ESCHERICHIA COLI BACTERIA TOTAL MAXIMUM DAILY LOAD EVALUATION FOR PIPESTONE CREEK LOCATED IN MOODY AND MINNEHAHA COUNTIES, SOUTH DAKOTA.

South Dakota Department of Environment and Natural Resources

Water Resources Assistance Program

November, 2011

Contents

Table of Figures

Table of Tables

Pipestone Creek Total Maximum Daily Load

Entity ID:	SD-BS-R-PIPESTONE_01
Location:	HUC Code: 10170203
Size of Watershed:	45,993 acres
Water Body Type:	Stream
303(d) Listing Parameter:	*Escherichia coli* bacteria
Initial Listing Date:	2010
TMDL Priority Ranking:	1
Listed Stream Segment:	Pipestone Creek Occurring within South Dakota
Designated Use of Concern:	Immersion Recreation
Analytical Approach:	Load Duration Curve Framework
Target	Meet applicable water quality standards 74:51:01:55
Threshold Value	<126 cfu/100 ml geometric mean concentration with a <235 cfu/100 ml maximum single sample
Load Allocations:	
High Flow Zone LA	8.24E+14 cfu/day
High Flow Zone WLA	0
High Flow Zone MOS	2.55E+11 cfu/day
High Flow Zone TMDL	8.24E+14 cfu/day

1.0 Introduction

The intent of this document is to clearly identify the components of the Total Maximum Daily Load (TMDL) submittal to support adequate public participation and facilitate the United States Environmental Protection Agency (EPA) review and approval. The TMDL was developed in accordance with Section 303(d) of the Federal Clean Water Act and guidance developed by the EPA. This TMDL document addresses the *Escherichia coli* (*E. coli*) bacteria impairment of Pipestone Creek contained within South Dakota.

1.1 Watershed Characteristics

Pipestone Creek originates in Pipestone County, Minnesota and is influenced by two tributaries, South Branch Pipestone Creek and North Branch Pipestone Creek. Within South Dakota Pipestone Creek drains 45,993 acres and is 35.4 miles in length (Figure 1). Pipestone Creek flows back into Rock County within Minnesota and joins Split Rock Creek. Split Rock Creek eventually flows into the Big Sioux River within South Dakota. The stream receives runoff from agricultural operations. Land use is mainly cropland interspersed with rangeland/grassland (Table 1). In addition to agricultural operations, Pipestone Creek within South Dakota may be influenced in Minnesota by the municipality of Pipestone, Minnesota. This municipality discharges only during specified days during the year (April 1 through June 15 and September 15 through December 15) (MPCA 2008).

Table 1: Pipestone Creek watershed landuse.

Landuse	Percent
Cropland	82
Range/Grassland	17
Built up land	1

The impaired reach of Pipestone Creek lies within Moody and Minnehaha Counties, near the town of Trent, SD (Figure 2). Common soil associations on the uplands in the watershed include Doland-Grovena-Houdek, Kranzburg-Houdek, Grovena-Dobalt-Flandreau, and Moody-Trent. The bottomland soil associations include Dempster-Flandreau-Lamo, Chaska-Davis-Bon, and Lamo-Graceville. The soil associations within this watershed primarily support cropland.

Moody and Minnehaha County have cold winters and hot summers. The average daily temperature during winter is 15 degrees F. The average daily temperature during summer is 70 degrees F. Average yearly precipitation is 21.98 inches. Over the year 75% of precipitation falls from April to September. Average yearly snow fall amounts to 30 inches.

Pipestone Creek was assessed as an individual portion of the larger Central Big Sioux River Watershed Assessment, which looked at individual streams such as Pipestone Creek as well as the entire drainage basin and the cumulative effects of the individual waterbodies.

In the 2010 Integrated Report, the portion of Pipestone Creek within South Dakota (Segment SD-BS-R-PIPESTONE_01) was listed as impaired for both limited contact and immersion recreation beneficial uses due to *E. coli* and fecal coliform. Livestock (grazing or feeding operations) was identified as the source.

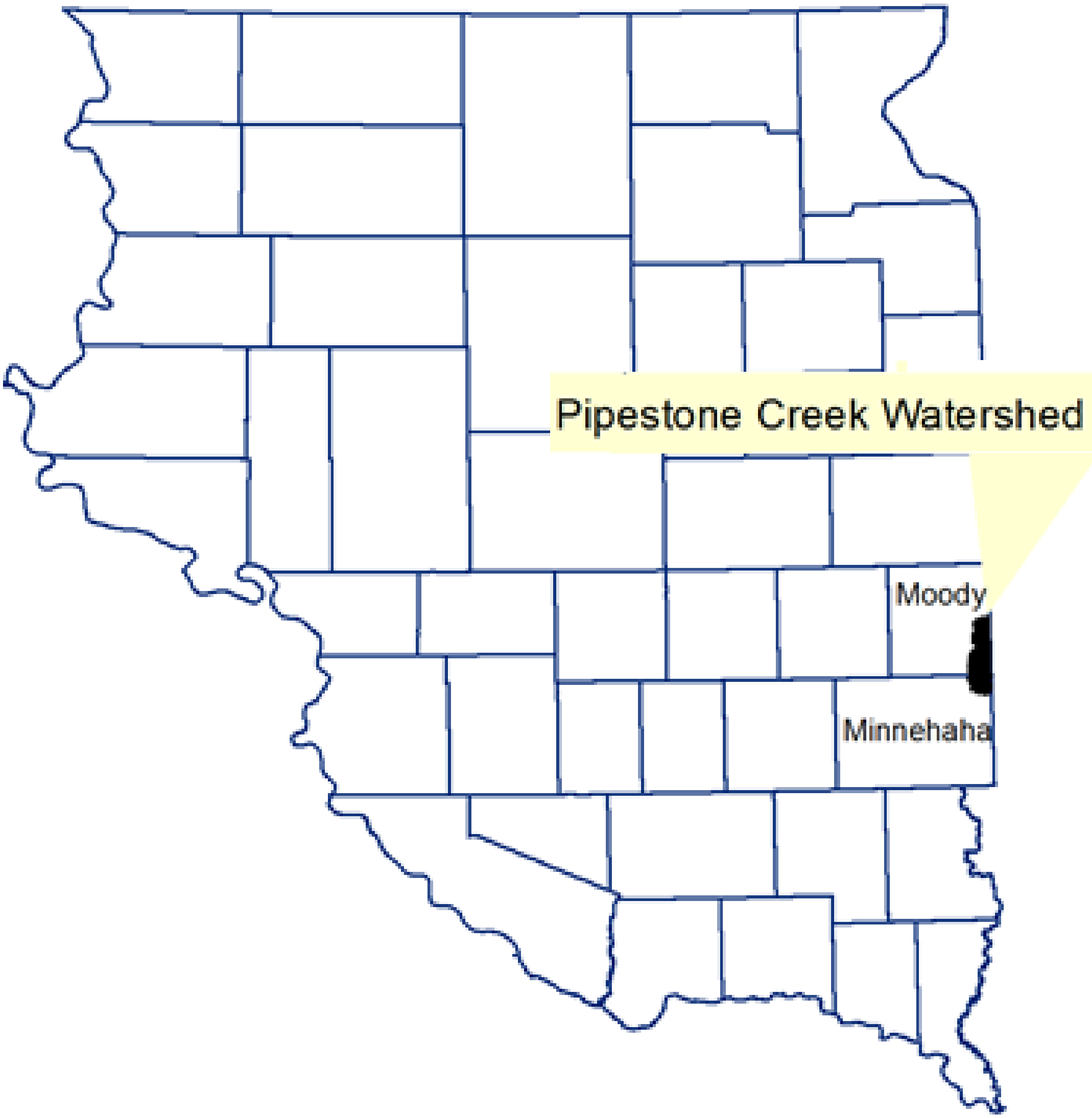

Figure 1: Pipestone Creek Watershed location within eastern South Dakota.

