Chippewa River Fecal Coliform

Total Maximum Daily Load

Report

Final – November, 2006

For Submission to:

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

Submitted by:

Minnesota Pollution Control Agency

Muriel Runholt
Gregory Johnson
Christopher Zadak
Regional Division

Wq-iw7-06e

Table of Contents

Figures

Tables

Minnesota Pollution Control Agency
Regional Division

July 2006

Total Maximum Daily Load Report for Fecal Coliform for the Chippewa River Watershed, Minnesota

Executive Summary

The Minnesota Pollution Control Agency (MPCA) listed nine stream reaches in the Chippewa River Watershed as impaired for swimming designated use (primary contact recreation) under Section 303(d) of the Clean Water Act. The main cause contributing to impairment is excessive fecal coliform bacteria load. This Total Maximum Daily Load (TMDL) report (report) describes the magnitude of the problem and provides direction for improving water quality at the listed reaches, as well as one reach that is not formally assessed but is believed to exhibit similar water quality conditions. Ten reaches are assessed in this report.

The Chippewa River originates in northeast Douglas County and flows about 130 miles southwest to Montevideo, Minnesota, where it flows into the Minnesota River. The Chippewa Watershed at approximately 2,080 square miles, or over 1.3 million acres is one of the largest watersheds in the Minnesota River Basin. There are seven sub-watersheds in the watershed; monitoring data from each was used to develop the TMDL. Land-use is dominated by agricultural cropping and animal production. Beef production and dairy represent over half of the approximately 160,000 animal units (AUs) in the watershed.

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

Fecal coliform loading capacities were calculated for each individual impaired reach, and those capacities are allocated among point sources (wasteload allocation), nonpoint sources (load allocation), and a margin of safety. A loading capacity is the product of stream flow at each impaired reach and the fecal

coliform water quality standard. Five flow zones, ranging from low flow to high flow are utilized, so that the entire range of conditions are accounted for in the report. The loading capacity and allocation vary by impaired reach, and by flow zone for a given reach. A description of the duration curve approach is in Appendix A.

1.0 Introduction

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

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

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

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

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

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

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

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

The 1994 and 2006 Minnesota TMDL Clean Water Act Section 303(d) lists identified one and eight impaired reaches respectively for the Chippewa River Watershed. These reaches were listed as impaired for failure to meet their swimming designated beneficial uses due to excessive fecal coliform concentrations. Data shows that Cottonwood Creek to Dry Weather Creek (HUC 07020005-508) is also impaired and is included in this report, but is not yet on the 303(d) list.

This document provides the information used to develop a TMDL report for ten impaired reaches in the Chippewa River Watershed which is located within the Minnesota River Basin in Minnesota in Minnesota (Table 1.01).

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

Reach	Description	Year listed	River Assessment Unit ID	Monitoring Station Used for Assessment	# months with ≥ 5 Obs.	# months geomean > 200cfu/100ml	Years of Data
Chippewa River	Watson Sag Diversion to Minnesota R	94	07020005-501	MNCH-.5, BB12A71, S000-175	7	4	82-93
Chippewa River	Headwaters to Little Chippewa R	06	07020005-503	S002-190	6	3	99-05
Chippewa River	Unnamed Cr to E Br Chippewa R	06	07020005-505	S002-193	6	3	99-05
Dry Weather Creek	Headwaters to Chippewa R	06	07020005-509	S002-204	6	4	99-05
Chippewa River, East Branch	Mud Cr to Chippewa R	06	07020005-514	S002-196	6	2	99-05
Shakopee Creek	Shakopee Lk to Chippewa R	06	07020005-559	S002-201	6	3	99-05
Unnamed Ditch (Judicial Ditch 29)	Headwaters to CD 29	06	07020005-566	S002-206	4	1	97-05
County Ditch 29	Headwaters to Unnamed Ditch	06	07020005-567	S002-197	4	1	97-05
County Ditch 27	Unnamed Ditch to Unnamed Ditch	06	07020005-570	S002-198	4	2	97-05
Chippewa River	Cottonwood Cr. To Dry Weather Cr.	Not listed	07020005-508	S002-203	6	3	99-05

The protocol for this assessment is outlined in MPCA "Listing Methodology" publications found at: http://www.pca.state.mn.us/water/tmdl/index.html#support. The applicable water body classifications and water quality standards are specified in Minnesota Rules Chapter 7050. Minn. R. ch. 7050.0222, subp. 5 lists applicable water quality standards for the impaired reaches and Minn. R. ch. 7050.0407 lists water body classifications. Assessment summary information for the ten reaches is listed in Table 1.01. The assessment protocol includes pooling of data by month over a 10-year period. Six reaches had more than two months with at least five fecal coliform samples that violated the geometric mean water quality standard of 200 colony forming units (cfu) /100ml. Four reaches violated the water quality standard for two or less months. The reach is partially supporting if the standard is violated two or less months, and non-supporting if violated greater than two months.

The Chippewa River Watershed Project (CRWP) was awarded a Clean Water Partnership (CWP) Phase I Diagnostic Study grant by the MPCA in 1998 to begin an intensive study of land use and water quality in the Chippewa Watershed. The CRWP was awarded a Phase II Implementation grant from the MPCA in 2001 to carry out the remediation strategies determined in the Phase I CWP. The CRWP has an ongoing monitoring effort in the watershed, results from which are used throughout this report.

Table 1.02 shows the conversion of flow from cubic feet per second (cfs) to million gallons per day (MGD), and loads from colony forming units (cfu)/ 100ml to organisms per day and vice versa. This report states flow in MGD, and loads in cfu/100ml and organisms per day.

Table 1.02: Conversion equations

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

2.0 Watershed Characteristics

The Chippewa River Watershed is located in the upper Minnesota River Basin. It comprises nearly 1,333,440 acres or about 2,084 square miles. The Chippewa River Watershed is predominately in the Northern Glaciated Plains ecoregion, with minor portions in the northeast and southwest in the North Central Hardwood Forest and Western Cornbelt Plains ecoregions respectively. The sub-watersheds and counties are shown in Figure 2.01.

The total human population in the watershed is estimated to be about 37,500 (Olson and Churchill, 2000). Of this 17,500 are rural and 20,000 are urban, 47% and 53% respectively. The majority of the urban population is served by centralized sewage treatment, but about 3% of the urban population lives in unsewered communities. It is estimated that 50% of the rural households have out of compliance septic systems. Of these 25%, or 875 households, have septic systems which directly discharge to tile.

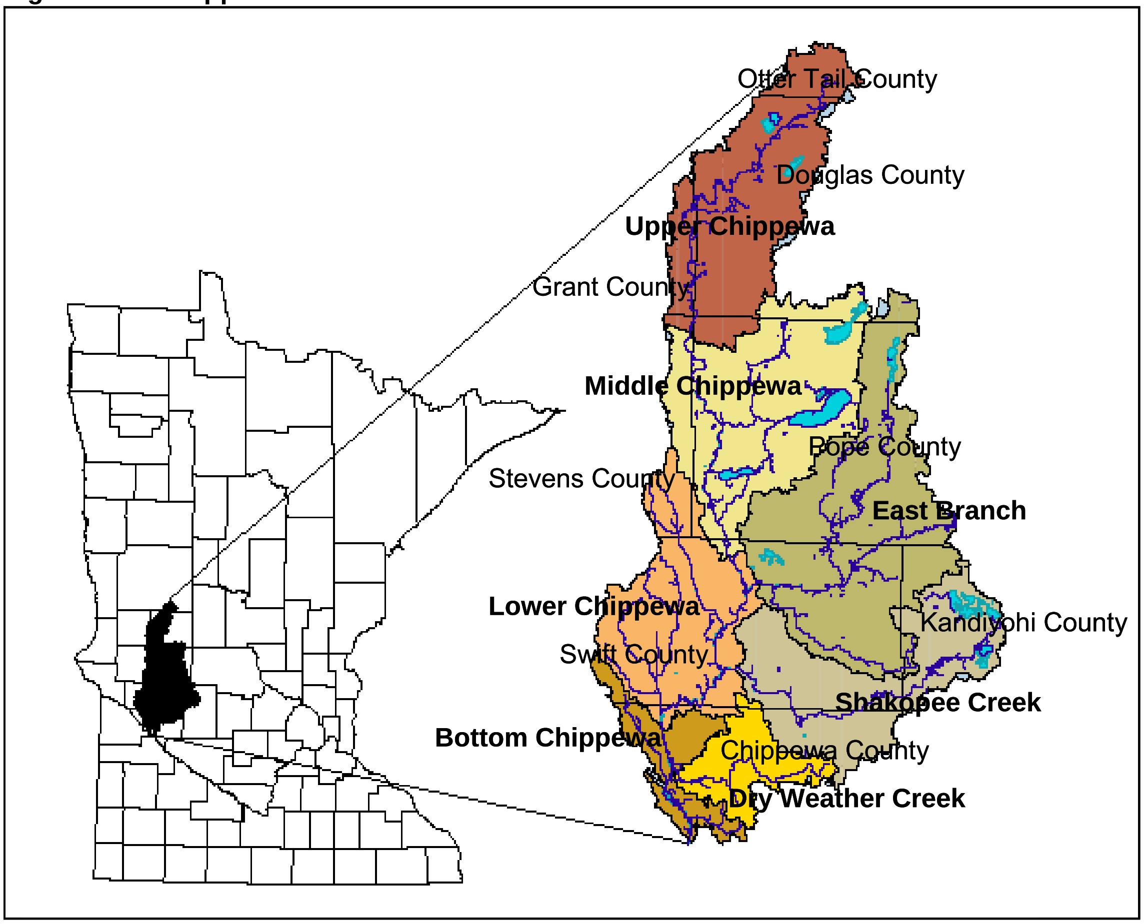
The Chippewa River originates in northeast Douglas County and flows about 130 miles southwest to Montevideo, Minnesota, where it flows into the Minnesota River. The Chippewa River watershed is one of the largest watersheds in the Minnesota River Basin and includes all or part of Chippewa, Kandiyohi, Swift, Stearns, Pope, Stevens, Douglas, Grant, and Otter Tail Counties. Tributaries of the Chippewa River include the Little Chippewa River, the East Branch of the Chippewa River, Shakopee Creek, Dry Weather Creek, Cottonwood Creek, Mud Creek, Spring Creek, and several county and unnamed ditches. Lakes in the watershed include Emily, Minnewaska, Norway, Florida, Chippewa, Lobster, Reno, Aaron, Moses, and Red Rock. The glacial river channel, Watson Sag, in the lower watershed connects the Chippewa River to the Lac qui Parle Reservoir on the Minnesota River.

Much of the Chippewa River flow is diverted to Lac qui Parle reservoir, on the Minnesota River, through the diversion channel (Watson Sag) located north of Watson. During low flow conditions one half of the Chippewa River's stream flow is diverted to the reservoir. At high flow, 1000 cubic feet per second is allowed to follow the natural channel through the Bottom sub-watershed to join the Minnesota River at Montevideo, while the remainder is diverted to the reservoir (Olson and Churchill, 2000).

There was concern that under flooding conditions the Chippewa River could commingle with the Minnesota River in the Bottom sub-watershed below the Watson Sag. Upon further review, it was determined that the actual back flow from the Minnesota River to the Chippewa River was probably fairly minimal and that conditions are primarily more of a back water effect. Much of the flow at the Minnesota River Hwy. 212 gage can often be accounted for by the flow in the

Chippewa River above the Watson Sag Diversion at the gage near Milan. A detailed discussion of the effect of the Watson Sag Diversion at the Bottom reach is in Appendix B.

Figure 2.01: Chippewa River Watershed Counties and Sub-watersheds



2.1 Land Use

The Chippewa River Watershed is largely rural. Cropland makes up 73.5 percent of the watershed, and urban land makes up nearly 2.0 percent. Corn, soybeans, and sugar beets are grown on most of the cropland (Olson and Churchill 2000). Table 2.11 shows the land uses in the Chippewa River watershed (CRWP, 2003). Table 2.12 shows the drainage area of the impaired reaches and sub-watershed land use.

Table 2.11: Chippewa River Watershed Land Use

Land Use	Acres	Percentage of Total
Agriculture	980,021	73.50%
Grassland	148,575	11.14%
Forest	71,798	5.38%
Water	71,668	5.37%
Wetlands	37,042	2.78%
Urban or Residential	23,565	1.77%
Gravel pits or exposed	724	0.05%
Unclassified	47	<0.01%

Table 2.12: Chippewa River Impaired Reach Drainage Area and Sub-watershed Land Use

Impaired Reach	Sub-watershed	Drainage Area (mi^2)	Land use Percentages					
			Cult.	Grass	Forest	Water/ Wetland	Urban/ Residential	Other
Chip. R: Watson Sag to Minnesota R.	Bottom	2084	84.9	6.6	4.3	0.99	3.21	0.01
Dry Weather Cr.: Head-waters to Chippewa R.	Dry Weather Cr.	106	94.2	2.4	1.5	0.5	1.3	0
Chip. R: Cottonwood Cr. to Dry Weather Cr.	Lower	1901	89.6	4.3	2.6	1.5	1.9	0
Shakopee Cr.: Shakopee Lk. To Chippewa R.	Shakopee Cr.	320	81.4	6.7	4.3	5.8	1.7	0.1
Unnamed Ditch: Head-waters to JD 29	Shakopee Cr.	2.7						
County Ditch 29	Shakopee Cr.	6.7						
County Ditch 27	Shakopee Cr.	13.4						
Chip. R.: Unnamed Cr. To E. Br. Chippewa R.	Middle	758	68.2	12.1	5.2	12.3	2.1	0.1
East Branch Chip. R.: Mud Cr. To Chip. R.	East Branch	509	65.9	17.3	6.3	9.3	1.2	0.1
Chip. R.: Headwaters to Little Chippewa R.	Upper	427	60.3	14.9	9.1	13.8	1.8	0

Douglas and Pope county personnel noted that the large number of lakes and type 1 and 2 wetlands in their counties can act as filters for fecal coliform thus potentially reducing the amount of fecal coliform bacteria observed in the Upper, Middle, East Branch and Lower sub-watersheds. This may account for the lower amount of fecal coliform observed in these sub-watersheds which have high numbers of animal units versus those sub-watershed with higher fecal coliform concentrations but lower animal unit numbers.

3.0 Description of Applicable Water Quality Standards and Assessment Procedures

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

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

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

According to Minn. R. ch. 7050.0407, the designated beneficial use for the different use classes is as follows:

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

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

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

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

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

Relative to the fecal coliform standard, all of the waters covered in this report are either Class 2B, 3B or 2C.

3.1 Applicable Minnesota Water Quality Standards

Minn. R. ch. 7050.0222 subp. 4 and 5, fecal coliform water quality standard for Class 2B and 2C waters states that fecal coliforms shall not 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 2,000 organisms per 100 milliliters. The standard applies only between April 1 and October 31.

This report focuses on 200 organisms per 100 ml monthly geometric mean as an environmental endpoint for impaired reaches. Establishing TMDLs to meet the geometric mean of 200 organisms/100ml rather than the no exceedance of the 2,000 organisms per 100 ml in more than 10% of single samples is consistent with EPAs recent promulgation of water quality criteria for coastal recreational waters. The preamble of the coastal recreational water rule states: *"the geometric mean is the more relevant value for ensuring that appropriate actions are taken to protect and improve water quality because it is a more reliable measure, being less subject to random variation"* (EPA, 2004). The same source-reduction measures that are required to attain compliance with the 'chronic" standard also will lead to attainment of compliance with the "acute" standard of 2,000 organisms/100ml cited above. This report requires compliance with both parts of the standard.

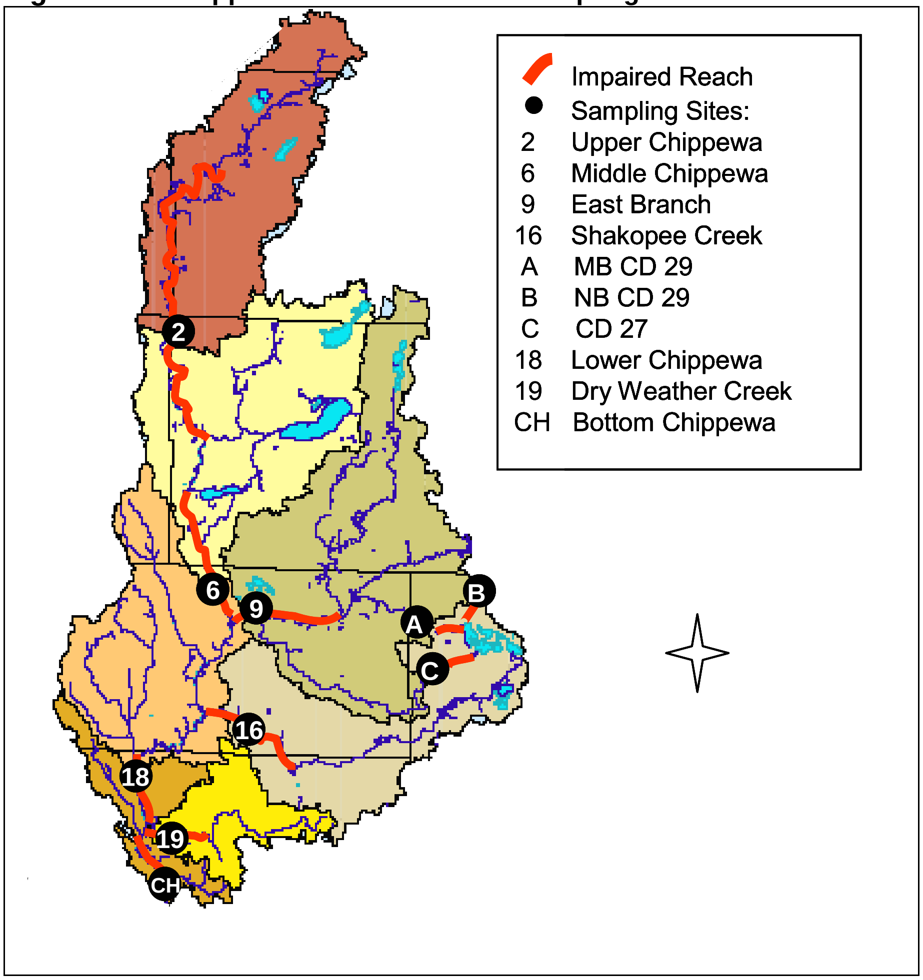
3.2 Impaired Assessment

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

> For support of swimming and recreation, the fecal coliform methodology (303(d) listing) is as follows: Data are aggregated over a ten-year period by month and by reach. If the geometric mean is at least five samples for each appropriate month (all years combined) exceeded 200 organisms per 100ml, that reach was placed on the 1998 303(d) list. In addition, if at least 10 percent of the entire data set for a reach during the ten-year period exceeded 2,000 organisms per 100ml then that reach was also placed on the list. The methodology focuses on monthly analysis of 200 organisms/ 100ml standard and brings in the aspect that stream reaches showing a minimum threshold number of high individual values have impaired use and are included on the list.

The MPCA and CRWP monitored the Chippewa River and its tributaries for fecal coliform at the locations identified in Figure 3.21. Table 1.01 provides summary information of the data used to determine the impairment status of the ten stream reaches included in this report.

Figure 3.21: Chippewa River Watershed Sampling Sites



Site CH-0.5, in the 'Bottom' sub-watershed was abandoned as a monitoring site, because of the diversion of water upstream through the Watson Sag to the Lac qui Parle reservoir on the Minnesota River.

Fecal coliform sampling data for 1999-2005 for the seven sub-watersheds is listed in Table 3.21. The Bottom Chippewa, Dry Weather Creek, Lower Chippewa, Shakopee Creek, East Branch, Middle Chippewa, and Upper Chippewa sub-watersheds correspond to sampling sites CH-0.5, 19, 18, 16, 9, 6, and 2 respectively. All sub-watersheds exceeded the chronic and acute standards at least once during the five years of sampling used in this report. Figure 3.22 shows the sampling data by month for each sub-watershed.

