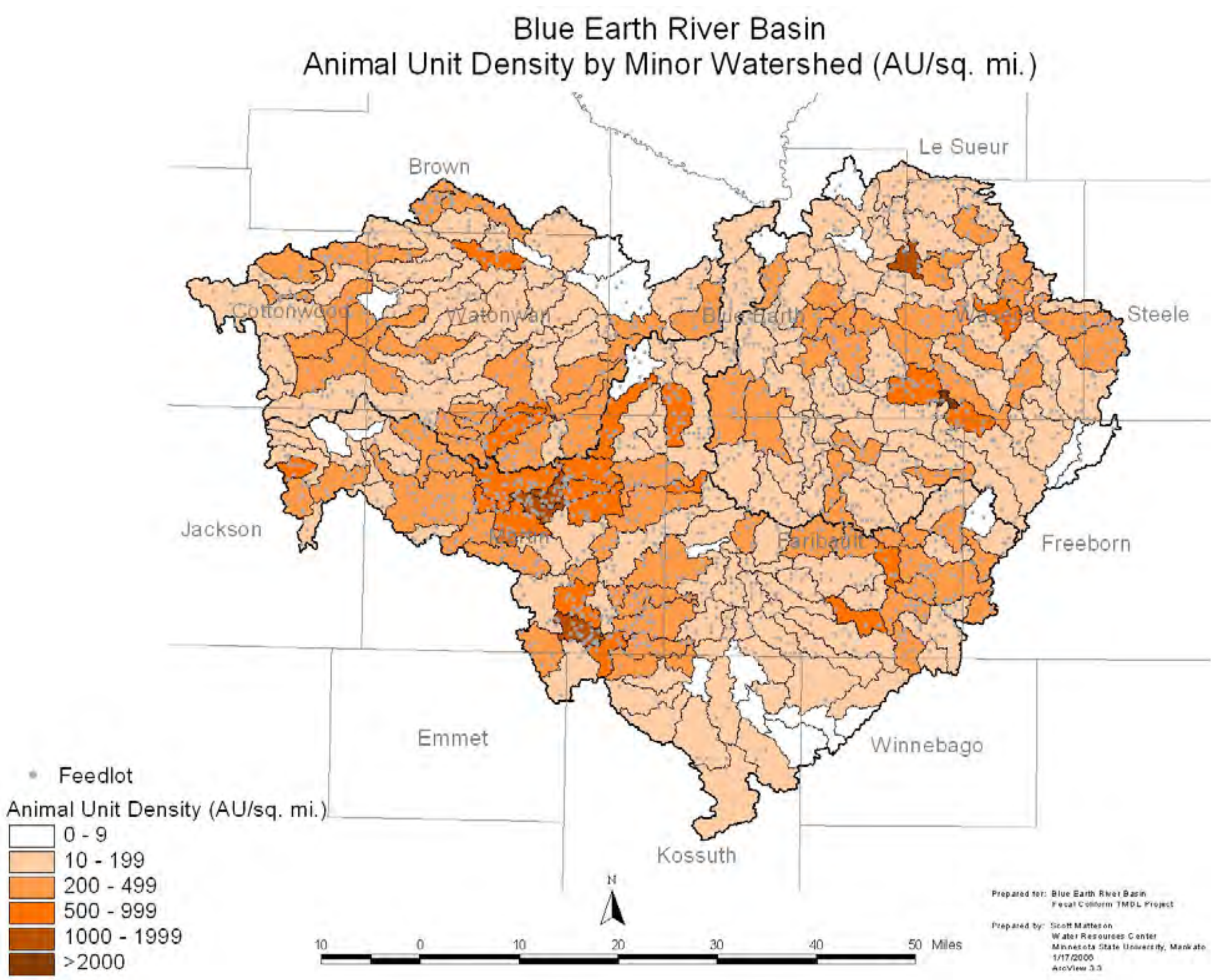
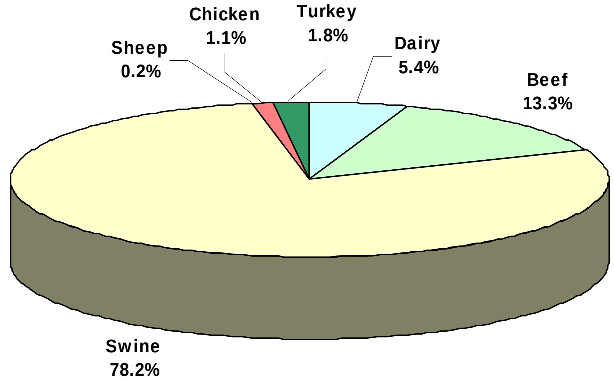


Figure 4.2a – Livestock Animal Unit Density by Minor Watershed

Figure 4.2b presents a breakdown of livestock animal type by county. These data show swine to be the dominant animal type for all counties in the basin. Martin County, the largest swine producing county in Minnesota, has the highest overall livestock density in the basin.

County	Total Estimated AU in BERB	Animal Units Per Square Mile
Winnebago	2,239	27
Emmet	2,936	226
Steele	5,896	164
Freeborn	9,601	61
Brown	11,977	218
Kossuth	14,511	60
Jackson	15,952	170
Cottonwood	47,387	238
Watonwan	68,739	157
Blue Earth	79,060	135
Waseca	96,307	272
Faribault	108,907	151
Martin	241,934	434
Total	**705,446**	

Blue Earth River Basin – Livestock (% Total)



Note: Minnesota and Iowa feedlot inventory databases vary significantly. The Iowa feedlot inventory only includes larger feedlots that were available in GIS format. Thus, feedlot values for Iowa counties are skewed lower than Minnesota Counties.

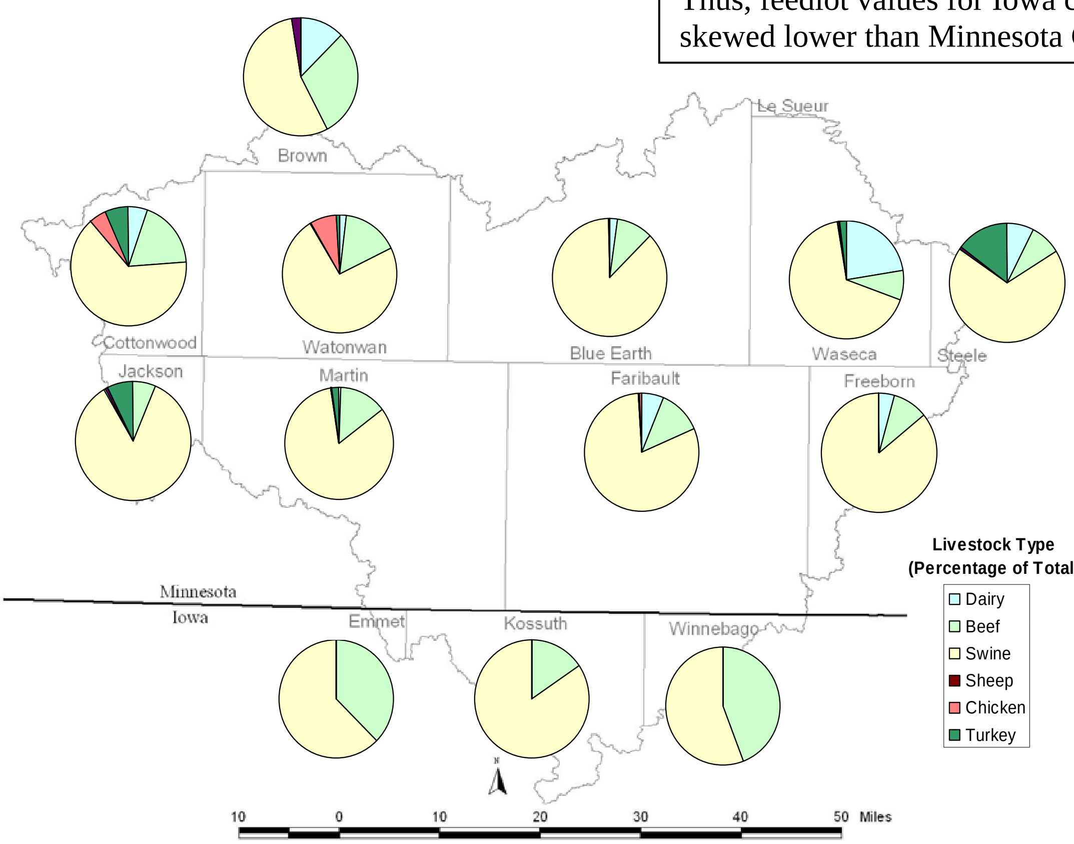


Figure 4.2b – Livestock Summary for Blue Earth River Basin by County

The majority (>98%) of livestock manure is either surface applied to, or incorporated into farm fields as a fertilizer and soil amendment. As such, the majority of fecal material that is produced in the basin is distributed on the land. Land application of this manure can be a major source of fecal coliform bacteria contamination. There are three potential pathways to waterways of fecal coliform from fields with applied manure; 1) overland runoff, 2) open tile intakes and 3) preferential flow through soil macropores. While all three pathways generally require precipitation or snowmelt runoff, poorly timed or improper application also could lead to surface water contamination.

4.2.1 Overland Runoff and Open Tile Intakes

During high precipitation storm events runoff of fecal coliform bacteria from fields with applied manure can occur from direct surface runoff to waterways or indirectly through field tile open intakes. To help address manure runoff concerns, manure application rules were put into place in Minnesota under MN Rules Chapter 7020 (table 4.2.1). This rule requires a setback of 300 feet for surface applied manure from streams, ditches and open tile intakes. The setback when manure is incorporated is 25 feet from streams and ditches and 0 feet from open intakes. In Iowa, Chapter 65 of the Iowa Administrative Code contains rules that govern land application of manure, including setback distance. The rule requires a setback of 200 feet for surface applied manure from stream, ditches and open intakes. For incorporated manure there is no required setback from streams, ditches or open tile intakes.

The effectiveness of current setbacks for applied manure related to bacterial contamination is largely unknown. Setback distances are primarily based on research involving nutrients (phosphorus), not bacterial transport. It is unclear weather current setbacks for surface applied and incorporated manure are appropriate for preventing bacterial transport to tile drainage systems. According to county and state feedlot officers, it is also difficult to monitor whether setback distance are being observed. As open intakes have the capacity of being a significant route for bacteria transport, further research into setback distances is recommended.

Open tile intake in road ditch, receiving runoff from field with surface applied manure.

An open tile intake along the edge of an agricultural field.

Table 4.2.1 - Manure Application Rules for Minnesota

Manure Application – Minimum setbacks near waters (counties can be more restrictive than state Rule 7020)

	Surface Application	Incorporation within 24 hrs.
Lake, stream	300'*	25'**
Wetlands (10+ ac.)	300'*	25'**
Ditches (w/o berms)	300'*	25'**
Open tile intakes	300'	0'
Well, quarry	50'	50'
Sinkhole (w/o berms)		
Downslope	50'	50'
Upslope	300'	50'

*100' vegetated buffer can be used instead of 300' setback for non-winter applications (50' buffer for wetlands/ditches)

**no long-term phosphorus buildup within 300'

4.2.2 Macropores/Preferential Flow

Transport of fecal coliform bacteria and associated pathogens may be enhanced by field tile systems even in the absence of surface tile intakes. The retardation and retention of bacteria in soils is apparently less effective than previously believed, primarily due to preferential flow processes, which can aid in the rapid transport of bacteria from manure application (Smith et al, 1998; Geohring et al, 1999). Field studies in various locations across the United States have shown significant transport of fecal coliform bacteria to tile drainage through soil macropores. Beven and Germann (1982) outlined the main processes which contribute to the formation of macropores in natural soils:

- Pores formed by soil fauna such as earthworms, insects, mole and gophers.
- Crack and fissures formed during the shrinkage of clay soils and freeze/thaw cycles.
- Pores formed by plant roots.
- Natural soil pipes that form due to erosive action of subsurface flows.

In Minnesota there has been limited research on macropores and bacterial transport. Earthworms, which are one of the primary creators of macropores, are in lower numbers in Minnesota compared with other portions of the country. Research has shown earthworm macropores are most common in no-till soils, not commonly utilized in south-central Minnesota. Also, soil types/conditions and climate may be different in Minnesota as compared to where other studies have taken place.

The only significant research in Minnesota related to assessing fecal coliform transport to tile drainage was two separate studies conducted by Gyles Randall at the University of Minnesota Southern Experiment Station in Waseca. The first study (Randall, 2000) conducted from 1995-1997 involved collection of tile water samples from a series of 13.5

by 15 meter plots that had received moldboard incorporation of fall applied dairy manure. The following spring samples were collected within three days of precipitation events that caused significant drainage. The study found 100% of samples to test positive for fecal coliform bacteria, yet e. coli was only detected in five of the 30 samples over the three year period. Fecal coliform concentrations were implied to be low and the authors speculated that significant winter dieoff may have occurred.

The second study, (Randall, 2003) involved spring tile monitoring of fall applied (2002/2003) injected swine manure. The study involved comparing field plots with applied manure vs. urea treatments. The authors found the number of fecal coliform bacteria to be similar in both urea-treated and manure treated plots. They suggested organisms did not survive over winter in the added manure and that levels seen during the six-week drainage sampling period were probably background concentrations.

Studies from other parts of the country have shown that the transport of fecal bacteria under conditions of ideal matrix flow is inversely related to particle size. Soil consisting of primarily silt and clay particles are very effective in physically filtering bacterial cells under conditions of matrix flow. However, column and field experiments have indicated that macropore flow is the dominant transport pathway for fecal bacteria. Therefore, soils more susceptible to shrinking or cracking, such as clays, could be less effective than sandy soils in terms of limiting bacterial transport (Jamieson, 2002).

Research by Dan Janyes (USDA, 2005) at the National Soil Tilth Laboratory in Ames, Iowa has looked at movement of tracers, similar to nitrate, through preferential flow. Four tracers were surface applied to a field at staggered time intervals. The area of tracer application was then lightly irrigated (3mm/hr) and the subsurface tile was monitored for preferential flow. Tracer movement from surface to tile line varied from 2 hours to 15 minutes, occurring quicker as soil conditions became wetter. Janyes estimates preferential flow accounts for about 1% of the mass loss of surface applied chemicals.

Work by the Agricultural Resource Service (USDA, 2005) Martin Shipitalo in Ohio have traced macropores made by earth worms from the surface to 4 feet deep. In many cases, these burrows end at a drain tile. Shipitalo and Frank Gibbs of Natural Resources Conservation Service (NRCS) in Ohio have demonstrated the connectivity of the soil surface and tile line via macropores by forcing smoke up tile lines when not flowing.

Fecal coliform bacteria can survive for great periods of time in soils under certain conditions. Gerba et al. (1975) reported survival times of fecal-associated bacteria in soils to range from 2 to 4 months. The survivability of fecal bacteria in soil is largely dependant on moisture, soil type, temperature, pH, and nutrient availability. Crane et al. (1981), Zhai et al. (1995) found manure application rate does not appear to influence bacterial survival, although little research has been done on fields that received excessive applications of manure.

Management strategies to reduce bacterial transport include tillage methods that disrupt preferential flow pathways.

The pictures depict a conventionally tilled, clayey soil where earthworms appear to preferentially burrow towards the drains. The tile in this photo is 4 feet deep.

In Ohio, Shipitalo and Gibbs pump smoke into a tile line to show the connectivity of the surface to tile.line.

Figure 4.2.2 – Examples of macropore/preferential flow routes in a no till tiled field in Ohio

4.3 Pets

The American Veterinary Medical Association estimates there are 0.66 cats and 0.58 dogs per household in the United States. Based on an average household of 2.43 people, this equates to 25,043 cats and 22,007 dogs in the BERB. High densities of pets in areas can lead to bacterial contamination of waterways; however pets are normally a minor contributor of fecal coliform bacteria contamination in the BERB.

4.4 Wildlife and Natural Background

Deer, pheasant, Canadian goose and wild turkey density estimates were obtained from the Minnesota Department of Natural Resources – Wildlife Section. The densities were interpolated to the Iowa portion of the basin.

Deer density is estimated annually by the DNR for each hunting permit area. Deer densities in the permitted BERB areas ranged from 2.9 to 4.8 deer per square mile. Basin wide this equates to 12,744 deer.

Pheasant population estimates were provided for each county in the basin, based on estimates made in August of each year. A ten-year average density (1995-2004) was calculated for each county. Based on DNR estimates, there is an average of 46 pheasant per square mile in the BERB. This equates to an estimated 162,000 pheasants basinwide. The DNR report that April populations are about 25% of August estimates.

Canadian goose populations are estimated by ecoregion. BERB estimates are based on 2001-2004 data for the prairie ecoregion. The DNR estimates a basinwide density of 4.5 geese per square mile or 15,771 total. The DNR estimate is for the resident geese population, not including migrating geese in the fall. Migrating geese in the fall season can concentrate in lakes and wetlands contributing large quantities of fecal waste. Geese are one of the largest wildlife sources of fecal contamination, simply because they are found directly on waterways.

The DNR bases wild turkey population estimates on harvest. Similar to deer densities, turkey estimates are based on permitted hunting areas. The mean wild turkey density in the BERB is 1.09 per square mile. However, like other wildlife, they are not equally distributed, instead clumping towards forested areas and ravines. The total basinwide estimated wild turkey population is 3,859.

Population estimates and monitoring data support that wildlife normally are not a significant contributor of fecal coliform bacteria contamination in the BERB. Conditions when wildlife can be a significant source include isolated areas of high density and during low flow/drought conditions.

4.5 Source Contribution Estimates

Sections 4.5.1 through 4.5.4 detail the process that was used for each impaired stream reach to estimate the primary sources of fecal coliform contamination. This procedure has no bearing on TMDL allocations and has no regulatory implications. The entire BERB is used as an example.

4.5.1 Fecal Coliform Produced (by source)

The first step was compiling population estimates and fecal coliform produced by each animal type in the Basin. Table 4.5.1a presents the estimated population figures (number of individuals or animal units) for the major animal types in the BERB. Figures 4.5.1a and 4.5.1b display the estimated fecal coliform produced by animal type and source groups.

Population figures were obtained from state feedlot inventories, the U.S. Census Bureau and the Wildlife section of the Minnesota Department of Natural Resources. The daily fecal coliform (FC) production was obtained from a variety of sources recommended in the EPA's guidance document Protocol for Developing Pathogen TMDLs (2002). Total FC produced by each animal type is calculated by multiplying the population by the daily FC produced per individual or animal unit. Table 4.5.1a and figures 4.5.1a and 4.5.1b represent the total FC available, not the amount delivered to surface waters.

Table 4.5.1a – Blue Earth River Basin Population Inventory

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced per Individual or AU Per Day	Total FC Available	Source (Daily FC Production)
Dairy	39,282		7.20E+10	2.83E+15	ASAE*, 1998
Beef	92,456		1.30E+11	1.20E+16	ASAE, 1998
Swine	554,339		8.00E+10	4.43E+16	ASAE, 1998
Chicken	7,903		3.40E+10	2.69E+14	ASAE, 1998
Turkey	9,834		6.20E+09	6.10E+13	ASAE, 1998
Horse	800		4.20E+08	3.36E+11	ASAE, 1998
Sheep	1,397		2.00E+11	2.79E+14	ASAE, 1998
Humans		92,202	2.00E+09	1.84E+14	Metcalf and Eddy, 1991
Cats		25,043	5.00E+09	1.25E+14	Horsley and Witten, 1996
Dogs		22,007	5.00E+09	1.10E+14	Horsley and Witten, 1996
Deer		12,744	5.00E+08	6.37E+12	Interp. from Metcalf and Eddy, 1991
Canadian Geese		15,771	1.04E+07	1.64E+11	Alderisio and DeLuca, 1999
Wild Turkey		3,859	9.50E+07	3.67E+11	turkey value used
Pheasants*		100,000	1.53E+04	1.53E+09	geese value used
Other Wildlife**		NA		6.37E+12	

*ASAE – American Society of Agricultural Engineers

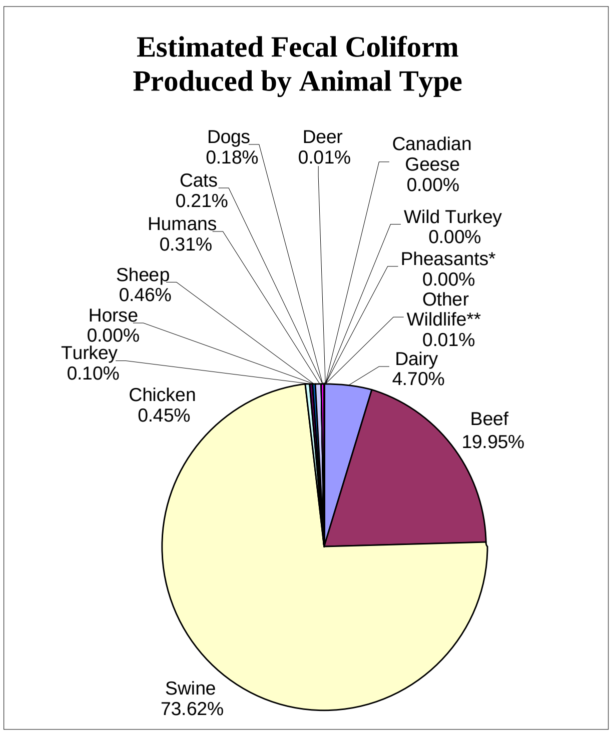


Figure 4.5.1a – Blue Earth River Basin Fecal Coliform Bacteria Produced by Animal Type

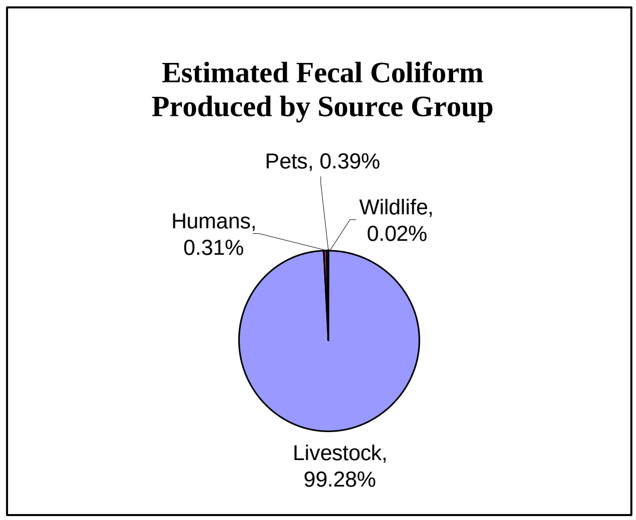


Figure 4.5.1b – Blue Earth River Basin Fecal Coliform Bacteria Produced by Source Group

Next, the total fecal coliform bacteria produced by each animal type was categorized in ways reflective of the potential for reaching surface waters. For humans, this meant calculating the number of people that had adequately treated and inadequately treated wastewater. For livestock categorization, assumptions were derived from the Generic Environmental Impact Statement (GEIS) on Animal Agriculture (Mulla, et all, 2000), prepared by the Minnesota Environmental Quality Board. This document provides general guidelines on how and where livestock manure is applied to farmland in Minnesota. These assumptions are subject to change as manure application methods and procedures change. For example, since year 2000 application of swine manure has continued to shift towards incorporation. Charts and values used in this report use the assumption that 80% of swine manure is incorporated and 20% surface applied. Current opinions are that up to 95% of swine manure is now incorporated. However, slight changes to assumptions described below does not change target areas described in section 4.5.3.

Table 4.5.1b – Assumptions Used to Calculate the FC Produced by Different Sources

Category	Source	Assumptions*	Animal Units or Individuals
Livestock	Overgrazed Pastures near Streams or Waterways	1% Dairy Manure	393 Dairy AU
		1% Beef Manure	925 Beef AU
		1% Horse Manure	8 Horse AU
		1% Sheep Manure	14 Sheep AU
	Feedlots or Manure Stockpiles without Runoff Controls	1% of Dairy Manure	393 Dairy AU
		5% of Beef Manure	4,623 Beef AU
		1% of Chicken Manure	79 Chicken AU
		1% Turkey Manure	98 Turkey AU
	Surface Applied Manure	49% Dairy Manure	19,248 Dairy AU
		47% Beef Manure	43,454 Beef AU
		20% Swine Manure	110,868 Swine AU
		49.5% Horse Manure	396 Horse AU
		49.5% Sheep Manure	692 Sheep AU
		49.5% Chicken Manure	3,912 Chicken AU
		49.5% Turkey Manure	4,868 Turkey AU
	Incorporated Manure	49% Dairy Manure	19,248 Dairy AU
		47% Beef Manure	43,454 Beef AU
		80% Swine Manure	443,471 Swine AU
		49.5% Horse Manure	396 Horse AU
		49.5% Sheep Manure	692 Sheep AU
		49.5% Chicken Manure	3,912 Chicken AU
		49.5% Turkey Manure	4,868 Turkey AU
Human	Inadequately Treated Wastewater ("Straight Pipe" Septic Systems)	14.33% of Human	13,213 Humans
	Unsewered Communities	2.94% of Humans	2,719 Humans
	ISTS that are not an Imminent Public Health Risk	22.67% of Humans	20,900 Humans
	Municipal Wastewater Treatment Facilities	60.05% of Humans	55,370 Humans
Pets	Cats	100% of Cats	25,043 Cats
	Dogs	100% of Dogs	22,007 Dogs
Wildlife	Canadian Geese (resident population)	100% of Canadian Geese	15,771 Canadian Geese
	Deer	100% of Deer	12,744 Deer
	Wild Turkey	100% of Wild Turkey	3,859 Wild Turkeys
	Pheasants	100% of Pheasant	100,000 Pheasant
	Other Wildlife	Unknown (est. as deer pop.)	Unknown (est. as deer pop.)

*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.

Figure 4.5.1c displays the source/application type for fecal coliform bacteria in the BERB. The data indicate most fecal material is applied to agricultural land. Again note that the figure represents the estimated fecal coliform bacteria produced by source and application type, not the fecal coliform that is actually delivered to surface water.

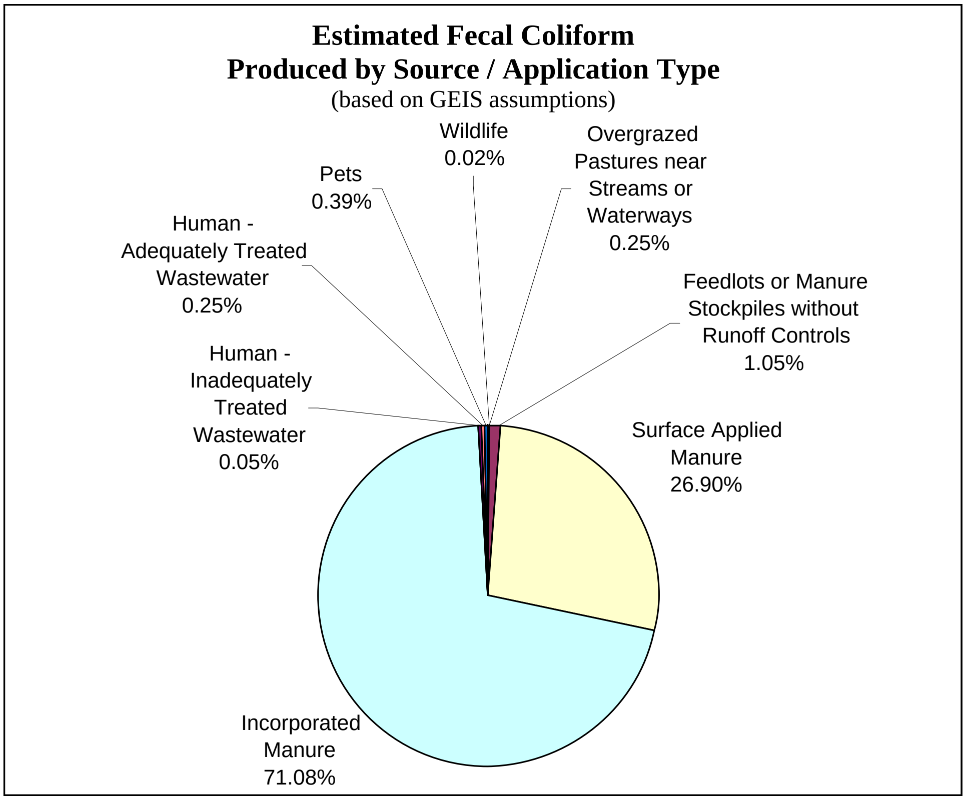


Figure 4.5.1c – Estimated Fecal Coliform Produced by Source/Application Type

4.5.2 Delivery Assumptions

To help identify what are the primary sources of fecal coliform bacteria contamination for each impaired stream reach, the delivery ratios in table 4.5.2 were used. The ratios were obtained from Appendix C of the Regional TMDL Evaluation of Fecal Coliform Bacteria Impairments in the Lower Mississippi River Basin in Minnesota, 2002 (revised 2006). While the revised report did not include delivery estimates, the source contribution process used in the original report still has utility.

The ratios presented in table 4.5.2 were based on expert opinions and should be considered in relative rather then absolute terms. Thus, while 1% of surface applied manure was assumed to be delivered to waterways, only .1% of incorporated manure was considered delivered. Straight pipe septic systems were given the highest delivery ratio, at 8%.

Table 4.5.2 – Delivery Assumptions

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	4.0%	1.0%
	Feedlots or Manure Stockpiles without Runoff Controls	4.0%	
	Surface Applied Manure	1.0%	
	Incorporated Manure	0.1%	
Human	Rural Population - ISTS that are an Imminent Public Health Risk	8.0%	8.0%
	Rural Population - Unsewered Communities	8.0%	8.0%
	Rural Population - ISTS that are not an Imminent Public Health Risk		
	Municiple Wastewater Treatment Facilities		
Pets	Cats/Dogs	0.5%	
Wildlife	Canadian Geese	4.0%	4.0%
	Other Wildlife	1.0%	1.0%

4.5.3 Target Areas

Delivery ratios used in section 4.5.2 come with a degree of uncertainty. The amount of fecal material delivered from any one source will vary depending on numerous factors. Because of this uncertainty, it is difficult to accurately breakdown the percentage contribution of bacterial contamination from each source. Instead, categories were used to list the sources of bacterial contamination in the impaired stream reaches. Table 4.5.3 presents the likely major sources of bacterial loading in the BERB, 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 would be considered dry; however the majority of bacterial loading to streams occurs during wet conditions. Categories were defined as <5% being a low contributor, 5%-20% a moderate contributor and >20% a high contributor.

Table 4.5.3 – Blue Earth River Basin – Major Contributors of Fecal Coliform Bacteria

Major Contributors of Fecal Coliform Bacteria by Flow Condition

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Pets		
Wildlife	Deer		

Low Contributor	
Moderate Contributor	
High Contributor	

Section 5.0 – Explanation of Load Allocations (LA) Wasteload Allocations (WLA) and Margin of Safety (MOS)

The following section provide background information, landuse statistics, water quality data, population inventories and load/wasteload allocations for the 17 impaired stream reaches and four potentially impaired stream reaches in the BERB. The TMDL assessment process was modeled after the approach used in the Regional Total Maximum Daily Load Evaluation of Fecal Coliform Bacteria Impairment in the Lower Mississippi River Basin in Minnesota, (MPCA, 2006).

The TMDLs consist of three components; WLA, LA and MOS as defined in section 1.2 on page 2. The WLA includes four subcategories: permitted wastewater treatment facilities; communities subject to MS4 NPDES permit requirements; livestock facilities requiring NPDES permits, and "straight pipe" septic systems. The LA, reported as a single category includes manure runoff from farm fields, pastures, and smaller non-NPDES-permitted feedlots, runoff from smaller non-MS4 communities, and fecal coliform bacteria contributions from wildlife. The LA includes land-applied manure from livestock facilities requiring NPDES permits, provided the manure is applied in accordance with a 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.

The three components were calculated as monthly loads of fecal coliform organisms. The fecal coliform load limits were calculated for five flow regimes, from near drought to flood condition. This method is referred to as the duration curve approach. By adjusting the WLA, LA and MOS 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 at the range of flow conditions experienced historically at each site.

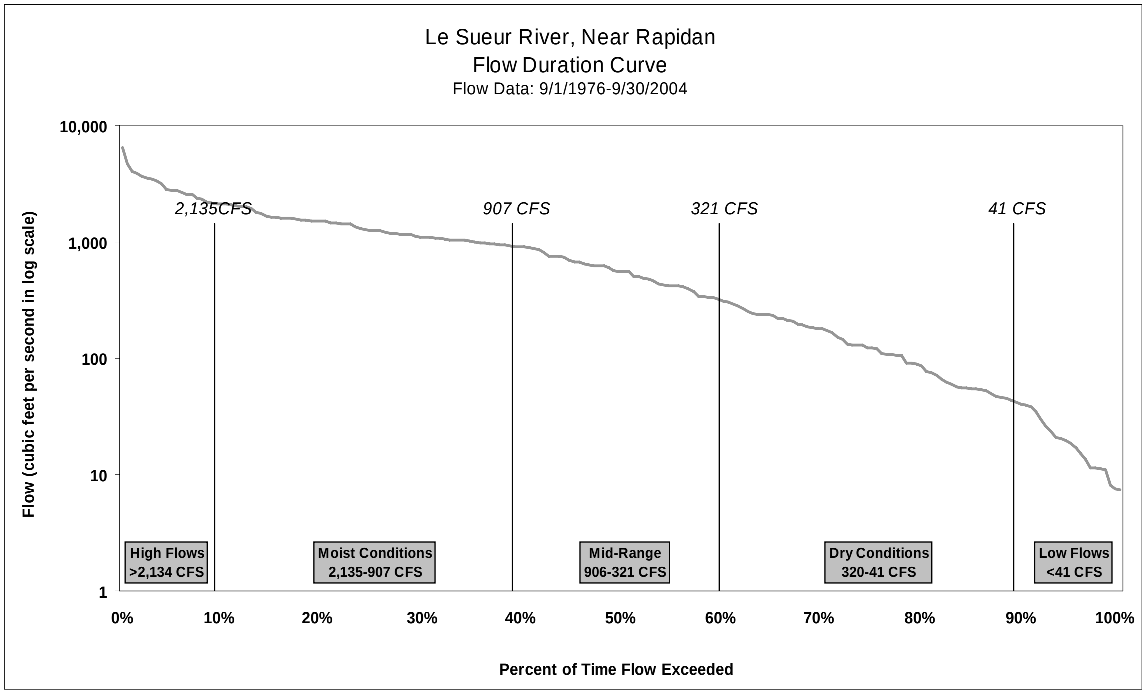
The duration curve approach involved using long term (1976-2004) flow monitoring data from three U.S. Geological Survey gage stations. One site was located near the outlet of each the Blue Earth, Le Sueur and Watonwan Rivers. For each gaging station, monthly mean flow values were obtained for April through October, from 1976 through 2004. The April through October period was selected as this corresponds with the fecal coliform standard. As an example, table 5.0a presents the USGS monthly flow values for the LeSueur River gaging site.

Table 5.0a - Le Sueur River, Monthly Mean Flow Values, CFS (1976-2004)

	Monthly Mean Flow						
Year	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
1976	172	63	87	21	12	8	11
1977	71	55	194	41	17	30	268
1978	1,253	602	1,180	653	243	60	26
1979	2,361	756	427	418	2,132	737	240
1980	1,168	332	1,127	152	108	179	132
1981	340	938	875	1,545	967	553	309
1982	1,059	1,603	914	505	105	178	562
1983	4,046	2,026	905	1,750	91	184	223
1984	2,219	2,135	2,038	631	105	42	209
1985	1,163	378	235	54	40	130	757
1986	1,424	1,426	2,351	1,179	122	419	985
1987	187	91	50	165	321	56	53
1988	566	679	121	21	20	12	13
1989	304	237	57	24	8	11	7
1990	66	625	1,509	1,104	1,005	197	55
1991	1,450	3,138	2,567	1,044	1,170	280	130
1992	1,503	814	907	1,592	1,086	562	1,627
1993	4,739	2,557	3,913	2,760	3,656	1,526	410
1994	1,213	1,047	1,445	1,090	951	673	1,593
1995	2,010	1,274	1,669	1,626	1,800	336	978
1996	1,252	750	1,948	393	254	108	89
1997	1,314	966	919	1,350	460	221	237
1998	2,173	1,039	1,029	860	122	38	340
1999	3,497	2,690	2,071	1,431	419	75	46
2000	145	1,247	3,362	1,538	214	53	35
2001	6,424	2,839	3,528	505	76	47	46
2002	433	477	1,523	295	620	110	1,105
2003	892	1,582	703	487	43	19	15
2004	130	627	2,108	1,082	1,027	2,754	

The resulting 203 monthly flow values for each site (7 months x 29 years) were then sorted by flow volume, from highest to lowest to develop a flow duration curve. Figure 5.0a displays the flow duration curve for the Le Sueur River outlet monitoring site. The chart depicts the percentage of time any particular flow is exceeded. For example, during the flow record 2,135 CFS was exceeded by 10% of monthly flow values, and thus represents “high flow” conditions. A value of 41 CFS was exceeded by 90% of monthly flow values and represents “low flow” conditions.

Figure 5.0a – Le Sueur 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 5th percentile. At this flow value, the mean monthly flow would be exceeded by 5% of all flow values in the dataset. Table 5.0b presents the flow regimes that were determined for the Le Sueur River gaging site, along with the flow value used to calculate the TMLC.

Table 5.0b – Flow Regimes and Values Used to Calculate Total Monthly Loading Capacity

Flow Condition	Percent of Time Flow Exceeded	Flow Range	Flow Used to Calculate Total Monthly Loading Capacity
High	0-10%	>2,134	2,839
Moist	10-40%	907-2,134	1,274
Mid	40-60%	321-906	562
Dry	60-90%	41-320	122
Low	90-100%	<41	19

The flow used to determine loading capacity for each flow regime was multiplied by a conversion factor of 146,776,126,400. This conversion factor is defined by the following equation:

Load Capacity (org/month) = Concentration (org/100mL) *X* Flow (cfs) *X* (200 org/100ml)

Multiply by 3,785.2 to convert mL per gallon to org/100 gallons
Divide by 100 to convert to org/gallon
Multiply by 7.48 to convert gallon per ft^3 to org/ft^3
Multiply by 86,400 to convert seconds per day to $ft^{3/}$day
Multiply by 30 to convert day per month to $ft^{3/}$month
Multiply by the water quality standard of 200 org/100 ml

Load Capacity = 733,880,632 X $ft^{3/}$sec = org/month

Next, a Margin of Safety was determined for each flow regime. 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 monthly flow, accounting for potential flow variability is the appropriate way to address the MOS. This is done within each of 5 flow zones. The MOS was determined as the difference between the median flow and minimum flow in each zone. For example, the MOS for the high flow zone is the 95^{th} percentile flow value subtracted from the 100^{th} percentile flow value. The resulting value was converted to a load and used as the MOS. The values that were used to calculate the TMLC and MOS are presented in figure 5.0b.

Figure 5.0b – Le Sueur River Flow Duration Curve with TMLC and MOS

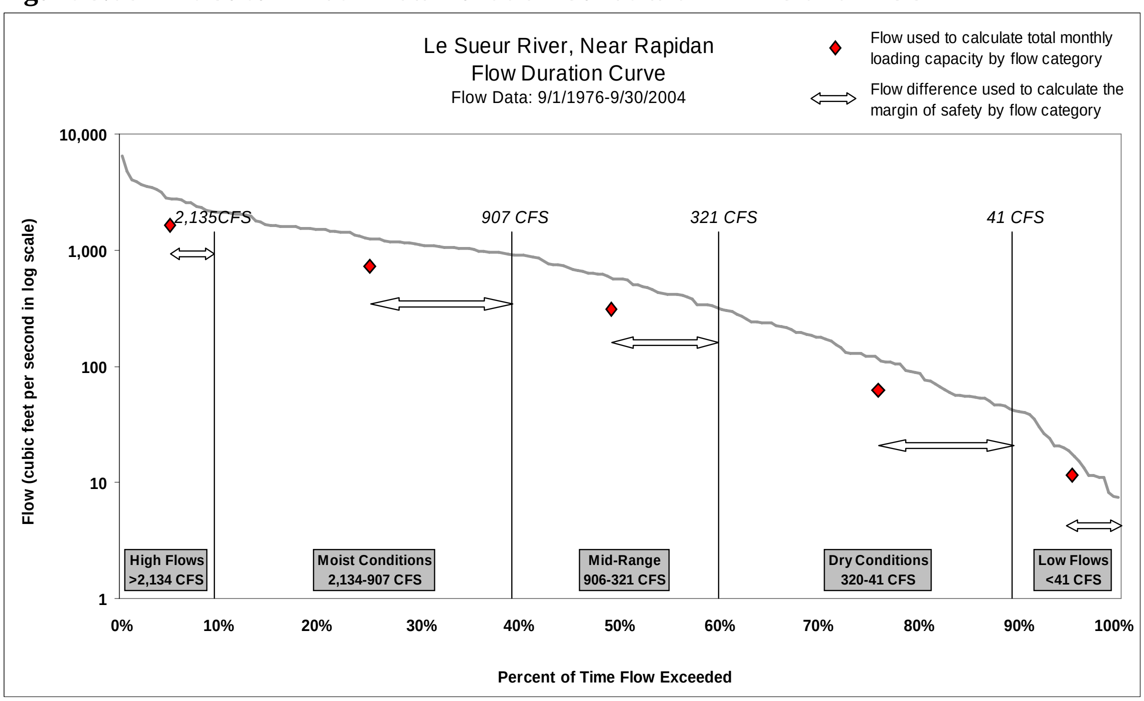


Table 5.0c presents the resulting TMDL (WLA+LA) and MOS for the Le Sueur River impaired reach based on the five flow regimes. The values expressed are in total organisms per month. For each of the five flow regimes, the monthly flow volume was multiplied by the water quality standard of 200 organisms/100 ml. This usually produces loading capacities in the trillions of organisms per month (T-org/month).

Table 5.0c – TMDL and MOS for Le Sueur River Watershed

Flow Zone	TMDL*	MOS*	Allocation*
High	416.7	103.3	520.0
Moist	187.0	53.9	240.9
Mid	82.5	35.4	117.9
Dry	17.9	12.0	29.9
Low	2.8	1.7	4.4

* Values expressed as trillion organisms per month

Several of the fecal coliform impaired reach watersheds did not have sufficient flow monitoring data. Flow values for these impaired watersheds were calculated by normalizing data from the three USGS gage stations. For example, the Maple River impaired stream reach is estimated to be 31% of the watershed area monitored by the Le Sueur USGS gaging station. To determine flow zones for the Maple River site, mean monthly flows were assumed to be 31% of the flow volumes at the Le Sueur gaging station. These values were then checked against available flow data for the Maple River (which had flow data for 2002 through 2004). Generally, normalized monthly flow values based the USGS sites were very close to actual monitored flows. This approach represents a valid method of determining flow values for unmonitored areas of the Basin.

The TMDL is divided into WLA and LA components. A description of the process used to determine the WLA and LA is provided below. The process is taken directly from the Regional Lower Mississippi TMDL report:

WASTELOAD ALLOCATION

- *Wastewater treatment facility (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) that applies to all WWTFs. As long as WWTFs discharge at or below this permit limit, they will not cause violations of the fecal coliform water quality standard regardless of their fecal coliform load.*
- *A number of smaller NPDES-permitted WWTF's are stabilization ponds systems. Unlike the larger (and some smaller) mechanical treatment systems which have continuous discharges, pond systems typically discharge over a 1-2 week period in the spring and in the fall. Because the discharge volumes from these pond systems are small, and to provide an extra margin of safety 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.*
- *Straight-pipe septic systems are illegal and un-permitted, and as such are assigned a zero wasteload allocation.*

- *Since wet-weather design flows represent a "maximum" flow for a facility, the WWTF allocations are conservative in that they are substantially greater than what is actually required.*
- *For seven of the impaired reaches WWTF design flows exceed minimum stream flow for the low flow zone. These reaches are:*
  - *Blue Earth River, Le Sueur River to Minnesota River*
  - *Le Sueur River, Maple River to Blue Earth River*
  - *Maple River; Rice Creek to Le Sueur River*
  - *Watonwan River; Headwaters to North Fork Watonwan River*
  - *Watonwan River; Perch Creek to Blue Earth River*
  - *Watonwan River; Butterfield Creek to South Fork Watonwan River*
  - *Watonwan River; North Fork Watonwan River to Butterfield Creek*

  Of course, actual WWTF flow can never exceed stream flow as it is a component of stream flow. To account for this unique situation, 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 orgs./100ml.)

  In essence, this amounts to assigning a concentration-based limit to MS4 communities and nonpoint source load allocation sources. While this might be seen as overly stringent, these sources tend not to be significant contributors under dry and low flow 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, as are livestock facilities with NPDES permits.
- *Livestock facilities that have been issued NPDES permits are assigned a zero wasteload allocation. This is consistent with the conditions of the permits, which allow no pollutant discharge from the livestock housing facilities and associated site. 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.*
- *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 allocation) 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% of an impaired reach watershed is covered by one or more MS4 permits, 10% of the remaining capacity is allocated to those permits. 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."*

LOAD ALLOCATION

- *Once the WLA and MOS (as described on page 42) 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, as well as "natural background" sources such as wildlife. The nonpoint pollution sources are largely related to livestock production, inadequate human wastewater treatment, and municipal stormwater systems. Portions of the latter two sources, straight-pipe septic systems and communities covered by MS4 NPDES permits, are included in the wasteload allocation.*

Daily Loading Capacity and Allocations

The TMDLs for the BERB are expressed in both monthly and maximum daily terms. This is to ensure that both the monthly geometric mean and upper 10 th percentile portions of the water quality standard are addressed. All maximum daily loading capacity and allocation values are set at 1/3 rd of the monthly loading capacity and allocation values based on the following rationale:

The upper 10 th percentile criterion is 10 times the geometric mean criterion (2000 org ./ 100ml = upper 10 th percentile; 200 org./100ml = geometric mean). Thus, assuming average daily loading capacities and allocations are 1/30 th of the monthly values, 10 times the average daily values could be allocated as maximum daily loading capacities and allocations under the upper 10 th percentile standard. In mathematical terms the maximum daily value = 10 x 1/30 th of the monthly value = 10/30 th or 1/3 rd of the monthly value.

It is important to note that neither the daily or monthly loading capacities should be violated. In conceptual terms, 3 days of bacteria loads that approach the maximum daily capacities will "use up" most of the monthly capacity.

Impacts of Growth on Allocations and Need for Reserve Capacity

As a result of population growth and movement, changes in the agricultural sector, and other land use changes in the BERB, sources and pathways of bacteria to surface waters will not remain constant over time. The potential impact of these changes on specific bacteria sources are discussed below.

<u>Straight-Pipe Septic Systems</u>
As a result of state and local rules, ordinances, and programs, the number of straight pipe septic systems in the BERB will decrease over time. Because these systems constitute illegal discharges, they are not provided a load allocation for any of the impaired reaches covered 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 likely to increase over time with increases in the populations they serve. As long as current fecal coliform discharge limits are met at these facilities, however, such increases will not impact the allocation provided

to other sources. This is because increased flows from wastewater treatment facilities add to the overall loading capacity by increasing river flows.

Municipal Separate Storm Sewer Systems

At least some expansion of the two current MS4 communities in the basin is likely to take place. The City of Manakto, in particular, is likely to see growth. As expansion of these communities occurs, MS4 wasteload allocations may also need to be increased. If this occurs, the nonpoint source load allocation will need to be reduced proportionally. This makes sense, because expansion of urban areas effectively reduces the amount of agricultural and other land which contributes nonpoint source runoff.

Livestock

Along with humans, the other major source of fecal coliform in the basin is livestock. While there have been changes in the sizes and types of facilities, 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 facilities themselves to land application practices may be warranted in the future. If growth in livestock numbers 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 of the basin.

For the reasons discussed above, no explicit adjustments were made to the waste load or load allocations, and no reserve capacity was added, 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.

Section 6.0 - TMDL Allocations for Individual Impaired Reaches

6.1 Blue Earth River; West Branch Blue Earth River to Coon Creek

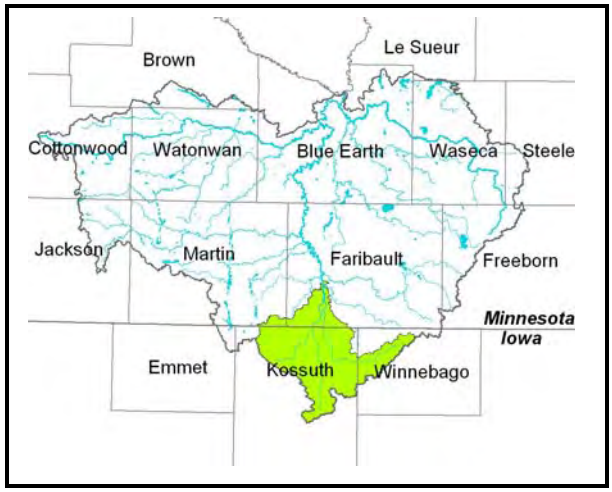


Figure 6.1a – Impaired Reach Watershed

Monitoring Site ID:
Blue Earth River, CSAH 4
(BE_109.1)

Stream Status:
Impaired Stream Reach (1994 Listing)

Impaired Reach Length
5.6 miles

Contributing Watershed Size
205,769 acres
322 square miles

Human Population (2000 Census)
5,413 (2,100 urban and 3,313 rural)

Cities Located in Watershed
Buffalo Center
Elmore
Lakota*
Ledyard*
* Unsewered Community

Livestock (2003 Feedlot Inventory)
67 feedlot facilities
20,336 total animal units

This reach of the Blue Earth River is listed as impaired based on review of 17 samples collected on the river between 1997 and 1998. The reach was first listed as impaired in 1994 based on samples collected during the late 1980's and early 1990's. The site was monitored extensively by the MPCA during the 1960's, 1970's and 1990's. The reach is 5.6 miles in length. Based on the data collected between 1995 through 2004, the reach exceeded standards during the month of May.

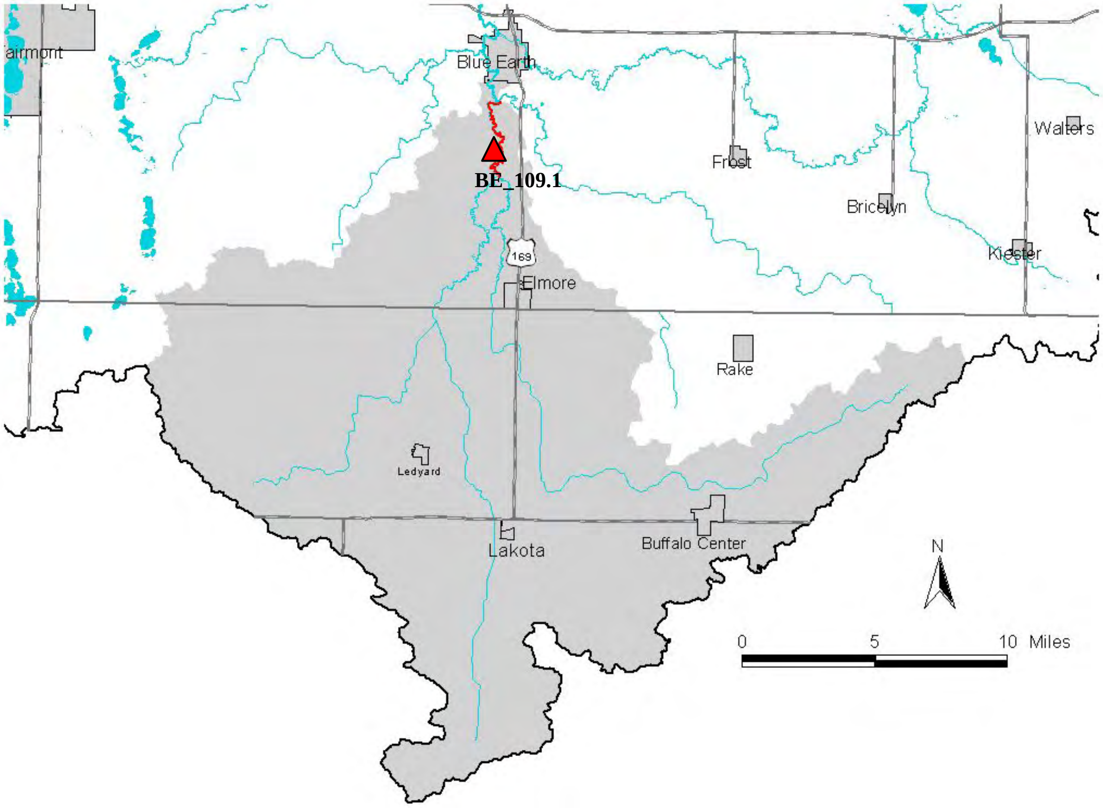
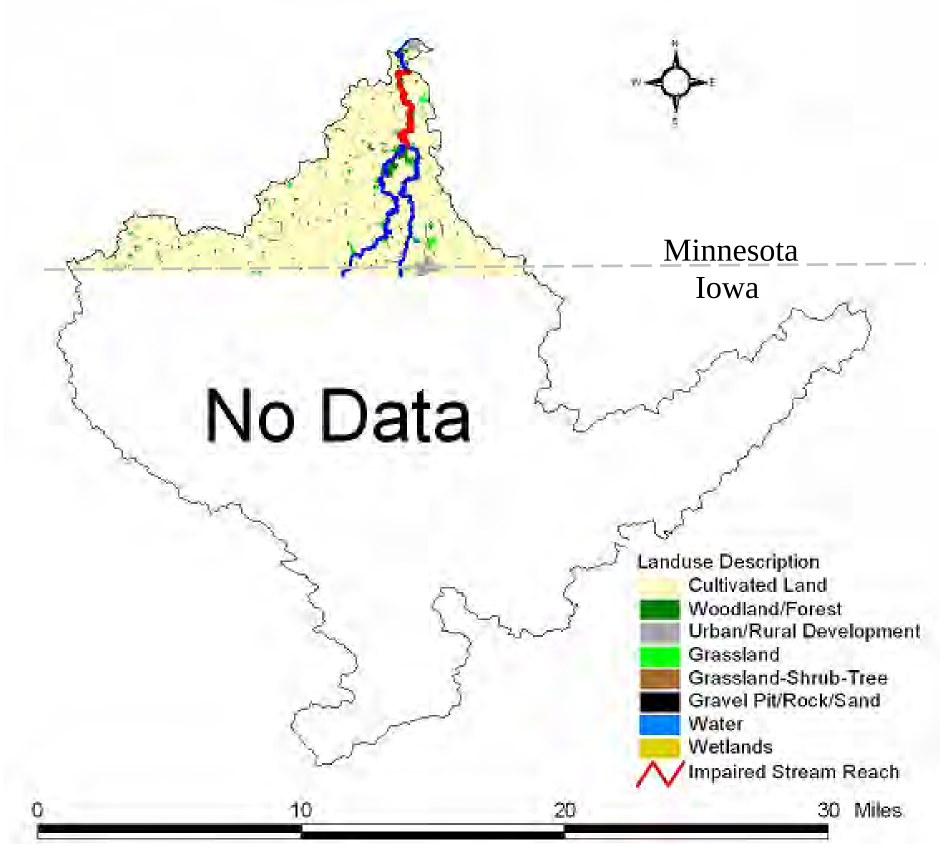


Figure 6.1b - BE River; West Branch Blue Earth River to Coon Creek Watershed

The impaired watershed encompasses the 322 square miles across Emmet, Kossuth and Winnebago counties in Iowa and Faribault and Martin counties in Minnesota. The watershed has a human population of 5,413, with 61% living in rural areas. The watershed has an estimated 67 feedlots with 20,336 livestock animal units. Landuse in the watershed is 89.4% cultivated land, followed by grassland at 8.0% and woodland at 1.0%.

There are four cities located in the watershed, Buffalo Center, Lakota, Ledyard in Iowa and Elmore in Minnesota. Lakota, population 255 and Ledyard, population 258, are both unsewered incorporated communities.

Based on county estimates, 40% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 545 households.



Landuse Category	Acres	Percent
Cultivated Land	183,879	89.4%
Grass/Shrub/Tree	82	0.0%
Grassland	16,391	8.0%
Gravel Pit/Rock/Sand	130	0.1%
Urban/Rural Development	1,690	0.8%
Water	1,098	0.5%
Wetlands	388	0.2%
Woodland/Forest	2,027	1.0%

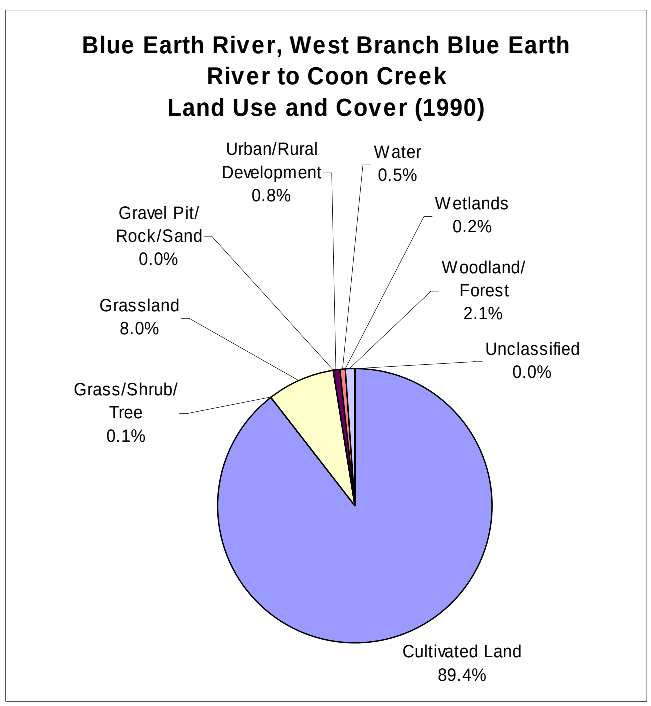


Figure 6.1c – 1990 Landuse and Cover Map and Statistics for Blue Earth River; West Branch Blue Earth River to Coon Creek Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Minnesota Pollution Control Agency
Years Monitored: 1997 & 1998
Samples Collected: 17

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	Inadequate Data
May	32.2%
June	Inadequate Data
July	Inadequate Data
August	Inadequate Data
September	Inadequate Data
October	Inadequate Data

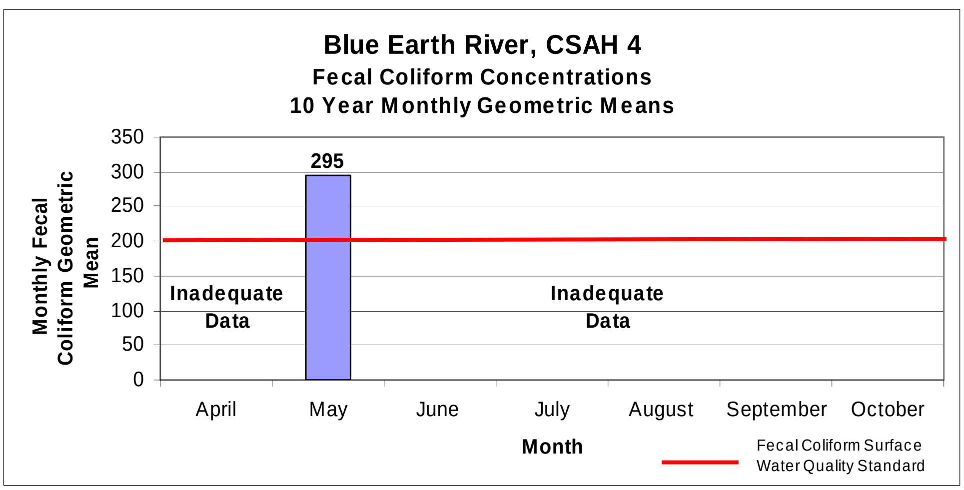


Figure 6.1d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.1a - Human and Animal Population Inventory for Blue Earth River; West Branch Blue Earth River to Coon Creek Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	142		7.20E+10	1.02E+13	ASAE*, 1998
Beef	3,122		1.30E+11	4.06E+14	ASAE, 1998
Swine	16,933		8.00E+10	1.35E+15	ASAE, 1998
Chicken	0		3.40E+10	3.40E+09	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	51		4.20E+08	2.14E+10	ASAE, 1998
Sheep	8		2.00E+11	1.60E+12	ASAE, 1998
Humans		5,413	2.00E+09	1.08E+13	Metcalf and Eddy, 1991
Cats		1,470	5.00E+09	7.35E+12	Horsley and Witten, 1996
Dogs		1,292	5.00E+09	6.46E+12	Horsley and Witten, 1996
Deer		441	5.00E+08	2.21E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		1,432	1.04E+07	1.49E+10	Alderisio and DeLuca, 1999
Wild Turkey		350	9.50E+07	3.33E+10	turkey value used
Pheasants		5,620	1.53E+04	8.60E+07	geese value used
Other Wildlife**				2.21E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

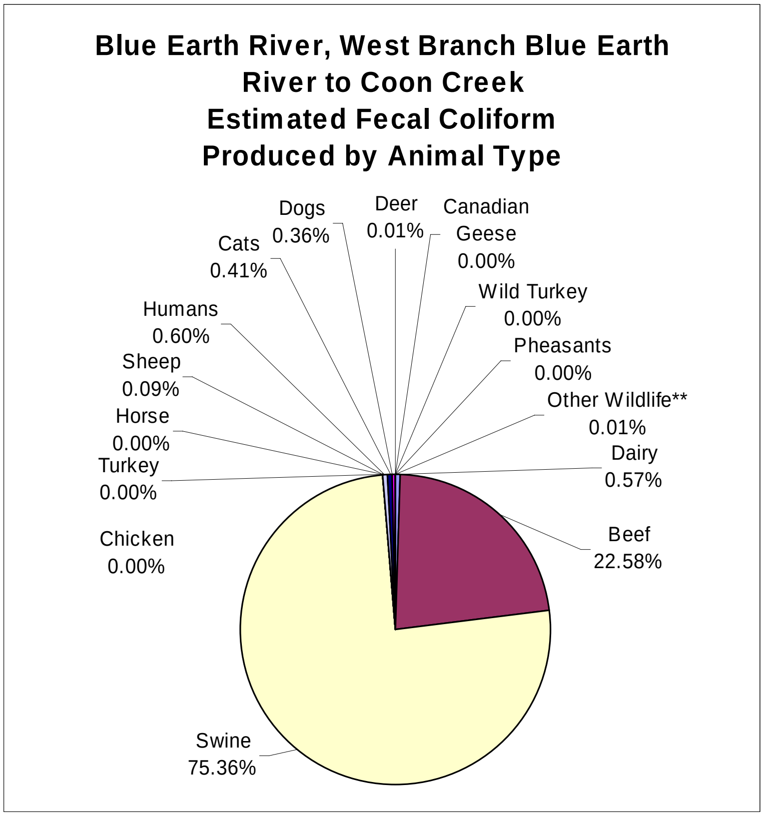


Figure 6.1e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

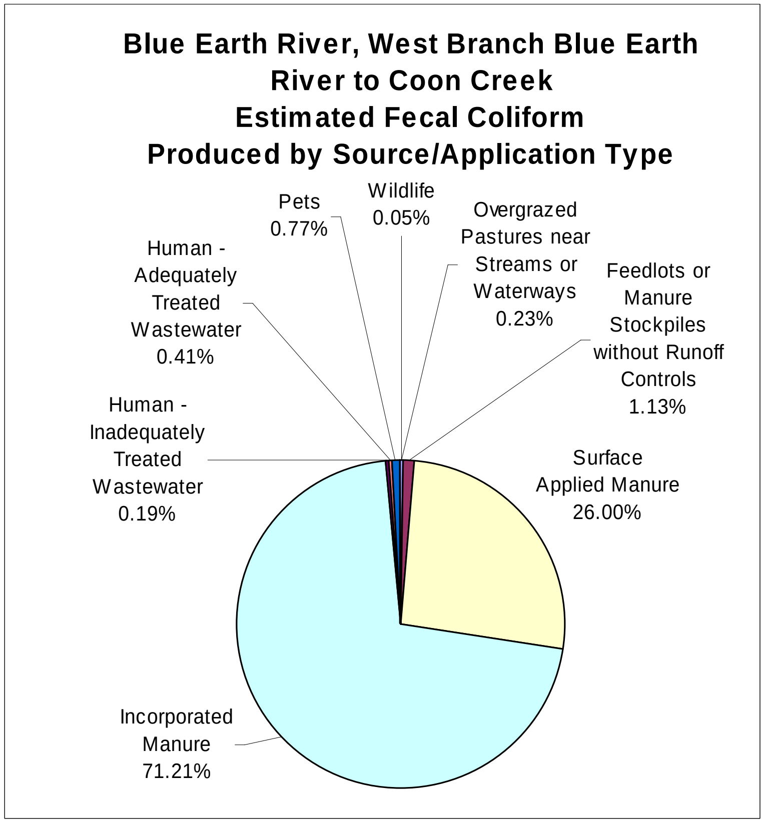


Figure 6.1f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of the Blue Earth River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Cats & Dogs		
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.		

Low Contributor	
Moderate Contributor	
High Contributor	

Figure 6.1g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Blue Earth River; West Branch Blue Earth River to Coon Creek

Fecal Coliform Loading Capacities and Allocations: Blue Earth River; West Branch Blue Earth River to Coon Creek

Table 6.1b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Buffalo Center	IA0047821	0.937	0.213
Elmore	MN0021920	1.451	0.329
Totals		2.388	0.542

Livestock Facilities with NPDES Permits

Refer to appendix C.

Table 6.1c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.1d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Blue Earth River; West Branch Blue Earth River to Coon Creek

Drainage Area (square miles): 322

USGS gage used to develop flow zones and loading capacities:

Blue Earth River, near Rapidan

% MS4 Urban: 0%

Total WWTF Design Flow (mgd): 2.39

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	142.29	47.43	58.40	19.47	28.12	9.37	10.28	3.43	1.51	0.50
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.54	0.18	0.54	0.18	0.54	0.18	0.54	0.18	0.54	0.18
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	111.30	37.10	44.63	14.88	20.84	6.95	5.54	1.85	0.43	0.14
Margin of Safety	30.45	10.15	13.22	4.41	6.74	2.25	4.20	1.40	0.54	0.18
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%		100%		100%		100%		100%	
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.4%		0.9%		1.9%		5.3%		35.9%	
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	78.2%		76.4%		74.1%		53.8%		28.3%	
Margin of Safety	21.4%		22.6%		24.0%		40.9%		35.8%	

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.2 Blue Earth River; Le Sueur River to Minnesota River

Monitoring Site ID:
Blue Earth River, Mankato
(BE_0.7)

Stream Status:
Impaired Stream Reach (1994 Listing)

Impaired Reach Length
3.2 miles

Contributing Watershed Size
2,265,492 acres
3,540 square miles

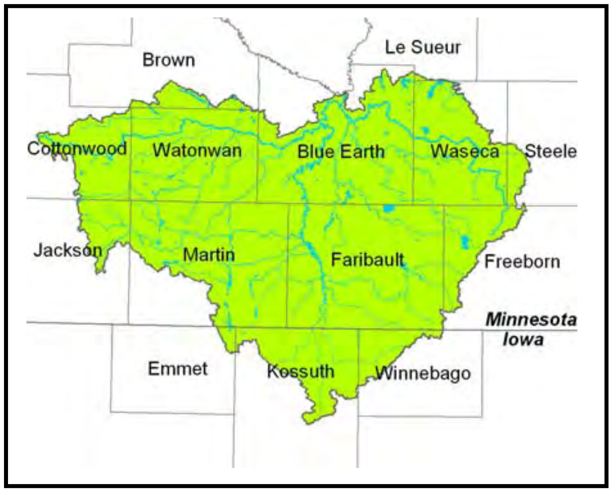


Figure 6.2a – Impaired Reach Watershed

Human Population (2000 Census)
92,202 (55,370 urban and 36,832 rural)

Cities Located in Watershed

Minnesota			**Iowa**
Alden	Hartland	Sherburn*	Buffalo Center
Amboy	Jackson*	Skyline***	Lakota**
Bingham Lake*	Janesville	St. Clair	Ledyard**
Blue Earth	Kiester	St. James	Rake
Bricelyn	La Salle**	Trimont	
Butterfield	Lewisville	Truman	
Darfur	Madelia	Vernon Center	
Delevan	Madison Lake	Waldorf	
Eagle Lake***	Mankato*	Walters**	
Easton****	Mapleton	Waseca*	
Elysian*	Minnesota Lake****	Welcome	
Elmore	Mountain Lake	Wells	
Fairmont	New Richland	Winnebago	
Freeborn	Northrop		
Frost	Odin**		
Good Thunder	Ormsby**		
Granada	Pemberton		

* Waste Water Effluent Discharged Outside Watershed Boundary
** Unsewered Community
*** Waste Water Treated in Mankato, discharged outside of watershed
**** Waste Water Treated in Wells

Livestock (2003 Feedlot Inventory)
2,311 feedlot facilities

706,694 total animal units

The Blue Earth River; Le Sueur River to Minnesota River qualifies as an impaired stream reach based on review of 45 samples collected on the river between 1995 through 2004. The 3.2 mile reach was added to the impaired waters list in 1994. The water quality data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months of June and September.