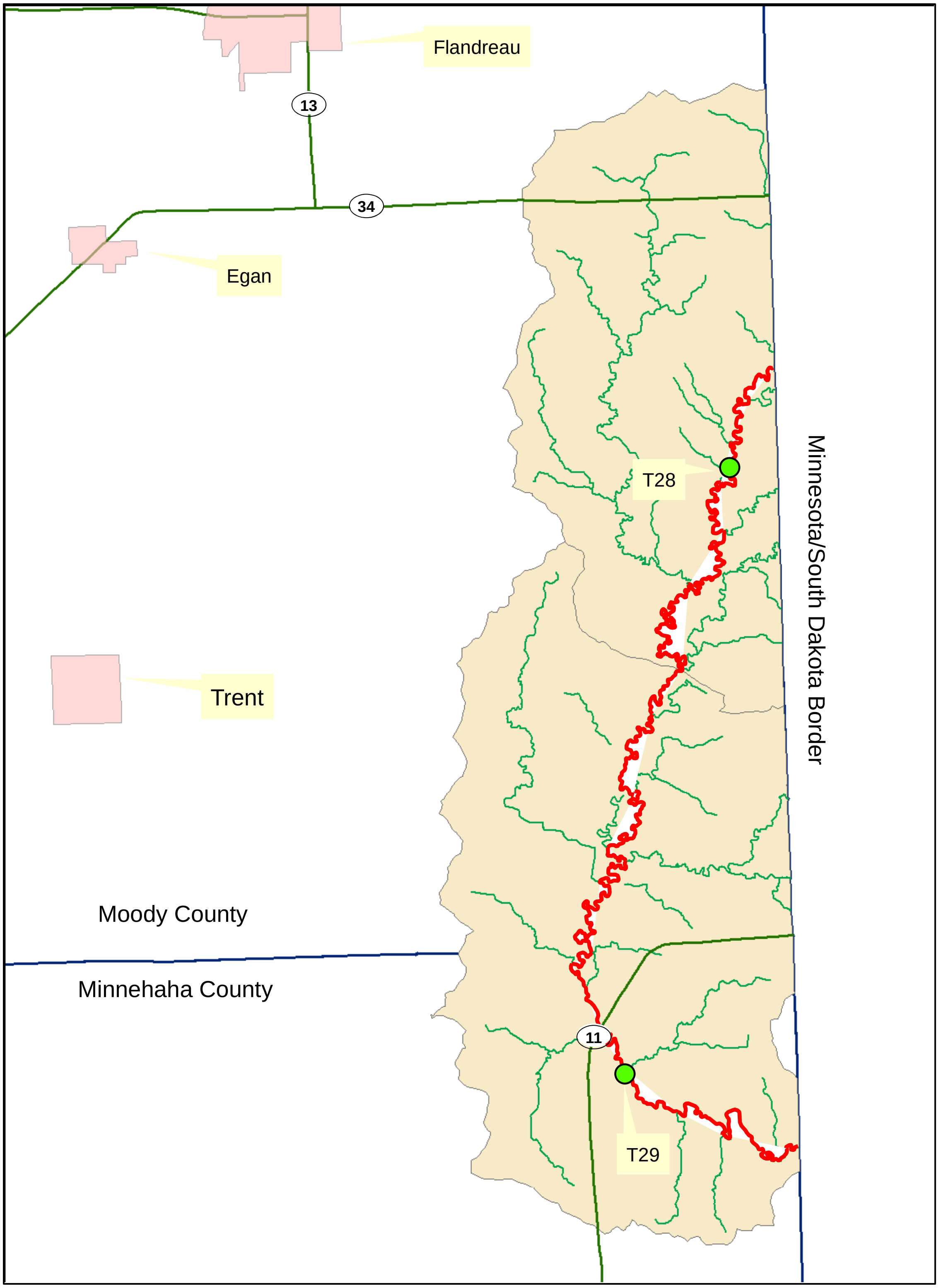

Figure 2: Pipestone Creek Watershed within South Dakota and listed segment indicated by red stream length, T28 indicated by a green circle in the upper watershed and T29 is indicated by a green circle in the lower watershed.

2.0 Water Quality Standards

Each waterbody within South Dakota is assigned beneficial uses. All waters (both lakes and streams) are designated the use of fish and wildlife propagation, recreation and stock watering. All streams are assigned the use of irrigation. Additional uses may be assigned by the state based on a beneficial use analysis of each waterbody. Water quality standards have been defined in South Dakota state statutes in support of these uses. These standards consist of suites of numeric criteria that provide physical and chemical benchmarks from which management decisions can be developed (Table 2).

Chronic standards, including geometric means and 30-day averages, are applied to a calendar month. While not explicitly described within the State's water quality standards, this is the method used in the South Dakota Integrated Water Quality Report (IR) as well as in permit development.

Additional "narrative" standards that may apply can be found in the "Administrative Rules of South Dakota: Articles 74:51:01:05; 06; 08; 09, and 12". These contain language that generally prohibits the presence of materials causing pollutants to form, visible pollutants, nuisance aquatic life, and biological integrity.

Pipestone Creek located within South Dakota has been assigned the beneficial uses of: warm water semi-permanent fish life, irrigation waters, immersion recreation, limited contact recreation, and fish and wildlife propagation, recreation, and stock watering. Table 1 lists the criteria that must be met to support the specified beneficial uses. When multiple criteria exist for a particular parameter, the most stringent criterion is used.

The numeric TMDL target established for Pipestone Creek is 126 cfu/100 ml, which is based on the chronic standard for *E. coli*. The *E. coli* criteria for the immersion recreation beneficial use requires that 1) no sample exceeds 235 cfu/100 ml and 2) during a 30-day period, the geometric mean of a minimum of 5 samples collected during separate 24-hour periods must not exceed 126 cfu/100 ml. These criteria are applicable from May 1 through September 30.

This document will use the immersion recreation beneficial use chronic threshold value for E. coli of 126 cfu/100 ml as a management goal. By using the chronic threshold of immersion recreation there is increased confidence that acute and chronic water quality criteria for immersion recreation and limited contact recreation will be achieved.

Table 2: State Water Quality Standards for Pipestone Creek.

Parameters	Criteria	Unit of Measure	Beneficial Use Requiring this Standard
Total ammonia nitrogen as N	Equal to or less than the result from Equation 3 in Appendix A of Surface Water Quality Standards	mg/L30 average May 1 to October 31	Warmwater Semi-Permanent Fish Life Propagation
	Equal to or less than the result from Equation 4 in Appendix A of Surface Water Quality Standards	mg/L 30 average November 1 to April 30	
	Equal to or less than the result from Equation c in Appendix A of Surface Water Quality Standards	mg/L Daily Maximum	
Dissolved Oxygen	≥5.0	mg/L	Warmwater Semi-Permanent Fish Life Propagation
Total Suspended Solids	≤90 (mean) ≤158 (single sample)	mg/L	Warmwater Semi-Permanent Fish Life Propagation
Temperature	>90	°C	Warmwater Semi-Permanent Fish Life Propagation
Fecal Coliform Bacteria (May 1 – Sept 30)	≤1,000 (geometric mean) ≤2,000 (single sample)	count/100 ml	Limited Contact Recreation
Escherichia coli Bacteria (May 1 – Sept 30)	≤630 (geometric mean) ≤1,178 (single sample)	count/100 ml	Limited Contact Recreation
Fecal Coliform Bacteria (May 1 – Sept 30)	≤200 (geometric mean) ≤400 (single sample)	count/100 ml	Immersion Recreation
Escherichia coli Bacteria (May 1 – Sept 30)	≤126 (geometric mean) ≤235 (single sample)	count/100 ml	Immersion Recreation
Alkalinity (CaCO3)	≤750 (mean) ≤1,313 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Conductivity	≤2,500 (mean) ≤4,375 (single sample)	μmhos/cm @ 25° C	Irrigation Waters
Nitrogen, Nitrate as N	≤50 (mean) ≤88 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
pH (standard Units	≥6.5 to ≤9.0	units	Warmwater Semi-Permanent Fish Life Propagation
Solids, total dissolved	≤2,500 (mean) ≤4,375 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Total Petroleum Hydrocarbon Oil and Grease	≤10 ≤10	mg/L mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Sodium Absorption Ratio	≤10	ratio	Irrigation Waters

3.0 Technical Analysis

3.1 Data Collection Method

Data on Pipestone Creek was collected during the Big Sioux River Watershed Assessment from two sampling points; T28 and T29. T28 was located near the Minnesota Border where Pipestone Creek enters South Dakota; T29 was located near the Minnesota Border where Pipestone Creek exits South Dakota. For this analysis T28 will be considered as a boundary condition site and T29 will represent the South Dakota reach. Average daily flows were tied to *E. coli* samples and this data was used to develop the load duration curve.

3.2 Sample Data

Samples were collected monthly from 2000 to 2008. Instantaneous flows were also calculated for the sampling dates. From site T29, 40 samples were collected and used in the TMDL analysis, 29 of which were modeled from fecal coliform sample data. From site T28, 52 samples were collected and used in the boundary condition analysis, 41 of which were modeled from fecal coliform sample data. Comparing flow and concentration resulted in a very weak relationship that was inadequate for use in predicting daily loads. Instead, the average daily flows based on the USGS gaging station were used for the load duration curves. It was thought this would be more accurately reflect the long term flow record rather than just using instantaneous flows.