Table 3.21: Chippewa River 1999-2005 Sampling Data for All Sites

Reach	503	505	514	559	508	509
Date	Site 2	Site 6	Site 9	Site 16	Site 18	Site 19
4/14/99	1	20	40	1	20	1
4/21/99	1	40	20	20	1	40
4/10/01	50	50	150	50	50	50
4/19/01	40	1		20	20	1
4/24/01	1	100	40		1	140
4/23/02		60	40	1	20	1
4/29/02	1	1	1	60	20	20
4/6/03	1	1	1	1	1	1
4/22/03	40	67	27	128	54	11
GEOMEAN	4	14	16	11	9	7
5/6/99	320	60	2080	320	100	80
5/10/99	140	40	460	720	60	60
5/12/99	200	220	280	1260	440	140
5/16/99	35	70	405	500	95	125
5/17/99	15	25	1500	290	130	55
5/19/99	5	25	5	40	10	25
5/3/00		1	50	100	50	50
5/8/00		1000	920	1280	440	80
5/11/00		400	760	700	100	
5/30/00		216	720	672	240	388
5/1/01	1	1	1	80	40	1
5/8/01	20	20	1	100	60	40
5/16/01	1	20		1	60	1
5/21/01	120	120		620	320	740
5/31/01	120	80	60	180	40	180
5/8/02	2840	80	100		220	60
5/13/02	1	20	1	1	20	1
5/20/02	1	1	1	220	1	1
5/28/02	80	340	1	80	20	1
5/8/03	39	61	89	352		42
5/14/03	23	52	116	63	52	48
5/20/03	103	56	317	81	174	172
5/28/03	50	50	40	40	120	82
5/6/04				60	1	19
5/11/05	30	10	10	64	36	50
5/17/05		450			130	55
GEOMEAN	29	45	55	129	58	33
6/7/99	140	180	620	220	80	1
6/9/99	60	240	10000	1080	360	120
6/10/99		260	8000	500	4000	280
6/11/99	40	40	360	280	720	40

Reach	501
Date	Site CH-0.5
4/14/72	1300
4/20/73	7900
4/10/74	40
4/5/82	170
4/11/85	**4200**
4/7/88	**8**
4/26/90	**68**
4/8/91	**9**
4/13/92	**16**
4/7/93	**45**
GEOMEAN	50
5/3/73	130
5/8/74	130
5/3/82	130
5/9/85	**18**
5/26/88	**68**
5/9/90	**170**
5/21/91	**40**
5/20/92	**44**
5/12/93	**130**
5/1/94	520
5/22/94	63
GEOMEAN	60
6/29/73	11000
6/1/82	490
6/6/85	**170**
6/9/88	**380**
6/11/90	**150**
6/10/91	**220**
6/28/93	**18000**
6/27/94	330
6/28/04	64
GEOMEAN	521
7/14/71	490
7/27/73	5400
7/6/82	1300
7/11/85	**3600**
7/6/88	**63**
7/11/90	**1600**
7/23/91	**1100**
7/1/92	**220**

Reach	567	566	570
Date	Site A	Site B	Site C
4/11/01	110	2900	220
4/22/02	2	32	1
4/11/05	63	250	600
4/14/05	10	10	20
GEOMEAN	19	123	40
5/20/99	200	130	160
5/22/01	460	8500	1230
5/1/02	8	8	4
5/15/02	32	13	11
5/29/02	48	46	35
5/17/04	330	34000	120000
5/24/04	9900	5900	15000
5/3/05	10	10	10
5/11/05	10	10	30
5/16/05	10	130	20
5/18/05	130	64	82
5/24/05	10	10	64
5/26/05	200	10	430
GEOMEAN	70	99	139
6/30/97	17000	15800	34200
6/12/98	5000	105000	13000
6/23/99	12000	20000	4000
6/24/99	7120	1340	
6/6/00	50	300	50
6/30/00		10000	10000
6/13/01	490	4100	2500
6/21/01	210	200	100
6/17/02	163	315	254
6/2/04	91	240	220
6/9/04	1200	1400	5000
6/10/04	150	1200	3000
6/15/04	18	320	160
6/30/04	27	82	70
6/6/05	210	270	290
6/8/05	1200	8700	1600
6/14/05	150	130	110
6/21/05	91	340	
GEOMEAN	399	1224	869
7/8/99	20000	40000	12000
7/9/99	8000		
7/20/99	400	700	350

Date	Site 2	Site 6	Site 9	Site 16	Site 18	Site 19
6/23/99	180	200	520	800		
6/24/99		180		960	280	
6/6/00		320		280	1	240
6/7/01	40	140	60	260	100	200
6/11/01	120	220		580	80	540
6/13/01	180	1120	100	10000	580	540
6/19/01	80	80	160	180	60	220
6/6/02		60	180	160	100	1
6/12/02	100	180	260	180	180	120
6/24/02		600	740	1720	1360	300
6/5/03	150	260	81	300	64	5
6/11/03		600	2500	170	171	200
6/19/03	105	133	115	137	192	98
6/24/03	3480	1480	90	2117	220	
6/1/04	1100	390	360	800	320	20
6/10/04	600	500	5100	3300	3400	1200
6/15/04	240	170	120	240	150	270
6/23/04	130	130	120	82	91	70
6/7/05	3760	1200	4120	1720	520	43
6/9/05	81	720	3880	5080	1560	2520
6/14/05	1240	1400	1450	880	1120	2040
6/28/05		450	160	310	230	90
GEOMEAN	213	285	486	550	237	112
7/8/99	900	1800	1	2000	2700	
7/9/99	100	1600	1	1800	2600	800
7/16/99	100					
7/20/99	50	750	150	150	150	100
7/5/00		2880	800	1660	1120	775
7/6/00		640	1100	1520	580	620
7/10/00		2080	820	540	820	
7/12/00		680	1000	24000	9000	
7/26/00		220	320	80	400	140
7/5/01	120	260	80	780	180	40
7/12/01	100	120		400	140	80
7/17/01	320	180	140	260	60	
7/23/01	280	740		10000	280	100
7/31/01		160			1	
7/2/02	1	840	400	400	320	120
7/17/02	200	300	250	2500	50	350
7/23/02	450	1	100	300	150	250
7/1/03	1200	1	900	500	2300	170
7/16/03	116	79	252		315	132
7/22/03	84	107			211	

Date	Site CH-0.5
7/27/92	**48**
7/29/93	**220**
7/11/94	400
7/21/04	240
GEOMEAN	369
8/11/71	50
8/31/73	490
8/2/82	1300
8/8/85	**430**
8/11/88	**1200**
8/1/90	**36**
8/12/91	**63**
8/24/92	**880**
8/16/93	**860**
8/31/94	27
8/24/01	64
GEOMEAN	310
9/13/71	790
9/19/73	50
9/22/82	20
9/5/85	**800**
9/6/88	**330000**
9/6/90	**120**
9/24/91	**99**
9/14/92	**54**
9/27/93	**4**
9/19/94	45
9/4/01	73
9/11/01	430
9/19/01	430
9/22/01	4
GEOMEAN	296
10/14/71	50
10/23/73	140
10/7/81	40
10/8/87	**12**
10/5/89	**8**
10/22/90	**330**
10/8/91	**28**
10/12/92	**27**
10/26/93	4
GEOMEAN	30

Assessment - bolded #s

Date	Site A	Site B	Site C
7/5/00	2960		
7/31/00		100	10000
7/16/01	80	250	430
7/23/01	2500	600	2500
7/10/02	1	4	1
7/24/02	1	1	1
7/29/02	1	1	1
7/6/04	1800	3100	13000
7/12/05	220	330	510
GEOMEAN	194	133	223
8/22/96			1200
8/10/99	100	150	1350
8/24/99	350	50	100
8/15/00	60	340	80
8/17/00	50		
8/22/01	30	140	150
8/5/02	1	1	1
8/29/02	6000	6000	6000
8/11/04	64	200	18
8/11/05	140	460	580
8/25/05	110	70	280
8/29/05	210	1600	280
GEOMEAN	92	172	187
9/21/99	200	50	50
9/9/02	172	284	174
9/7/04	100	3100	1100
9/13/05	1600	9800	1200
GEOMEAN	272	810	327
10/28/99	50	50	200
10/10/01	10	2500	980
10/5/05	6000	14000	37000
10/6/05	13000	1300	16000
GEOMEAN	444	1228	3282

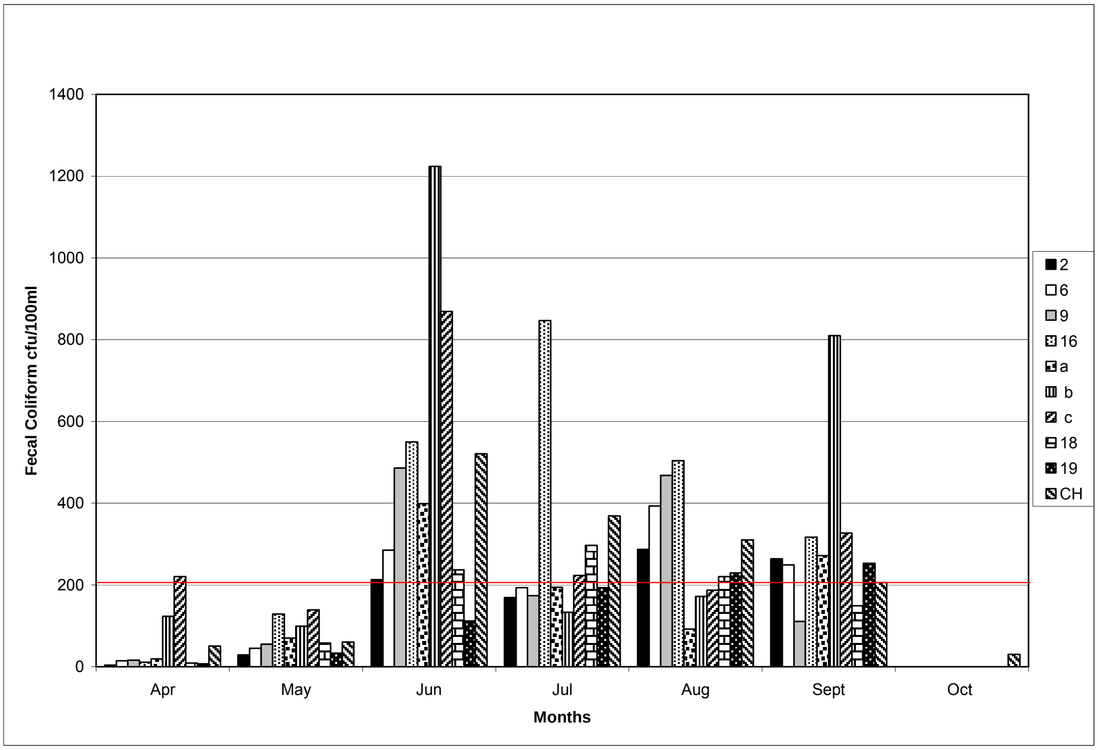
Date	Site 2	Site 6	Site 9	Site 16	Site 18	Site 19
7/30/03	84	124	171	301	63	279
7/21/04	10000	301	271		170	122
7/13/05		220	540	4900	760	260
GEOMEAN	169	193	174	847	297	193
8/1/99			50	2000	800	150
8/9/99		3000	1050		1150	
8/10/99		800	74400	11400	50	
8/11/99		300	150	50	2200	
8/24/99	200	200	50	50	300	400
8/16/00		520	180	60	180	780
8/9/01	260	380	520	600	120	160
8/16/01	180	25		180	60	40
8/23/01	120	260	80	140	20	40
8/30/01	320	700	5540	640	180	1220
8/1/02	1700	60	640	220	180	100
8/6/02	120	140	520	4600	700	480
8/21/02		2100	7500	10500	10800	860
8/22/02				520		620
8/29/02	5240	1560	200	100	60	280
8/6/03		212			96	
8/12/03	89	711	216	188	144	321
8/17/04	104	45	321	10000	25	18
8/4/05	310	210	110	130	110	
8/18/05		10000	530	1000	710	400
GEOMEAN	287	393	468	504	220	229
9/21/99	100	50	150	700	400	100
9/18/00		220	180	160	60	340
9/6/01	240	500		520	80	220
9/13/01	340	460		360	180	700
9/20/01	200	700		1720	260	60
9/27/01	100	240	1	340	200	40
9/5/02	400	250	125	50	150	400
9/11/02	420	180	160	560	80	1400
9/30/02	280	160	100	40	140	240
9/11/03	751	402	391	617	294	10000
9/1/04	324	252	112		36	52
9/1/05		140	180	390	130	
9/22/05	230	330	680		440	80
GEOMEAN	264	249	111	317	149	253
10/28/99	50	50	50	50	50	50
10/11/01	60	320	80	300	1	1
GEOMEAN	55	126	63	122	7	7

No assessment for months with less than five sampling periods

Site 2: Upper Chippewa
Site 6: Middle Chippewa
Site 9: East Branch
Site 16: Shakopee Creek
Site 18: Lower Chippewa
Site 19: Dry Weather Creek
Site CH-0.5: Bottom Chippewa
Site A: MB JD 29
Site B: NB JD 29
Site C: JD 27

Site 2: S002-190
Site 6: S002-193
Site 9: S002-196
Site 16: S002-201
Site 18: S002-203
Site 19: S002-201
Site CH-0.5: S000-175
Site A: S002-197
Site B: S002-206
Site C: S002-198

Figure 3.22: Chippewa River Watershed 1999-2005 Fecal Coliform (cfu/100ml) Sampling Data by Month and Sub-watershed



3.3 MPCA Non-degradation Policy

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

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

4.0 Description of Fecal Coliform Bacteria and Its Sources

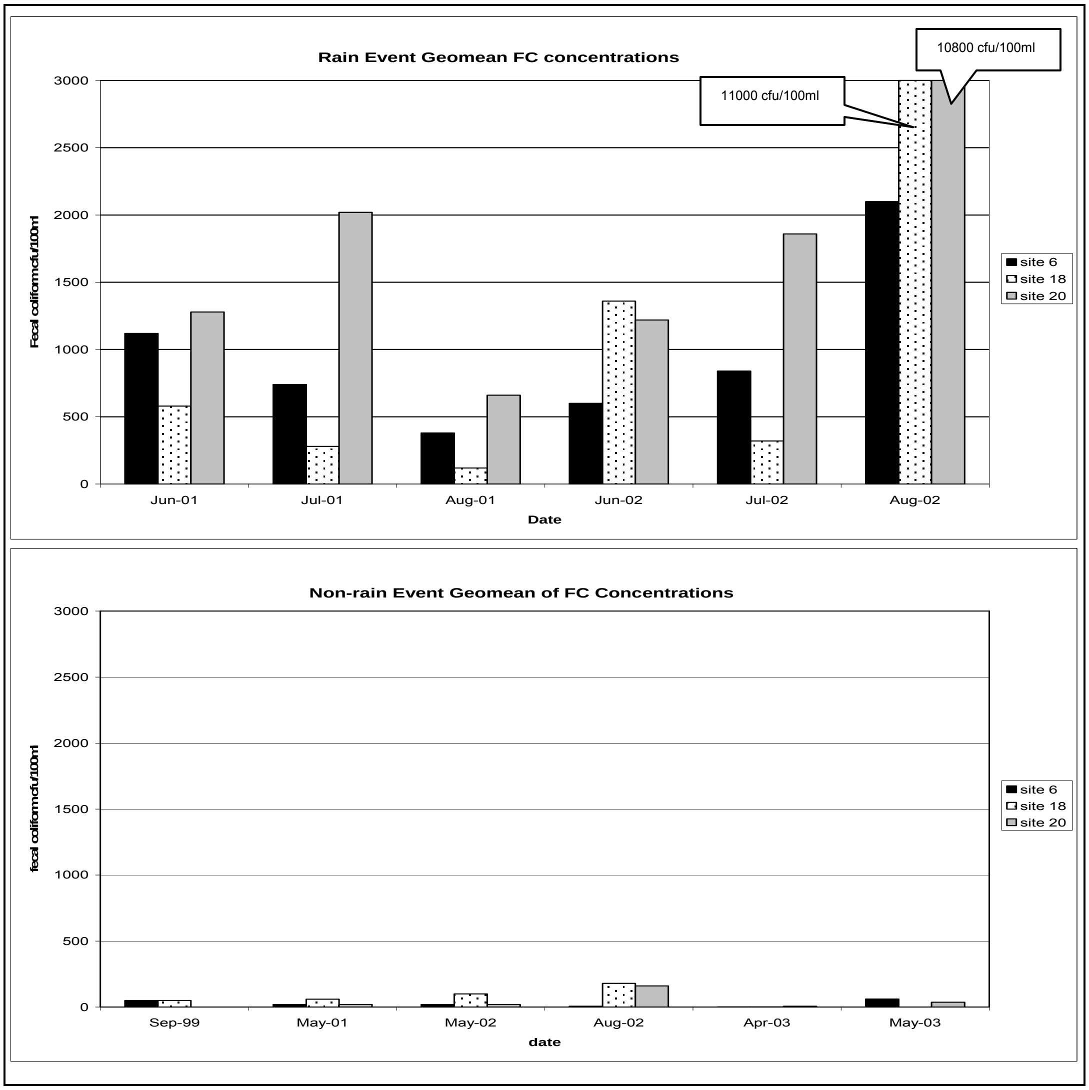
Fecal coliform bacteria represent a group of several genera found in the intestines of warm-blood animals and is always associated with fecal matter. Certain strains of the fecal coliform bacteria group e.g. Escherichia coli are extremely pathogenic. Public health uses fecal coliform as an indicator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

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

Data at several Chippewa sub-watershed sites shows a strong positive correlation between precipitation, and fecal coliform bacteria concentrations (Figure 4.01). When storms occur, weather-driven sources, e.g. feedlot runoff, overgrazed pasture runoff, manured fields, and urban stormwater overshadow continuous sources. In drought or low-flow conditions continuous sources, e.g. cattle in streams, failing individual sewage treatment systems, unsewered communities, and wastewater treatment facilities dominate. Besides precipitation and flow, factors such as temperature, livestock management practices, wildlife activities, fecal deposit age, and channel and bank storage also affect bacterial concentrations in runoff (Baxter-Potter and Gilliland, 1988).

Sites close to rain gages indicated differences between wet and dry periods. Comparing rain events at the National Weather Service station at site 18 and sampling data, the data indicates that the standard is not breached in rain events less than 0.5 inches. If there are two or more rain events of 0.5 inches or greater within a day of each other, the standard may be breached in three or four days. If the rain event is 2-3 inches in magnitude or more, the standard is breached immediately. This suggests that readily available fecal coliform sources are storm event driven, and runoff from rain events is the primary delivery mechanism in wet periods. Figure 4.01 compares storm events and non storm event data at different time periods from sites 6 and 20, above and below respectively from the NWS station at site 18.

Figure 4.01: Storm Event Effect on Fecal Coliform Concentrations at Sites 6, 18 & 20



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

Wastewater Treatment Facilities

There are 19 municipal wastewater treatment plants in the watershed servicing approximately 18,000 people (Table 4.01). According to state rule, each facility is required to meet a discharge limit of 200 cfu/100ml fecal coliform concentration. This is accomplished through disinfection of the wastewater at the final treatment stage, through chlorination or equivalent processes.

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

Table 4.01: Waste Water Treatment Facilities in the Chippewa Watershed

WWTF	Permit #	Sub-watershed	County	1999-2005 Mean FC cfu/100ml	1999-2005 Mean MGD	1999-2005 Mean FC Discharge orgs/day[1]	Load at Standard	Population[2]
Benson	MN0020036	Lower Chippewa	Swift	33	0.379	4.73E+08	2.87E+09	3396
Brandon[3]	MN0055841	Upper Chippewa	Douglas		0	0	--	448
Clontarf*	MNG580108	Lower Chippewa	Swift	No data				170
Cyrus[3]	MN0052396	Middle Chippewa	Pope		0	0	--	296
Danvers	MN0025593	Lower Chippewa	Swift	18	0.136	9.27E+07	1.03E+09	107
Evansville	MNG580074	Upper Chippewa	Douglas	16.4	0.642	3.990E+08	4.86E+09	565
Farwell-Kensington[4]	MN0065293	Upper Chippewa	Douglas	23	0.12	1.04E+08	9.08E+08	341
Glenwood[3]	MN0052710	Middle Chippewa	Pope		0	0	--	2601
Hancock[5]	MN0023582	Lower Chippewa	Stevens	580	0.144	3.16E+09	1.09E+09	718
Hoffman	MNG580134	Upper Chippewa	Grant	328	0.25	3.10E+09	1.89E+09	668
Holloway[3]	MN0023728	Lower Chippewa	Swift		0	0	--	111
Kerkhoven	MN0020583	Shakopee Creek	Swift	246	0.136	1.27E+09	1.03E+09	764
Lowry	MNG580123	Middle Chippewa	Pope	56	0.2694	5.70E+08	2.04E+09	273
Millerville[3]	MN0054305	Upper Chippewa	Douglas		0	0	--	117
Montevideo	MN0020133	Bottom Chippewa	Chippewa	6.1	0.969	2.24E+08	7.34E+09	5482
Murdock	MN0052990	Shakopee Creek	Swift	57	0.3	6.47E+08	2.27E+09	304
Starbuck	MN0021415	Middle Chippewa	Pope	236	0.2	1.79E+09	1.51E+09	1334
Sunburg	MN0063894	East Branch	Kandiyohi	16.8	0.5	3.18E+08	3.79E+09	111
Watson	MN0022144	Bottom Chippewa	Chippewa	162	0.03	1.84E+08	2.27E+08	204
					TOTALS	1.23E+10	3.09E+10	18010

[1]MPCA 1999-2005 Daily Monitoring Report Data

[2]Olson and Churchill, 2000; and League of MN Cities, 2003

[3]No discharge to surface water

[4]Upgrade in 2002

[5]Upgrade in 2003

*Upgraded in 2005

Fourteen of the19 municipalities with WWTFs, discharge to surface water, while five WWTFs do not discharge to water (Table 4.01). The seven year average discharge from the 13 WWTFs with available data is 1.23E+10 organisms per day. The seven year load equivalent to the standard is 3.09E+10 organisms per day.

Of the 14 that discharge, seven WWTFs, Hancock, NPDES permit # MN0023582, Hoffmann, NPDES permit # MN0021199, Kerkhoven, NPDES permit # MN0020583, Lowry, NPDES permit # MN0024007, Murdock, NPDES permit # MN0052990, Starbuck, NPDES permit # MN0021415, and Watson, NPDES permit # MN0022144 discharged above the chronic standard. Hancock violated the standard two times in 2000, five times in 2001, six times in 2002, and three times in 2003. The Hancock WWTF was upgraded in August 2003, and has been in compliance since its upgrade. Hoffmann discharged above the standard once each in 1999, 2001, 2004, and 2005. The Hoffmann WWTF has resolved its fecal violations. The Kerkhoven WWTF had three violations each in 1999 and 2001, one violation each in 2004 and 2005. The Kerkhoven WWTF has upgraded its chlorination system and is working to keep in compliance. The Lowry WWTF violated the standard once in 2002. The Lowry WWTF has corrected its fecal violation and currently is in compliance. The Murdock WWTF discharged above the standard in 2005. The Murdock WWTF is currently in compliance. The Starbuck WWTF discharged above the standard three times in 2001 and was above the acute standard once in 2001. The Starbuck WWTF has corrected its fecal violations and currently is in compliance. The Watson WWTF discharges above the standard once in 2001 and three times in 2005. Watson plans to upgrade their WWTF in 2007.