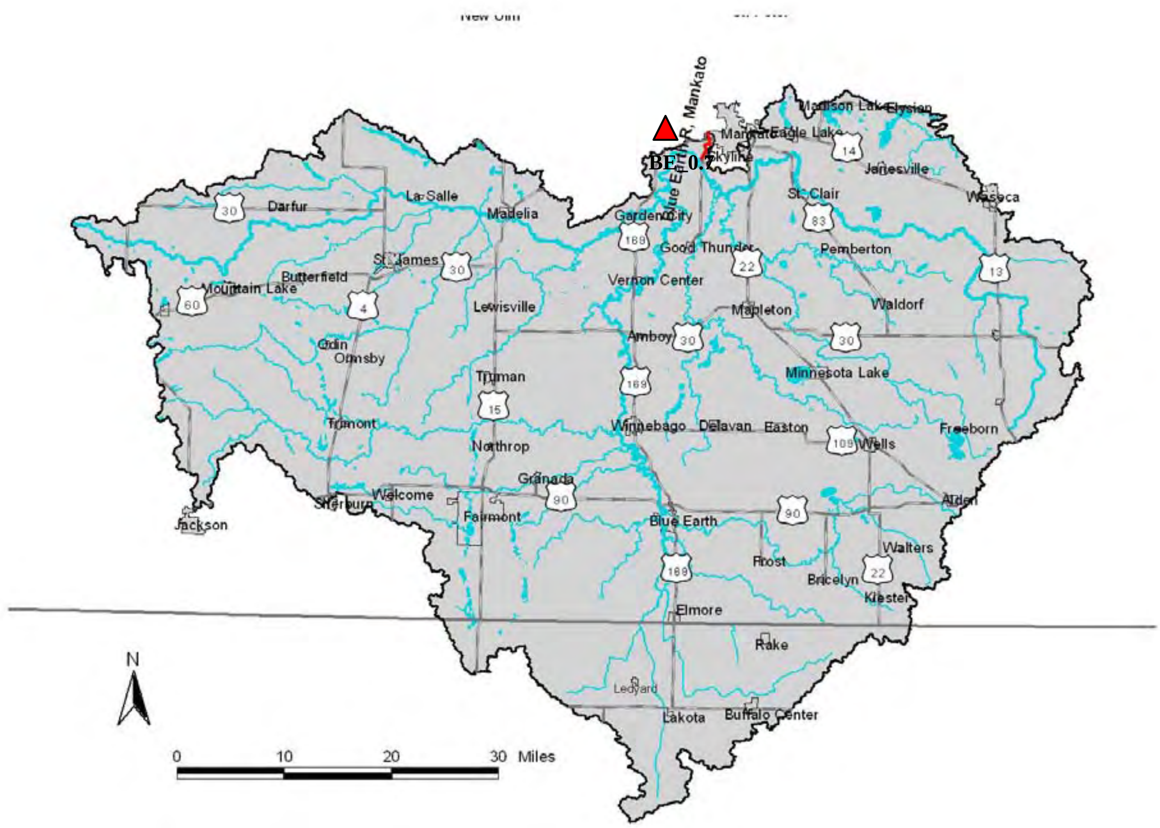
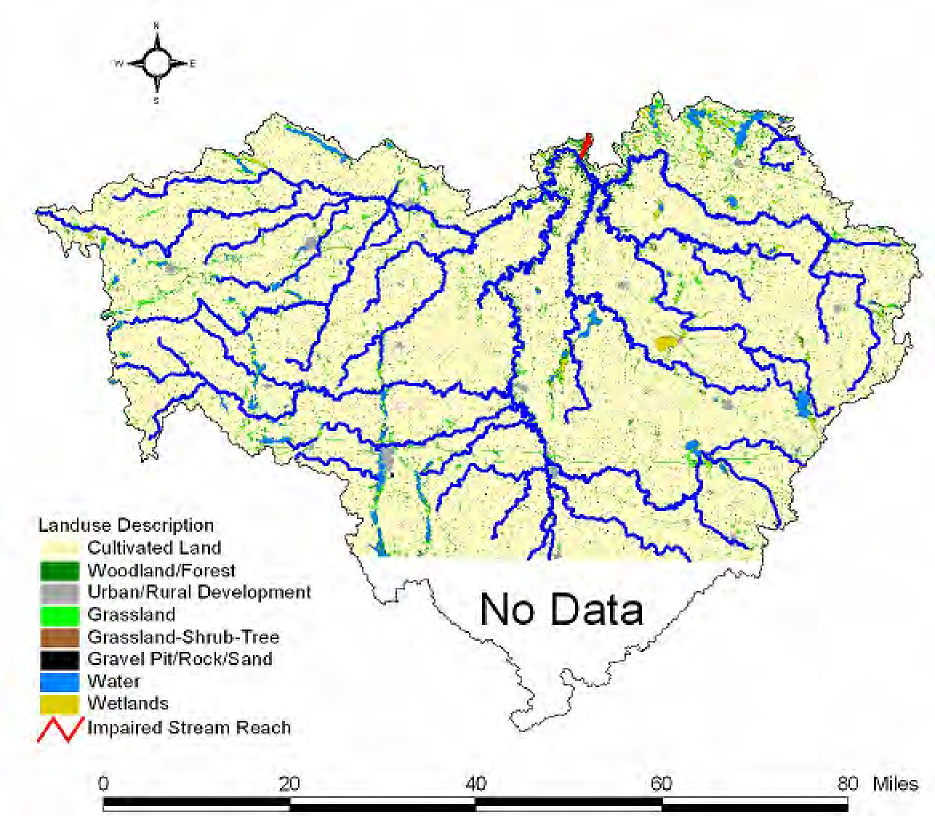


Figure 6.2b - Blue Earth River; Le Sueur River to Minnesota River Watershed

The reach watershed encompasses the entire 3,540 square mile BERB. The Basin includes parts of 11 Minnesota and three Iowa counties. The Basin contains three major watersheds, the Blue Earth, Le Sueur and Watonwan. The impaired reach extends from the mouth of the Blue Earth River in Mankato, up to the mouth of the Le Sueur River. The Basin has a human population of 55,370, with 40% living in rural areas. The Basin has an estimated 2,311 feedlots with 706,694 livestock animal units. The Basin is 88.0% cultivated land, followed by grassland at 4.2% and woodland at 3.5%.

There are 51 cities located in the Basin, 47 in Minnesota and four in Iowa. There are 938 individuals living in six incorporated unsewered communities; Lakota, Lasalle, Ledyard, Odin, Ormsby and Walters. Lasalle is currently in the process of developing a waste water treatment system, that is expected to be under construction in 2006. There are an estimated 1,532 individuals living in 22 unincorporated unsewered communities in the Basin, with Rapidan Town (250) and Garden City (230) being the largest. Fairmont, Mankato and Waseca are cities in the Basin requiring MS4 stormwater permits. As such, they are required to have stormwater management plans. Based on county estimates, 39% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 5,900 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	1,992,767	88.0%
Grass/Shrub/Tree	1,845	0.1%
Grassland	94,593	4.2%
Gravel Pit/Rock/Sand	1,104	0.0%
Urban/Rural Development	49,497	2.2%
Water	30,593	1.4%
Wetlands	14,828	0.7%
Woodland/Forest	79,837	3.5%

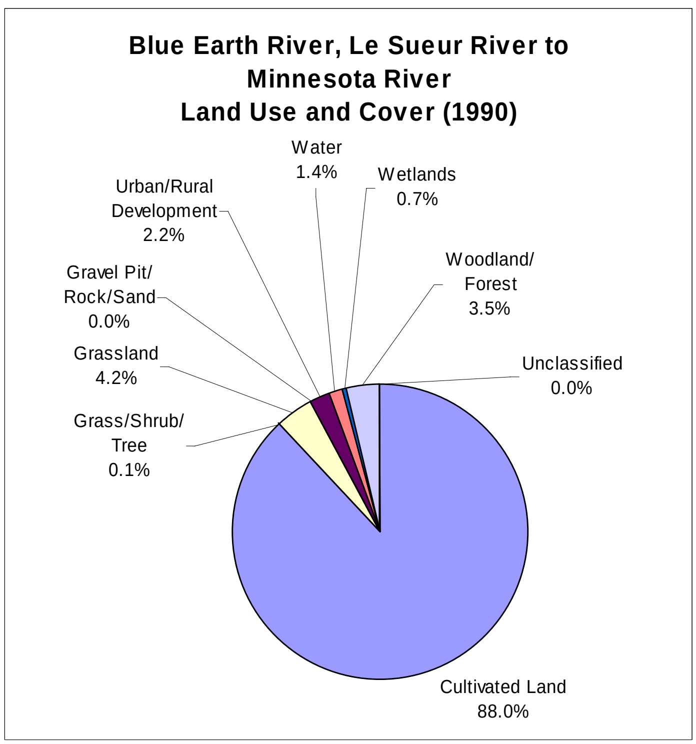


Figure 6.2c – 1990 Landuse and Cover Map and Statistics for Blue Earth River; Le Sueur River to Minnesota River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: MPCA, Milestone Monitoring Program
Years Monitored: 1995 through 2004
Samples Collected: 45

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	Inadequate Data
May	None Required
June	51.5%
July	None Required
August	None Required
September	18.0%
October	Inadequate Data

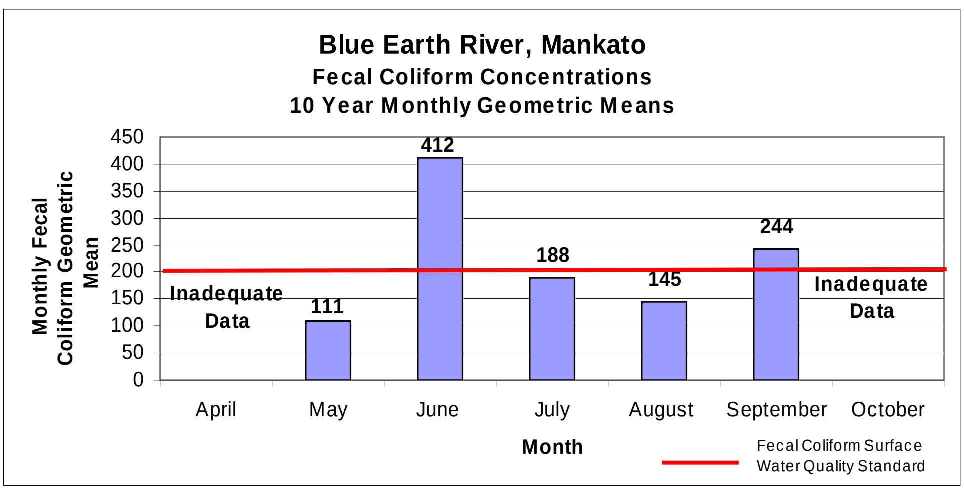


Figure 6.2d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.2a - Human and Animal Population Inventory for Blue Earth River; Le Sueur River to Minnesota River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	39,282		7.20E+10	2.83E+15	ASAE*, 1998
Beef	92,456		1.30E+11	1.20E+16	ASAE, 1998
Swine	554,339		8.00E+10	4.43E+16	ASAE, 1998
Chicken	7,903		3.40E+10	2.69E+14	ASAE, 1998
Turkey	9,834		6.20E+09	6.10E+13	ASAE, 1998
Horse	800		4.20E+08	3.36E+11	ASAE, 1998
Sheep	1,397		2.00E+11	2.79E+14	ASAE, 1998
Humans		92,202	2.00E+09	1.84E+14	Metcalf and Eddy, 1991
Cats		25,043	5.00E+09	1.25E+14	Horsley and Witten, 1996
Dogs		22,007	5.00E+09	1.10E+14	Horsley and Witten, 1996
Deer		12,744	5.00E+08	6.37E+12	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		15,771	1.04E+07	1.64E+11	Alderisio and DeLuca, 1999
Wild Turkey		3,859	9.50E+07	3.67E+11	turkey value used
Pheasants		100,000	1.53E+04	1.53E+09	geese value used
Other Wildlife**				6.37E+12	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

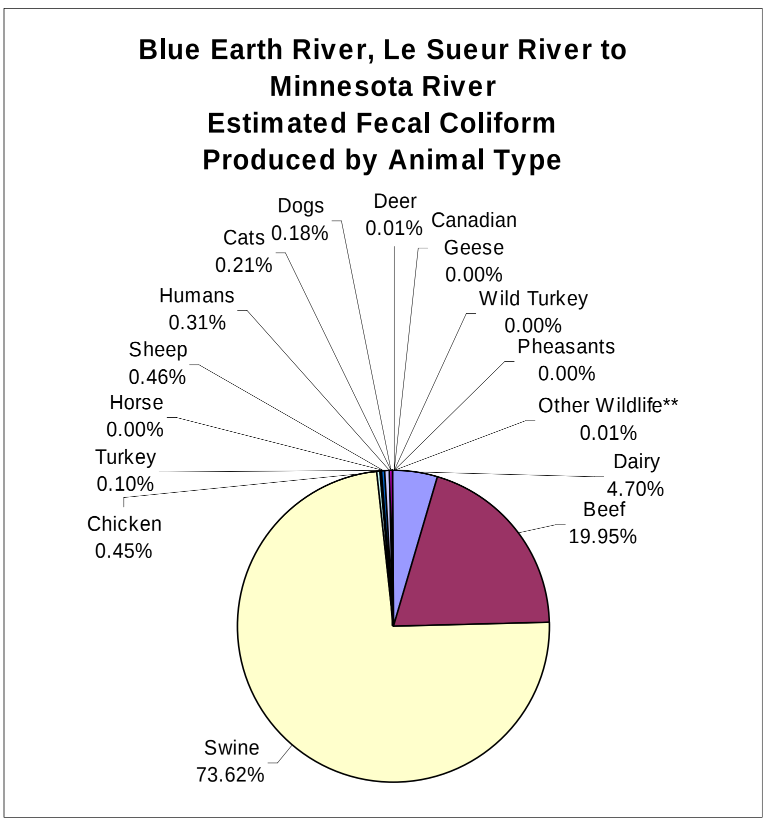


Figure 6.2e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

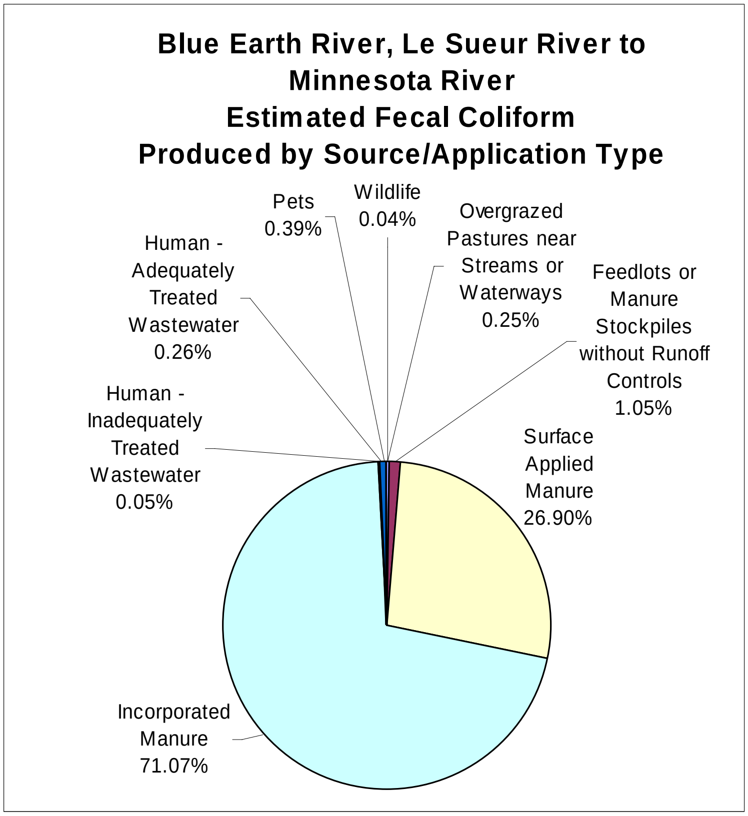


Figure 6.2f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of the Blue Earth River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low	High
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate	Low
	Surface Applied Manure	High	Low
	Incorporated Manure	Moderate	Low
Human	Human - Inadequately Treated Wastewater	Low	High
Pets	Cats & Dogs	Low	Low
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low	Low

Low Contributor	
Moderate Contributor	
High Contributor	

Figure 6.2g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Blue Earth River; Le Sueur River to Minnesota River

Fecal Coliform Loading Capacities and Allocations: Blue Earth River; Le Sueur River to Minnesota River

Table 6.2b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Alden	MN0020605	1.239	0.281
Amboy	MN0022624	0.287	0.065
Blue Earth	MN0020532	0.981	0.223
Bricelyn	MN0022918	0.466	0.106
Buffalo Center	IA0047821	0.937	0.213
Butterfield	MN0022977	1.060	0.241
Darfur	county permitted	0.010	0.002
Delavan	MN0066095	0.408	0.093
Elmore	MN0021920	1.451	0.329
Fairmont	MN0030112	3.900	0.886
Freeborn	MNG580018	0.245	0.056
Frost	MN0064432	0.393	0.089
Good Thunder	MN0020851	0.709	0.161
Granada	MNG580023	0.362	0.082
Hartland	MN0049174	0.396	0.090
Janesville	MNG580025	1.304	0.296
Kiester	MN0039721	1.917	0.435
Lewisville	MN0065722	0.039	0.009
Madelia	MN0024040	1.310	0.298
Madison Lake	MN0040789	0.130	0.030
Mapleton	MN0021172	3.651	0.829
Mountain Lake	MNG580035	2.168	0.492
New Richland	MN0021032	0.600	0.136
Northrop	MN0024384	0.456	0.104
Pemberton	MNG580075	0.652	0.148
Rake	IA0062804	0.538	0.122
St. Clair	MN0024716	0.212	0.048
St. James	MN0024759	2.960	0.672
Trimont	MN0022071	0.351	0.080
Truman	MN0021652	0.780	0.177
Vernon Center	MN0030490	0.036	0.008
Waldorf	MN0021849	0.096	0.022
Welcome	MN0021296	0.260	0.059
Wells/Easton	MN0025224	15.567	3.535
Winnebago	MN0025267	1.700	0.386
Totals		47.568	10.803

Livestock Facilities with NPDES Permits

Refer to appendix C.

Table 6.2c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
Fairmont	10,889	Designated by rule; >10,000 population
Mankato	3,560	Designated by rule; >10,000 population
Waseca	2,274	Designated by rule; >5,000 population

Table 6.2d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Blue Earth River; Le Sueur River to Minnesota River

Drainage Area (square miles): 3,540

USGS gage used to develop flow zones and loading capacities:

Blue Earth River, near Rapidan and Le Sueur River, near Rapidan

	Flow Zone									
% MS4 Urban: 0.53%	High		Moist		Mid		Dry		Low	
Total WWTF Design Flow (mgd): 47.57	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	1595.19	531.73	682.16	227.39	330.37	110.12	107.54	35.85	15.83	5.28
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	10.80	3.60	10.80	3.60	10.80	3.60	10.80	3.60	*	*
Communities Subject to MS4 NPDES Requirements	6.69	2.23	2.77	0.92	1.25	0.42	0.28	0.09	*	*
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	1244.29	414.76	514.78	171.59	232.01	77.34	52.74	17.58	*	*
Margin of Safety	333.40	111.13	153.81	51.27	86.31	28.77	43.71	14.57	na	na
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%		100%		100%		100%		100%	
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.7%		1.6%		3.3%		10.0%		*	
Communities Subject to MS4 NPDES Requirements	0.4%		0.4%		0.4%		0.3%		*	
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	78.0%		75.5%		70.2%		49.0%		*	
Margin of Safety	20.9%		22.5%		26.1%		40.6%		na	

*Note - WWTF design/discharge flow exceeded low flow

alllocation = (flow contribution from a given source) X (200 orgs./100ml.), see section 5.0 for details

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.3 Cedar Creek; T104 R33W S6 West Line to Cedar Lake

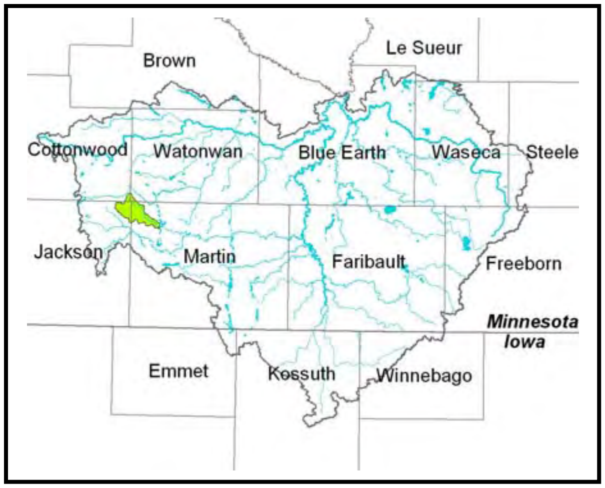


Figure 6.3a – Impaired Reach Watershed

Monitoring Site ID:
Cedar Creek; CSAH 9
(CEC_12.3)

Stream Status:
Impaired Stream Reach (2006 Listing)

Impaired Reach Length
10.0 miles

Contributing Watershed Size
15,137 acres
24 square miles

Human Population (2000 Census)
91 (100% rural)

Cities Located in Watershed
None

Livestock (2003 feedlot inventory)
8 Feedlot Facilities
1,744 total animal units

This impaired portion of the Cedar Creek watershed qualifies as an impaired stream reach based on review of 28 samples collected on the river between 2000 through 2002. The monitoring data used to assess the river as impaired was collected as part of the Center and Elm Creek Clean Water Partnership. This data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months June, July and August (the only months with monitoring data). The reach, which is 10 miles in length, was added to the impaired waters list in 2006.

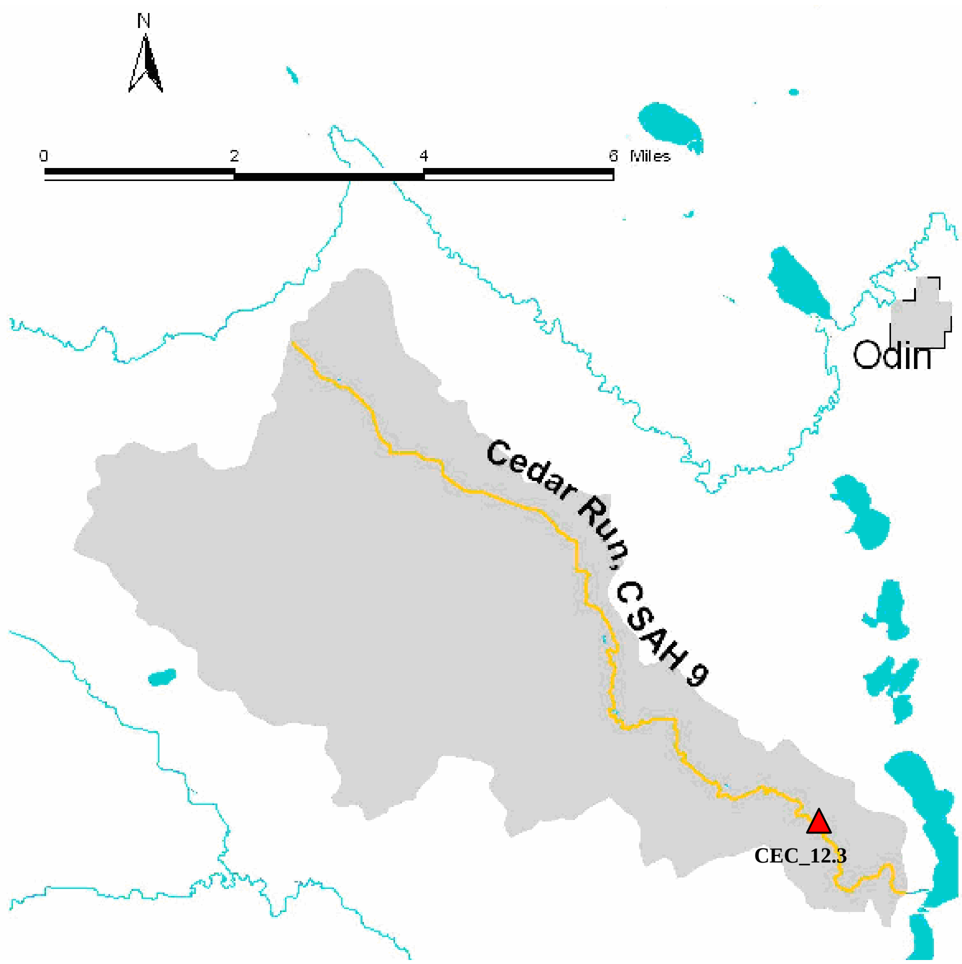
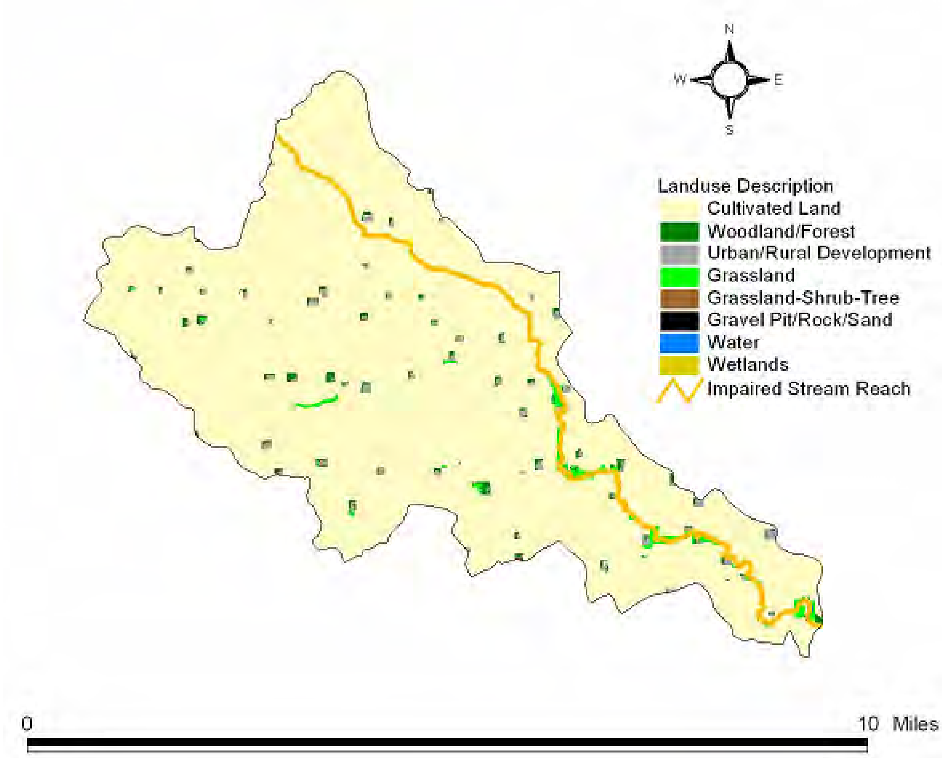


Figure 6.3b - Cedar Creek; T104 R33W S6 West Line to Cedar Lake Watershed

The impaired portion of the Cedar Creek watershed encompasses 24 square miles in portions of four counties, Cottonwood, Jackson, Martin and Watonwan. The watershed has a human population of 91, with 100% living in rural areas. The watershed also contains an estimated 8 feedlots with 1,744 livestock animal units. The watershed is 96.1% cultivated land, followed by grassland at 1.7% and rural development (homesteads) at 1.2%.

There are no communities in the watershed. Based on county estimates, 45% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 17 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	14,541	96.1%
Grass/Shrub/Tree	0	0.0%
Grassland	251	1.7%
Gravel Pit/Rock/Sand	0	0.0%
Urban/Rural Development	188	1.2%
Water	3	0.0%
Wetlands	0	0.0%
Woodland/Forest	155	1.0%

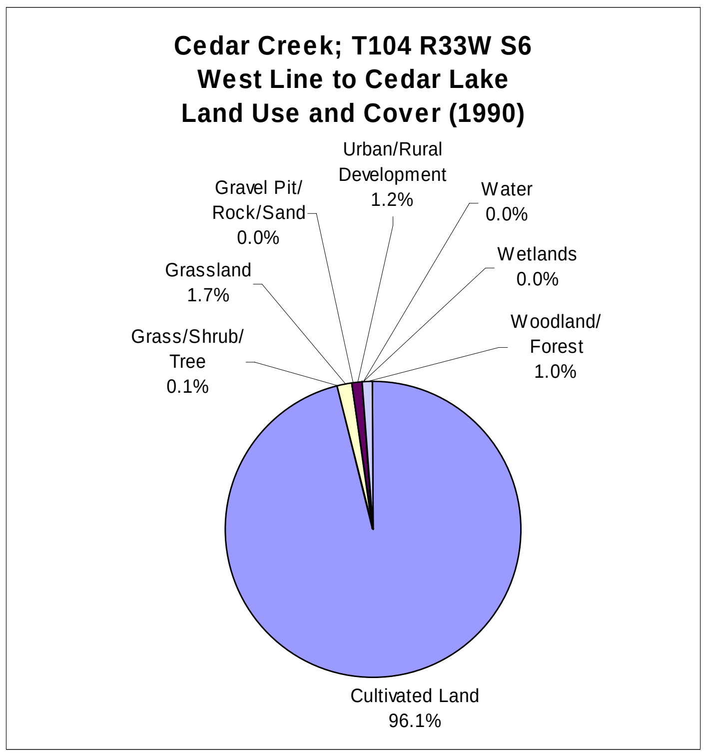


Figure 6.3c – 1990 Landuse and Cover Map and Statistics for Cedar Creek; T104 R33W S6 West Line to Cedar Lake Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Center and Elm Clean Water Partnership
Years Monitored: 2000 through 2002
Samples Collected: 28

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	Inadequate Data
May	Inadequate Data
June	20.6%
July	87.5%
August	90.0%
September	Inadequate Data
October	Inadequate Data

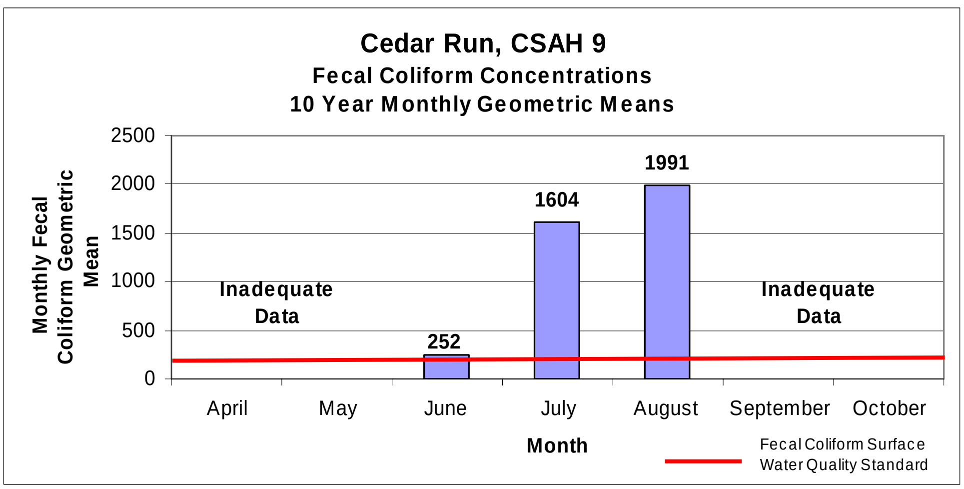


Figure 6.3d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.3a - Human and Animal Population Inventory for Cedar Creek; T104 R33W S6 West Line to Cedar Lake Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	0		7.20E+10	0.00E+00	ASAE*, 1998
Beef	390		1.30E+11	5.07E+13	ASAE, 1998
Swine	1,342		8.00E+10	1.07E+14	ASAE, 1998
Chicken	0		3.40E+10	0.00E+00	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	10		4.20E+08	4.20E+09	ASAE, 1998
Sheep	0		2.00E+11	0.00E+00	ASAE, 1998
Humans		91	2.00E+09	1.82E+11	Metcalf and Eddy, 1991
Cats		25	5.00E+09	1.25E+11	Horsley and Witten, 1996
Dogs		22	5.00E+09	1.10E+11	Horsley and Witten, 1996
Deer		85	5.00E+08	4.25E+10	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		105	1.04E+07	1.09E+09	Alderisio and DeLuca, 1999
Wild Turkey		26	9.50E+07	2.47E+09	turkey value used
Pheasants		1,086	1.53E+04	1.66E+07	geese value used
Other Wildlife**				4.25E+10	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

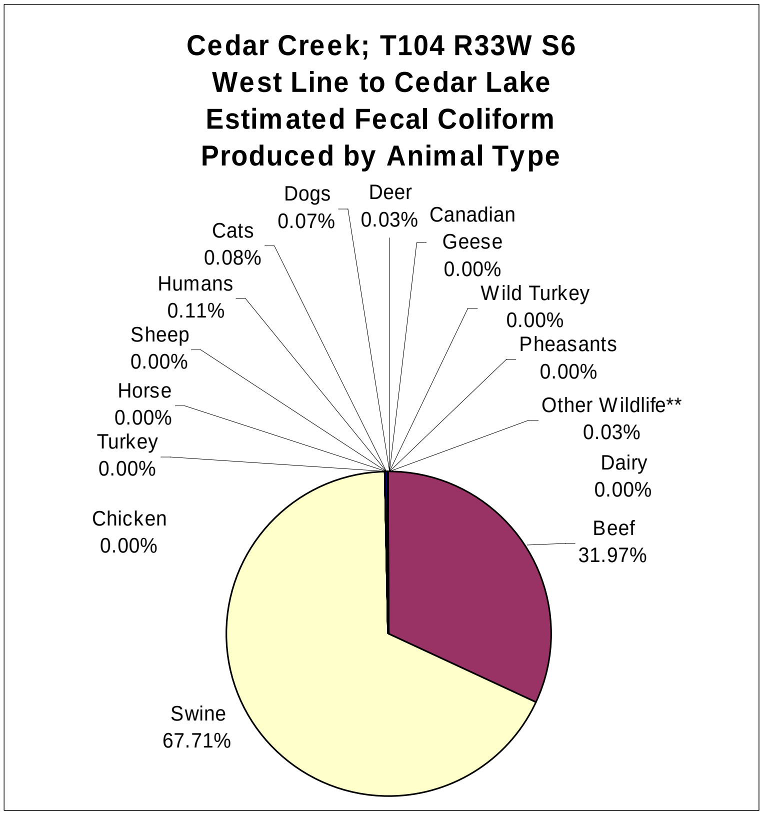


Figure 6.3e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

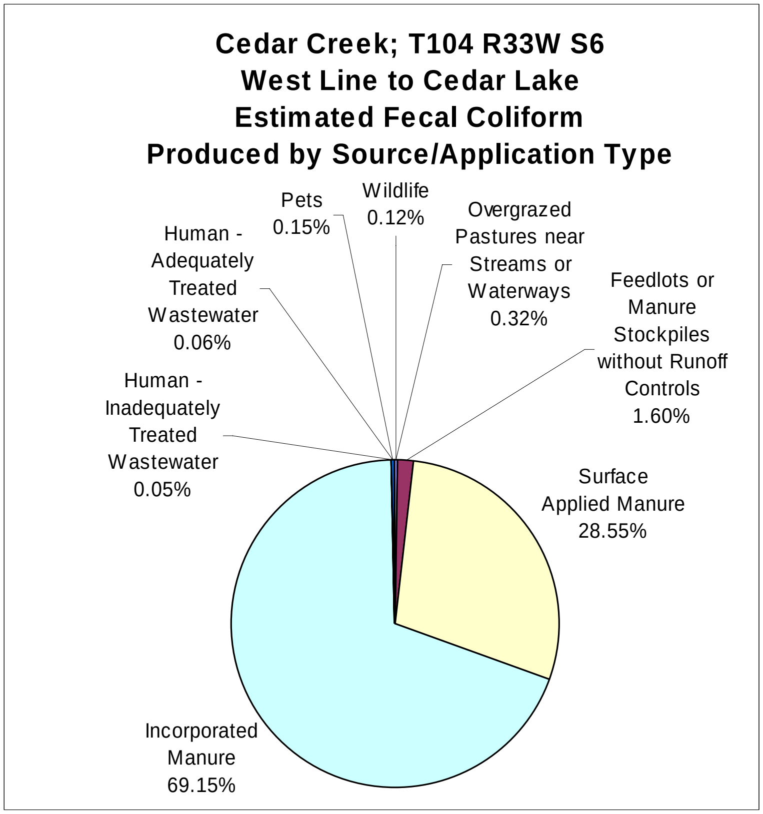


Figure 6.3f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of Cedar Cr.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Cats & Dogs		
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.		

Low Contributor
Moderate Contributor
High Contributor

Figure 6.3g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Cedar Creek; T104 R33W S6 West Line to Cedar Lake

Fecal Coliform Loading Capacities and Allocations Cedar Creek; T104 R33W S6 West Line to Cedar Lake

Table 6.3b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
None			
Totals		0.000	0.000

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 6.3c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.3d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Cedar Creek; T104 R33W S6 West Line to Cedar Lake

Drainage Area (square miles): 24										
USGS gage used to develop flow zones and loading capacities:										
Blue Earth River, near Rapidan										
% MS4 Urban: 0%	Flow Zone									
Total WWTF Design Flow (mgd): 0.00	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	10.47	3.49	4.30	1.43	2.07	0.69	0.76	0.25	0.11	0.04
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	8.23	2.74	3.32	1.11	1.57	0.52	0.45	0.15	0.07	0.02
Margin of Safety	2.24	0.75	0.97	0.32	0.50	0.17	0.31	0.10	0.04	0.01
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / 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	78.6%		77.4%		76.0%		59.1%		64.2%	
Margin of Safety	21.4%		22.6%		24.0%		40.9%		35.8%	

<u>Daily Loading Capacity and Allocations</u>

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.4 Cedar Creek; Cedar Creek to Elm Creek

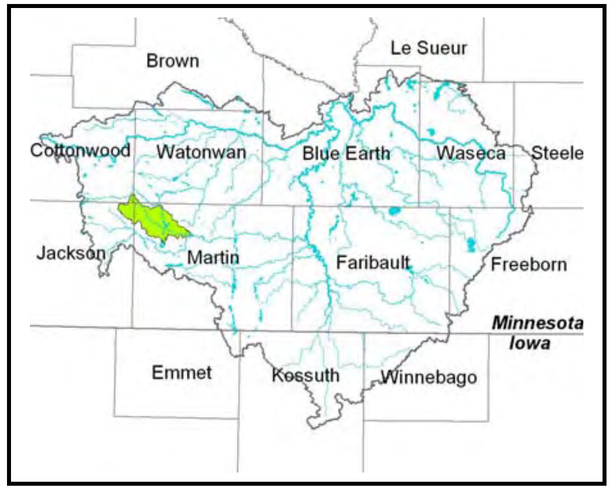


Figure 6.4a – Impaired Reach Watershed

Monitoring Site ID:
Cedar Creek; S34/35
(CEC_2.4)

Stream Status:
Impaired Stream Reach (2006 Listing)

Impaired Reach Length
7.3 miles

Contributing Watershed Size
33,858 acres
53 square miles

Human Population (2000 Census)
623 (397 urban and 226 rural)

Cities Located in Watershed
Trimont

Livestock (2003 feedlot inventory)
36 Feedlot Facilities
9,291 total animal units

This impaired portion of the Cedar Creek watershed qualifies as an impaired stream reach based on review of 40 samples collected on the river between 2000 through 2002. The monitoring data used to assess the river as impaired was collected as part of the Center and Elm Creek Clean Water Partnership. The data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months June, July and August (the only months with monitoring data). The reach, which is 7.3 miles in length, was added to the impaired waters list in 2006.

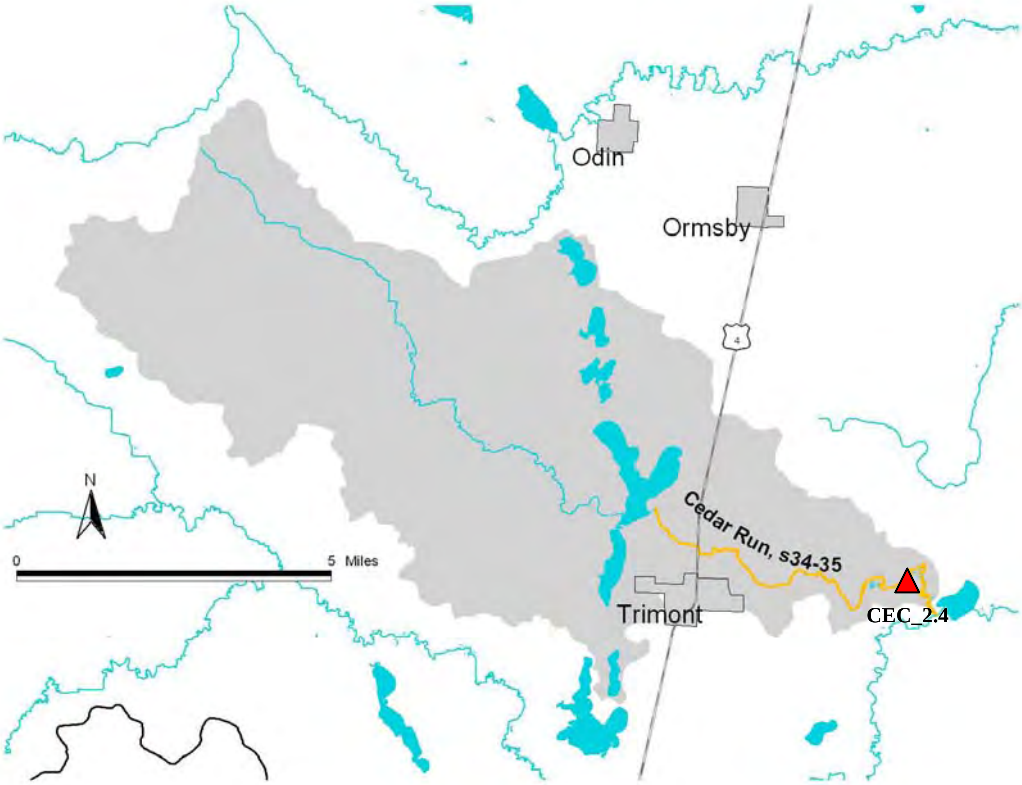


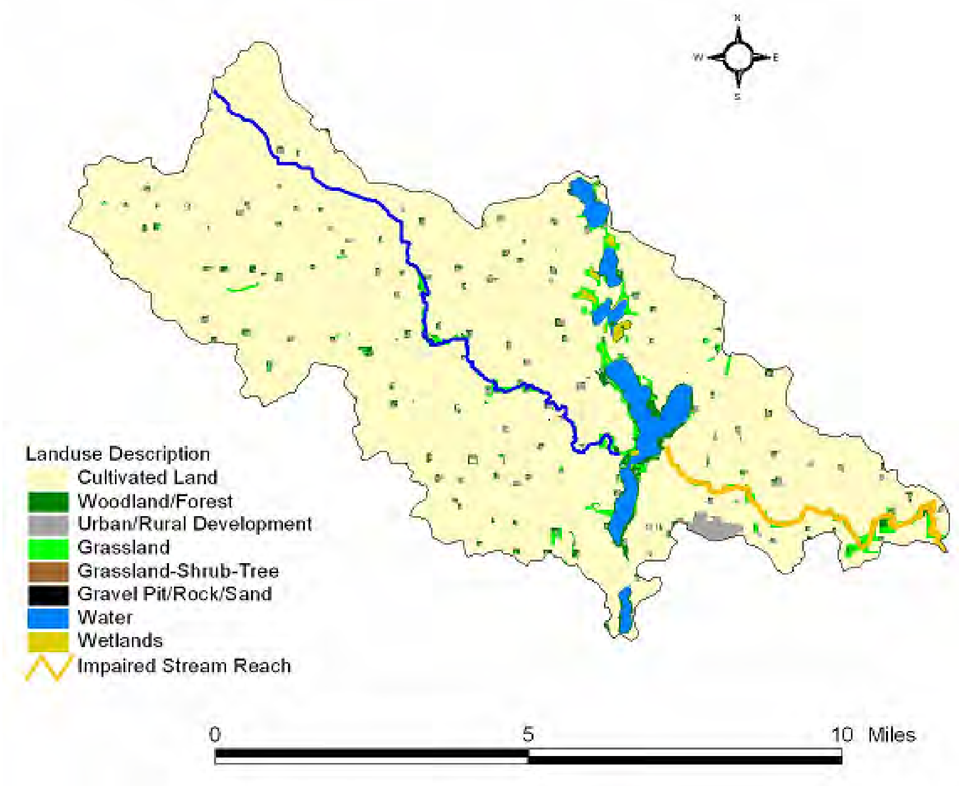
Figure 6.4b - Cedar Creek; Cedar Creek to Elm Creek Watershed

The impaired portion of the Cedar Creek watershed encompasses 53 square miles in portions of four counties, Cottonwood, Jackson, Martin and Watonwan. The watershed has a human population of 623, with 36% living in rural areas. The watershed also contains an estimated 36 feedlots with 9,261 livestock animal units. The watershed is 89.9% cultivated land, followed by water at 3.2% and grassland at 2.5%.

There is one community in the watershed, Trimont, with an estimated population of 397. The creek passes directly through Cedar Lake, which is located near the middle of the watershed.

Based on county estimates, 36% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 35 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	30,430	89.9%
Grass/Shrub/Tree	24.9	0.1%
Grassland	862	2.5%
Gravel Pit/Rock/Sand	0	0.0%
Urban/Rural Development	616	1.8%
Water	1,098	3.2%
Wetlands	90.7	0.3%
Woodland/Forest	737	2.2%

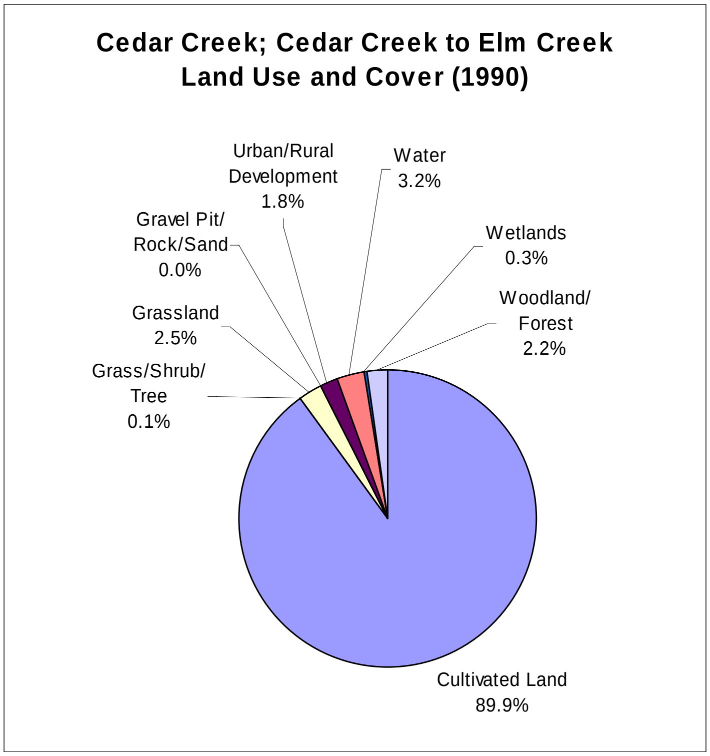


Figure 6.4c – 1990 Landuse and Cover Map and Statistics for Cedar Creek; Cedar Creek to Elm Creek Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Center and Elm Clean Water Partnership
Years Monitored: 2000 through 2002
Samples Collected: 40

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	Inadequate Data
May	Inadequate Data
June	66.4%
July	91.6%
August	91.6%
September	Inadequate Data
October	Inadequate Data

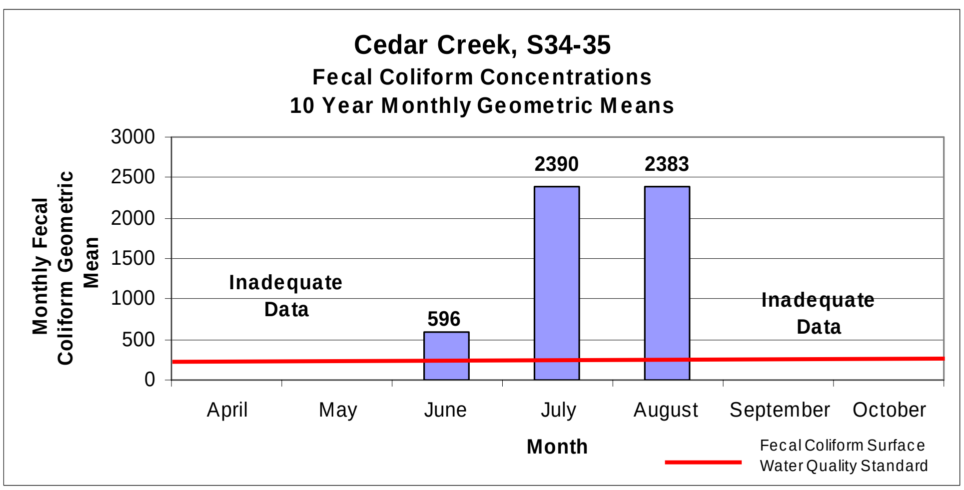


Figure 6.4d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.4a - Human and Animal Population Inventory Cedar Creek; Cedar Creek to Elm Creek Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	0		7.20E+10	0.00E+00	ASAE*, 1998
Beef	4,330		1.30E+11	5.63E+14	ASAE, 1998
Swine	4,834		8.00E+10	3.87E+14	ASAE, 1998
Chicken	0		3.40E+10	0.00E+00	ASAE, 1998
Turkey	3		6.20E+09	1.86E+10	ASAE, 1998
Horse	16		4.20E+08	6.72E+09	ASAE, 1998
Sheep	101		2.00E+11	2.02E+13	ASAE, 1998
Humans		623	2.00E+09	1.25E+12	Metcalf and Eddy, 1991
Cats		169	5.00E+09	8.45E+11	Horsley and Witten, 1996
Dogs		149	5.00E+09	7.45E+11	Horsley and Witten, 1996
Deer		190	5.00E+08	9.50E+10	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		236	1.04E+07	2.45E+09	Alderisio and DeLuca, 1999
Wild Turkey		58	9.50E+07	5.51E+09	turkey value used
Pheasants		2,428	1.53E+04	3.71E+07	geese value used
Other Wildlife**				9.50E+10	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

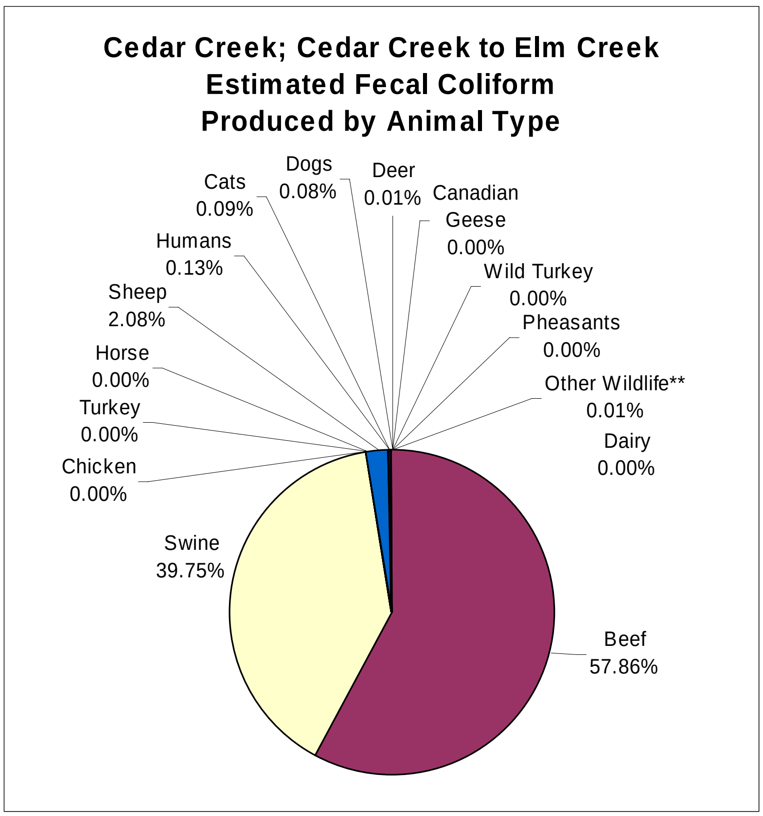


Figure 6.4e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

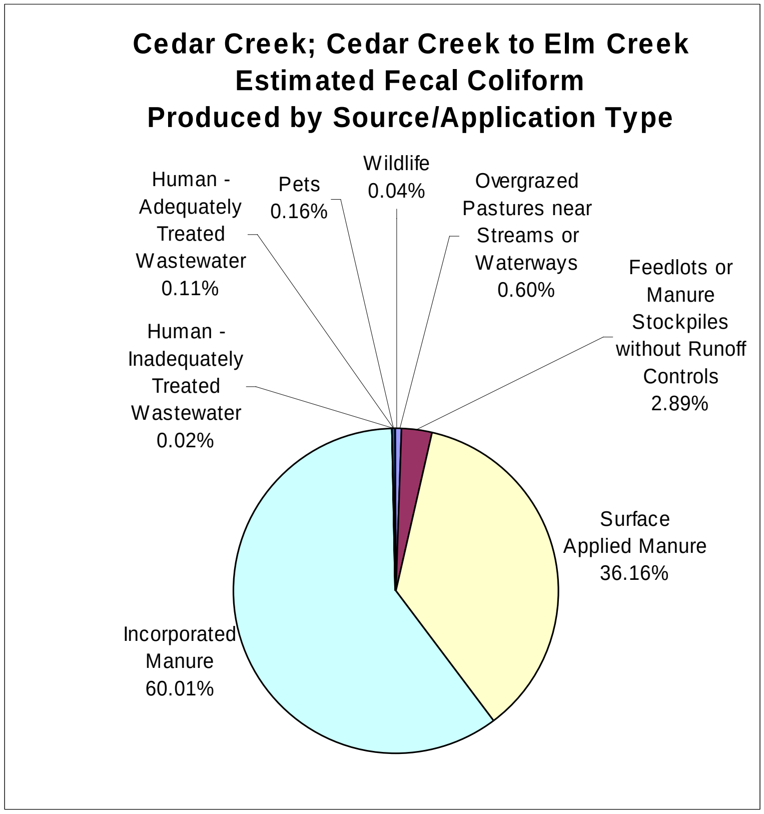


Figure 6.4f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of Cedar Cr.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Cats & Dogs		
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.		

Low Contributor	
Moderate Contributor	
High Contributor	

Figure 6.4g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Cedar Creek; Cedar Creek to Elm Creek

Fecal Coliform Loading Capacities and Allocations: Cedar Creek; Cedar Creek to Elm Creek

Table 6.4b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Trimont	MN0022071	0.351	0.080
Totals		0.351	0.080

Livestock Facilities with NPDES Permits

Refer to appendix C.

Table 6.4c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.4d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Cedar Creek; Cedar Creek to Elm Creek

Drainage Area (square miles): 53										
USGS gage used to develop flow zones and loading capacities:										
Blue Earth River, near Rapidan										
% MS4 Urban: 0%	Flow Zone									
Total WWTF Design Flow (mgd): 0.35	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	23.41	7.80	9.61	3.20	4.63	1.54	1.69	0.56	0.25	0.08
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03	0.08	0.03
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	18.32	6.11	7.35	2.45	3.44	1.15	0.92	0.31	0.08	0.03
Margin of Safety	5.01	1.67	2.18	0.73	1.11	0.37	0.69	0.23	0.09	0.03
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%		100%		100%		100%		100%	
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.3%		0.8%		1.7%		4.7%		32.1%	
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	78.3%		76.5%		74.3%		54.4%		32.1%	
Margin of Safety	21.4%		22.6%		24.0%		40.9%		35.8%	

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.5 Center Creek; George Lake to Lily Creek

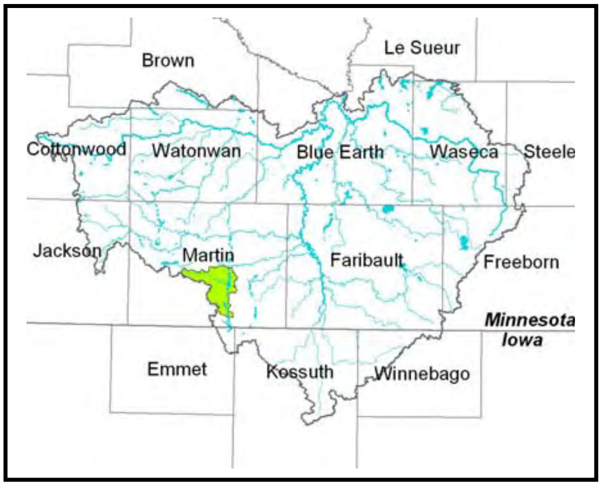


Figure 6.5a – Impaired Reach Watershed

Monitoring Site ID:
 Center Creek, George Lake
 (CC_29.9)

Stream Status:
 Impaired Stream Reach (2006 Listing)

Impaired Reach Length
 0.8 mile

Contributing Watershed Size
 31,191 acres
 49 square miles

Human Population (2000 Census)
 7,652 (7,227 urban and 425 rural)

Cities Located in Watershed
 Fairmont*
 Welcome*
 * Waste Water Effluent Discharged Outside Watershed Boundary

Livestock (2003 feedlot inventory)
 28 Feedlot Facilities
 7,517 total animal units

This portion of Center Creek qualifies as an impaired stream reach based on review of 28 samples collected on the river between 2000 through 2001. The monitoring data used to assess the river as impaired was collected as part of the Center and Elm Creek Clean Water Partnership. The data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the month of August. The reach, which is 0.8 mile in length, was added to the impaired waters list in 2006.

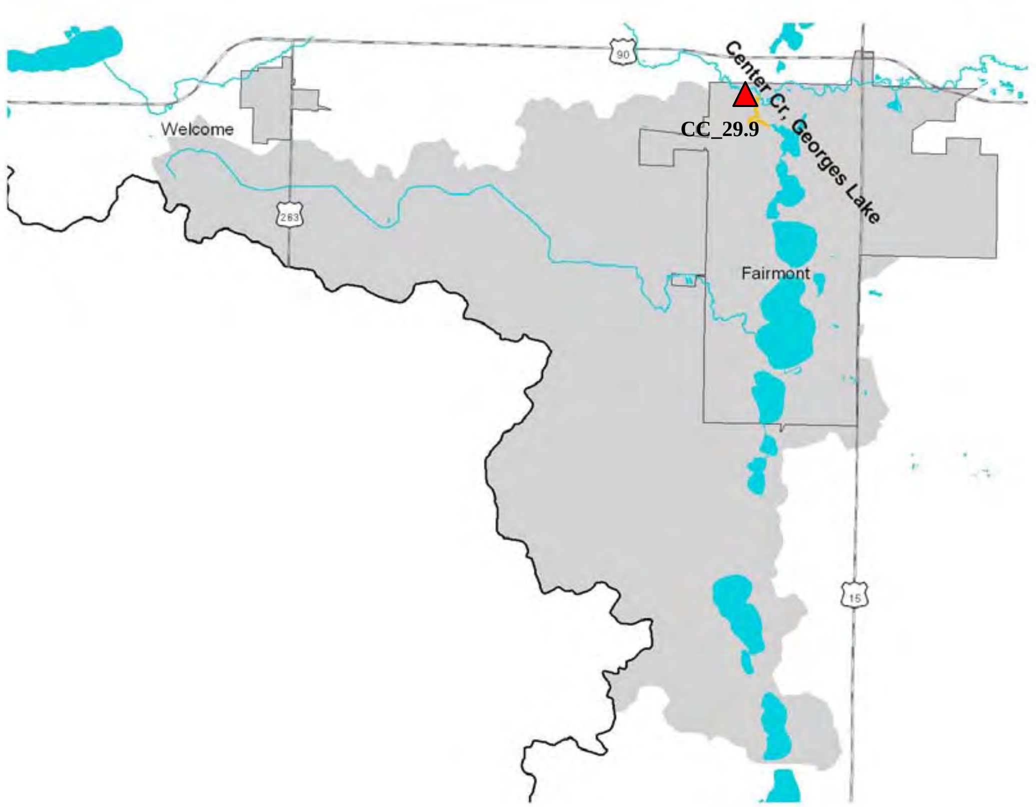


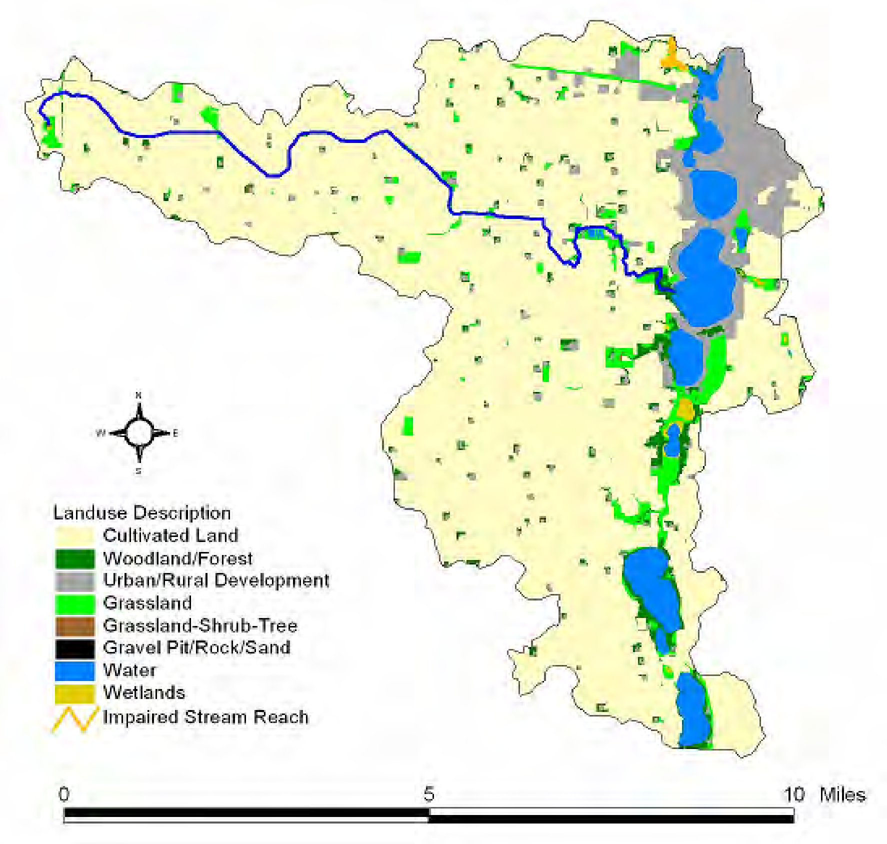
Figure 6.5b - Center Creek; George Lake to Lily Creek Watershed

The impaired portion of the Cedar Creek watershed encompasses 49 square miles in Martin County. The watershed has a human population of 7,652, with 6% living in rural areas. The watershed also contains an estimated 28 feedlots with 7,517 livestock animal units. The watershed is 79.4% cultivated land, followed by development at 7.8% and water at 5.8%.

The watershed contains much of the city of Fairmont and a small section of Welcome. The majority, 94%, of the humans in the watershed reside in Fairmont. Fairmont is required to hold a MS4 stormwater permit for managing their surface water runoff. Of the monthly fecal coliform loading capacity, Fairmont is allocated approximately 15%-18%, depending on flow conditions.