From site T29, 27 samples exceeded the chronic threshold and 24 samples exceeded the acute threshold (Table 4). From site T28, 45 samples exceeded the chronic threshold and 42 samples exceeded the acute threshold (Table 3). The chronic threshold represents the numeric target of the chronic standard whereas the chronic standard represents the geometric mean of a minimum of five samples collected within a 30-day period.

Table 3: T28 Actual and modeled *E. coli* samples, modeled *E. coli* samples indicated by red text.

Date	Average Daily Flow/Instantaneous Flow	Fecal Coliform	*E. Coli*	Date	Average Daily Flow/Instantaneous Flow	Fecal Coliform	*E. Coli*
06/13/2000		1800	1783	10/25/2005	112.6/-	50	91
07/10/2000	11/11.38	580	520	04/05/2006	425.8/-	10	28
08/15/2000	7.3/7.71	6000	6614	05/03/2006	314.5/-	300	411
09/19/2000	4.3/6.05	1400	1356	06/08/2006*	89.9/-	420	435
10/17/2000	7.406.05	1400	1356	06/08/2006	89.9/-	380	161
04/02/2001*	569.5/-	100	77	07/13/2006	46.2/-	300	345
04/02/2001	569.5/-	180	145	08/08/2006	119/-	3400	2420
04/12/2001	436.5/-	3800	4022	09/13/2006	25.9/-	3000	2420
04/12/2001*	436.5/-	4000	4253	10/24/2006	36.8/-	90	192
04/23/2001	633.9/-	12000	14067	04/02/2007	379.9/-	670	1050
04/23/2001*	633.9/-	13000	15348	04/17/2007	216.8/-	10	15
05/07/2001	366.9/412.91	1700	1675	05/23/2007	125.2/-	460	404
05/07/2001*	366.9/412.91	1800	1783	06/21/2007	130.4/-	750	687
06/05/2001*	48.9/48.15	1100	1043	07/19/2007	45.9/-	2700	2772
06/05/2001	48.9/48.15	1000	940	08/22/2007	56.6/-	1200	1147
06/13/2001*	377/161.16	33000	42321	09/19/2007*	29.1/-	1100	1043
06/13/2001	377/161.16	25000	31281	09/19/2007	29.1/-	1000	940
07/09/2001*	33.3/54.1	800	737	10/10/2007*	87.4/-	1300	1251
07/09/2001	33.354.1	700	638	10/10/2007	87.4/-	1800	1783
07/23/2001*	29/26.68	17000	20555	04/08/2008	135.9/-	10	6
07/23/2001	29/26.68	5100	5541	05/07/2008	165.1/-	10	6
08/14/2001	13.6/13.57	2400	2439	06/11/2008	271.8/-	1400	1356
08/14/2001*	13.6/13.57	1500	1462	07/08/2008	72.1/-	90	68
09/11/2001*	10.8/11.13	1600	1568	08/13/2008	92.9/-	1000	940
09/11/2001	10.8/11.13	1600	1568	09/09/2008	20.7/-	300	253
10/10/2001	14.8/-	5100	5541	10/09/2008	68.2/-	670	608
10/10/2001*	14.8/-	7000	7822				

*samples of duplicate pairs used in load duration curve analysis

Table 4: T29 Actual and modeled E. coli samples, modeled E. coli samples indicated by red text.

Data	Average Daily Flow/Instantaneous Flow	Fecal Coliform	*E. Coli*	Data	Average Daily Flow/Instantaneous Flow	Fecal Coliform	*E. Coli*
06/13/2000		1300	1251	07/13/2006	46.2/-	600	488
07/10/2000	11/41.95	1600	1568	08/08/2006	119/-	990	687
08/16/2000	7.4/34.78	350	300	09/13/2006	25.9/-	1100	980
08/16/2000*	7.4/34.78	310	263	10/24/2006	36.8/-	80	42
09/19/2000	4.3/33.42	1500	1462	04/02/2007	379.9/-	980	1550
10/17/2000	7.4/-	120	93	04/02/2007*	379.9/-	200	1300
04/02/2001	569.5/-	130	102	04/17/2007	216.8/-	50	13
04/12/2001	436.5/-	5700	6255	05/23/2007	125.2/-	470	413
04/23/2001	633.9/-	29000	36767	06/21/2007	130.4/-	730	667
05/07/2001	366.9/446.27	1900	1891	07/19/2007	45.9/-	270	226
06/05/2001	48.9/66.55	400	347	08/22/2007	56.6/-	600	539
06/13/2001	377/142	5000	5423	09/19/2007	29.1/-	470	413
07/09/2001	33.3/59.16	560	500	10/10/2007	87.4/-	260	217
07/23/2001	29/69.64	4000	4253	04/08/2008	135.9/-	10	6
08/14/2001	13.6/39.66	420	366	05/07/2008	165.1/-	10	6
09/11/2001	10.8/36.51	400	347	06/11/2008	271.8/-	130	102
10/10/2001	14.8/-	390	337	07/08/2008	72.1/-	90	68
10/25/2005	112.6/-	40	44	08/13/2008	92.9/-	70	52
04/05/2006	425.8/-	30	12	09/09/2008	20.7/-	40	28
05/03/2006	314.5/-	70	167	10/09/2008	68.2/-	470	413
06/08/2006	89.9/-	380	24				

*samples of duplicate pairs used in load duration curve analysis

Log transformed *E. coli* samples were correlated with log transformed fecal coliform samples. The resulting relationship was strong and was used to model *E. coli* concentrations from unpaired fecal coliform samples (Figure 3).

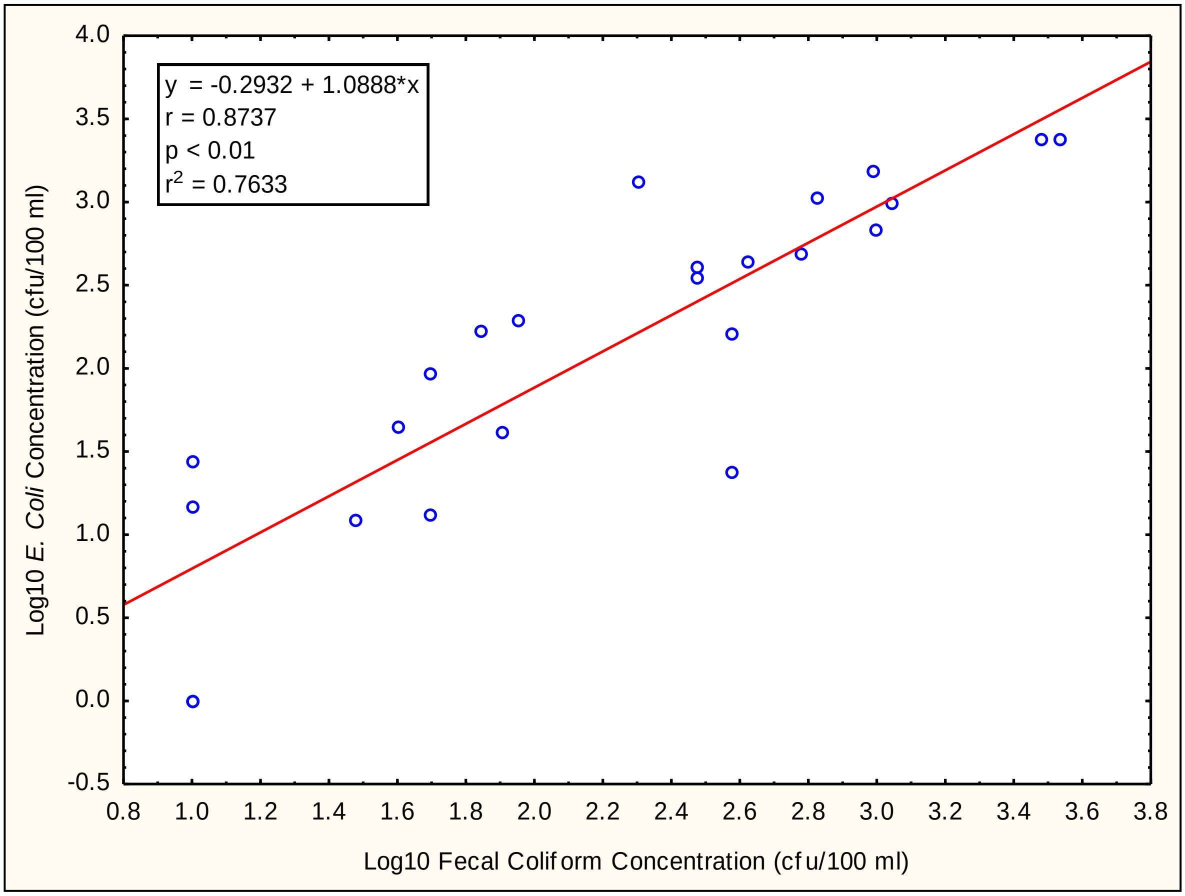

Figure 3: *E. coli* - fecal coliform regression relationship.