Unsewered Communities

The population in the unsewered areas in the Chippewa Watershed is nearly 590 people and represents approximately 227 households (Table 4.02).

Table 4.02: Unsewered Communities in the Chippewa River Watershed

CITY	Sub-watershed	County	Population[1]
Hagen/Big Bend	Lower Chippewa	Swift	130
Long Beach	Middle Chippewa	Pope	277
N. Benson Subdiv.	Lower Chippewa	Swift	29
Swift Falls	East Branch	Swift	65
Terrace	East Branch	Pope	30
Urbank*	Upper Chippewa	Otter Tail	59
		Total	590

[1]Olson and Churchill, 2000; and League of MN Cities, 2003

*Plan to upgrade to stabilization ponds in 2007

Urban and Rural Stormwater

Untreated stormwater from cities, small towns, and rural residential or commercial areas can be a source for many pollutants including fecal coliform bacteria and associated pathogens. Fecal coliform concentrations in urban runoff can be a great or greater than those found in cropland runoff, and feedlot runoff (USEPA 2001). Sources of fecal coliform in urban and residential stormwater include pet and wildlife waste that can be directly conveyed to streams and rivers via impervious surfaces and storm sewer systems. Newer urban development often includes stormwater treatment, such as, sedimentation basins, infiltration areas, and vegetated filter strips.

Montevideo is the only city in the watershed which is required to have a Municipal Separate Storm Sewer System (MS4) permit. The MS4 permit requires a range of actions that will ultimately reduce the impact of stormwater from the community to downstream water bodies. Smaller communities or even rural residences not covered under MS4 permits may still need to take action to reduce stormwater, and associated bacteria runoff.

Livestock facilities with NPDES Permits

A Confined Animal Feeding Operation (CAFO) is a feedlot having 1,000 or more animal units, or a smaller feedlot with a direct man-made conveyance to surface water. A feedlot designated as a CAFO is required to operate in accordance with a National Pollutant Discharge Elimination System (NPDES) permit.

According to the MPCA Feedlot database there are eight CAFOs in the watershed. Four, three and one CAFOs are located in the Shakopee Creek, Lower Chippewa, and Middle Chippewa sub-watersheds respectively, and represent 2954 dairy AUs and 5400 turkey AUs, 11, 748 turkey AUs, and 1430 swine AUs respectively (Table 4.03).

Individual Sewage Treatment Systems

The number of failing Individual Septic Treatment Systems (ISTS) was extrapolated from a survey done in the Hawk Creek Watershed in 1999 as part of the Clean Water Partnership study (Gillingham, 2003). Dye studies showed that 50% of the septic systems in the study area were nonconforming and of these 25% had a direct-to-tile discharge and were identified as failing. There are approximately 17,500 rural residents in the Chippewa Watershed, using the 2002 census figure of nearly 2.5 residents per household, there are 7,000 rural households in the Watershed. If 50% of the septic systems in rural households are noncompliant and 25% of these are discharging directly to tile, it is assumed that there are 875 rural households, representing 2,188 people, with failing septic systems in the Watershed.

NonCAFO Livestock Facilities and Manure

Runoff from livestock feedlots, pastures, and land application areas has the potential to be a significant source of fecal coliform bacteria and other pollutants. There is considerable spatial variation in the type and density of livestock across the watershed.

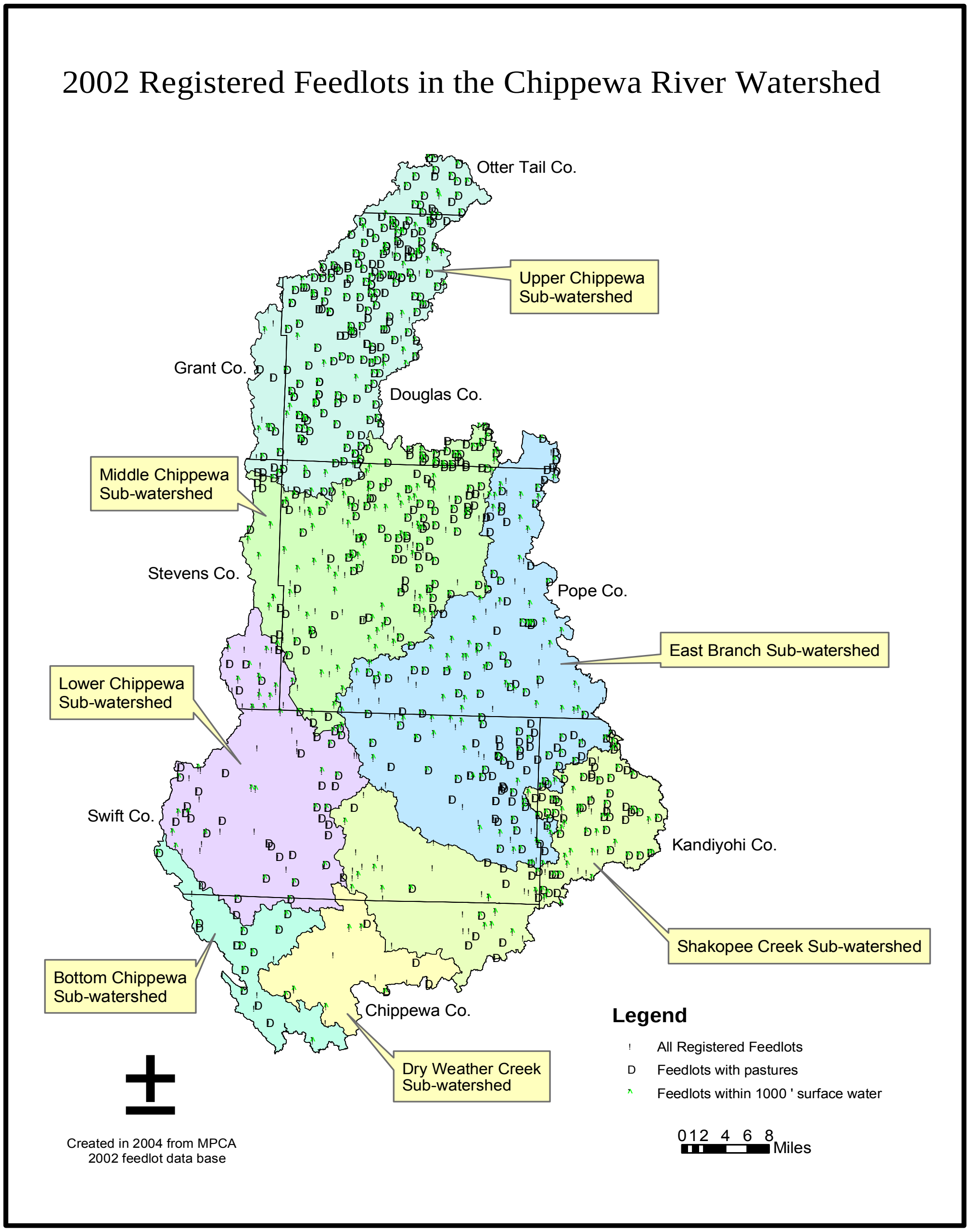
The 2002 MPCA registered feedlot data base lists over 160,000 animal units (AUs) in the watershed mainly representing dairy, beef, swine, and turkey (MPCA, 2002). Other animals e.g. emu and buffalo are included in the horse numbers. The type and number of AUs in each sub-watershed is listed in Table 4.03. Figure 4.02 is the watershed map showing the location of feedlots and pastures in the sub-watersheds. County personnel in the eight counties in the watershed verified that the 2002 feedlot database gave an accurate accounting of animals in their jurisdictions.

The Middle Chippewa sub-watershed has the highest number of AUs with 40,064, followed by the Upper Chippewa, Shakopee Creek, Lower Chippewa and East Branch sub-watersheds with 36,261, 29,368, 27,678 and 26,992 AUs respectively. The lowest number of AUs are in Dry Weather Creek and Bottom Chippewa sub-watersheds with 3,061 and 2,516 AUs respectively. For the entire watershed, beef AUs are nearly twice the AUs of dairy, followed by swine and turkeys.

Table 4.03: Chippewa River Watershed CAFO and Non-CAFO Animal Units by Type and Sub-watershed

Sub-watershed	Source	CAFO AU	Non-CAFO AU	Total AU
Bottom Chippewa	Dairy	--	146	146
	Beef	--	1651	1651
	Swine	--	475	475
	Poultry	--	2	2
	Horses	--	242	242
Dry Weather Creek	Dairy	--	--	--
	Beef	--	696	696
	Swine	--	1715	1715
	Poultry	--	496	496
	Horses	--	154	154
Shakopee Creek	Dairy	2954	5832	8786
	Beef	--	3555	3555
	Swine	--	5936	5936
	Poultry	5400	5629	11029
	Horses	--	62	62
Lower Chippewa	Dairy	--	961	961
	Beef	--	10414	10414
	Swine	--	6154	6154
	Poultry	11748	--	11748
	Horses	--	42	42
East Branch	Dairy	--	6197	6197
	Beef	--	12640	12640
	Swine	--	2934	2934
	Poultry	--	4734	4734
	Horses	--	487	487
Middle Chippewa	Dairy	--	9300	9300
	Beef	--	20009	20009
	Swine	1430	3864	5294
	Poultry	--	413	413
	Horses	--	5048	5048
Upper Chippewa	Dairy	--	13749	13749
	Beef	--	16975	16975
	Swine	--	4933	4933
	Poultry	--	360	360
	Horses	--	244	244
Total		21532	146049	167581

Figure 4.02: 2002 Registered Feedlots in the Chippewa Watershed



Natural and Background Fecal Coliform Pollutant Loads

Natural background loads for fecal coliform bacteria can be attributed to wildlife (primarily deer and geese). Deer populations, estimated by modeling, range from 2.6 to 9.4 deer per square mile in the spring 2001 with an average density of 5.1 deer per square mile, for a total of 10,628 deer in the watershed (Osborn, 2003). The goose population, determined from the 1996-2000 DNR Goose Management Blocks, ranged from 3.78 to 6.74 geese per square mile in the lower watershed, and 9.97 to 10.90 geese per square mile in the upper watershed (Maxson, 2003). The average goose population in the entire watershed is 7.8 geese per square mile, for 16,250 geese.

The Department of Natural Resources (DNR) population indices for pheasants, Hungarian partridge, cottontails and jackrabbits are 100 mile averages and are too crude to use in determining their background contribution, as are the DNR skunk, raccoon, coyote, and red fox scent station surveys (Giudice, 2003). Other wildlife, and rural cats and dogs in the watershed can be roughly accounted for by doubling the deer population to 21,000 animals.

Table 4.04 summarizes the inventory of fecal coliform producers in the watershed.

Table 4.04: Inventory of Fecal Coliform Producers in the Chippewa River Watershed

		Animal Units or individuals		
Category	**Source**	**Within 1000' surface water**	**Not within 1000' surface water**	**Total**
Non-CAFO Livestock[1]	Dairy	25491 AU	12981 AU	38472 AU
	Beef	43215 AU	22725 AU	65940 AU
	Swine	14736	12735 AU	27471 AU
	Chickens	--	437 AU	437 AU
	Turkeys	11847 AU	14457 AU	26304 AU
	Ducks	400 AU	--	400 AU
	Horses	4332 AU	2688 AU	7020 AU
Human[2]	Population with inadequate septic systems	2188 People	--	2188 People
	Population in unsewered communities	590 People	--	590 People
	WWTP	Facilities which discharge above 200 cfu/100ml		
Wildlife[3]	Deer	21000 Deer		21000 Deer
	Geese	16250 Geese	--	16250 Geese
	Other wildlife including rural cats & dogs	--	--	Accounted for in deer population
Urban Stormwater[4]	Dogs and cats - urban	--	9288 Individuals	9288 Individuals

[1]2002 MPCA registered feedlot database
[2]Olson and Churchill, 2000; League of MN Cities, 2003; W. Gillingham, 2003
[3]MnDNR, 2003
[4]AVMA, 2002

5.0 Load Allocations (LA), Wasteload Allocations (WLA), and Margins of Safety (MOS)

5.1 Approach to Allocations Needed to Satisfy the TMDLs

The TMDLs developed for the ten reaches in this report consists of three main components: WLA, LA, and MOS as defined in section 1.0. The WLA includes four sub-categories: Permitted wastewater treatment facilities; communities' subject to Stormwater MS4 NPDES permit requirements; livestock facilities requiring NPDES permits, and “straight pipe” septic systems. The LA, reported as a singe category includes manure runoff from farm fields, pastures, and smaller non-NPDES permitted feedlots, runoff from smaller non-MS4 communities, and fecal coliform contributions from wildlife. The LA includes land-applied manure from livestock facilities requiring NPDES permits, provided the manure is applied in accordance with the permit. The third component, MOS, is the part of the allocation that accounts for uncertainty that the allocations will result in attainment of water quality standards.

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

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

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

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 WWTFs are stabilization ponds systems. Unlike the mechanical treatment systems which have continuous discharges, pond systems typically discharge over a 1-2 week period in the spring and in the fall. In the event they need to discharge outside of the spring or wall window, the WWTF wasteload allocation assumed that these facilities could discharge for an entire month under any flow conditions.
- Since wet-weather design flows represent a “maximum” flow for a mechanical treatment (continuous discharge) facility, the WWTF allocations are conservative in that they are substantially greater than what is actually required.
- Straight-pipe septic systems are illegal and un-permitted, and as such are assigned a zero wasteload allocation.
- For two of the impaired reaches on the Chippewa River mainstem (Watson Sag Diversion to Minnesota R and Cottonwood Cr to Dry Weather Cr) and the Shakopee Creek (Shakopee Lk to Chippewa R) impaired reach the total daily loading capacities in the low flow zone are very small and the calculated margins of safety are relatively large. This is due to the occurrence of zero to near-zero flows in the long-term flow records used for these sites. Consequently, the permitted wastewater treatment facility (WWTF) design flows for both of the mainstem sites exceed the stream flow at the low flow zone. Of course actual WWTF flow can never exceed stream flow as it is a component of stream flow. In the case of Shakopee Creek the calculated MOS would take up all of the remaining allocation capacity. To account for these three unique situations only, the wasteload and load allocations are expressed as an equation rather than an absolute number. That equation is simply:

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

  In essence, this amounts to assigning a concentration-based limit to the MS4 community and nonpoint source load allocation sources for this low flow zone. While this might be seen as quite stringent, these sources tend not to be significant contributors under the low flow zone conditions. The contribution of fecal coliform from straight-pipe septic systems could be substantial under these conditions; however, these systems are still assigned a zero allocation, 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 sties. Discharge of fecal coliform from fields where manure has been land applied may occur at times. Such discharges are covered under the load allocation portion of the TMDLs, provided the manure is applied in accordance with the permit.

- The WWTF allocation and MOS were subtracted from the total loading capacity. The remaining capacity was divided between municipal separate storm sewer system (MS4) permits (wasteload allocations) and all nonpoint sources (load allocation) based on the percentage of land in an impaired reach watershed covered by MS4 permits. For example, if 10% of an impaired reach watershed is covered by a MS4 permit, 10% of the remaining capacity is allocated to that permit. In addition to being a practical way to allocate between MS4 permits and all other nonpoint sources, it is also equitable from the standpoint of rural and urban fecal coliform sources being held to the same “standard”.

Margin of Safety

- Margins of safety were calculated based on the difference between the median flow and minimum flow in each zone. For the low flow zone, this reflects the lowest daily flow observed over the period of record at the specific flow gage site used to develop allocations for each impaired reach.
- The purpose of the MOS is to account for uncertainty that the allocations will result in attainment of water quality standards. Because the allocations are a direct function of daily flows, accounting for potential flow variability in the appropriate way to address the MOS. This is done within each of the five flow zones. As stated above, the absolute minimum daily flows over long periods of record at the flow gage sites define the MOS for the low flow zone.

Load Allocations

- Once the WLA and MOS were determined for a given reach and flow zone, the remaining loading capacity was considered load allocation. The load allocation includes nonpoint pollution sources that are not subject to NPDES permit requirements, 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.

5.2 TMDL Allocations for Individual Impaired Reaches

In the sections below TMDL allocations are provided for the individual impaired reaches. Calculations for the TMDL, LA, WLA and MOS consider the total drainage area represented by the end of the listed reach. However, for simplicity the individual WLAs for permitted point sources are listed only for those permittees existing within the reach's sub-watershed. To see the individual WLA for those permitted point sources in upstream sub-watersheds see the corresponding table(s) within the section addressing those sub-watersheds.

5.21 Chippewa River; Watson Sag Diversion to Minnesota River (AUID: 07020005-501)

This reach of the Chippewa River from Watson Sag Diversion to the Minnesota River was added to the Section 303(d) Clean Water Act impaired waters list in 1994. The primary source of data that led to this listing was the MPCA long-term monitoring program. The sampling site is CH-0.5 (CH in Figure 3.21).

The Watson Sag Diversion is upstream of this site and influences flow through the main river channel. See Appendix B for an in depth discussion. As mentioned before, sampling site CH-0.5 was abandoned as a sampling site because of the influence of the Watson Sag Diversion.

The drainage area to the downstream end of this impaired reach is 2084 square miles. This represents 100% of the Chippewa River watershed area. Land use in the sub-watershed upstream of the impairment is dominated by cultivated land, but exhibits a relatively high percentage of water and wetlands. The two communities in the Bottom Chippewa sub-watershed are Montevideo and Watson. They are served by permitted wastewater treatment facilities (Table 5.21A). Montevideo has a MS4 NPDES stormwater permit (Table 5.21B). The MS4 permit covers approximately 4.5 square miles, or 4.5% of the sub-watershed, and allows for growth. The urban population, serviced by WWTFs, is 5, 686, and the rural population, serviced by ISTSs, is approximately 844, or 338 homes. Of these about 42 homes are straight-pipe septic systems. There are no NPDES permitted confinement animal feeding operations (CAFOs) in the sub-watershed (Table 5.21C). The number of non-CAFO animal units for dairy, beef, swine, poultry, and horses in the sub-watershed are 146, 1,651, 475, 2, and 242 respectively.

Table 5.21D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the USGS gage site on the Chippewa River at Milan. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.21A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Montevideo WWTF	MN0020133	3	22.7
Watson WWTF	MN0022144	0.025	0.2

Table 5.21B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
Montevideo	5482	Designated by rule: >5,000 population and within ½ mile of an impaired water

Table 5.21C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
None		

Table 5.21D: Daily Fecal Coliform Loading Capacities and Allocations – Chippewa River, Watson Sag Diversion to Minnesota River (AUID: 07020005-501)

Drainage area for listed reach (sq mi):	2084.0					
Flow gage used:	5304500					
Land Area MS4 Urban (%):	0.22	Flow Zone				
Total WWTF Flow (mgd):	9.217	High	Moist	Mid	Dry	*Low
		Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY		8026	2386	841	249	46
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		71	71	71	71	"*"
Communities Subject to MS4 NPDES Requirements		12	3	1	0.1	"*"
Livestock Facilities Requiring NPDES Permits		0	0	0	0	0
"Straight Pipe" Septic Systems		0	0	0	0	0
Load Allocation		5297	1146	454	26	"*"
Margin of Safety		2646	1166	315	152	NA
		Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY		100%	100%	100%	100%	100%
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		1%	3%	8%	29%	"*"
Communities Subject to MS4 NPDES Requirements		0.1%	0.1%	0.1%	0.02%	"*"
Livestock Facilities Requiring NPDES Permits		0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems		0%	0%	0%	0%	0%
Load Allocation		66%	48%	54%	10%	"*"
Margin of Safety		33%	49%	37%	61%	NA

Note - Allocation for all "" = (flow contribution from source) x (200 orgs./100 ml); see Sect. 5.1

5.22 Dry Weather Creek; Headwaters to Chippewa River (AUID: 07020005-509)

The Dry Weather Creek reach from its headwaters to the Chippewa River was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the Chippewa River Watershed Project (CRWP) Phase I Chippewa River Clean Water Partnership (CWP). The sampling site is 19 (Figure 3.21).

The drainage area to the downstream end of this impaired reach is 106 square miles. Land use in the sub-watershed upstream of the impairment is 94.2% cultivated, 2.4% grass, 1.5% forest, 0.5% water/wetlands, and 1.3% urban. The sub-watershed contains no communities served by permitted wastewater treatment facilities (Table 5.22A), and there are no communities requiring MS4 permits (Table 5.22B). No livestock facilities were issued NPDES permits (Table 5.22C).The number of non-CAFO animal units for dairy, beef, swine, poultry and horses in the sub-watershed are 0, 696, 1,715, 496, and 154 respectively. The rural population, served by ISTS, is approximately 889 people, or 356 homes. Of these about 46 homes are straight-pipe septic systems.

Table 5.22D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from Dry Weather Creek. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.22A: Wastewater Treatment Facilities

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

Table 5.22B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
none		

Table 5.22C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
none		

Table 5.22D: Daily Fecal Coliform Loading Capacities and Allocations – Dry Weather Creek, Headwaters to Chippewa River (AUID: 07020005-509)

Drainage area for listed reach (sq mi):	106					
Flow gage used:	Dry Weather Creek					
Land Area MS4 Urban (%):	0	Flow Zone				
Total WWTF Flow (mgd):	0	High	Moist	Mid	Dry	Low
		Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY		640	141	49	23	6
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		0	0	0	0	0
Communities Subject to MS4 NPDES Requirements		0	0	0	0	0
Livestock Facilities Requiring NPDES Permits		0	0	0	0	0
"Straight Pipe" Septic Systems		0	0	0	0	0
Load Allocation		326	71	36	10	2
Margin of Safety		313	70	13	13	4
		Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY		100%	100%	100%	100%	100%
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		0%	0%	0%	0%	0%
Communities Subject to MS4 NPDES Requirements		0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits		0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems		0%	0%	0%	0%	0%
Load Allocation		51%	50%	74%	44%	35%
Margin of Safety		49%	50%	26%	56%	65%

5.23 Chippewa River, Cottonwood Creek to Dry Weather Creek (AUID: 07020005-508)

The Chippewa River from Cottonwood Creek to Dry Weather Creek is not yet listed in the 303(d) Clean Water Act impaired waters list. Sampling data shows that this reach is impaired. The primary source of data is from the CRWPs Phase I Chippewa River CWP. The sampling site is 18 (Figure 3.21). The reach is in the Lower Chippewa River sub-watershed.