Based on county estimates 28% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 50 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	24,763	79.4%
Grass/Shrub/Tree	23.7	0.1%
Grassland	1,186	3.8%
Gravel Pit/Rock/Sand	0	0.0%
Urban/Rural Development	2,419	7.8%
Water	1,809	5.8%
Wetlands	77.8	0.2%
Woodland/Forest	914	2.9%

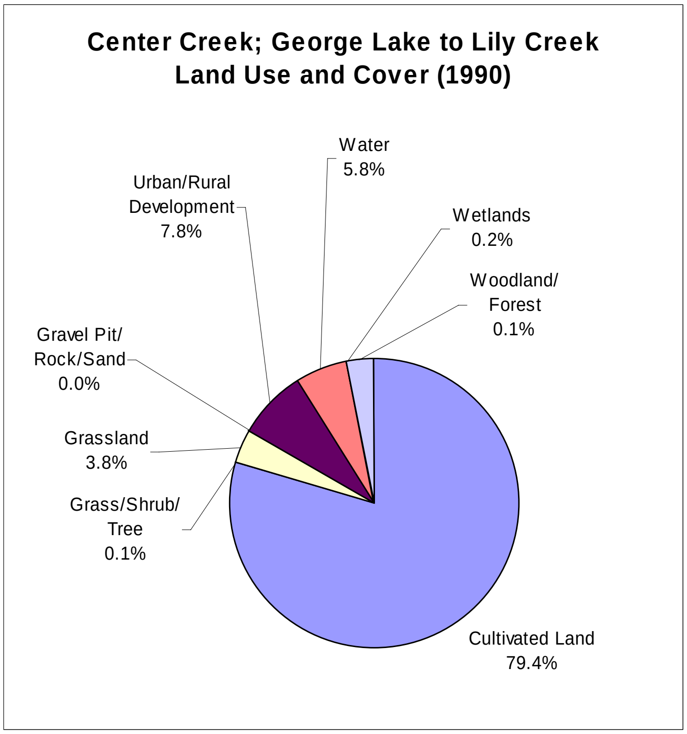


Figure 6.5c – 1990 Landuse and Cover Map and Statistics for Center Creek; George Lake to Lily Creek Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Center and Elm Clean Water Partnership
Years Monitored: 2000 through 2001
Samples Collected: 28

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	Inadequate Data
May	Inadequate Data
June	None Required
July	None Required
August	64.2%
September	Inadequate Data
October	Inadequate Data

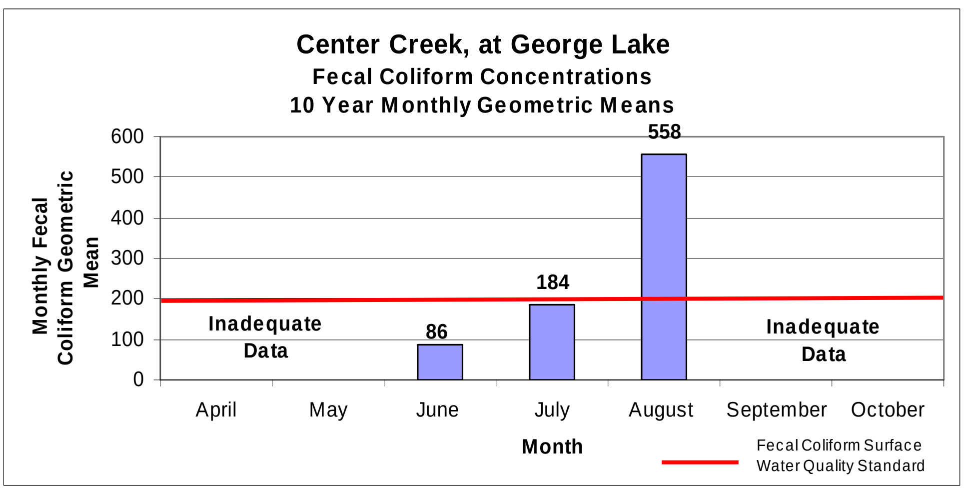


Figure 6.5d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.5a - Human and Animal Population Inventory for Center Creek; George Lake to Lily Creek Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	0		7.20E+10	0.00E+00	ASAE*, 1998
Beef	1,370		1.30E+11	1.78E+14	ASAE, 1998
Swine	6,138		8.00E+10	4.91E+14	ASAE, 1998
Chicken	0		3.40E+10	0.00E+00	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	2		4.20E+08	8.40E+08	ASAE, 1998
Sheep	0		2.00E+11	0.00E+00	ASAE, 1998
Humans		7,652	2.00E+09	1.53E+13	Metcalf and Eddy, 1991
Cats		2,078	5.00E+09	1.04E+13	Horsley and Witten, 1996
Dogs		1,826	5.00E+09	9.13E+12	Horsley and Witten, 1996
Deer		175	5.00E+08	8.75E+10	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		217	1.04E+07	2.26E+09	Alderisio and DeLuca, 1999
Wild Turkey		53	9.50E+07	5.04E+09	turkey value used
Pheasants		2,237	1.53E+04	3.42E+07	geese value used
Other Wildlife**				8.75E+10	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

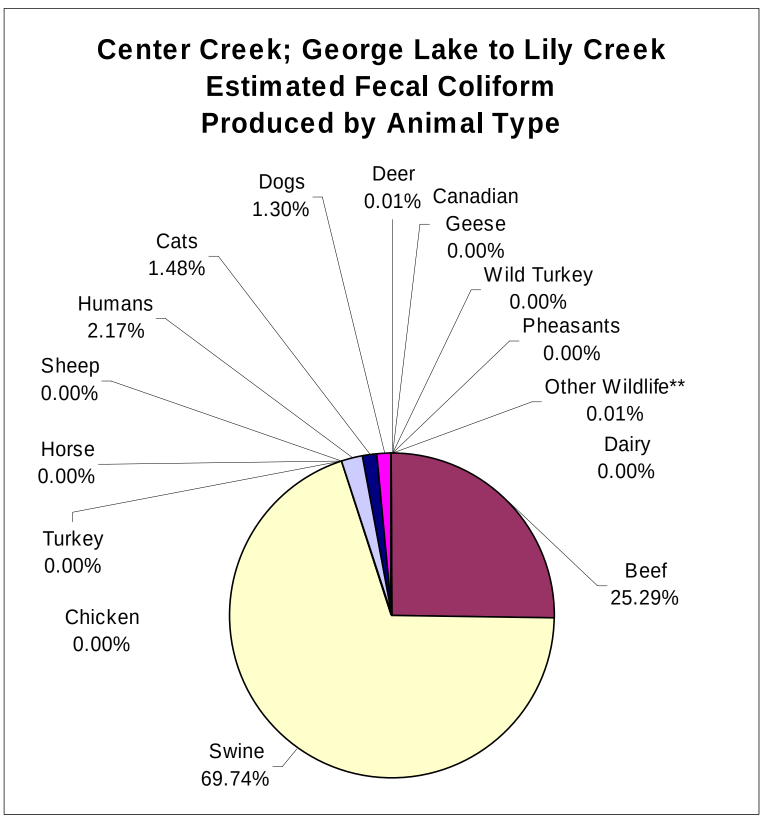


Figure 6.5e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

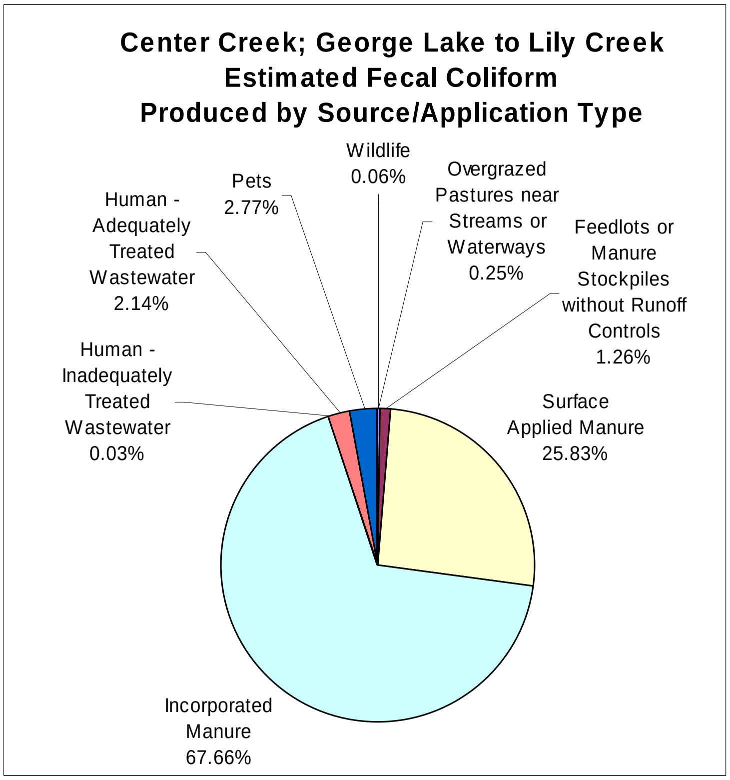


Figure 6.5f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of Center Creek.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low Contributor	High Contributor
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate Contributor	Low Contributor
	Surface Applied Manure	High Contributor	Low Contributor
	Incorporated Manure	Moderate Contributor	Low Contributor
Human	Human - Inadequately Treated Wastewater	Low Contributor	High Contributor
Pets	Cats & Dogs	Low Contributor	Low Contributor
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low Contributor	Low Contributor

Low Contributor	(light green)
Moderate Contributor	(yellow)
High Contributor	(orange)

Figure 6.5g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Center Creek; George Lake to Lily Creek

Fecal Coliform Loading Capacities and Allocations: Center Creek; George Lake to Lily Creek

Table 6.4b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
None			
Totals		0.000	0.000

Livestock Facilities with NPDES Permits
Refer to appendix C.

Table 6.5c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
Fairmont	7,227	Designated by rule; >10,000 population

Table 6.5d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Center Creek; George Lake to Lily Creek

Drainage Area (square miles): 49
USGS gage used to develop flow zones and loading capacities:
Blue Earth River, near Rapidan

	Flow Zone									
% MS4 Urban: 22.55%										
Total WWTF Design Flow (mgd): 0.00	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	21.57	7.19	8.85	2.95	4.26	1.42	1.56	0.52	0.23	0.08
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Communities Subject to MS4 NPDES Requirements	3.82	1.27	1.54	0.51	0.73	0.24	0.21	0.07	0.03	0.01
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	13.13	4.38	5.30	1.77	2.51	0.84	0.71	0.24	0.11	0.04
Margin of Safety	4.62	1.54	2.00	0.67	1.02	0.34	0.64	0.21	0.08	0.03
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / 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	17.7%		17.4%		17.1%		13.3%		14.5%	
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	60.9%		59.9%		58.9%		45.8%		49.7%	
Margin of Safety	21.4%		22.6%		24.0%		40.9%		35.8%	

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.6 Center Creek; Lily Creek to Blue Earth River

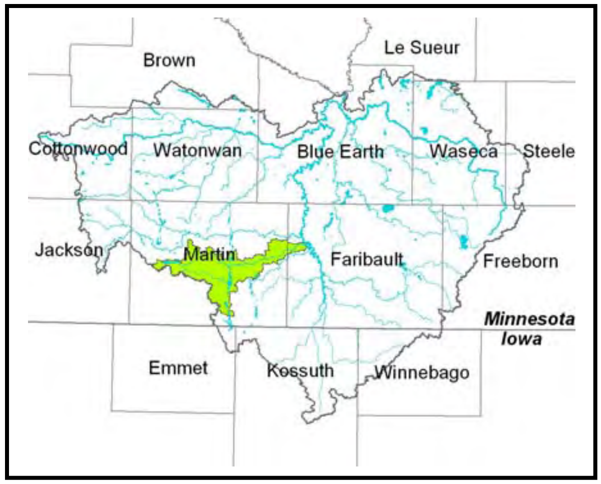


Figure 6.6a – Impaired Reach Watershed

Monitoring Site ID:
    Center Creek, 315th Avenue
    (CC_6.4)

Stream Status:
    Impaired Stream Reach (1996 Listing)

Impaired Reach Length
    23.3 miles

Contributing Watershed Size
    87,555 acres
    137 square miles

Human Population (2000 Census)
    13,260 (12,077 urban and 1,183 rural)

Cities Located in Watershed
    Fairmont
    Granada
    Sherburn*
    Welcome
    * Waste Water Effluent Discharged Outside Watershed Boundary

Livestock (2003 feedlot inventory)
    104 feedlot facilities
    40,633 total animal units

This portion of Center Creek qualifies as an impaired stream reach based on review of 67 samples collected on the river between 2002 through 2004. The monitoring data used to assess the river as impaired was collected as part of the Center and Elm Creeks Clean Water Partnership. The data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months of June, July and August. The reach, which is 23.3 miles in length, was added to the impaired waters list in 1996.

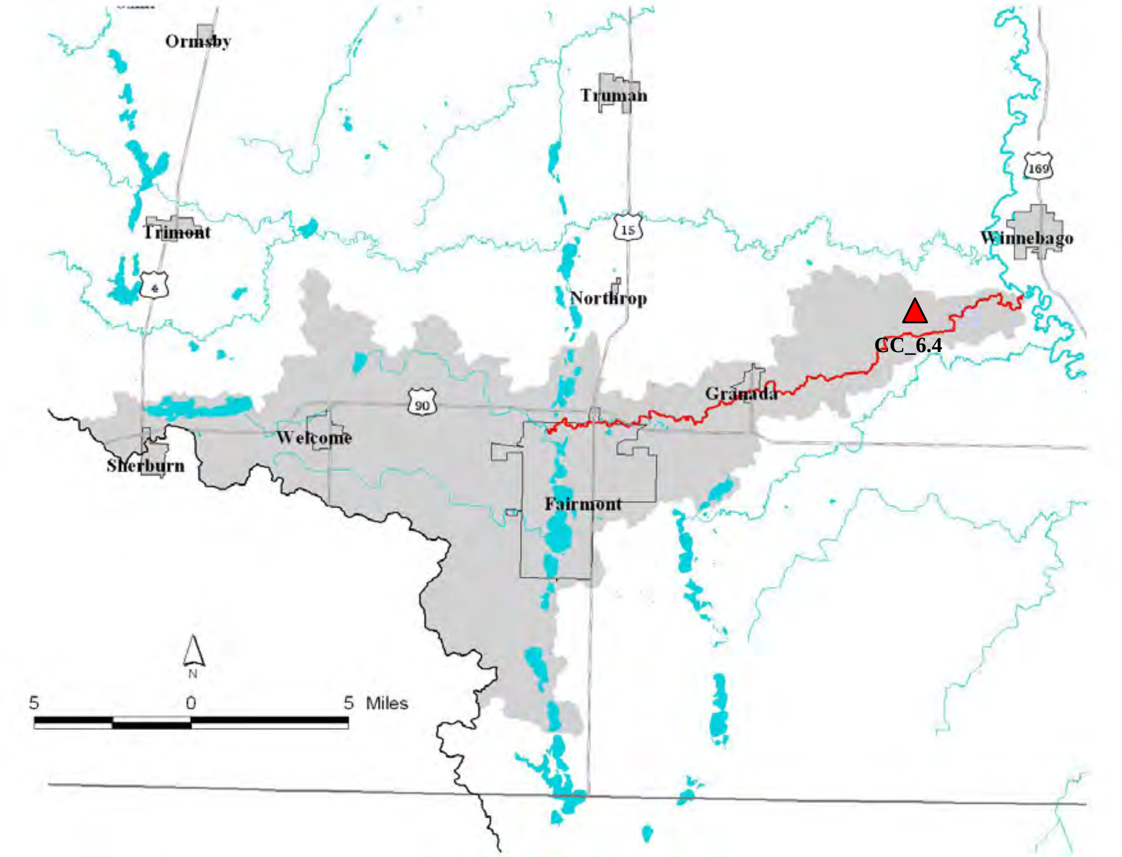


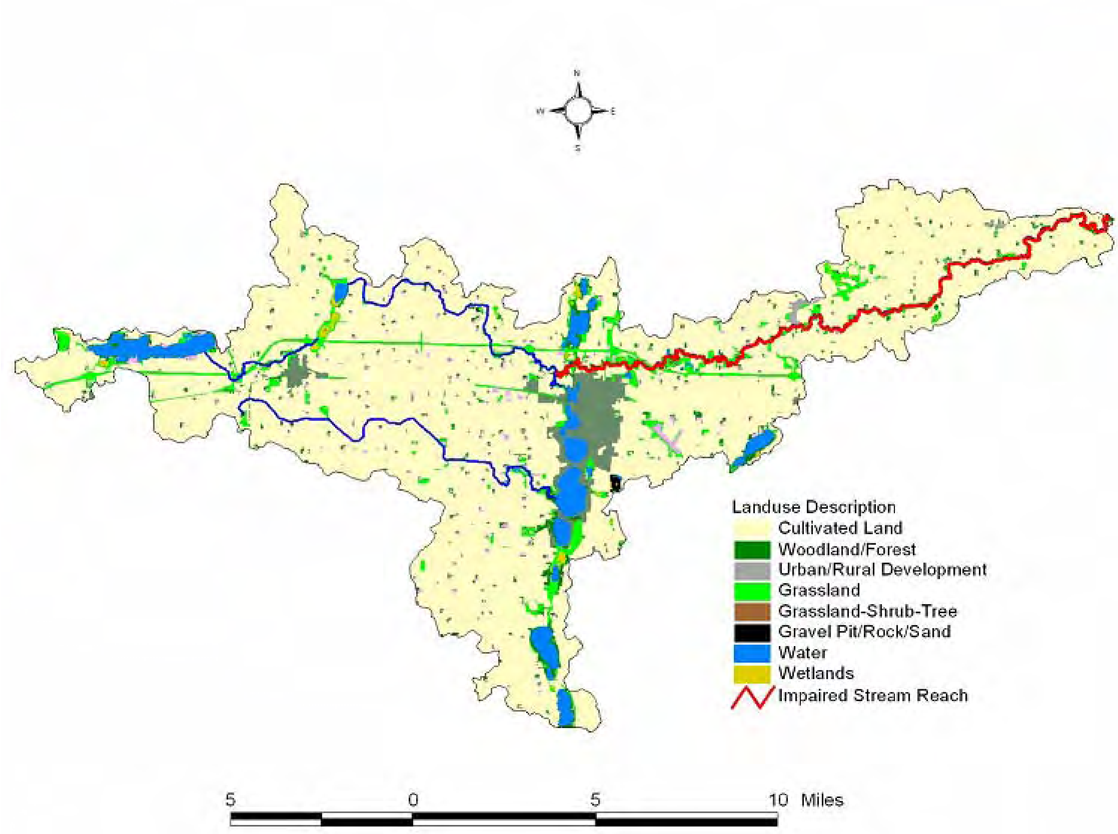
Figure 6.6b - Center Creek; Lily Creek to Blue Earth River Watershed

The Center Creek watershed encompasses 137 square miles in Faribault and Martin counties. The watershed has a human population of 13,260, with 10% living in rural areas. The watershed also contains an estimated 104 feedlots with 40,633 livestock animal units. The watershed is 81.0% cultivated land, followed by grassland at 6.2%, urban/rural development at 5.4% and water at 4.0%.

The watershed contains the cities of Granada, Fairmont and Welcome, and a portion of Sherburn. Nearly 82% of the human population resides in Fairmont. Fairmont is required to hold a MS4 stormwater permit for managing their surface water runoff. Fairmont stormwater is allocated anywhere from <1% to 9% of the total allowable fecal coliform load allocation, depending on flow condition.

Based on county estimates 28% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 135 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	70,963	81.0%
Grass/Shrub/Tree	75	0.1%
Grassland	5,437	6.2%
Gravel Pit/Rock/Sand	79	0.1%
Urban/Rural Development	4,718	5.4%
Water	3,498	4.0%
Wetlands	360	0.4%
Woodland/Forest	2,427	2.8%

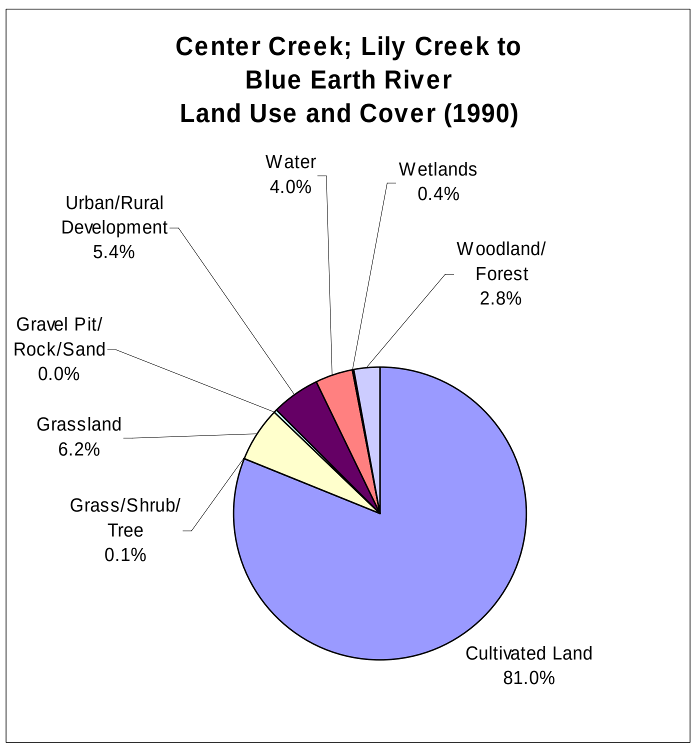


Figure 6.6c – 1990 Landuse and Cover Map and Statistics for Center Creek; Lily Creek to Blue Earth River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Center and Elm Creeks Clean Water Partnership
Years Monitored: 2002 through 2004
Samples Collected: 67

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	None Required
June	68.8%
July	84.3%
August	87.1%
September	Inadequate Data
October	Inadequate Data

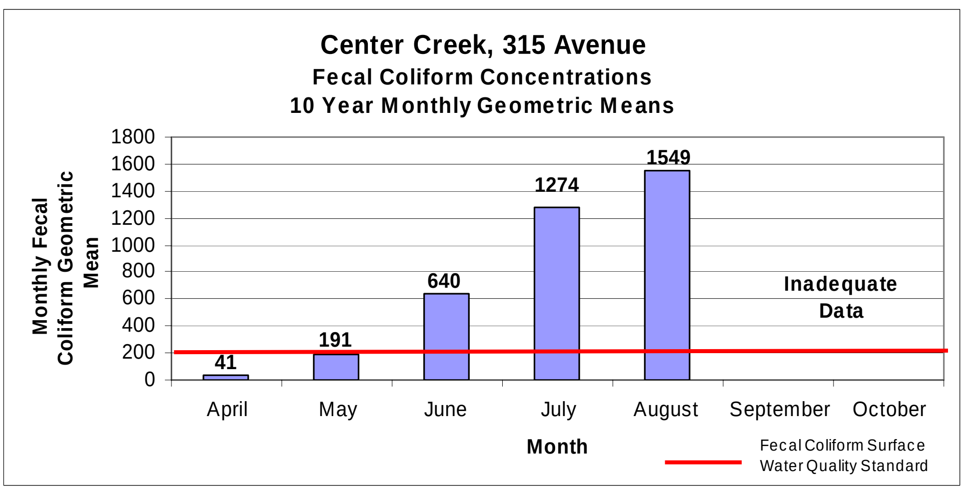


Figure 6.6d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.6a - Human and Animal Population Inventory for Center Creek; Lily Creek to Blue Earth River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	0		7.20E+10	0.00E+00	ASAE*, 1998
Beef	5,855		1.30E+11	7.61E+14	ASAE, 1998
Swine	34,640		8.00E+10	2.77E+15	ASAE, 1998
Chicken	3		3.40E+10	1.02E+11	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	60		4.20E+08	2.52E+10	ASAE, 1998
Sheep	59		2.00E+11	1.18E+13	ASAE, 1998
Humans		13,260	2.00E+09	2.65E+13	Metcalf and Eddy, 1991
Cats		3,601	5.00E+09	1.80E+13	Horsley and Witten, 1996
Dogs		3,165	5.00E+09	1.58E+13	Horsley and Witten, 1996
Deer		424	5.00E+08	2.12E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		610	1.04E+07	6.34E+09	Alderisio and DeLuca, 1999
Wild Turkey		149	9.50E+07	1.42E+10	turkey value used
Pheasants		7,319	1.53E+04	1.12E+08	geese value used
Other Wildlife**				2.12E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

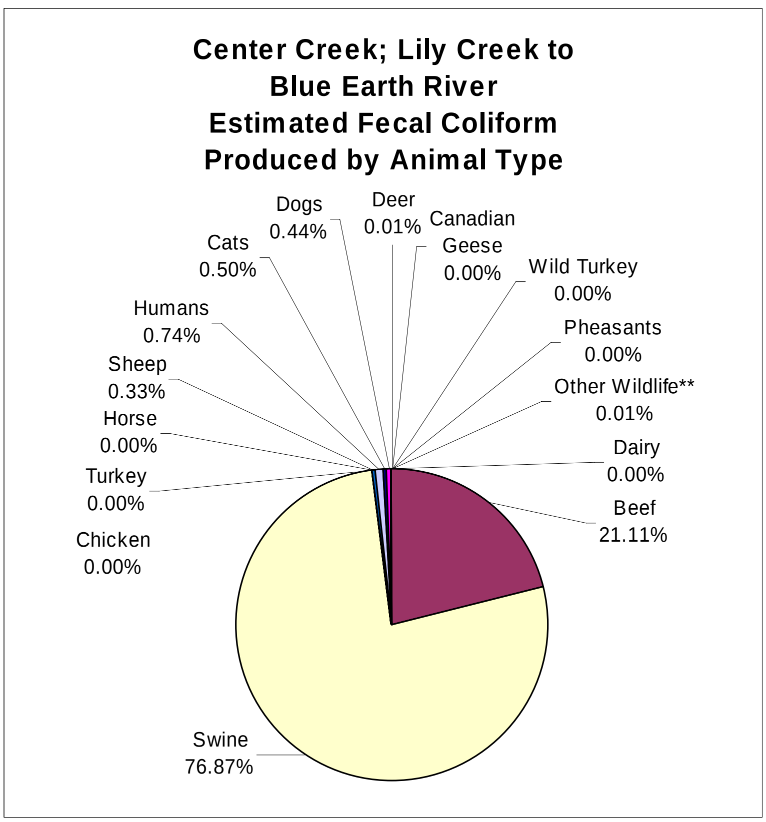


Figure 6.6e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

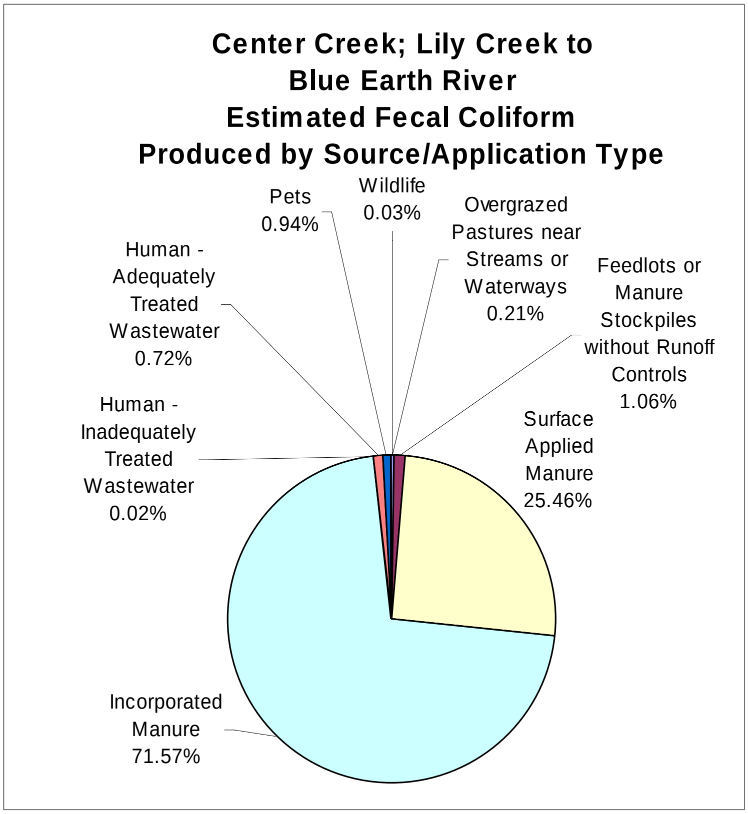


Figure 6.6f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of Center Creek.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Cats & Dogs		
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.		

Low Contributor	
Moderate Contributor	
High Contributor	

Figure 6.6g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Center Creek; Lily Creek to Blue Earth River

Fecal Coliform Loading Capacities and Allocations: Center Creek; Lily Creek to Blue Earth River

Table 6.6b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Fairmont	MN0030112	3.900	0.886
Granada	MNG580023	0.362	0.082
Welcome	MN0021296	0.260	0.059
Totals		4.522	1.027

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 6.6c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
Fairmont	10,856	Designated by rule; >10,000 population

Table 6.6d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Center Creek; Lily Creek to Blue Earth River

Drainage Area (square miles): 137
USGS gage used to develop flow zones and loading capacities:
Blue Earth River, near Rapidan
% MS4 Urban: 12.05%
Total WWTF Design Flow (mgd): 4.52

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	60.55	20.18	24.85	8.28	11.97	3.99	4.37	1.46	0.64	0.21
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	1.03	0.34	1.03	0.34	1.03	0.34	1.03	0.34	*	*
Communities Subject to MS4 NPDES Requirements	5.61	1.87	2.19	0.73	0.97	0.32	0.19	0.06	*	*
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	40.95	13.65	16.00	5.33	7.10	2.37	1.37	0.46	*	*
Margin of Safety	12.96	4.32	5.63	1.88	2.87	0.96	1.79	0.60	na	na

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	1.7%	4.1%	8.6%	23.5%	*
Communities Subject to MS4 NPDES Requirements	9.3%	8.8%	8.1%	4.3%	*
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	67.6%	64.4%	59.3%	31.4%	*
Margin of Safety	21.4%	22.6%	24.0%	40.9%	na

*Note - WWTF design/discharge flow exceeded low flow
alllocation = (flow contribution from a given source) X (200 orgs./100ml.), see section 5.0 for details

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.7 Dutch Creek; Headwaters to Hall Lake

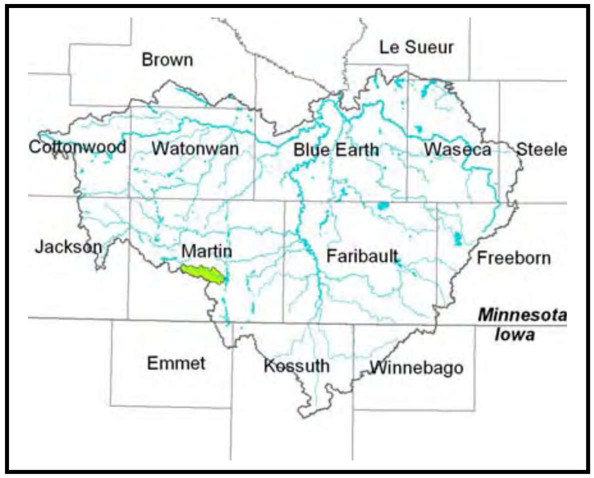


Figure 6.7a – Impaired Reach Watershed

Monitoring Site ID:
Dutch Creek, 100th Street
(DC_2.7)

Stream Status:
Impaired Stream Reach (2006 Listing)

Impaired Reach Length
4.6 miles

Contributing Watershed Size
10,950 acres
17 square miles

Human Population (2000 Census)
753 (606 urban and 144 rural)

Cities Located in Watershed
Fairmont*
Welcome*
* Waste Water Effluent Discharged Outside Watershed Boundary

Livestock (2003 Feedlot Inventory)
15 feedlot facilities
5,203 total animal units

Elm Creek; Cedar Creek to Blue Earth River qualifies as an impaired stream reach based on review of 55 samples collected on the stream from between 2002 through 2004. The stream was monitored as part of the Center and Elm Creeks Clean Water Partnership. The 4.6 mile reach was added to the impaired waters list in 2006. The monitoring data indicate the river exceeded surface water standards in June, July and August (the only months with adequate monitoring data).

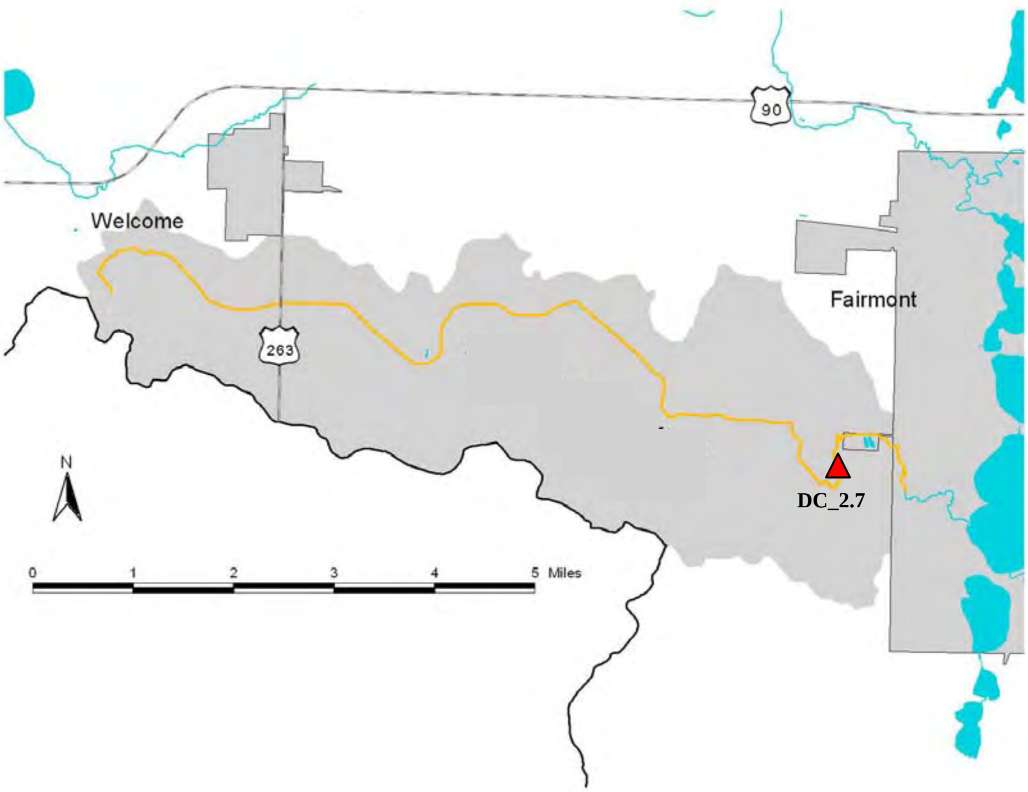
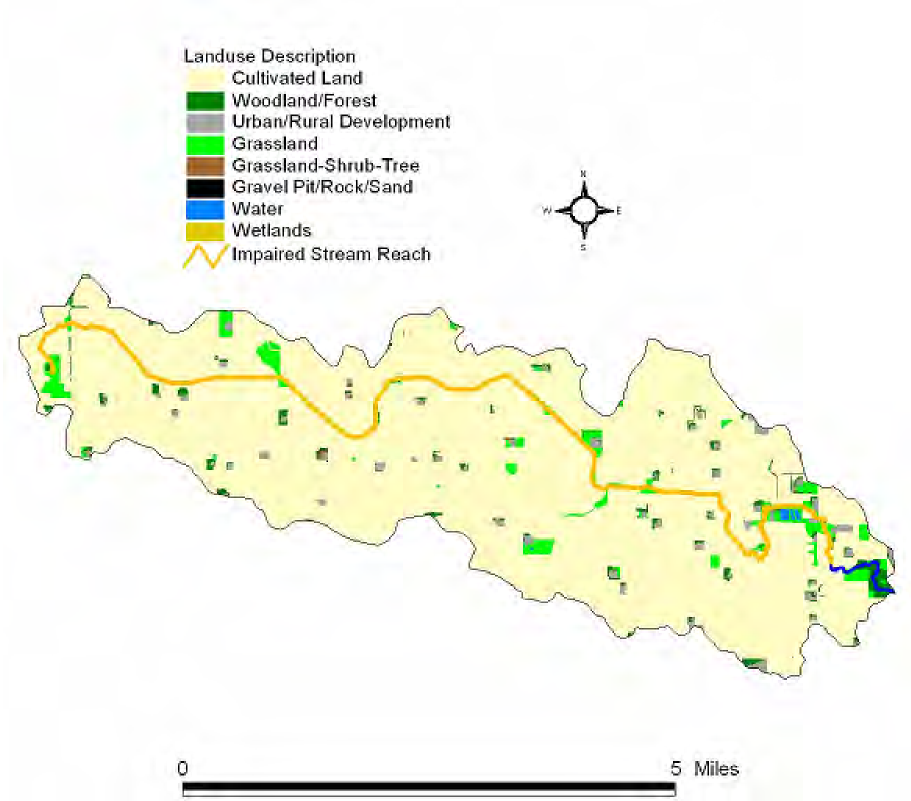


Figure 6.7b - Dutch Creek; Headwaters to Hall Lake Watershed

The Dutch Creek watershed encompasses 17 square miles in Martin County. The watershed has an estimated human population of 756 with 19% living in rural areas. The watershed contains a very small portion of Fairmont and Welcome. Wastewater treatment facility discharges from these communities are outside the Dutch Creek watershed. The watershed has an estimated 15 feedlots with 5,203 livestock animal units. The watershed is 92.7% cultivated land, followed by grassland at 3.4% and woodland at 1.9%.

Based on county estimates, 28% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 17 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	10,146	92.7%
Grass/Shrub/Tree	11.3	0.1%
Grassland	370	3.4%
Gravel Pit/Rock/Sand	0	0.0%
Urban/Rural Development	197	1.8%
Water	12	0.1%
Wetlands	3.7	0.0%
Woodland/Forest	209	1.9%

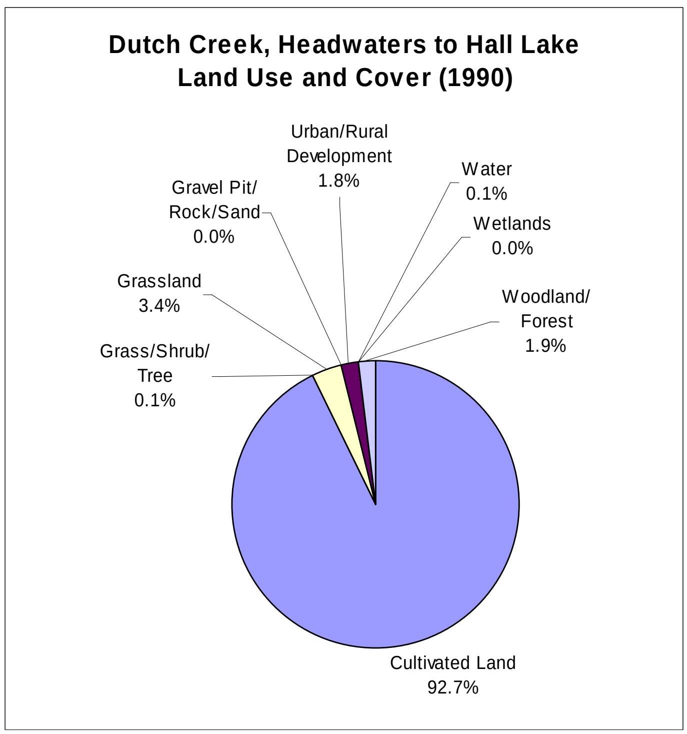


Figure 6.7c – 1990 Landuse and Cover Map and Statistics for Dutch Creek; Headwaters to Hall Lake Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Center and Elm Creeks Clean Water Partnership
Years Monitored: 2002 through 2004
Samples Collected: 65

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	Inadequate Data
May	Inadequate Data
June	52.9%
July	85.8%
August	85.0%
September	Inadequate Data
October	Inadequate Data

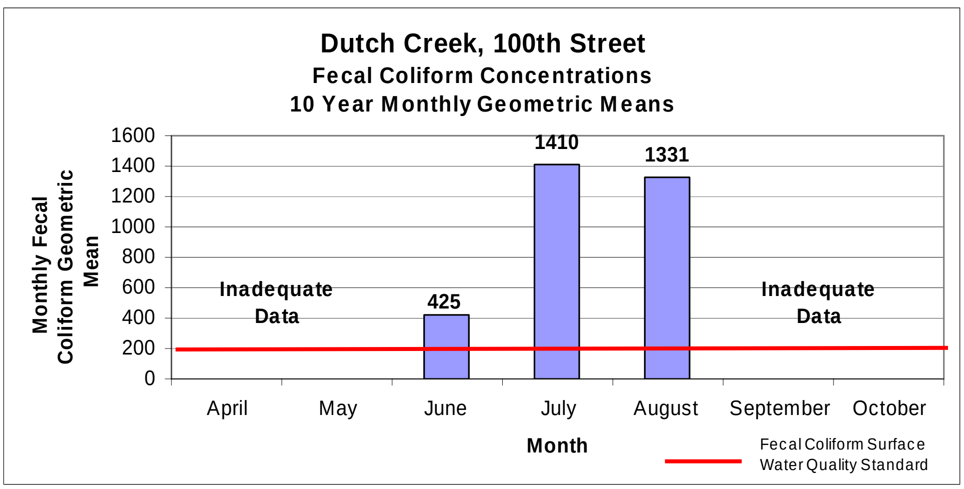


Figure 6.7d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.7a - Human and Animal Population Inventory for Dutch Creek; Headwaters to Hall Lake Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	0		7.20E+10	0.00E+00	ASAE*, 1998
Beef	1,132		1.30E+11	1.47E+14	ASAE, 1998
Swine	4,066		8.00E+10	3.25E+14	ASAE, 1998
Chicken	0		3.40E+10	0.00E+00	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	2		4.20E+08	8.40E+08	ASAE, 1998
Sheep	0		2.00E+11	0.00E+00	ASAE, 1998
Humans		753	2.00E+09	1.51E+12	Metcalf and Eddy, 1991
Cats		205	5.00E+09	1.03E+12	Horsley and Witten, 1996
Dogs		180	5.00E+09	9.00E+11	Horsley and Witten, 1996
Deer		62	5.00E+08	3.10E+10	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		76	1.04E+07	7.90E+08	Alderisio and DeLuca, 1999
Wild Turkey		19	9.50E+07	1.81E+09	turkey value used
Pheasants		785	1.53E+04	1.20E+07	geese value used
Other Wildlife**				3.10E+10	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

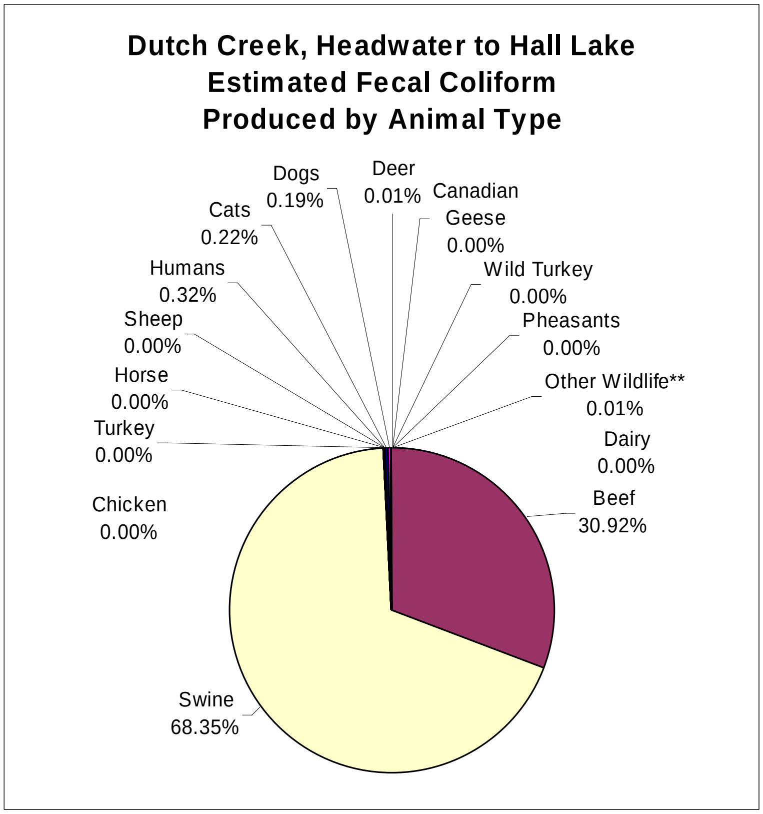


Figure 6.7e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

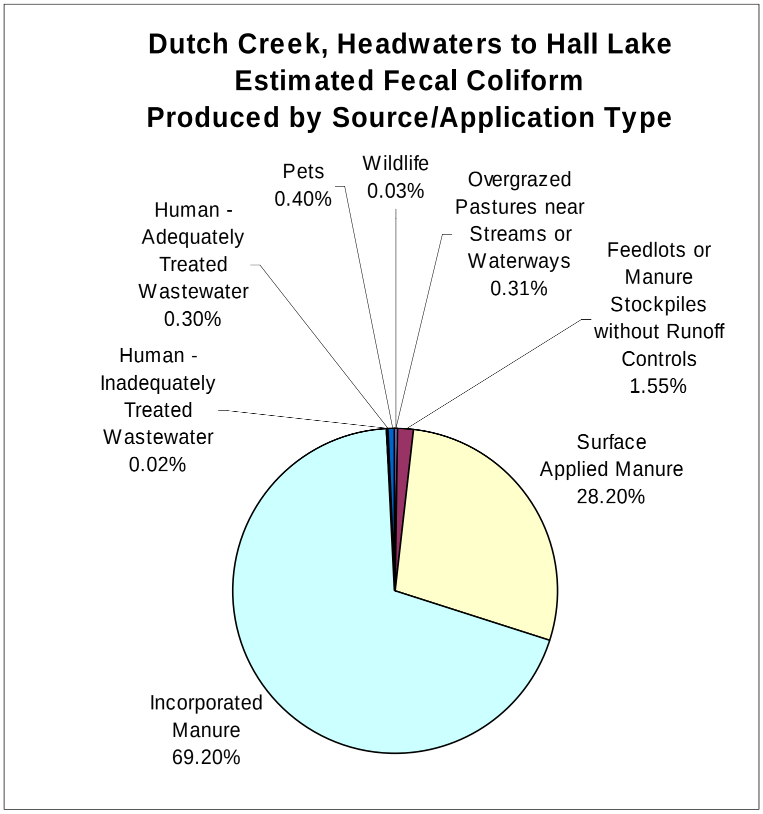


Figure 6.7f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of Dutch Creek.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low	High
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate	Low
	Surface Applied Manure	High	Low
	Incorporated Manure	Moderate	Low
Human	Human - Inadequately Treated Wastewater	Low	High
Pets	Cats & Dogs	Low	Low
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low	Low

Low Contributor
Moderate Contributor
High Contributor

Figure 6.7g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Elm Creek; South Fork Elm Creek to Cedar Creek

Fecal Coliform Loading Capacities and Allocations: Elm Creek; South Fork Elm Creek to Cedar Creek

Table 6.7b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
None			
Totals		0.000	0.000

Livestock Facilities with NPDES Permits
Refer to appendix C.

Table 6.7c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
Fairmont	606	Designated by rule; >10,000 population

Table 6.7d – Monthly Fecal Coliform Loading Capacities and Allocations

Dutch Creek; Headwaters to Hall Lake

Drainage Area (square miles): 17
USGS gage used to develop flow zones and loading capacities:
Blue Earth River, near Rapidan
% MS4 Urban: 5.37%
Total WWTF Design Flow (mgd): 0.00

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	7.57	2.52	3.11	1.04	1.50	0.50	0.55	0.18	0.08	0.03
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Communities Subject to MS4 NPDES Requirements	0.32	0.11	0.13	0.04	0.06	0.02	0.02	0.01	0.00	0.00
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	5.63	1.88	2.27	0.76	1.08	0.36	0.31	0.10	0.05	0.02
Margin of Safety	1.62	0.54	0.70	0.23	0.36	0.12	0.22	0.07	0.03	0.01

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / 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	4.2%	4.2%	4.1%	3.2%	3.4%
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	74.4%	73.2%	72.0%	56.0%	60.8%
Margin of Safety	21.4%	22.6%	24.0%	40.9%	35.8%

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.8 Elm Creek; South Fork Elm Creek to Cedar Creek

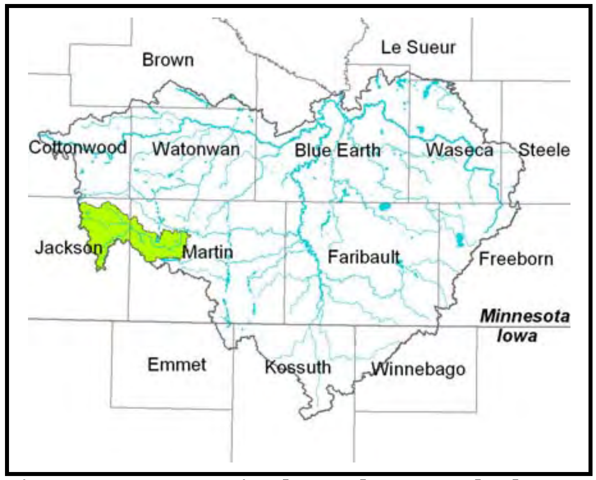


Figure 6.8a – Impaired Reach Watershed

Monitoring Site ID:
Elm Creek, 185th Street
(EC_48.7)

Stream Status:
Impaired Stream Reach (2006 Listing)

Impaired Reach Length
19.7 miles

Contributing Watershed Size
86,283 acres
135 square miles

Human Population (2000 Census)
1,277 (357 urban and 920 rural)

Cities Located in Watershed
Trimont*
Jackson*
* Waste Water Effluent Discharged Outside Watershed Boundary

Livestock (2003 Feedlot Inventory)
88 feedlot facilities
27,234 total animal units

Elm Creek; South Fork Elm Creek to Cedar Creek qualifies as an impaired stream reach based on review of 40 samples collected on the stream from between 2000 through 2002. The stream was monitored as part of the Center and Elm Creeks Clean Water Partnership. The 19.7 mile reach was added to the impaired waters list in 2006. The monitoring data indicate the river exceeded surface water standards in June, July and August (the only months the site was monitored).

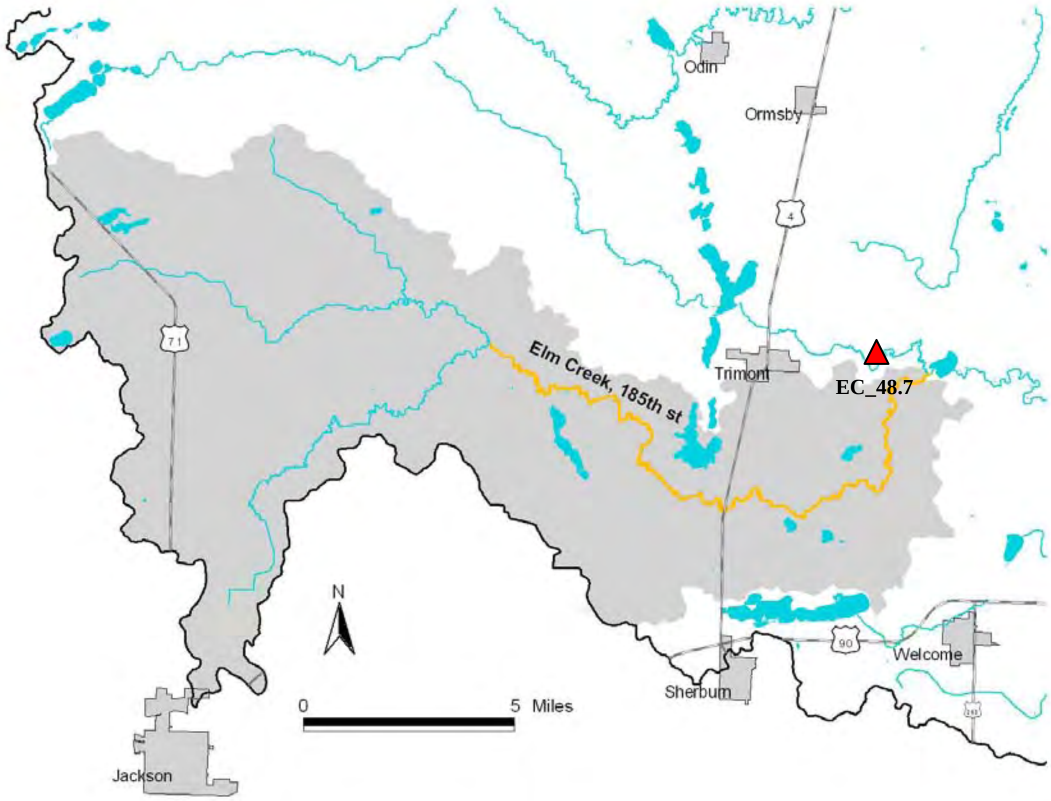


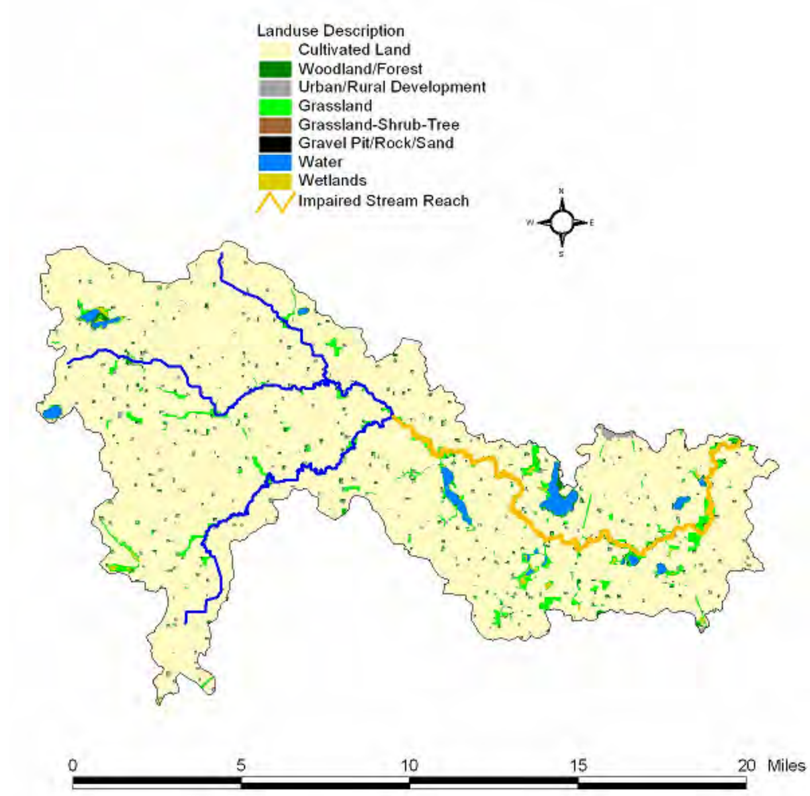
Figure 6.8b - Elm Creek; South Fork Elm Creek to Cedar Creek Watershed

This reach of Elm Creek encompasses a watershed of 135 square miles in two counties, Jackson and Martin. The watershed has an estimated human population of 1,277 with 72% living in rural areas. The watershed has an estimated 88 feedlots with 27,234 livestock animal units. The watershed is 90.4% cultivated land, followed by grassland at 4.2% and woodland at 2.1%.

There are portions of two cities located in the watershed, Jackson and Trimont. Wastewater treatment discharges from these cities are outside the impaired watershed.

Based on county estimates, 55% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 195 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	78,007	90.4%
Grass/Shrub/Tree	58.6	0.1%
Grassland	3,650	4.2%
Gravel Pit/Rock/Sand	2.4	0.0%
Urban/Rural Development	1,319	1.5%
Water	1,198	1.4%
Wetlands	264.3	0.3%
Woodland/Forest	1,784	2.1%

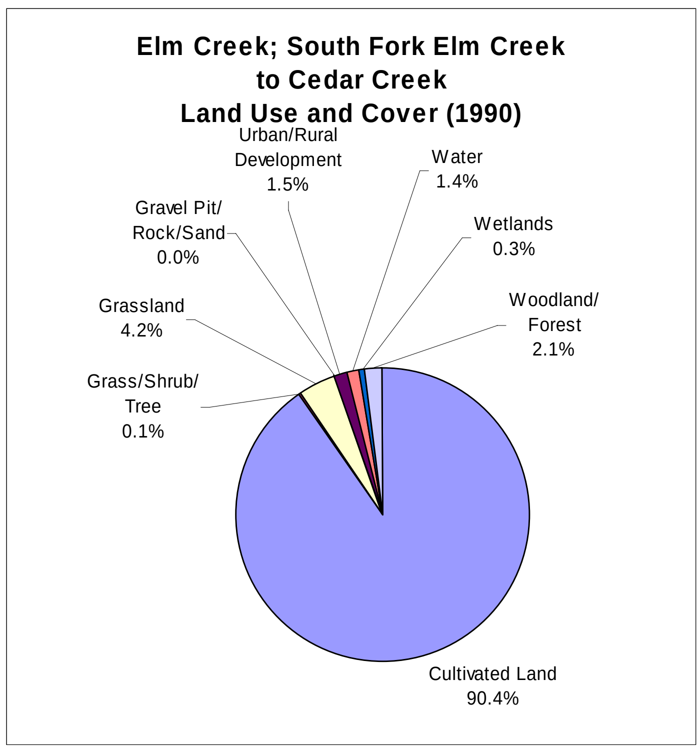


Figure 6.8c – 1990 Landuse and Cover Map and Statistics for Elm Creek; South Fork Elm Creek to Cedar Creek Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Center and Elm Creeks Clean Water Partnership
Years Monitored: 2000 through 2002
Samples Collected: 40

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	**Required Reduction**
April	Inadequate Data
May	Inadequate Data
June	71.1%
July	81.1%
August	80.3%
September	Inadequate Data
October	Inadequate Data

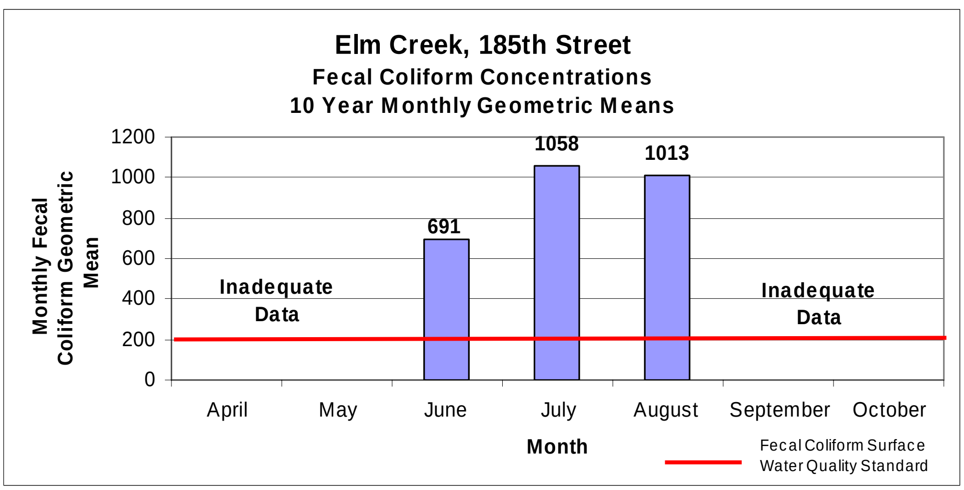


Figure 6.8d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.8a - Human and Animal Population Inventory for Elm Creek; South Fork Elm Creek to Cedar Creek Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	465		7.20E+10	3.35E+13	ASAE*, 1998
Beef	2,100		1.30E+11	2.73E+14	ASAE, 1998
Swine	23,269		8.00E+10	1.86E+15	ASAE, 1998
Chicken	0		3.40E+10	1.02E+10	ASAE, 1998
Turkey	1,072		6.20E+09	6.65E+12	ASAE, 1998
Horse	50		4.20E+08	2.10E+10	ASAE, 1998
Sheep	147		2.00E+11	2.94E+13	ASAE, 1998
Humans		1,277	2.00E+09	2.55E+12	Metcalf and Eddy, 1991
Cats		329	5.00E+09	1.65E+12	Horsley and Witten, 1996
Dogs		290	5.00E+09	1.45E+12	Horsley and Witten, 1996
Deer		485	5.00E+08	2.43E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		601	1.04E+07	6.25E+09	Alderisio and DeLuca, 1999
Wild Turkey		147	9.50E+07	1.40E+10	turkey value used
Pheasants		6,188	1.53E+04	9.47E+07	geese value used
Other Wildlife**				2.43E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

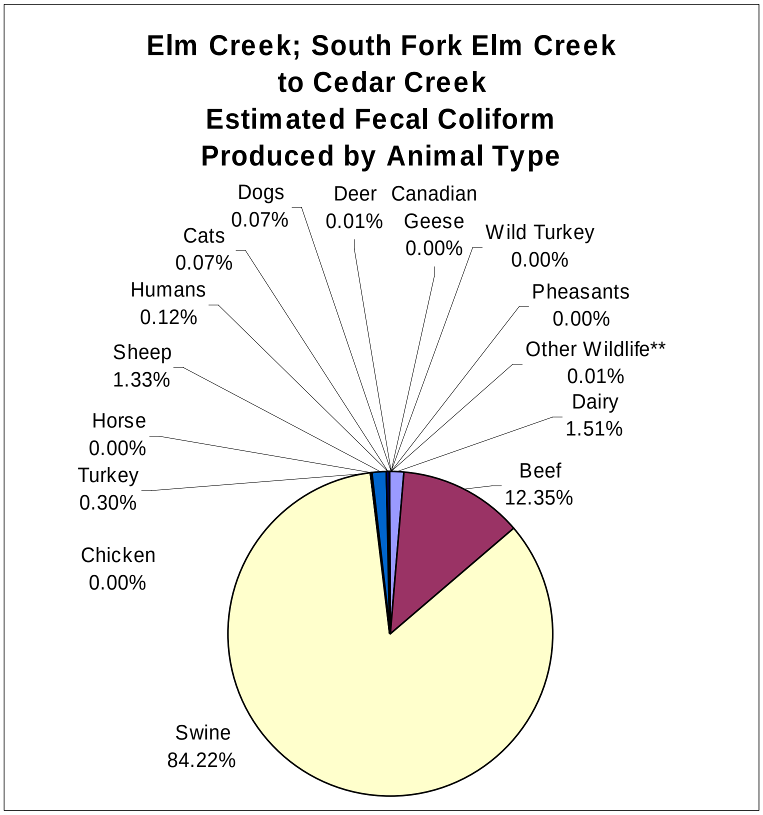


Figure 6.8e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

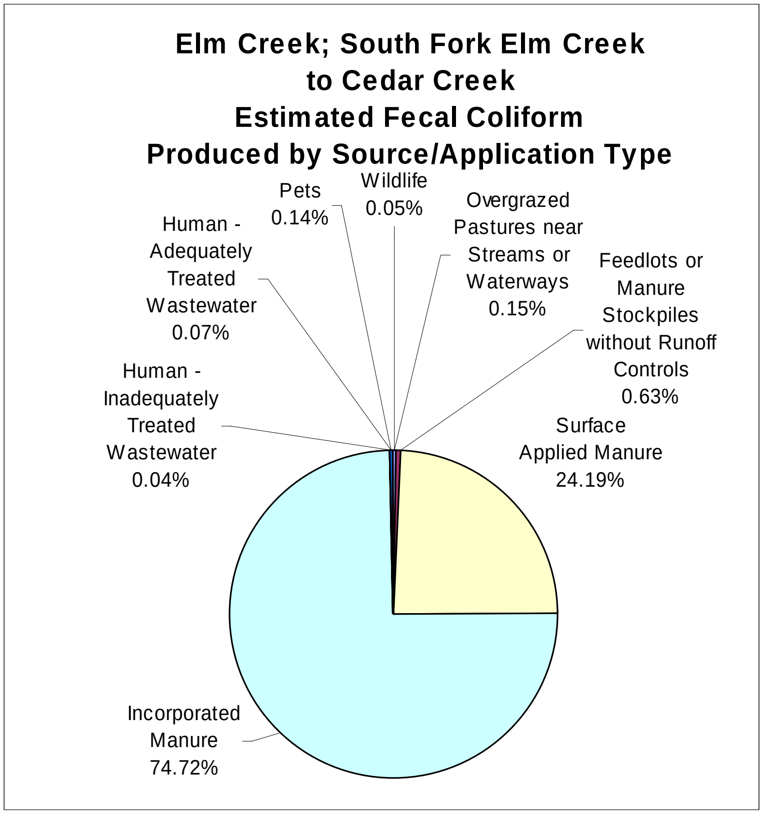


Figure 6.8f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of Elm Creek.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low Contributor	Moderate Contributor
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate Contributor	Low Contributor
	Surface Applied Manure	High Contributor	Low Contributor
	Incorporated Manure	Moderate Contributor	Low Contributor
Human	Human - Inadequately Treated Wastewater	Low Contributor	High Contributor
Pets	Cats & Dogs	Low Contributor	Low Contributor
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low Contributor	Low Contributor

Low Contributor
Moderate Contributor
High Contributor

Figure 6.8g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Elm Creek; South Fork Elm Creek to Cedar Creek

Fecal Coliform Loading Capacities and Allocations: Elm Creek; South Fork Elm Creek to Cedar Creek

Table 6.8b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
None			
Totals		0.000	0.000

Livestock Facilities with NPDES Permits
Refer to appendix C.

Table 6.8c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.8d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Elm Creek; South Fork Elm Creek to Cedar Creek

Drainage Area (square miles): 135
USGS gage used to develop flow zones and loading capacities:
Blue Earth River, near Rapidan

	Flow Zone									
% MS4 Urban: 0%										
Total WWTF Design Flow (mgd): 0.00	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	59.67	19.89	24.49	8.16	11.79	3.93	4.31	1.44	0.63	0.21
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	46.90	15.63	18.94	6.31	8.97	2.99	2.55	0.85	0.41	0.14
Margin of Safety	12.77	4.26	5.55	1.85	2.83	0.94	1.76	0.59	0.23	0.08

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / 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	78.6%	77.4%	76.0%	59.1%	64.2%
Margin of Safety	21.4%	22.6%	24.0%	40.9%	35.8%

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.9 Elm Creek; Cedar Creek to Blue Earth River

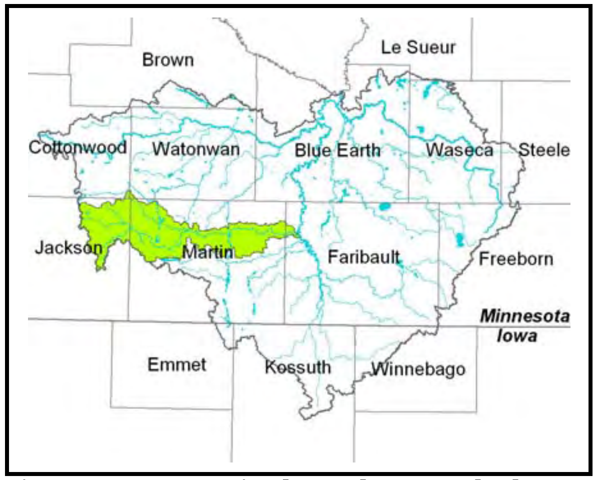


Figure 6.9a – Impaired Reach Watershed

Monitoring Site ID:
Elm Creek, 290th Avenue
(EC_11.7)

Stream Status:
Impaired Stream Reach (1994 Listing)

Impaired Reach Length
42.0 miles

Contributing Watershed Size
178,809 acres
279 square miles

Human Population (2000 Census)
3,014 (1,080 urban and 1,934 rural)

Cities Located in Watershed
Jackson*
Northrop
Trimont
* Waste Water Effluent Discharged Outside Watershed Boundary

Livestock (2003 Feedlot Inventory)
255 feedlot facilities
98,677 total animal units

Elm Creek; Cedar Creek to Blue Earth River qualifies as an impaired stream reach based on review of 65 samples collected on the stream from between 2002 through 2004. The stream was monitored as part of the Center and Elm Creeks Clean Water Partnership. The 42.0 mile reach was added to the impaired waters list in 1996. The monitoring data indicate the river exceeded surface water standards in June, July and August.

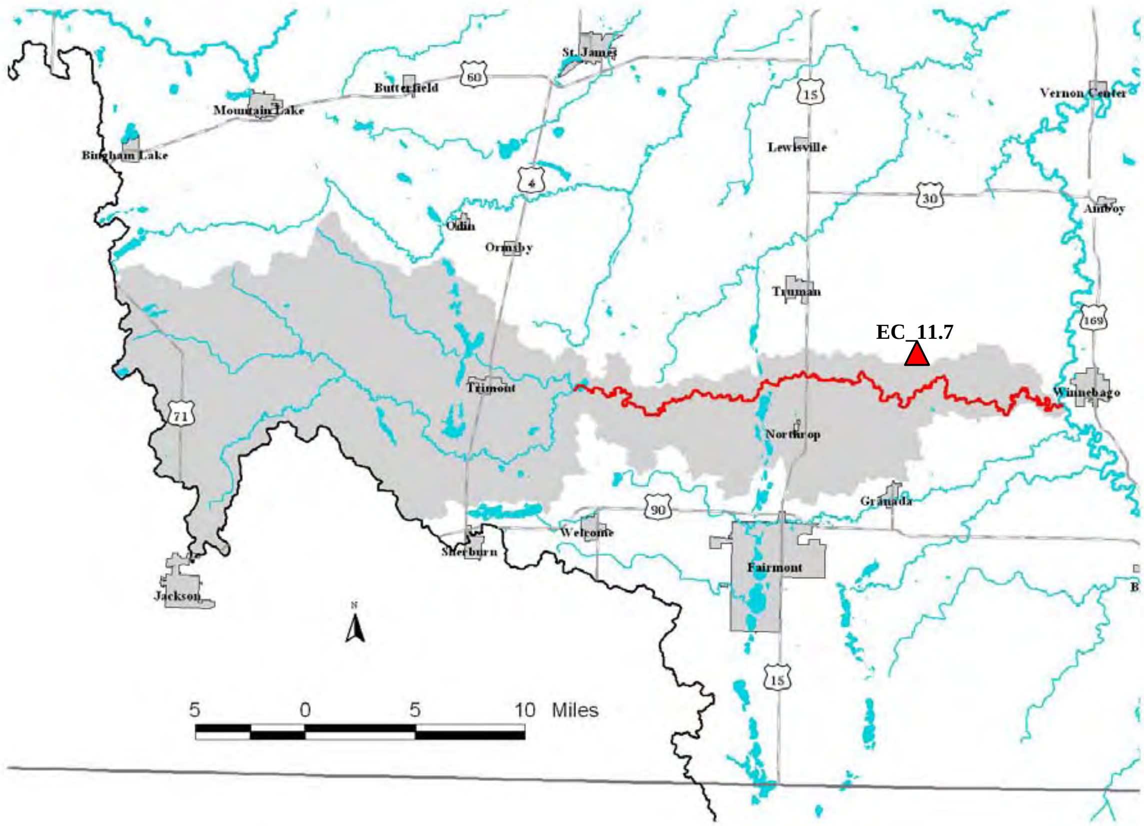
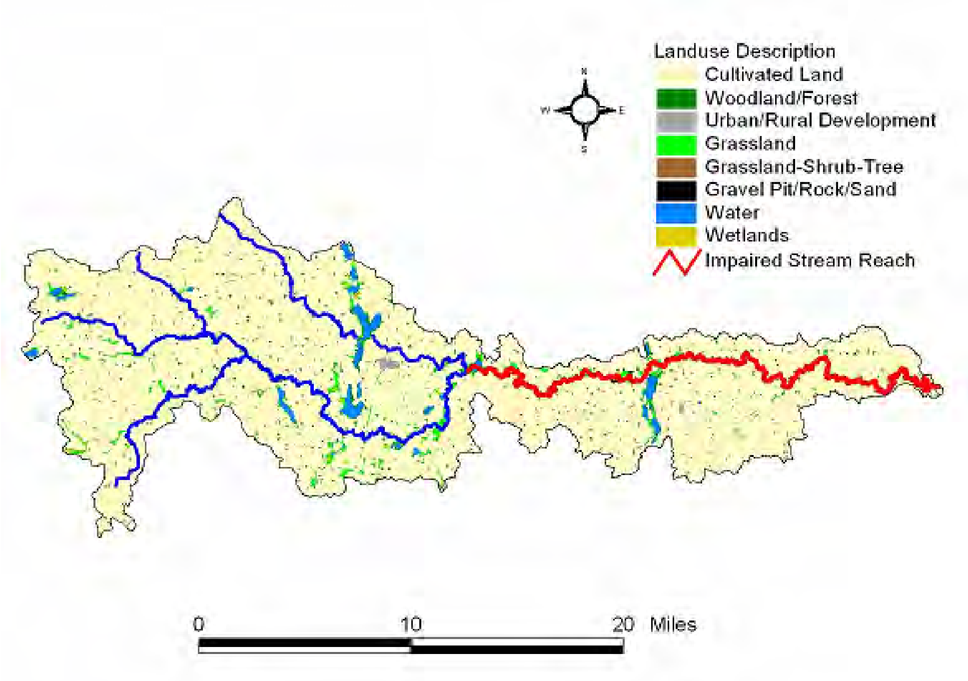


Figure 6.9b - Elm Creek; Cedar Creek to Blue Earth River Watershed

This reach of Elm Creek encompasses a watershed of 135 square miles in portions of five counties; Cottonwood, Faribault, Jackson, Martin and Watonwan. There are three cities located in the watershed, Trimont, Northrop and a portion of Jackson. The watershed has an estimated human population of 3,014 with 64.2% living in rural areas. The watershed has an estimated 255 feedlots with 98,677 livestock animal units. The watershed is 90.0% cultivated land, followed by grassland at 3.5% and woodland at 2.9%.