3.3 Flow Analysis

Flow data was collected at T28 (Figure 4 and 5). Also flow was collected at T29 (Figure 4 and 6) but was found to be unreliable because discharge values derived from this site exceeded discharge values observed from downstream USGS gaging station 06482610 (Figure 4 and 8). In addition flow data was collected at site T30 from Split Rock Creek near Sherman, SD (Figure 4 and 7). An Aquarius model was built using flow data from T28, T30 and USGS flow data. USGS flow data only overlapped with T28 flow data for the month of October of 2001 and the flow record for this month did not contain any event based flows. T30 data overlapped temporally with T28 data for a longer period of time and T30 data was adjusted in Aquarius to better match USGS data. After this was completed, corrected T30 data was correlated with T28 data and a non-linear artificial neural model was created from the relationship. A validation factor of 8, 500 training epochs, and two member functions were used to create the model between corrected T30 and T28 data. As mentioned earlier data from T30 was adjusted to match USGS gaging station 06482610 data. This was done because USGS flow data only overlapped for one moth with T28 data when no event flows occurred. By adjusting T30 data to match USGS flow data we were able to create a relationship between T28 and T30 data in which we could later use USGS flow data as a surrogate for estimating a longer-term flow record for T28 for use in the load duration curve analysis. Flow data from USGS gaging station 06482610 collected from 10/1/2001 to 10/16/2011 was used as a surrogate to model a flow record for T28. The entire flow record from 06482610 was not used because it was desired that flow data would represent land use characteristics during the sampling decade. The modeled flow record for T28 was used to represent the impaired reach.

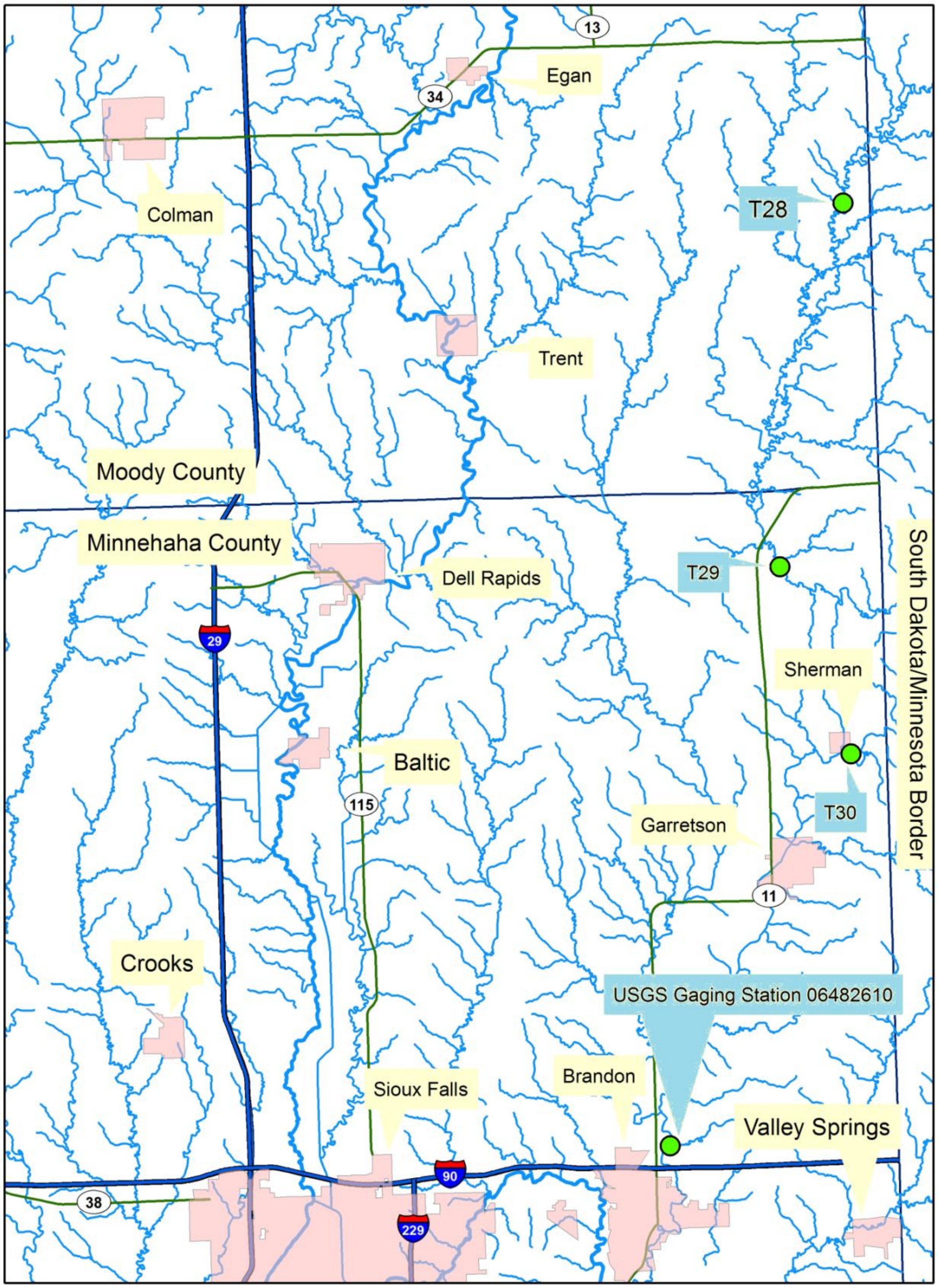

Figure 4: Location of sites T28, T29, T30, and USGS gaging station 06482610.