The drainage area to the downstream end of this reach is 1901 square miles. Land use in the sub-watershed includes 89.6% cultivated, 4.3% grass, 2.6% forest, 1.5% water/wetlands, and 1.9% urban. There are five wastewater treatment facilities in the sub-watershed (Table 5.23A) servicing the communities of Benson, Clontarf, Danvers, Hancock, and Holloway. These communities do not require a MS4 Stormwater permit (Table 5.23B). Three feedlots were issued NPDES permits (Table 5.23C). The number of non-CAFO animal units for dairy, beef, swine, poultry, and horses in the sub-watershed are 961, 10,414, 6,154, 0, and 42 respectively. The rural population serviced by ISTS is approximately 2,566 people or about 1,026 homes. Of these approximately 128 homes have straight-pipe septic systems.

Table 5.23D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the USGS gage site on the Chippewa River at Milan. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.23A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Benson	MN0020036	0.782	5.9
Clontarf	MNG580108	0.212	1.6
Danvers	MN0025593	0.189	1.4
Hancock	MN0023582	0.143	1.1
Holloway	MN0023728	No discharge	NA

Table 5.23B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.23C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Jennie-O Turkey Store – AJ Farm	151-50005	163,210 Turkeys
Jennie-O Turkey Store – Commerford Grower	151-50003	163,210 Turkeys
Jennie-O Turkey Store – Swenson Farm	151-50002	163,210 Turkeys

Table 5.23D: Daily Fecal Coliform Loading Capacities and Allocations – Chippewa River, Cottonwood Creek to Dry Weather Creek (AUID: 07020005-508)

Drainage area for listed reach (sq mi): 1901					
Flow gage used: 5304500					
Land Area MS4 Urban (%): 0	Flow Zone				
Total WWTF Flow (mgd): 6.192	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY	7321	2177	767	228	42
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	48	48	48	48	"*"
Communities Subject to MS4 NPDES Requirements	0	0	0	0	0
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	4859	1065	431	41	"*"
Margin of Safety	2414	1064	287	139	NA
	Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	1%	2%	6%	21%	"*"
Communities Subject to MS4 NPDES Requirements	0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits	0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems	0%	0%	0%	0%	0%
Load Allocation	66%	49%	56%	18%	"*"
Margin of Safety	33%	49%	37%	61%	NA
Note - Allocation for all "" = (flow contribution from source) x (200 orgs./100 ml); see Sect. 5.1					

5.24 Shakopee Creek, Shakopee Lake to Chippewa River (AUID: 07020005-559)

Shakopee Creek from Shakopee Lake to the Chippewa River was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the CRWP Phase I CWP. The sampling site is 16 (Figure 3.21).

The drainage area to the downstream end of this reach is 320 square miles. Land use in the sub-watershed is approximately 81.4% cultivated, 6.7% grass, 4.3% forest, 5.8% water/wetlands, 1.7% urban, and 0.11% other. There is one wastewater treatment facility in the sub-watershed (Table 5.24A) servicing the community of Kerkhoven. There are no communities which require a MS4 Stormwater permit (Table 5.24B). Four feedlots were issued NPDES permits (Table 5.24C). The number of non-CAFO animal units for dairy, beef, swine, poultry, and horses in the sub-watershed are 5,832, 3,555, 5,936, 5,629, and 62 respectively. The rural population serviced by ISTS is approximately 2,587 people or about 1,035 homes. Of these approximately 129 homes have straight-pipe septic systems.

Table 5.24D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from Shakopee Creek. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.24A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Kerkhoven	MN0020583	0.15	1.1

Table 5.24B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.24C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Dublin Dairy LLP	151-84835	2,110 Mature Dairy Cows
Willmar Poultry Farms Inc.-Countryline	151-50006	100,000 Turkeys
Willmar Poultry Farms Inc.-Highland	067-500023	100,000 Turkeys
Willmar Poultry farms Inc.-Magnum	067-500024	100,000 Turkeys

Table 5.24D: Daily Fecal Coliform Loading Capacities and Allocations – Shakopee Creek, Shakopee LK to Chippewa River (AUID: 07020005-559)

Drainage area for listed reach (sq mi):	320					
Flow gage used:	Skakopee Creek					
Land Area MS4 Urban (%):	0	Flow Zone				
Total WWTF Flow (mgd):	0.15	High	Moist	Mid	Dry	*Low
		Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY		1780	838	397	186	23
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		1	1	1	1	1
Communities Subject to MS4 NPDES Requirements		0	0	0	0	0
Livestock Facilities Requiring NPDES Permits		0	0	0	0	0
"Straight Pipe" Septic Systems		0	0	0	0	0
Load Allocation		1383	526	276	69	"*"
Margin of Safety		396	311	120	116	NA
		Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY		100%	100%	100%	100%	100%
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		0%	0%	0%	1%	5%
Communities Subject to MS4 NPDES Requirements		0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits		0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems		0%	0%	0%	0%	0%
Load Allocation		78%	63%	70%	37%	"*"
Margin of Safety		22%	37%	30%	62%	NA
Note - Allocation for all "" = (flow contribution from source) x (200 orgs./100 ml); see Sect. 5.1						

5.25 Unnamed Ditch (Judicial Ditch 29), Headwaters to CD 29 (AUID: 07020005-566)

The unnamed ditch on judicial ditch 29 was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the CRWP Phase I CWP. The sampling site is B (Figure 3.21).

The unnamed ditch is located in the upper part of the Shakopee Creek sub-watershed, and discharges to Norway Lake. The drainage area to the downstream end of this reach is 2.7 square miles. The drainage area contains no communities served by permitted wastewater treatment facilities (Table 5.25A), and there are no communities requiring MS4 permits (Table 5.25B). No livestock facilities were issued NPDES permits (Table 5.25C).

Table 5.25D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from Shakopee Creek. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.25A: Wastewater Treatment Facilities

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

Table 5.25B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.25C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
None		

Table 5.25D: Daily Fecal Coliform Loading Capacities and Allocations – Unnamed Ditch (Judicial Ditch 29), Headwaters to CD 29 (AUID: 07020005-566)

Drainage area for listed reach (sq mi): 2.7					
Flow gage used: Skakopee Creek					
Land Area MS4 Urban (%): 0	Flow Zone				
Total WWTF Flow (mgd): 0	High	Moist	Mid	Dry	Low
	Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY	15	7	3	2	0.2
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0	0	0	0	0
Communities Subject to MS4 NPDES Requirements	0	0	0	0	0
Livestock Facilities Requiring NPDES Permits	0	0	0	0	0
"Straight Pipe" Septic Systems	0	0	0	0	0
Load Allocation	12	5	2	0.6	0.01
Margin of Safety	3	3	1	1	0.2
	Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY	100%	100%	100%	100%	100%
Wasteload Allocation					
Permitted Wastewater Treatment Facilities	0%	0%	0%	0%	0%
Communities Subject to MS4 NPDES Requirements	0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits	0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems	0%	0%	0%	0%	0%
Load Allocation	78%	63%	70%	38%	4%
Margin of Safety	22%	37%	30%	62%	96%

5.26 County Ditch 29, Headwaters to Unnamed Ditch (AUID: 07020005-567)
County Ditch 29, Headwaters to unnamed ditch was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the CRWP Phase I CWP. The sampling site is A (C-10 in the Chippewa River CWP Report (Figure 3.21).

County ditch 29 is located in the upper part of the Shakopee Creek sub-watershed, and discharges to Norway Lake. The drainage area to the downstream end of this reach is 6.7 square miles. The drainage area contains no communities served by permitted wastewater treatment facilities (Table 5.26A), and there are no communities requiring MS4 permits (Table 5.26B). No livestock facilities were issued NPDES permits (Table 5.26C).

Table 5.26D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from Shakopee Creek. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.26A: Wastewater Treatment Facilities

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

Table 5.26B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.26C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
None		

Table 5.26D: Daily Fecal Coliform Loading Capacities and Allocations – County Ditch 29, Headwaters to Unnamed Ditch (AUID: 07020005-567)

Drainage area for listed reach (sq mi):	6.7					
Flow gage used:	Skakopee Creek					
Land Area MS4 Urban (%):	0	Flow Zone				
Total WWTF Flow (mgd):	0	High	Moist	Mid	Dry	Low
		Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY		37	17	8	4	0.5
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		0	0	0	0	0
Communities Subject to MS4 NPDES Requirements		0	0	0	0	0
Livestock Facilities Requiring NPDES Permits		0	0	0	0	0
"Straight Pipe" Septic Systems		0	0	0	0	0
Load Allocation		29	11	6	1	0.02
Margin of Safety		8	6	2	2	0.5
		Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY		100%	100%	100%	100%	100%
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		0%	0%	0%	0%	0%
Communities Subject to MS4 NPDES Requirements		0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits		0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems		0%	0%	0%	0%	0%
Load Allocation		78%	63%	70%	38%	4%
Margin of Safety		22%	37%	30%	62%	96%

5.27 County Ditch 27, Unnamed Ditch to Unnamed Ditch (AUID: 07020005-570)

County Ditch 27, unnamed ditch to unnamed ditch was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the CRWP Phase I CWP. The sampling site is C…A-12 in the Chippewa River CWP Report (Figure 3.21).

County ditch 27 is located in the upper part of the Shakopee Creek sub-watershed, and discharges to Norway Lake. The drainage area to the downstream end of this reach is 13.4 square miles. The drainage area contains no communities served by permitted wastewater treatment facilities (Table 5.27A), and there are no communities requiring MS4 permits (Table 5.27B). No livestock facilities were issued NPDES permits (Table 5.27C).

Table 5.27D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from Shakopee Creek. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.27A: Wastewater Treatment Facilities

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

Table 5.27B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.27C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
None		

Table 5.27D: Daily Fecal Coliform Loading Capacities and Allocations – County Ditch 27, Unnamed Ditch to Unnamed Ditch (AUID: 07020005-570)

Drainage area for listed reach (sq mi):	13.4					
Flow gage used:	Skakopee Creek					
Land Area MS4 Urban (%):	0	Flow Zone				
Total WWTF Flow (mgd):	0	High	Moist	Mid	Dry	Low
		Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY		74	35	17	8	1
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		0	0	0	0	0
Communities Subject to MS4 NPDES Requirements		0	0	0	0	0
Livestock Facilities Requiring NPDES Permits		0	0	0	0	0
"Straight Pipe" Septic Systems		0	0	0	0	0
Load Allocation		58	22	12	3	0.03
Margin of Safety		17	13	5	5	1
		Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY		100%	100%	100%	100%	100%
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		0%	0%	0%	0%	0%
Communities Subject to MS4 NPDES Requirements		0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits		0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems		0%	0%	0%	0%	0%
Load Allocation		78%	63%	70%	38%	4%
Margin of Safety		22%	37%	30%	62%	96%

5.28 Chippewa River East Branch, Mud Creek to Chippewa River (AUID: 07020005-514)

The East Branch, Mud Creek to Chippewa River was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the CRWP Phase I CWP. The sampling site is 9 (Figure 3.21).

The drainage area to the downstream end of this reach is 509 square miles. Land use in the sub-watershed includes 65.9% cultivated, 17.3% grass, 6.3% forest, 9.3% water/wetlands, 1.2% urban, and 0.1 other. There are two wastewater treatment facilities in the sub-watershed (Table 5.28A) servicing the communities of Murdock, and Sunburg. These communities do not require a MS4 Stormwater permit (Table 5.28B). No feedlots were issued NPDES permits (Table 5.28C). The number of non-CAFO animal units for dairy, beef, swine, poultry, and horses in the sub-watershed are 6,197, 12,640, 2,934, 4,734, and 487 respectively. The urban population serviced by WWTFs is approximately 206. The rural population serviced by ISTS is approximately 4,249 people or about 1,670 homes. Of these approximately 212 homes have straight-pipe septic systems.

Table 5.28D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from East Branch Chippewa River. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.28A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Murdock	MN0052990	0.319	2.4
Sunburg	MN0063894	0.122	0.9

Table 5.28B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.28C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
None		

Table 5.28D: Daily Fecal Coliform Loading Capacities and Allocations – Chippewa River East Branch, Mud Creek to Chippewa River (AUID: 07020005-514)

Drainage area for listed reach (sq mi):	509					
Flow gage used:	East Branch					
Land Area MS4 Urban (%):	0	Flow Zone				
Total WWTF Flow (mgd):	0.442	High	Moist	Mid	Dry	Low
		Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY		3387	1549	829	484	242
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		3	3	3	3	3
Communities Subject to MS4 NPDES Requirements		0	0	0	0	0
Livestock Facilities Requiring NPDES Permits		0	0	0	0	0
"Straight Pipe" Septic Systems		0	0	0	0	0
Load Allocation		2386	1045	674	309	106
Margin of Safety		997	501	152	171	132
		Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY		100%	100%	100%	100%	100%
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		0%	0%	0%	1%	1%
Communities Subject to MS4 NPDES Requirements		0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits		0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems		0%	0%	0%	0%	0%
Load Allocation		70%	67%	81%	64%	44%
Margin of Safety		29%	32%	18%	35%	55%

5.29 Chippewa River, Unnamed Creek to East Branch Chippewa River (AUID: 07020005-505)

Chippewa River, unnamed Creek to the East Branch of the Chippewa River was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the CRWP Phase I CWP. The sampling site is 6 (Figure 3.21).

The drainage area to the downstream end of this reach is 758 square miles. Land use in the sub-watershed includes 68.2% cultivated, 12.1% grass, 5.2% forest, 11.3% water/wetlands, 2.1% urban, and 0.1 other. There are four wastewater treatment facilities in the sub-watershed (Table 5.29A) servicing the communities of Cyrus, Glenwood, Lowry, and Starbuck. These communities do not require a MS4 Stormwater permit (Table 5.29B). One feedlot was issued a NPDES permit (Table 5.29C). The number of non-CAFO animal units for dairy, beef, swine, poultry, and horses in the sub-watershed are 9,300, 20,009, 3,864, 413, and 5,048 respectively. The urban population serviced by WWTFs is approximately 4,951. The rural population serviced by ISTS is approximately 3,383 people or about 1,353 homes. Of these approximately 169 homes have straight-pipe septic systems.

Table 5.29D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the middle sub-watershed of the Chippewa River. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.29A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Cyrus	MN0052396	No discharge	NA
Glenwood	MN0052710	No discharge	NA
Lowry	MN0024007	0.408	3.1
Starbuck	MN0021415	0.281	2.1

Table 5.29B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.29C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
Canadian Connection	149-50009	4,400 Swine-55lbs or more

Table 5.29D: Daily Fecal Coliform Loading Capacities and Allocations – Chippewa River, Unnamed Creek to East Branch Chippewa River (AUID: 07020005-505)

Drainage area for listed reach (sq mi):	758					
Flow gage used:	Middle					
Land Area MS4 Urban (%):	0	Flow Zone				
Total WWTF Flow (mgd):	4.5	High	Moist	Mid	Dry	Low
		Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY		3621	2070	1057	664	262
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		34	34	34	34	34
Communities Subject to MS4 NPDES Requirements		0	0	0	0	0
Livestock Facilities Requiring NPDES Permits		0	0	0	0	0
"Straight Pipe" Septic Systems		0	0	0	0	0
Load Allocation		2953	1321	808	335	74
Margin of Safety		634	715	216	295	154
		Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY		100%	100%	100%	100%	100%
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		1%	2%	3%	5%	13%
Communities Subject to MS4 NPDES Requirements		0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits		0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems		0%	0%	0%	0%	0%
Load Allocation		82%	64%	76%	50%	28%
Margin of Safety		18%	35%	20%	44%	59%

5.210 Chippewa River, Headwaters to Little Chippewa River (AUID: 07020005-503)

The Chippewa River, headwaters to Little Chippewa River was added to the Section 303(d) Clean Water Act impaired waters list in 2006. The primary source of data that led to this listing was the CRWP Phase I CWP. The sampling site is 2 (Figure 3.21).

The drainage area to the downstream end of this reach is 427 square miles. Land use in the sub-watershed includes 60.3% cultivated, 14.9% grass, 9.1% forest, 13.8% water/wetlands, and 1.8% urban. There are five wastewater treatment facilities in the sub-watershed (Table 5.210A) servicing the communities of Brandon, Evansville, Farwell-Kensington, Hoffman, and Millerville. These communities do not require a MS4 Stormwater permit (Table 5.210B). No feedlots were issued NPDES permits (Table 5.210C). The number of non-CAFO animal units for dairy, beef, swine, poultry, and horses in the sub-watershed are 13,749, 16,975, 4,933, 360, and 244 respectively. The urban population serviced by WWTFs is approximately 2,198. The rural population serviced by ISTS is approximately 2,984 people or about 1,194 homes. Of these approximately 149 homes have straight-pipe septic systems.

Table 5.210D describes the average daily fecal coliform loading capacities for this reach to achieve water quality standards, as well as the component wasteload allocations, load allocations, and margins of safety. The loading capacities for five flow zones were developed using flow data from the upper sub-watershed of the Chippewa River. Substantial reductions in fecal coliform loading from straight-pipe septic systems, and a variety of nonpoint sources will likely be required to meet the allocations. The flow duration curve for this reach is in appendix C.

Table 5.210A: Wastewater Treatment Facilities

Name	Permit Number	Discharge (mgd)	WLA (billions/day)
Brandon	MN0055841	No discharge	NA
Evansville	MNG580074	0.750	5.7
Farwell-Kensington	MN0065293	0.571	4.3
Hoffman	MN0021199	2.478	18.8
Millerville	MN0054305	No discharge	NA

Table 5.210B: Municipal Separate Storm Sewer System (MS4) Communities

Community	Population Estimate	Category
None		

Table 5.210C: Livestock Facilities with NPDES Permits

Facility	ID Number	Description
None		

\

Table 5.210D: Daily Fecal Coliform Loading Capacities and Allocations – Chippewa River, Headwaters to Little Chippewa River (AUID: 07020005-503)

Drainage area for listed reach (sq mi):	427					
Flow gage used:	Upper					
Land Area MS4 Urban (%):	0	Flow Zone				
Total WWTF Flow (mgd):	3.8	High	Moist	Mid	Dry	Low
		Billion organisms per day				
TOTAL DAILY L0ADING CAPACITY		1911	1312	561	331	137
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		29	29	29	29	29
Communities Subject to MS4 NPDES Requirements		0	0	0	0	0
Livestock Facilities Requiring NPDES Permits		0	0	0	0	0
"Straight Pipe" Septic Systems		0	0	0	0	0
Load Allocation		1687	726	444	162	17
Margin of Safety		194	558	89	140	91
		Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY		100%	100%	100%	100%	100%
Wasteload Allocation						
Permitted Wastewater Treatment Facilities		2%	2%	5%	9%	21%
Communities Subject to MS4 NPDES Requirements		0%	0%	0%	0%	0%
Livestock Facilities Requiring NPDES Permits		0%	0%	0%	0%	0%
"Straight Pipe" Septic Systems		0%	0%	0%	0%	0%
Load Allocation		88%	55%	79%	49%	13%
Margin of Safety		10%	42%	16%	42%	67%

5.3 Impacts of Growth on Allocations

The overall projected population growth for the next 15 years in the watershed is estimated to be 2% with Douglas, Kandiyohi, Otter Tail, and Stevens increasing in population while Chippewa, Grant, Pope, and Swift will decrease in population. This growth will occur with adequate WWTF and/or good septic systems such that fecal coliform will not increase. Municipal WWTF currently represent a small proportion of the watershed loads and are regulated through NPDES permits. Under these permits, WWTFs must discharge below the standard of 200 cfu/100ml. New septic systems that are functioning properly will not discharge fecal coliform to surface waters. Changes in the human population should not change the load allocations provided in this report.

<u>Straight Pipe Septic Systems</u>

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

<u>Wastewater Treatment Facilities</u>

Flows at some wastewater treatment facilities are 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, the increased flows will not impact the allocation given to other sources. This is because an increased flow from WWTFs adds to the overall loading capacity by increasing river flows.

<u>Municipal Separate Strom Sewer Systems</u>

Expansion of the current MS4 community in the watershed is not likely to take place, because of the declining population trend in the County.

<u>Livestock</u>

The other major source of fecal coliform in the watershed, besides human, is livestock. While there have been changes in the sizes and types of 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 in the watershed.

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

6.0 Margin of Safety

Under section 303(d) of the Clean Water Act, a "margin of safety" (MOS) is required as part of a TMDL report. The purpose of the MOS is to account for uncertainty that the allocations will result in attainment of water quality standards. For the ten impaired reaches covered in this report, an explicit margin of safety is provided for each of the flow periods for each impaired reach. As described in section 5 and Appendix A of this document, the MOS is based on the difference between the loading capacity as calculated at the mid-point of each of the five flow ranges, and the loading capacity calculated at the minimum flow in each zone. Given that the loading capacity is typically much less at the minimum flow of a zone as compared to the mid-point, a substantial MOS is provided. The MOS ensures that allocations will not exceed the load associated with the minimum flow in each zone. Because the allocations are a direct function of daily flow, accounting for potential flow variability is the appropriate way to address the MOS. The minimum daily flows over long periods of record define the MOS for the low flow zone.