Based on county estimates, 43% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 340 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	160,939	90.0%
Grass/Shrub/Tree	135	0.1%
Grassland	6,190	3.5%
Gravel Pit/Rock/Sand	56.7	0.0%
Urban/Rural Development	2,975	1.7%
Water	3,005	1.7%
Wetlands	395	0.2%
Woodland/Forest	5,114	2.9%

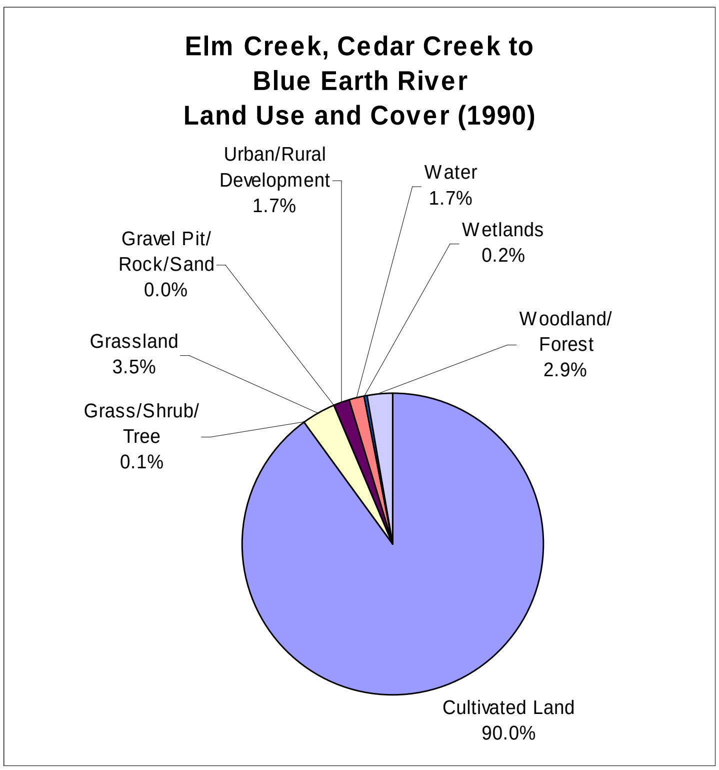


Figure 6.9c – 1990 Landuse and Cover Map and Statistics for Elm Creek; Cedar Creek to Blue Earth River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Center and Elm Creeks Clean Water Partnership
Years Monitored: 2002 through 2004
Samples Collected: 65

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	None Required
June	41.7%
July	58.0%
August	79.8%
September	Inadequate Data
October	Inadequate Data

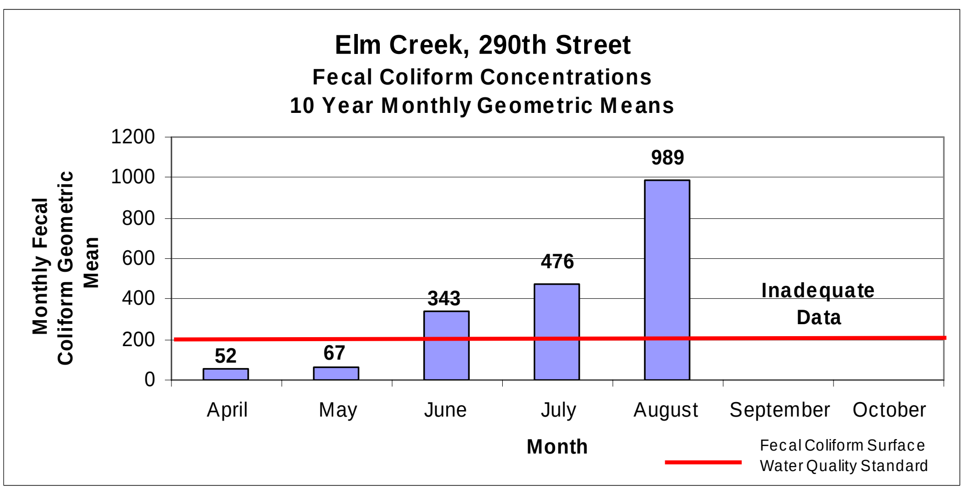


Figure 6.9d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.9a - Human and Animal Population Inventory for Elm Creek; Cedar Creek to Blue Earth River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	790		7.20E+10	5.69E+13	ASAE*, 1998
Beef	9,945		1.30E+11	1.29E+15	ASAE, 1998
Swine	86,265		8.00E+10	6.90E+15	ASAE, 1998
Chicken	34		3.40E+10	1.17E+12	ASAE, 1998
Turkey	1,273		6.20E+09	7.89E+12	ASAE, 1998
Horse	84		4.20E+08	3.53E+10	ASAE, 1998
Sheep	258		2.00E+11	5.16E+13	ASAE, 1998
Humans		3,014	2.00E+09	6.03E+12	Metcalf and Eddy, 1991
Cats		819	5.00E+09	4.10E+12	Horsley and Witten, 1996
Dogs		719	5.00E+09	3.60E+12	Horsley and Witten, 1996
Deer		1,006	5.00E+08	5.03E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		1,245	1.04E+07	1.29E+10	Alderisio and DeLuca, 1999
Wild Turkey		305	9.50E+07	2.90E+10	turkey value used
Pheasants		12,824	1.53E+04	1.96E+08	geese value used
Other Wildlife**				5.03E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

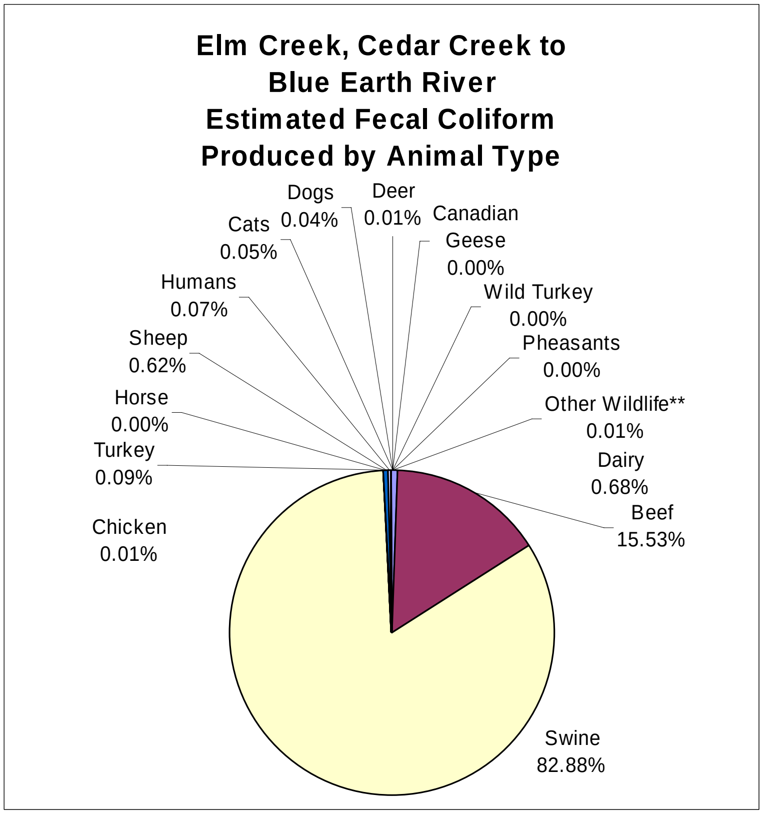


Figure 6.9e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

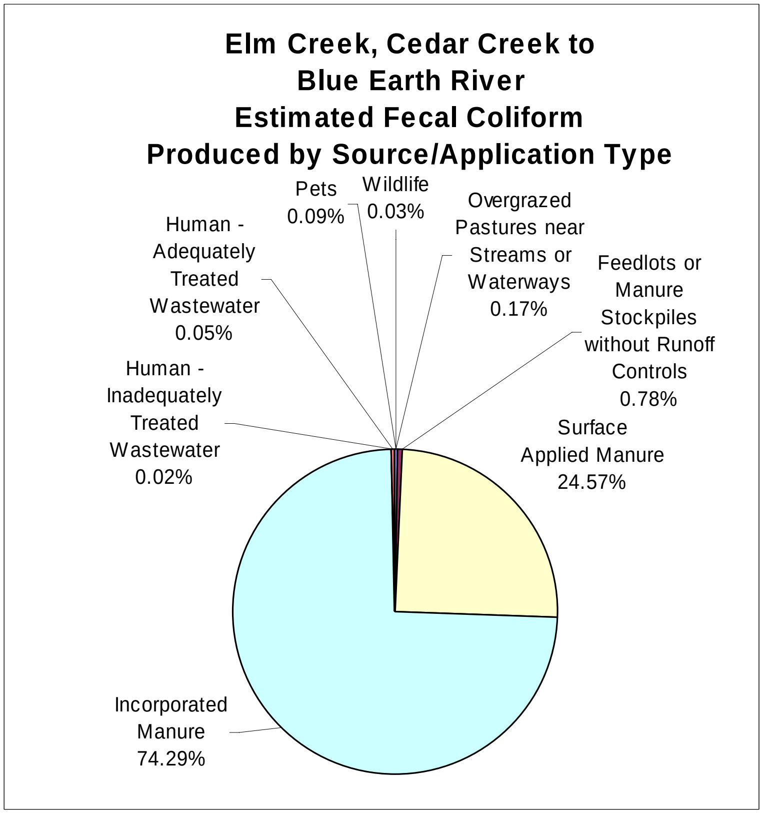


Figure 6.9f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of Elm Creek.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low Contributor	High Contributor
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate Contributor	Low Contributor
	Surface Applied Manure	High Contributor	Low Contributor
	Incorporated Manure	Moderate Contributor	Low Contributor
Human	Human - Inadequately Treated Wastewater	Low Contributor	High Contributor
Pets	Cats & Dogs	Low Contributor	Low Contributor
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low Contributor	Low Contributor

Low Contributor
Moderate Contributor
High Contributor

Figure 6.9g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Elm Creek; Cedar Creek to Blue Earth River

FC Loading Capacities and Allocations: Elm Creek; Cedar Creek to Blue Earth R.

Table 6.9b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Northrop	MN0024384	0.456	0.104
Trimont	MN0022071	0.351	0.080
Totals		0.807	0.183

Livestock Facilities with NPDES Permits
Refer to appendix C.

Table 6.9c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.9d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Elm Creek; Cedar Creek to Blue Earth River

Drainage Area (square miles): 279
USGS gage used to develop flow zones and loading capacities:
Blue Earth River, near Rapidan
% MS4 Urban: 0%
Total WWTF Design Flow (mgd): 0.81

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	123.65	41.22	50.74	16.91	24.44	8.15	8.93	2.98	1.31	0.44
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.18	0.06	0.18	0.06	0.18	0.06	0.18	0.06	0.18	0.06
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	97.00	32.33	39.07	13.02	18.40	6.13	5.10	1.70	0.66	0.22
Margin of Safety	26.46	8.82	11.49	3.83	5.86	1.95	3.65	1.22	0.47	0.16

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.1%	0.4%	0.8%	2.1%	14.0%
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	78.5%	77.0%	75.3%	57.1%	50.2%
Margin of Safety	21.4%	22.6%	24.0%	40.9%	35.8%

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.10 Judicial Ditch #3; Headwater to Elm Creek

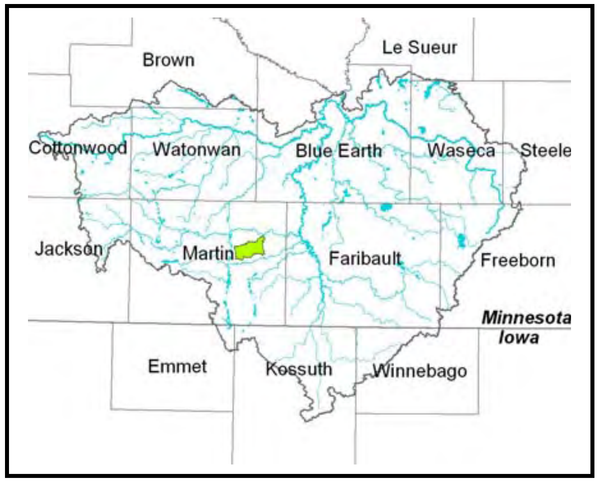


Figure 6.10a – Impaired Reach Watershed

Monitoring Site ID:
Judicial Ditch #3
(JD3_2.1)

Stream Status:
Impaired Stream Reach (2006 Listing)

Impaired Reach Length
6.2 miles

Contributing Watershed Size
9,283 acres
15 square miles

Human Population (2000 Census)
161 (100% rural)

Cities Located in Watershed
None

Livestock (2003 Feedlot Inventory)
18 feedlot facilities
8,161 total animal units

Judicial Ditch #3 qualifies as an impaired stream reach based on review of 39 samples collected on the stream from between 2000 through 2002. The stream was monitored as part of the Center and Elm Creeks Clean Water Partnership. The 6.2 mile reach was added to the impaired waters list in 2006. The monitoring data indicate the river exceeded surface water standards in June, July and August (the only months the site was monitored).

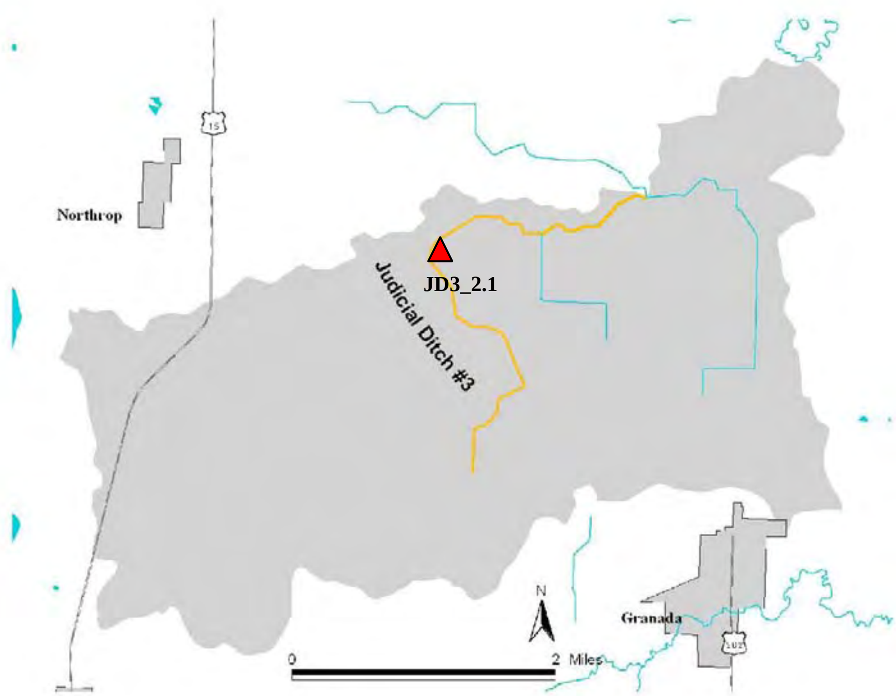
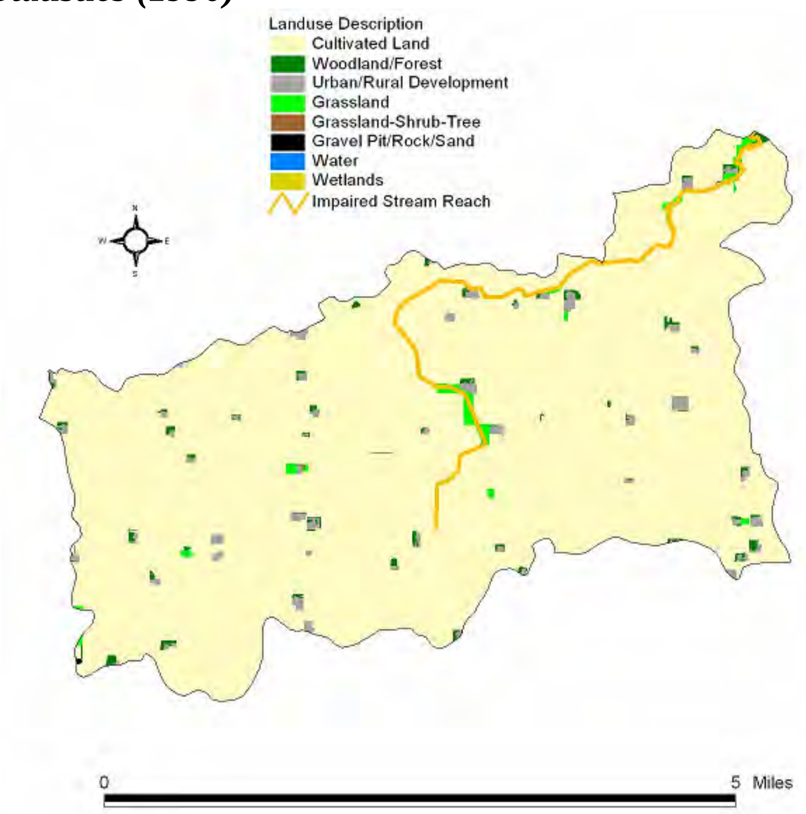


Figure 6.10b - Judicial Ditch #3; Headwater to Elm Creek Watershed

The Judicial Ditch 3 watershed encompasses 15 square miles in Martin County. The watershed has an estimated human population of 161 with 100% living in rural areas. The watershed has an estimated 18 feedlots with 8,161 livestock animal units. The watershed is 96.6% cultivated land, followed by rural development at 1.6% and grassland and woodland at 0.9% each.

There are no communities located within the basin. Based on county estimates, 28% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 19 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	8,963	96.6%
Grass/Shrub/Tree	1.3	0.0%
Grassland	85	0.9%
Gravel Pit/Rock/Sand	1.2	0.0%
Urban/Rural Development	148	1.6%
Water	0	0.0%
Wetlands	0	0.0%
Woodland/Forest	85	0.9%

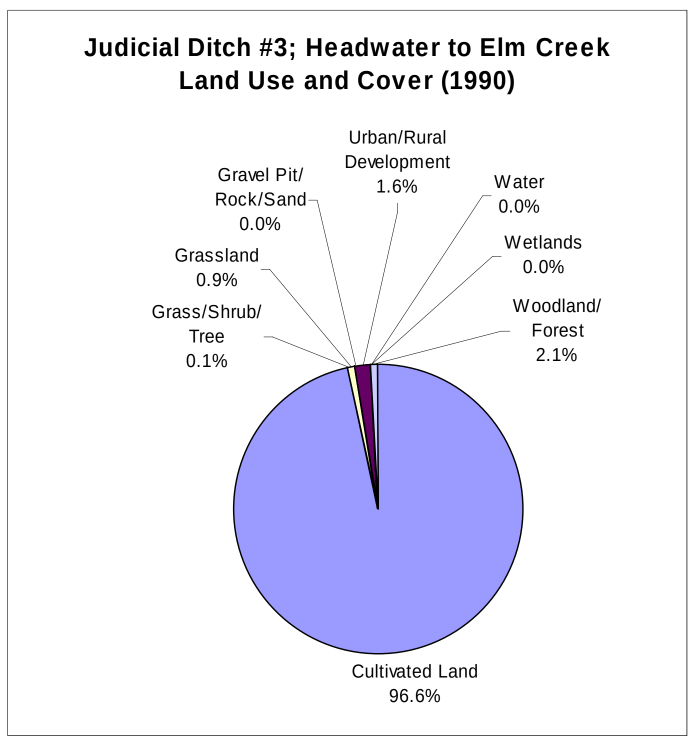


Figure 6.10c – 1990 Landuse and Cover Map and Statistics for Judicial Ditch #3; Headwaters to Elm Creek Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Center and Elm Creeks Clean Water Partnership
Years Monitored: 2000 through 2002
Samples Collected: 39

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	Inadequate Data
May	Inadequate Data
June	46.2%
July	78.1%
August	93.0%
September	Inadequate Data
October	Inadequate Data

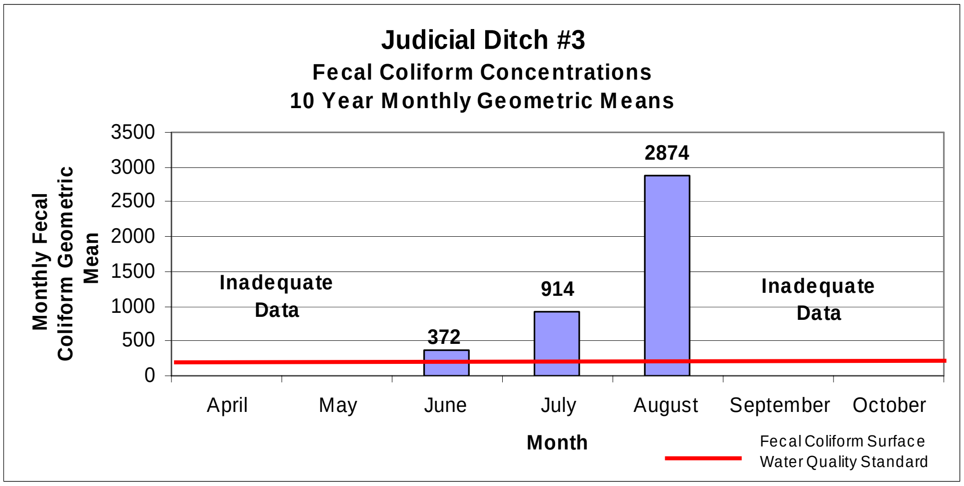


Figure 6.10d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.10a - Human and Animal Population Inventory for Judicial Ditch #3; Headwaters to Elm Creek Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	0		7.20E+10	0.00E+00	ASAE*, 1998
Beef	770		1.30E+11	1.00E+14	ASAE, 1998
Swine	7,386		8.00E+10	5.91E+14	ASAE, 1998
Chicken	0		3.40E+10	0.00E+00	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	4		4.20E+08	1.68E+09	ASAE, 1998
Sheep	0		2.00E+11	0.00E+00	ASAE, 1998
Humans		161	2.00E+09	3.22E+11	Metcalf and Eddy, 1991
Cats		44	5.00E+09	2.20E+11	Horsley and Witten, 1996
Dogs		38	5.00E+09	1.90E+11	Horsley and Witten, 1996
Deer		52	5.00E+08	2.60E+10	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		65	1.04E+07	6.76E+08	Alderisio and DeLuca, 1999
Wild Turkey		16	9.50E+07	1.52E+09	turkey value used
Pheasants		666	1.53E+04	1.02E+07	geese value used
Other Wildlife**				2.60E+10	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

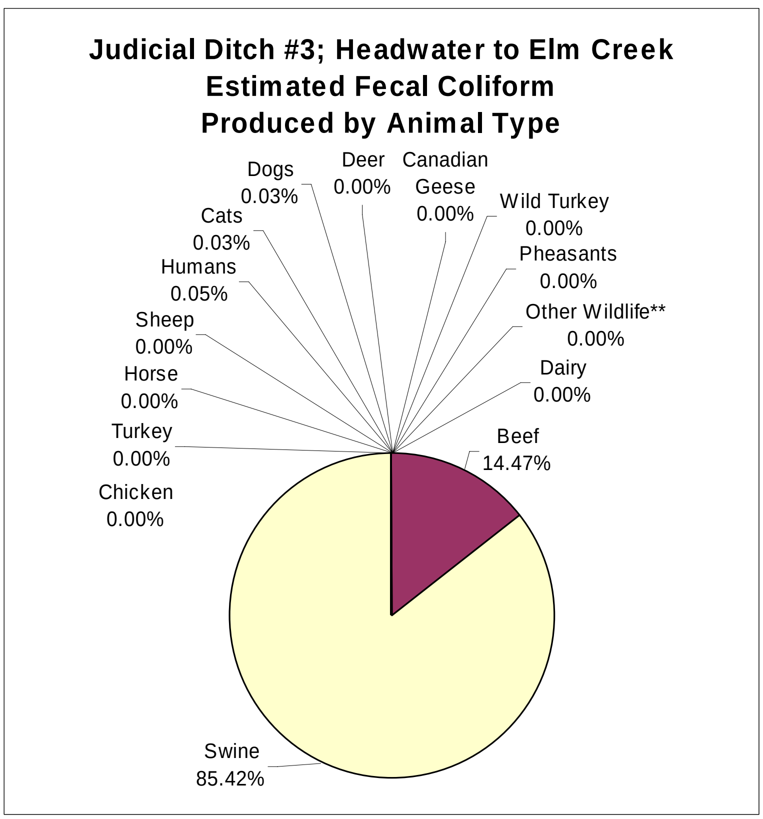


Figure 6.10e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

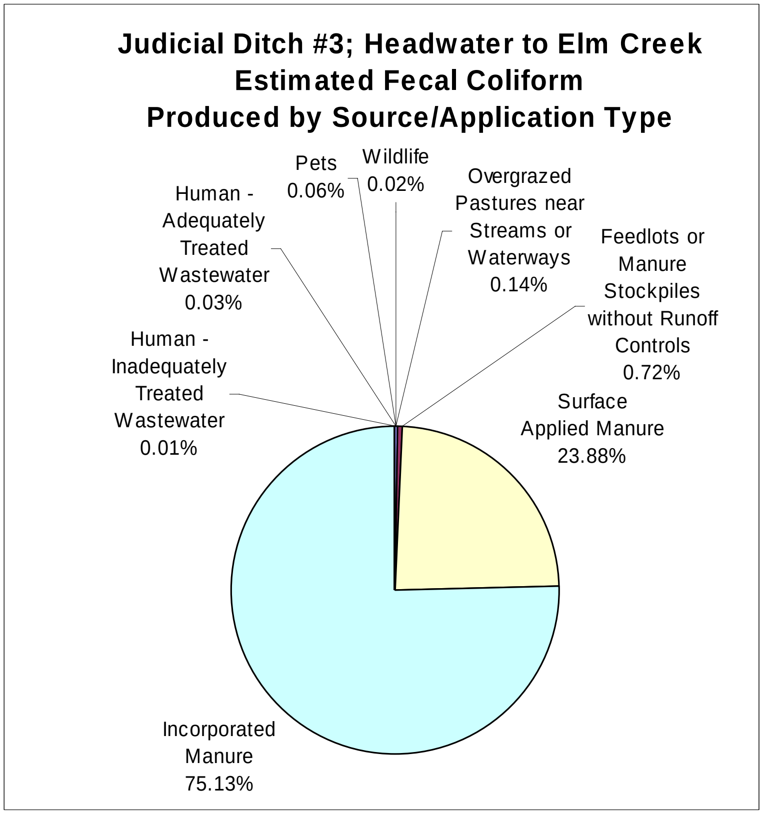


Figure 6.10f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in Judical Ditch #3.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Cats & Dogs		
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.		

Low Contributor	
Moderate Contributor	
High Contributor	

Figure 6.10g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Judicial Ditch #3; Headwater to Elm Creek

Fecal Coliform Loading Capacities and Allocations: Judicial Ditch #3; Headwater to Elm Creek

Table 6.10b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
None			
Totals		0.000	0.000

Livestock Facilities with NPDES Permits
Refer to appendix C.

Table 6.10c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.10d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Judicial Ditch #3; Headwater to Elm Creek

Drainage Area (square miles): 15
USGS gage used to develop flow zones and loading capacities:
Blue Earth River, near Rapidan
% MS4 Urban: 0%
Total WWTF Design Flow (mgd): 0.00

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	6.42	2.14	2.63	0.88	1.27	0.42	0.46	0.15	0.07	0.02
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5.05	1.68	2.04	0.68	0.96	0.32	0.27	0.09	0.04	0.01
Margin of Safety	1.37	0.46	0.60	0.20	0.30	0.10	0.19	0.06	0.02	0.01
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / 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	78.6%		77.4%		76.0%		59.1%		64.2%	
Margin of Safety	21.4%		22.6%		24.0%		40.9%		35.8%	

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.11 Lily Creek; Headwaters to Center Creek

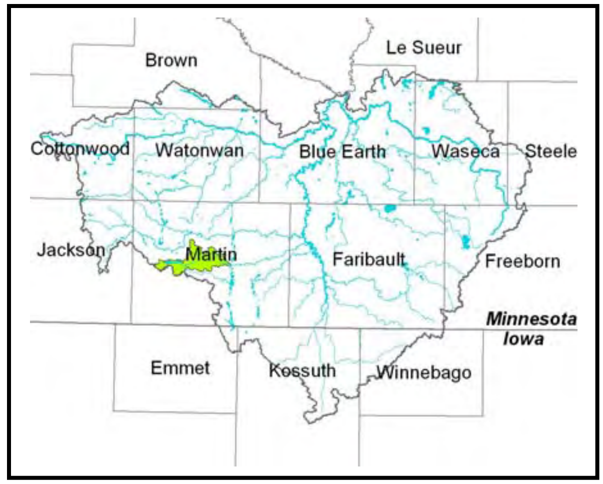


Figure 6.11a – Impaired Reach Watershed

Monitoring Site ID:
Lily Creek, Hunt Farm
(LC_1.2)

Stream Status:
Impaired Stream Reach (2006 Listing)

Impaired Reach Length
13.3 miles

Contributing Watershed Size
25,062 acres
39 square miles

Human Population (2000 Census)
1,356 (1,021 urban and 335 rural)

Cities Located in Watershed
Fairmont*
Sherburn*
Welcome
* Waste Water Effluent Discharged Outside Watershed Boundary

Livestock (2003 Feedlot Inventory)
42 feedlot facilities
19,840 total animal units

The Lily Creek qualifies as an impaired stream reach based on review of 41 samples collected on the stream from between 2000 through 2002. The impaired reach is 13.3 miles in length and includes the entire river from headwaters to it outlet at Center Creek. The reach was added to the impaired waters list in 2006. The stream was monitored as part of the Lily Creek Clean Water Partnership. The monitoring data indicate the river exceeded surface water standards in June, July and August, with insufficient samples for analysis all other months.

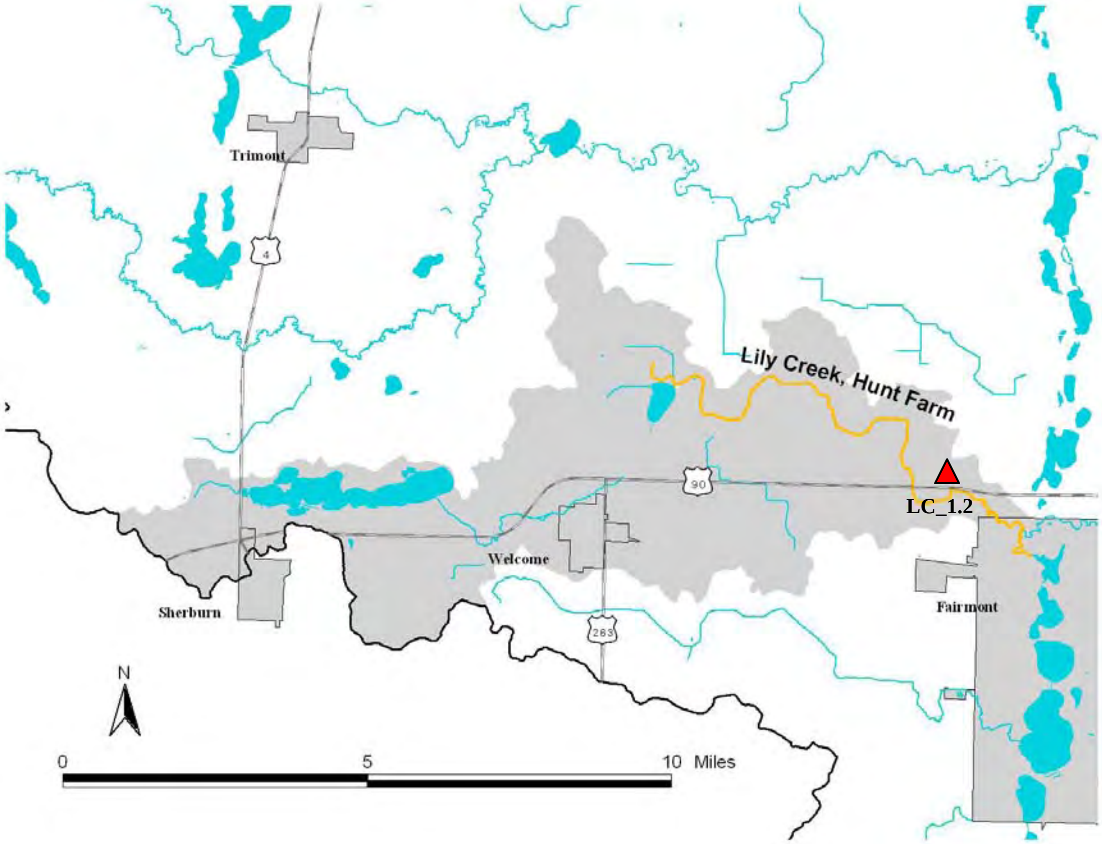


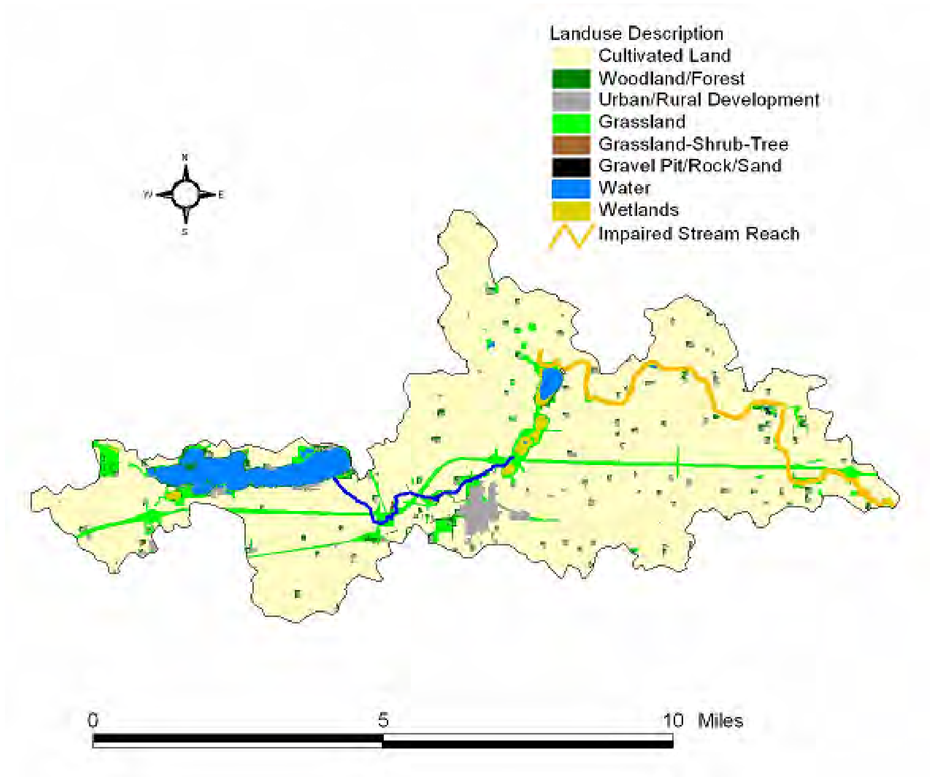
Figure 6.11b - Lily Creek; Headwaters to Center Creek Watershed

The Lily Creek watershed encompasses 39 square miles in Martin County. The watershed has a human population of 1,356, with 33% living in rural areas. The watershed has an estimated 42 feedlots with 19,840 livestock animal units. The watershed is 82.9% cultivated land, followed by grassland at 6.8% and woodland at 4.2%.

There are three cities located in the watershed, Fairmont, Sherburn and Welcome. Fairmont, which comprises 0.6% of the watershed, requires an MS4 stormwater permit.

Based on county estimates, 28% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 40 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	20,775	82.9%
Grass/Shrub/Tree	22.4	0.1%
Grassland	1,704	6.8%
Gravel Pit/Rock/Sand	5.3	0.0%
Urban/Rural Development	834	3.3%
Water	1,059	4.2%
Wetlands	176.3	0.7%
Woodland/Forest	487	1.9%

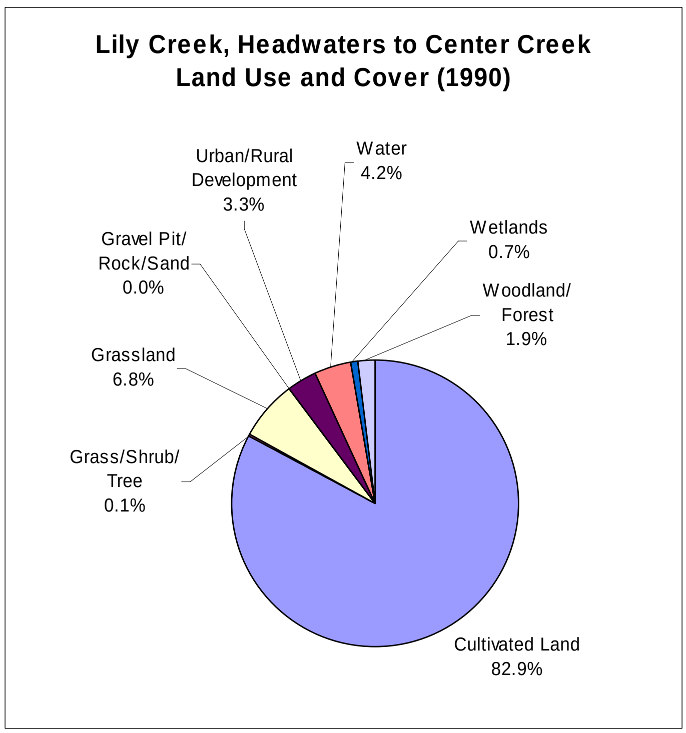


Figure 6.11c – 1990 Landuse and Cover Map and Statistics for Lily Creek; Headwaters to Center Creek Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Lily Creek Clean Water Partnership
Years Monitored: 2000 through 2002
Samples Collected: 41

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	**Required Reduction**
April	Inadequate Data
May	Inadequate Data
June	77.3%
July	78.4%
August	91.0%
September	Inadequate Data
October	Inadequate Data

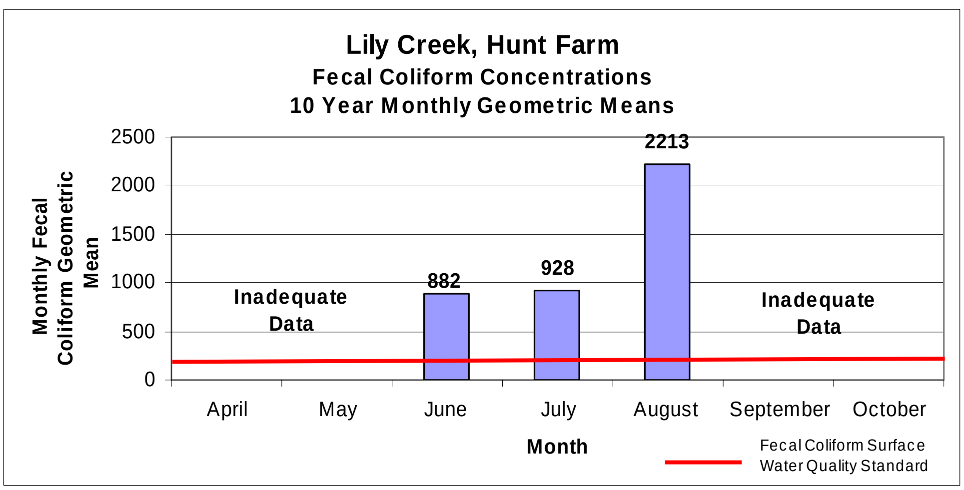


Figure 6.11d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.11a - Human and Animal Population Inventory for Lily Creek; Headwaters to Center Creek Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	0		7.20E+10	0.00E+00	ASAE*, 1998
Beef	3,344		1.30E+11	4.35E+14	ASAE, 1998
Swine	16,462		8.00E+10	1.32E+15	ASAE, 1998
Chicken	0		3.40E+10	0.00E+00	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	28		4.20E+08	1.18E+10	ASAE, 1998
Sheep	0		2.00E+11	0.00E+00	ASAE, 1998
Humans		1,356	2.00E+09	2.71E+12	Metcalf and Eddy, 1991
Cats		368	5.00E+09	1.84E+12	Horsley and Witten, 1996
Dogs		324	5.00E+09	1.62E+12	Horsley and Witten, 1996
Deer		141	5.00E+08	7.05E+10	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		174	1.04E+07	1.81E+09	Alderisio and DeLuca, 1999
Wild Turkey		43	9.50E+07	4.09E+09	turkey value used
Pheasants		1,797	1.53E+04	2.75E+07	geese value used
Other Wildlife**				7.05E+10	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

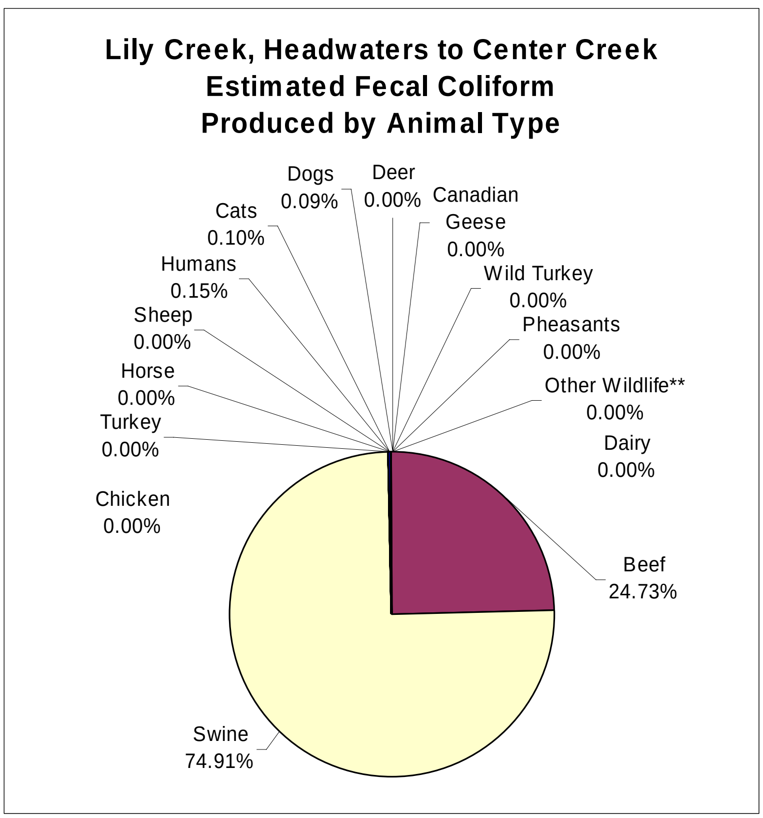


Figure 6.11e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

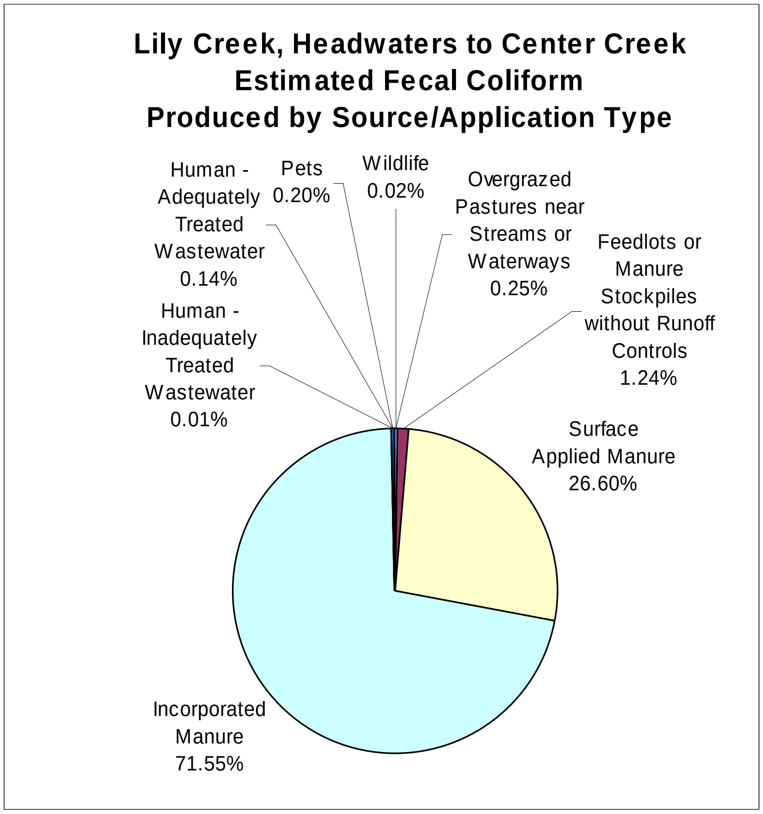


Figure 6.11f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of Lily Creek.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Cats & Dogs		
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.		

Low Contributor
Moderate Contributor
High Contributor

Figure 6.11g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Lily Creek; Headwaters to Center Creek

Fecal Coliform Loading Capacities and Allocations: Lily Creek; Headwaters to Center Creek

Table 6.11b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Welcome	MN0021296	0.260	0.059
Totals		0.260	0.059

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 6.11c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
Fairmont	115	Designated by rule; >10,000 population

Table 6.11d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Lily Creek; Headwaters to Center Creek

Drainage Area (square miles): 39
USGS gage used to develop flow zones and loading capacities:
Blue Earth River, near Rapidan

	Flow Zone									
% MS4 Urban: 0.60%										
Total WWTF Design Flow (mgd): 0.26	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	17.33	5.78	7.11	2.37	3.43	1.14	1.25	0.42	0.18	0.06
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02	0.06	0.02
Communities Subject to MS4 NPDES Requirements	0.08	0.03	0.03	0.01	0.02	0.01	0.00	0.00	0.00	0.00
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	13.48	4.49	5.41	1.80	2.53	0.84	0.68	0.23	0.06	0.02
Margin of Safety	3.71	1.24	1.61	0.54	0.82	0.27	0.51	0.17	0.07	0.02
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%		100%		100%		100%		100%	
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.3%		0.8%		1.7%		4.7%		32.1%	
Communities Subject to MS4 NPDES Requirements	0.5%		0.5%		0.4%		0.3%		0.2%	
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	77.8%		76.1%		73.9%		54.1%		31.9%	
Margin of Safety	21.4%		22.6%		24.0%		40.9%		35.8%	

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.12 Little Beauford Ditch; Headwater to Cobb River

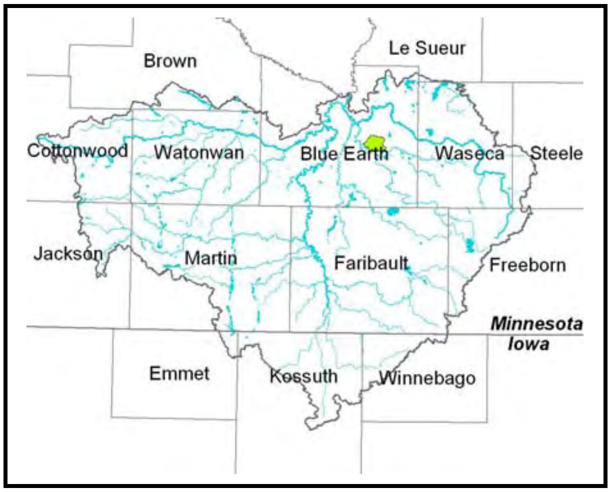


Figure 6.12a – Impaired Reach Watershed

Monitoring Site ID:
Beauford Ditch
(BEA_0.6)

Stream Status:
Impaired Stream Reach (2004 Listing)

Impaired Reach Length
3.0 miles

Contributing Watershed Size
5,531 acres
9 square miles

Human Population (2000 Census)
101 (100% rural)

Cities Located in Watershed

Livestock (2005 Blue Earth County Feedlot Inventory)
6 Feedlot Facilities
4,270 total animal units

The Beauford ditch qualifies as an impaired stream reach based on review of 142 samples collected on the river between 1995 through 2004. The Beauford ditch impaired reach is 3.0 miles in length and was listed as impaired in 2004. The ditch is one of the most monitored minor watersheds in the state of Minnesota. The watershed has been part of many studies/projects, including a septic upgrade project in the mid 1990's. Groups that have collected fecal coliform samples from the site include the Minnesota Pollution Control Agency, United States Geologic Survey and the Water Resources Center, MN State University, Mankato The data set indicate that based on MPCA impaired waters listing criteria, the ditch exceeded standards during the months June through October.

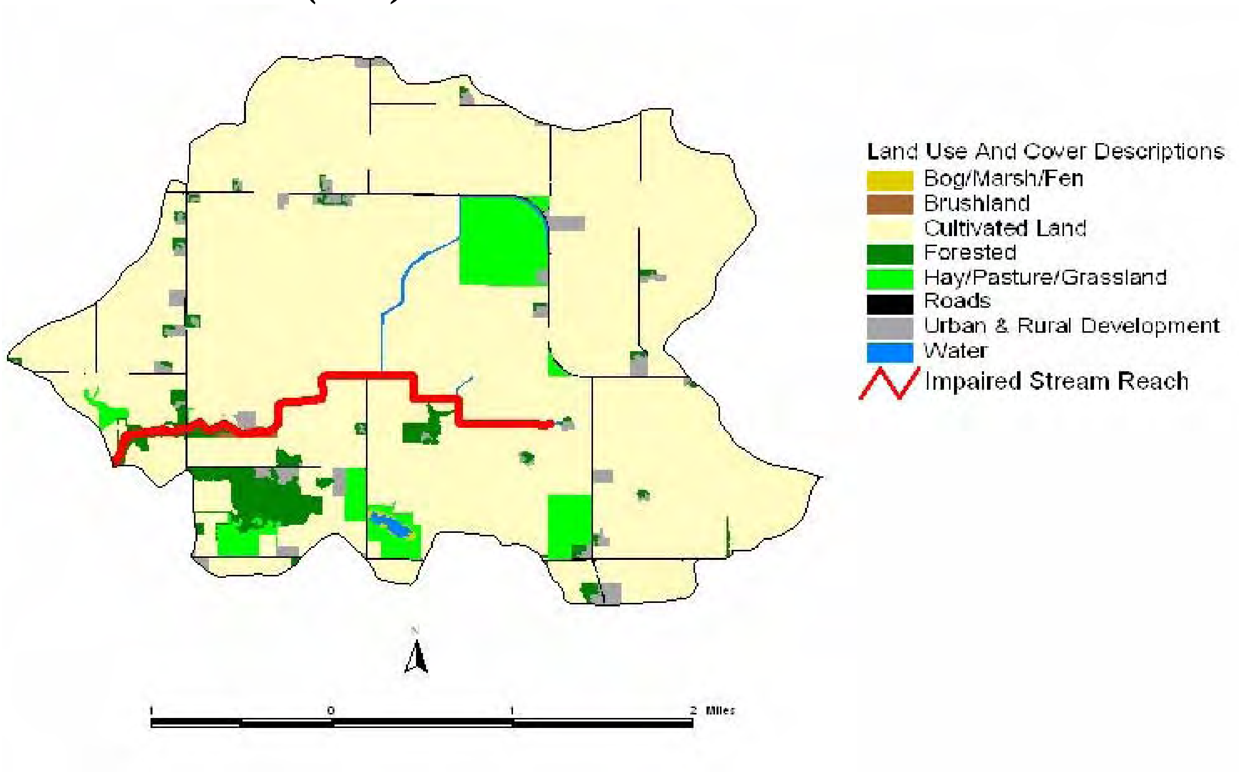
Figure 6.12b - Little Beauford Ditch; Headwater to Cobb River Watershed

The Beauford ditch watershed encompasses 9 square miles in Blue Earth County. This is the smallest impaired watershed in the Basin. The watershed has a human population of 101, all living in rural areas. The watershed also contains 6 feedlots with an estimated 4,270 livestock animal units. The watershed is 86.1% cultivated land, followed by grassland at 5.4% and woodland at 3.6%.

The watershed has the highest compliance rate of ISTS of all the impaired stream reach watersheds. In 1994 and 1995, 18 of 32 septic systems were upgraded in the watershed as part of a project conducted by the MPCA, Blue Earth Soil and Water Conservation District and University of Minnesota. As of 2005, 83% of the 42 septic systems in the watershed are permitted by Blue Earth County, (66% since 1993). Upgrades to septic systems appear to have reduced fecal levels somewhat during low flow conditions. (based on pre 1995 vs post 1995 water quality comparisons). However, the Beauford ditch still has elevated bacterial levels during most of the summer and fall months. In 2005, 29 of 39 (74%) water samples collected from the outlet of Beauford ditch exceeded 200 org/100 ml.

Based on county estimates, 17% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 7 households.

Land Use Statistics (2005)



Landuse Category	Acres	Percent
Cultivated Land	4,768	86.1%
Grass/Shrub/Tree	12	0.2%
Grassland	300	5.4%
Roads	74	1.3%
Urban/Rural Development	135	2.4%
Water	41	0.7%
Bog/Marsh	4	0.1%
Woodland/Forest	201	3.6%

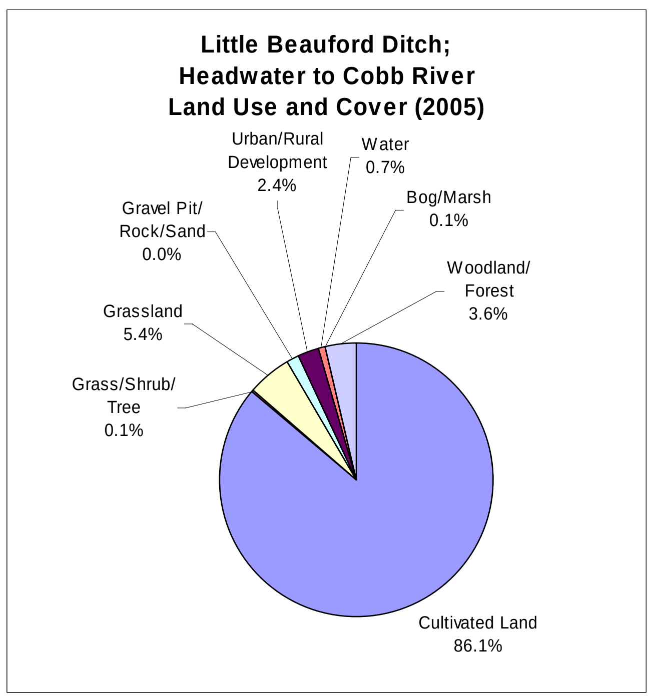


Figure 6.12c – 2005 Landuse and Cover Map and Statistics for Little Beauford Ditch; Headwaters to Cobb River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Water Resources Center, MN State University, Mankato
Minnesota Pollution Control Agency
United States Geological Survey
Years Monitored: 1995-2004
Samples Collected: 142

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	None Required
June	49.9%
July	73.0%
August	85.3%
September	18.0%
October	11.1%

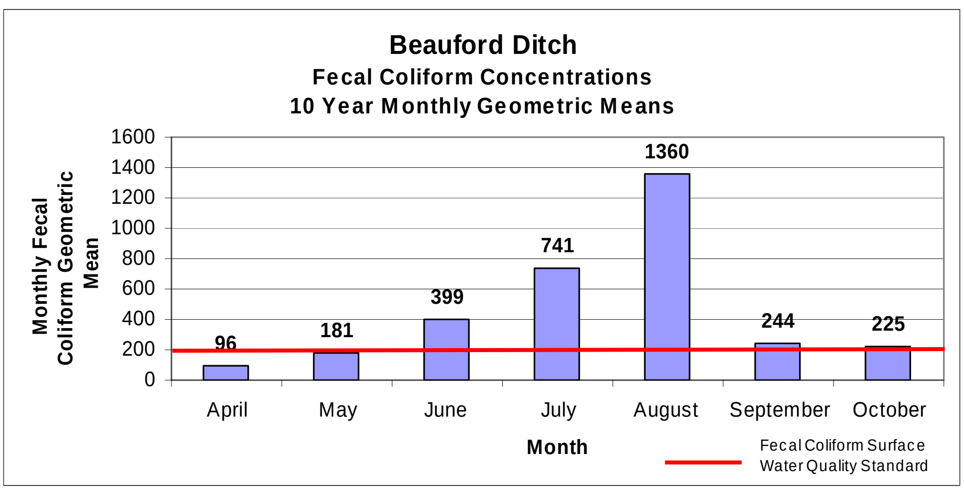


Figure 6.12d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.12a - Human and Animal Population Inventory for Little Beauford Ditch; Headwaters to Cobb River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	0		7.20E+10	0.00E+00	ASAE*, 1998
Beef	375		1.30E+11	4.88E+13	ASAE, 1998
Swine	3,895		8.00E+10	3.12E+14	ASAE, 1998
Chicken	0		3.40E+10	0.00E+00	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	0		4.20E+08	0.00E+00	ASAE, 1998
Sheep	0		2.00E+11	0.00E+00	ASAE, 1998
Humans		101	2.00E+09	2.02E+11	Metcalf and Eddy, 1991
Cats		47	5.00E+09	2.35E+11	Horsley and Witten, 1996
Dogs		41	5.00E+09	2.05E+11	Horsley and Witten, 1996
Deer		31	5.00E+08	1.55E+10	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		39	1.04E+07	4.06E+08	Alderisio and DeLuca, 1999
Wild Turkey		9	9.50E+07	8.55E+08	turkey value used
Pheasants		397	1.53E+04	6.07E+06	geese value used
Other Wildlife**				1.55E+10	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

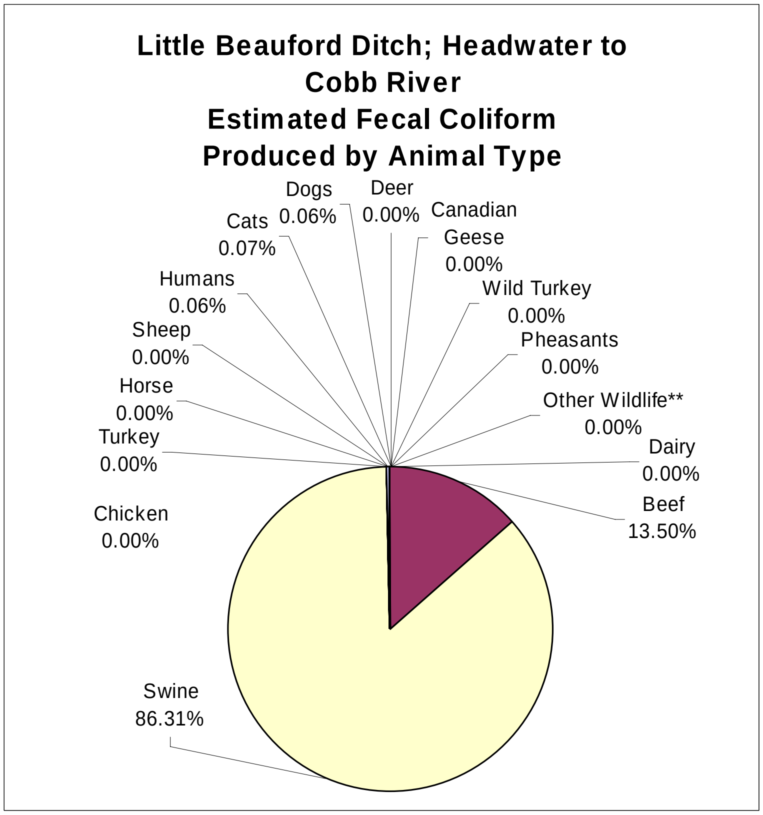


Figure 6.12e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

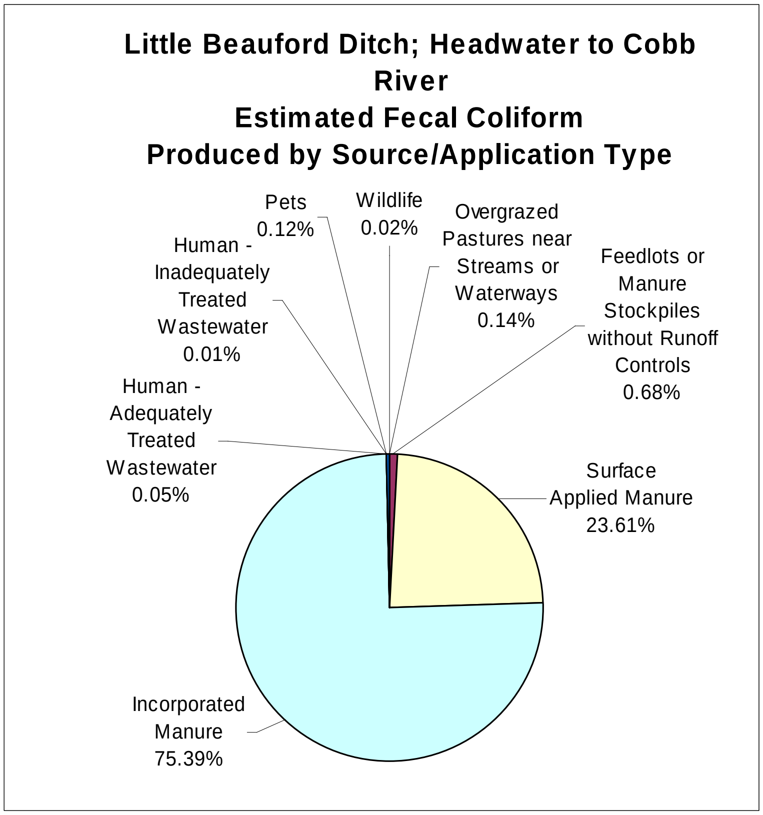


Figure 6.12f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems during dry conditions are the major sources of fecal coliform bacteria contamination in Little Beauford Ditch.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low Contributor	Low Contributor
	Feedlots or Manure Stockpiles without Runoff Controls	Low Contributor	Low Contributor
	Surface Applied Manure	High Contributor	Low Contributor
	Incorporated Manure	Moderate Contributor	Low Contributor
Human	Human - Inadequately Treated Wastewater	Low Contributor	High Contributor
Pets	Cats & Dogs	Low Contributor	Low Contributor
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low Contributor	Moderate Contributor

Low Contributor	(green)
Moderate Contributor	(yellow)
High Contributor	(orange)

Figure 6.12g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Little Beauford Ditch; Headwater to Cobb River

Fecal Coliform Loading Capacities and Allocations: Little Beauford Ditch; Headwater to Cobb River

Table 6.12b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
None			
Totals		0.000	0.000

Livestock Facilities with NPDES Permits
Refer to appendix C.

Table 6.12c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.12d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Little Beauford Ditch; Headwater to Cobb River

Drainage Area (square miles): 9
USGS gage used to develop flow zones and loading capacities:
Le Sueur River, near Rapidan

	Flow Zone									
% MS4 Urban: 0%										
Total WWTF Design Flow (mgd): 0.00	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	4.05	1.35	1.88	0.63	0.92	0.31	0.23	0.08	0.03	0.01
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3.25	1.08	1.46	0.49	0.64	0.21	0.14	0.05	0.02	0.01
Margin of Safety	0.81	0.27	0.42	0.14	0.28	0.09	0.09	0.03	0.01	0.00
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / 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	80.1%		77.6%		70.0%		60.0%		62.3%	
Margin of Safety	19.9%		22.4%		30.0%		40.0%		37.7%	

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.13 Watonwan River; Headwaters to North Fork Watonwan River

Monitoring Site ID:
    Watonwan River, CSAH 4
    (WAT_52.2)

Stream Status:
    Impaired Stream Reach (2006 Listing)

Impaired Reach Length
    50.3 miles

Contributing Watershed Size
    78,361 acres
    122 square miles

Human Population (2000 Census)
    4,057 (1,823 urban and 2,234 rural)

Cities Located in Watershed
    Darfur
    Mountain Lake

Livestock (2003 feedlot inventory)
    42 Feedlot Facilities
    20,688 total animal units

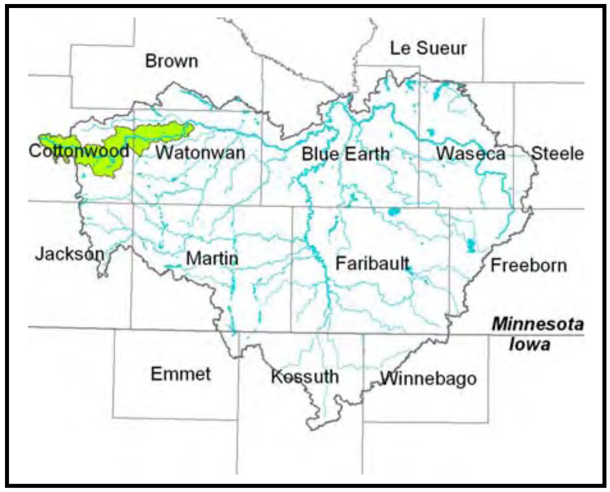


Figure 6.13a – Impaired Reach Watershed

The Watonwan River; Headwaters to North Fork Watonwan River qualifies as an impaired stream reach based on review of 59 samples collected on the river between 2000 through 2002. This is the longest impaired stream reach in the basin at 50.3 miles. The reach was added to the impaired waters list in 2006. The monitoring data used to assess the river as impaired was collected as part of the Watonwan Phase I Clean Water Partnership. The data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months May through August.