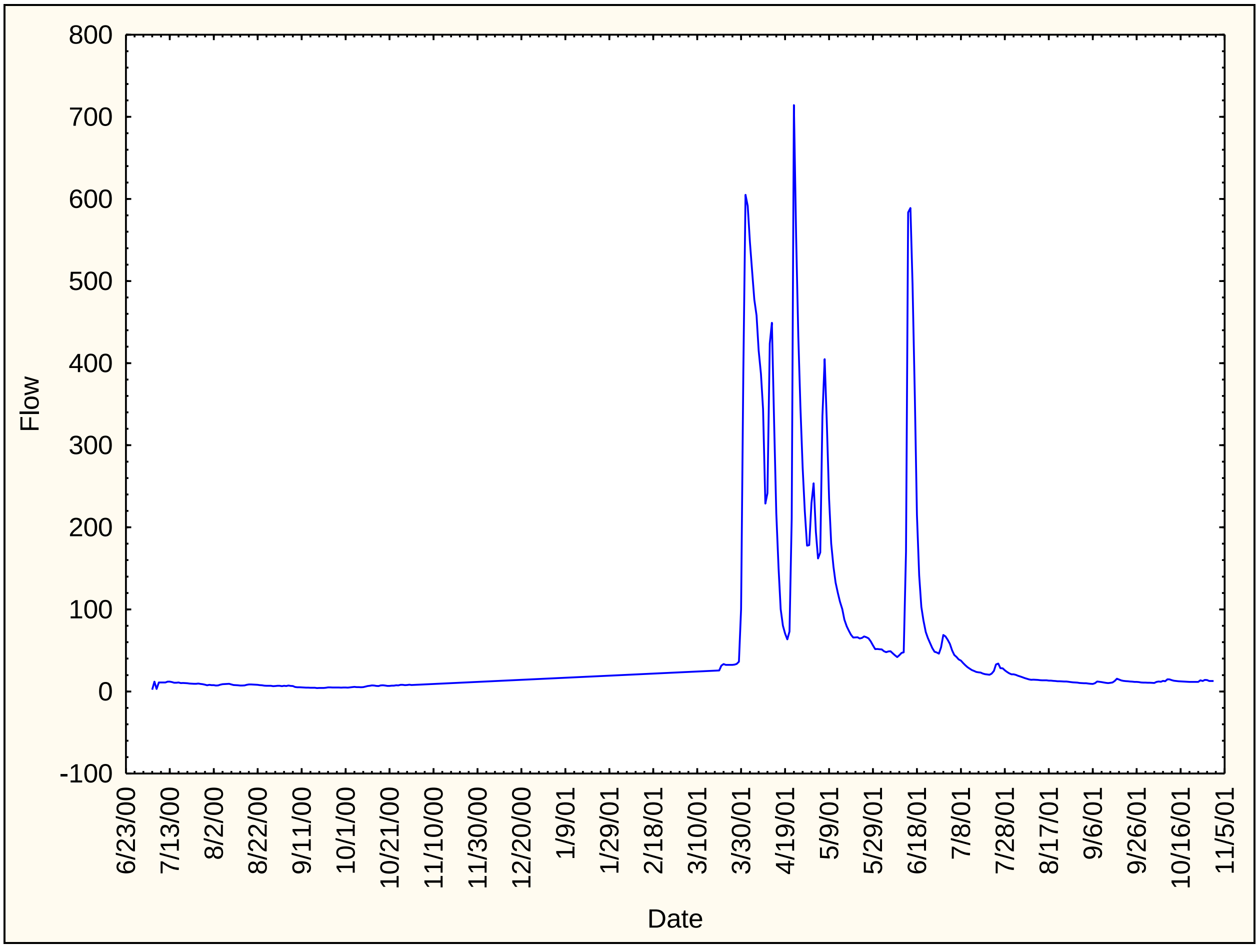

Figure 5: Flow record from T28 from 7/5/2000 to 10/31/2001.

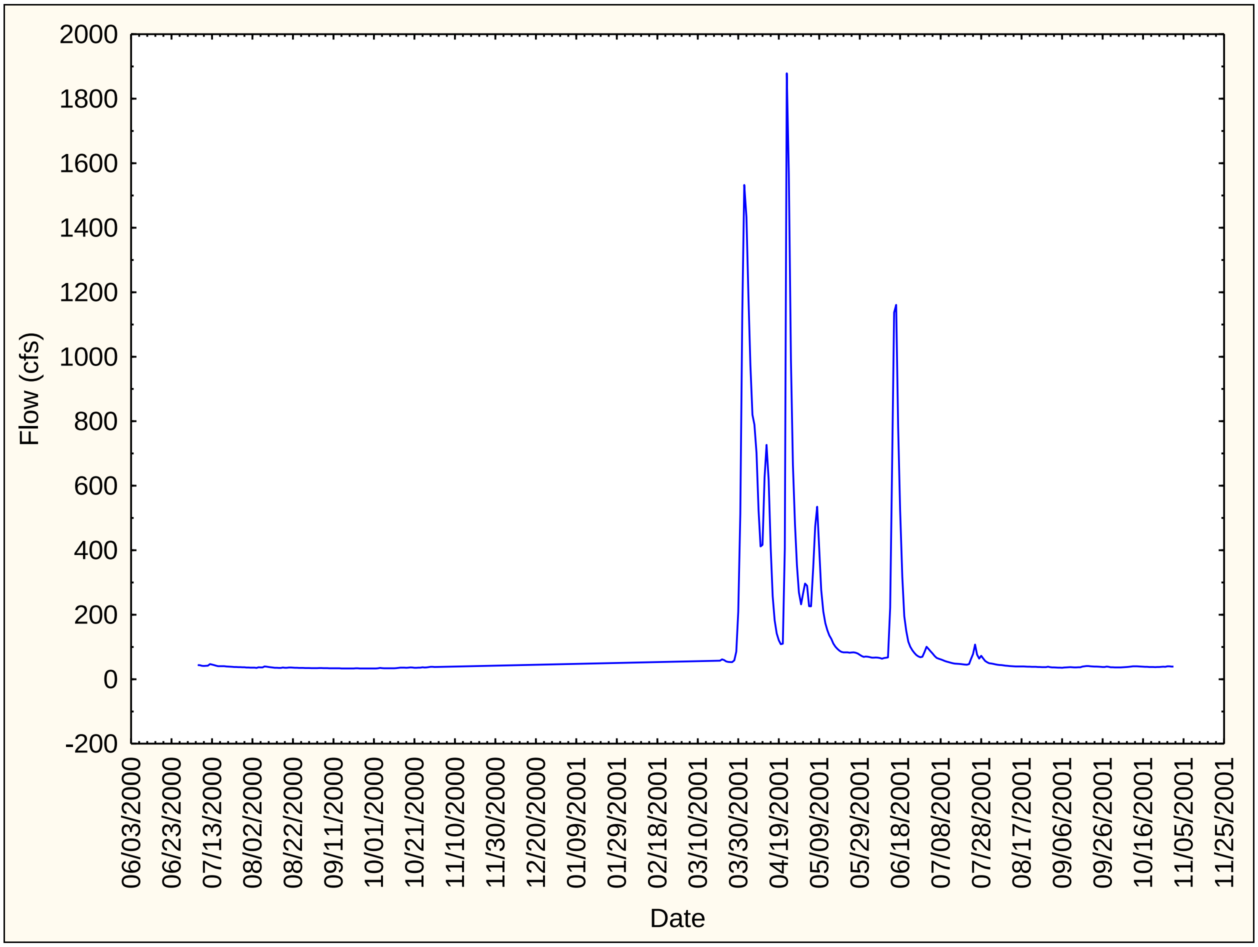

Figure 6: Flow data from T29 dating from 7/6/2000 through 10/31/2001. Flow data exceeded downstream USGS flow data and was not used to estimate loading.

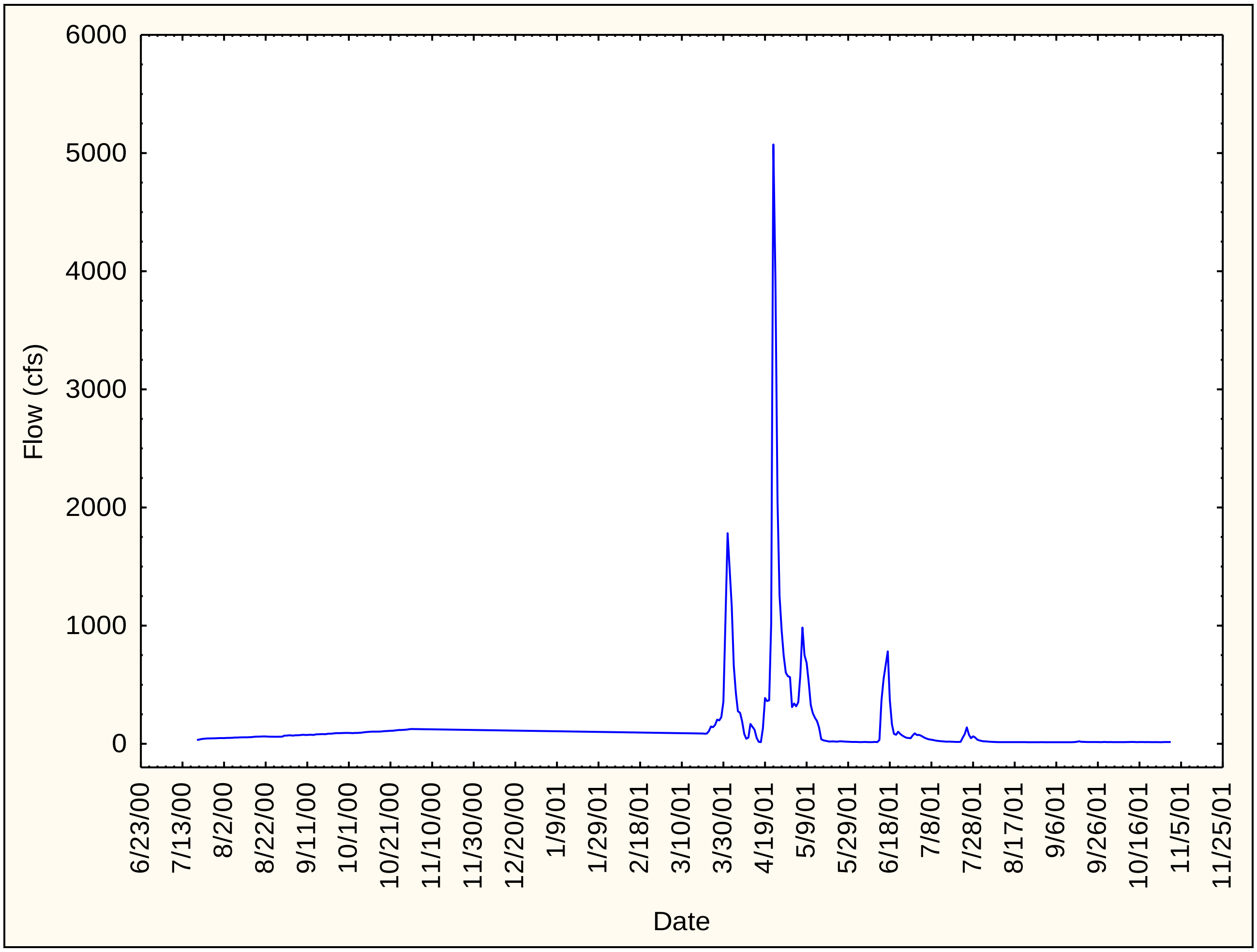

Figure 7: Flow record from T30 from 7/5/2000 to 10/31/2001.