7.0 Seasonal Variation

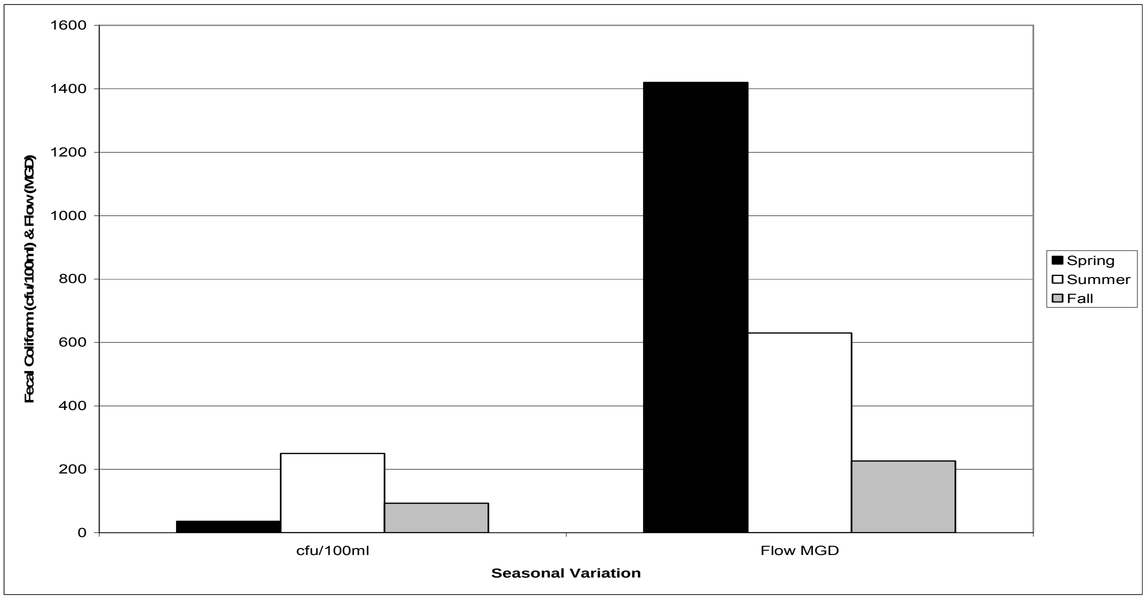
The flow duration approach utilized in this report captures the full range of flow conditions over the April-October period when the fecal coliform water quality standard applies. Seasonal variation in flow is a key part of TMDL development. Daily loads are directly proportional to flows (i.e. load equals flow times concentration times a conversion factor).

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

Summer is the peak season of cattle grazing and agriculture. Soil applications of manure are limited in summer and the soil is presumably at peak seasonal load for fecal coliform by mid summer and is most sensitive to rainfall driven transport mechanisms. Site 18 in the Lower sub-watershed illustrates the variation in fecal coliform concentrations and flows by season (Table and Figure 7.01).

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

Figure 7.01: Seasonal Variation of Fecal Coliform cfu/100ml & Flow MGD at site 18



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

Table 7.01: Flow Duration Curve Loading by Months

	Duration Curve Zone (Loading Capacity expressed as Billion organisms per day)				
	High	**Moist**	**Mid**	**Dry**	**Low**
Chippewa River: Watson Sag Diversion to Minnesota River	7,321	2,177	767	228	42
Seasonal Considerations [most likely zone(s) by month]		**April**			
		May	**May**		
			June	**June**	
			July	**July**	
				August	
				September	
			October	**October**	

8.0 Monitoring Plan

The goal of the monitoring plan is to assess if the reduction strategies are effective in attaining water quality standards and designated uses. The impaired reaches will remain listed until water quality standards for fecal coliform are met.

The CRWP will continue their monitoring efforts in the watershed. Further monitoring sites may be added upon the implementation of the BMPs. Implementation activities at the sub-watershed level will be re-evaluated after monitoring and BMPs can be modified as needed. Annual results will be included in the yearly Chippewa River Watershed Monitoring Summary.

9.0 Implementations

9.1 Implementation through Source Reduction Strategies

The CRWP embraces a watershed-wide approach to achieving water quality standards for fecal coliform bacteria within ten years. The final implementation plan will be developed within a year of the final approval of the report by the EPA. The implementation plan will spell out what and where BMPs will be applied in the sub-watersheds, and identifies the cost and funding sources for their application.

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

Table 9.01: Implementation Opportunities for the Different Flows Regimes

<table>
<tr><th rowspan="2"></th><th colspan="5">Duration Curve Zone</th></tr>
<tr><th>High</th><th>Moist</th><th>Mid</th><th>Dry</th><th>Low</th></tr>
<tr><td rowspan="6">Implementation Opportunities</td><td colspan="2">Long-term CSO plans</td><td></td><td colspan="2">Municipal NPDES</td></tr>
<tr><td></td><td colspan="4">On-site wastewater management</td></tr>
<tr><td></td><td colspan="4">Pasture management & riparian protection</td></tr>
<tr><td colspan="4">Urban stormwater management</td><td></td></tr>
<tr><td colspan="4">Open lot agreements</td><td></td></tr>
<tr><td colspan="2">Manure management</td><td colspan="3"></td></tr>
</table>

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

9.2 Locally Targeted Implementation

Change does not happen without good information and education, but once that is delivered people need instructions and options for making changes. The CRWPs plan for implementing clean water has been broken down into several phases. Based on water quality data the large 1.3 million acre watershed was divided into six priority sub-watersheds. Additional dollars are sought for each priority sub-watershed and specialized implementation practices are targeted. Each person has the ability to choose to implement BMPs for water quality in their daily life. The CRWPs goal is to help make these changes happen through education, training, and monetary incentives.

- The Shakopee Creek Sub-watershed, the first identified priority area in the watershed due to elevated levels of sediment, nutrients and bacteria, received a 319 grant in 2001 and in 2005 to implement best management practices for improving water quality. The BMPs include: CRP filter strips, CREP filter strips, livestock exclusion, sediment basins, nutrient management plans, wetland restorations, and shoreline naturalizations.
- East Branch Sub-watershed, the second priority sub-watershed, received 319 funding of in 2002 for improvement projects. BMPs include fencing and watering for livestock, buffer strip incentives, shoreline naturalization projects, alternative tile intakes, nutrient management, and special projects.
- The Lower Sub-watershed, the third priority sub-watershed was awarded a 319 grant in 2003 to use for water quality improvement projects and practice incentives. Money is targeted towards buffer strips, alternative tile intakes, livestock exclusion, and other special projects.
- The Upper Sub-watershed, mostly Douglas County, has funds available in 2004 for shoreline restorations, alternative tile intakes, buffer strips, septic system compliance, manure testing and other water quality improvement projects.
- Conservation Security Program (CSP) – The CSP is a component of the Federal Farm Bill that pays producers for good conservation they are currently doing and provides financial incentives for producers wanting to increase their conservation activities. The USDA plans to rotate CSP throughout all the watersheds in the country. The Chippewa River Watershed is making producers aware of this opportunity and provides a CSP Self-Assessment Workbook on their website: http://www.chippewariver.com.
- Waste Water Treatment Facilities – Counties, Regional Development Commissions and MPCA staff will work with unsewered areas to bring them into compliance. The six unsewered areas in this report are listed in Table 4.02. It is estimated that it will cost approximately 6 million dollars to upgrade these communities with WWTFs.

- Individual Septic Treatment Systems – Three percent low interest loan dollars are available to aid landowners in upgrading their ISTS.

Watershed County	Funds Available
Douglas	$175,000
Chippewa	$ 65,000
Swift	$65,000 (Expended all funds)
Pope	$70,000 (Expended all funds)
Kandiyohi	$ 99,000
Grant	$ 25,000

10. Reasonable Assurance

10.1 Evidence of BMP Implementability

The source reduction strategies listed are shown to be successful in reducing pathogen transport and survival and to be capable of widespread adoption by land owners and local resource managers. The CWRP will apply for available grants and loans to implement BMPs.

- Feedlot runoff controls – these are evaluated by professional engineers through the Feedlot Evaluation Model referenced in Minn. R. ch. 7020. These rules are implemented by the MPCA staff and by local staff of counties via a delegation agreement with the Agency.
- Individual Sewage Treatment Systems –ISTS with proper drain fields provide virtually complete treatment of fecal coliform bacteria. Acceptable designs are described in Minn. R. ch. 7080. All counties in the watershed are delegated to implement these rules, which require conformance with state standards for new construction and disclosure of the state of the system when property transfers ownership.
- Municipal Wastewater Disinfection – Disinfection with chlorine or ultraviolet radiation is required of all NPDES permitted facilities.
- Land Application of Manure – Buffer strips, immediate incorporation, and maintenance of surface residue have been demonstrated to reduce manure and pathogen runoff (EQB, 1999). The state feedlot rules (Minn. Rules part 7020) require manure application record-keeping and manure management planning, with requirements differing according to operation size, and manure application pollution risk based on method, time and place of application.
- Erosion Control and Sediment Reduction – Conservation tillage and riparian buffer strips have been shown to be effective in reducing sediment delivery to streams. Since embedded sediment can serve as a substrate for fecal coliform survival, reduction of sediment sources is considered an effective measure for controlling fecal coliform bacteria in streams.
- Planned Rotational Grazing – Sovell, et.al., 2000, demonstrated that rotational grazing, in contrast to conventional grazing, significantly reduces

both sedimentation and fecal coliform concentrations in water downstream of study sites in southeastern Minnesota.

- Urban Stormwater Management – Practices such as runoff detention, infiltration, and street sweeping have been shown to be effective in reducing urban runoff and associated pollutant.

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

The lead for implementation will be sponsored by the Chippewa River Watershed Project. The local work group of the CRWP is composed of CRWP technical staff, County representatives and personnel from Soil and Water Conservation Districts, Board of Soil and Water Resources, Department of Natural Resources, Minnesota Pollution Control Agency, and the Natural Resources and Conservation Services. The local work group will monitor and evaluate the implementation strategies, and will advise and make recommendations on the progress of the strategies to the CRWP Board.

11.0 Public Participation

The CRWP conducted four public meetings in June, 2003 in four cities around the watershed, Benson, Glenwood, Brandon, and Montevideo, to inform citizens on the impact of the fecal coliform TMDL on the Chippewa River. Over 400 invitations were mailed or emailed to citizens and interested parties in the watershed, and notices of the meetings were put in the local newspapers. Comments from the meetings, and the agendas and handouts are in the Appendix.

The draft TMDL report is available to the public via the MPCA web site at http://www.pca.mn.us/water/tmdl.html. A public meeting was held on September 14, 2006 at Glenwood. A public notice was posted in the State Register and the public comment period extended from October 9, 2006 to November 7, 2006. Written comments are in the Appendix.

Many local, state, and federal agencies have been involved in the public participation process including, but not limited to, representatives from the Soil and Water Conservation Districts and Natural Resources Conservation Services, County Boards, County Environmental Services, and Land and Resource Management Offices, MN Department on Natural Resources, MN Pollution Control Agency, Board of Soil and Water Resources, County Extension Service, Prairie Country RC&D, Land Stewardship, and the Chippewa River Watershed Project. These agencies, in cooperation with the local residents, landowners, and farm operators, have contributed to the understanding of the political, economic, and natural resource aspects of the report and the ultimate implementation plan.

12.0 References

Aldersisio, K. A. and N. DeLuca. 1999. Seasonal enumeration of fecal coliform bacteria from the feces of ring-billed gulls (Larus delawarensis) and canada geese (Branta canadensis). Applied and Environmental Microbiology, December, p.5628-5630

American Veterinary Medical Association (AVMA). 2002. Pet ownership and demographics source book. AVMA, Schaumberg, IL

Baxter-Potter, W., and M. Gilliland.1988. Bacterial pollution in runoff form agricultural lands. J. Environmental Quality. 17(1):27-34

Chippewa River Watershed Project (CRWP). 2003. Chippewa River watershed monitoring summary 2003. www.chippewariver.com, 9p.

Cleland, B, R. 2002. Tmdl development from the "bottom up" – part II: using duration curves to connect the pieces. National TMDL Science and Policy 2002 -- WEF Specialty Conference. Phoenix, AZ

Gillingham, W. 2003. Minnesota Pollution Control Agency. Personal communication

Guidice, John. 2003. DNR Farmland Wildlife Research Group. Personal communication

League of Minnesota Cities. 2003. Directory of Minnesota city officials. League of MN Cities. 296 p.

Maxson, Steve, DNR Goose Specialist. 2003. Personal Communication.

Minnesota Department of Natural Resources (MnDNR). 2003. Personal Communication.

Minnesota Environmental Quality Board (EQB). 1999. Generic environmental impact statement on animal agriculture. EQB, St, Paul MN. 142p

Minnesota Pollution Control Agency. 2006. Revised regional total maximum daily load evaluation of fecal coliform bacteria impairments in the lower Mississippi river basin in Minnesota. MPCA, St. Paul. 123p

Mulla, D. J., 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. EQP and Citizen Advisory Comm., 125 p.

Olsen, K, and J. Churchill. 2000. Chippewa river watershed project, clean water partnership phase I, diagnostic study report and implementation plan. Chippewa River Watershed Project. 135 p.

Osborn, Robert. 2003. DNR Farmland Research Group. Personal Communication

Sovell, Laurie, et. al., 2000. Impacts of rotational grazing and riparian buffers on physiochemical and biological characteristics of southeastern Minnesota, USA, streams. Environmental Management, 26(6) pp629-641

USEPA. 2001. Protocol for developing pathogen tmdls, 1st Edition. EPA 841-R-00-002. Office of Water, USEPA, Washington, DC. 132 pp.

Appendix A:

Chippewa River Fecal Coliform TMDL: Methodology for TMDL Equations and Load Duration Curves

The loading capacity determination used for this report is based on the process developed for the "Revised Regional Total Maximum Daily Load Evaluation of Fecal Coliform Bacteria Impairments in the Lower Mississippi River Basin in Minnesota" (Jan 2006). This process is known as the "Duration Curve" method.

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

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

$$\text{100 cubic feet/sec} \times \text{200 orgs/100ml} \times \text{28,312 ml/cubic ft} \times \text{86,400 sec/day} \div \text{1 billion}$$
$$= \text{489 billion organisms per day}$$

The flow monitoring data used in this project was from one U.S. Geological Survey gage station and five Clean Water Partnership (CWP) stations. The USGS database contained 69 years of flow data; the CWP stations had from six to seven years of flow data (Table A). Because for some listed reaches the drainage areas represented is somewhat larger than the drainage area represented by the flow gage station used, a proportional adjustment was made for the TMDL calculation. For example, the TMDL for Site 2 (AUID 07020005-503) was normalized by a factor of 427/347 (the respective drainage areas), or 1.23, to provide a more accurate allowable loading capacity for the larger area.

A similar adjustment was made for the Bottom Chippewa site (Site CH 0.5; AUID 07020005-501). Flow data at the upstream USGS gage (05304500) near Milan was used and was adjusted upward based on the respective drainage areas. The actual flow at the Bottom site is actually lower than this estimate, however, due to an upstream diversion of a portion of the flow to the Lac qui Parle Reservoir for the purpose of flood control. While it may be possible through a series of assumptions and estimates to approximate the allowable loads for upstream sources based on which portion of the load goes to the Bottom site vs. the diversion (and during what flow regimes), but that likely would have been needlessly complicated. To keep matters simpler, while still being protective of the water quality, this project chose to base the TMDL on the total estimated flow of the watershed and simply point out that a portion of the allowable load goes to the Bottom site and the remainder goes to the diversion.

Flow data for the three ditch sites was not available and, therefore, were estimated by normalizing data from the downstream Shakopee Creek gage station. For example, the Unnamed Ditch (JD 29; Site B) impaired reach drainage area is 0.89% (2.7/303) of the drainage area monitored by the Shakopee Creek gaging station. Calculated flows were then checked against a single year of available flow data for the ditch site, which showed a reasonable degree of alignment.

TMDLs were calculated for all the flow zones for each listed reach of the project. The TMDLs were then divided into a Margin of Safety (MOS), Wasteload Allocations (WLAs) and a Load Allocation (LA).

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

The final step in the process was determining the portion of the load that needs to be allocated for wastewater treatment facilities (WWTFs) and the one permitted stormwater municipal separate storm sewer system (MS4) community in the watershed (Montevideo).

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

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

The WWTF allocation and MOS were subtracted from the total loading capacity. The remaining capacity was divided between MS4 permitted stormwater and all nonpoint sources (load allocation) based on the percentage of land in an impaired reach watershed covered by MS4 permits. In the case of the Bottom watershed the percentage of land area covered by Montevideo was 0.22%, so 0.22% of the remaining capacity was allocated to that permit. In addition to being a practical way to allocate between MS4 permits and all other nonpoint sources, it is also equitable from the standpoint of rural and urban fecal coliform sources being held to the same “standard.” (Note: for Montevideo the area currently designated as urbanized is 2.3 square miles according to http://www.census.gov/geo/www/ua/uaucinfo.html, but this project used the actual municipal boundary area, 4.5 square miles, to provide for future growth or “reserve capacity.”)

Load duration curves used the flow duration data and factored in the fecal coliform standard to determine and display the allowable load for each flow percentile. The loads represented by grab samples were calculated and plotted. The samples representing greater than 50% storm flow were calculated using the methodology described in “HYSEP: A Computer Program for Streamflow Hydrograph Separation and Analysis,” US Geological Survey, Water-Resources Investigations Report 96-4040.

Table A. Chippewa River Fecal Coliform TMDL general reach information

Reach	Description	Assessment Unit ID	STORET	CWRP MPCA Site #	Subshed	Flow Data source (years)	Drainage area*, sq mi	
							AUID	At monitoring station
Chippewa River	Watson Sag Diversion to Minnesota R	07020005-501	S000-175	CH-0.5	Bottom	USGS 05304500 (37-05)	2084	1880
Chippewa River	Headwaters to Little Chippewa R	07020005-503	S002-190	2	Upper	CWP / Hydstra (99, 01-05)	427	347
Chippewa River	Unnamed Cr to E Br Chippewa R	07020005-505	S002-193	6	Middle	CWP / Hydstra (99-05)	758	740**
Chippewa River	Cottonwood Cr to Dry Weather Cr	07020005-508	S002-203	18	Lower	USGS 05304500 (37-05)	1901	1880
Dry Weather Creek	Headwaters to Chippewa R	07020005-509	S002-204	19	Dry Weather Cr	CWP / Hydstra (99-05)	106	98
Chippewa River, East Branch	Mud Cr to Chippewa R	07020005-514	S002-196	9	East Branch	CWP / Hydstra (99-05)	510	509
Shakopee Creek	Shakopee Lk to Chippewa R	07020005-559	S002-201	16	Shakopee Cr	CWP / Hydstra (99-05)	320	303
Unnamed Ditch (Judicial Ditch 29)	Headwaters to CD 29	07020005-566	S002-206	B	Shakopee Cr	Est from Shak Cr	2.7	2.7
County Ditch 29	Headwaters to Unnamed Ditch	07020005-567	S002-197	C	Shakopee Cr	Est from Shak Cr	6.7	6.6
County Ditch 27	Unnamed Ditch to Unnamed Ditch	07020005-570	S002-198	A	Shakopee Cr	Est from Shak Cr	13.4	12.9

* Drainage areas were taken from either the 8 digit HUCs or the NRCS watersheds (similar to 12 digit HUCs). For reaches that do not correspond to the outlet of these watersheds, Arc Hydro was used to generate drainage areas. The Arc Hydro delineations were checked against the DNR minor watersheds for error. Discrepancies between the two watershed datasets were approximated and appended to the total drainage area. The datum and projection that this was done in is Nad 1983, UTM 15N.

** This area was corrected for discrepancies in the Arc Hydro delineation (vs. DNR delineation). The final drainage area was adjusted to reflect the DNR delineation (12,829 acres were added to the Arc Hydro delineation acreage).

Appendix B:
<u>Lower Chippewa River Back Water/Back Flow Issues</u>

3/17/06, GDJ
Revised 3/21/06
Revised 3/30/06
Revised 4/06/06
Revised 4/20/06

See my preferred recommendation and proposed actions at the end of the text for my key conclusion and suggested approach (page 7 & 8).

The presence of back flow from the Minnesota River into the lower reach of the Chippewa River has been identified as a possible source of fecal coliform bacteria in the draft Chippewa River Fecal Coliform TMDL. A weight of evidence evaluation was undertaken in an effort to determine if the Minnesota River is a likely source of fecal coliform bacteria in the lower reach of the Chippewa River. The evaluation consisted of conversations with people familiar with the reach, development of duration curves, and comparisons of USGS discharge information for gage sites on the Minnesota and Chippewa Rivers.

A map of the area is provided in Figure 1 for reference. Site 20 has alternate names of MNCH-0.5 and CH-0.5. Its STORET identification number is S000-175. It is located at the Minnesota Highway 7 Bridge over the Chippewa River. Site 20 is approximately ½ ways between the dam and the river's confluence with the Minnesota River. Ambient monitoring by the MPCA was discontinued in 1994 (from NH3 TMDL) with follow-up monitoring by PCA and the Chippewa River Project in 2001 and 2001 – 2004, respectively (already in report, or in NH3 TMDL report). The Montevideo WWTP discharge is located just upstream of the sampling site.