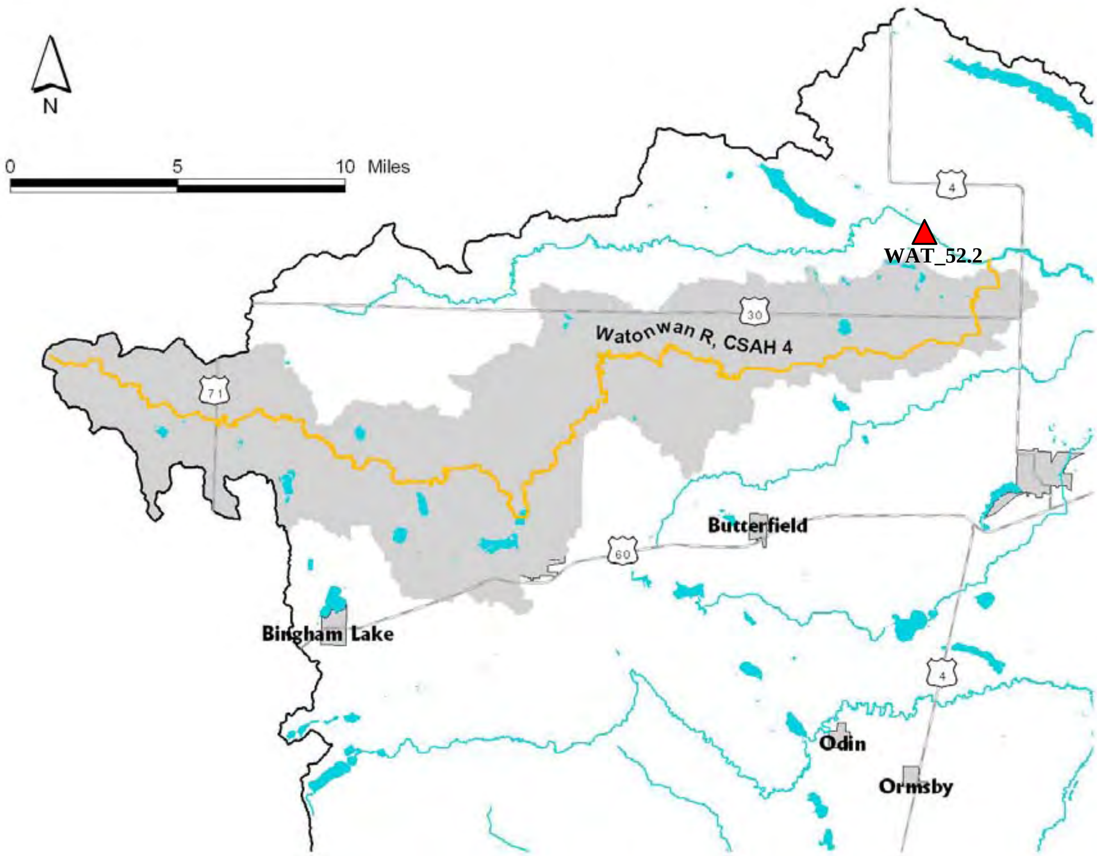


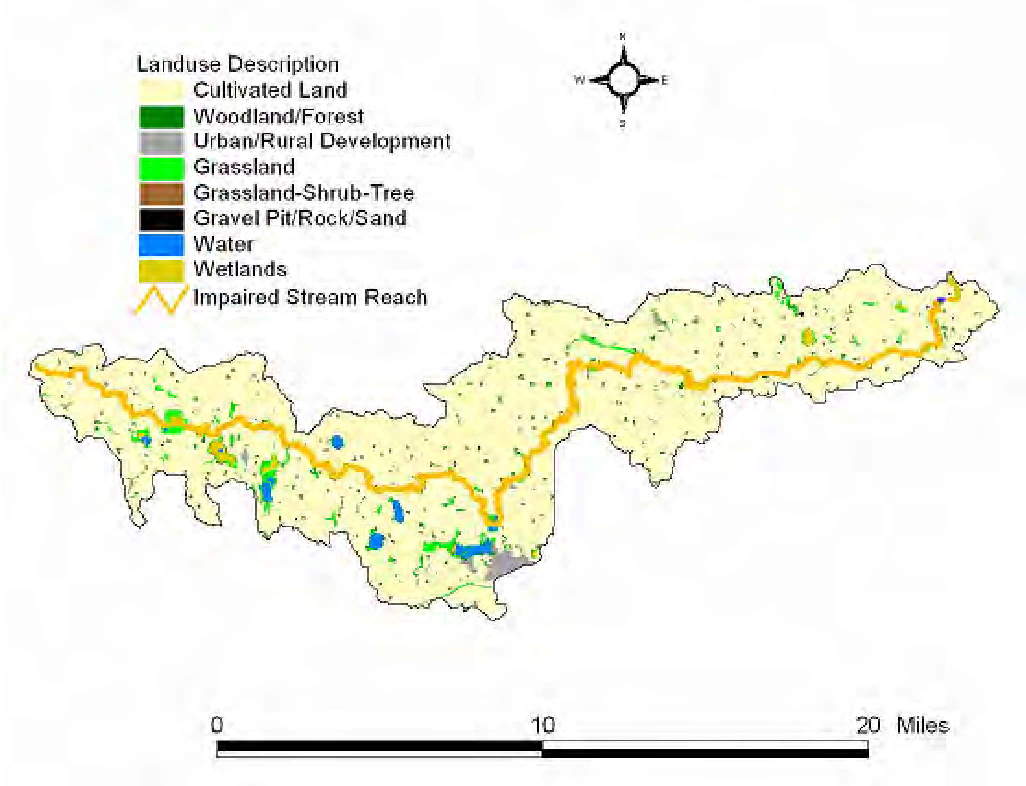
Figure 6.13b - Watonwan River; Headwaters to North Fork Watonwan River Watershed

This portion of the Watonwan River watershed encompasses 122 square miles in Cottonwood and Watonwan counties. The watershed has a human population of 4,057, with 55% living in rural areas. The watershed also contains an estimated 42 feedlots with 20,688 livestock animal units. The watershed is 90% cultivated land, with grassland and forested areas comprising another 6%.

Two cities are located in the watershed, Darfur and Mountain Lake.

Based on county estimates, 43% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 375 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	70,845	90.4%
Grass/Shrub/Tree	21.4	0.0%
Grassland	2,815	3.6%
Gravel Pit/Rock/Sand	17.8	0.0%
Urban/Rural Development	1,797	2.3%
Water	772	1.0%
Wetlands	519.4	0.7%
Woodland/Forest	1,573	2.0%

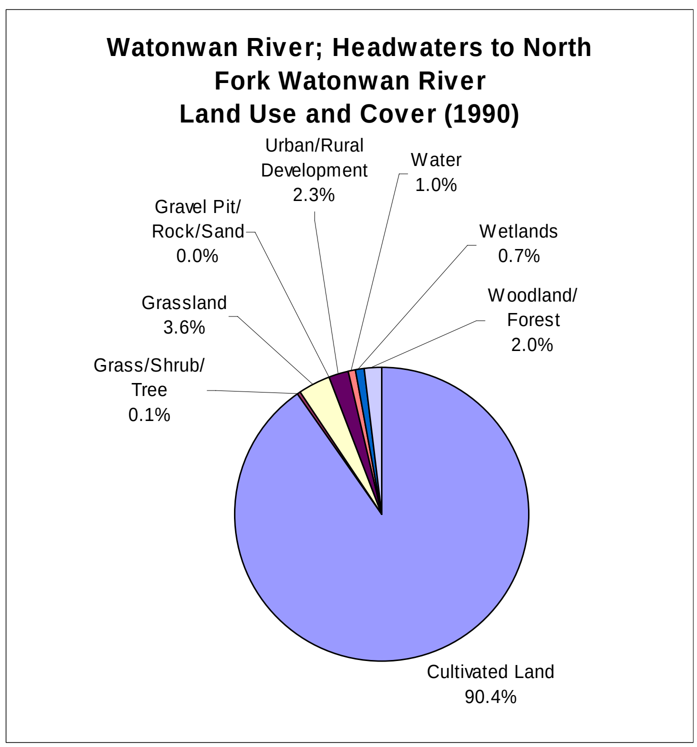


Figure 6.13c – 1990 Landuse and Cover Map and Statistics for Watonwan River; Headwaters to North Fork Watonwan River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Watonwan River Clean Water Partnership
Years Monitored: 2000 through 2002
Samples Collected: 59

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	44.6%
June	77.0%
July	85.3%
August	79.6%
September	Inadequate Data
October	Inadequate Data

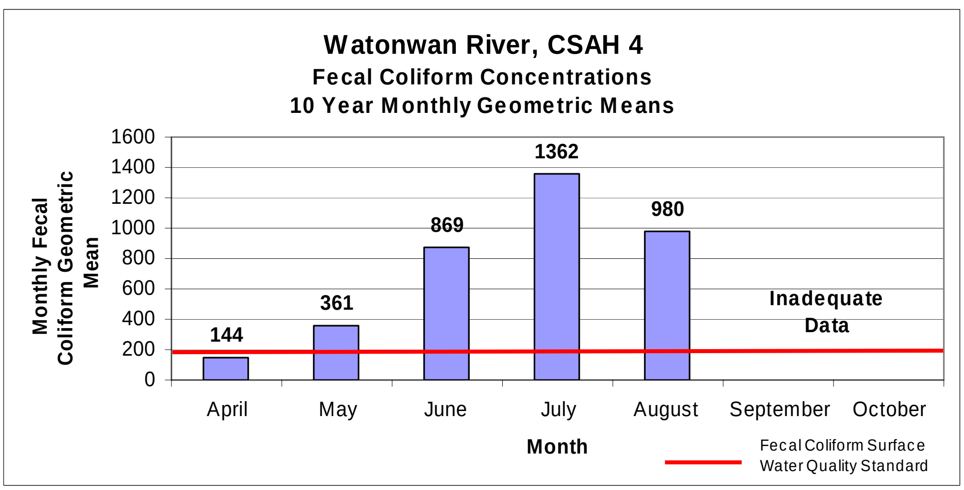


Figure 6.13d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.13a - Human and Animal Population Inventory for Watonwan River; Headwaters to North Fork Watonwan River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	2,236		7.20E+10	1.61E+14	ASAE*, 1998
Beef	2,710		1.30E+11	3.52E+14	ASAE, 1998
Swine	13,236		8.00E+10	1.06E+15	ASAE, 1998
Chicken	1,620		3.40E+10	5.51E+13	ASAE, 1998
Turkey	782		6.20E+09	4.85E+12	ASAE, 1998
Horse	9		4.20E+08	3.78E+09	ASAE, 1998
Sheep	92		2.00E+11	1.84E+13	ASAE, 1998
Humans		4,057	2.00E+09	8.11E+12	Metcalf and Eddy, 1991
Cats		957	5.00E+09	4.79E+12	Horsley and Witten, 1996
Dogs		841	5.00E+09	4.21E+12	Horsley and Witten, 1996
Deer		441	5.00E+08	2.21E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		545	1.04E+07	5.67E+09	Alderisio and DeLuca, 1999
Wild Turkey		133	9.50E+07	1.26E+10	turkey value used
Pheasants		5,620	1.53E+04	8.60E+07	geese value used
Other Wildlife**				2.21E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

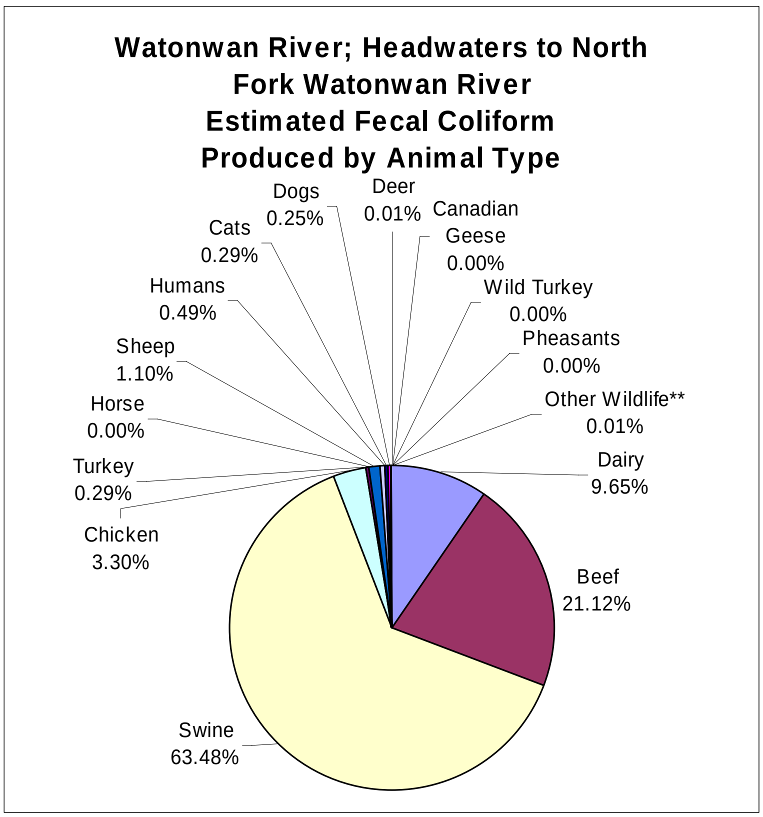


Figure 6.13e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

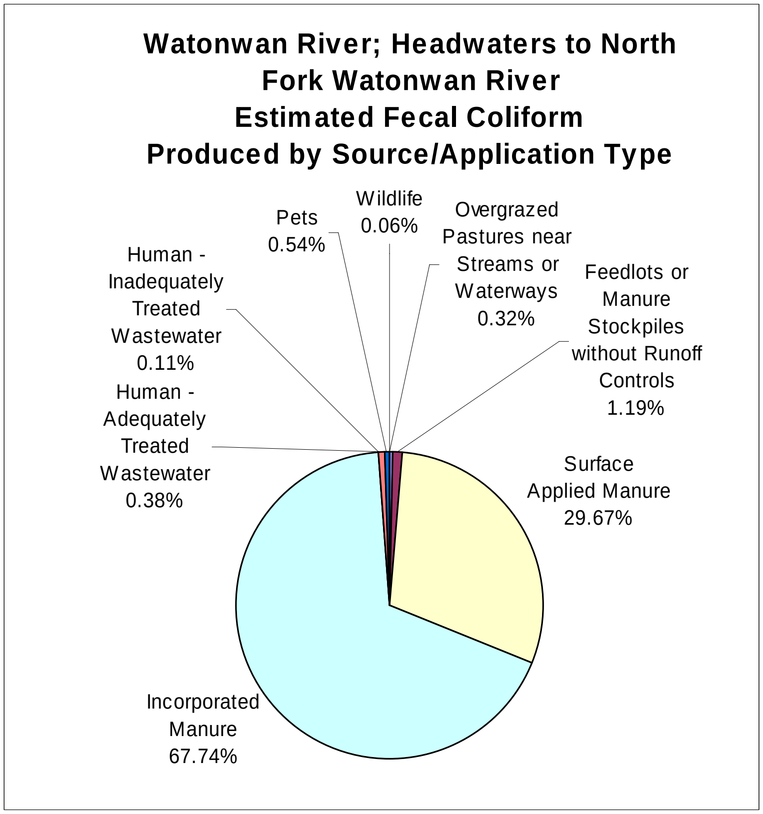


Figure 6.13f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of the Watonwan River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low Contributor	Moderate Contributor
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate Contributor	Low Contributor
	Surface Applied Manure	High Contributor	Low Contributor
	Incorporated Manure	Moderate Contributor	Low Contributor
Human	Human - Inadequately Treated Wastewater	Low Contributor	High Contributor
Pets	Cats & Dogs	Low Contributor	Low Contributor
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low Contributor	Low Contributor

Low Contributor
Moderate Contributor
High Contributor

Figure 6.13g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Watonwan River; Headwaters to North Fork Watonwan River Watershed

Fecal Coliform Loading Capacities and Allocations: Watonwan River; Headwaters to North Fork Watonwan River Watershed

Table 6.13b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Darfur	county permitted	0.010	0.002
Mountain Lake	MNG580035	2.168	0.492
Totals		2.177	0.495

Livestock Facilities with NPDES Permits

Refer to appendix C.

Table 6.13c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.13d – Monthly/Daily Fecal Coliform Loading Capacities and Allocations

Watonwan River; Headwaters to North Fork Watonwan River

Drainage Area (square miles): 122

USGS gage used to develop flow zones and loading capacities:

Watonwan River, near Garden City

% MS4 Urban: 0%

Total WWTF Design Flow (mgd): 2.18

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	42.24	14.08	20.53	6.84	9.06	3.02	2.28	0.76	0.44	0.15
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.49	0.16	0.49	0.16	0.49	0.16	0.49	0.16	*	*
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	34.88	11.63	14.63	4.88	6.07	2.02	0.89	0.30	*	*
Margin of Safety	6.86	2.29	5.41	1.80	2.49	0.83	0.90	0.30	na	na
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%		100%		100%		100%		100%	
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	1.2%		2.4%		5.5%		21.7%		*	
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	82.6%		71.3%		67.0%		38.9%		*	
Margin of Safety	16.3%		26.3%		27.5%		39.4%		na	

*Note - WWTF design/discharge flow exceeded low flow

alllocation = (flow contribution from a given source) X (200 orgs./100ml.), see section 5.0 for details

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.14 Watonwan River; North Fork Watonwan River to Butterfield Creek

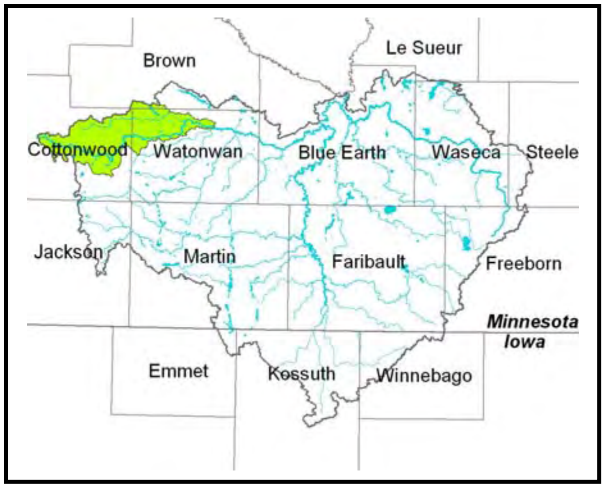


Figure 6.14a – Impaired Reach Watershed

Monitoring Site ID:
    Watonwan River, CR 16
    (WAT_42.6)

Stream Status:
    Impaired Stream Reach (2006 Listing)

Impaired Reach Length
    8.1 miles

Contributing Watershed Size
    133,627 acres
    209 square miles

Human Population (2000 Census)
    4,147 (2,234 urban and 1,913 rural)

Cities Located in Watershed
    Darfur
    La Salle*
    Mountain Lake
    * Waste Water Effluent Discharged Outside Watershed Boundary

Livestock (2003 feedlot inventory)
    99 Feedlot Facilities
    45,841 total animal units

The Watonwan River; North Fork Watonwan River to Butterfield Creek qualifies as an impaired stream reach based on review of 58 samples collected on the river between 2000 through 2002. The impaired reach is 8.1 miles in length. The reach was added to the impaired waters list in 2006. The monitoring data used to assess the river as impaired was collected as part of the Watonwan Phase I Clean Water Partnership. The water quality data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months April through August.

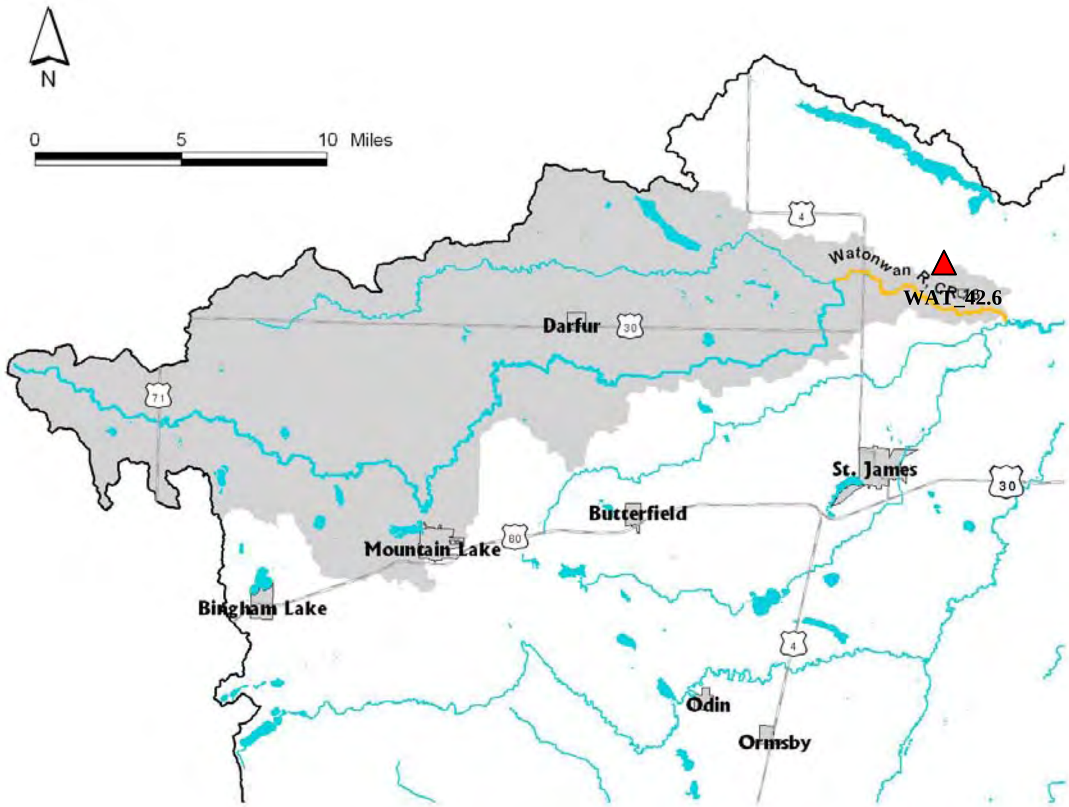


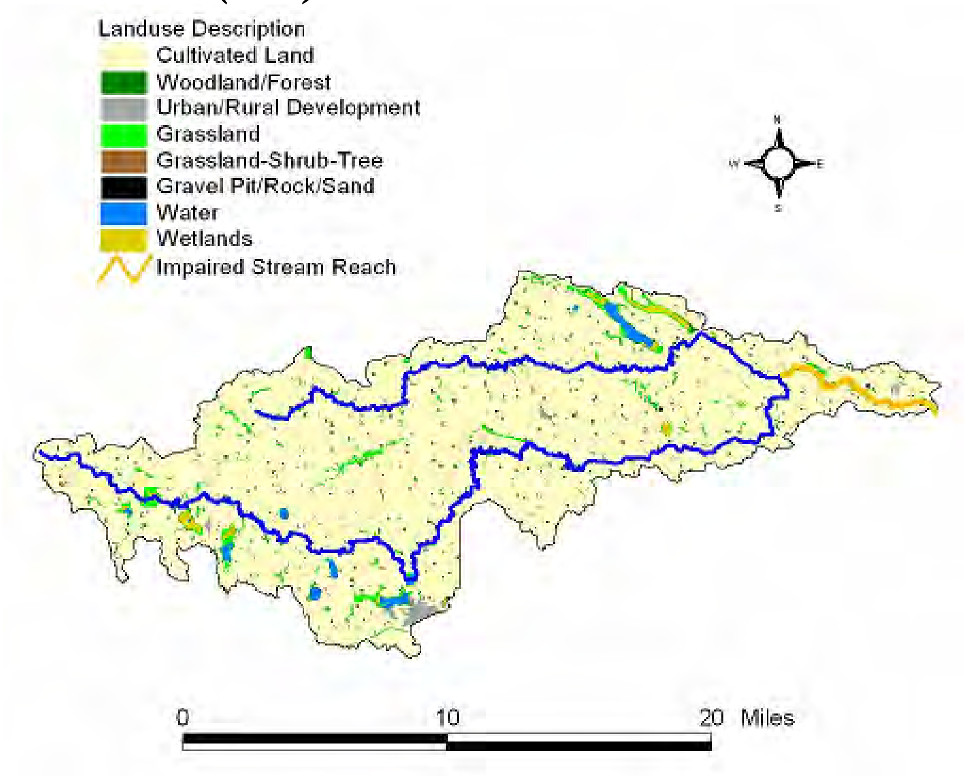
Figure 6.14b - Watonwan River; North Fork Watonwan River to Butterfield Creek Watershed

This portion impaired stream reach watershed encompasses 209 square miles in Cottonwood, Watonwan and Brown counties. The watershed has a human population of 4,147, with 54% living in rural areas. The watershed also contains an estimated 99 feedlots with 45,841 livestock animal units. The watershed is 90.1% cultivated land, followed by grassland (3.9%), woodland (2.2%) and urban/rural development (2.0%).

There are three cities located in the watershed, Darfur, La Salle and Mountain Lake. La Salle, which is currently unsewered, is scheduled to have some type of wastewater treatment system in place by the end of 2006.

Based on county estimates, 41% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 375 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	120,385	90.1%
Grass/Shrub/Tree	34.8	0.0%
Grassland	5,192	3.9%
Gravel Pit/Rock/Sand	28.5	0.0%
Urban/Rural Development	2,728	2.0%
Water	1,298	1.0%
Wetlands	1014.3	0.8%
Woodland/Forest	2,946	2.2%

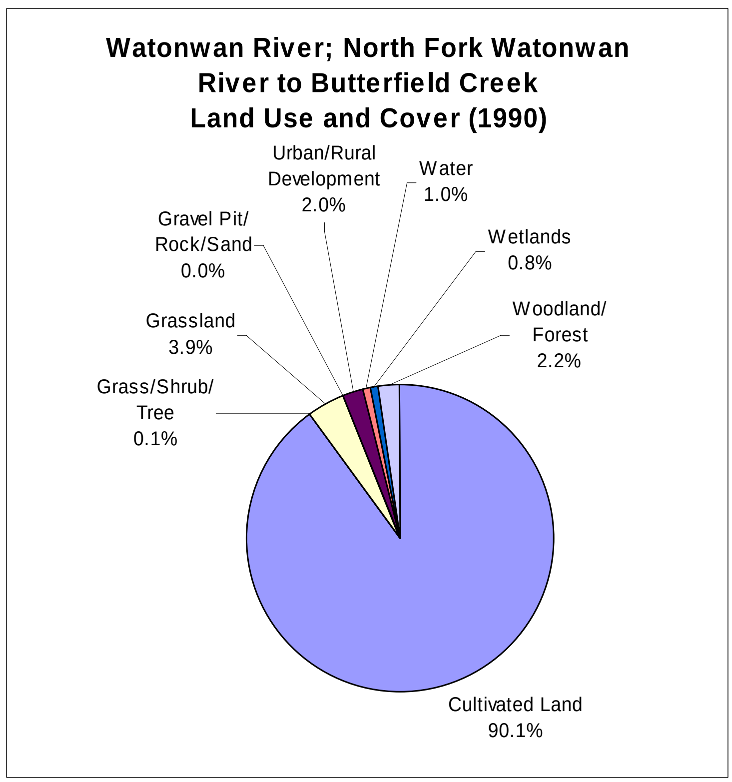


Figure 6.14c – 1990 Landuse and Cover Map and Statistics for Watonwan River; North Fork Watonwan River to Butterfield Creek Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Watonwan River Clean Water Partnership
Years Monitored: 2000 through 2002
Samples Collected: 58

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	29.3%
May	40.8%
June	76.2%
July	88.7%
August	93.8%
September	Inadequate Data
October	Inadequate Data

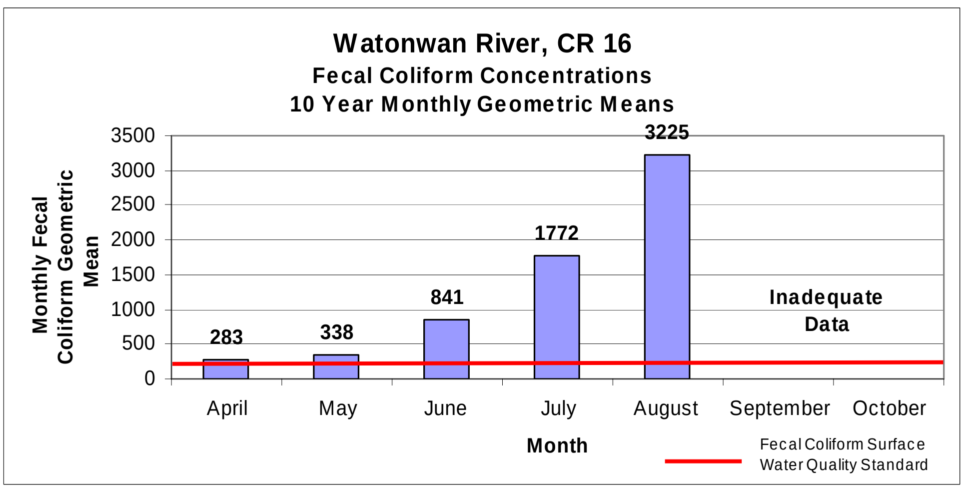


Figure 6.14d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.14a - Human and Animal Population Inventory for Watonwan River; North Fork Watonwan River to Butterfield Creek Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	3,092		7.20E+10	2.23E+14	ASAE*, 1998
Beef	10,116		1.30E+11	1.32E+15	ASAE, 1998
Swine	30,057		8.00E+10	2.40E+15	ASAE, 1998
Chicken	1,620		3.40E+10	5.51E+13	ASAE, 1998
Turkey	782		6.20E+09	4.85E+12	ASAE, 1998
Horse	25		4.20E+08	1.05E+10	ASAE, 1998
Sheep	141		2.00E+11	2.82E+13	ASAE, 1998
Humans		4,147	2.00E+09	8.29E+12	Metcalf and Eddy, 1991
Cats		1,126	5.00E+09	5.63E+12	Horsley and Witten, 1996
Dogs		990	5.00E+09	4.95E+12	Horsley and Witten, 1996
Deer		752	5.00E+08	3.76E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		930	1.04E+07	9.67E+09	Alderisio and DeLuca, 1999
Wild Turkey		228	9.50E+07	2.17E+10	turkey value used
Pheasants		9,583	1.53E+04	1.47E+08	geese value used
Other Wildlife**				3.76E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

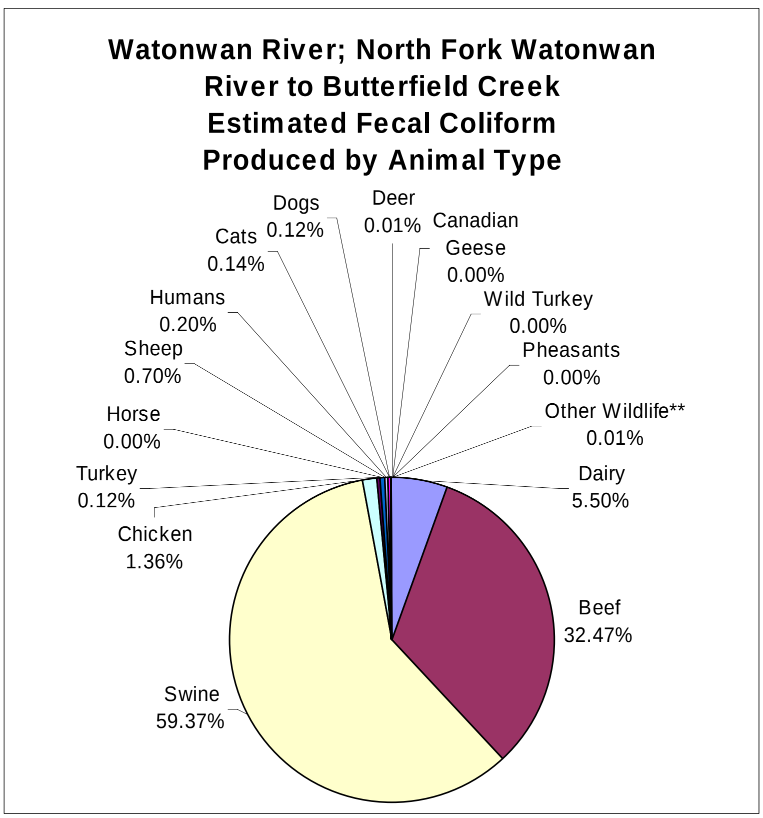


Figure 6.14e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

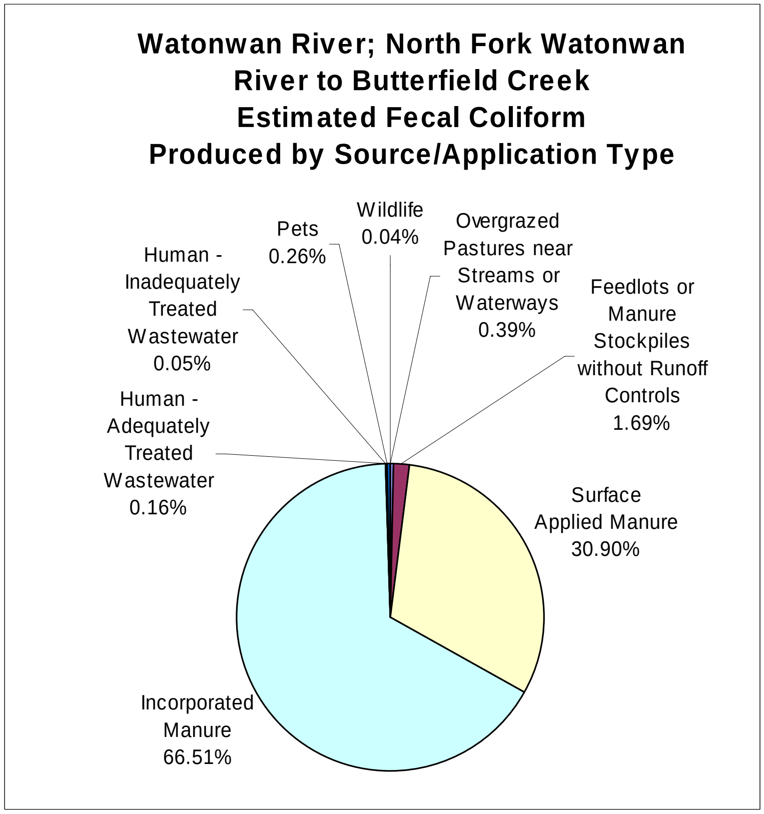


Figure 6.14f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of the Watonwan River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Cats & Dogs		
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.		

Low Contributor
Moderate Contributor
High Contributor

Figure 6.14g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Watonwan River; Headwaters to North Fork Watonwan River

Fecal Coliform Loading Capacities and Allocations: Watonwan River; North Fork Watonwan River to Butterfield Creek

Table 6.14b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Darfur	county permitted	0.010	0.002
Mountain Lake	MNG580035	2.168	0.492
Totals		2.177	0.495

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 6.14c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.14d – Monthly Fecal Coliform Loading Capacities and Allocations

Watonwan River; North Fork Watonwan River to Butterfield Creek

Drainage Area (square miles): 209
USGS gage used to develop flow zones and loading capacities:
Watonwan River, near Garden City
% MS4 Urban: 0%
Total WWTF Design Flow (mgd): 2.18

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	72.02	24.01	35.00	11.67	15.45	5.15	3.89	1.30	0.76	0.25
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.49	0.16	0.49	0.16	0.49	0.16	0.49	0.16	*	*
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	59.82	19.94	25.29	8.43	10.71	3.57	1.86	0.62	*	*
Margin of Safety	11.70	3.90	9.22	3.07	4.25	1.42	1.53	0.51	na	na

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.7%	1.4%	3.2%	12.7%	*
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	83.1%	72.2%	69.3%	47.9%	*
Margin of Safety	16.3%	26.3%	27.5%	39.4%	na

*Note - WWTF design/discharge flow exceeded low flow
alllocation = (flow contribution from a given source) X (200 orgs./100ml.), see section 5.0 for details

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.15 Watonwan River; Butterfield Creek to South Fork Watonwan River

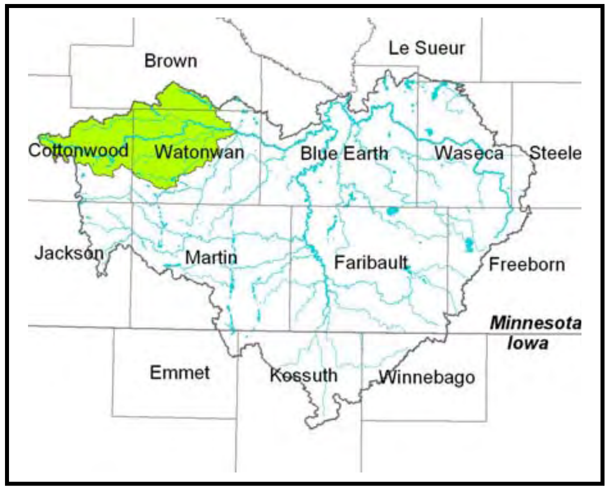


Figure 6.15a – Impaired Reach Watershed

Monitoring Site ID:
    Watonwan River, CR 6
    (WAT_38.5)

Stream Status:
    Impaired Stream Reach (2006 Listing)

Impaired Reach Length
    6.9 miles

Contributing Watershed Size
    251,347 acres
    393 square miles

Human Population (2000 Census)
    11,216 (7,172 urban and 4,044 rural)

Cities Located in Watershed
    Butterfield
    Darfur
    La Salle*
    Mountain Lake
    St. James
    * Waste Water Effluent Discharged Outside Watershed Boundary

Livestock (2003 feedlot inventory)
    215 Feedlot Facilities
    82,281 total animal units

The Watonwan River; Butterfield Creek to South Fork Watonwan River qualifies as an impaired stream reach based on review of 68 samples collected on the river between 2000 through 2002. The impaired reach is 6.9 miles in length. The reach was added to the impaired waters list in 2006. The monitoring data used to assess the river as impaired was collected as part of the Watonwan Phase I Clean Water Partnership. In addition, several samples were collected in 1996 by the Water Resources Center. The combined data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months April through September.

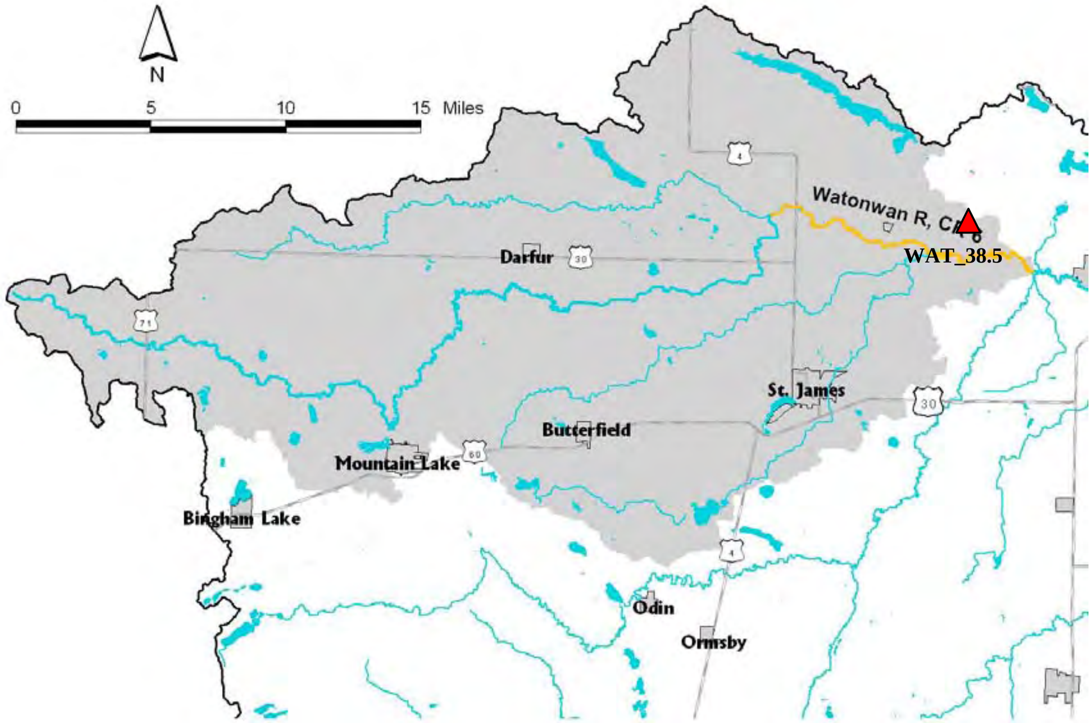


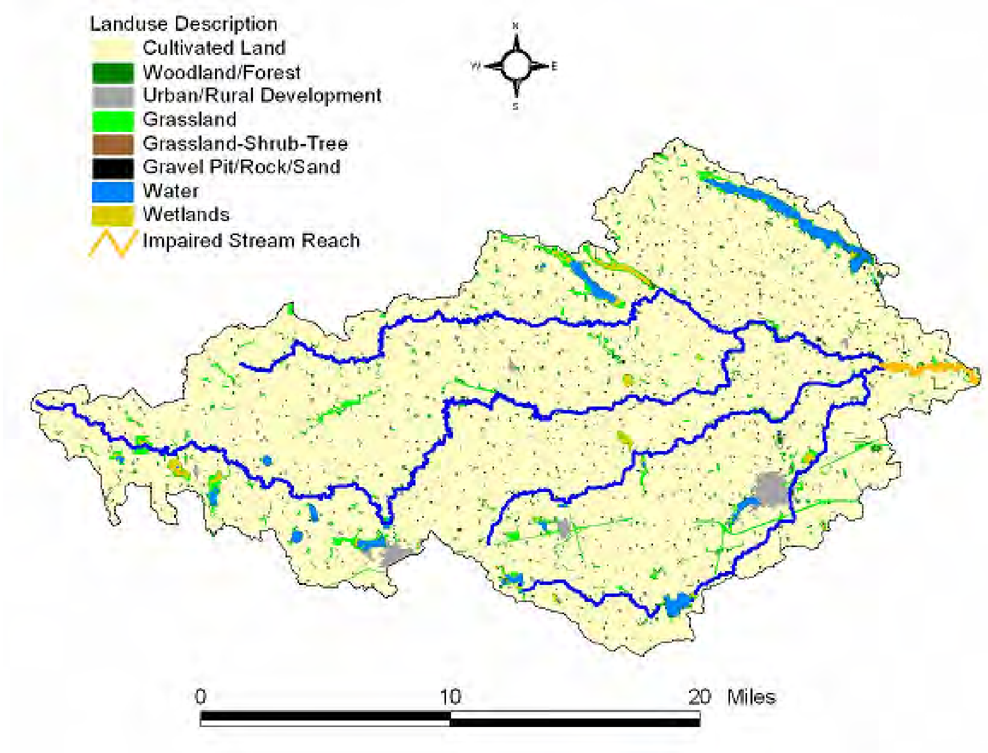
Figure 6.15b - Watonwan River; Butterfield Creek to South Fork Watonwan River Watershed

This portion impaired stream reach watershed encompasses 393 square miles in Cottonwood, Watonwan and Brown counties. The watershed has a human population of 11,216, with 36% living in rural areas. The watershed also contains an estimated 215 feedlots with 82,281 livestock animal units. The watershed is 89% cultivated land, with grassland and forested areas comprising another 6%.

There are five cities located in the watershed, Butterfield, Darfur, La Salle, Mountain Lake and St. James. La Salle, a community of 96, is currently unsewered. La Salle is scheduled to have some type of wastewater treatment system in place by the end of 2006.

Based on county estimates, 41% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 680 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	224,776	89.4%
Grass/Shrub/Tree	100	0.0%
Grassland	9,150	3.6%
Gravel Pit/Rock/Sand	93	0.0%
Urban/Rural Development	6,008	2.4%
Water	3,940	1.6%
Wetlands	1599	0.6%
Woodland/Forest	5,682	2.3%

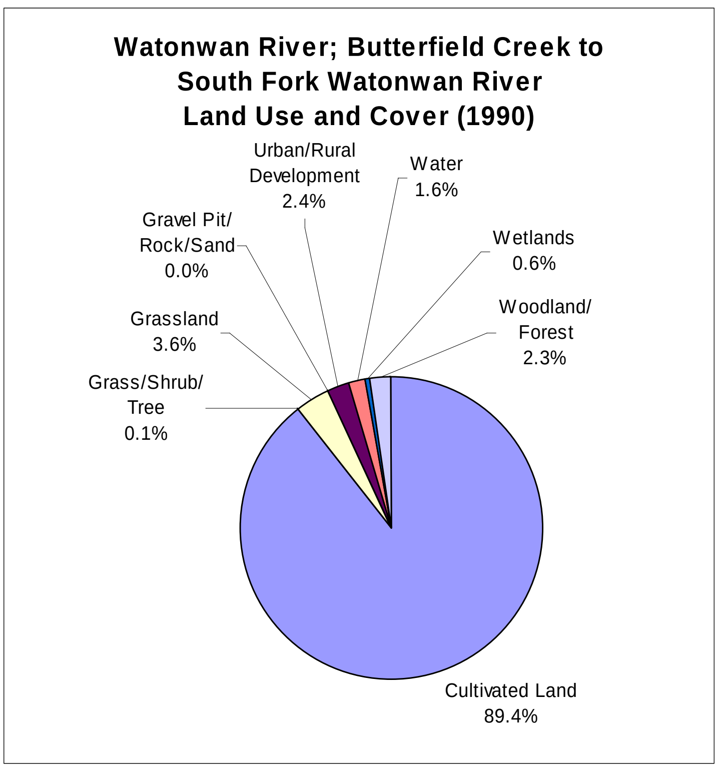


Figure 6.15c – 1990 Landuse and Cover Map and Statistics for Watonwan River; Butterfield Creek to South Fork Watonwan River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Watonwan River Clean Water Partnership
Water Resources Center, MN State University, Mankato
Years Monitored: 1996, 2000 through 2002
Samples Collected: 68

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	7.8%
May	36.5%
June	80.8%
July	92.3%
August	90.9%
September	74.0%
October	Inadequate Data

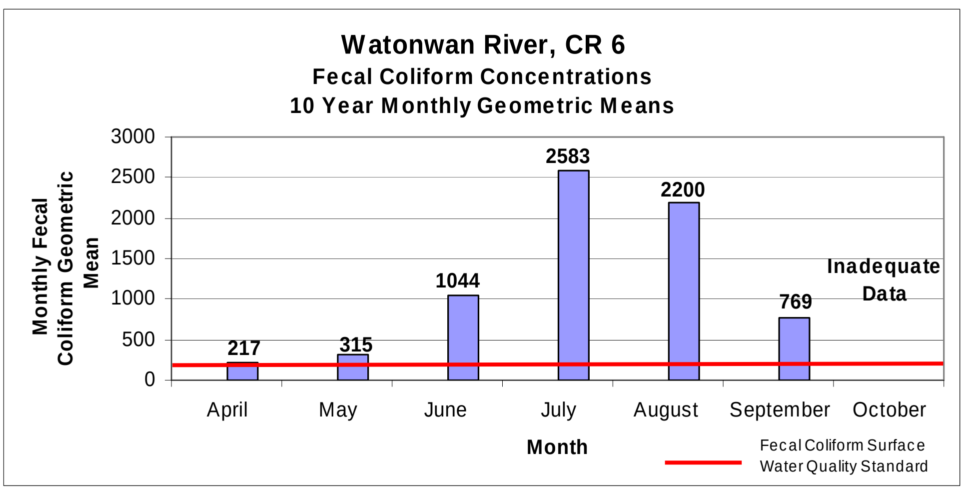


Figure 6.15d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.15a - Human and Animal Population Inventory for Watonwan River; Butterfield Creek to South Fork Watonwan River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	4,802		7.20E+10	3.46E+14	ASAE*, 1998
Beef	19,483		1.30E+11	2.53E+15	ASAE, 1998
Swine	50,337		8.00E+10	4.03E+15	ASAE, 1998
Chicken	5,581		3.40E+10	1.90E+14	ASAE, 1998
Turkey	1,538		6.20E+09	9.54E+12	ASAE, 1998
Horse	56		4.20E+08	2.35E+10	ASAE, 1998
Sheep	468		2.00E+11	9.36E+13	ASAE, 1998
Humans		11,216	2.00E+09	2.24E+13	Metcalf and Eddy, 1991
Cats		3,046	5.00E+09	1.52E+13	Horsley and Witten, 1996
Dogs		2,677	5.00E+09	1.34E+13	Horsley and Witten, 1996
Deer		1,414	5.00E+08	7.07E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		1,750	1.04E+07	1.82E+10	Alderisio and DeLuca, 1999
Wild Turkey		428	9.50E+07	4.07E+10	turkey value used
Pheasants		18,026	1.53E+04	2.76E+08	geese value used
Other Wildlife**				7.07E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

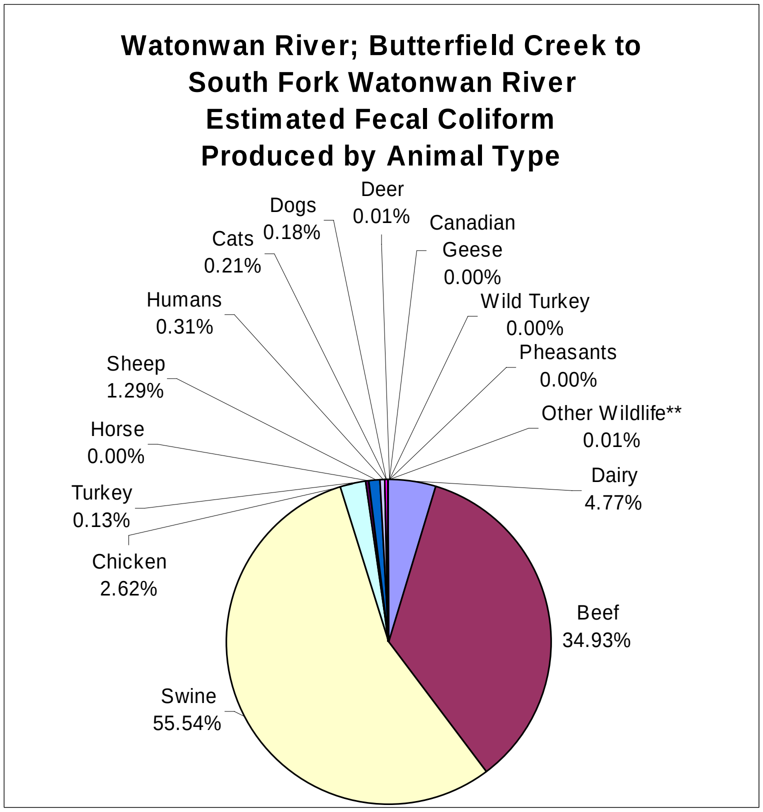


Figure 6.15e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

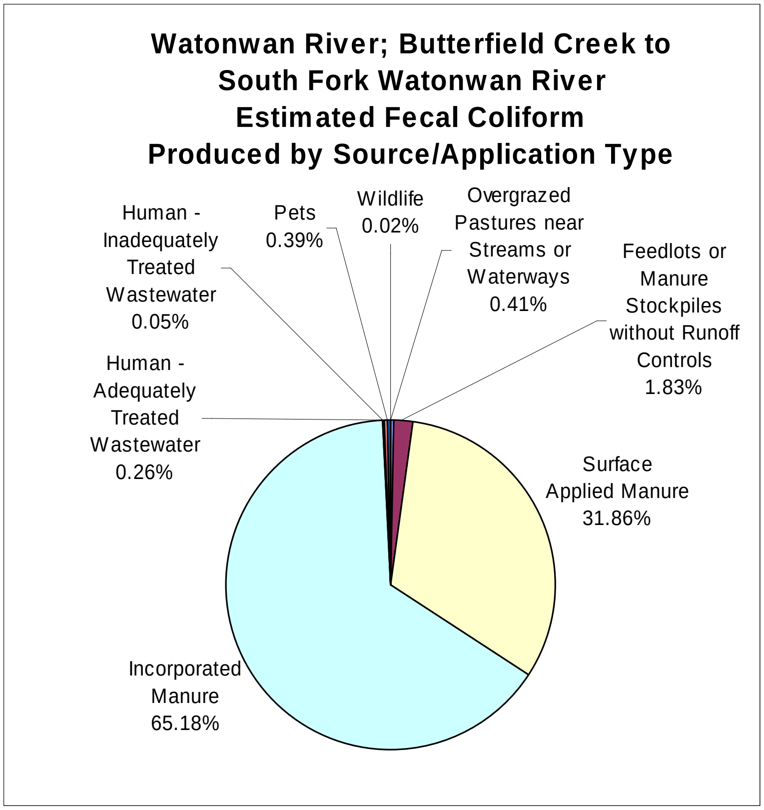


Figure 6.15f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of the Watonwan River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low Contributor	High Contributor
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate Contributor	Low Contributor
	Surface Applied Manure	High Contributor	Low Contributor
	Incorporated Manure	Moderate Contributor	Low Contributor
Human	Human - Inadequately Treated Wastewater	Low Contributor	High Contributor
Pets	Cats & Dogs	Low Contributor	Low Contributor
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low Contributor	Low Contributor

Low Contributor
Moderate Contributor
High Contributor

Figure 6.15g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Watonwan River; Butterfield Creek to South Fork Watonwan River

Fecal Coliform Loading Capacities and Allocations: Watonwan River; Butterfield Creek to South Fork Watonwan River

Table 6.15b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Butterfield	MN0022977	1.060	0.241
Darfur	county permitted	0.010	0.002
Mountain Lake	MNG580035	2.168	0.492
St. James	MN0024759	2.960	0.672
Totals		6.197	1.407

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 6.15c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.15d – Monthly Fecal Coliform Loading Capacities and Allocations

Watonwan River; Butterfield Creek to South Fork Watonwan River

Drainage Area (square miles): 393
USGS gage used to develop flow zones and loading capacities:
Watonwan River, near Garden City

% MS4 Urban: 0%	Flow Zone									
Total WWTF Design Flow (mgd): 6.20	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	135.47	45.16	65.84	21.95	29.06	9.69	7.31	2.44	1.42	0.47
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	1.41	0.47	1.41	0.47	1.41	0.47	1.41	0.47	*	*
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	112.05	37.35	47.09	15.70	19.66	6.55	3.02	1.01	*	*
Margin of Safety	22.01	7.34	17.34	5.78	7.99	2.66	2.88	0.96	na	na
	values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%		100%		100%		100%		100%	
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	1.0%		2.1%		4.8%		19.3%		*	
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	82.7%		71.5%		67.7%		41.4%		*	
Margin of Safety	16.3%		26.3%		27.5%		39.4%		na	

*Note - WWTF design/discharge flow exceeded low flow
alllocation = (flow contribution from a given source) X (200 orgs./100ml.), see section 5.0 for details

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as $1/3^{rd}$ of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.16 Watonwan River; Perch Creek to Blue Earth River

Monitoring Site ID:
Watonwan River, Garden City
(WAT_7.9)

Stream Status:
Impaired Stream Reach (1994 Listing)

Impaired Reach Length
17.5 miles

Contributing Watershed Size
561,620 acres
878 square miles

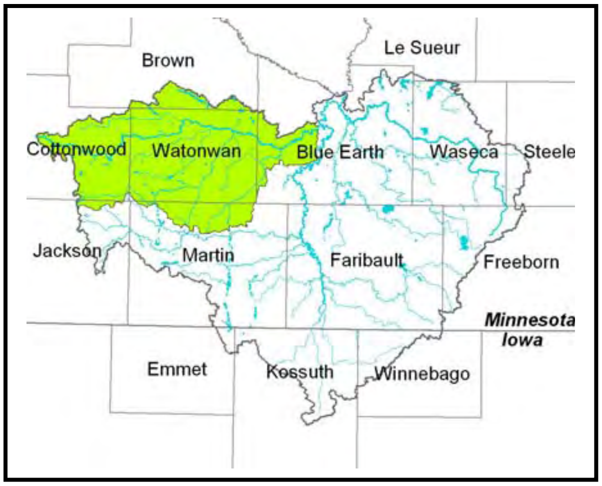


Figure 6.16a – Impaired Reach Watershed

Human Population (2000 Census)
20,293 (12,032 urban and 8,261 rural)

Cities Located in Watershed

Bingham Lake*	Mountain Lake
Butterfield	Odin**
Darfur	Ormsby**
La Salle**	St. James
Lewisville	Truman
Madelia	Vernon Center*

* Waste Water Effluent Discharged Outside Watershed Boundary
** Unsewered Community

Livestock (2003 feedlot inventory)
510 Feedlot Facilities
177,456 total animal units

The Watonwan River; Perch Creek to Blue Earth River qualifies as an impaired stream reach based on review of 173 samples collected on the river between 1995 through 2004. The impaired reach is 17.5 miles in length. The reach was added to the impaired waters list in 1994. The river has been monitored near Garden City since the 1970's as part of the Minnesota Pollution Control Agency Milestone Monitoring Program. In 2000 monitoring data were collected as part of the Watonwan Phase I Clean Water Partnership. The Watonwan CWP, which is now in a phase II implementation, continues to collect monitoring data from the site. The water quality data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months June through September.

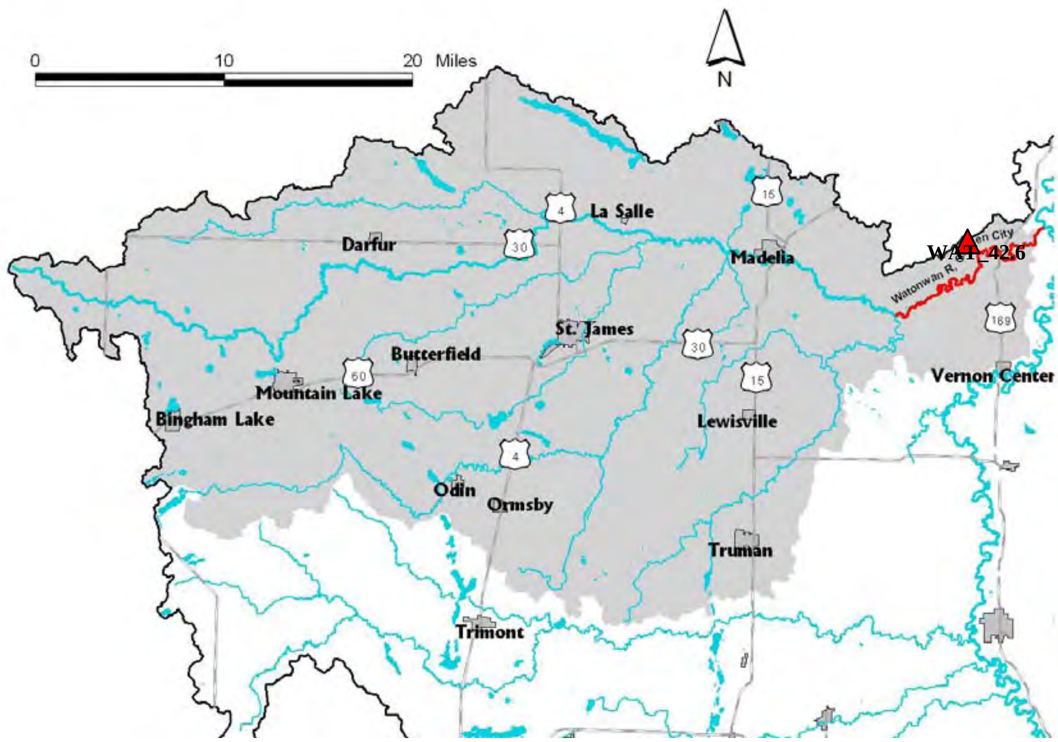


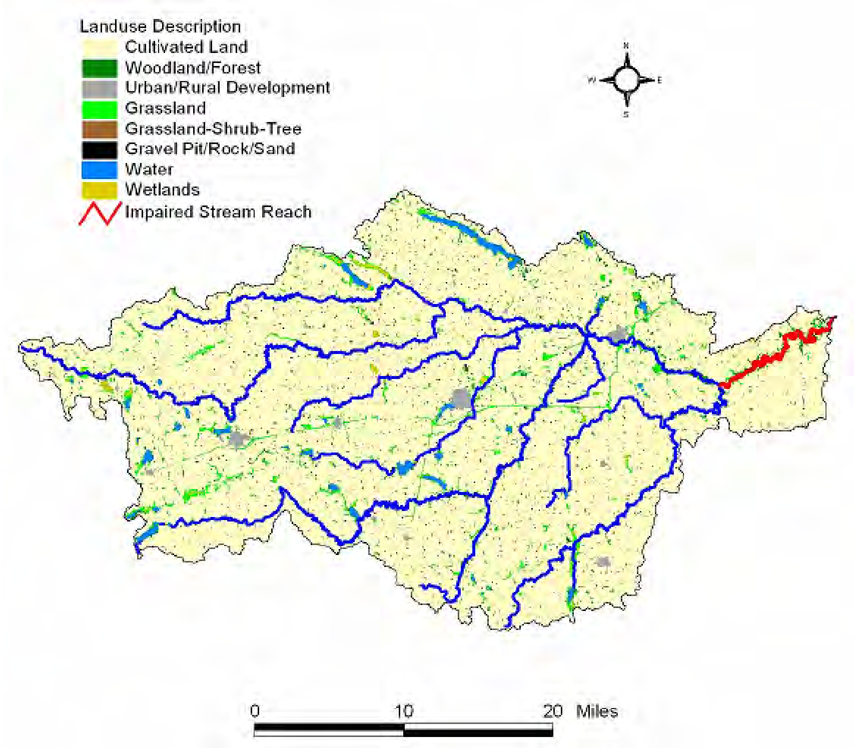
Figure 6.16b - Watonwan River; Perch Creek to Blue Earth River Watershed

This portion impaired stream reach watershed encompasses 878 square miles in portions of Brown, Cottonwood, Blue Earth, Jackson, Martin and Watonwan counties. The watershed has a human population of 20,293, with 41% living in rural areas. The watershed also contains an estimated 510 feedlots with 177,456 livestock animal units. The watershed is 89.4% cultivated land, followed by grassland (3.9%), woodland (2.9%) and urban/rural development (2.3%).

There are twelve cities located in the watershed, with St. James as the largest. Three of the twelve cities, Odin, Ormsby and La Salle are unsewered. La Salle is scheduled to have some type of wastewater treatment system in place by the end of 2006. There are currently no plans for wastewater treatment facilities for Odin or Ormsby.

Based on county estimates, 39% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 1,325 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	502,118	89.4%
Grass/Shrub/Tree	352	0.1%
Grassland	21,833	3.9%
Gravel Pit/Rock/Sand	114	0.0%
Urban/Rural Development	12,746	2.3%
Water	6,730	1.2%
Wetlands	2449.4	0.4%
Woodland/Forest	15,277	2.7%

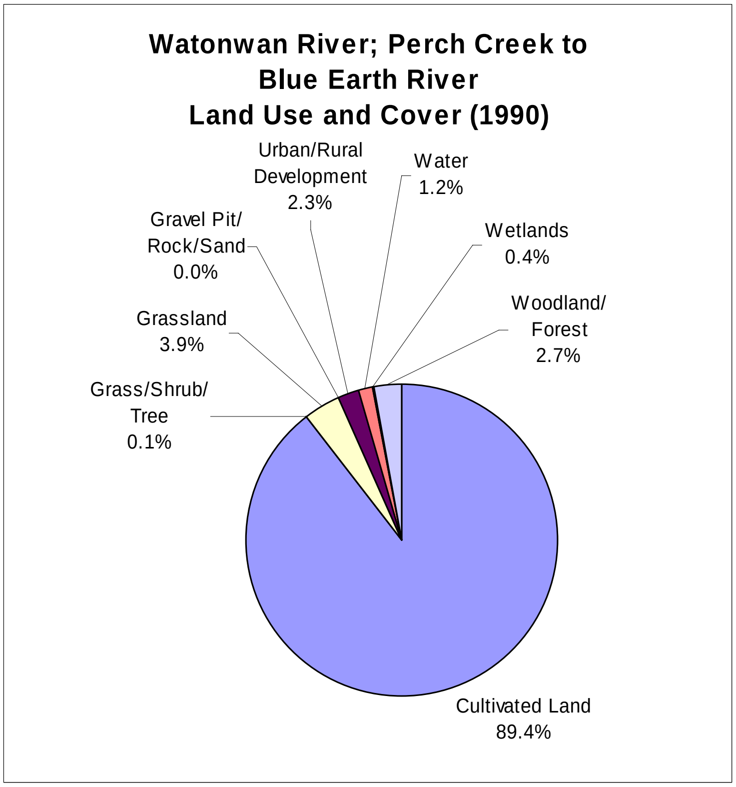


Figure 6.16c – 1990 Landuse and Cover Map and Statistics for Watonwan River; Perch Creek to Blue Earth River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: MPCA – Milestone Monitoring Program
Watonwan River Clean Water Partnership
Years Monitored: 1995-2004
Samples Collected: 173

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	**Required Reduction**
April	No Reduction Needed
May	No Reduction Needed
June	80.9%
July	75.1%
August	20.3%
September	4.3%
October	Inadequate Data

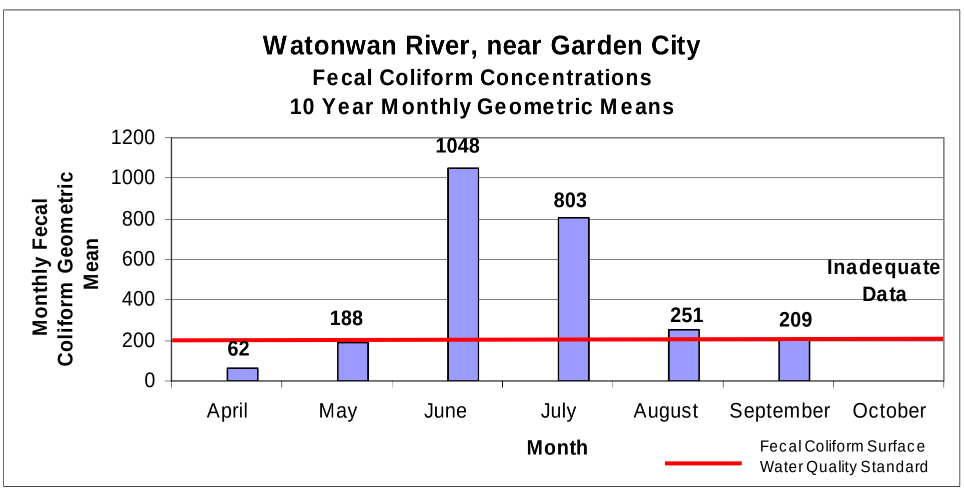


Figure 6.16d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.16a - Human and Animal Population Inventory for Watonwan River; Perch Creek to Blue Earth River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	5,708		7.20E+10	4.11E+14	ASAE*, 1998
Beef	29,455		1.30E+11	3.83E+15	ASAE, 1998
Swine	128,905		8.00E+10	1.03E+16	ASAE, 1998
Chicken	7,299		3.40E+10	2.48E+14	ASAE, 1998
Turkey	5,422		6.20E+09	3.36E+13	ASAE, 1998
Horse	91		4.20E+08	3.82E+10	ASAE, 1998
Sheep	518		2.00E+11	1.04E+14	ASAE, 1998
Humans		20,291	2.00E+09	4.06E+13	Metcalf and Eddy, 1991
Cats		5,512	5.00E+09	2.76E+13	Horsley and Witten, 1996
Dogs		4,844	5.00E+09	2.42E+13	Horsley and Witten, 1996
Deer		3,159	5.00E+08	1.58E+12	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		3,910	1.04E+07	4.07E+10	Alderisio and DeLuca, 1999
Wild Turkey		957	9.50E+07	9.09E+10	turkey value used
Pheasants		40,279	1.53E+04	6.16E+08	geese value used
Other Wildlife**				1.58E+12	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

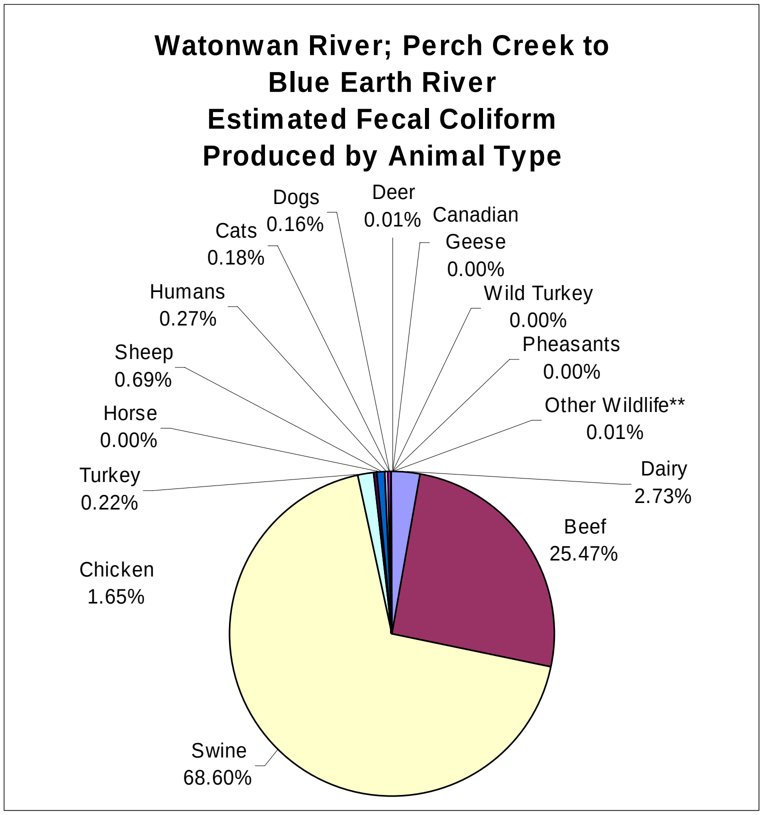


Figure 6.16e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

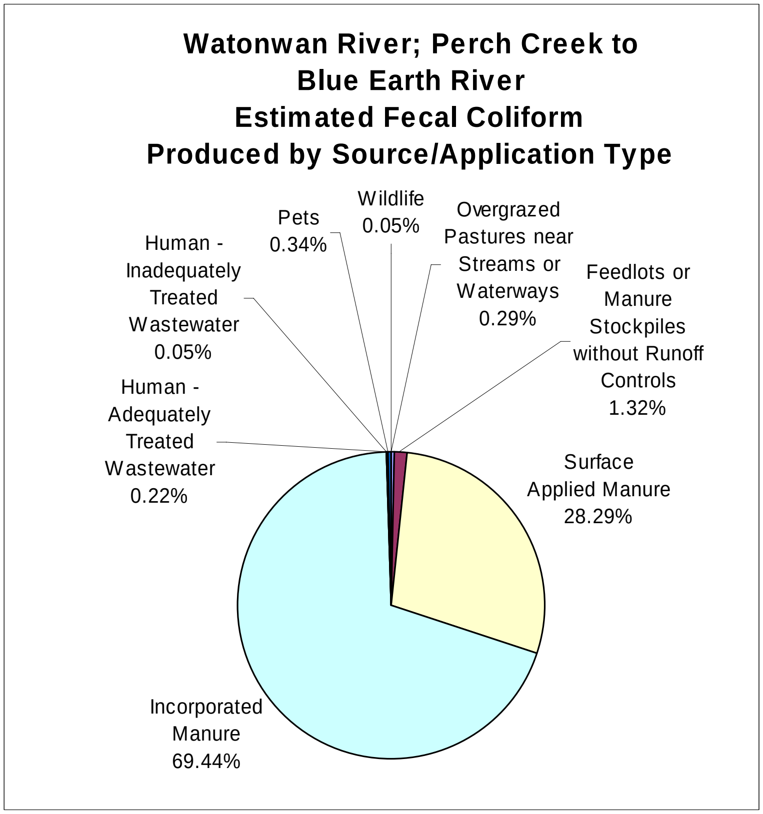


Figure 6.16f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of the Watonwan River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low Contributor	High Contributor
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate Contributor	Low Contributor
	Surface Applied Manure	High Contributor	Low Contributor
	Incorporated Manure	Moderate Contributor	Low Contributor
Human	Human - Inadequately Treated Wastewater	Low Contributor	High Contributor
Pets	Cats & Dogs	Low Contributor	Low Contributor
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low Contributor	Low Contributor

Low Contributor
Moderate Contributor
High Contributor

Figure 6.16g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Watonwan River; Perch Creek to Blue Earth River

Fecal Coliform Loading Capacities and Allocations: Watonwan River; Perch Creek to Blue Earth River

Table 6.16b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Butterfield	MN0022977	1.060	0.241
Darfur	county permitted	0.010	0.002
Lewisville	MN0065722	0.039	0.009
Madelia	MN0024040	1.310	0.298
Mountain Lake	MNG580035	2.168	0.492
St. James	MN0024759	2.960	0.672
Truman	MN0021652	0.780	0.177
Totals		8.326	1.891

Livestock Facilities with NPDES Permits
Refer to appendix C.