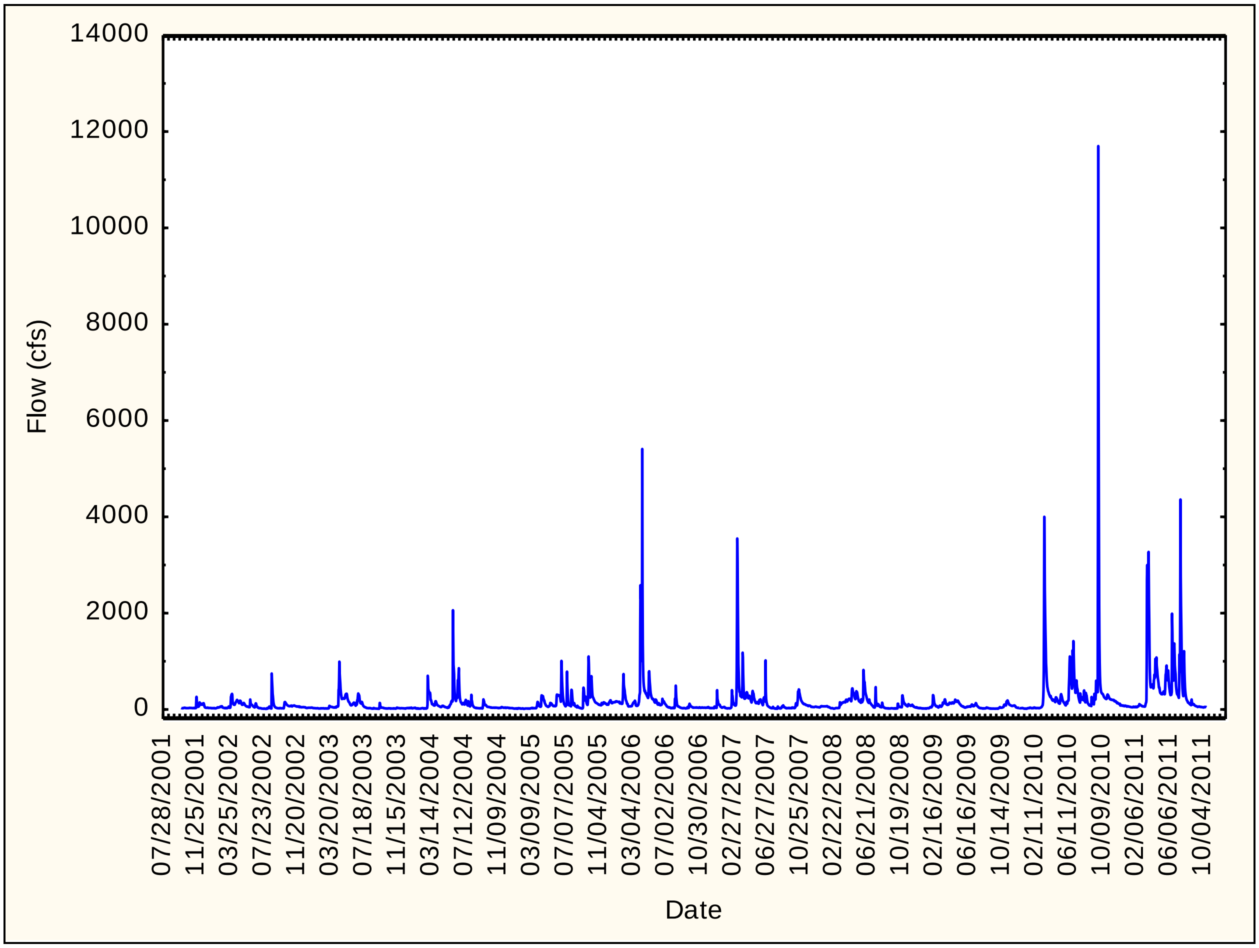

Figure 8: Flow record from USGS gaging station 06482610 from 10/1/2001 to 10/16/2011.

This TMDL was developed using the Load Duration Curve (LDC) approach that results in a flow-variable target that considers the entire flow regime (Figure 9). The LDC is a dynamic expression of the allowable load for a given flow. Paired flow - *E. coli* samples from 2000, 2001, 2006, 2007, and 2008 were used to create a load duration curve. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into five flow zones representing high flows (0-10 percent), moist conditions (10-40 percent), mid-range flows (40-60 percent), dry conditions (60-90 percent), and low flows (90-100 percent) (USEPA 2006). Modeled and observed T28 data served as the flow record for generating the load duration curve. A flow record for T28 using a T28/adjusted T30 flow data and using USGS flow data as a surrogate is likely to provide a good approximation for use in a load duration curve framework. Using an estimated flow record is preferred over using a short term flow record involving only real values which will not adequately capture yearly variations in flow dynamics (the results of a drought or deluge year would not be adequately represented with only short term data, whereas a model based on real data from a downstream USGS gaging station would allow for drought and deluge patterns to be represented).

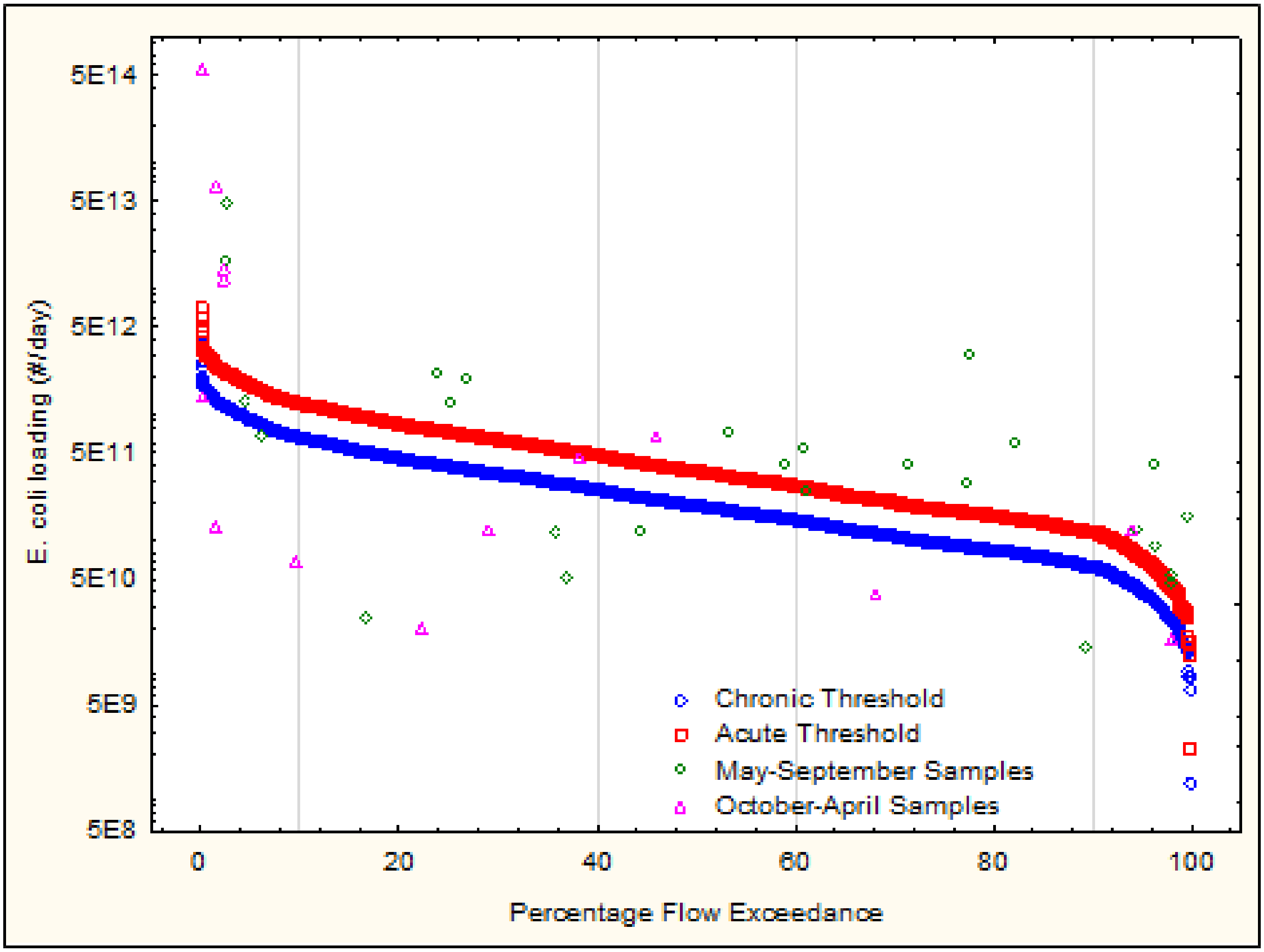

Figure 9: Load duration curve for Pipestone Creek (SD-BS-R-PIPESTONE_01) based on data from sites T28 and T29.