<u>Observations made by people familiar with the rivers at Montevideo:</u>

- Terry Zien, USCOE – he did river modeling work for flood control design project – the modeling was focused on high water levels following the 1997 flood
    - <u>Modeling</u> indicated:
        - o that the Minnesota River is largely a pool above the Hwy. 212 constriction
        - o water level drop was only about ½ foot compared with about a ten foot drop with the dam at lower flows
        - o still some velocity in the Chippewa River – no to limited actual back flow probably exists – if it does exist, it probably would only extend up the Chippewa about ¼ to ½ mile
        - o Chippewa River becomes a flat surface about ½ way up into the city, but no back flow expected
        - o Little effect of the Minnesota River expected on the Chippewa River in in-bank flows (other than decreased stream velocities)

- High water (flooding) results in pooled water behind the area's roads – they fill with water and then just sit there
- Discharge peaks for the two rivers usually coincide – upwards of 95% of the time
- Wastewater treatment plant levy was not topped in the modeling
- Design report conclusion was that the Chippewa River flow was not a big factor in the water levels present; rather, levels primarily a result of Minnesota River stage
- Modeling completed for spring flood conditions – conditions may be different in different seasonal situations
- Possible fecal sources in the reach area – WWTP, stormwater, septics (especially in subdivision located on west bank of river on a point bar)

- Skip Wright, DNR
  - Didn't have specific information, but knows that there can be back water, river is channelized from the dam to the confluence with the Minnesota River
  - DNR interested in removing the dam given its barrier to fish and safety hazard
  - Involved in some monitoring in Willmar that is showing high fecal coliform numbers in stormwater – thinking is that they may be a result of cross-over between sewage and stormwater pipes (CSO), septics not being hooked up, and geese
- Paul Wymar, Chippewa River Watershed Project
  - Site 20 is located at the MN Hwy. 7 bridge
  - The dam is located about ½ mile upstream of the Hwy. 7 bridge
  - Confluence with the Minnesota River is about ½ to 1 mile downstream
  - Floodplain of the Minnesota River is higher than the Chippewa River – observes flood waters flowing down into the Chippewa River, sees back flow and water levels being the same
  - Doesn't have elevations for the area
- Dave Berryman, city engineer for Montevideo
  - Dam not owned by the city, may be owned by MnDOT
    - City Parks staff manage the water level planks on the dam
  - Has design plans for the dam from MnDOT dated 1957
    - Proposed elevation of concrete slab at bottom of dam is 913 feet
    - Dam was new given realignment of the channel
- Glenn Yakel, DNR Hydrographics Office
  - Letter in file infers that MnDOT owns the dam – but is surprised that MnDOT would own a dam
- Gerry Vick, MnDOT
  - No information that the dam is owned by MnDOT – cooperative agreement for the project identifies the road work, but not the dam
  - Sent link to view the plans on-line

<u>1958 design plans for the dam on the Chippewa River in Montevideo</u>

- Top of dam at elevation 932.0 ft
- Base of dam at elevation 913.0 ft
- High water elevation identified as 930.0 ft in 1952

Text in Chippewa River Un-ionized Ammonia TMDL

- Page 3 – There is a U.S. Army Corps of Engineers flood control project on the Chippewa upstream of Montevideo, Minnesota. This project provides a flow diversion from the Chippewa River into the Lac qui Parle Reservoir on the Minnesota River. The flow diversion is designed to provide flood protection to downstream areas including Montevideo. The project was authorized by Congress in 1936 and construction was completed in 1951 (http://www.mvp.usace.army.mil/flood_control/LacQuiParle/; accessed 9/4/2002). The diversion consists of two control structures, the Chippewa diversion dam and the Watson Sag Weir. Flood waters are diverted through the weir into the Watson Sag which flows into the Lac qui Parle Reservoir upstream of the Chippewa River confluence with the Minnesota River, effectively bypassing the Chippewa River. The structures work in concert to store and release flood waters while maintaining some flow in both the Chippewa River and the Watson Sag.

  During non-winter months, the inflow is split approximately equally between the Watson Sag and the Chippewa River below the diversion. However, during low flow conditions, the U.S. Army Corps of Engineers sometimes lets more water go through the diversion dam and allows only 10 to 20 percent of the flow to go over the Sag under the theory that the Chippewa River has more critical in-stream flow needs (Kenton Spading, U.S. ACOE, via telefax). As winter approaches, the gate at the Chippewa diversion dam is closed and subsequently becomes frozen shut. During icing periods, a low-flow outlet diverts about 10 percent of inflow into the Watson Sag (in order to maintain its aquatic habitat) while the remaining 90 percent continues down the Chippewa River (http://www.crh.noag.gov/ncrtc/forecast_groups/min/ wtsm5/wtsm5_new.html; accessed 9/4/02).

- Page 29 – Seasonal 30-day low flow data were estimated based on surrogate flow series at Montevideo for 19382000 based on the USGS gaging on the Chippewa River near Milan (05304500). According to USGS, this station has a drainage area of 1,880 square miles. The flow data were adjusted to account for additional drainage area below this gage, including Dry Weather Creek and Spring Creek, for a total area of approximately 2,083 square miles. Flow from the ungaged areas was calculated by drainage area ratio to the Milan gage. This estimate is based on the Minnesota DNR Minor Watershed File - 1995 version. Flow at the diversion may thus be estimated as 1.08989 times the flow at the gage. U.S. Army Corps of Engineers operations at Watson Sag divert approximately 50 percent of the low flow during non-icing conditions, and 10 percent of the low flow during icing conditions. Flow in the Chippewa past the diversion is therefore estimated as 0.5

times flow above the diversion, although these proportions may vary during low flow conditions.

- Page 34 – A key source of uncertainty for the TMDL is the absence of flow gauging in the lower Chippewa. Neither flow at Montevideo nor the portion of the upper Chippewa gauged flow that is diverted through Watson Sag is regularly and reliably monitored. Without such gauging, it is difficult to precisely assess the dilution capacity available at Montevideo. If such additional data are obtained it may be advisable to refine the TMDL with further modeling.

<u>USGS Gage Information</u>

- The stage versus discharge data for the Minnesota River at Montevideo (USGS Site 05311000) were plotted to look for possible changes in the relationship that might indicate back water effects (Figure 2).
- The daily flow data for the gages at the Minnesota River at Montevideo and Chippewa River near Milan sites were plotted to compare general flow patterns. As noted previously, the hydrographs largely paralleled each other (Figure 3).
- Flow duration curves were developed for each site (Figures 4, 5, and 6).

<u>Fecal coliform bacteria data</u>

- Data plotted on flow duration curves to evaluate when concentrations exceeded the standard. Plots are not typical (same site flow and concentration data) in that Site 20 fecal concentrations were plotted against the flow duration curves of the two nearby gages given that there is no gage on the lower Chippewa River (Figures 7 and 8).

<u>Site Visit</u>

- Chris Z., John H., Muriel R., and Greg J. met with Paul Wymar on Tuesday afternoon, March 28, 2006, to view the lower section of the Chippewa River in relation to the Minnesota River flows.
- The Minnesota River at Montevideo discharge was about 2,900 cfs. The Chippewa River discharge near Milan was about 900 cfs.
- The stage on the Minnesota River was about 9.9 feet. Water surface elevation would be about 919 feet given that the datum for the gage is 909.12 feet above sea level NGVD29.
- The water level below the dam in Montevideo was approximately 5 feet below the top of the dam (Figure 9). Paul estimated that the water level at “base” flows was at least 10 feet lower (i.e., the top of the dam is about 15 feet above the water level below the dam at “base” flows). His observations seem to affirm that the as-built dimensions of the dam are close to the design plans. Note that the design plans for the dam indicate that the dam would be 19 feet high from the base of the dam to the top.
- The water below the dam appeared partially pooled, but a downstream water velocity was present below the bridge just downstream of the dam (Figure 10). It was still partially ice-covered so water movement was difficult to determine

further down the river, but still appeared to have some movement downstream at the Hwy. 7 Bridge (Figure 11 and 12).

- Paul made the following observations:
  - The rivers are about at their bankful levels based on general observation of the channel shape and water level (Figure 13). The banks of both the Chippewa River and the Minnesota River at lower flows are nearly vertical with a short toe slope to the water and about ten feet high.
  - There is a low point in the bank of the Minnesota River at a location upstream of the confluence with a subsequent "channel" of water present during high flows from that location through land now in CREP to the Chippewa River downstream of the Hwy. 7 Bridge. Water was in the "channel" during our visit.
  - The Chippewa River Watershed Project sampled Spring Creek for a year or so (~ 2003) for the county, but did not submit the data for STORET. Fecal coliform numbers tended to be quite high. Spring Creek sort of wraps around the west and northwest side of the city and flows into the Chippewa River upstream of the dam. (Subsequent discussions with and between STORET staff resulted in Paul being contacted and asked if he'd submit the data given that the site had already been established in STORET. Paul said he would.)
  - The highest recorded flood level on the Chippewa was in 1997 and was near the roof line of one of the buildings in Smith Park above the dam. Sandbags were used in increase the height of the dikes (sometimes they are the roads) to prevent flooding of the downtown area, WWTP, and some houses. Most roads on the floodplain were closed.
- Paul was pretty much comfortable with the perspective that actual back flow from the Minnesota River to the Chippewa River was probably fairly minimal and that conditions are primarily more of a back water effect. He noted that much of the flow at the Minnesota River Hwy. 212 gage can often be accounted for by the flow in the Chippewa River above the Watson Sag Diversion at the gage near Milan.

<u>Conclusions</u>

- Three factors were identified as possible influences on or descriptors of the backwater effects present in the lower section of the Chippewa River. These include the dam design elevation compared to the datum at the Minnesota River gage, bankful level calculations using Rosgen's method, and a break/change in the stage-discharge curve for the Minnesota River gage (Figure 14).
  - Factor #1 – The water level elevation of the Minnesota River at Hwy. 212 at 500 cfs is approximately equal to the elevation of the channel bottom at the dam on the Chippewa River. Some backwater effect would be expected in the lower Chippewa River section.
  - Factor #2 – The approximate bankful stage of the Minnesota River is probably in the range of 8.4 to 11 feet which corresponds to estimated flows between 2,000 and 3,000 cfs (Chris Zadak). This may indicate the range of Minnesota River flows where channel flooding begins resulting in increasing backwater effects on the lower Chippewa River.

- Factor #3 – The stage-discharge curve shows a distinct change in slope at a stage of about 15 feet and 7,000 cfs. The break in the curve indicates a significant change in the stage-discharge relationship at a point of extensive flooding. It is at about this point where backwater effects may become actual back flow concerns.
- The three factors presented above were revised to the following after the site visit:
  - Factor #1 – remains the same
  - Factor #2 – Observations of the river at about 2,900 cfs affirms this estimate; however, the conclusion that backwater effects just begin to increase at this level doesn't appear accurate. Rather, it appears that backwater effects are present to some extent from about 500 cfs in the Minnesota River up through the channel forming flows with the extent being quite significant throughout this range.
  - Factor #3 – The break in the curve is definitely present, but the physical layout of the area would seem to indicate that full scale flooding would occur at this point making any estimate of actual back flow difficult.
- Incorporating these ranges into the water quality duration curves provides a look at when fecal coliform concentrations typically exceed the standard. Typical evaluations of conditions using duration curves relate flow conditions to dry to wet conditions or low to high flows. In this case, it may provide a comparison of the fecal data against the likelihood of backwater and/or back flow in the lower Chippewa River (Figure 9).
  - Fecal coliform concentrations typically exceed 200 orgs./100 ml only at moist conditions and higher flows.
  - While backwater conditions are estimated to begin occurring at about the 35^{th} to 40^{th} percent duration interval and increase up through the 10^{th} percent duration interval, the likelihood of actual back flow from the Minnesota River into the Chippewa River is not great until a flow duration interval of less than 3 percent is reached. Widespread flooding in the area though pretty much makes an accurate estimate of flow contribution at the Hwy. 7 site impossible.
- The "source" of elevated fecal coliform levels in the lower section of the Chippewa River (i.e., Site 20) is apt not to be back flow from the Minnesota River.
- Sources within the direct drainage area to Site 20 may be the result of elevated water levels due to the stage of the Minnesota River, but they are likely located in the direct drainage area and may be exacerbated by the high water levels. Possible sources include:
  - combined sewer overflow (CSO) or sewage bypass situations (are these possibilities?),
  - higher fecal concentrations in stormwater than has previously been assumed – consider the possibility of fecal coliform "being stored" in storm sewers and flushed into the river with runoff
  - increased contributions from septic systems strained by elevated water levels, and
  - fecal present in the channel and/or flooded area sediments –

        - consider the possibility of bottom sediment in the channel below the dam contributing fecal coliform to the water – depending on how water flows past the dam, is there turbulence that could “stir” up the bottom
        - consider the possibility of fecal coliform being released from flooded ground and sediment

<u>Recommendations</u>

- Make specific observations of flow conditions in the two rivers this spring.
- If more certainty is deemed necessary, make various measurements to check assumptions and observations, including:
    - Stream channel elevations
    - Base of dam elevation
    - Water velocity measurements at various stages
    - Water level in the lower Chippewa River
    - DNA analysis of fecal coliform samples
- Consider assigning an allocation to the direct drainage area of the lower reach to account for the elevated concentrations – i.e., give the city area a load allocation.
    - Issues then becomes how much delineation is needed between the different “urban” sources; should storm sewer monitoring be added; etc.
- In lieu of additional work, incorporate the above information and conclusions into the current draft TMDL, identify the “likely elevated sources of fecal” in and near the city of Montevideo, and complete the TMDL.
    - Develop the TMDL equation for the reach by applying the standard to Site 20 and using flow estimates for the site/reach using the flow estimation method/factor used in the un-ionized ammonia TMDL
    - Specify the TMDL equations for selected flow ranges using the duration curve analysis and provide a range of reduction numbers to reflect the uncertainty present in sources
    - Consider using a unit area allocation from rural to urban areas to “balance” the allocations for the two areas as done in the revised SE Fecal TMDL

<u>Preferred Recommendation</u>

- **The last recommendation above** → In lieu of additional work, incorporate the above information and conclusions into the current draft TMDL, identify the “likely elevated sources of fecal” in and near the city of Montevideo, and complete the TMDL....

<u>Actions (my proposal)</u>

Part 1

- Provide review and comments on the above document

- Develop rough flow estimates for the lower section of the Chippewa River by adapting and/or applying the flow estimation method/factor used in the un-ionized ammonia TMDL (i.e., estimate the flow at the Watson Diversion to be 1.08989 times the flow at the USGS gage near Milan; assume that 50% of this flow moves past the diversion down the Chippewa River; and then add a flow factor using a drainage area ratio for the watershed area between the diversion and the Hwy. 7 monitoring site)
    - **$Q_{Mouth} = 0.563 \times Q_{Milan}$**
    - **See spreadsheet, 'Flow Estimate for Lower Chippewa R.xls', for details**

- "Calculate" TMDL "loads" for the appropriate flow duration intervals

- Estimate allocations (WLA and LA) for the TMDL equations using a unit area allocation from rural to urban areas to "balance" the allocations for the two areas as done in the revised SE Fecal TMDL

- Revise TMDL report to include the above items

Part 2

- Incorporate new 2006 impaired reaches into the overall TMDL report
    - Data compilation and analysis
    - **Duration curve work**
    - TMDL equations

...

• Figure 1.

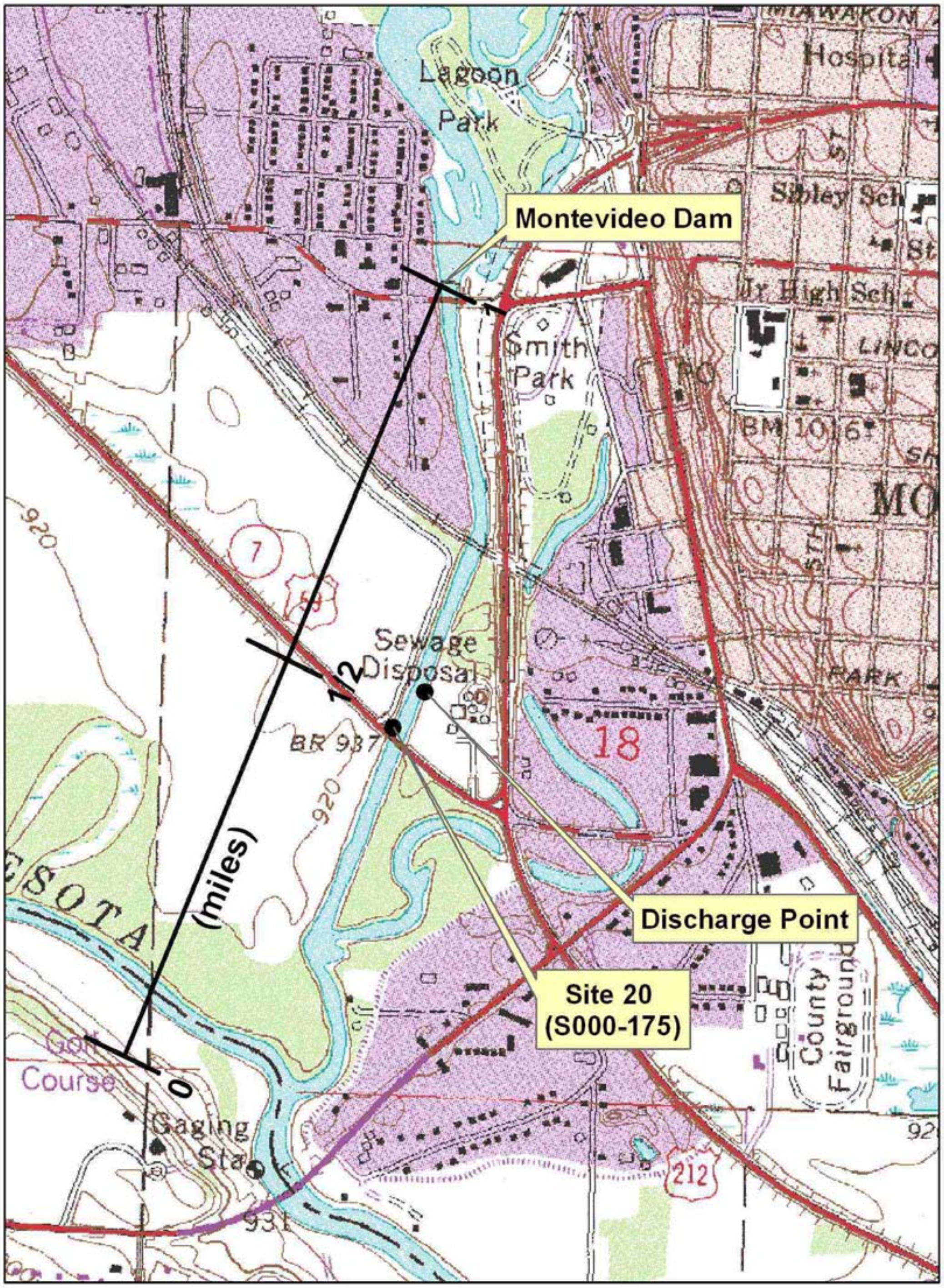

Montevideo Dam
Discharge Point
Site 20
(S000-175)
(miles)
0
1/2
1
Lagoon
Park
Smith
Park
Sewage
Disposal
Hospital
Sibley Sch
Jr High Sch
BM 1016
18
BR 937
920
931
Golf
Course
Gaging
Sta
County
Fairground
212
7
59

Figure 2.

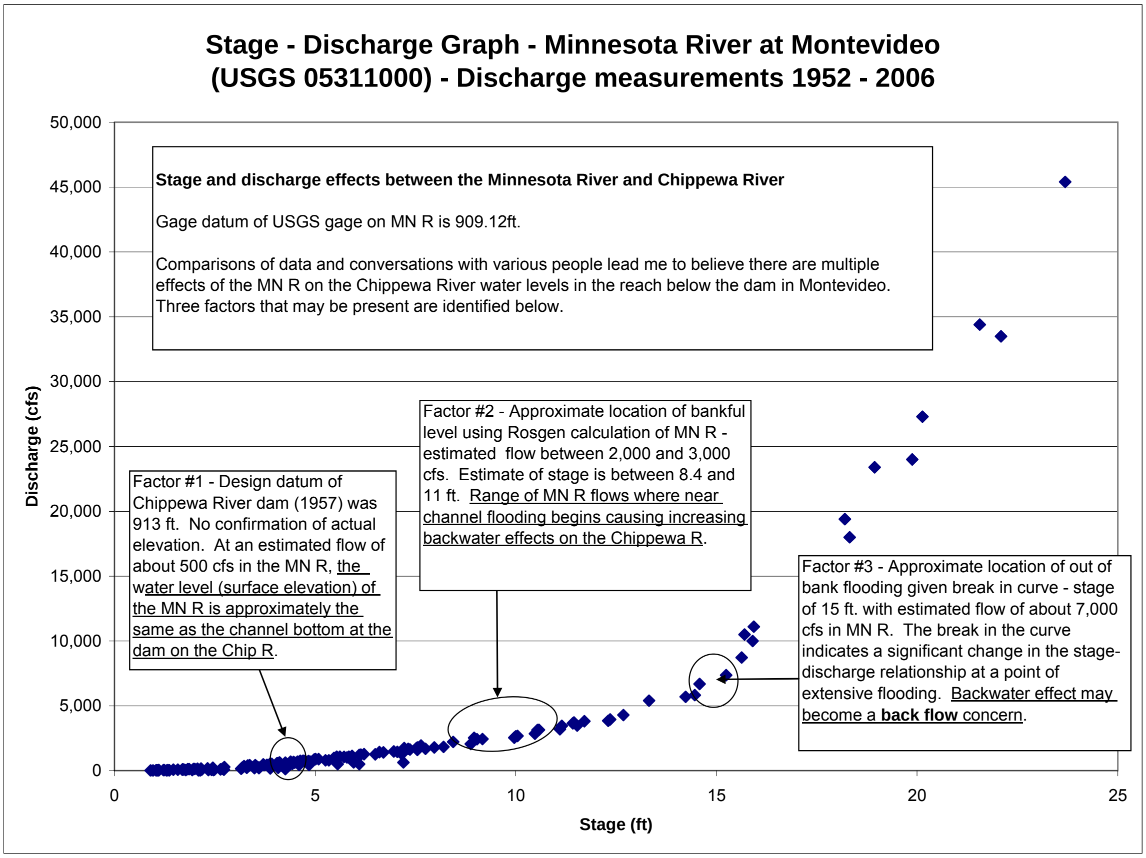


Figure 3.