Table 6.16c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.16d – Monthly Fecal Coliform Loading Capacities and Allocations

Watonwan River; Perch Creek to Blue Earth River

Drainage Area (square miles): 878
USGS gage used to develop flow zones and loading capacities:
Watonwan River, near Garden City
% MS4 Urban: 0%
Total WWTF Design Flow (mgd): 8.33

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	302.70	100.90	147.11	49.04	64.93	21.64	16.33	5.44	3.17	1.06
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	1.89	0.63	1.89	0.63	1.89	0.63	1.89	0.63	*	*
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	251.62	83.87	106.48	35.49	45.18	15.06	8.01	2.67	*	*
Margin of Safety	49.19	16.40	38.75	12.92	17.86	5.95	6.43	2.14	na	na

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.6%	1.3%	2.9%	11.6%	*
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	83.1%	72.4%	69.6%	49.0%	*
Margin of Safety	16.3%	26.3%	27.5%	39.4%	na

*Note - WWTF design/discharge flow exceeded low flow
alllocation = (flow contribution from a given source) X (200 orgs./100ml.), see section 5.0 for details

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

6.17 South Fork Watonwan River; Willow Creek to Watonwan River

Monitoring Site ID:
Watonwan River, near Madelia
(WATS_1.9)

Stream Status:
Impaired Stream Reach (2006 Listing)

Impaired Reach Length
24.7 miles

Contributing Watershed Size
129,057 acres
202 square miles

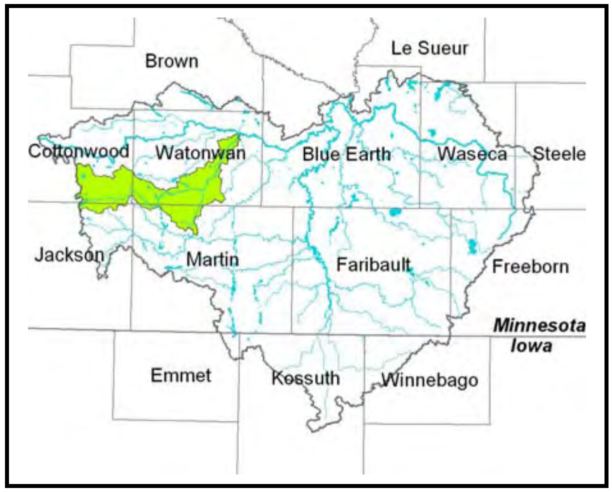


Figure 6.17a – Impaired Reach Watershed

Human Population (2000 Census)
2,609 (842 urban and 1,767 rural)

Cities Located in Watershed
Bingham Lake*
Mountain Lake*
Odin**
Ormsby**
* Waste Water Effluent Discharged Outside Watershed Boundary
** Unsewered Community

Livestock (2003 feedlot inventory)
112 Feedlot Facilities
41,442 total animal units

The South Branch Watonwan River qualifies as an impaired stream reach based on review of 59 samples collected on the river between 2000 through 2002. The 25 mile long impaired reach was added to the impaired waters list in 2006. The monitoring data used to assess the river as impaired was collected as part of the Watonwan Phase I Clean Water Partnership. This data indicate that based on MPCA impaired waters listing criteria, the river exceeded standards during the months May through August.

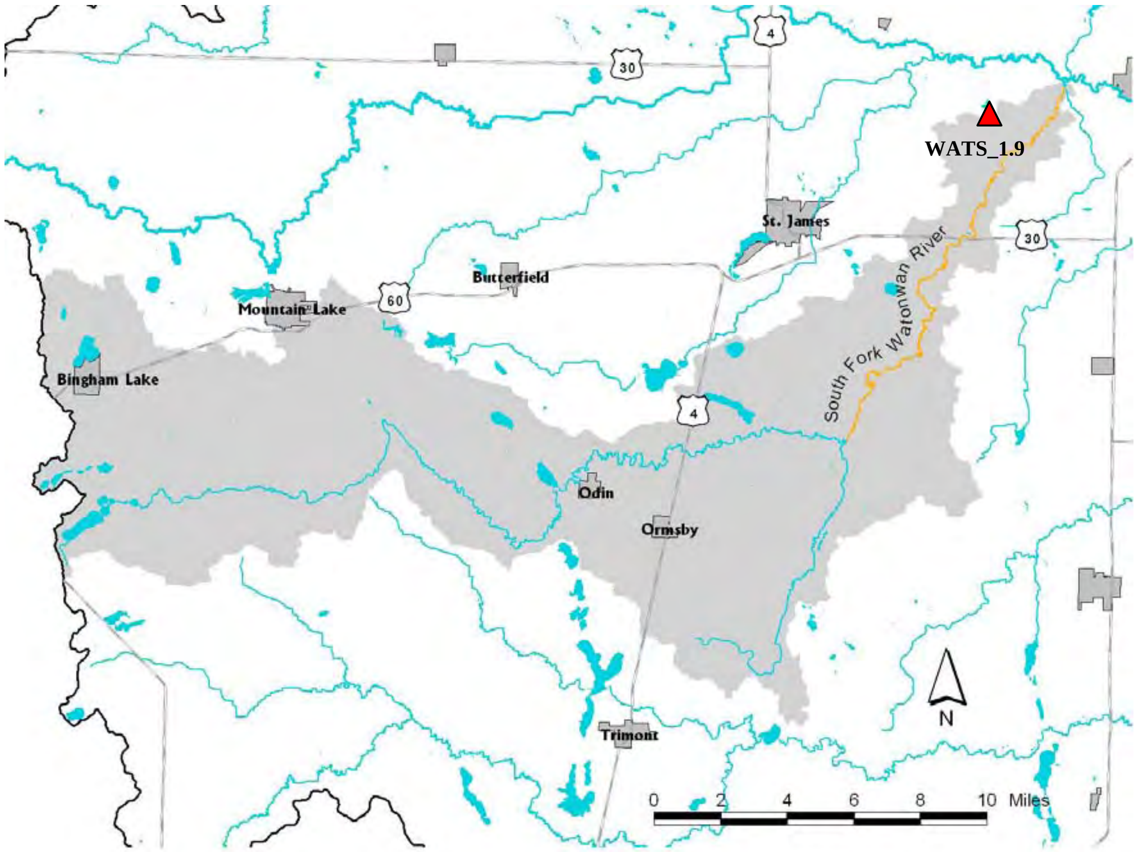


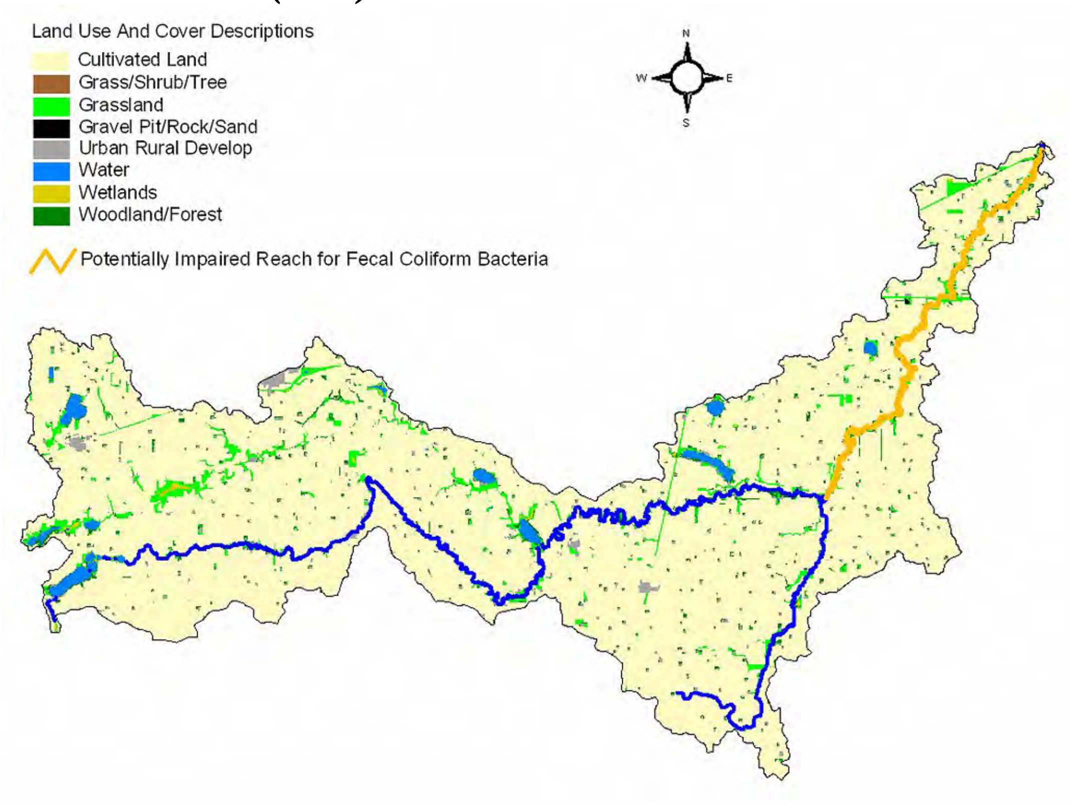
Figure 6.17b - South Fork Watonwan River; Willow Creek to Watonwan River Watershed

The South Branch Watonwan River watershed encompasses 202 square miles in four counties (Cottonwood, Watonwan, Martin and Jackson). The watershed has a human population of 2,609, with 68% living in rural areas. The watershed also contains an estimated 112 feedlots with 41,000 livestock animal units. The watershed is 89% cultivated land, with another 5% in grassland.

Four cities are located in the watershed, Bingham Lake, Mountain Lake, Odin and Ormsby. No permitted wastewater is discharged in this watershed. Bingham Lake wastewater is treated in Windom, outside the impaired watershed. Mountain Lake wastewater is treated and discharged to the mainstem Watonwan River, north of this impaired watershed. Odin and Ormsby, populations 125 and 154, are both unsewered communities located within the watershed.

Based on county estimates, 41% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to just over 300 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	114,741	88.9%
Grass/Shrub/Tree	95	0.1%
Grassland	5,981	4.6%
Gravel Pit/Rock/Sand	16	0.0%
Urban/Rural Development	2,543	2.0%
Water	1,717	1.3%
Wetlands	241	0.2%
Woodland/Forest	3,723	2.9%

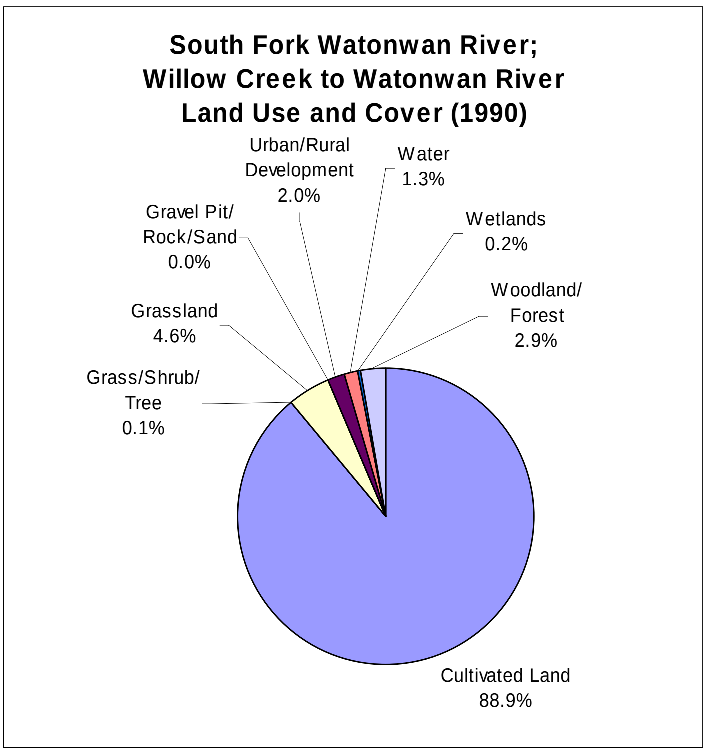


Figure 6.17c – 1990 Landuse and Cover Map and Statistics for South Fork Watonwan River; Willow Creek to Watonwan River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Watonwan River Clean Water Partnership
Years Monitored: 2000 through 2002
Samples Collected: 59

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	50.7%
June	76.1%
July	73.8%
August	91.7%
September	Inadequate Data
October	Inadequate Data

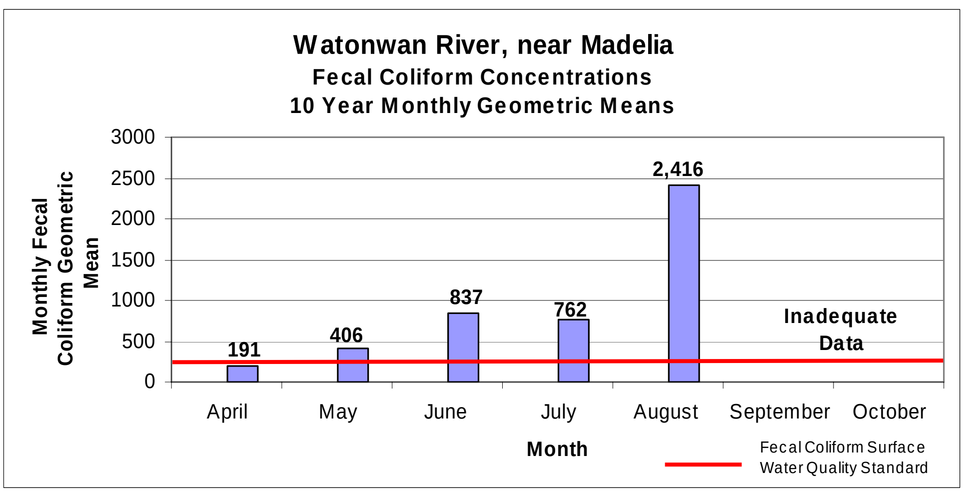


Figure 6.17d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 6.17a - Human and Animal Population Inventory for South Fork Watonwan River; Willow Creek to Watonwan River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	239		7.20E+10	1.72E+13	ASAE*, 1998
Beef	6,303		1.30E+11	8.19E+14	ASAE, 1998
Swine	32,288		8.00E+10	2.58E+15	ASAE, 1998
Chicken	660		3.40E+10	2.24E+13	ASAE, 1998
Turkey	1,905		6.20E+09	1.18E+13	ASAE, 1998
Horse	4		4.20E+08	1.68E+09	ASAE, 1998
Sheep	35		2.00E+11	7.00E+12	ASAE, 1998
Humans		2,609	2.00E+09	5.22E+12	Metcalf and Eddy, 1991
Cats		709	5.00E+09	3.55E+12	Horsley and Witten, 1996
Dogs		623	5.00E+09	3.12E+12	Horsley and Witten, 1996
Deer		726	5.00E+08	3.63E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		898	1.04E+07	9.34E+09	Alderisio and DeLuca, 1999
Wild Turkey		220	9.50E+07	2.09E+10	turkey value used
Pheasants		9,256	1.53E+04	1.42E+08	geese value used
Other Wildlife**				3.63E+11	

* American Society of Agricultural Engineers
** Unknown, estimated to be roughly the equivalent of the deer population.

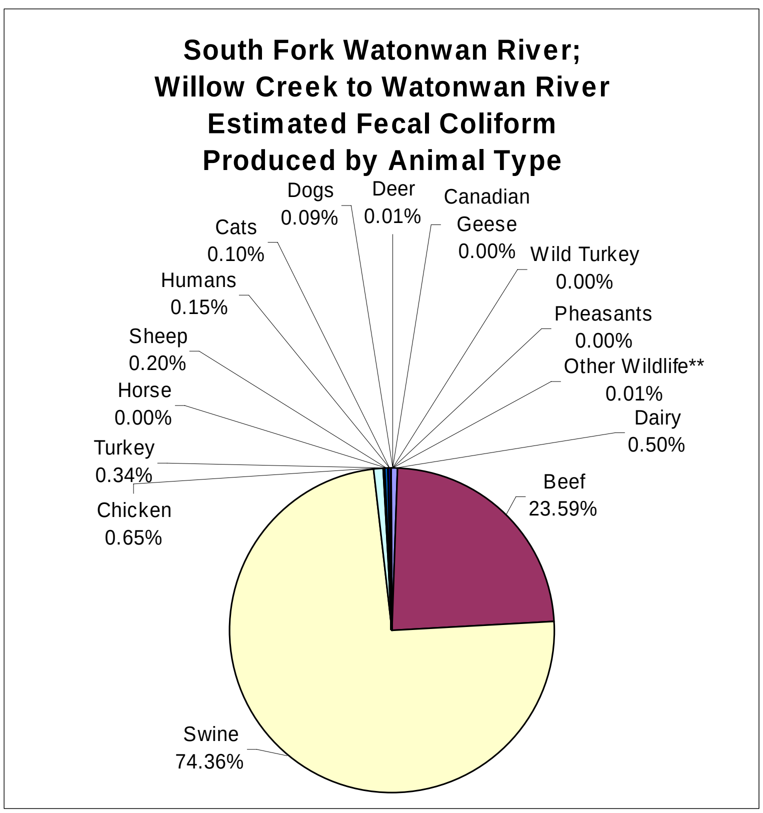


Figure 6.17e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

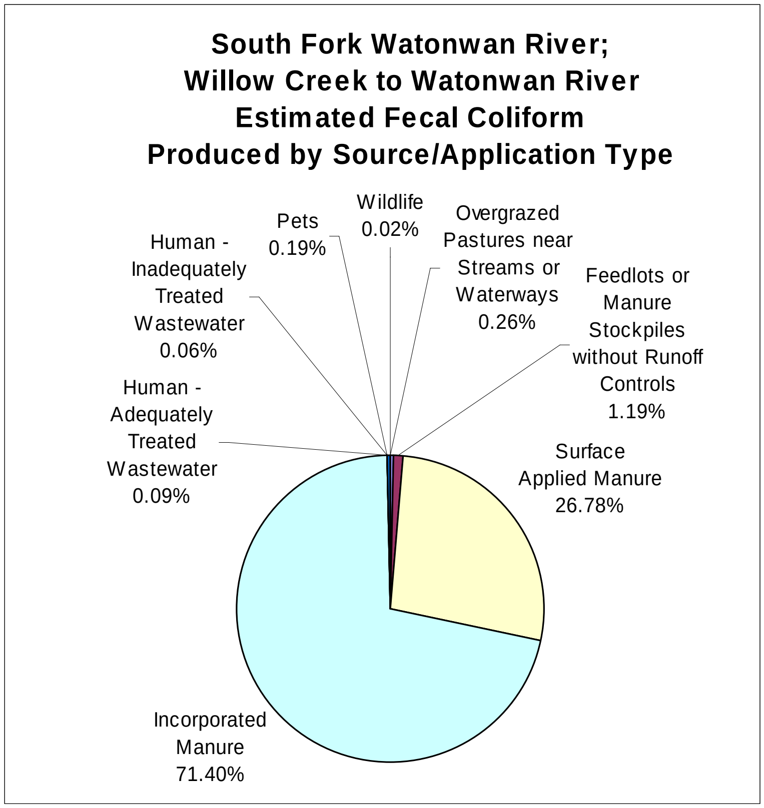


Figure 6.17f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of the Watonwan River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low	Moderate
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate	Low
	Surface Applied Manure	High	Low
	Incorporated Manure	Moderate	Low
Human	Human - Inadequately Treated Wastewater	Low	High
Pets	Cats & Dogs	Low	Low
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low	Low

Low Contributor
Moderate Contributor
High Contributor

Figure 6.17g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for South Fork Watonwan River; Willow Creek to Watonwan River

Fecal Coliform Loading Capacities and Allocations: South Fork Watonwan River, Willow Creek to Watonwan River

Table 6.17b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
None			
Totals		0.000	0.000

Livestock Facilities with NPDES Permits
Refer to appendix C.

Table 6.17c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 6.17d – Monthly Fecal Coliform Loading Capacities and Allocations

South Fork Watonwan River; Willow Creek to Watonwan River

Drainage Area (square miles): 202
USGS gage used to develop flow zones and loading capacities:
Watonwan River, near Garden City
% MS4 Urban: 0%
Total WWTF Design Flow (mgd): 0.00

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	69.56	23.19	33.81	11.27	14.92	4.97	3.75	1.25	0.73	0.24
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	58.26	19.42	24.90	8.30	10.82	3.61	2.27	0.76	0.43	0.14
Margin of Safety	11.30	3.77	8.90	2.97	4.10	1.37	1.48	0.49	0.30	0.10

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / 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	83.8%	73.7%	72.5%	60.6%	58.7%
Margin of Safety	16.3%	26.3%	27.5%	39.4%	41.3%

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

Section 7.0 – TMDL Allocations for Individual Unlisted Reaches

In 2004, as part of the BERB Fecal Coliform TMDL project, four streams were monitored in the basin that had previously not been monitored for fecal coliform bacteria. Results of this testing indicated each of these stream reaches will qualify for impaired waters listing during the 2008 listing process. Thus, TMDL allocations and watershed assessment have also been assessed for these four reaches.

7.1 Blue Earth River; Rapidan Dam to Le Sueur River

Monitoring Site ID:
  Blue Earth River, Rapidan
  (BE_11.9)

Stream Status:
  Not Listed
  Potentially Qualifies in 2008

Impaired Reach Length
  12.9 miles

Contributing Watershed Size
  1,553,287 acres
  2,427 square miles

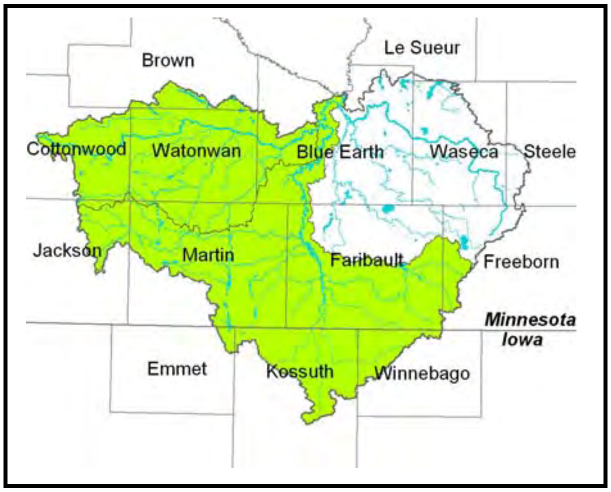


Figure 7.1a – Impaired Reach Watershed

Human Population (2000 Census)
  57,376 (34,992 urban and 22,384 rural)

Cities Located in Watershed

Minnesota			**Iowa**
Alden	Granada	St. James	Buffalo Center
Amboy*	Jackson*	Trimont	Lakota**
Bingham Lake*	Kiester	Truman	Ledyard**
Blue Earth	La Salle**	Vernon Center	Rake
Bricelyn	Lewisville	Walters**	
Butterfield	Madelia	Welcome	
Darfur	Mountain Lake	Wells*	
Elmore	Northrop	Winnebago	
Fairmont	Odin**		
Frost	Ormsby**		
Good Thunder*	Sherburn*		

* Waste Water Effluent Discharged Outside Watershed Boundary
** Unsewered Community

Livestock (2003 Feedlot Inventory)
  1,514 feedlot facilities
  515,222 total animal units

This reach of the Blue Earth River is not listed as impaired. In 2004, as part of the BERB Fecal Coliform TMDL project this site was monitored five times monthly, April through August. The monitoring data indicate the river exceeded surface water standards in July of 2004. The impaired stream reach listing process used by the MPCA for the 2006 listings utilized data collected from 1994 through 2003. Based on MPCA listing methodology, this Blue Earth River reach will qualify for listing as an impaired stream reach in 2008. The potentially impaired reach is 12.9 miles in length, from Rapidan dam to the outlet of the Le Sueur River.

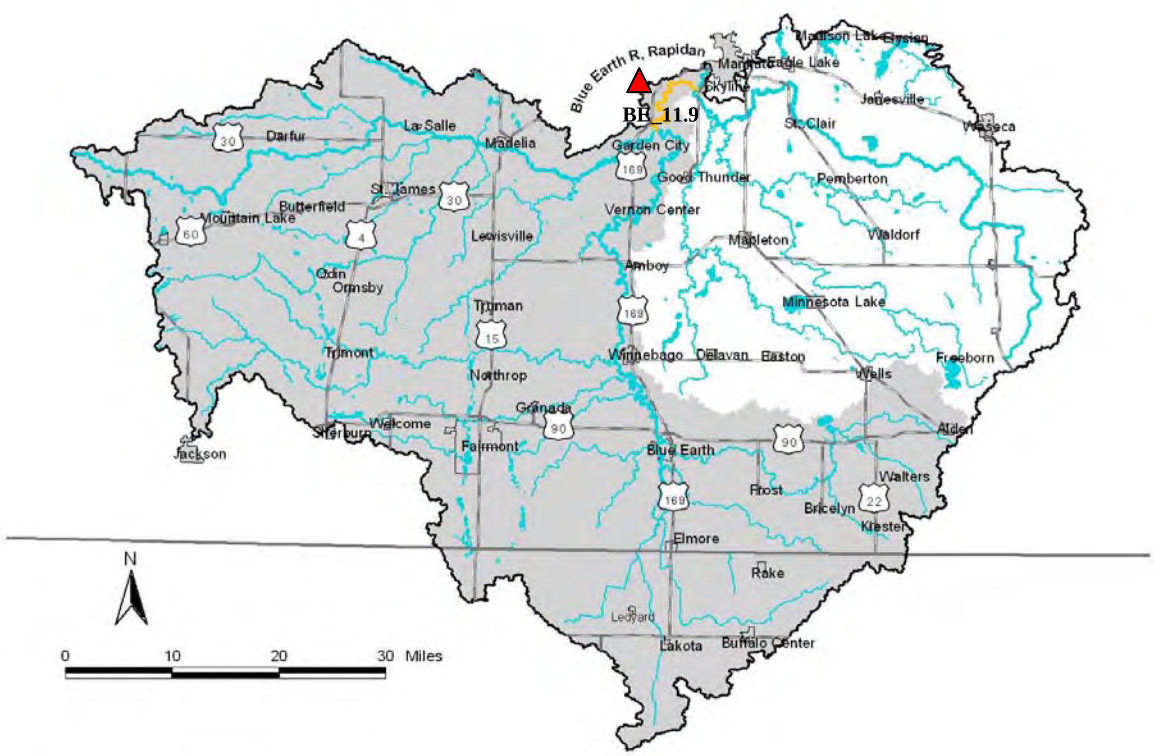


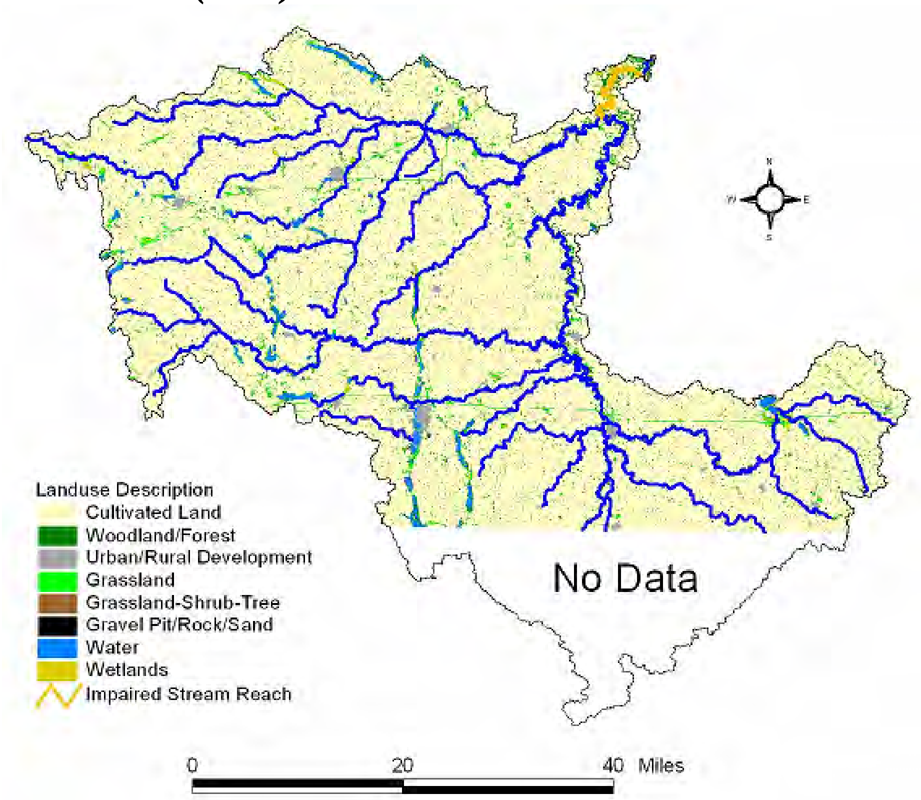
Figure 7.1b - Blue Earth River; Rapidan Dam to Le Sueur River

The watershed encompasses the 2,427 square miles across portions of seven Minnesota and three Iowa counties. The reach watershed includes the entire Watonwan Watershed, and almost the entire Blue Earth Watershed. The watershed has a human population of 57,376, with 39% living in rural areas. The watershed has contains an estimated 1,514 feedlots with 515,222 livestock animal units. Landuse is 88.6% cultivated land, followed by grassland at 4.5% and woodland at 3.1%.

There are 34 cities located in the watershed, 30 in Minnesota and four in Iowa. There are 938 individuals living in six incorporated unsewered communities; Lakota, Lasalle, Ledyard, Odin, Ormsby and Walters. Lasalle is currently in the process of developing a waste water treatment system, that is expected to be under construction in 2006. Fairmont, the largest community in the watershed, requires a MS4 stormwater permits. As such, they are required to have stormwater management plan and are allocated a portion of the fecal coliform loading limit.

Based on county estimates, 42% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 3,870 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	1,376,362	88.6%
Grass/Shrub/Tree	1,247	0.1%
Grassland	69,190	4.5%
Gravel Pit/Rock/Sand	804	0.1%
Urban/Rural Development	32,437	2.1%
Water	19,692	1.3%
Wetlands	5,293	0.3%
Woodland/Forest	47,859	3.1%

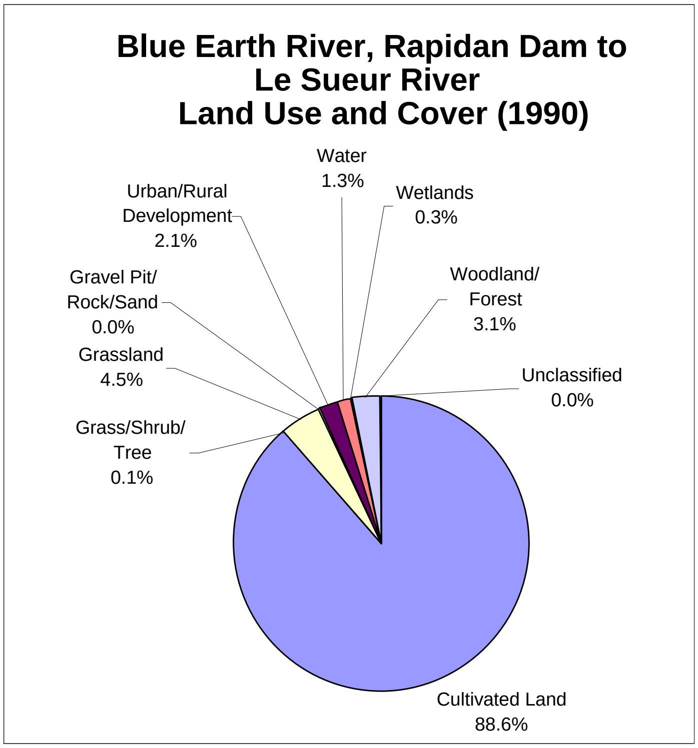


Figure 7.1c – 1990 Landuse and Cover Map and Statistics for Blue Earth River; Rapidan Dam to Le Sueur River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Resources Center, MN State University, Mankato
Years Monitored: 2004
Samples Collected: 24

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	None Required
June	None Required
July	80.1%
August	None Required
September	Inadequate Data
October	Inadequate Data

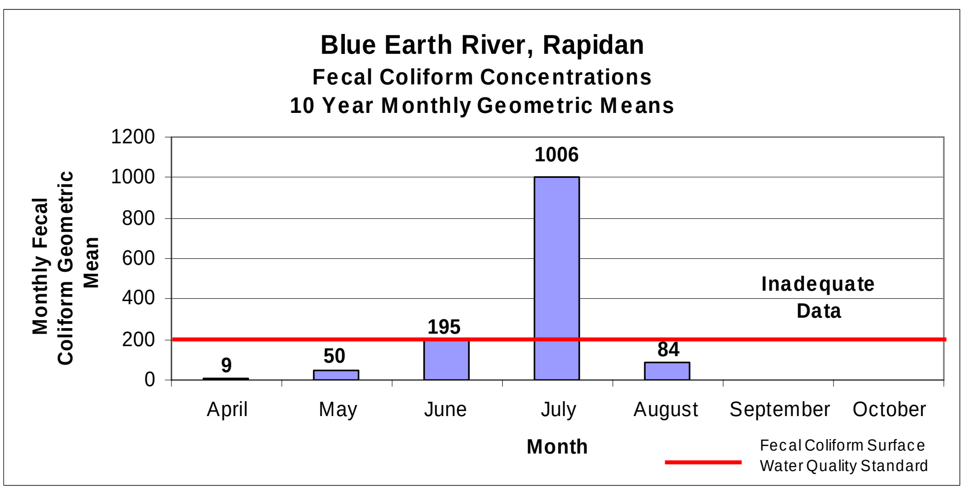


Figure 7.1d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 7.1a - Human and Animal Population Inventory for Blue Earth River; Rapidan Dam to Le Sueur River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	12,475		7.20E+10	8.98E+14	ASAE*, 1998
Beef	75,593		1.30E+11	9.83E+15	ASAE, 1998
Swine	410,917		8.00E+10	3.29E+16	ASAE, 1998
Chicken	7,374		3.40E+10	2.51E+14	ASAE, 1998
Turkey	6,965		6.20E+09	4.32E+13	ASAE, 1998
Horse	484		4.20E+08	2.03E+11	ASAE, 1998
Sheep	1,076		2.00E+11	2.15E+14	ASAE, 1998
Humans		57,376	2.00E+09	1.15E+14	Metcalf and Eddy, 1991
Cats		15,584	5.00E+09	7.79E+13	Horsley and Witten, 1996
Dogs		13,695	5.00E+09	6.85E+13	Horsley and Witten, 1996
Deer		5,578	5.00E+08	2.79E+12	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		10,813	1.04E+07	1.12E+11	Alderisio and DeLuca, 1999
Wild Turkey		2,645	9.50E+07	2.51E+11	turkey value used
Pheasants		71,120	1.53E+04	1.09E+09	geese value used
Other Wildlife**				2.79E+12	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

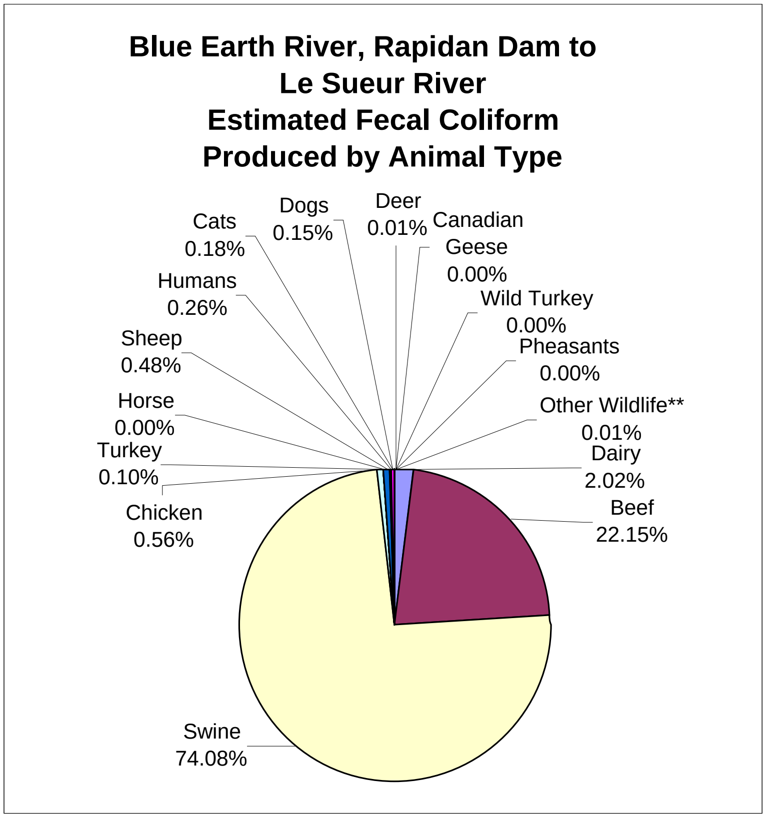


Figure 7.1e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

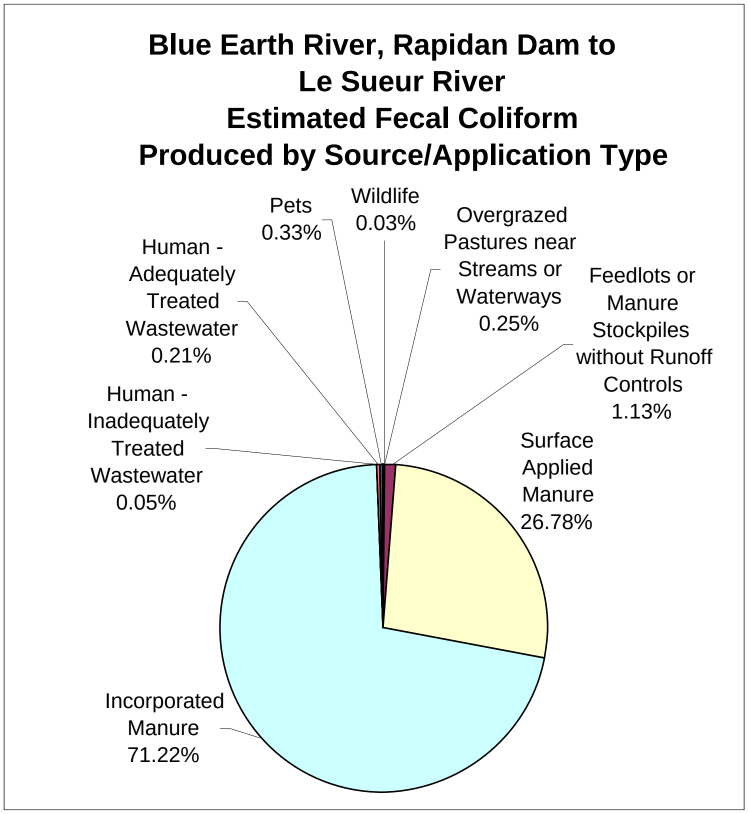


Figure 7.1f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems and overgrazed pastures during dry conditions are the major sources of fecal coliform bacteria contamination in this portion of the Blue Earth River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways		
	Feedlots or Manure Stockpiles without Runoff Controls		
	Surface Applied Manure		
	Incorporated Manure		
Human	Human - Inadequately Treated Wastewater		
Pets	Cats & Dogs		
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.		

Low Contributor	
Moderate Contributor	
High Contributor	

Figure 7.1g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Blue Earth River; Rapidan Dam to Le Sueur River

Fecal Coliform Loading Capacities and Allocations: Blue Earth River; Rapidan Dam to Le Sueur River

Table 7.1b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Alden	MN0020605	1.239	0.281
Blue Earth	MN0020532	0.981	0.223
Bricelyn	MN0022918	0.466	0.106
Buffalo Center	IA0047821	0.937	0.213
Butterfield	MN0022977	1.060	0.241
Darfur	county permitted	0.010	0.002
Elmore	MN0021920	1.451	0.329
Fairmont	MN0030112	3.900	0.886
Frost	MN0064432	0.393	0.089
Granada	MNG580023	0.362	0.082
Kiester	MN0039721	1.917	0.435
Lewisville	MN0065722	0.039	0.009
Madelia	MN0024040	1.310	0.298
Mountain Lake	MNG580035	2.168	0.492
Northrop	MN0024384	0.456	0.104
Rake	IA0062804	0.538	0.122
St. James	MN0024759	2.960	0.672
Trimont	MN0022071	0.351	0.080
Truman	MN0021652	0.780	0.177
Vernon Center	MN0030490	0.036	0.008
Welcome	MN0021296	0.260	0.059
Winnebago	MN0025267	1.700	0.386
Totals		23.312	5.295

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 7.1c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
Fairmont	10,889	Designated by rule; >10,000 population

Table 7.1d – Monthly Fecal Coliform Loading Capacities and Allocations

Blue Earth River; Rapidan Dam to Le Sueur River

Drainage Area (square miles): 2,427
USGS gage used to develop flow zones and loading capacities:
Blue Earth River, near Rapidan
% MS4 Urban: 0.68%
Total WWTF Design Flow (mgd): 23.31

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	1074.11	358.04	440.81	146.94	212.27	70.76	77.61	25.87	11.39	3.80
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	5.29	1.76	5.29	1.76	5.29	1.76	5.29	1.76	5.29	1.76
Communities Subject to MS4 NPDES Requirements	5.71	1.90	2.28	0.76	1.06	0.35	0.28	0.09	0.01	0.00
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	833.24	277.75	333.40	111.13	155.04	51.68	40.31	13.44	2.01	0.67
Margin of Safety	229.86	76.62	99.83	33.28	50.87	16.96	31.72	10.57	4.08	1.36

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.5%	1.2%	2.5%	6.8%	46.5%
Communities Subject to MS4 NPDES Requirements	0.5%	0.5%	0.5%	0.4%	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	77.6%	75.6%	73.0%	51.9%	17.6%
Margin of Safety	21.4%	22.6%	24.0%	40.9%	35.8%

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

7.2 Le Sueur River; Maple River to Blue Earth River

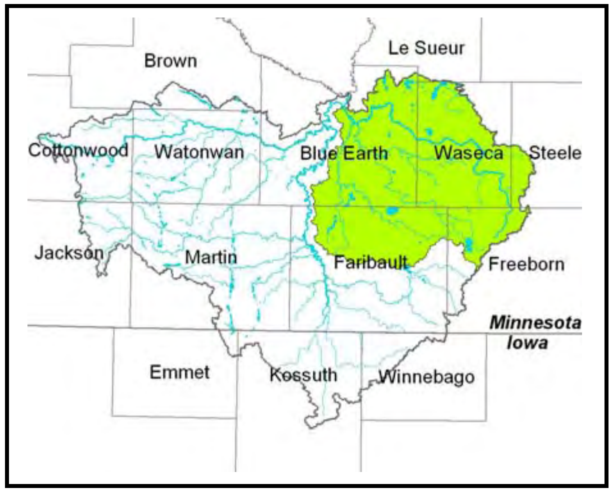


Figure 7.2a – Impaired Reach Watershed

Monitoring Site ID:
Le Sueur River, Near Rapidan
(LES_1.4)

Stream Status:
Not Listed
Potentially Qualifies in 2008

Impaired Reach Length
6.1 miles

Contributing Watershed Size
711,838 acres
1,112 square miles

Human Population (2000 Census)
33,038 (18,747 urban and 14,291 rural)

Cities Located in Watershed

Amboy	Hartland	Pemberton
Delevan	Janesville	St. Clair
Eagle Lake***	Madison Lake	Waldorf
Easton****	Mankato*	Waseca*
Elysian*	Mapleton	Wells
Freeborn	Minnesota Lake****	Winnebago*
Good Thunder	New Richland	

* Waste Water Effluent Discharged Outside Watershed Boundary
** Unsewered Community
*** Waste Water Treated in Mankato, discharged outside of watershed
**** Waste Water Treated in Wells

Livestock (2003 Feedlot Inventory)
797 feedlot facilities
191,471 total animal units

This reach of the Le Sueur River is not listed as impaired. In 2004, as part of the BERB Fecal Coliform TMDL project this site was monitored five times monthly, April through August. The monitoring data indicate the river exceeded surface water standards in May and July of 2004. The impaired stream reach listing process used by the MPCA for the 2006 listings utilized data collected from 1994 through 2003. Based on MPCA listing methodology, the Le Sueur River will qualify for listing as an impaired stream reach in 2008. The potentially impaired reach of the Le Sueur River is 6.1 miles in length, from its outlet at the Blue Earth River to the Maple River.

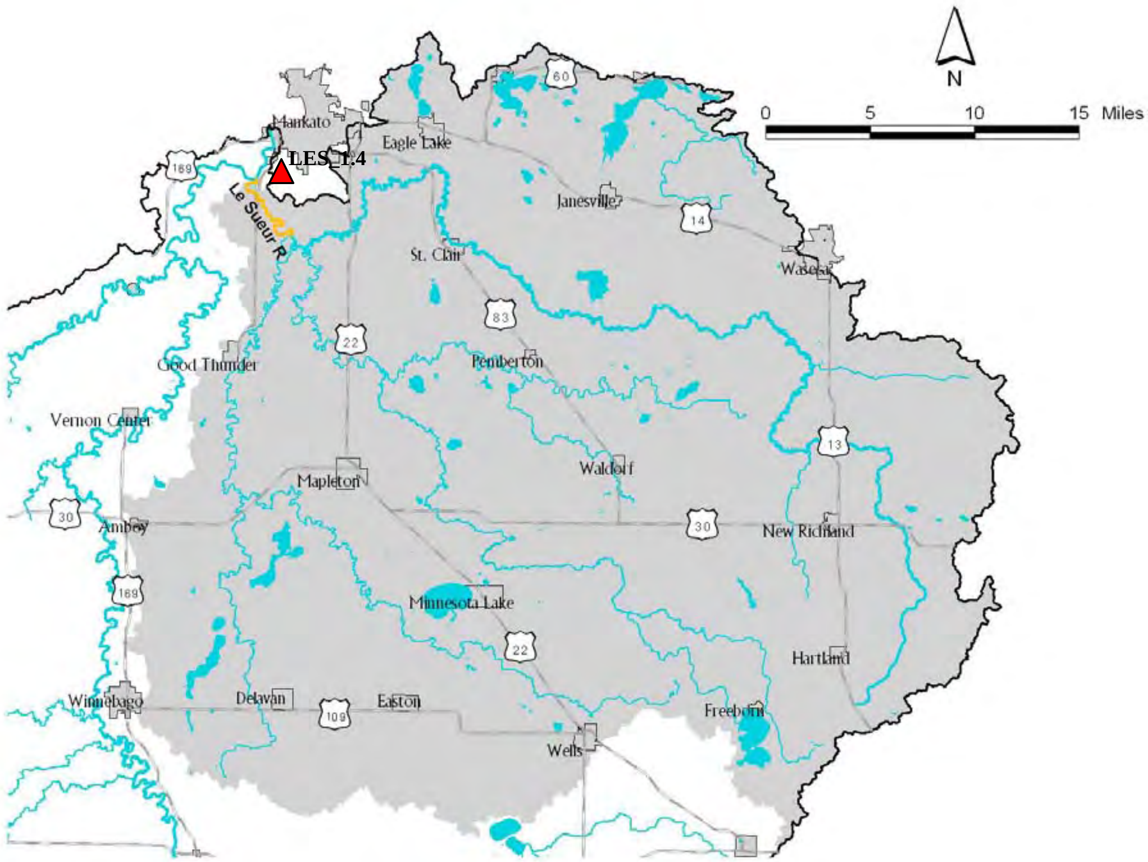


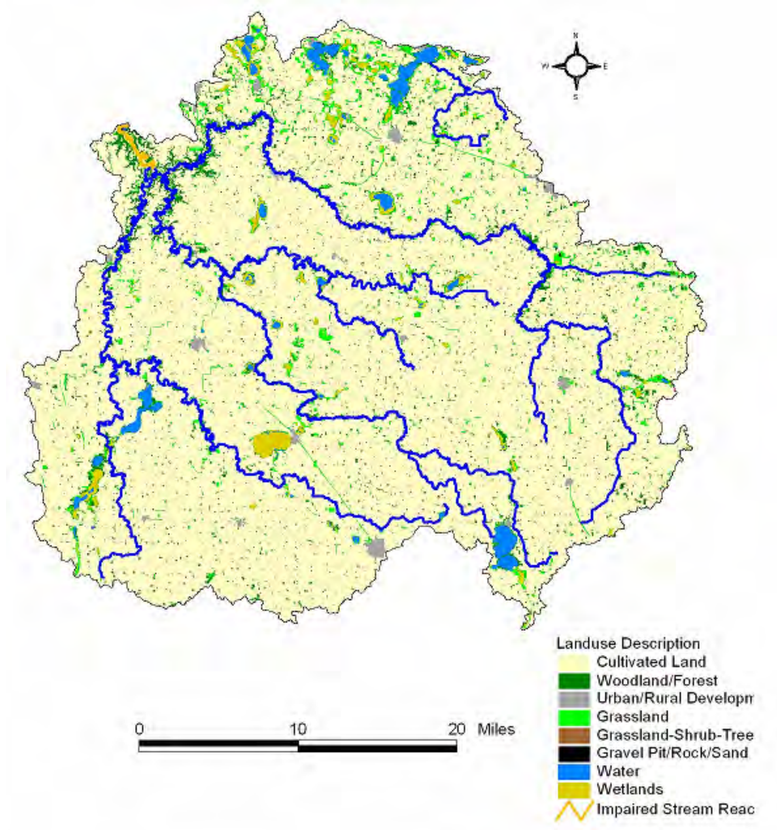
Figure 7.2b - Le Sueur River; Maple River to Blue Earth River Watershed

The Le Sueur River watershed encompasses 1,112 square miles six southern Minnesota counties; Blue Earth, Faribault, Freeborn, Le Sueur, Steele and Waseca. The potentially impaired reach as located near the mouth of the Le Sueur River, thus the contributing drainage area includes the entire Le Sueur watershed. The watershed has a human population of 33,038, with 43.3% living in rural areas. The watershed has an estimated 797 feedlots with 191,471 livestock animal units. The watershed is 86.6% cultivated land, followed by woodland at 4.5% and grassland at 3.6%.

There are 20 cities located in the watershed, the largest being portions of Mankato and Waseca. The Le Sueur Watershed has no incorporated unsewered communities, (although there are several unincorporated unsewered communities). Mankato and Waseca are cities requiring MS4 stormwater permits. As such, they are required to have stormwater management plans.

Based on county estimates, 33% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 1,940 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	616,390	86.6%
Grass/Shrub/Tree	586.8	0.1%
Grassland	25,331	3.6%
Gravel Pit/Rock/Sand	277.6	0.0%
Urban/Rural Development	16,892	2.4%
Water	10,889	1.5%
Wetlands	9,534.7	1.3%
Woodland/Forest	31,912	4.5%

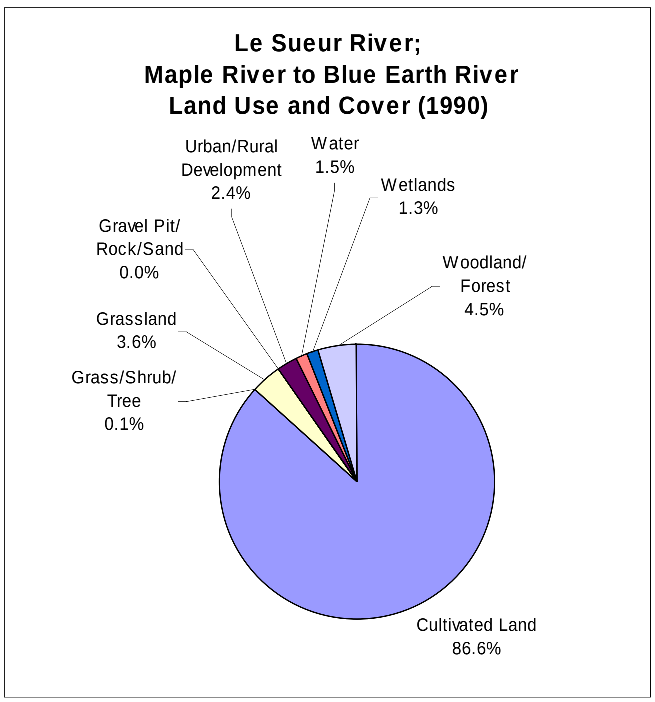


Figure 7.2c – 1990 Landuse and Cover Map and Statistics for Le Sueur River; Maple River to Blue Earth River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Water Resources Center, MN State University, Mankato
Years Monitored: 2004
Samples Collected: 24

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	12.3%
June	None Required
July	71.3%
August	Inadequate Data
September	Inadequate Data
October	Inadequate Data

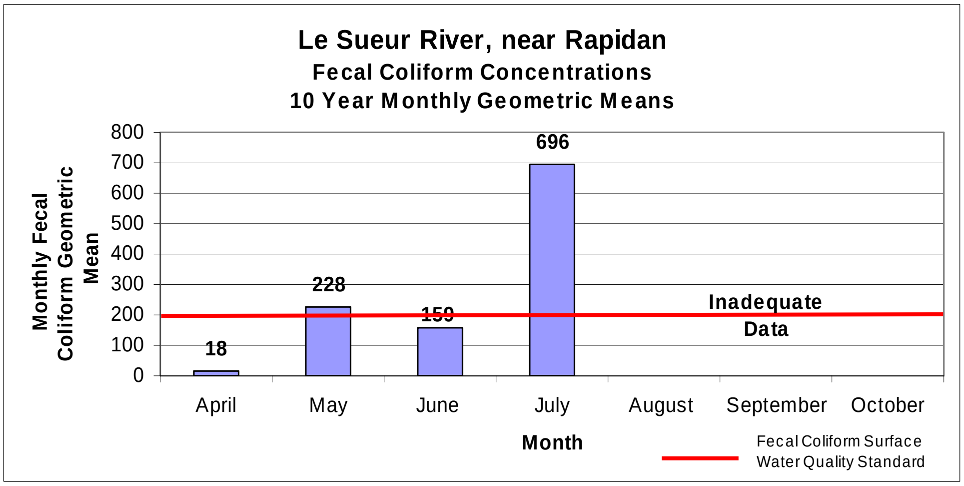


Figure 7.2d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 7.2a - Human and Animal Population Inventory for Le Sueur River; Maple River to Blue Earth River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	25,502		7.20E+10	1.84E+15	ASAE*, 1998
Beef	18,169		1.30E+11	2.36E+15	ASAE, 1998
Swine	143,422		8.00E+10	1.15E+16	ASAE, 1998
Chicken	530		3.40E+10	1.80E+13	ASAE, 1998
Turkey	2,869		6.20E+09	1.78E+13	ASAE, 1998
Horse	316		4.20E+08	1.33E+11	ASAE, 1998
Sheep	321		2.00E+11	6.42E+13	ASAE, 1998
Humans		33,038	2.00E+09	6.61E+13	Metcalf and Eddy, 1991
Cats		8,973	5.00E+09	4.49E+13	Horsley and Witten, 1996
Dogs		7,886	5.00E+09	3.94E+13	Horsley and Witten, 1996
Deer		4,004	5.00E+08	2.00E+12	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		4,955	1.04E+07	5.15E+10	Alderisio and DeLuca, 1999
Wild Turkey		1,212	9.50E+07	1.15E+11	turkey value used
Pheasants		51,052	1.53E+04	7.81E+08	geese value used
Other Wildlife**				2.00E+12	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

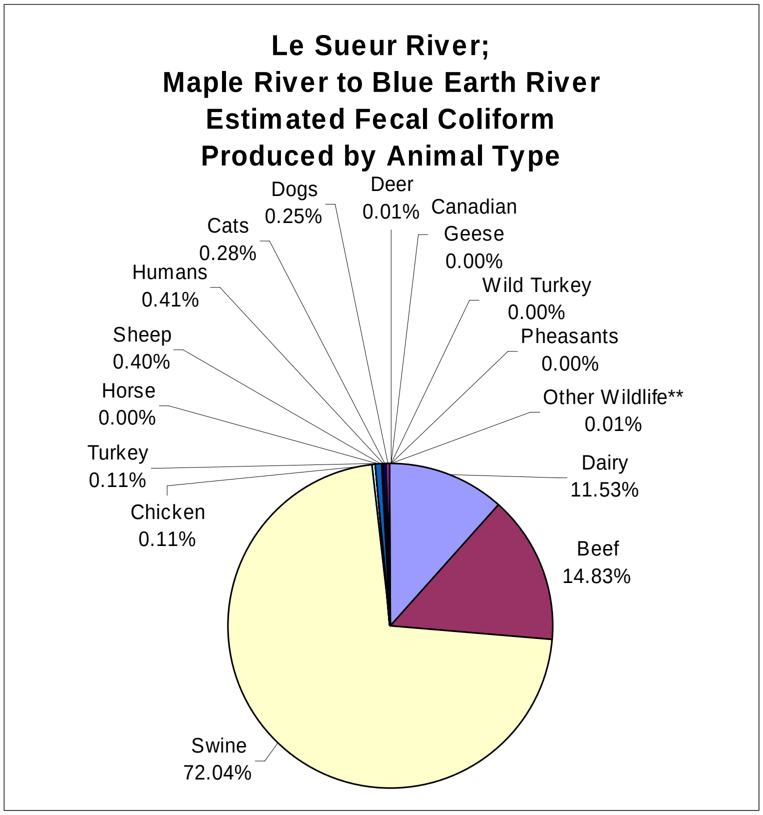


Figure 7.2e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

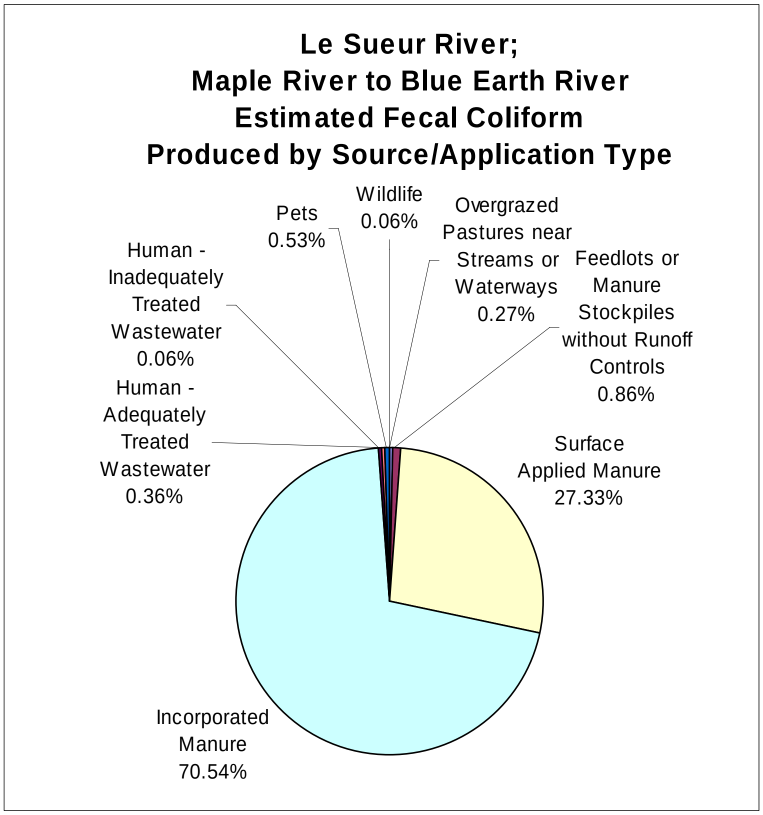


Figure 7.2f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems during dry conditions are the major sources of fecal coliform bacteria contamination in the Le Sueur River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low	Moderate
	Feedlots or Manure Stockpiles without Runoff Controls	Moderate	Low
	Surface Applied Manure	High	Low
	Incorporated Manure	Moderate	Low
Human	Human - Inadequately Treated Wastewater	Low	High
Pets	Cats & Dogs	Low	Low
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low	Low

Low Contributor	(light green)
Moderate Contributor	(yellow)
High Contributor	(orange)

Figure 7.2g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Le Sueur River; Maple River to Blue Earth River

Fecal Coliform Loading Capacities and Allocations: Le Sueur River; Maple River to Blue Earth River

Table 7.2b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Amboy	MN0022624	0.287	0.065
Delavan	MN0066095	0.408	0.093
Freeborn	MNG580018	0.245	0.056
Good Thunder	MN0020851	0.709	0.161
Hartland	MN0049174	0.396	0.090
Janesville	MNG580025	1.304	0.296
Madison Lake	MN0040789	0.130	0.030
Mapleton	MN0021172	3.651	0.829
New Richland	MN0021032	0.600	0.136
Pemberton	MNG580075	0.652	0.148
St. Clair	MN0024716	0.212	0.048
Waldorf	MN0021849	0.096	0.022
Wells/Easton	MN0025224	15.567	3.535
Totals		24.256	5.509

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 7.2c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
Mankato	2,137	Designated by rule; >10,000 population
Waseca	2,274	Designated by rule; >5,000 population

Table 7.2d – Monthly Fecal Coliform Loading Capacities and Allocations

Le Sueur River; Maple River to Blue Earth River

Drainage Area (square miles): 1,112
USGS gage used to develop flow zones and loading capacities:
Le Sueur River, near Rapidan
% MS4 Urban: 0.17%
Total WWTF Design Flow (mgd): 24.26

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	521.08	173.69	241.35	80.45	118.10	39.37	29.93	9.98	4.44	1.48
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	5.51	1.84	5.51	1.84	5.51	1.84	5.51	1.84	*	*
Communities Subject to MS4 NPDES Requirements	0.71	0.24	0.31	0.10	0.13	0.04	0.02	0.01	*	*
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	411.33	137.11	181.55	60.52	77.01	25.67	12.41	4.14	*	*
Margin of Safety	103.54	34.51	53.98	17.99	35.44	11.81	11.99	4.00	na	na

	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	1.1%	2.3%	4.7%	18.4%	*
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	78.9%	75.2%	65.2%	41.5%	*
Margin of Safety	19.9%	22.4%	30.0%	40.0%	na

*Note - WWTF design/discharge flow exceeded low flow
alllocation = (flow contribution from a given source) X (200 orgs./100ml.), see section 5.0 for details

Daily Loading Capacity and Allocations

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

7.3 Little Cobb River; Bull Run Creek to Big Cobb River

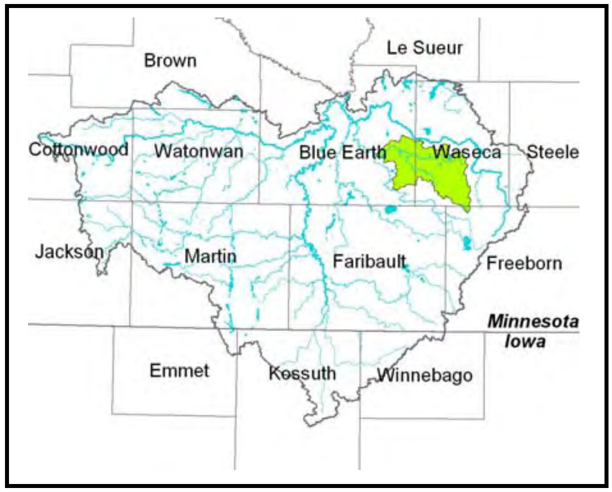


Figure 7.3a – Impaired Reach Watershed

Monitoring Site ID:
Little Cobb River
(LCR_1.6)

Stream Status:
Not Listed
Potentially Qualifies in 2008

Impaired Reach Length
17.4 miles

Contributing Watershed Size
84,664 acres
132 square miles

Human Population (2000 Census)
1,758 (488 urban and 1270 rural)

Cities Located in Watershed
Pemberton
Waldorf

Livestock (2003 Feedlot Inventory)
88 feedlot facilities
27,898 total animal units

This reach of the Little Cobb River is not listed as impaired. In 2004, as part of the BERB Fecal Coliform TMDL project this site was monitored five times monthly, April through August. The monitoring data indicated the river exceeded surface water standards in May and July of 2004. The impaired stream reach listing process used by the MPCA for the 2006 listings utilized data collected from 1994 through 2003. Based on MPCA listing methodology, the Le Sueur River will qualify for listing as an impaired stream reach in 2008. The potentially impaired reach of the Le Sueur River is 17.4 miles in length.