4.0 Significant Sources

4.1 Point Sources

There are no point sources within the Pipestone Creek watershed.

4.2 Nonpoint Sources

Nonpoint pollution of fecal coliform in Pipestone Creek comes primarily from agricultural sources. Fecal coliform is used as a measure of bacterial contribution due to defined fecal coliform contribution rates as illustrated in the EPA bacterial indicator tool. E. coli contribution rates are expected to be a portion of fecal coliform rates and relative contribution of livestock, human, and wildlife are expected to be similar to fecal coliform contributions. Data from the 2003 and 2009 National Agricultural Statistic Survey (NASS) and from the 2002 South Dakota Game Fish and Parks county wildlife assessment were utilized for livestock and wildlife densities, respectively. Animal density information (Table 4) was used to estimate relative source contributions of bacteria loads.

4.2.1 Agriculture

Manure from livestock is a potential source of *E. coli* to the stream. Livestock in the basin are predominantly hogs and beef cattle. Livestock can contribute *E. coli* bacteria directly to the stream by defecating while wading in the stream. They also can contribute by defecating while grazing on rangelands that get washed off during precipitation events. Table 5 allocates the sources for bacteria production in the watershed into four primary categories. The summary is based on several assumptions. Feedlot numbers were calculated as the sum of all dairy, hog, and the NASS estimate of beef in feeding areas. All remaining livestock were assumed to be on grass. Feedlots occurring in best management practice priority areas indicated in Figure 10.

Table 5: Fecal coliform source allocation for Pipestone Creek.

Source	Percentage
livestock on range	56.80%
feedlots	42.15%
wildlife	0.80%
human	0.25%

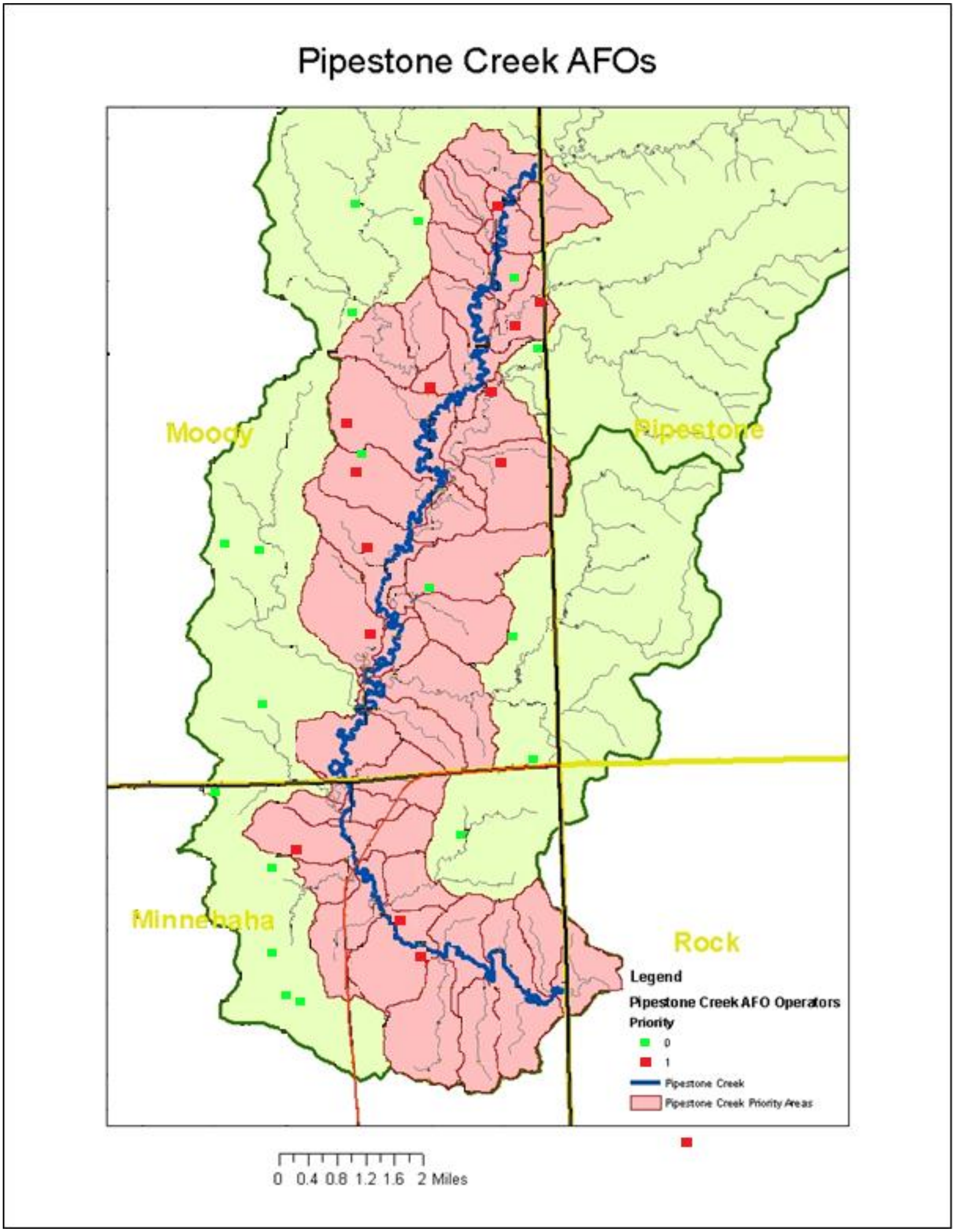

Figure 10: Animal feeding operation locations throughout the Pipestone Creek watershed.

4.2.2 Natural background/wildlife

Wildlife within the watershed is a natural background source of *E. coli* bacteria. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish, and Parks (Table 6). Wildlife contributes 0.001% of the total *E. coli* load.

4.2.3 Human

An estimated 33 septic systems occur along Pipestone Creek within South Dakota. Data does not exist on the condition of such systems. Human density was estimated from the 2010 census and an estimated *E. coli* load was generated. The estimated loading is likely an overestimation of human contribution assuming that most of the waste is handled by municipalities and most septic systems are operating correctly.

Table 6: Pipestone Creek potential nonpoint sources.

Species	#/sq mile	#/acre	FC/Animal/Day	Fecal Coliform Daily Load (cfu/acre)	Percent
Dairy	7.386	0.012	1.01E+11	1.16E+09	7.36%
Hogs	64.611	0.101	1.08E+10	1.09E+09	6.89%
Cattle on Feed	27.151	0.042	1.04E+11	4.41E+09	27.90%
Cattle on Range	54.509	0.085	1.04E+11	8.86E+09	56.01%
Sheep	6.528	0.010	1.20E+10	1.22E+08	0.77%
Horses	2.388	0.004	4.20E+08	1.57E+06	0.01%
Chicken7	9.428	0.015	1.36E+08	2.00E+06	0.01%
Human	12.690	0.020	2.00E+09	3.97E+07	0.25%
All Wildlife	Sum of all Wildlife			1.26E+08	0.80%
Deer3	3.884	0.006	5.00E+08	3.00E+06	
Turkey1	0.182	0.000	9.30E+07	2.79E+04	
Opossom5	2.554	0.004	1.25E+08	5.00E+05	
Mink5	1.907	0.003	1.25E+08	3.75E+05	
Beaver3	1.908	0.003	2.50E+08	7.50E+05	
Muskrat1	5.814	0.009	1.25E+08	1.13E+06	
Skunk5	5.402	0.008	1.25E+08	1.00E+06	
Badger5	0.825	0.001	1.25E+08	1.25E+05	
Coyote4	0.308	0.001	4.09E+09	2.04E+06	
Fox4	1.533	0.002	4.09E+09	8.17E+06	
Raccoon3	4.055	0.006	1.25E+08	7.50E+05	
Jackrabbit5	0.857	0.001	1.25E+08	1.25E+05	
Cottontail5	23.424	0.037	1.25E+08	4.63E+06	
Squirrel5	19.822	0.031	1.25E+08	3.88E+06	
Partridge2	8.273	0.013	1.36E+08	1.77E+06	
Canada Goose6	1.119	0.002	4.90E+10	9.80E+07	
1 USEPA 2001					
2 FC/Animal/Day copied from chicken (USEPA 2001) to provide an estimate of background affects of wildlife					
3 Bacteria Indicator Tool worksheet					
4 Best professional judgment based off of dogs					
5 FC/Animal/Day copied from raccoon to provide a more conservative estimate of background affects of wildlife					
6 FC/Animal/Day copied from goose (USEPA 2001) to provide an estimate of background effects of wildlife					
7 Data from 2003 NASS					

5.0 Boundary Conditions

T28 occurs near the Minnesota border where Pipestone Creek enters South Dakota. It was considered a boundary condition in respect to this document. All five flow zones were populated with 52 samples and a load duration curve was generated (Figure 11). *E. coli* concentrations occurring at this site largely originate from Minnesota.