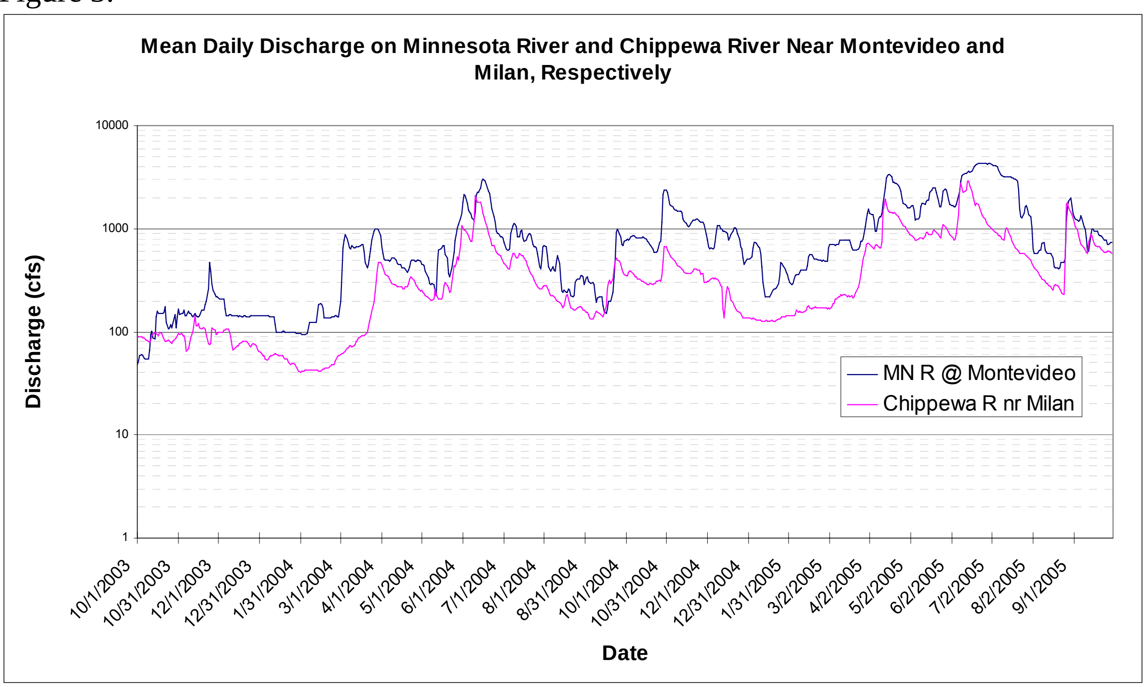


Figure 4.

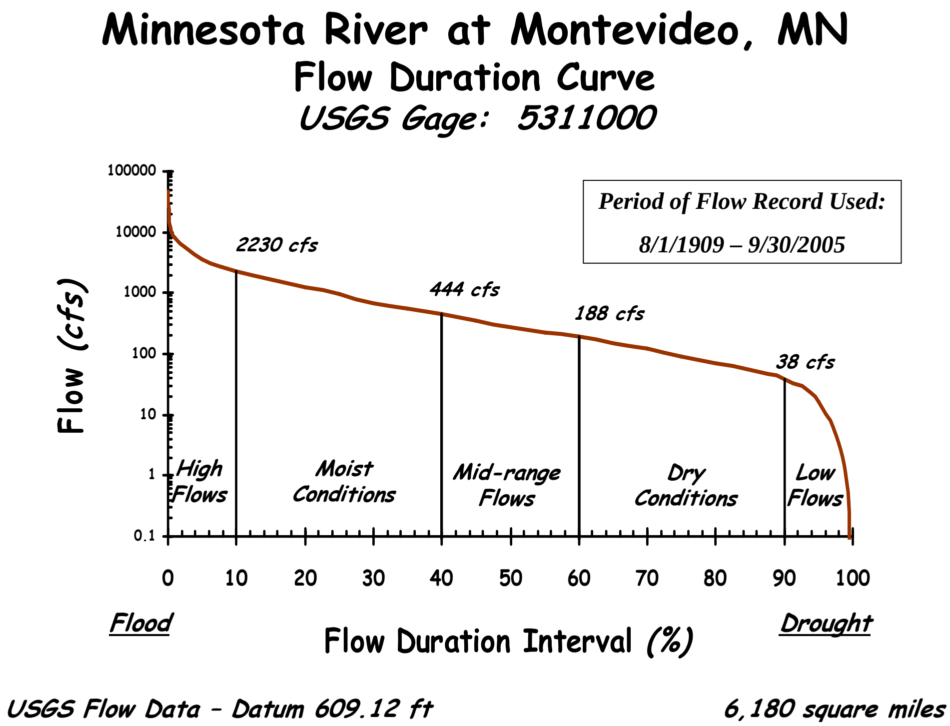


Figure 5.

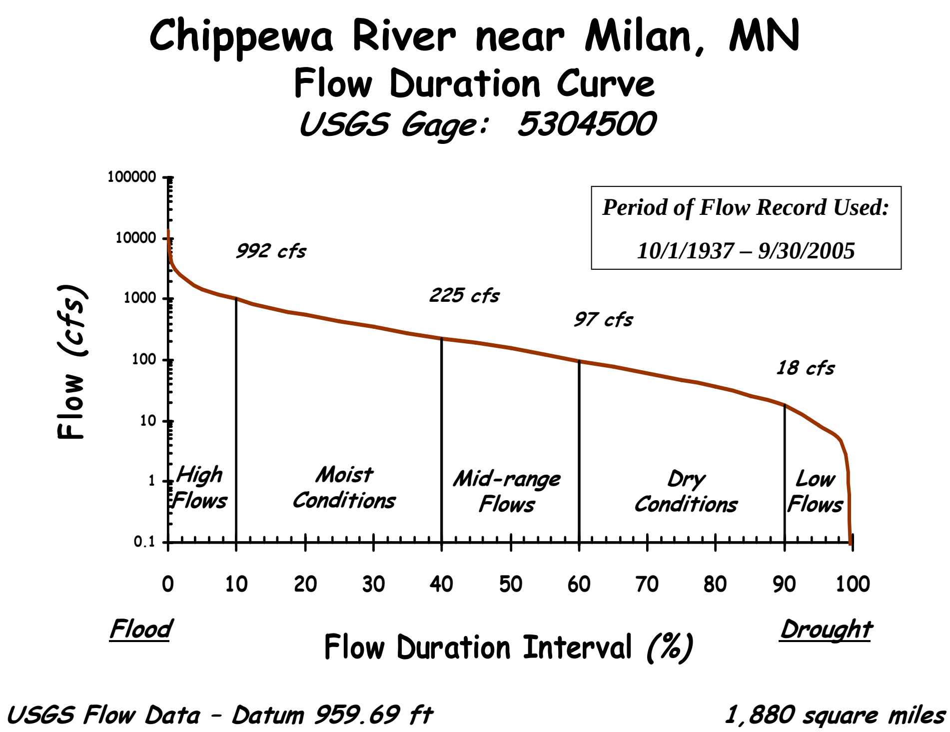


Figure 6.

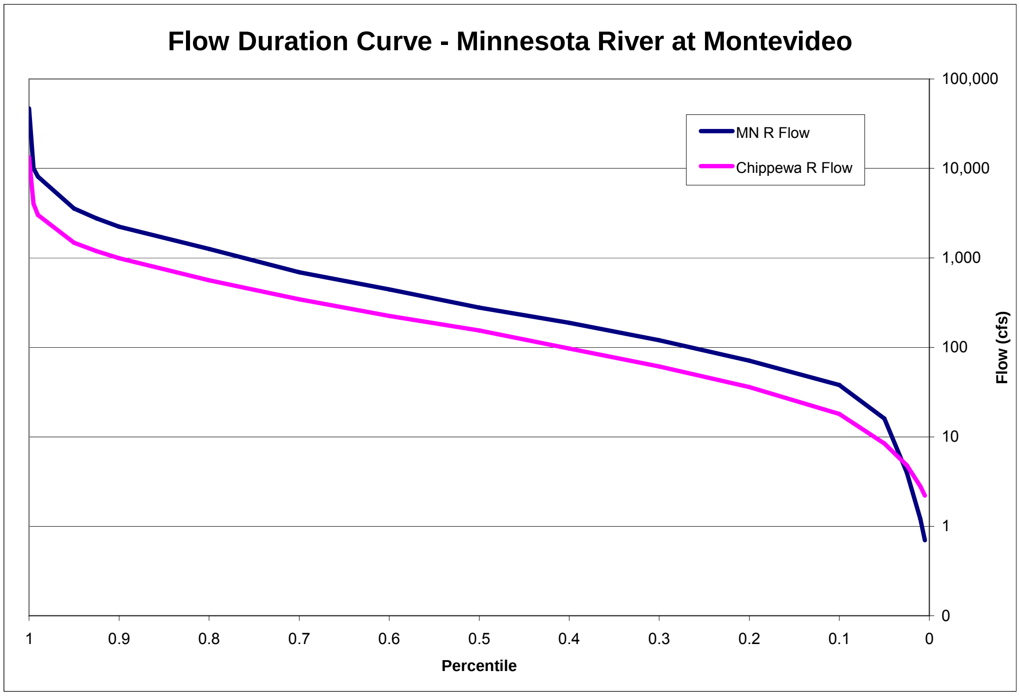


Figure 7.

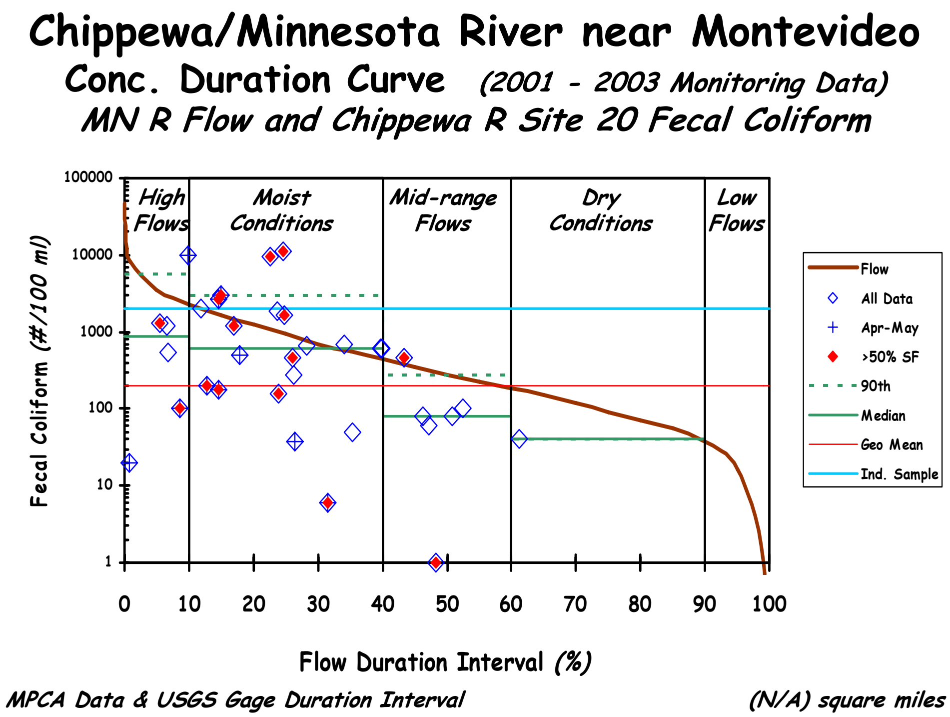


Figure 8.

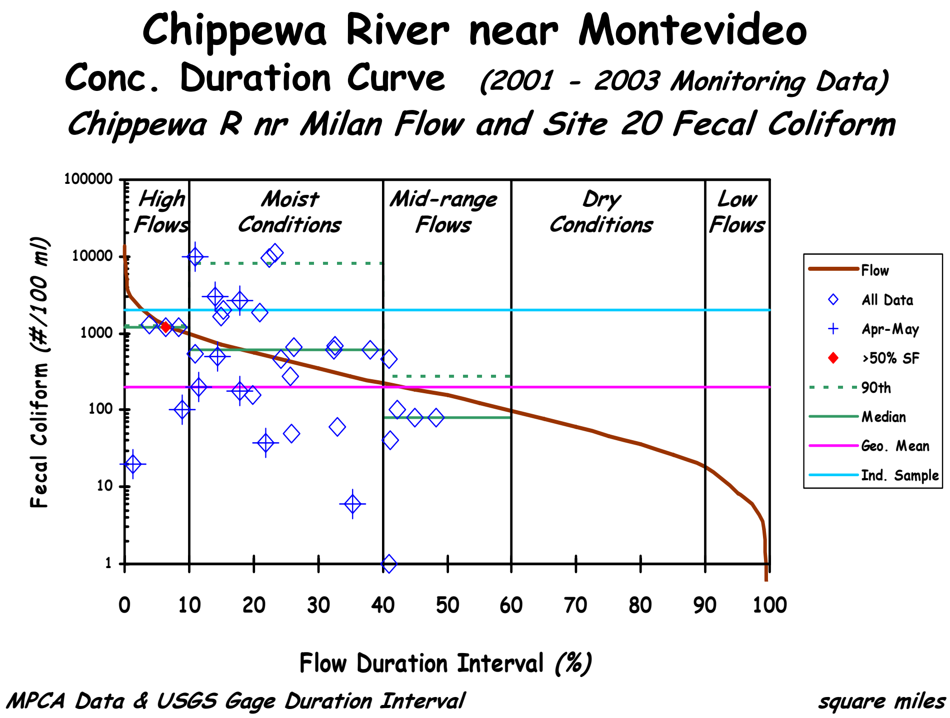


Figure 9.

Figure 10.

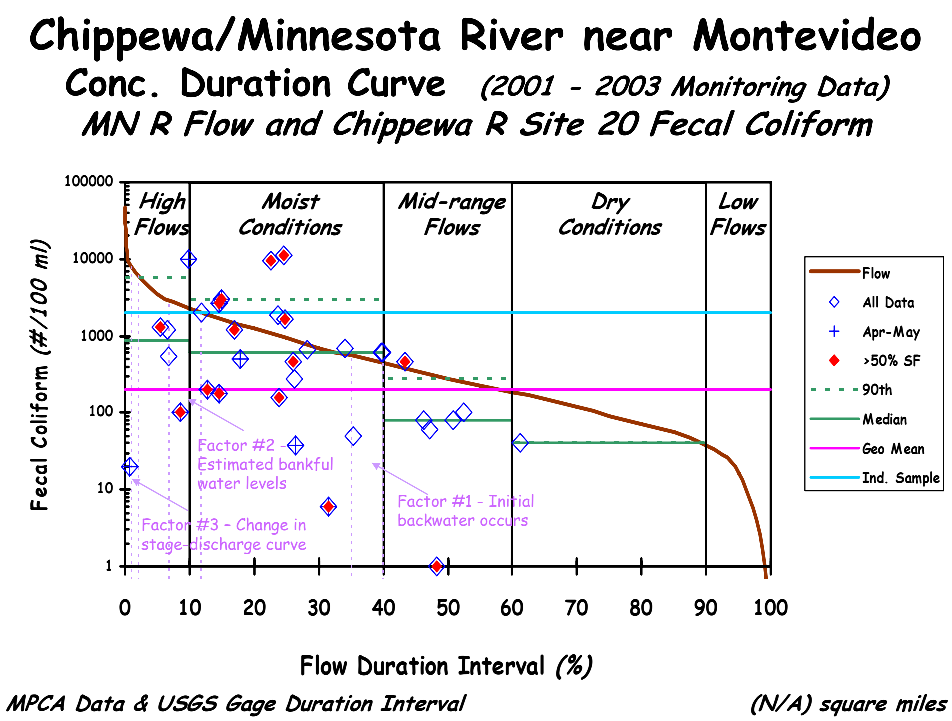
Figure 11.

Figure 12.

Figure 13.

Confluence of Chippewa and Minnesota Rivers

Figure 14.



Flow Estimation for Lower Chippewa River (Confluence with MN R) 4/20/2006
GDJ

- using area ratio estimates and assumed 50% diversion of flows at the Chippewa Diversion
- drainage areas from USGS Interactive

	Drainage Area (sq. mi.)
USGS Gage near Milan	1,880
Chippewa Diversion	2,048.6
Mouth of Chippewa River	2,083

Q_{Milan} = USGS Mean Daily Fow

$Q_{Abv\ Div}$ $= 2{,}048.6 \times (Q_{Milan} / 1{,}880)$ $= 1.0897 \times Q_{Milan}$

Watson Sag

$Q_{Blw\ Div}$ $= 0.5 \times Q_{Abv\ Div}$

$Q_{Mouth\ -\ Abv\ Div} = (2{,}083 - 2{,}048.6) \times Q_{Abv\ Div} / 2{,}048.6$

$= 0.017 \times Q_{Abv\ Div}$

$\mathbf{Q_{Mouth}}$ $= 0.5 \times (1.0897 \times Q_{Milan}) + (0.017 \times (1.0897 \times Q_{Milan}))$

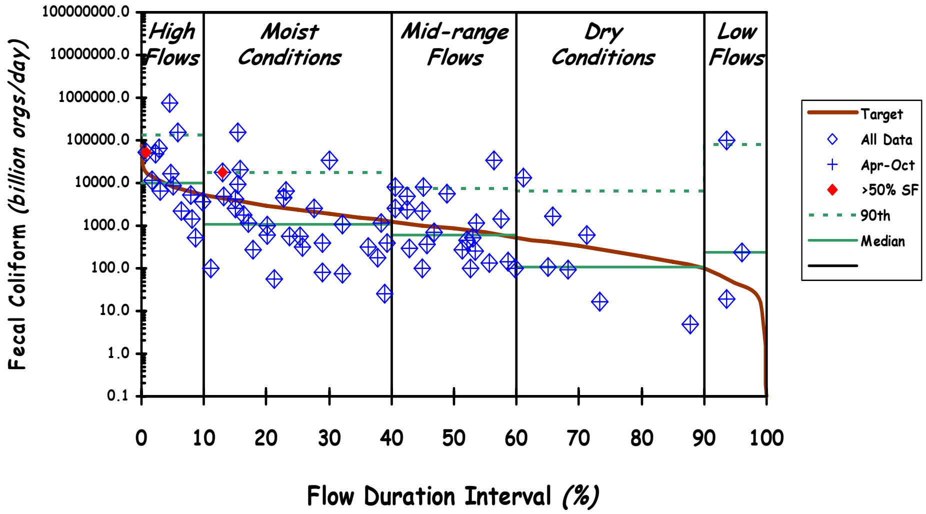
$= 0.545 \times Q_{Milan} + 0.018 \times Q_{Milan}$

$\mathbf{= 0.563 \times Q_{Milan}}$

$\mathbf{Q_{Mouth}}$ = Estimated mean daily flow at the mouth of the Chippewa River, based on procedure described in the Chippewa River Ammonia TMDL - procedure does not account for varied diversions at low flows and during winter ice conditions

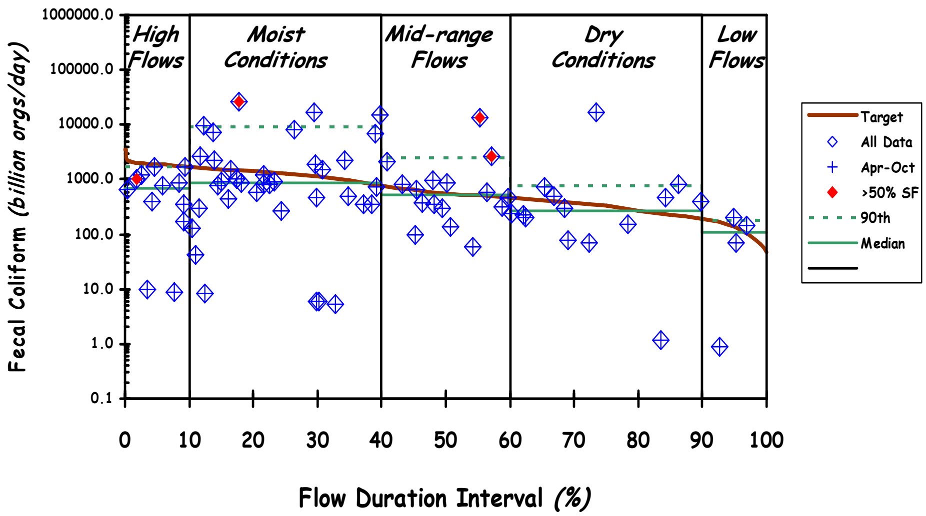
Appendix C: Load Duration Curves for the Impaired Reaches

Chippewa R; Watson Sag Diversion to Minnesota R
Load Duration Curve *(1971 - 2004 Monitoring Data)*
Site CH-0.5—Bottom



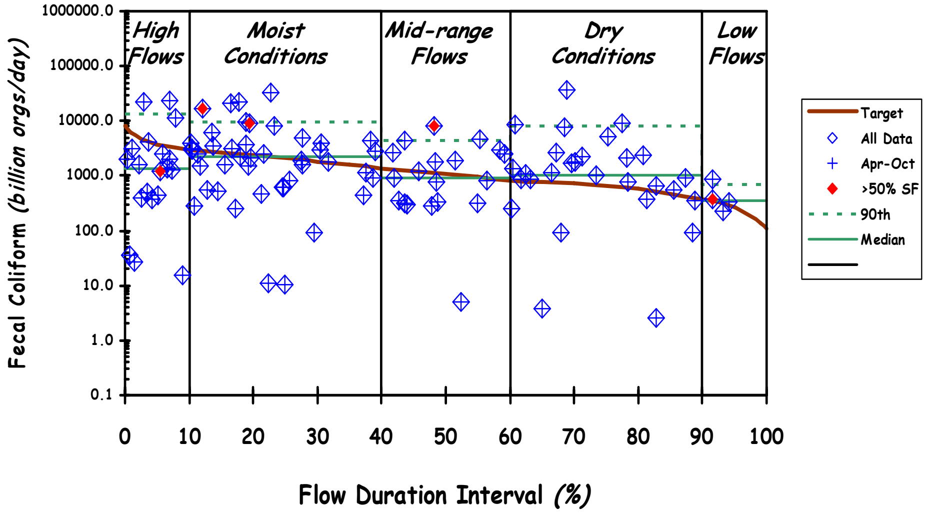
CRWP Data & USGS Gage Duration Interval *2084 square miles*