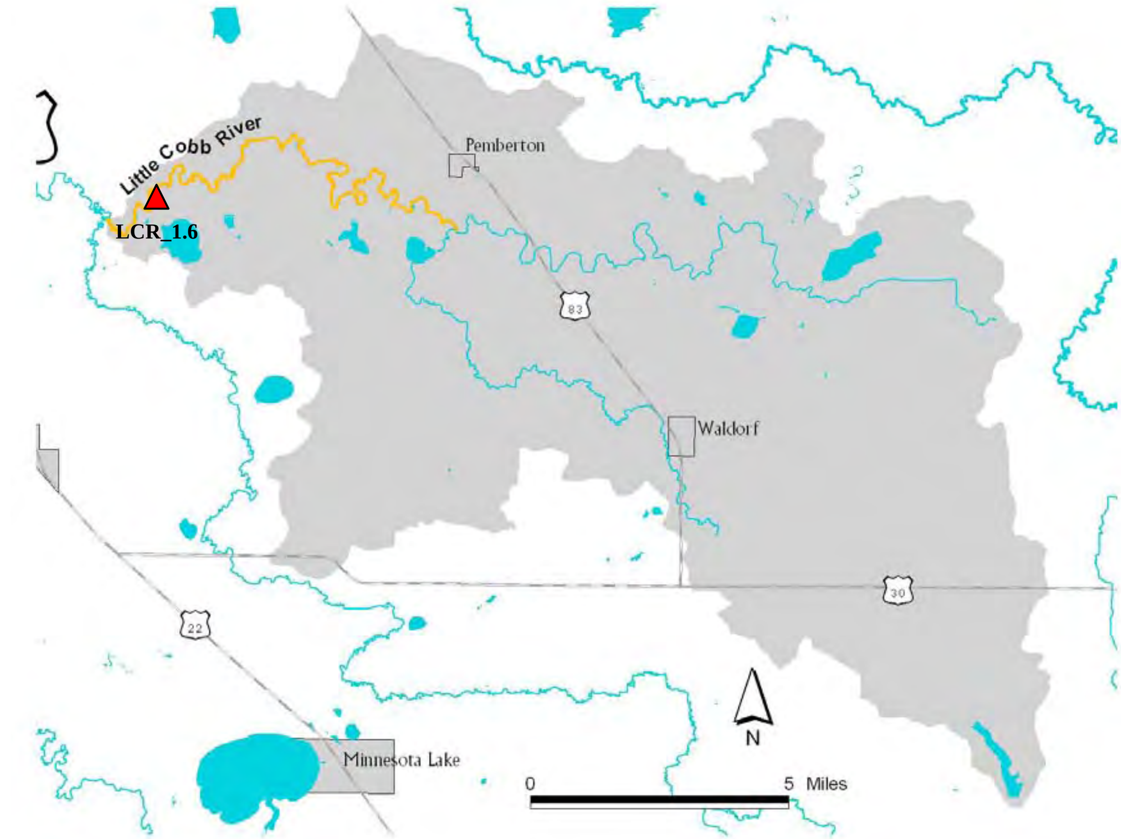
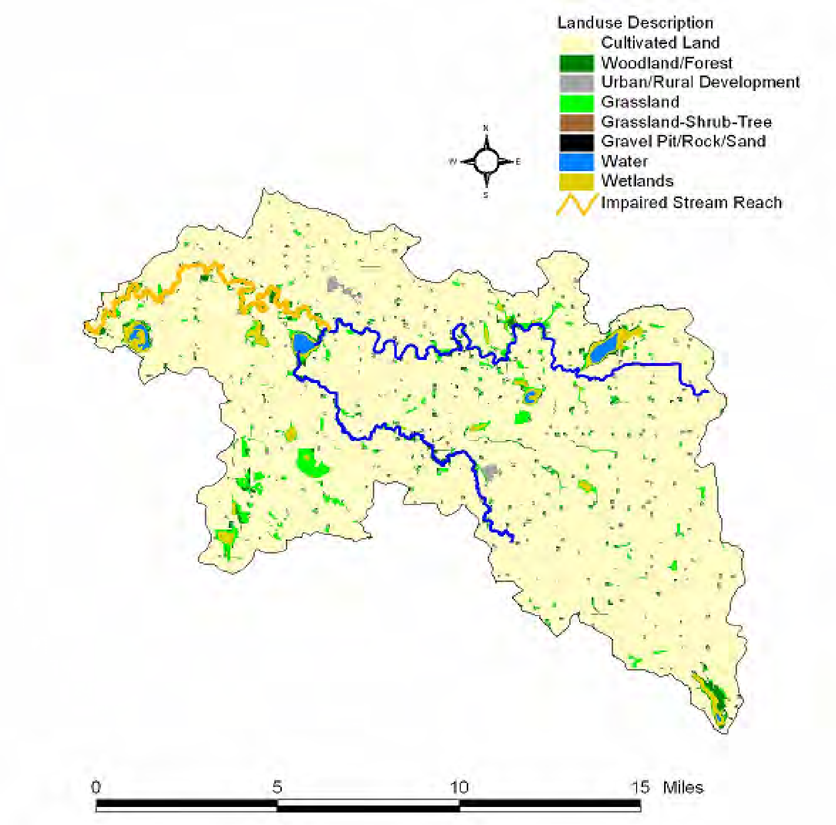


Figure 7.3b - Little Cobb River; Bull Run Creek to Big Cobb River Watershed

The Le Sueur River watershed encompasses 132 square miles six southern Minnesota counties; Blue Earth, Freeborn, and Waseca. The watershed has a human population of 1,758, with 72.2% living in rural areas. The watershed has an estimated 88 feedlots with 84,664 livestock animal units. The watershed is 89.9% cultivated land, followed by grassland at 3.5% and woodland at 2.8%.

There are only two cities located in the watershed Pemberton and Waldorf. Based on county estimates, 27% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 140 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	76,091	89.9%
Grass/Shrub/Tree	44	0.1%
Grassland	2,992	3.5%
Gravel Pit/Rock/Sand	0	0.0%
Urban/Rural Development	1,448	1.7%
Water	471	0.6%
Wetlands	1246	1.5%
Woodland/Forest	2,373	2.8%

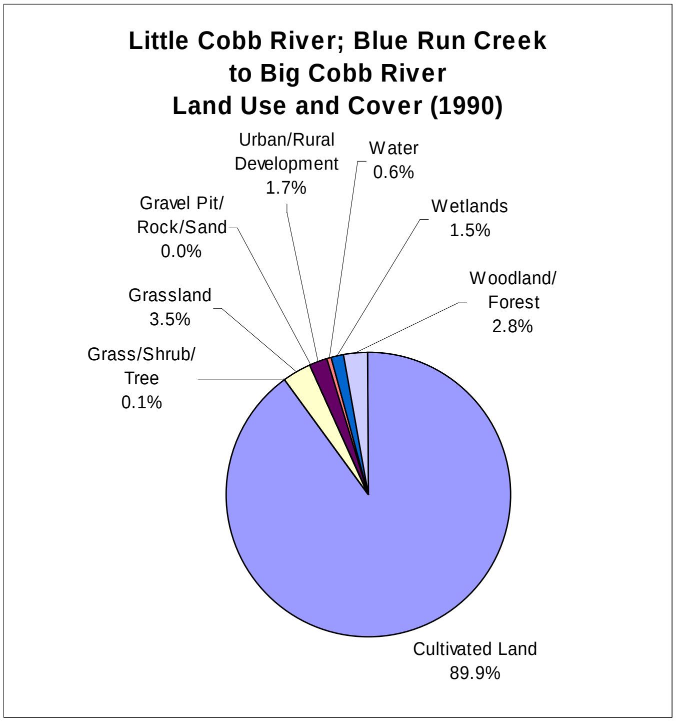


Figure 7.3c – 1990 Landuse and Cover Map and Statistics for Little Cobb River; Bull Run Creek to Big Cobb River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Water Resources Center, MN State University, Mankato
Years Monitored: 2004
Samples Collected: 25

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	20.3%
June	None Required
July	64.0%
August	Inadequate Data
September	Inadequate Data
October	Inadequate Data

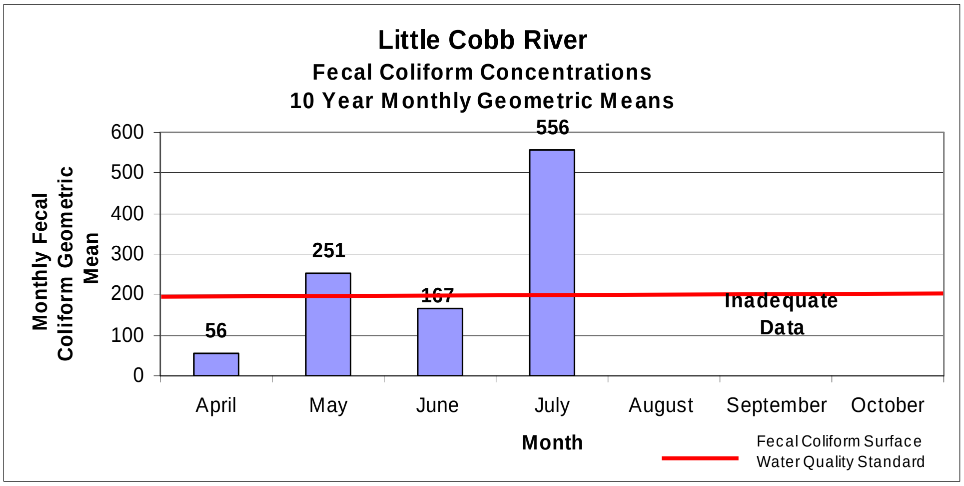


Figure 7.3d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 7.3a - Human and Animal Population Inventory for Little Cobb River; Bull Run Creek to Big Cobb River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	2,466		7.20E+10	1.78E+14	ASAE*, 1998
Beef	1,211		1.30E+11	1.57E+14	ASAE, 1998
Swine	23,708		8.00E+10	1.90E+15	ASAE, 1998
Chicken	2		3.40E+10	6.80E+10	ASAE, 1998
Turkey	442		6.20E+09	2.74E+12	ASAE, 1998
Horse	36		4.20E+08	1.51E+10	ASAE, 1998
Sheep	10		2.00E+11	2.00E+12	ASAE, 1998
Humans		1,758	2.00E+09	3.52E+12	Metcalf and Eddy, 1991
Cats		477	5.00E+09	2.39E+12	Horsley and Witten, 1996
Dogs		420	5.00E+09	2.10E+12	Horsley and Witten, 1996
Deer		476	5.00E+08	2.38E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		589	1.04E+07	6.13E+09	Alderisio and DeLuca, 1999
Wild Turkey		144	9.50E+07	1.37E+10	turkey value used
Pheasants		6,072	1.53E+04	9.29E+07	geese value used
Other Wildlife**				2.38E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

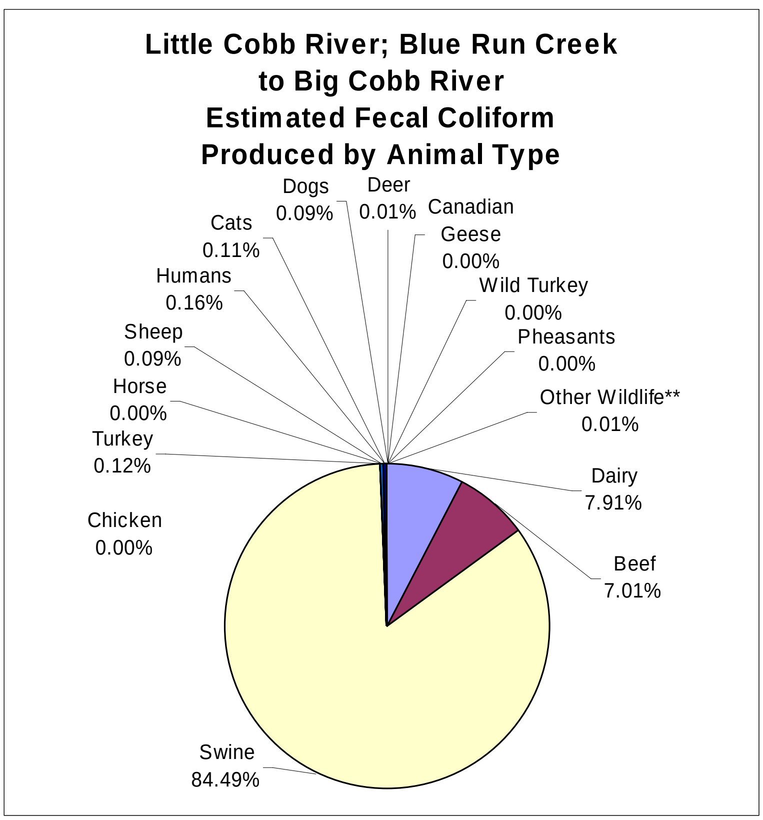


Figure 7.3e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

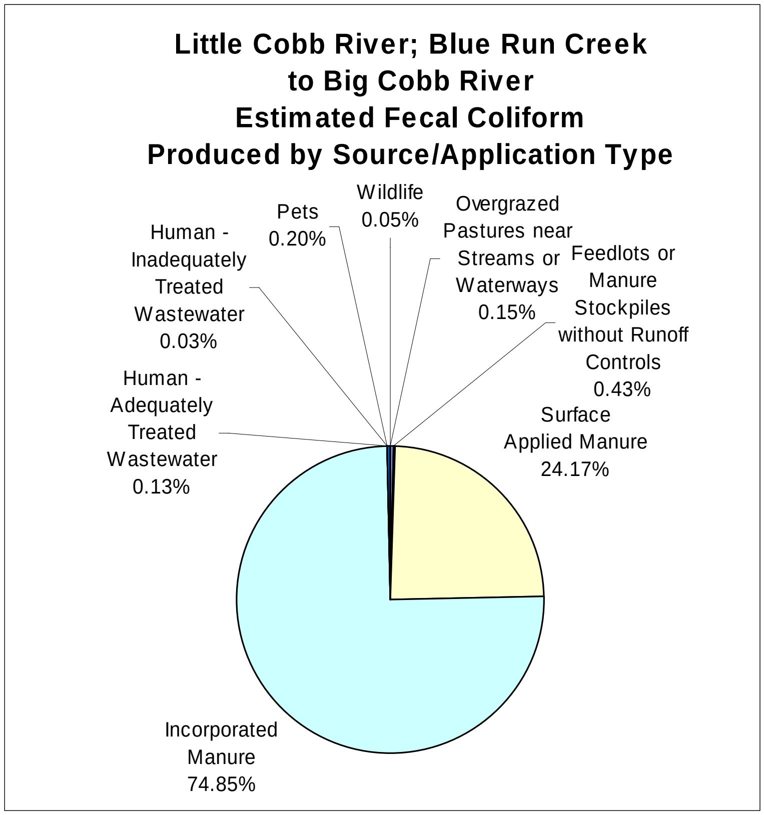


Figure 7.3f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems during dry conditions are the major sources of fecal coliform bacteria contamination in the Little Cobb River.

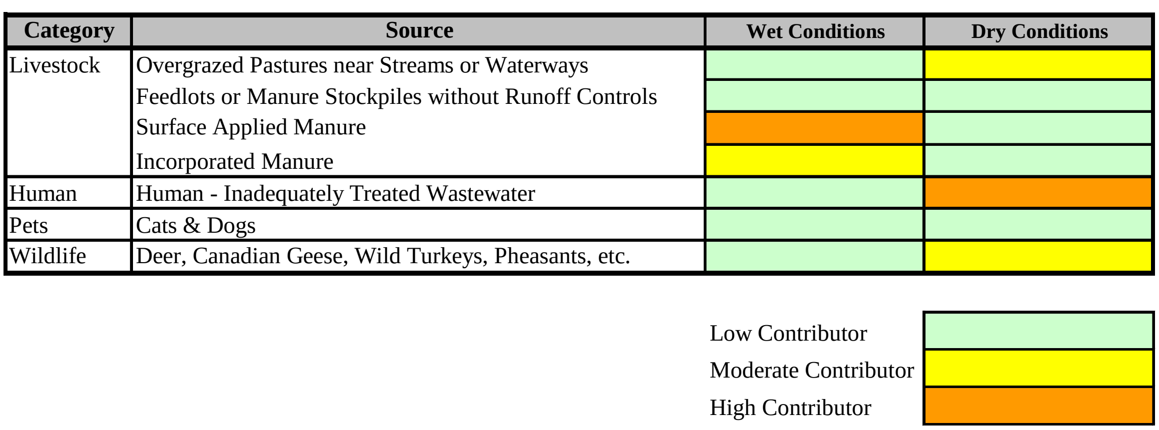


Figure 7.3g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Le Sueur River; Maple River to Blue Earth River

Fecal Coliform Loading Capacities and Allocations: Little Cobb River; Bull Run Creek to Big Cobb River

Table 7.3b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Pemberton	MNG580075	0.652	0.148
Waldorf	MN0021849	0.096	0.022
Totals		0.748	0.170

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 7.3c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 7.3d – Monthly Fecal Coliform Loading Capacities and Allocations

Little Cobb River; Bull Run Creek to Big Cobb River

Drainage Area (square miles): 132
USGS gage used to develop flow zones and loading capacities:
Le Sueur River, near Rapidan
% MS4 Urban: 0%
Total WWTF Design Flow (mgd): 0.75

	Flow Zone									
	High		Moist		Mid		Dry		Low	
	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
	values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY	61.98	20.66	28.71	9.57	14.05	4.68	3.56	1.19	0.53	0.18
Wasteload Allocation										
Permitted Wastewater Treatment Facilities	0.17	0.06	0.17	0.06	0.17	0.06	0.17	0.06	0.17	0.06
Communities Subject to MS4 NPDES Requirements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	49.49	16.50	22.12	7.37	9.66	3.22	1.96	0.65	0.16	0.05
Margin of Safety	12.31	4.10	6.42	2.14	4.22	1.41	1.43	0.48	0.20	0.07

	High	Moist	Mid	Dry	Low
	values expressed as percent of total monthly/daily loading capacity				
TOTAL MONTHLY / DAILY LOADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0.3%	0.6%	1.2%	4.8%	32.2%
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	79.9%	77.0%	68.8%	55.2%	30.1%
Margin of Safety	19.9%	22.4%	30.0%	40.0%	37.7%

<u>Daily Loading Capacity and Allocations</u>

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

7.4 Maple River; Rice Creek to Le Sueur River

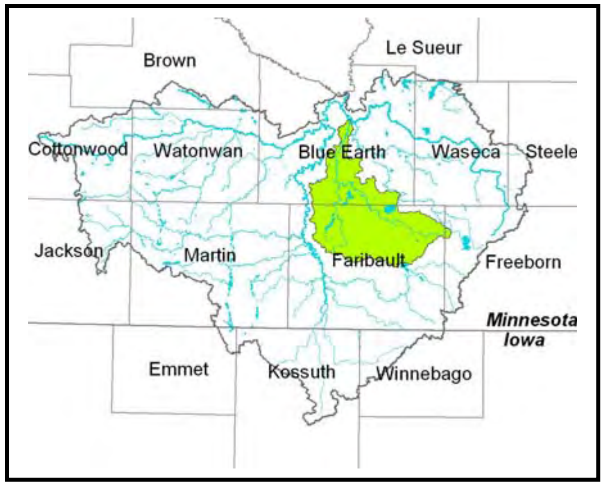


Figure 7.4a – Impaired Reach Watershed

Monitoring Site ID:
  Maple River CSAH 35
  (MAP_3.5)

Stream Status:
  Not Listed
  Potentially Qualifies in 2008

Impaired Reach Length
  30.6 miles

Contributing Watershed Size
  219,045 acres
  342 square miles

Human Population (2000 Census)
  7,141 (4,397 urban and 2,744 rural)

Cities Located in Watershed

Amboy	Mapleton*
Delevan	Minnesota Lake**
Easton**	Wells
Good Thunder	Winnebago*

* Waste Water Effluent Discharged Outside Watershed Boundary
** Waste Water Treated at Wells WWTP, Outside Watershed

Livestock (2003 Feedlot Inventory)
  268 feedlot facilities
  52,124 total animal units

This reach of the Maple River is not listed as impaired. The Maple River was monitored from 2003 through present by the Maple River Clean Water Partnership Implementation Project. The monitoring data indicate the river exceeded surface water standards in May, June, July, August and September. The impaired stream reach listing process used by the MPCA for the 2006 listings utilized data collected from 1994 through 2003. As of 2003, not enough samples had been collected to list the reach as impaired. However, frequent sampling in 2004 shows the river to be clearly impaired for fecal coliform bacteria. Based on MPCA listing methodology, the Maple River will qualify for listing as an impaired stream reach in 2008. The potentially impaired reach of the Maple River is 30.6 miles in length.

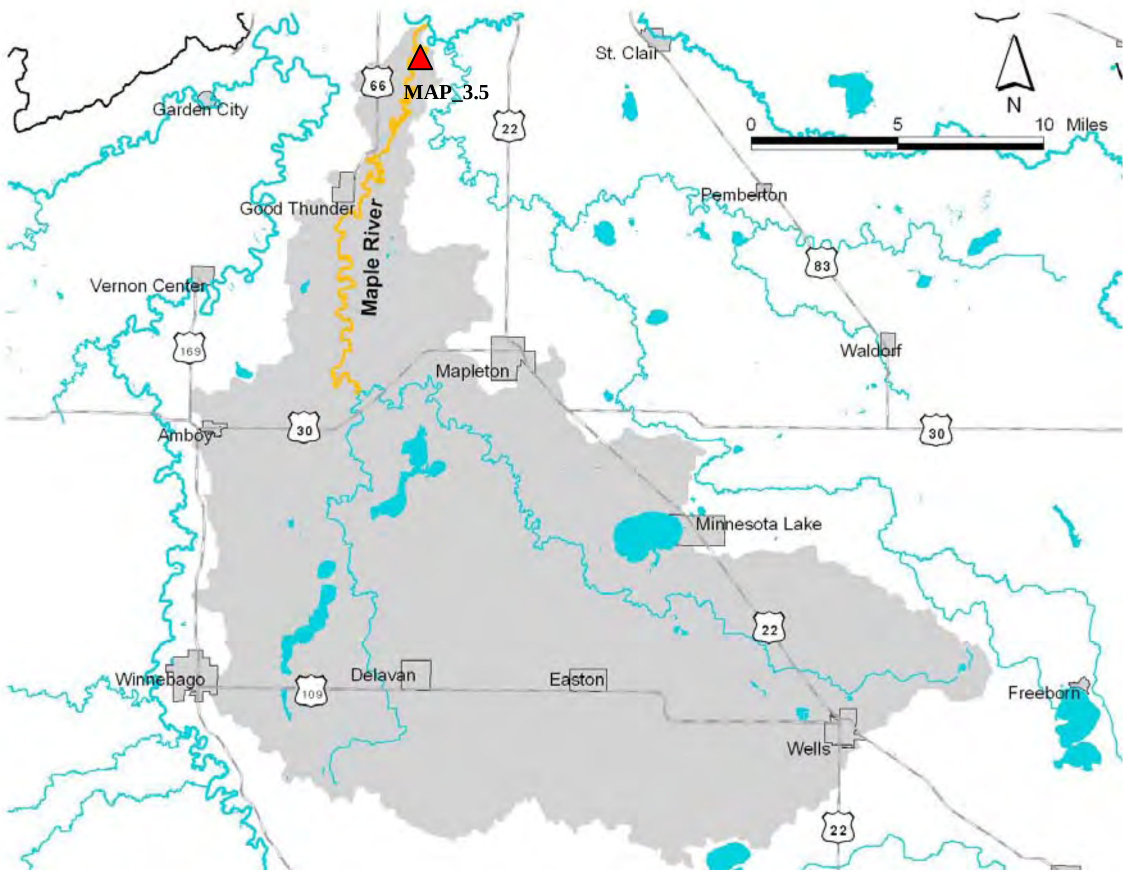
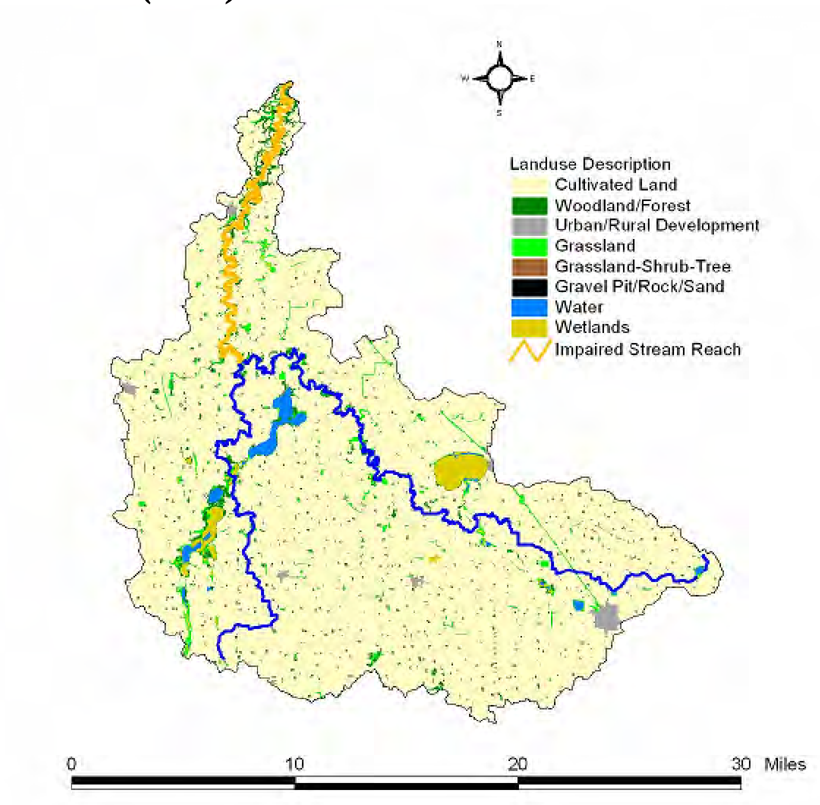


Figure 7.4b - Maple River; Rice Creek to Le Sueur River Watershed

The Maple River watershed encompasses 342 square miles three southern Minnesota counties; Blue Earth, Faribault and Freeborn. The watershed has a human population of 7,141, with 38% living in rural areas. The watershed has an estimated 268 feedlots with 52,124 livestock animal units. The watershed is 89.2% cultivated land, followed by woodland at 3.5% and grassland at 2.6%.

There are eight cities located, with Wells being the largest. The eight cities are all sewered. Based on county estimates, 55% of the individual sewage treatment systems in the watershed are an imminent threat to public health or safety. This equates to an estimated 620 households.

Land Use Statistics (1990)



Landuse Category	Acres	Percent
Cultivated Land	195,294	89.2%
Grass/Shrub/Tree	183.8	0.1%
Grassland	5,649	2.6%
Gravel Pit/Rock/Sand	51.6	0.0%
Urban/Rural Development	4,657	2.1%
Water	2,401	1.1%
Wetlands	3205.5	1.5%
Woodland/Forest	7,603	3.5%

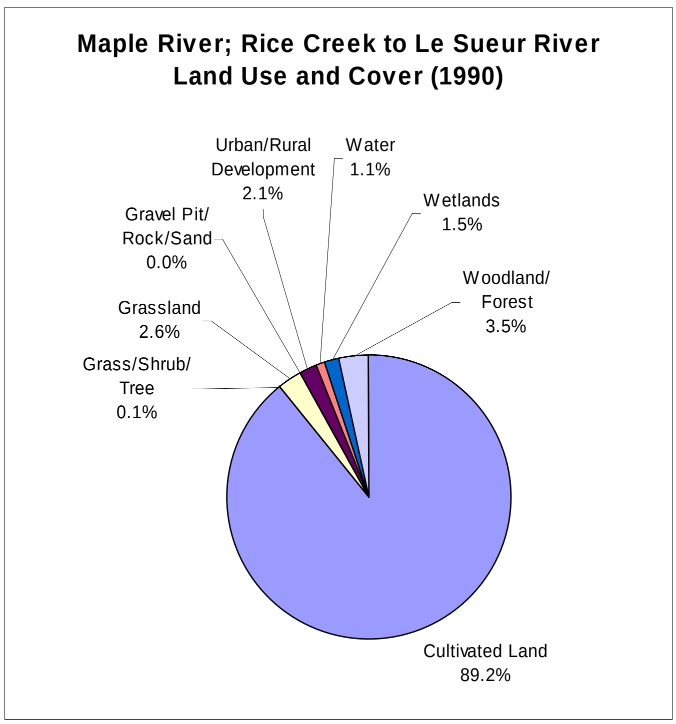


Figure 7.4c – 1990 Landuse and Cover Map and Statistics for Maple River; Rice Creek to Le Sueur River Watershed

Water Quality Data and Required Reductions

Monitoring Conducted by: Maple River Clean Water Partnership Implementation Project
Years Monitored: 2003 and 2004
Samples Collected: 86

The following reduction represents the percentage reduction in bacterial concentration 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.

Month	Required Reduction
April	None Required
May	16.3%
June	89.0%
July	90.2%
August	51.1%
September	77.8%
October	Inadequate Data

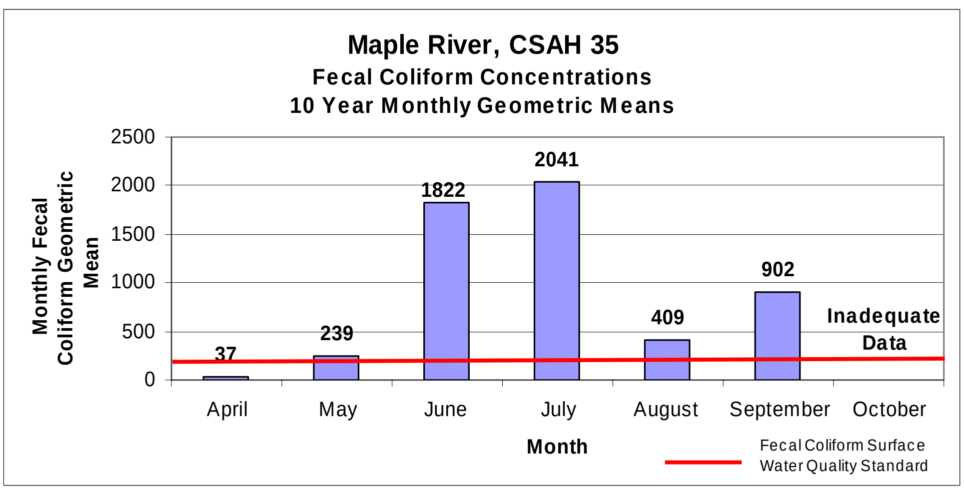


Figure 7.4d - Monthly Geometric Mean Fecal Coliform Concentrations (1995-2004)

Table 7.4a - Human and Animal Population Inventory for Maple River; Rice Creek to Le Sueur River Watershed

Animal Type	Animal Units	Individuals	Fecal Coliform (FC) Organisms Produced Per Individual or AU Per Day	Total FC Available	Source (Daily FC Produced)
Dairy	1,169		7.20E+10	8.42E+13	ASAE*, 1998
Beef	3,678		1.30E+11	4.78E+14	ASAE, 1998
Swine	46,445		8.00E+10	3.72E+15	ASAE, 1998
Chicken	504		3.40E+10	1.71E+13	ASAE, 1998
Turkey	0		6.20E+09	0.00E+00	ASAE, 1998
Horse	64		4.20E+08	2.69E+10	ASAE, 1998
Sheep	131		2.00E+11	2.62E+13	ASAE, 1998
Humans		7,141	2.00E+09	1.43E+13	Metcalf and Eddy, 1991
Cats		1,940	5.00E+09	9.70E+12	Horsley and Witten, 1996
Dogs		1,704	5.00E+09	8.52E+12	Horsley and Witten, 1996
Deer		1,232	5.00E+08	6.16E+11	Interpolated from Metcalf and Eddy, 1991
Canadian Geese		1,525	1.04E+07	1.59E+10	Alderisio and DeLuca, 1999
Wild Turkey		373	9.50E+07	3.54E+10	turkey value used
Pheasants		15,710	1.53E+04	2.40E+08	geese value used
Other Wildlife**				6.16E+11	

* American Society of Agricultural Engineers

** Unknown, estimated to be roughly the equivalent of the deer population.

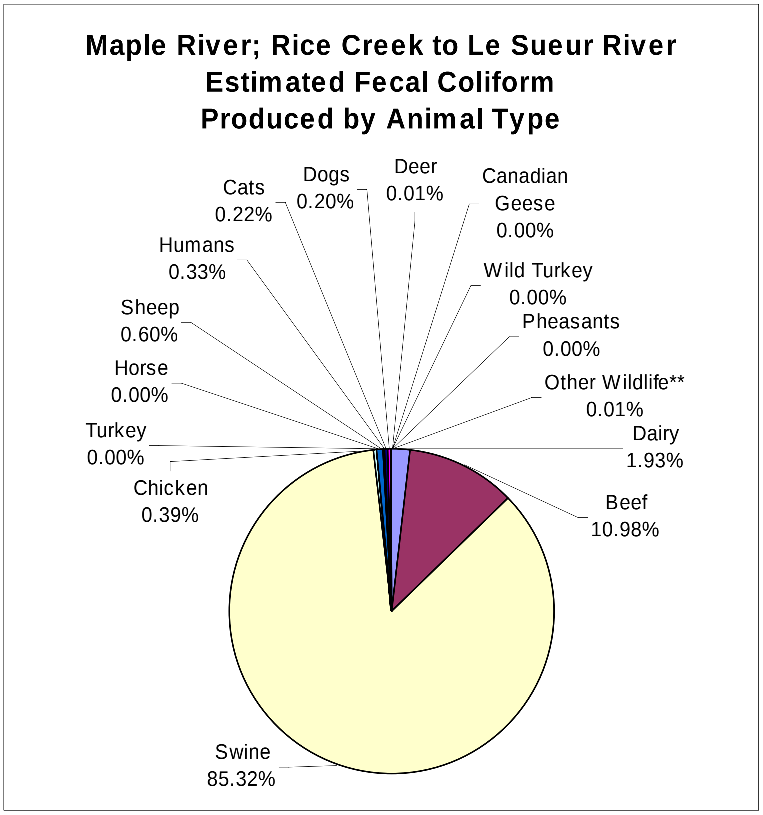


Figure 7.4e – Estimated Fecal Coliform Bacteria Produced by Humans and Animals

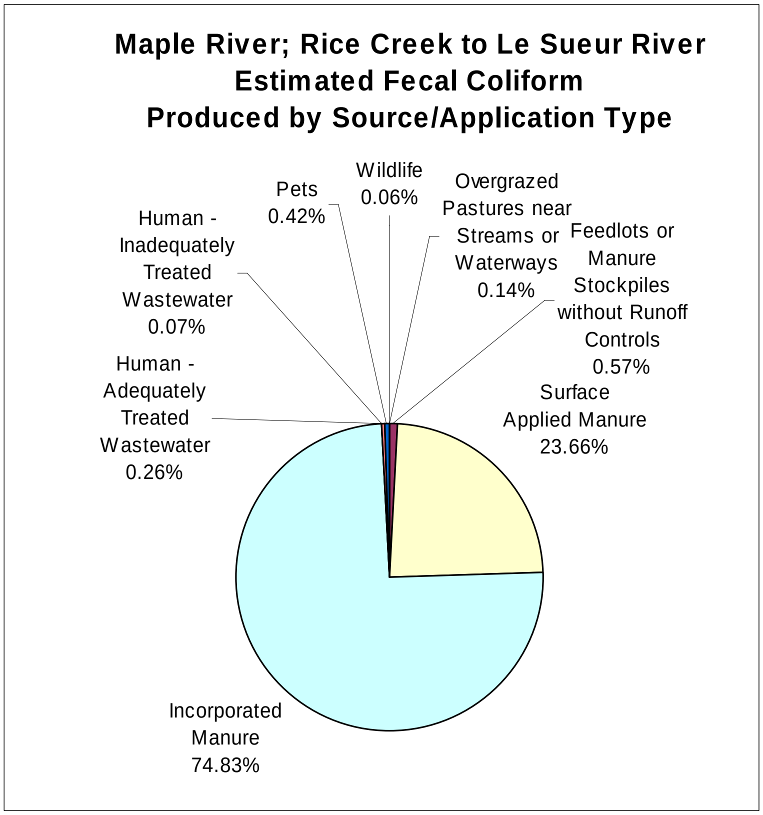


Figure 7.4f - Estimated Fecal Coliform Produced by Source Category

Major Sources of Fecal Coliform Bacteria in Impaired Stream Reach

Based on assumptions outlined in section 4.5.2, land applied livestock manure during wet conditions and straight pipe septic systems during dry conditions are the major sources of fecal coliform bacteria contamination in the Maple River.

Category	Source	Wet Conditions	Dry Conditions
Livestock	Overgrazed Pastures near Streams or Waterways	Low	Moderate
	Feedlots or Manure Stockpiles without Runoff Controls	Low	Low
	Surface Applied Manure	High	Low
	Incorporated Manure	Moderate	Low
Human	Human - Inadequately Treated Wastewater	Low	High
Pets	Cats & Dogs	Low	Low
Wildlife	Deer, Canadian Geese, Wild Turkeys, Pheasants, etc.	Low	Low

Low Contributor	(light green)
Moderate Contributor	(yellow)
High Contributor	(orange)

Figure 7.4g – Major Contributors of Fecal Coliform Bacteria by Flow Condition for Maple River; Rice Creek to Le Sueur River

Fecal Coliform Loading Capacities and Allocations: Maple River; Rice Creek to Le Sueur River

Table 7.4b - Wastewater Treatment Facilities

Name/Location	Permit Number	Design Flow (mgd)	WLA (t-orgs./mo.)
Amboy	MN0022624	0.287	0.065
Delavan	MN0066095	0.408	0.093
Good Thunder	MN0020851	0.710	0.161
Wells/Easton	MN0025224	15.567	3.535
Totals		16.971	3.854

<u>Livestock Facilities with NPDES Permits</u>
Refer to appendix C.

Table 7.4c - Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 7.4d – Monthly Fecal Coliform Loading Capacities and Allocations

Maple River; Rice Creek to Le Sueur River

Drainage Area (square miles):	342										
USGS gage used to develop flow zones and loading capacities: Le Sueur River, near Rapidan											
% MS4 Urban:	0%	Flow Zone									
Total WWTF Design Flow (mgd):	16.97	High		Moist		Mid		Dry		Low	
		Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily
		values expressed as trillion organisms per month / day									
TOTAL MONTHLY / DAILY LOADING CAPACITY		160.35	53.45	74.27	24.76	36.34	12.11	9.21	3.07	1.37	0.46
Wasteload Allocation											
Permitted Wastewater Treatment Facilities		3.85	1.28	3.85	1.28	3.85	1.28	3.85	1.28	*	*
Communities Subject to MS4 NPDES Requirements		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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		124.63	41.54	53.80	17.93	21.58	7.19	1.67	0.56	*	*
Margin of Safety		31.86	10.62	16.61	5.54	10.91	3.64	3.69	1.23	na	na
		values expressed as percent of total monthly/daily loading capacity									
TOTAL MONTHLY / DAILY LOADING CAPACITY		100%		100%		100%		100%		100%	
Wasteload Allocation											
Permitted Wastewater Treatment Facilities		2.4%		5.2%		10.6%		41.8%		*	
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		77.7%		72.4%		59.4%		18.1%		*	
Margin of Safety		19.9%		22.4%		30.0%		40.0%		na	

*Note - WWTF design/discharge flow exceeded low flow
alllocation = (flow contribution from a given source) X (200 orgs./100ml.), see section 5.0 for details

<u>Daily Loading Capacity and Allocations</u>

Daily loading capacities and allocations are defined as 1/3rd of the monthly loading capacities and allocations. Neither monthly loading capacities/allocations nor daily capacities allocations may be violated. See section 5.0 for more details.

Section 8.0 – Margin of Safety

The margin of safety is established to account for uncertainty that the load and wasteload allocations will result in attainment of water quality standards. The MOS in TMDLs may include "implicit" and/or "explicit" components. The implicit MOS includes conservative approaches to sampling and conservative assumptions made during load calculation. The explicit MOS takes into account a lack of knowledge concerning flow limitations and water quality. An explicit MOS is incorporated by setting aside a portion of the TMDL as the MOS.

The margin of safety for the BERB Fecal Coliform TMDL reaches was the difference between the calculated loading capacity at the mid-point of each flow regime and the minimum flow in each zone. This method will insure that allocations will not exceed the load associated with the minimum flow in each zone. As load is directly related to flow (conc. *X* flow = load), a MOS that varies by flow is the appropriate approach. The table below represents the actual range of MOS that was calculated for the 21 stream reaches in the basin.

Table 8.0 – Margin of Safety Range by Flow

	Flow Zone				
	High	Moist	Mid	Dry	Low
Margin of Safety (Range based on all 21 TMDLs)	16-21%	22-26%	24-30%	39-41%	36-41%

Section 9.0 – Monitoring Plan

Continued bacterial monitoring will be needed in the basin to assess if reductions in fecal contamination are being achieved. Currently there are three types of surface water monitoring projects in the BERB.

1.) Clean Water Partnership Projects

The majority of bacteria monitoring data collected over the past ten years is attributed to the three current Clean Water Partnership (CWP) projects in the basin. The Blue Earth River, Maple River and Watonwan River CWP projects were all diagnostic studies that began in 2000/2001. These studies were conducted to determine the sources of surface water pollution and degree of impairment of basin streams. The three projects are all now in a second, "implementation" phase of the CWP program. The projects now focus efforts on implementing best management practices that will improve surface water quality. The projects continue surface water monitoring to assess how BMP implementation is impacting water quality. This monitoring includes fecal coliform bacteria and/or e. coli bacteria. The three basin CWPs are currently funded through 2008. Monitoring after 2008 will be dependant on future funding.

2) Interagency Water Monitoring Initiative (IWMI)

The IWMI was formed in 1998 with the focus of assessing the water quality of four streams in the BERB and two locations along the Minnesota River. The program was implemented by Metropolitan Council and coordinated along with the Department of Agriculture and the Minnesota Pollution Control Agency. While the IWMI did sample for a wide variety of sample parameters, bacteria was not included because of sample holding time issues. In 2005, Metropolitan Council transferred the monitoring stations to the Water Resources Center at Minnesota State University, Mankato. The WRC plans to begin collecting bacteria samples in 2006 at the four original BERB sites, as well as two new sites. The IWMI is a biannually funded program and as such functions on a two year workplan. Bacterial monitoring after 2007 will be dependant on available funding.

3.) Minnesota Milestone River Monitoring Program

The Minnesota Milestone River Monitoring Program was implemented to collect water quality data at designated rivers over a long period of time. The data are used to obtain a long term understanding of river health in Minnesota. The program was initiated in 1953 by the Water Pollution Control Commission. In 1967 the Minnesota Pollution Control Agency took over the program which now includes more than 80 monitoring sites. The BERB has three Milestone sites, the Blue Earth River in Mankato, the Watonwan River near Garden City and Center Creek near Fairmont. These sites were established in 1967, 1968 and 1974 respectively. The Milestone Program tests each of Minnesota's ten basins twice in a five-year period. This monitoring is conducted monthly, April through September. Monitoring is scheduled for the BERB in 2006 and 2009. This monitoring includes fecal coliform and/or e.coli bacteria.

Table 9.0 presents a list of streams that will be monitored over the next several years.

Table 9.0 – Monitoring Sites with Future Bacterial Monitoring Plans

Montoring Site	Impaired Reach	Parameters	Responsibility	Years
Center Creek, 315 Ave.	Center Creek; Lily Creek to Blue Earth River	fc	Blue Earth CWP	06,07,08
Elm Creek, 290th Ave.	Elm Creek; Cedar Creek to Blue Earth River	fc	Blue Earth CWP	06,07,08
Dutch Creek, 100th St.	Dutch Creek; Headwaters to Hall Lake	fc	Blue Earth CWP	06,07,08
Maple River CSAH 35	Maple River; Rice Creek to Le Sueur River	fc	Maple River CWP	06,07,08
Blue Earth River, Mankato	Blue Earth River; Le Sueur River to Minnesota River	fc & e. coli	MPCA - Milestone	Ongoing
Center Creek, S34/35	Center Creek; Lily Creek to Blue Earth River	fc & e. coli	MPCA - Milestone	Ongoing
Le Sueur, Near Rapidan #1	Le Sueur River; Maple River to Blue Earth River	fc & e. coli	MSUM-WRC	06,07
Beauford Ditch	Little Beauford Ditch; Headwater to Cobb River	fc & e. coli	MSUM-WRC	06,07
Little Cobb River	Little Cobb River; Blue Run Creek to Big Cobb River	fc & e. coli	MSUM-WRC	06,07
Blue Earth River, Rapidan	Blue Earth River; Watonwan River to Le Sueur River	fc & e. coli	MSUM-WRC	06,07
Blue Earth River, Amboy	NA - New Monitoring Station in 2006	fc & e. coli	MSUM-WRC	06,07
Le Sueur, St. Clair	NA - New Monitoring Station in 2006	fc & e. coli	MSUM-WRC	06,07
Watonwan River, Garden City	Watonwan River; Perch Creek to Blue Earth River	fc & e. coli	Watonwan CWP & MPCA Milestone	06,07,08 Ongoing

As mentioned previously, the majority of bacterial monitoring in the basin is by grant based projects that are funded every two to three years. It is important that these projects maintain funding so that effectiveness monitoring continues into the future.

Section 10.0 – Implementation Activities

Source inventories and water quality testing as part of the BERB TMDL project indicated sources of fecal coliform contamination to streams can vary by a number of factors, especially flow. These analyses indicate the primary sources of fecal coliform contamination during wet conditions to be livestock manure (land applied manure and runoff from feedlots without controls). The primary sources during low flow conditions are inadequately functioning septic systems and unsewered communities. Implementation activities will be targeted towards these sources.

Recommendations for implementation activities were solicited during a TMDL Implementation Strategy Planning meeting with the Blue Earth River Basin Alliance (BERBA) on June 26th, 2006. Additional strategies detailed below are taken from the Implementation Plan for the Lower Mississippi River Basin Regional Fecal Coliform TMDL and the Implementation Plan for the Lower Minnesota River Dissolved Oxygen TMDL. The outlined strategies are broad in scope and will be refined by BERBA during 2005/2006.

10.1 Feedlots Runoff Reduction

State rules for feedlot runoff control will reduce, but not eliminate, bacteria transport to waters from open lots by October 2010. At that time, the bacteria contributions from open lot runoff will need to be reassessed. The Environmental Quality Incentive Program assists feedlots that have a high risk for runoff problems. This cost share funding typically goes for high cost fixes, such as manure storage basins.

However, financial assistance for low cost fixes such as gutters, diversions, filter strips, etc, is often inadequate. Counties in the BERB utilize State Cost Share funding from the Board of Soil and Water Resources (BWSR) for these small cost fixes. County Soil and Water Conservation Districts receive between $10,000 to $20,000 from BWSR each year for cost share practices (terraces, diversions, sediment control basin, feedlot runoff structures, etc). When this funding is spread between these various cost share practices, funding is expended quickly. Members of BERBA recommend additional cost share be obtained for low cost fixes for feedlots.

10.2 Manure Management Planning

Feedlot rules require manure management plans be developed for any feedlots that are required a permit. Feedlots that fall into this category include the following:

- Those with more than 300 animal units that are planning new construction or expansion;
- There is a pollution hazard that has not been corrected through the Open Lot Agreement;
- Feedlot has been designed as a CAFO (more than 1000 animal units or direct mane-made conveyance to waters);

- Feedlot has more the 300 animal units and is applying in sensitive areas, including: a) soil P levels exceeding 120/150 ppm (Olsen/Bray soil phosphorus tests, respectively), or half those values within 300 feet of public waters; b) vulnerable drinking water supply management areas; or c)slopes exceeding 6 percent within 300 feet of waters.

In March of 2006 the BERBA assessed key issues related to manure management, particularly the lack of manure management plans for feedlot with less than 300 animal units (AU). The following is an excerpt from a grant application put forth by BERBA for funding from the USDA Cooperative Conservation Partnership Initiative (CCPI) grant program.

In Minnesota's portion of the basin, the land application of manure is an important factor for crop production and water quality. The Feedlot Program (Minn. Rules 7020) is currently addressing manure generated, stored, and applied from feedlots with 300 animal units (AU) or greater. In the GBERB (MN), 72% of the animal feedlots have < 300 AU. This includes 1,628 feedlots with about 139,000 AU. County staff are working hard on the category of 300-1000 AU, while state of Minnesota personnel are addressing the >1000 AU CAFOs. This leads to a large gap for manure management for those operations with < 300AU.

To address this critical gap, project participants will form a partnership and develop a practical plan to engage producers to manage manure correctly at both the feedlot site and the application sites. The project objectives that will be pursued to develop and implement this plan are:

1) Identify and understand the "manure management issue" for the operations with < 300 AU;

2) Develop nutrient management "templates" by producer type and size, which can be more efficiently tailored to individual farms and environmental settings;

3) For each major watershed, define critical zones and areas where adherence to application setback requirements are of particular importance;

4) Develop an acceptable marketing plan for reaching the <300 AU community, testing and refining such methods as field days, promotions for manure and soil testing, mailings, one-on-one meetings, coffee-shop discussions, and the like;

5) Investigate and define how sustainable farming practices that will promote manure management and water quality improvements should be deployed across the watersheds, including hay and small grains within crop rotations, and controlled grazing;

6) Determine the best type of watershed-scale predictive model that will consider land use and land management patterns, implementation adoption rates, as well as water quality targets for rivers and streams;

7) Partner with the conservation planning community, within both the public and private sectors, soliciting their ideas and suggestions for more successful plan development; and

8) Assist with the yet-to-be completed implementation plan for the GBERB Fecal Coliform TMDL.

10.3 Issues Related to Non-Conforming Septic Systems

- **Need for Increases in Administrative Funding**
  There was a consensus among county staff that current administrative funding for county septic programs is inadequate. The majority of counties receive less than $3,000 annually for septic program administration. Current administrative does not adequately allow for proper inventorying or educational activities related to septic systems. It is recommended that funding be increased or that additional funding be obtained through available grant opportunities.

- **Need for Low Interest Loan Funding in Portions of BERB**
  Low Interest Loan funding is available from some counties through ISTS low interest loan programs. In addition, the Watonwan River, Blue Earth River, and Maple River Clean Water Partnership Projects have low interest loan funding for non-compliant septic systems available at a 3% interest rate.

  Loan funding for noncompliant septic systems in watersheds with Clean Water Partnership funding has been adequate. However, many noncompliant systems in the BERB are located outside these three watersheds. In some areas of the BERB, low interest loans may be the incentive needed to convince homeowners to upgrade their systems.

- **Shortage of Septic System Contractors in Portions of Basin**
  Some counties in the basin point to a lack of septic system installers as placing a limit on how fast septic systems can be installed. For example, Cottonwood County with a majority of septic systems in the county failing has an only two contractors. Other counties, such as Blue Earth report no shortage of contractors. Cottonwood county staff recommends that some sort of incentive be given to lure contractors into septic system installations.

- **Education and Demonstration Projects**
  Many homeowners with systems that are not in compliance feel that their systems are not having an adverse effect on the downstream water quality. Other have fear of a new septic system failing, as they don't believe mound systems will adequately function. Some do not understand or know of current low interest loan options, and thus think they cannot afford it. Education and demonstrations projects are needed to help convince rural residents of the need for properly functioning septic systems.

- **<u>Basinwide Coordination</u>**
  Basin coordination may be effective for education purposes, such as educating on health concerns related to improperly functioning septic systems.

10.4 Unsewered Communities

Nearly 2,500 individuals in the BERB live in unsewered communities. There are six unsewered incorporated communities; Walters, Lasalle, Ormsby, Odin, Ledyard and Lakota. Walters and Lasalle are in the process of developing sewage treatment systems. Plans need to be put in place for proper sewage treatment of wastewater for Ormsby, Odin, Ledyard and Lakota. In addition, there are many unsewered unincorporated communities, the largest being Rapidan and Garden City. BERBA recommends a strategy be developed for addressing these remaining unsewered communities.

10.5 Municipal Wastewater Treatment

Permitted facilities are required to disinfect wastewater to levels that will not exceed surface water quality standards. In most cases effluent from facilities is much lower than current standards. However, violations and bypasses during high precipitation periods do occur.

The communities of Blue Earth, Winnebago and Elmore most frequently reported bypasses during the five year period (2000-2004) that was examined. Wastewater violations, which are monthly exceedances of discharge limits, were most frequently reported during this same time period from the communities of Truman and Waldorf.

Section 11.0 – Reasonable Assurance

As a requirement of TMDLs, reasonable assurance must be provided demonstrating the ability to reach and maintain water quality endpoints. The source reduction strategies detailed in section 11.0 have been shown to be effective in reducing pathogen transport and survival and to be capable of widespread adoption by land owners and local resource managers.

11.1 Feedlot Runoff Controls

These are evaluated by professional engineers through the Feedlot Evaluation Model referenced in Minn. R. ch. 7080. These rules are implemented by the MPCA staff and by local counties via a delegation agreement with the Agency. In Minnesota, feedlot rule 7020 requires the registration of feedlots and manure storage areas having a capacity of 50 animal units (AU) or more and 10 AU or more in shoreland areas.

In Iowa there is a voluntary registration process, thus the majority of operations are not inventoried. Open lot feedlots over 1000 AU and confined operations with over 500 AU are required to have an approved manure management plan and use a certified manure applicator.

11.2 Land Application of Manure

Buffer strips, immediate incorporation, observance of setback rules, and maintenance of surface residue have been demonstrated to reduce manure and pathogen runoff (Environmental Quality Board, General Environmental Impact State for Feedlots). Minnesota Rules Chapter 7020 require manure application record keeping and manure management planning, with requirements varying according to size of operation and pollution risk of application, based on method, time and place of application.

Section 4.2.1 and 4.2.2 detail the possible routes of transport of fecal coliform bacteria from lands receiving manure application. Current manure application rules are based on the best available research. However, in Minnesota, relatively little research has been conducted examing manure application setback rules related to fecal coliform bacteria. Tile outlet monitoring conducted as part of this project has documented high bacterial levels discharging from manure applied agricultural fields after high intensity precipitation events. Further research should be put towards refining current manure application rules, especially setback distances for applied manure from open tile intakes.

11.3 Individual Sewage Treatment Systems

ISTS with proper drain fields provide virtually complete treatment of fecal coliform bacteria. Straight-pipe septics discharge untreated wastewater to surface water. Acceptable designs are described in Minn. R. ch. 7080. Minnesota counties in the basin are delegated to implement these rules, which require conformance with state standards for new construction and disclosure of the state of the ISTS when property transfers ownership. Several counties require ISTS upgrades at property transfer.

In Iowa, administrative code chapter 68 provides acceptable designs and other rules related to individual sewage treatment systems. The county boards of health are responsible for enforcing the standards and licensing requirements contained in Chapter 68 and other referenced rules relating to the cleaning of private waste facilities and disposal of waste from such facilities.

11.4 Municipal Waster Water Disinfection

Disinfection with chlorine or ultraviolet radiation is required of all NPDES municipal wastewater permittees.

11.5 Erosion Control and Sediment Reduction

Conservation tillage and riparian buffer strips have been demonstrated to be effective in reducing sediment delivery to streams. Since embedded sediment can serve as a substrate for fecal coliform survival, reduction of sediment is considered an effective measure of controlling fecal coliform bacteria in streams.

11.6 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 southern Minnesota.

11.7 Urban Stormwater Management

Practices such as runoff detention, infiltration, and street sweeping have been shown to be effective in reducing urban runoff and associated pollutants. Fairmont, Mankato and Waseca are required to have Phase II Stormwater Management Plans.

Section 12.0 – Public Participation

Public participation opportunities were provided throughout the project. As detailed below, information was disseminated to the public through a variety of methods, including news releases, brochures, open houses, radio/tv interviews and the project website.

10.1 Stakeholder Involvement

The BERB Fecal Coliform TMDL project worked closely with a broad array of county, state and individual stakeholders. From the beginning, the Blue Earth River Basin Alliance (BERBA) served as an advisory role for the project. The BERBA is a group of the 11 Minnesota counties that make up the Basin. The Alliance has a policy board made up of county commissioners and Soil and Water Conservation District (SWCD) managers and a technical committee consisting of county water planners and soil and water conservation district staff. The Alliance technical committee also formed a smaller TMDL subcommittee which assisted in reviewing the project workplan, outreach material and review of the draft TMDL report.

The Alliance technical committee was updated monthly on the progress of the project. Key finding were discussed and input was gathered from the group. The project also presented key finding of the project to the policy committee.

The Alliance TMDL subcommittee, technical committee and policy committee were the primary stakeholder group during the projects two year span.

Public outreach for this project also included the following activities:

Mar. 2005	News Releases Submitted to 23 newspapers in the basin explaining the project and promoting a series of April open houses.
Mar. 2005	Brochure detailing the project and upcoming open houses sent to 550 county commissioners, county water planners, soil and water conservation districts, environmental groups, drainage/septic contractors, agricultural producers and environmental groups.
Apr. 2005	Public open house meetings held in the communities of St. James, Waldorf and Blue Earth explaining TMDLs, fecal coliform bacteria, associated health risks, potential sources of fecal coliform and water quality monitoring data.
Apr. 2005	Radio interview with Mike Lemmer from KNUJ in New Ulm on water quality monitoring data, fecal coliform bacteria and health risks.
Jun. 2005	Radio interview during canoe trip down Blue Earth River. This news story provided information on fecal coliform pollution in the Blue Earth

	River. Sources of bacterial contamination in the river were discussed, with expanded information provided on unsewered communities.
Jun. 2005	Interview held with local news channel, KEYC 12, discussing bacterial pollution in the Blue Earth River.
Jul. & Aug. 2005	A display featuring the project was brought to county fairs across the BERB. Water Resources Center staff attended several of these fairs to answer questions and gather input from the public.
Nov. 2005	Letters, maps and fact sheets concerning the project and describing the 21 impaired stream reaches sent to 235 county commissioners, SWCD staff/supervisors, county environmental services staff, county planning and zoning staff, city mayors, city clerks and state agency staff.
Dec. 2005	A newly created website for the project is listed on the Minnesota River Basin Data Center website. The website contains the majority of fact sheets and other materials that have been produced for the project.
Jul. 2006	The draft Blue Earth River Basin Fecal Coliform Project is submitted for public/agency review.
Oct. 2006	Public informational meeting regarding the project held in Mankato.

10.2 Input and Comments - Refer to Appendix F for comments and responses.

Appendix A - References

Alderisio, K.A., & DeLuca, H. 1999. Seasonal Enurmeration of Fecal Coliform Bacteria from the Feces of Ring-Billed Gulles (Larus delewarensis) and Canada Geese (Branta Canadensis). Applied and Environmental Microbiology.

American Society of Agricultural Engineers (ASAE). 1998. ASAE Standards, 45th Edition. Standards, Engineering Practices, Data.

Beven, K. and P. Germann, 1982. Macropores and water flow in soils. Water Resources Research 18:1311-1325.

Chapelle, F.H., 2001. Ground-Water Microbiology and Geochemistry (Second Edition). John Wiley and Sons, Inc., New York, New York, 424 pp.

Crane, S.R., P.W. Westerman and M.R. Overcash. 1981 Dieoff of fecal indicator organisms following land application of poultry manure. Journal of Environmental Quality 9:531-537.

Cullimore, R.D., 1993. Practical Manual of Groundwater Microbiology. Lewis Publishers, Chelsea, Michigan, 412 pp.

Davis, R.K., S. Hamilton, and J.V. Brahana. 2005. *Escherichia Coli* Survival in Mantled Karst Springs and Streams, Northwest Arkansas Ozarks, USA

Ewert, Jason, MPCA, personal communication, December 20, 2005.

Geohring, L.D, P.E. Wright, T.S. Steenhuis and M.F. Walter. 1999. Fecal coliforms in tile drainage effluent. ASAE Paper No. 992203. St. Joseph, MI: ASAE

Gerba, C.P., C. Wallis and J.L. Melnick. 1975. Fate of wastewater bacteria and viruses in soil. Journal of Irrigation and Drainage Engineering 101:157-174.

Horsley and Witten, Inc. 1996. Identification and evaluation of nutrient and bacterial loadings to Maquoit Bay, New Brunswick and Freeport, Maine. Final Report

Jamieson, R.C., 2002. Movement and persistence of fecal bacteria in agricultural soils and subsurface drainage water: A review.

Jolley, L.W., J.W. Pike, M. Goddard. 2004 The Role of Bottom Sediments in the Storage and Transport of Indicator Bacteria. Department of Forestry and Natural Resources, Clemson University. Poster Presentation.

Metcalf and Eddy. 1991. Wastewater Engineering: Treatment, Disposal, Reuse. 3rd ed. McGraw-Hill, Inc., New York.

Minnesota Easement GIS data layer, provided by Minnesota Board of Soil and Water Resources, January 2006.

Minnesota Pollution Control Agency. 2006. Regional Total Maximum Daily Load Evaluation of Fecal Coliform Bacteria Impairment in the Lower Mississippi River Basin in Minnesota.

Minnesota Pollution Control Agency. 2003. Guidance Manual for Assessing the Quality of Minnesota Surface Water for the Determination of Impairment.

Mulla, D. J., and A.S. Birr, G. Randall, J. Moncrief, M. Schmitt, A. Sekely, and E. Kerre. 2001. "Technical Work Paper: Impacts of Animal Agriculture on Water Quality," Department of Soil, Water and Climate, University of Minnesota, Prepared by the Minnesota Environmental Quality Board and Citizen Advisory Committee.

National Climatic Data Center, 1971-2000.

Randall, G. W., T.K. Iragavarapu and M.A. Schmitt. 2000. Nutrient Losses in Subsurface Drainage Water from Dairy Manure and Urea Applied for Corn. Journal of Environmental Quality 29: 1244-1252

Randall, G.W., S. Goyal, J.A. Vetsch and S. Meharchandani. 2003. Nutrient and Pathogen Losses to Tile Lines as Influenced by Source of N.

Smith, M.S., M.S. Coyne and J.H. Grove. 1998. Fecal bacteria survival and infiltration through shallow agricultural soil: Timing and tillage effects. Journal of Environmental Quality 27:1516-1523.

U.S. Environmental Protection Agency. 2001. Protocol for Developing Pathogen TMDLs. EPA 841-J-00-002. Office of Water (4503F), United States Environmental Protection Agency, Washington, DC. 132 pp.

Water Resources Center, Minnesota State University, Mankato. 2000. Blue Earth River Major Watershed Diagnostic Report.

Wieskel, P.K., B.L. Howes, and G.R. Heufelder. 1996. Coliform contamination of a coastal embayment: sources and transport pathways. Environmental Science Technology 30(6): 1872-1881.

Yagow, G. and V Shanholtz. 1998. Targeting sources of fecal coliform in Mountain Run. An ASAE Meeting Presentation. 98-2031. July 12-26, 1998.

Zhai, Q., M.S Coyne and R.I. Barnhisel. 1995. Mortality rates of fecal bacteria in subsoil amended with poultry manure. Bioresource Technology 54:165-169.

Appendix B – Stream and Monitoring Site ID's

Blue Earth Watershed

Site Number	Site* ID	Alternative** ID
1	Blue Earth River, Mankato	BE_0.7
2	Blue Earth River, Rapidan	BE_11.9
3	Blue Earth River, CSAH 4	BE_109.1
4	Cedar Run, S34/35	CEC_2.4
5	Cedar Run, CSAH 9	CEC_12.3
6	Center Creek, George Lake	CC_29.9
7	Center Creek, 315 Ave.	CC_6.4
8	Center Creek, S34/35	CC_22.6
9	Dutch Creek, 100th St.	DC_2.7
10	Elm Creek, 290th Ave.	EC_11.7
11	Elm Creek, 260th Ave.	EC_19.5
12	Elm Creek, CSAH 149	EC_23.9
13	Elm Creek, 185th St.	EC_48.7
14	Judicial Ditch #3	JD3_2.1
15	Lily Creek, Hunt Farm	LC_1.2

Le Sueur Watershed

Site Number	Site* ID	Alternative** ID
16	Le Sueur, Near Rapidan #1	LES_1.4
17	Beauford Ditch	BEA_0.6
18	Little Cobb River	LCR_1.6
19	Maple River CSAH 35	MAP_3.5

Watonwan Watershed

Site Number	Site* ID	Alternative** ID
20	Watonwan River, Madelia	WATS_1.9
21	Watonwan River, CSAH 4	WAT_52.2
22	Watonwan River, CR 6	WAT_38.5
23	Watonwan River, CR 16	WAT_42.6
24	Watonwan River, Garden City	WAT_7.9

** The site ID is the name commonly used to describe the monitoring location.*
*** The alternative ID provides the distance in river miles to the outlet of the identified stream. For example, site LES_1.4 is located 1.4 miles from the outlet of the Le Sueur River.*

Appendix C: Livestock Facilities with NPDES Permits

Facility Name	Facility ID Number	Dairy Animal Units	Beef Animal Units	Swine Animal Units	Poultry Animal Units	Total Animal Units	Fecal Coliform Bacteria Impaired Stream Reach Watersheds																				
							Blue Earth R.; Le Sueur R. to MN R.	Blue Earth R.; Watonwan R. to Le Sueur R.	Blue Earth R.; W. Br. Blue Earth R. to Coon Cr.	Cedar Cr.; Cedar Cr. to Elm Cr.	Cedar Cr.; T104 R33W S6 W. Line to Cedar Lk.	Center Cr.; George Lk. to Lily Cr.	Center Cr.; Lily Cr. to Blue Earth R.	Dutch Cr.; Headwaters to Hall Lk.	Elm Cr.; Cedar Cr. To Blue Earth R.	Elm Cr.; S. Fork Elm Cr. To Cedar Cr.	Judicial Ditch #3; Headwaters to Elm Cr.	Lily Cr.; Headwaters to Center Cr.	Le Sueur R.; Maple R. to Blue Earth R.	Little Beauford Ditch; Headwaters to Cobb R.	Little Cobb R.; Blue Run Cr. to Le Sueur R.	Maple R.; Rice Cr. to Le Sueur R.	S. Fork Watonwan R.; Willow Cr. to Watonwan R.	Watonwan R.; Headwaters to N. Fork Watonwan R.	Watonwan R.; Butterfield Cr. to S. Fk. Watonwan R.	Watonwan R.; N. Fk. Watonwan R. to Butterfield Cr.	Watonwan R.; Perch Cr. to Blue Earth R.
Alan Marble	013-86339		10	900		910	X												X								
Armstrong Feedlot	161-71266		193	1,200	443	1,836	X												X		X						
Bentdale Farms Inc	091-50008			1,284		1,284	X	X																			X
Bill Schaible	043-50003			1,170		1,170	X												X			X					
Bottem Farms Inc	165-50157		2,750			2,750	X	X																	X	X	X
Brad Bowers	165-106101			900		900	X	X																			X
Brandts Hog Farm Inc	013-86026			576		576	X	X																			X
Brandts Hog Farm Inc	013-86028			727		727	X	X																			X
Brandts Hog Farm Inc	013-86029			576		576	X	X																			
Brandts Hog Farm Inc	013-95081			864		864	X	X																			
Brent & Mona Keuker Farm	165-99260			900		900	X	X															X				X
Brent & Mona Keuker Farm	165-105400			900		900	X	X															X				X
Brian Nowicki	091-106420			900		900	X	X	X																		
Brian P Millmann	043-50006			1,040		1,040	X	X																			
Brolsma Hog Farm	161-71254			1,152		1,152	X												X		X						
Bruce E Maurer	013-50013			984		984	X												X								
Bruce Ward	013-50016			1,200		1,200	X												X		X						
Bruce Ward	013-76240			1,200		1,200	X												X	X							
Burke Farms	161-60155			991		991	X												X								
Caldwell Finishing Inc	013-50024			1,440		1,440	X												X			X					
Calvin Priem	161-60341			1,044		1,044	X												X								
Camelot Breeders	091-96266			1,174		1,174	X	X					X					X									
Center Creek Pork Inc	091-96265			1,564		1,564	X	X							X												
Charles Carlson	013-50023			1,200		1,200	X	X																			
Choice Connection LLP	013-95103			1,200		1,200	X												X								
Choice Connection/Vista Farms	043-60221			1,000		1,000	X	X																			
Choice Connection/Vista Farms	091-60225			1,200		1,200	X	X							X	X											
Choice Connection/Vista Farms	161-60226			1,200		1,200	X												X								
Choice Connection/Vista Farms	161-60242			1,200		1,200	X												X								
Choice Connection/Vista Farms	165-50063			1,200		1,200	X	X																			X
Christensen Brothers	091-50010			1,233		1,233	X	X															X				X
Christensen Family Farms Inc	033-50005			1,060		1,060	X	X																	X	X	X
Christensen Family Farms Inc	033-50008			1,290		1,290	X	X																	X	X	X
Christensen Family Farms Inc	091-50022			1,560		1,560	X	X																			
Christensen Family Farms Inc	091-96262			936		936	X	X							X	X											
Christensen Family Farms Inc	091-96259			768		768	X	X																			X
Christensen Family Farms Inc	091-106001			768		768	X	X					X					X									
Christensen Family Farms Inc	165-50023			1,200		1,200	X	X															X				X
Christensen Family Farms Inc	165-50135			576		576	X	X																	X	X	X
Circle R Farms Inc	033-50003			1,495		1,495	X	X																X	X	X	X
Cottonwood Acres	013-86140				918	918	X												X								
Cottonwood Acres	013-86173				918	918	X												X								
Cougar Run Inc.	091-50028			1,952		1,952	X	X																			
Cougar Run Inc.	091-50026			1,180		1,180	X	X																			
Dahl Farm	091-63047			1,200		1,200	X	X					X														
Dahl Farm	091-62847			1,500		1,500	X	X																			
Dale Jensen	091-95971			1,080		1,080	X	X	X																		
Dan Sturm	165-50002			1,110		1,110	X	X																	X		X
Darrell Anderegg	013-86416			1,125		1,125	X												X								
Darren Hanson	047-68549			942		942	X												X								
Daryl Erdman	161-98982			1,200		1,200	X												X								
David & Doug Bicknase	091-96164			960		960	X	X							X												
David Brandts	165-50006			975		975	X	X															X				X
David Murra	043-50004			1,745		1,745	X	X																			
Dennis & Lynda Arduser	013-86250			900		900	X	X																			X
Dennis Coleman	165-50024			2,643		2,643	X	X															X				X
Dennis Richter	047-50004			1,200		1,200	X	X																			
Dennis W Sohre	013-50008			1,125		1,125	X												X								
Dickens Pigs Inc	165-50003			1,152		1,152	X	X																	X		X
Diversified Agriculture Inc	043-50009			1,440		1,440	X	X																			
Diversified Agriculture Inc	091-50020			1,440		1,440	X	X					X														
Doug Meyer Farm	043-80420			1,200		1,200	X	X																			
Duane Behrens	091-96179			765		765	X	X							X												
Dykstra Farms	091-104740			900		900	X	X		X					X												
Elroy Geistfeld Farm	165-66785			1,396		1,396	X	X																			X
Elwood Heldt	165-63734			1,152		1,152	X	X																	X		X
Extra Tender LLP	091-50012			1,116		1,116	X	X															X				X
Fast Dairy	033-61685	1,065				1,065	X	X																X	X	X	X
FAST Development Inc	161-50016			1,624		1,624	X												X		X						
Fine Swine Inc	091-50025			780		780	X	X							X												
Flagship Pork Properties LLP	013-50011			1,202		1,202	X												X			X					
Flohrs Farm	091-96074			2,289		2,289	X	X															X				X

Appendix C: Livestock Facilities with NPDES Permits

							Fecal Coliform Bacteria Impaired Stream Reach Watersheds																				
Facility Name	Facility ID Number	Dairy Animal Units	Beef Animal Units	Swine Animal Units	Poultry Animal Units	Total Animal Units	Blue Earth R.; Le Sueur R. to MN R.	Blue Earth R.; Watonwan R. to Le Sueur R.	Blue Earth R.; W. Br. Blue Earth R. to Coon Cr.	Cedar Cr.; Cedar Cr. to Elm Cr.	Cedar Cr.; T104 R33W S6 W. Line to Cedar Lk.	Center Cr.; George Lk. to Lily Cr.	Center Cr.; Lily Cr. to Blue Earth R.	Dutch Cr.; Headwaters to Hall Lk.	Elm Cr.; Cedar Cr. To Blue Earth R.	Elm Cr.; S. Fork Elm Cr. To Cedar Cr.	Judicial Ditch #3; Headwaters to Elm Cr.	Lily Cr.; Headwaters to Center Cr.	Le Sueur R.; Maple R. to Blue Earth R.	Little Beauford Ditch; Headwaters to Cobb R.	Little Cobb R.; Blue Run Cr. to Le Sueur R.	Maple R.; Rice Cr. to Le Sueur R.	S. Fork Watonwan R.; Willow Cr. to Watonwan R.	Watonwan R.; Headwaters to N. Fork Watonwan R.	Watonwan R.; Butterfield Cr. to S. Fk. Watonwan R.	Watonwan R.; N. Fk. Watonwan R. to Butterfield Cr.	Watonwan R.; Perch Cr. to Blue Earth R.
Floyd Olson	165-105320			900		900	X	X															X				X
Freking Family Farm Inc	063-88150			900		900	X	X							X	X											
Freking Farms	091-105600			900		900	X	X		X	X				X												
Garth Carlson	091-96136			990		990	X	X																			X
Gary Dial	063-95331			900		900	X	X							X	X											
Geistfeld Brothers Farm	091-96150			750		750	X	X																			X
Geistfeld Farm Inc	165-50018			900		900	X	X																			X
Geistfeld LLP	165-50025			1,440		1,440	X	X															X				X
Grathwohl Bros LLP	091-60180			1,200		1,200	X	X																			
Grathwohl Bros LLP	091-60181			1,200		1,200	X	X																			
Great Plains Family Farms Inc	161-50006			1,200		1,200	X												X								
Green Feedlots LLP	091-105240			936		936	X	X																			
Green Power Acres	047-50001			1,200		1,200	X												X								
Gronewald Farms	165-97280			1,200		1,200	X	X																			X
Ham-It-Up Hog Farm Inc	091-50015			1,229		1,229	X	X							X		X										
Ham-It-Up Hog Farm Inc	091-95936			720		720	X	X							X												
Ham-It-Up Hog Farm Inc	091-95938			720		720	X	X							X												
Hawkeye LLP	091-50005			1,140		1,140	X	X					X					X									
Hawton's Hilltop Farms	091-96261			936		936	X	X					X					X									
Henry Roelofs	013-95127			1,011		1,011	X	X																			X
HQ Finishing	091-50007			1,440		1,440	X	X					X					X									
Jay Moore	091-106360			900		900	X	X							X	X											
Joecks Farm	161-100298			1,140		1,140	X												X		X						
John Brindley	013-50012			1,080		1,080	X												X			X					
John Covey Jr	013-50014			1,200		1,200	X												X			X					
John Covey Jr	013-50015			1,200		1,200	X												X			X					
John D Regier	063-50003			1,000		1,000	X	X							X	X											
K & L Pork Inc	013-50009			1,080		1,080	X	X																			
Kal-Mar	091-99321			1,952		1,952	X	X																			
Karl Duncanson	013-86144			624		624	X												X			X					
Keith Greier	165-50028			1,200		1,200	X	X																			X
Keith L Krause	161-72500		48	1,800		1,848	X												X								
Kent Lewis	091-95896			1,248		1,248	X	X							X												
Kevin Hugoson	091-95980			1,440		1,440	X	X																			
Kevin Mosloski	091-50019			1,440		1,440	X	X																			
Kevin Nowicki	091-95820			675		675	X	X																			
Kevin Zimmer Farm	091-60820			1,470		1,470	X	X					X														
Kiester Swine Finishing	043-62456			1,200		1,200	X	X																			
Kirk Vogt	091-95639			1,440		1,440	X	X							X												
KMB Inc	161-71178			842		842	X												X								
KMB Inc	161-71177			102		102	X												X								
Larry Mohwinkel	165-50164			936		936	X	X																			X
Larry Mohwinkel	165-105940			990		990	X	X															X				X
Lenort Pork	091-60077		580	995		1,575	X	X																			
Lily Creek Farm c/o Daryl Bartz	091-76280			1,275		1,275	X	X					X					X									
Lindeland Farms	013-86065			900		900	X												X		X						
LL Hog Enterprises	091-95742			1,110		1,110	X	X							X												
Lonny Schwieger	091-50001			1,100		1,100	X	X							X												
Loren Schoenrock	161-71075			1,380		1,380	X												X		X						
Lyle Ibeling	165-99220			936		936	X	X																X	X	X	X
Lynn A Below	161-50013		900	1,200		2,100	X												X								
M & S Farms	161-50007			1,200		1,200	X												X								
Macho-Eckstein Co LLC	165-50128			1,200		1,200	X	X																	X	X	X
MAN/ERD Hog's	161-50009			1,152		1,152	X												X								
Marc & Steph Fischer	063-103100			900		900	X	X							X	X											
Mark Kotewa	091-95935			384		384	X	X																			
Mark Kotewa	091-95942			720		720	X	X																			
Mark Kotewa	091-95943			298		298	X	X																			
Marlin Pankratz	033-50002			2,155		2,155	X	X																X	X	X	X
Matzke Farms Inc	013-50025			900		900	X	X																			
MCL Enterprises LLP	063-50002			1,248		1,248	X	X															X				X
Melvin Moore Family Share Trust	013-86112			990		990	X												X								
Michael Juergens	013-50017			1,200		1,200	X												X			X					
Michael L Anderson	013-50001			1,185		1,185	X												X		X						
Michael Pearson	165-96440			900		900	X	X																X	X	X	X
Michael Richison	091-95764			900		900	X	X																			
Mike Brandts	165-50004			870		870	X	X																	X	X	X
Minnesota Pork Inc	013-50018			1,600		1,600	X	X																			
Minnesota Pork Inc	013-50019			1,600		1,600	X	X																			
Minnesota Pork Inc	013-50020			1,440		1,440	X	X																			
Minnesota Pork Inc	013-50021			1,440		1,440	X												X			X					
Minnesota Pork Inc	013-50022			1,440		1,440	X	X																			

Appendix C: Livestock Facilities with NPDES Permits

Facility Name	Facility ID Number	Dairy Animal Units	Beef Animal Units	Swine Animal Units	Poultry Animal Units	Total Animal Units	Fecal Coliform Bacteria Impaired Stream Reach Watersheds																				
							Blue Earth R.; Le Sueur R. to MN R.	Blue Earth R.; Watonwan R. to Le Sueur R.	Blue Earth R.; W. Br. Blue Earth R. to Coon Cr.	Cedar Cr.; Cedar Cr. to Elm Cr.	Cedar Cr.; T104 R33W S6 W. Line to Cedar Lk.	Center Cr.; George Lk. to Lily Cr.	Center Cr.; Lily Cr. to Blue Earth R.	Dutch Cr.; Headwaters to Hall Lk.	Elm Cr.; Cedar Cr. To Blue Earth R.	Elm Cr.; S. Fork Elm Cr. To Cedar Cr.	Judicial Ditch #3; Headwaters to Elm Cr.	Lily Cr.; Headwaters to Center Cr.	Le Sueur R.; Maple R. to Blue Earth R.	Little Beauford Ditch; Headwaters to Cobb R.	Little Cobb R.; Blue Run Cr. to Le Sueur R.	Maple R.; Rice Cr. to Le Sueur R.	S. Fork Watonwan R.; Willow Cr. to Watonwan R.	Watonwan R.; Headwaters to N. Fork Watonwan R.	Watonwan R.; Butterfield Cr. to S. Fk. Watonwan R.	Watonwan R.; N. Fk. Watonwan R. to Butterfield Cr.	Watonwan R.; Perch Cr. to Blue Earth R.
Moen Hogs	161-50008			1,200		1,200	X												X								
Neil D Hansen	091-50023			1,152		1,152	X	X																			X
Neusch Farms Inc	091-50014		1,500			1,500	X	X																			
New Fashion Pork LLP	091-105801			900		900	X	X		X					X												
New Fashion Pork LLP	091-105580			900		900	X	X							X	X											
New Fashion Pork LLP	091-105960			900		900	X	X		X	X				X												
North Branch Pork	165-50153			840		840	X	X																X	X	X	X
North Country Pork	091-106580			1,200		1,200	X	X							X												
North Ridge Farm LLP	043-50008			930		930	X												X								
North Ridge Farm LLP	043-50007			205		205	X												X								
North Ridge Farm LLP	043-50005			340		340	X												X								
Noy Farms Inc	013-50006		400	1,080		1,480	X	X																			X
Noy Farms Inc	013-50007			1,497		1,497	X	X																			X
Our Farm Gedicke - Jones	147-72485			1,248		1,248	X												X								
Pankratz-Agri Production	033-50004			2,246		2,246	X	X																	X	X	X
Patrick Duncanson	013-104901			576		576	X												X			X					
Patrick Duncanson	013-50027			1,152		1,152	X												X			X					
Penner Poultry Farm	165-50163				3,960	3,960	X	X																	X		X
Peter Sonnek Farm	161-50002			1,248		1,248	X												X								
Petes Pigs	091-95784			900		900	X	X																			X
Pleasant Prairie Pork Inc	091-50002			1,440		1,440	X	X																			
Pleasant Prairie Pork Inc	091-50003			1,440		1,440	X	X																			
Pleasant View Hogs	043-77440			1,245		1,245	X	X																			
Pork Plus Inc	063-88569			900		900	X	X							X	X											
Pork Plus Inc	063-50005			1,440		1,440	X	X							X	X											
Prairie Growers Inc	161-50014			874		874	X												X		X						
Randy Wellman	165-96433			936		936	X	X																	X	X	X
Robert Cunningham	165-50052			999		999	X	X															X				X
Robert Cunningham	165-50009			1,200		1,200	X	X																	X		X
Robert Cunningham	165-50008			1,152		1,152	X	X															X				X
Robert Nienow	013-50005		1,900			1,900	X												X								
Rodney Wedin	047-50002			1,200		1,200	X	X																			
Rodney Wedin	047-50003			1,200		1,200	X	X																			
Ron & Mary & Cameron Mulder Farm	063-50004			997		997	X	X							X	X											
Sahrside Dairy Inc	043-50010	1,999				1,999	X	X																			
Samuel Jones & Brain Steen	063-50001			1,152		1,152	X	X							X	X											
Schwartz Farms Inc	165-106100			900		900	X	X																			X
Scott Schweer	161-66260			883		883	X												X		X						
Silver Lake Finishing	091-50009			1,440		1,440	X	X																			
SJS Ranch Inc	063-87738			990		990	X	X							X	X											
South Branch Hogs LLP	165-50027			576		576	X	X															X				X
Stiernagle	047-50006			1,158		1,158	X												X								
Strobel Farms	013-50028			1,440		1,440	X												X								
Strobel Farms	161-50017			1,488		1,488	X												X		X						
TDL Farms LLP	161-50015			1,680		1,680	X												X								
Terry & David Pettersen	013-50004			1,200		1,200	X	X																			X
Terry & David Pettersen	165-50007			1,080		1,080	X	X																			X
Terry & Jody Wordekemper	165-96460			936		936	X	X																X	X	X	X
Terry Traynor	161-50001			1,200		1,200	X												X								
The Trams Farm Inc	161-89042			280		280	X												X								
The Trams Farm Inc	161-50005			1,353		1,353	X												X								
Three Generations Pork Inc	161-50004			1,158		1,158	X												X		X						
Tilney Pork LLP	165-50016			1,216		1,216	X	X																			X
Tim A Steier Farm	043-62846			600		600	X	X																			
Tim Steuber Pork Inc	091-95699			900		900	X	X																			X
Todd Arduser	165-50067			990		990	X	X																			X
Tom Staloch	043-88871			696		696	X												X			X					
Tracy Melson	091-95862		196	679		875	X	X		X					X												
Trent Tumbleson	091-104780			936		936	X	X							X	X											
Triple J Land & Livestock LLP	091-50021		2,200			2,200	X	X																			
Troy Melson	091-100900			900		900	X	X		X	X				X												
Troy Melson	091-100901			900		900	X	X		X					X												
Vaubel Farms Inc	013-50029			1,047		1,047	X												X								
Vaubel Farms Inc	013-50030			1,094		1,094	X												X		X						
Vaubel Farms Inc	013-86088			930		930	X												X								
Wakefield Pork Inc	013-50026			1,060		1,060	X	X																			
Walnut Creek Properties LLP	043-50002			1,200		1,200	X	X																			
Watkins Acres	091-105340			900		900	X	X							X	X											
West Ridge Pork	091-76281			1,523		1,523	X	X							X												
Wing Farm	063-105540			900		900	X	X							X	X											
Wingen Farms LLP	013-50002			498		498	X												X			X					
Wingen Farms LLP	013-50003			1,248		1,248	X												X								

Appendix C: Livestock Facilities with NPDES Permits

							Fecal Coliform Bacteria Impaired Stream Reach Watersheds																					
Facility Name	Facility ID Number	Dairy Animal Units	Beef Animal Units	Swine Animal Units	Poultry Animal Units	Total Animal Units	Blue Earth R.; Le Sueur R. to MN R.	Blue Earth R.; Watonwan R. to Le Sueur R.	Blue Earth R.; W. Br. Blue Earth R. to Coon Cr.	Cedar Cr.; Cedar Cr. to Elm Cr.	Cedar Cr.; T104 R33W S6 W. Line to Cedar Lk.	Center Cr.; George Lk. to Lily Cr.	Center Cr.; Lily Cr. to Blue Earth R.	Dutch Cr.; Headwaters to Hall Lk.	Elm Cr.; Cedar Cr. To Blue Earth R.	Elm Cr.; S. Fork Elm Cr. To Cedar Cr.	Judicial Ditch #3; Headwaters to Elm Cr.	Lily Cr.; Headwaters to Center Cr.	Le Sueur R.; Maple R. to Blue Earth R.	Little Beauford Ditch; Headwaters to Cobb R.	Little Cobb R.; Blue Run Cr. to Le Sueur R.	Maple R.; Rice Cr. to Le Sueur R.	S. Fork Watonwan R.; Willow Cr. to Watonwan R.	Watonwan R.; Headwaters to N. Fork Watonwan R.	Watonwan R.; Butterfield Cr. to S. Fk. Watonwan R.	Watonwan R.; N. Fk. Watonwan R. to Butterfield Cr.	Watonwan R.; Perch Cr. to Blue Earth R.
Wolter Brothers Farm	091-96271			900		900	X	X							X		X										

Appendix D - Reported Waste Water Treatment Facility Bypasses (2000-2004)

County	City	State	Report ID	Incident ID	Incident Description	Location Description	Incident First Observed	Report Received
Blue Earth	Amboy	MN	33849	33863	Wastewater bypass due to heavy rains.	Manhole at 4th and Main Street	8/21/2002 11:15	8/21/02 11:23
Blue Earth	Amboy	MN	76759	76760	Wastewater bypass due to rain.	WWTF	9/15/2004 9:30	9/15/04 14:23
Blue Earth	Good Thunder	MN	14947	14948	Wastewater bypass	Good Thunder WWTF overflow to Maple R.		4/11/01 14:50
Blue Earth	Madison Lake	MN	14661	14662	Wastewater released from manhole when system was pressurized. Release was to soil.	Madison Lake WWTF. Forcemain from lift station to wwtf. located approx.1 mile west of mn 60.		4/7/01 12:16
Blue Earth	Madison Lake	MN	14924	14925	Wastewater leaked from lift station.	Madison Lake liftstation. sleeve leaked in lifstation released wastewater to soil.		4/11/01 11:10
Blue Earth	Mapleton	MN	14757	14758	Bypass of wastewater to Co. ditch 57A	Mapleton WWTF		4/11/01 15:05
Blue Earth	Pemberton	MN	76827	76828	Wastewater bypass due to rain.	WWTF	9/15/2004 8:30	9/16/04 12:45
Blue Earth	St. Clair	MN	2079	2083	Wastewater bypass due to control panel malfunction.	Bypass from main pumping station. Started on 1/17/00 ended on 1/18/00 @ 0730. Approx. 10,000 gallons flowed overland to Lesueur River. Nothing was recovered. No evidence of fish kill.		01/18/00
Cottonwood	Mountain Lake	MN	2982	2989	Uncontrolled discharge of Mountain lakes Wastewater Stabilization (Secondary Pond) into recievieng stream as a result of leak around control structure. About 2 feet were drained from pond app 7.8 million gallons. The control structure has been repaired by packing clay around it. It is no longer leaking. The City of Mountain Lake has hired an Engineer and will be replacing all of the control structures this spring.		02/25/00	2/25/00 14:25
Faribault	Blue Earth	MN	5639	5640	Wastewater bypass.	Blue Earth WWTF	5/18/2000 1:25	5/18/00 1:25
Faribault	Blue Earth	MN	8958	8959	Excavator hit wastewater line at Darling Int. site. Estimated 1000 gals of wastewater soaked into gravel parking lot.	Darling Int. - Blue Earth		8/21/00 19:20
Faribault	Blue Earth	MN	15747	15748	Wastewater bypass due to heavy rain.	Blue earth WWTF to Blue Earth R.		5/3/01 10:23

Appendix D - Reported Waste Water Treatment Facility Bypasses (2000-2004)

County	City	State	Report ID	Incident ID	Incident Description	Location Description	Incident First Observed	Report Received
Faribault	Blue Earth	MN	15921	15922	Wastewater bypass.	Blue Earth WWTF to Blue Earth R. 2000 gpm for unknown duration		5/20/01 21:07
Faribault	Blue Earth	MN	16558	16560	Wastewater bypass.	Blue Earth WWTF to Blue Earth R.		6/13/01 1:14
Faribault	Blue Earth	MN	30163	30164	Wastewater bypass from City of Blue Earth to Blue Earth River.	City of Blue Earth	6/11/2002 2:45	6/11/02 7:59
Faribault	Blue Earth	MN	72243	72244	Wastewater bypass.	11th and Gorman ST	7/5/2004 20:00	7/5/04 3:35
Faribault	Blue Earth	MN	72240	72241	Wastewater bypass.	4th and Galbraith St	7/5/2004 17:30	7/5/04 18:14
Faribault	Delavan	MN	76742	76743	Wastewater bypass due to rain.	WWTF	9/14/2004 21:36	9/15/04 14:03
Faribault	Elmore	MN	15924	15925	Wastewater bypass.	Elmore WWTF bypassing from east lift station.		5/20/01 23:44
Faribault	Elmore	MN	16603	16604	Wastewater bypass.	Elmore WWTF to Blue Earth R.	6/14/2001 2:00	6/14/01 9:34
Faribault	Elmore	MN	76745	76746	Wastewater bypass due to rain.	WWTF	9/14/2004 10:15	9/15/04 14:08
Faribault	Winnebago	MN	7674	7680	Wastewater bypass.	Winnebago WWTF to Blue Earth River.		7/10/00 1:29
Faribault	Winnebago	MN	14762	14763	Wastewater bypass.	Winnebago - lift station at hwy 109 & hwy 169 started at 1130 / 300 gpm and at 1st ave NW and 2nd St NW statrted at 100 approx. 500gpm..		4/11/01 15:29
Faribault	Winnebago	MN	15075	15078	Wastewater bypass.	Winnebago WWTF. Bypassing from 2 lift stations. Hwy 109 & Hwy 169 300 gpm. 1st Ave. NW & 2nd St. NW 700 gpm.		4/23/01 3:05
Faribault	Winnebago	MN	76748	76749	Wastewater bypass due to rain.	WWTF	9/15/2004 0:30	9/15/04 14:12
Freeborn	Hartland	MN	16581	16583	Wastewater bypass.	Hartland WWTF to ditch # 6		6/13/01 8:21
Freeborn	Hartland	MN	73940	73941	Wastewater bypass.	Hartland WWTF	8/3/2004 16:15	8/4/04 8:10
Martin	Granada	MN	76754	76755	Wastewater bypass due to rain.	WWTF	9/15/2004 10:00	9/15/04 14:19
Martin	Trimont	MN	15150	15151	Wastewater bypass to cedar run creek. 250 gpm, unknown duration.	Trimont WWTF		4/23/01 11:52
Waseca	Janesville	MN	70332	70333	Wastewater bypass.	Janesville WWTP	6/9/2004 5:30	6/9/04 6:49
Waseca	Janesville	MN	72926	72839	Wastewater bypass.	Janesville, city of	7/11/2004 6:00	7/11/04 7:57
Waseca	New Richland	MN	6396	37141	Bypass at wastewater treatment plant due to heavy rains.	New Richland WWTP	6/1/2000 13:30	6/1/00 14:55
Waseca	New Richland	MN	7676	7677	Wastewater bypass due to heavy rains.	New Richland WWTP	6/4/2000 10:00	6/4/00 15:51
Waseca	Waldorf	MN	14855	14860	Wastewater bypass due to heavy rain.	Waldorf WWTF to Little Cobb.		4/16/01 14:34

Appendix D - Reported Waste Water Treatment Facility Bypasses (2000-2004)

County	City	State	Report ID	Incident ID	Incident Description	Location Description	Incident First Observed	Report Received
Watonwan	Lewisville	MN	54729	54730	Caller is upset about new wastewater system.	City of Lewisville		8/26/03 8:30
Watonwan	Madelia	MN	3027	3028	Odors from City of Madelia's wastewater treatment facility.	Madelia wastewater treatment facility.	2/29/2000 8:21	2/29/00 8:21
Watonwan	St. James	MN	5616	8284	Due to high industrial slug load, plant needed to bypass wastewater to stabilize levels.	WWTF	4/19/2000 7:55	4/24/00 14:43
Winnebago	Buffalo Center	IA			Wastewater bypass.	Buffalo Center WWTP		05/24/04

Appendix E - Reported Waste Water Treatment Facility Violations (2000-2004)

WWTF ID	Name	Limit	Reported Value	Start Date	End Date	County	Major Watershed
MN0022977	Butterfield WWTP	200	300	9/1/04	9/30/04	Watonwan	Watonwan River
MN0065722	Lewisville WWTP	200	>6,000	9/1/04	9/30/04	Watonwan	Watonwan River
MN0021849	Waldorf WWTP	200	1,551	6/1/00	6/30/00	Waseca	Le Sueur River
MN0021849	Waldorf WWTP	200	238	7/1/00	7/31/00	Waseca	Le Sueur River
MN0021849	Waldorf WWTP	200	304	9/1/01	9/30/01	Waseca	Le Sueur River
MN0021849	Waldorf WWTP	200	1,039	8/1/04	8/31/04	Waseca	Le Sueur River
MN0021849	Waldorf WWTP	200	888	9/1/04	9/30/04	Waseca	Le Sueur River
MN0022071	Trimont WWTP	200	503	6/1/01	6/30/01	Martin	Blue Earth River
MN0021652	Truman WWTP	200	2,263	5/1/01	5/31/01	Martin	Watonwan River
MN0021652	Truman WWTP	200	1,485	8/1/02	8/31/02	Martin	Watonwan River
MN0021652	Truman WWTP	200	1,312	9/1/02	9/30/02	Martin	Watonwan River
MN0021652	Truman WWTP	200	215	6/1/03	6/30/03	Martin	Watonwan River
MN0021652	Truman WWTP	200	528	7/1/03	7/31/03	Martin	Watonwan River
MN0021652	Truman WWTP	200	245	10/1/03	10/31/03	Martin	Watonwan River
MN0021652	Truman WWTP	200	245	8/1/04	8/31/04	Martin	Watonwan River
MN0021296	Welcome WWTP	200	253	4/1/02	4/30/02	Martin	Blue Earth River
MN0022918	Bricelyn WWTP	200	367	9/1/02	9/30/02	Faribault	Blue Earth River
MN0025224	Wells Easton Minnesota Lake WWTP	200	220	10/1/02	10/31/02	Faribault	Le Sueur River
MN0025267	Winnebago WWTP	200	273	5/1/04	5/31/04	Faribault	Blue Earth River
MNG580035	Mountain Lake WWTP	200	287	4/1/01	4/30/01	Cottonwood	Watonwan River
MNG580035	Mountain Lake WWTP	200	6,000	6/1/02	6/30/02	Cottonwood	Watonwan River
MN0062588	Neuhof Hutterian Brethren	200	1,000	6/1/01	6/30/01	Cottonwood	Watonwan River
MN0040789	Madison Lake WWTP	200	266	5/1/04	5/31/04	Blue Earth	Le Sueur River

Phone conversation, November 16th, 2004 - Curt Krieger, Iowa DNR said there is no violation data for Iowa because the cities of Rake and Buffalo Center are on systems that don't require fecal coliform testing.

Appendix F - Inputs and Comments

1. Minnesota Soybean Growers Association

2. Minnesota Department of Agriculture

3. Minnesota Farm Bureau Association

4. Mr. Steven Sodeman

March 26, 2007

Mr. Bob Worth
Minnesota Soybean Growers Association
360 Pierce Avenue, Suite #110
North Mankato, MN 56003

Dear Mr. Worth:

Thank you for your December 5, 2006, comment letter on the Draft Greater Blue Earth River Basin Fecal Coliform TMDL Report. Yours was one of four comment letters received during the public notice period. Our responses to your comments are provided below.

Comment 1 - Stakeholder Involvement:

The Minnesota Soybean Growers Association (MSGA) is concerned that the Blue Earth River Basin (BERB) TMDL process did not involve agricultural stakeholders to the extent indicated by the recent 'Minnesota Clean Water Legacy Act.' The MSGA does not believe the groups involved with the TMDL process represented agricultural stakeholders. General farm and commodity organizations, agricultural professionals, and active farmers are in the best position to represent agriculture as stakeholders.   Involvement of agricultural stakeholders early in the process would probably have allowed for many of the MSGA's other concerns to be addressed in the TMDL study.

Response to Comment 1:

We agree that stakeholder involvement is imperative, and continue to strive to encourage and facilitate it in TMDL projects. In this particular project, we do feel there were reasonable opportunities for stakeholder involvement and public participation. In addition to the extensive list of events outlined in section 12.0 of the report, two meetings were held with agricultural stakeholders, including the Minnesota Pork Producers, the Minnesota Farm Bureau, representative of the poultry industry, Extension, and the Blue Earth County feedlot officer. It is also worth noting that the Greater Blue Earth River Basin Alliance (GBERBA), a major project partner, is governed by elected county commissioners and Soil and Water Conservation District (SWCD) supervisors. In the agricultural counties of the Blue Earth River Basin, these commissioners and supervisors are directly involved in agriculture.

Comment 2 - Natural Background Levels:

The draft TMDL didn't quantify natural background levels of fecal coliform for the agricultural ecosystems of the BERB. The Federal Clean Water Act provides a mechanism for accounting for natural background levels of a pollutant in the TMDL process. The 'Minnesota Clean Water Legacy Act' requires that an allocation for natural background levels be made. Natural background loadings of pollutants occur in all ecosystems.

There are various approaches that could be used to determine natural background levels of Fecal Coliform in the BERB. Natural background loadings should not just be from wildlife, which presently exists on the landscape in the basin. However, at the very minimum, loading levels equal to present wildlife concentration extrapolated across the entire basin should be used. A study in Nebraska during the late 1970s (J. W. Doran, USDA 1979, attached) determined that more bacterial runoff occurred from an ungrazed control area than from pastureland. However, in both cases, runoff concentrations were substantially higher than water quality standards.

The MSGA encourages additional research be done to determine natural background levels for the type of agricultural ecosystems that presently exist in the Blue Earth River Basin.

Response to Comment 2:

The U.S. Environmental Protection Agency (USEPA) guidance allows natural background to be incorporated into the load allocation portion of a TMDL. In this study, because we did not feel that there was sufficient information to provide separate numeric estimates of natural background levels of fecal coliform bacteria, we chose to follow this guidance. The study does, however, provide semi-quantitative, categorical estimates of wildlife contributions of fecal coliform bacteria to the impaired stream and river reaches. These estimates, which were based on wildlife populations, suggest low to moderate contributions, as compared to other sources.

Several comments we have received have raised the question of whether natural background levels of bacteria might exceed water quality standards. We have found that streams and rivers in the forested northern parts of Minnesota tend not to violate the fecal coliform standard. We do, however, agree that additional research in this area is needed.

Comment 3 - Fecal Coliform Linkage to Livestock:

The draft BERB Fecal Coliform TMDL determined that land application of manure was a primary source of pollution of waters in the BERB. This was done without scientific evidence supporting a linkage between land application of manure and fecal coliform levels that exceed standards. A scientific study was sited, which actually contradicted this conclusion. *"Gerba et al.(1975) reported survival times of fecal-associated bacteria in soils range from 2 to 4 months."* Most manure in the BERB is applied in the fall, while fecal counts don't increase dramatically until June, July, and August. In order for manure application to be the source of the summer bacteria levels, a survival time that is twice that which has been documented would need to occur. In addition, there would need to be a viable transport mechanism. No logical or documented transport mechanism was presented.

The Draft BERB Fecal Coliform TMDL made some assumptions (which were not validated) in an effort to draw a conclusion that land application of manure is responsible for summertime violations of fecal coliform standards. In our society today, being called a polluter has very negative connotations and implications. It is neither fair nor ethical to label livestock producers in the Blue Earth River Basin as polluters, without substantial evidence to support those claims. This conclusion should be removed from the TMDL report until scientific evidence support it exists.

Response to Comment 3:

As you note, this project revealed what appears to be a systematic relationship between bacteria levels and temperature, with the highest average bacteria levels occurring during the warm summer months. This would seem to contradict the suggestion that land applied manure, much of which occurs in the fall and spring, is a potential major source of fecal coliform. It is important to note, however, that very high bacteria levels are also associated with watershed runoff, regardless of season or temperature. It is also the case that bacteria can survive in soils and stream sediments so there could be "lag times" between bacteria deposition on the land or in stream sediments and when it shows up in the water column of a stream.

We agree that additional work needs to be done to more fully understand fecal coliform bacteria dynamics in watersheds and in streams. As such, we believe the report attempts to avoid any absolute conclusions relative to particular sources. The report did attempt to identify "likely major contributors of fecal coliform contamination," such that the federal Clean Water Act and State Clean Water Legacy implementation funding can be directed to the areas where the application or expansion of voluntary Best Management Practices (BMPs) is most likely to improve water quality." We have made changes to the report to more clearly capture the uncertainty associated with such statements.

Comment 4 - Account for Wildlife contributions:

The MSGA believes that the TMDL study did not adequately account for wildlife contributions to the high Fecal Coliform levels in the summertime. It would seem logical that wildlife is a primary source of summertime spikes in Fecal Coliform bacteria levels. Wildlife is increasing due to increasing wildlife habitat as a result of conservation programs that encourage buffer strips along rivers, streams, and drainage ditches. In addition, there is significant Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP) and Wetland Reserve Program (WRP) acres in the basin. Wildlife will tend to concentrate in areas where there is habitat and water in the summertime when other sources of water dry up.

The close proximity to water of wildlife during the summer months is likely to dramatically increase the delivery ratio of wildlife sourced fecal bacteria. In addition to a much higher delivery ratio, there are many more species in the basin than were sited in the TMDL report. The MSGA recommends development and use of DNA Finger Printing technologies to determine the actual source of summertime spikes in Fecal Coliform counts. The DNA Fingerprinting would help to quantify the levels of both wildlife and non-compliant septic systems in the BERB.

Response to Comment 4:

The approach of the study to wildlife was to estimate populations for the major groups of wildlife likely to be present in the basin in the April-October time period, when the fecal coliform water quality standard applies. While not all wildlife species were directly accounted for, we believe this approach provides a general sense for the relative magnitude of wildlife contributions to fecal coliform levels. The delivery ratio assigned to Canada Geese was 4 times that assigned to surface-applied manure and 40 times that assigned to incorporated manure.

Early in the project, we investigated the use of some type of bacteria source tracking tool, such as DNA fingerprinting. Because there still appears to be good deal of uncertainty associated with these techniques, it was decided not to conduct such analysis in this project. We do support on-going research in this area. It has recently come to our attention that the Minnesota Department of Agriculture will be directing some of their TMDL resources to a University of Minnesota bacterial fingerprinting project. We will be very interested in cooperation with, and results from that project.

Comment 5 - Water Quality Standards:

Fecal Coliform water quality standards need to be re-evaluated. Fecal Coliform is a surrogate test for the presence of various potential pathogens organisms. Those pathogens may or may not be present when Fecal Coliform is detected above standard levels. It would be more appropriate to develop standards for the individual pathogens of concern. This would help to focus resources on the real problems and ensure that unnecessary costs are avoided.

Response to Comment 5:

A change in the water quality standard from fecal coliform to E. *coli* is currently proposed to take place in 2007. While this is arguably a modest move closer to a direct pathogen indicator, it is still primarily a surrogate. One major limitation on standards for individual pathogen is likely to be lab analysis costs.

A recent report by Moorman, et al., of the USDA-ARS National Soil Tilth Laboratory in Ames Iowa (ftp://ftp-fc. sc.egov.usda.gov/NHQ/nri/ceap/swcs_ecoli_poster.pdf) found E. *coli* 0157:H7, a pathogenetic strain, in 65% of 52 stream water samples tested.

Comment 6 - Designated Use:

The established designated use for all the surface waters of the Blue Earth River Basin, as swimmable, is the basis for the Fecal Coliform standard that presently exists. The Fecal Coliform TMDL does not address the appropriateness of this designated use for these waters. It is not likely that most of the waters that are impaired for Fecal Coliform are ever used for the established designated use. The potential cost to implement practices to achieve a water quality standard for a designated use, which is not appropriate for most of the surface waters within the Blue Earth River Basin, needs to be addressed.

Response to Comment 6:

The Minnesota Pollution Control Agency (MPCA) is certainly aware of concerns related to classification of waters and designated uses. However, addressing the appropriateness of designated uses was beyond the scope of this TMDL study. We are currently beginning to assess the possibility of adopting more sophisticated "tiered" water quality standards that take into account both the wide range of types of waters in Minnesota, and the variability in how those waters are used.

We should point out that the term “swimmable” is interpreted broadly to include a range of activities that may put individuals in contact with surface waters. These could include wading, boating, trapping, and fishing.

We hope that we have addressed your comments adequately. At this time, it is our intent to submit the TMDL report to USEPA for review and approval. Upon approval of the TMDL by the USEPA, a public process for completion of an implementation plan will be initiated. It is our feeling that the implementation planning can build on work and discussions that have occurred as part of the TMDL development. We would welcome the assistance of the Minnesota Soybean Growers Association.

Sincerely,

Lee W. Ganske
TMDL Project Manager
Minnesota Pollution Control Agency
Rochester Office

LWG:ml

cc: Shannon Fisher – Water Resources Center, Mankato State University, Mankato
Bob Finley – Southeast Regional Manager, MPCA, Rochester

March 26, 2007

Mr. Joe Martin, Assistant Commissioner
Minnesota Department of Agriculture
625 Robert Street North
St. Paul, MN 55155-2538

Dear Mr. Martin:

Thank you for your December 5, 2006, comment letter on the Draft Greater Blue Earth River Basin Fecal Coliform TMDL Report. Yours was one of four comment letters received during the public notice period. Our responses to your comments are provided below.

Comment 1 - Agricultural Stakeholder Involvement:

The Minnesota Department of Agriculture (MDA) has been working with the Minnesota Pollution Control Agency (MPCA) and other state agencies to educate and engage agricultural stakeholders on the impaired waters and TMDL process in Minnesota. The MDA believes it is imperative that agricultural stakeholders not only be made aware of this TMDL, but are an integral part of the effort in developing and approving the future implementation plan for the Blue Earth River fecal coliform TMDL. The MDA offers to assist the MPCA and local county staff in engaging the agricultural community during the implementation plan development stage of the TMDL.

Response to Comment 1:

We appreciate the efforts, to date, of the MDA to educate and engage agricultural stakeholders on the impaired waters and TMDL process. We agree that stakeholder involvement is imperative, and continue to struggle with how best to encourage and facilitate it. In addition to the public participation activities outlines in section 12.0 of the report, two meetings were held with agricultural stakeholders, including the Minnesota Pork Producers, the Minnesota Farm Bureau, representative of the poultry industry, Extension, and the Blue Earth County feedlot officer. Matt Drewitz, formerly of your staff, helped organize these meetings. We look forward to your continuing support in engaging the agricultural community in the development of the implementation plan.

Comment 2 - Adaptive Management:

The MDA believes it is important for the MPCA, local officials, and other organizations involved with this TMDL, to use adaptive management principles when new information (i.e., monitoring, modeling, or research data) and new best management practices (BMPs) are available that will be helpful in updating and/or redirecting the load reduction goals and implementation plan steps for the TMDL. The MDA anticipates that the model for predicting fecal coliform loads will need to be refined in the future to more accurately and precisely quantify fecal coliform loads during various hydrologic regimes. With that in mind, there may be a need to adjust the load allocations for fecal coliform bacteria within the time-frame of this TMDL. In addition, adaptive management should be used to incorporate future fecal coliform impairments for other stream reaches within the Blue Earth River Watershed into this TMDL over time, rather than constructing separate, new TMDLs.

Response to Comment 2:

We agree that adaptive management principles must be used in the implementation of TMDLs. New information will certainly become available in this and other projects that will suggest adjustment or refocusing of bacteria load reduction activities. We do not feel there will be a need to revise the allocations within the timeframe of the current TMDL, as specific load allocations were not set for individual nonpoint sources in the way they were set for point sources in the wasteload allocation. In addition, our understanding of adaptive management does not include the incorporation of new impairment listing in this TMDL study. Nevertheless, we do anticipate a process by which additional impaired reaches can be added by an amendment or similar process, such that the entire TMDL effort does not need to be repeated.

Comment 3 - Research Needs:

The MDA believes that there are significant needs for researching the fate, transport, and resiliency of fecal coliform bacteria within agricultural watersheds and systems. The MDA believes it is important for the MPCA to work with the MDA, the University of Minnesota, and producer organizations in undertaking future research projects to further investigate the fecal coliform issue. This is of particular importance with respect to load reductions associated with specific BMPs. It is crucial that research be undertaken that is comprehensive and that entails a degree of rigor that is needed for peer reviewed research. Because there are a number of fecal coliform TMDLs that will be completed throughout Minnesota over the next few years and funding for new research may be limited, the MDA believes it is important that the MPCA and the Conservation Research Wetland Program (CRWP) work with other similar watersheds in developing research strategies that will provide more insight on the intricacies of fecal coliform impairments. Lastly, the MDA will be working cooperatively with the University of Minnesota on a bacterial DNA fingerprinting research project, and there may be potential for collaboration between this new research project and the Blue Earth River Fecal Coliform TMDL.

Response to Comment 3:

We support your call for additional research on the fate and transport of bacteria in the environment. In particular, we are interested in the survival and possible reproduction of bacteria in soils and stream sediments, the potential re-entrainment into the water column of bacteria in stream sediments, and the transport of bacteria through agricultural drainage systems. We have encouraged and funded some applied research on these topics though TMDL and other watershed projects. In addition, our staff strives to stay current with the scientific literature on bacteria in the environment. Your suggestion of cooperative research strategies among multiple agencies, watershed projects, and academic institutions is an important one. We understand that a “DNA fingerprinting” project with the University of Minnesota is indeed underway. We hope to participate in that project.

Comment 4 – Agricultural Practices and Funding:

The MDA AgBMP loan program will be a very good vehicle to provide funding installing new practices that will help reduce fecal coliform levels from livestock production systems and from individual sewage treatment systems (ISTS). If you have any questions about the AgBMP loan program and how it can be utilized to address TMDLs, please contact MDA staff person, Dwight Wilcox, at 651-201-6618.

Response to Comment 4: We anticipate that the AgBMP loan program will be integral to the implementation of this and other TMDLs. We are encouraged by the on-going support of this program through the Clean Water Legacy Act.

Comment 5 – Specific Comments on the Water Quality Monitoring Portion of the TMDL:

Heather Johnson, MDA hydrologist (651-201-6098), reviewed the water quality monitoring data and made the following comment:

- The standard for classifying a reach of a water body impaired for fecal coliform is provided by the Minn. R. ch. 7050. Within the Blue Earth River Basin, there (are) 24 stream reaches with monitoring data collected from them pertaining to fecal coliform. After a review of the water quality data, only locations with adequate monitoring data and which fit the guidelines outlined for Class 2B waters were used to generate these impairment listings. The MDA finds that the WRC-MSU used the water quality data appropriately and with the guidelines to state that 21 reaches (17 impaired and 4 that will quality for listing in 2008) quality to be listed as impaired for fecal coliform.

Response to Comment 5:

We appreciate your review of the data. We hope that we have addressed your comments adequately. At this time, it is our intent to submit the TMDL report to the U.S. Environmental Protection Agency (USEPA) for review and approval. Upon approval of the TMDL by the USEPA, a public process for completion of an implementation plan will be initiated. It is our feeling that the implementation planning can build on work and discussions that have occurred as part of the TMDL development. We would welcome the assistance of the Minnesota Department of Agriculture..

Sincerely,

Lee W. Ganske
TMDL Project Manager
Minnesota Pollution Control Agency
Rochester Office

LWG:ml

cc: Shannon Fisher – Water Resources Center, Mankato State University, Mankato
Bob Finley – Southeast Regional Manager, MPCA, Rochester

March 26, 2007

Mr. Kevin Papp, President
Minnesota Farm Bureau Federation
P.O. Box 64370
St. Paul, MN 55164-0370

Dear Mr. Papp:

Thank you for your November 16, 2006, comment letter on the Draft Greater Blue Earth River Basin Fecal Coliform TMDL Report. Yours was one of four comment letters received during the public notice period. Our responses to your comments are provided below.

Comment 1 – Agricultural Stakeholder Involvement:

The Farm Bureau has been working to educate and engage farmers on impaired waters and the Total Maximum Daily Load (TMDL) process in Minnesota. We believe it is imperative that agricultural stakeholders are not only made aware of this TMDL, but are an integral part of developing and approving the future implementation plan for the Blue Earth River Basin Fecal Coliform TMDL. The Farm Bureau is willing to assist the Minnesota Pollution Control Agency (MPCA) and the Blue Earth River Basin Alliance (BERBA) in engaging farmers during the implementation plan development stage of the TMDL. Farmers may be reluctant to participate because TMDL meetings are often overloaded with agency staff and environmental groups, creating an intimidating atmosphere. The TMDL meetings, hearings, and comment periods should be scheduled at times that are conducive to farmer involvement (avoid the busy fall harvest and spring planting season).

Response to Comment 1:

We appreciate the efforts, to date, of the Farm Bureau to educate and engage agricultural stakeholders on the impaired waters and TMDL process. We agree that stakeholder involvement is imperative, and continue to strive to encourage and facilitate it in TMDL projects. In this particular project, we do feel there were reasonable opportunities for stakeholder involvement and public participation. In addition to the public participation activities outlined in section 12.0 of the report, two meetings were held with agricultural stakeholders, including the Minnesota Pork Producers, Minnesota Farm Bureau, representatives of the poultry industry, Extension, and the Blue Earth County feedlot officer. We look forward to your continuing support in engaging the agricultural community in the development of the implementation plan.

Comment 2 – Research Needs:

The Farm Bureau believes that there are significant research needs regarding the movement and survival of fecal coliform bacteria within watersheds. We also believe that there is a need for more DNA “fingerprinting” to properly determine all sources of fecal coliform. This process needs to be improved so we can properly allocate with reasonable certainty the background levels coming from wildlife, and the percentage coming from humans and pets, in order to make sure we aren't blaming livestock for more than their share. The Farm Bureau believes it is important for the MPCA to work with the Minnesota Department of Agriculture, the University of Minnesota, and producer organizations in undertaking future research projects to further investigate the fecal coliform issue. This is of particular importance with respect to load reductions associated with specific Best Management Practices (BMPs). We need to be sure the BMPs we are recommending will actually have the desired effect. The Farm Bureau would like the MPCA and the BERBA to incorporate a research component into the TMDL implementation plan. Because there are a number of fecal coliform TMDLs that will be completed throughout Minnesota over the next few years and funding for new research may be limited, we believe it is important that the MPCA and the BERBA work with other watersheds in developing collaborative research strategies that will provide more insight on the intricacies of fecal coliform impairments. Another possible research need could be the development of manure additives that farmers could use during land application to reduce fecal coliform. In general, the Farm Bureau policy supports the use of repeatable, peer-reviewed, scientific data through all phases of the TMDL, including the allocation of natural/background levels of various impairments. On page 39, the TMDL report allocates only .02% of the fecal coliform to wildlife, a number which seems to be extremely low to us. Can we say with any degree of certainty that the TMDL has allocated the correct degree of impairment caused by wildlife and other background sources? A recent article in the Washington Post refers to a Virginia Tech study that found 50% of the bacteria in streams came from wildlife (compared to 16-24% from humans, and only 10% from livestock). Wildlife may produce a smaller percentage of bacteria; however, a much larger percentage of what they produce gets into the water, especially in the case of geese.

Response to Comment 2:

Early in the project, we investigated the use of some types of bacteria source tracking tool, such as DNA fingerprinting. Because there still appears to be good deal of uncertainty associated with these techniques, was decided not to conduct such analysis in this project. We do support on-going research in this area. It has recently come to our attention that the Minnesota Department of Agriculture will be directing some of their TMDL resources to a University of Minnesota bacterial fingerprinting project. We will be very interested in cooperation with, and results from that project.

It is important to understand that the 0.02% figure that you cite from the figure on page 39 is not an allocation. It is simply an estimate of the percent of all fecal coliform produced in the basin that is attributable to wildlife. As you correctly note, wildlife may produce a smaller percentage of bacteria, but more could get into the water. The "delivery" factors assigned to geese in the report, for example, were 40 times higher than those assigned to land applied manure. The estimation process still resulted in wildlife being deemed a minor to moderate, but not insignificant, contributor to bacteria in streams.

The comment about research into additives for disinfecting manure is a good one. We would welcome your suggestions about how to get such a project going. In addition, we feel there is room to more fully understand the disinfection benefits from long-term manure storage, composting, and timing and method of land application. A paper currently in draft by Spiehs and Goyal, at the University of Minnesota, suggests that lime stabilization may be a viable option for small to mid-sized producers, while chemical treatments, such as ozone may work for larger producers.

Comment 3 – Adaptive Management:

The Farm Bureau encourages the use of adaptive management principles when new information (i.e., monitoring or research data) and new BMPs are available, which will be helpful in updating and/or redirecting the load reduction goals and implementation steps for the TMDL. In addition, adaptive management should be used to incorporate future fecal coliform impairments within the Blue Earth River Basin into this TMDL over time, rather than constructing separate, new TMDLs. It is also vitally important that we consider the feasibility of attaining the water quality standards for each impaired water body. There may be some cases where the reductions needed to meet water quality standards are not realistic. In those cases, the TMDL plan should include a strategy for re-evaluating the designated use of those water bodies. We are concerned that many water bodies were arbitrarily assigned a designated use, which, in some cases, may be inappropriate.

Response to Comment 3:

We agree that adaptive management principles must be used in the implementation of TMDLs. New information will certainly become available in this and other projects that will suggest adjustment or refocusing of bacteria load reduction activities. We do not feel that there will be a need to revise the allocations within the timeframe of the current TMDL, as specific load allocations were not set for individual nonpoint sources in the way they were set for point sources in the wasteload allocation. In addition, our understanding of adaptive management does not include the incorporation of new impairment listing in this TMDL study. Nevertheless, we do anticipate a process by which additional impaired reaches can be added by an amendment or similar process, such that the entire TMDL effort does not need to be repeated.

The MPCA is certainly aware of concerns related to classification of waters, designated uses, and attainability of standards. However, addressing these complex issues is beyond the scope of this TMDL study and subsequent implementation plan. On the other hand, the TMDL program does contemplate the possibility of site-specific water quality standards in cases where a high level of BMP implementation has occurred, yet standards are still not attained.

Comment 4 – Implementation Strategies:

The Farm Bureau is pleased with the BERBA implementation plan that identified the high priority areas, and within those areas focuses on septic systems, education, training, and incentives for the voluntary adoption of BMPs to meet the goals of improved water quality. We encourage the MPCA and other agencies involved in TMDL development to focus on voluntary, incentive-based BMPs for this and all TMDL projects.

Response to Comment 4:

For the load allocation pollutant sources that are not subject to National Pollutant Discharge Elimination System (NPDES) permit requirements, our primary goal for this TMDL is to direct federal Clean Water Act and State Clean Water Legacy implementation funding to the areas where the application or expansion of voluntary BMPs is most likely to improve water quality. We firmly believe that conservation and manure management practices exist, or can be developed, that will mitigate potential impacts of manure on water quality.

We hope that we have addressed your comments adequately. At this time, it is our intent to submit the TMDL report to the US Environmental Protection Agency (USEPA) for review and approval. Upon approval of the TMDL by the USEPA, a public process for completion of an implementation plan will be initiated. It is our feeling that the implementation planning can build on work and discussions that have occurred as part of the TMDL development. We would welcome the assistance of the Farm Bureau.

Sincerely,

Lee W. Ganske
TMDL Project Manager
Minnesota Pollution Control Agency
Rochester Office

LWG:ml

cc: Shannon Fisher – Water Resources Center, Mankato State University, Mankato
Bob Finley – Southeast Regional Manager, MPCA, Rochester

March 26, 2007

Mr. Steven Sodeman
42050 - 737th Avenue
St. James, MN 56081

Dear Mr. Sodeman:

Thank you for your December 5, 2006, comment letter on the Draft Greater Blue Earth River Basin Fecal Coliform TMDL Report. Yours was one of four comment letters received during the public notice period. Our responses to your comments are provided below.

Comment 1:

I went to the final session for this TMDL at the Mankato Library. I was surprised to see almost no one present. I was totally unaware that this was the last session in a three-year process. Where were the stakeholders?

Response to Comment 1:

We agree that stakeholder involvement is imperative, and continue to struggle with how best to encourage and facilitate it in TMDL projects. In this particular project, we do feel there was a reasonable level of stakeholder involvement and public participation. In addition to the extensive list of events outlined in section 12.0 of the report, two meetings were held with agricultural stakeholders, including the Minnesota Pork Producers, the Minnesota Farm Bureau, representative of the poultry industry, Extension, and the Blue Earth County feedlot officer.

Comment 2:

I was not impressed by the final conclusion that livestock manure is the culprit. There was no cause and effect established. In fact, the numbers demonstrated the opposite. How can high FC that occurs June through August be linked to manure that is applied from October through November? The conclusion is only based on volume of animals, not on evidence. There was no DNA supporting evidence. There is a poor accounting for NATURAL sources. The Draft only works off of volume, not impact or timing. Much more work needs to be done.

Responses to Comment 2:

We agree that additional work needs to be done to more fully understand fecal coliform bacteria dynamics in watersheds and in streams. As such, we believe the report avoids making a "final conclusion that livestock manure is the culprit." The report does suggest that applied manure and inadequately functioning septic systems are "likely major contributors of fecal coliform contamination." We have made changes to the report to more clearly capture the uncertainty associated with such statements.

This project revealed what appears to be a systematic relationship between bacteria levels and temperature, with the highest average bacteria levels occurring during the warm summer months. This would seem to contradict the suggestion that land applied manure, much of which occurs in the fall and spring, is a potential major source of fecal coliform. It is important to note, however, that very high bacteria levels are also associated with watershed runoff, regardless of temperature. It is also the case that bacteria can survive in soils and stream sediments, so there could be "lag times" between bacteria deposition on the land or in stream sediments, and when it shows up in the water column of a stream. We agree that this is an area where further research is needed.

Early in the project, we investigated the use of some type of bacteria source tracking tool, such as DNA fingerprinting. Because there still appears to be good deal of uncertainty associated with these techniques, it was decided not to conduct such analysis in this project. We do support on-going research in this area. It has recently come to our attention that the Minnesota Department of Agriculture will be directing some of their TMDL resources to a University of Minnesota bacterial fingerprinting project. We will be very interested in cooperation with, and results from that project.

See response to comment 3 on natural sources.

Comment 3:

What if the true NATURAL contribution is higher than the allowable standards? Does this mean the standards are inappropriate? I realize the good intentions of health officials, but let's be realistic. When Governor Arne Carlson said "all waters of Minnesota should be fishable and swimable," many thought he was too far reaching and unrealistic, but we allowed him to say that because he is a politician. Now the rooster is home to roost. Let's use COMMON SENSE here. Their standards are not correct.

Response to Comment 3:

It can be a challenge to define "natural' conditions in watersheds like the Blue Earth that are heavily impacted by the activities of humans. Nevertheless, an attempt was made in the study to estimate potential "natural background" bacteria contributions based on wildlife populations in the basin. It is worth noting that streams in the forested parts of northern Minnesota tend not to violate the fecal coliform water quality standard.

Comment 4:

Maybe I'm being an alarmist, but I see your conclusion as the beginning of legal and regulatory attempts to alter the landscape by eliminating animal agriculture in the Blue Earth River Basin. The present make-up of livestock, wildlife, and human activity is an ECO-SYSTEM that we must live with.

Response to Comment 4:

Given your involvement in the livestock industry, we understand how you would have concerns about the potential for increased regulation. However, the report does not suggest limits on, and certainly not elimination of, livestock in the Blue Earth River Basin. The TMDLs create no new regulatory authority for the MPCA. For the load allocation pollutant sources that are not subject to the National Pollutant Disposal System (NPDES) permit requirements, our primary goal is to direct federal Clean Water Act and state Clean Water Legacy implementation funding to the areas where the application or expansion of voluntary best management practices (BMPs) is most likely to improve water quality. We firmly believe that conservation and manure management practices exist, or can be developed, that mitigate potential impacts of manure. We have edited the report to reflect this and to include some discussion of the environmental benefits of livestock as an integral part of agricultural watersheds.

We hope that we have addressed your comments adequately. At this time, it is our intent to submit the TMDL report to the U.S. Environmental Protection Agency (USEPA) for review and approval. Upon approval of the TMDL by the USEPA, a public process for completion of an implementation plan will be initiated. It is our feeling that the implementation planning can build on work and discussions that have occurred as part of the TMDL development. We would welcome your assistance.

Sincerely,

Lee W. Ganske
TMDL Project Manager
Minnesota Pollution Control Agency
Rochester Office

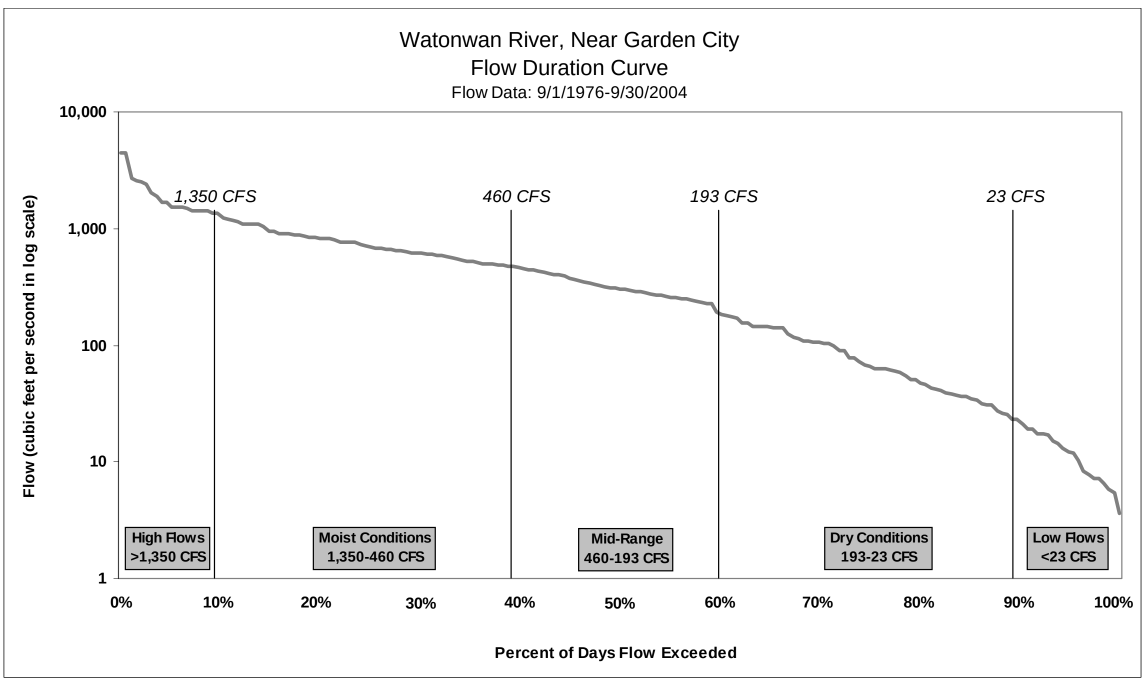
LWG:ml

cc: Shannon Fisher – Water Resources Center, Mankato State University, Mankato
Bob Finley – Southeast Regional Manager, MPCA, Rochester

Appendix G – USGS Flow Tables and Duration Curves

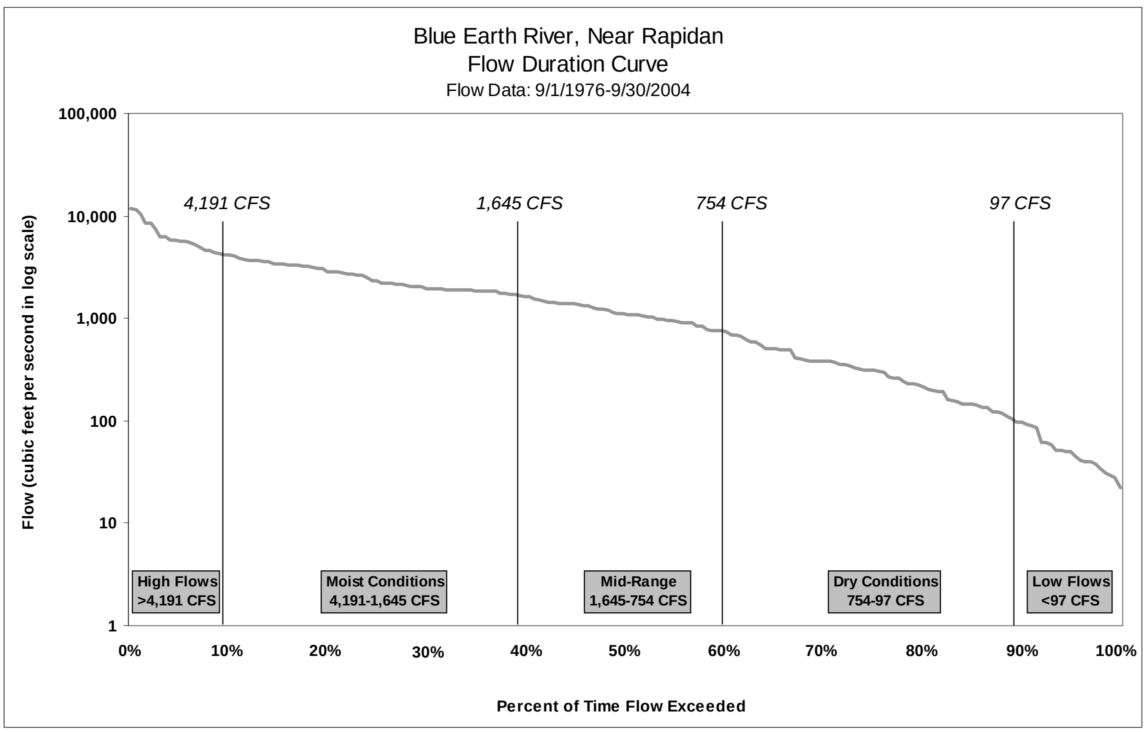
Watonwan River near Garden City, Monthly Mean Flow Values (1976-2004)

	Monthly Mean Flow						
Year	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
1976						4	7
1977	65	109	256	39	14	23	116
1978	523	311	302	145	43	15	10
1979	1,523	558	545	434	1,095	716	378
1980	649	289	1,427	105	51	37	23
1981	51	37	527	356	239	125	146
1982	646	460	443	176	55	72	440
1983	2,570	1,091	760	1,098	78	36	47
1984	2,505	885	1,350	477	103	60	106
1985	949	619	256	90	63	279	614
1986	1,431	1,032	896	765	181	701	607
1987	394	155	104	41	17	19	17
1988	251	193	42	8	12	8	7
1989	141	63	17	19	7	6	5
1990	34	171	483	407	267	67	32
1991	1,157	1,675	1,905	908	270	413	183
1992	1,168	595	616	879	483	311	686
1993	2,696	2,025	4,494	2,389	822	819	323
1994	803	823	1,097	667	588	229	455
1995	1,499	1,203	770	576	535	62	331
1996	607	501	1,691	405	499	242	262
1997	1,220	763	838	1,543	427	144	90
1998	1,409	496	348	235	63	26	146
1999	1,361	861	663	896	113	31	28
2000	38	227	338	370	79	21	31
2001	4,411	1,519	1,436	476	141	46	35
2002	250	291	512	109	294	58	141
2003	315	735	628	306	26	13	12
2004	99	273	939	848	156	680	



Blue Earth River near Rapidan, Monthly Mean Flow Values (1976-2004)

	Monthly Mean Flow						
Year	Apr	May	Jun	Jul	Aug	Sep	Oct
1976	352	144	110	50	38	22	31
1977	142	203	370	104	40	40	233
1978	1,259	766	1,923	1,524	489	120	51
1979	5,044	1,705	1,026	968	5,541	3,547	1,081
1980	2,070	750	3,698	382	662	583	328
1981	400	1,028	2,321	2,717	1,403	1,095	693
1982	2,143	2,624	2,517	1,658	506	850	2,061
1983	8,419	3,800	2,880	3,637	310	199	266
1984	6,286	4,044	5,184	1,870	313	134	193
1985	2,735	1,634	933	262	159	684	1,884
1986	4,172	3,328	3,127	1,902	387	1,058	1,833
1987	1,077	488	349	542	298	123	85
1988	1,101	1,141	316	59	44	30	34
1989	492	507	160	147	61	52	28
1990	212	977	1,831	1,381	1,224	384	144
1991	3,263	5,775	7,504	2,782	1,545	898	383
1992	3,333	1,918	1,645	3,321	1,913	947	2,209
1993	10,310	5,634	11,700	8,540	4,586	4,313	1,397
1994	2,092	2,326	2,879	3,230	1,876	783	1,960
1995	4,441	3,420	3,409	1,970	1,438	232	760
1996	1,832	1,412	3,718	1,121	918	503	392
1997	2,864	2,225	2,186	3,074	847	261	195
1998	3,554	1,850	1,887	1,449	359	307	1,705
1999	5,679	3,849	4,639	3,076	591	136	89
2000	153	1,316	2,070	1,971	386	97	61
2001	11,510	5,759	6,311	1,459	318	98	92
2002	617	754	1,757	415	1,361	241	954
2003	1,324	2,673	1,778	1,197	122	50	41
2004	224	1,224	3,374	2,140	915	4,191	



Minnesota Pollution Control Agency

Blue Earth River Basin

Total Maximum Daily Load for Fecal Coliform Bacteria

Water Quality, Impaired Waters 7-05a • October 2006

The Blue Earth River Basin (BERB) covers parts of 14 counties in south-central Minnesota and northern Iowa. The basin includes three major watersheds, the Blue Earth, LeSueur and Watonwan. The BERB contains 17 stream segments, called reaches (see map), that are listed as "impaired" under section 303(d) of the Federal Clean Water Act.

The listings are based on violations of Minnesota's water-quality standard for fecal coliform bacteria, which indicates these waters are not suitable for swimming and other body-contact recreation. Water testing and data analysis indicate four additional stream reaches are likely to be included on the 2008 impaired waters list for violations of this standard. This fact sheet provides details on a cleanup process called a TMDL (see below) addressing all 21 reaches.

TMDL Background

Impaired waters are those that do not meet water-quality standards established to protect their designated uses such as recreation, fishing, irrigation, and support of wildlife. Examples of pollutants or conditions that may place a lake or stream on the impaired waters list include nutrients, bacteria, sediment, high turbidity, low dissolved oxygen, and bioaccumulative toxins such as mercury and PCBs. Waters are sometimes impaired by multiple pollutants.

For each impaired water, federal law requires that states determine an acceptable Total Maximum Daily Load (TMDL) for the relevant pollutant(s). This total acceptable load is then allocated among all the sources of the pollutant, and reductions necessary to restore the water to required standards are identified. This information serves as the basis for an implementation (cleanup) plan.

A draft TMDL report addressing the fecal coliform impairments in the BERB has been prepared collaboratively by the Greater Blue Earth River Basin Alliance, the Water Resources Center at Minnesota State University-Mankato, and the Minnesota Pollution Control Agency.

The problem

Fecal coliform is a group of bacteria that live in the intestines of warm-blooded animals, including humans. High concentrations of fecal coliform in surface waters indicates the likelihood of recent contamination by human or animal feces, and that water-borne pathogens (disease-causing bacteria, viruses, or protozoa) may be present.

Assessment and implementation

Assessment of fecal coliform sources in the BERB was completed to aid the TMDL process. Sources include wastewater treatment facilities, rural household septic systems, livestock, wildlife and pets. Land-applied manure and inadequately functioning septic systems appear to be the primary sources.

It's important to note that most livestock manure is used appropriately as a fertilizer and soil amendment. However, the sheer volume of manure produced in the BERB means that runoff of even a very small percentage of what is applied may contaminate surface waters. An estimated 39% (about 5,500) of individual sewage treatment systems in the BERB are allowing inadequately treated wastewater into waterways. Direct discharge of sewage to waterways during low-flow conditions can be a major contributor of fecal coliform bacteria contamination.

In the streams and rivers of the Blue Earth River Basin, fecal coliform levels are typically highest in the months of June, July and August, and during periods of higher water. Restoring impaired stream reaches to compliance will require reducing bacteria levels in most of them by 80-90 percent.

A detailed implementation plan will be developed following completion and approval of this TMDL report. Cleanup of all the impaired reaches will be a complex undertaking involving a mix of regulation, education and incentives, and may take a number of years. However, resources available through the recently passed Minnesota Clean Water Legacy Act should speed up the process.

Public involvement

The public and specific stakeholders were involved in the TMDL project in several ways including:

- A TMDL technical sub-committee
- Frequent discussion with local agency staff and elected officials that make up the Greater Blue Earth River Basin Alliance
- News releases to newspapers throughout the BERB;
- Two radio interviews; one TV interview
- Two mailings to local elected officials, agency staff, and interest groups
- Public open houses at three communities in the basin
- A website hosted by the Minnesota River Basin Data Center.

For more information

The complete report for the Blue Earth River Basin Fecal Coliform TMDL is available on the MPCA Web site at http://www.pca.state.mn.us/water/tmdl/index.html#drafttmdl

For questions, comments and requests for additional information, contact:
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