Chippewa R; Headwaters to Little Chippewa R
Load Duration Curve *(1999 - 2005 Monitoring Data)*
Site 2—Upper



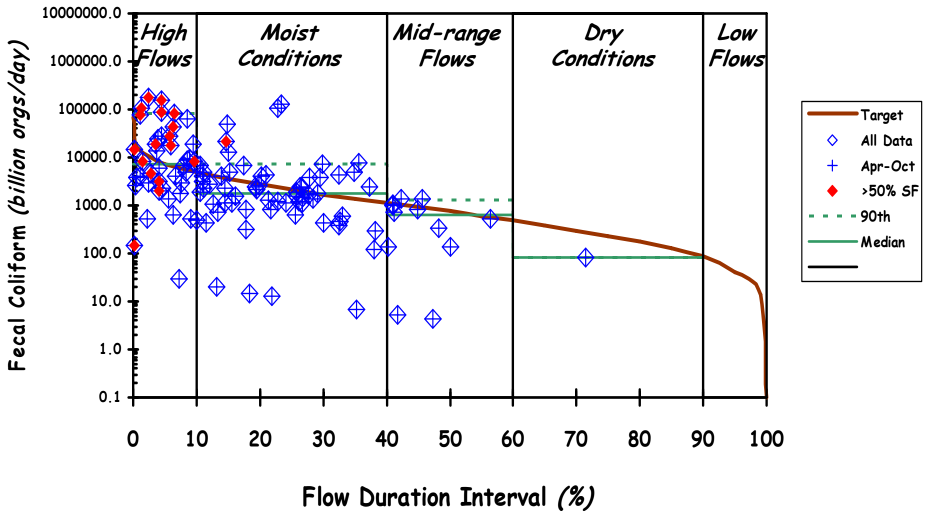
CRWP Data & Gage Duration Interval *427 square miles*

Chippewa R; Unnamed Cr to E Br Chippewa R
Load Duration Curve *(1999 - 2005 Monitoring Data)*
Site 6—Middle



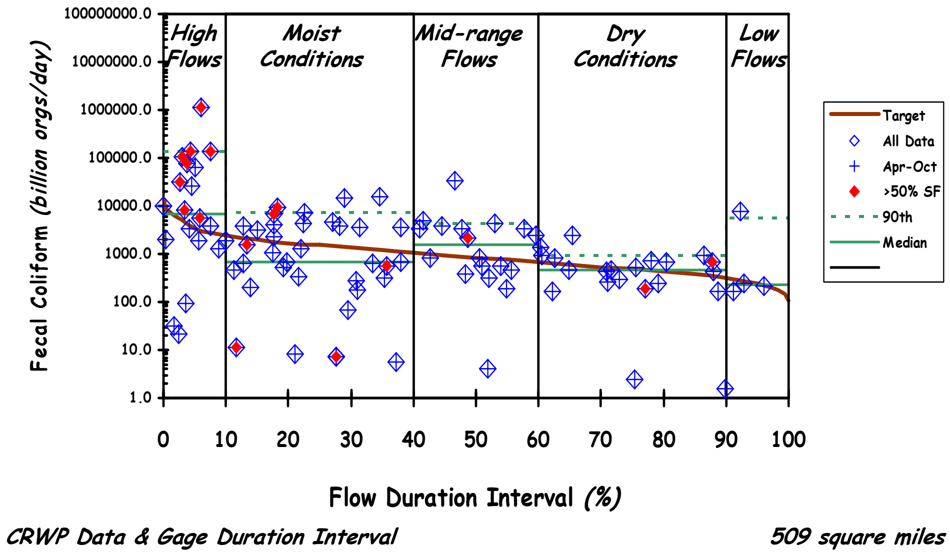
CRWP Data & Gage Duration Interval *758 square miles*

Chippewa R; Cottonwood Cr to Dry Weather Cr
Load Duration Curve *(1999 - 2005 Monitoring Data)*
Site 18—Lower

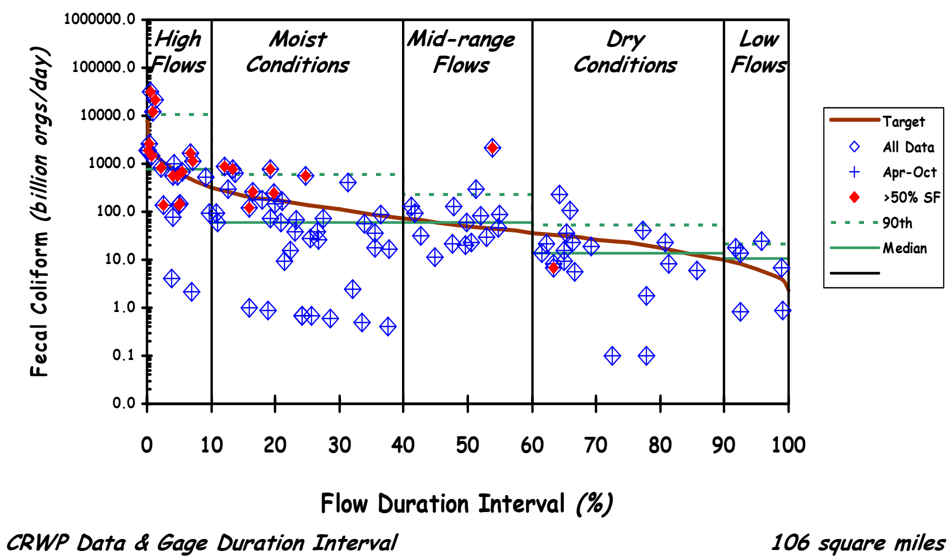


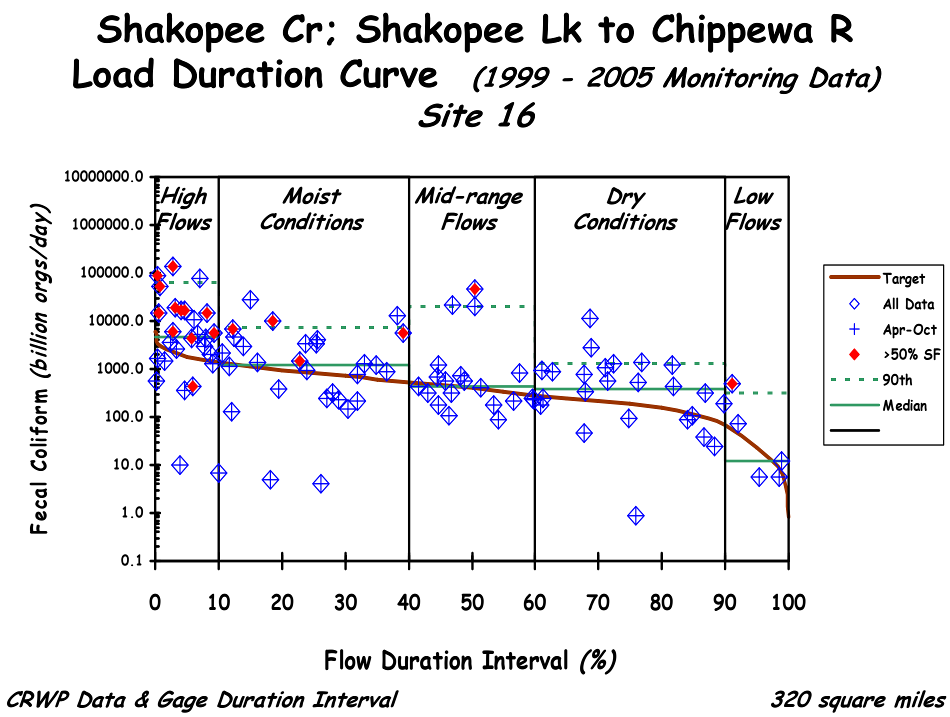
CRWP Data & USGS Gage Duration Interval *1901 square miles*

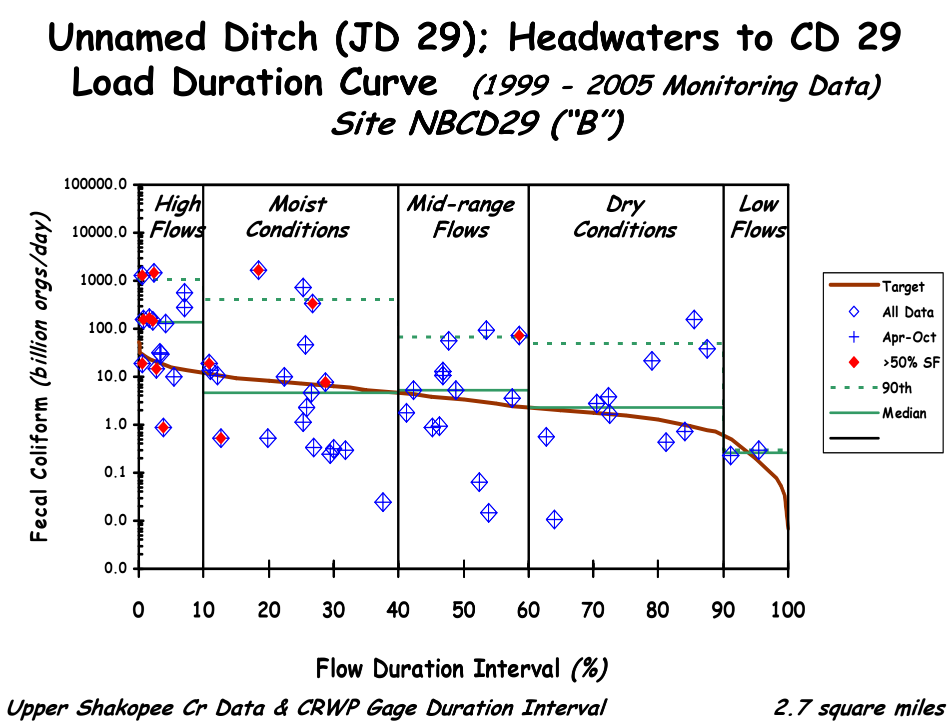
Chippewa R, E Br; Mud Cr to Chippewa R
Load Duration Curve *(1999 - 2005 Monitoring Data)*
Site 9—East Branch



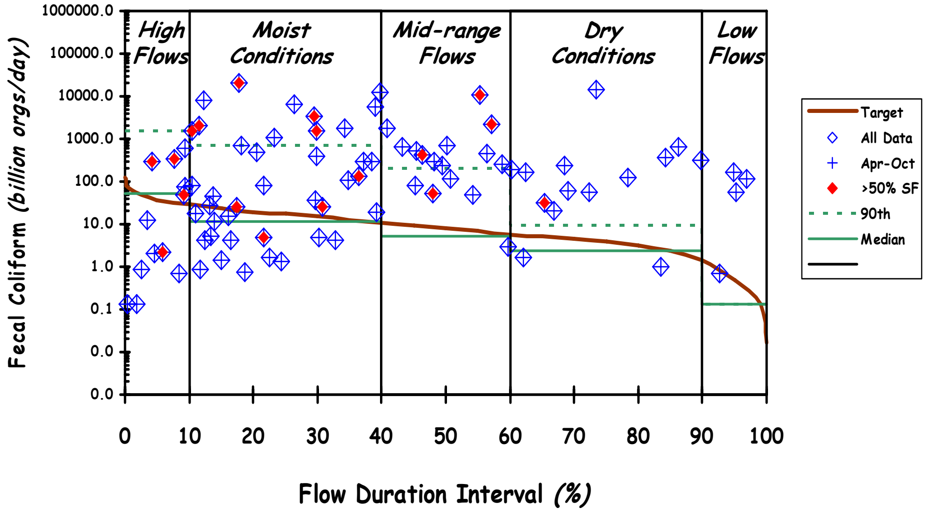
Dry Weather Cr; Headwaters to Chippewa R
Load Duration Curve *(1999 - 2005 Monitoring Data)*
Site 19




Shakopee Cr; Shakopee Lk to Chippewa R
Load Duration Curve (1999 - 2005 Monitoring Data)
Site 16
High Flows
Moist Conditions
Mid-range Flows
Dry Conditions
Low Flows
Fecal Coliform (billion orgs/day)
10000000.0
1000000.0
100000.0
10000.0
1000.0
100.0
10.0
1.0
0.1
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Target
All Data
Apr-Oct
>50% SF
90th
Median
CRWP Data & Gage Duration Interval
320 square miles

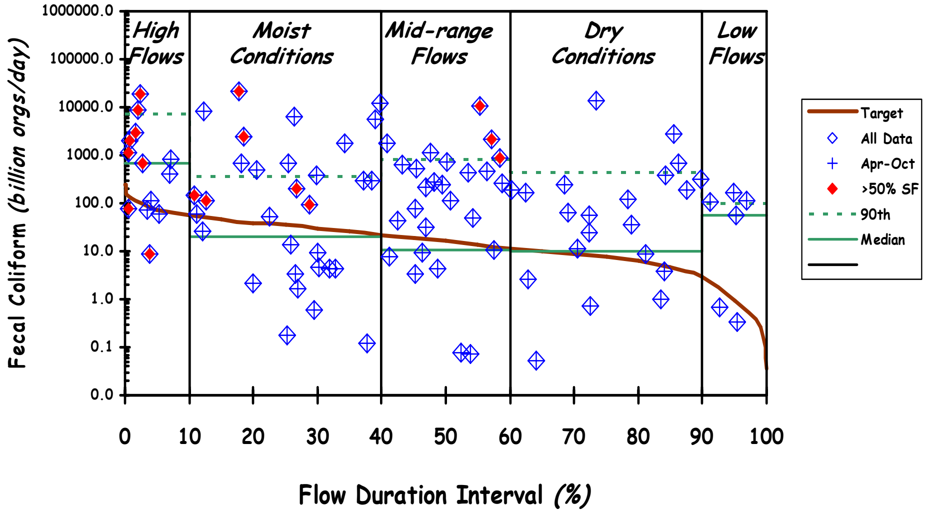

Unnamed Ditch (JD 29); Headwaters to CD 29
Load Duration Curve (1999 - 2005 Monitoring Data)
Site NBCD29 ("B")
High Flows
Moist Conditions
Mid-range Flows
Dry Conditions
Low Flows
Fecal Coliform (billion orgs/day)
100000.0
10000.0
1000.0
100.0
10.0
1.0
0.1
0.0
0.0
0 10 20 30 40 50 60 70 80 90 100
Flow Duration Interval (%)
Target
All Data
Apr-Oct
>50% SF
90th
Median
Upper Shakopee Cr Data & CRWP Gage Duration Interval
2.7 square miles

County Ditch 29; Headwaters to Unnamed Ditch
Load Duration Curve *(1999 - 2005 Monitoring Data)*
Site MBCD29 ("C")



Upper Shakopee Cr Data & CRWP Gage Duration Interval *6.7 square miles*

County Ditch 27; Unnamed Ditch to Unnamed Ditch
Load Duration Curve *(1999 - 2005 Monitoring Data)*
Site CD27 ("A")



Upper Shakopee Cr Data & CRWP Gage Duration Interval *13.4 square miles*

Appendix D: Responses to Written Comments

November 27, 2006

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 November 7, 2006 comment letter on the Draft Chippewa River Fecal Coliform TMDL Report. Yours was one of two comment letters received during the public notice period. Our responses to your comments are provided below.

Comment 1 - Agricultural Stakeholder Involvement: The MDA has been working with the 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 Chippewa River Fecal Coliform TMDL. The MDA offers to assist the MPCA and Chippewa River Watershed Partnership [sic] (CRWP) in engaging the agricultural community during the implementation plan development stage of the TMDL.

Response: 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. Due to Clean Water Legacy Act funding requirements, the timeline for implementation plan development is relatively short – the end of February 2007. Nevertheless, we will be in contact to discuss ways in which our two agencies can work together to support the Chippewa River Watershed Partnership in engaging the agricultural community.

Comment 2 - Adaptive Management: The MDA believes it is important for the MPCA, the CRWP, 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 Chippewa Watershed into this TMDL over time, rather than constructing separate, new TMDLs.

Response: We agree that adaptive management principles must be used in the implementation of TMDLs. New information will certainly come 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 MN over the next few years and funding for new research may be limited, the MDA believes it is important that the MPCA and the 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 Chippewa River Fecal Coliform TMDL.

Response: 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 of bacteria in soils and stream sediments, the potential re-intrainment 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 would like to discuss collaborative opportunities further.

Upon approval of the TMDL by the USEPA, a public process for developing the implementation plan will be initiated by the CRWP. As noted earlier, the timeline is short. Despite this, we would welcome the assistance of the MDA.

Sincerely,

Muriel Runholt
Minnesota Pollution Control Agency
1420 East College Drive
Marshall MN 5625

November 27, 2006

Mr. Kevin Paap, President
Minnesota Farm Bureau Federation
3080 Eagandale Place
Eagan MN 55121-2118

Dear Mr. Paap,

Thank you for your October 31, 2006 comment letter on the *Draft Chippewa River Fecal Coliform TMDL Report*. Yours was one of two comment letters received during the public notice period. Our responses to your comments are provided below.

Comment 1 - Agricultural Stakeholder Involvement: Farm Bureau has been working to educate and engage farmers on impaired waters and the 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 Chippewa River Fecal Coliform TMDL. Farm Bureau is willing to assist MPCA and Chippewa River Watershed Partnership [sic] (CRWP) in engaging farmers during the implementation plan development state 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. 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 seasons).

Response: We are pleased that Farm Bureau members want to be involved in creating the implementation plan for the Chippewa River Fecal Coliform TMDL (TMDL). Your request has been forwarded to Kylene Olson, Director CRWP. The schedule for completing a TMDL is agreed upon by the MPCA and the U.S. Environmental Protection Agency (USEPA). While we understand it is not desirable to hold public meetings and hearings during the busy farming seasons, it is not always possible to do so…such was the case in scheduling the public meeting for this TMDL. Scheduling public meetings and hearings always conflicts with someone, that is why ample opportunity is provided to read, respond to, and provide public comments on the TMDL.

Comment 2 - Research Needs: 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. Farm Bureau believes it is important for 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 BMPs. We need to be sure the BMPs we are recommending will actually have the desired effect. Farm Bureau would like MPCA and the CRWP to incorporate a research component into the TMDL implementation plan. Because there are a number of fecal coliform TMDLs that will be completed throughout MN over the next few years and funding for new research may be limited, we believe it is important that MPCA and the CRWP 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 farmers could use during land application to reduce fecal coliform. In general, 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. In our opinion, there are way to [sic] many assumptions in the Chippewa River Fecal Coliform TMDL report. For example, paragraph 2, page 15 [sic] it states "The assessment of fecal coliform sources…is complex and difficult to quantify. The survival rate of fecal coliform…is poorly understood and further exacerbates efforts to track sources." Then on page 26, paragraph 4, the TMDL assumes "the non-point pollution sources are largely related to livestock production." What data supports that assumption? 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 percent of the bacteria in streams came from wildlife (compared to 16-24% from humans, and only 10% from livestock). The TMDL mentions over-grazed pastures as a "significant source". Is this an assumption, or has someone done an assessment to quantify the number of acres of pasture adjacent to the Chippewa River, and of those, what percentage are over-grazed each year?

Response: We agree that more research is needed on the transport of fecal coliform in the environment. In a Watershed where there are more cattle than people, and the amount of waste that one 1,000 pound steer produces in a day is equivalent to 15 people, it is reasonable to assume that livestock are a major contributor of fecal coliform. We believe that the allocations in the TMDL to wildlife, humans, and pets are valid. Your point on the affect of BMPs on fecal coliform reductions is legitimate…monitoring is an integral part of the implementation plan to see if BMPs are working. While the livestock industry is highly regulated in Minnesota, pastures are not. County Feedlot Officers verified that overgrazed pastures adjacent to the river are a major source of fecal coliform that is transported to the river in rain events. Studies have shown that fencing cattle from rivers and streams reduces the amount of fecal coliform reaching the rivers and streams.

Comment 3 - Adaptive Management: Farm Bureau encourages the use of adaptive management principles when new information (i.e. monitoring 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 steps for the TMDL. In addition, adaptive management should be used to incorporate future fecal coliform impairments within the Chippewa Watershed 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 is some cases may be inappropriate.

Response: The ten reaches listed in the TMDL represent all of the sub-watersheds…when each reach meets the standard, the entire Chippewa River Watershed will meet the standard. The MPCA is following USEPA protocol in developing the TMDL. The Agency and the USEPA are reviewing the ability to meet the current standard.

Comment 4 - Implementation Strategies: Farm Bureau is pleased with the CRWPs implementation plan that identifies the high priority areas, and within those areas focuses on education, training, and incentives for the voluntary adoption of BMPs to meet the goal of improved water quality. We encourage MPCA and other agencies involved in TMDL development to focus on voluntary, incentive-based BMPs for this and all TMDL projects.

Response: We encourage Farm Bureau members to take part in developing the implementation plan to reduce fecal coliform in the Chippewa River. Your concerns have been forwarded to the CRWP who is responsible for developing the implementation plan.

Upon approval of the TMDL by the USEPA, a public process for developing the implementation plan will be initiated by the CRWP. We have forwarded your request to take part in the implementation planning for the Chippewa River to the CRWP.

Sincerely,

Muriel Runholt
Minnesota Pollution Control Agency
1420 East College Drive
Marshall MN 56258