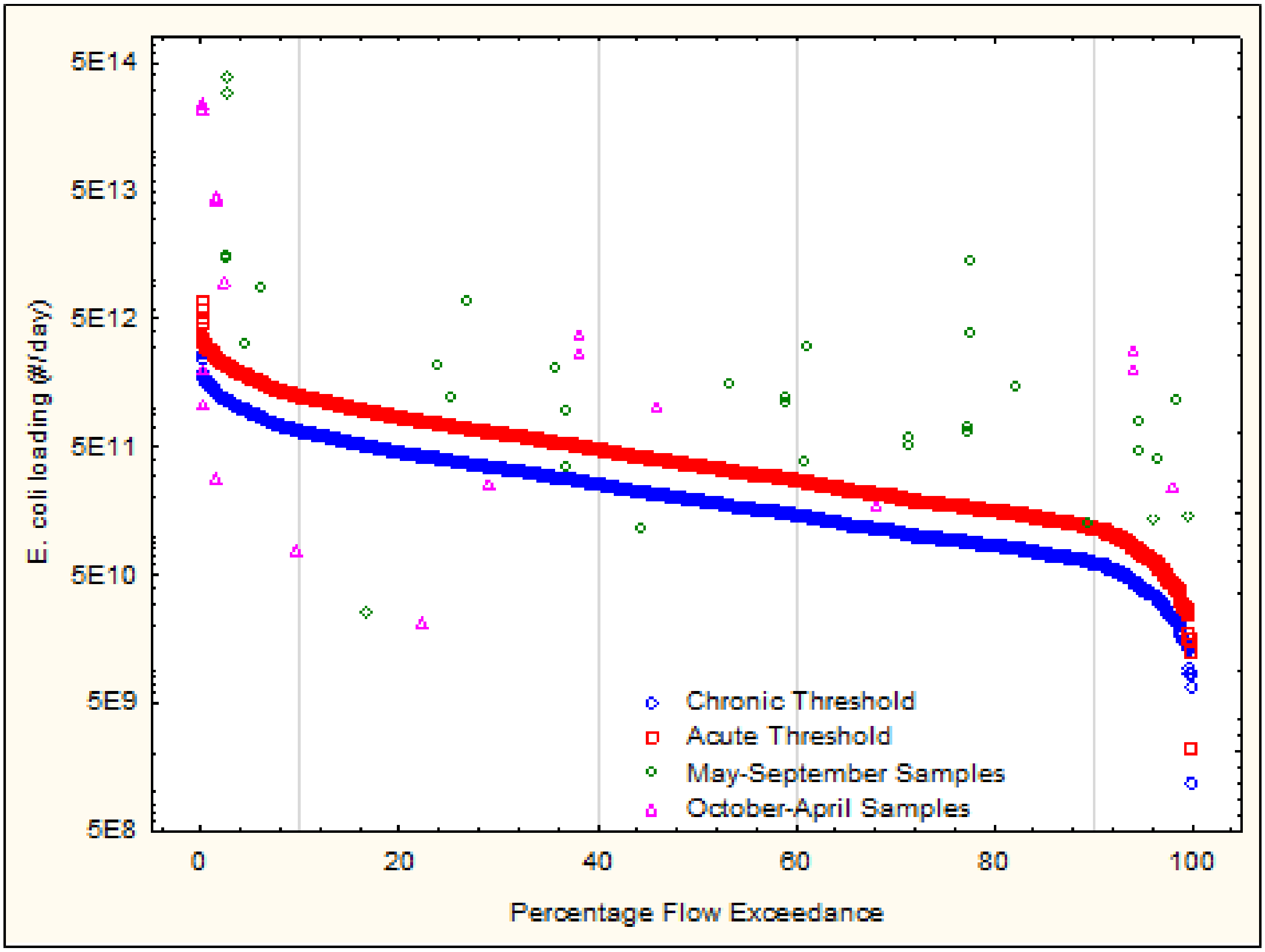

Figure 11: Boundary condition load duration curve.

Load reductions were required in all flow zones in order to meet the chronic threshold. The highest reduction was needed in the high flow zone (Table 7).

Table 7: Boundary conditions at T28.

Flow Zone	High	Moist Condition	Mid-Range	Dry	Low Flow
CFS	≥ 212.67	82.64 - 212.62	47.54 - 82.4	20.51 - 47.54	≤ 20.04
TMDL	8.45E+14	1.23E+14	1.94E+13	6.32E+12	1.24E+12
MOS	2.57E+11	1.32E+11	4.37E+10	3.14E+10	3.89E+10
LA	8.45E+14	1.23E+14	1.94E+13	6.29E+12	1.20E+12
Load Reduction (%)	99	89	84	98	97

6.0 TMDL and Calculations

6.0.1 High Flows

The high flow zone includes flows that exceed 213 cfs. Eleven samples were collected in the high flow zone. Of these one exceeded the chronic threshold but not the acute standard and six exceeded the chronic threshold and acute standard. A loading reduction of 99% is needed to bring *E. coli* concentrations into compliance with the chronic threshold. Table 8 depicts a TMDL for a flow of 517 cfs, which is the 95th percentile flow for high flows. Higher or lower flows within this zone may acceptably carry higher or lower flows as long as the concentration does not exceed the state standard.

The concentration of 235 cfu/100 ml represents the acute standard threshold. This may make an appropriate target because flows in excess of 213 cfs typically last for short periods of time.

While the acute threshold would have made an appropriate goal, a chronic threshold of 126 cfu/100 ml was used. Chronic exceedences are not likely in this flow zone but using the chronic threshold helps to ensure that water quality violations will be less likely.

Table 8: TMDL calculation for high flows for Pipestone Creek.

	Flow Zone (expressed as cfu/day)	
	High Flows	
	> 213 cfs	
LA	8.24E+14	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	2.55E+11	
TMDL @ 126 cfu/100 ml	8.24E+14	Standard multiplied by 95th% flow by zone.
Current Load	1.65E+17	95th% of observed *E. coli* bacteria loads for each zone multiplied by 95th% flow for zone.
Load Reduction	99%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.0.2 Moist Conditions

The moist condition flow zone occurs from 83 to 213 cfs. Within this flow zone nine samples were collected. Four samples exceeded both the chronic threshold and the acute standard. At a flow of 200 cfs (95th percentile flow) a load reduction of 70% will be needed to bring *E. coli* concentrations into compliance with the chronic standard (Table 9). Using the chronic threshold as a target helps to ensure that both the acute and chronic standards will not be violated. Flows higher or lower than 200 cfs can acceptably carry higher or lower loads as long as the concentration does not exceed the state standard.

Table 9: TMDL calculation for moist conditions for Pipestone Creek.

	Flow Zone (expressed as cfu/day)	
	Moist Conditions	
	83 – 213 cfs	
LA	1.23E+14	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	1.33E+11	
TMDL @ 126 cfu/100 ml	1.23E+14	Standard multiplied by 95th% flow by zone.
Current Load	4.16E+14	95th% of observed *E. coli* bacteria loads for each zone multiplied by 95th% flow for zone.
Load Reduction	70%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.0.3 Mid-Range Flows

The mid-range flow zone is characterized by discharges ranging from 48 to 82 cfs.
Four samples were collected within the mid-range flow zone. Three samples exceeded both the chronic threshold and the acute standard. A reduction of 67% will be needed to meet the chronic threshold. A flow of 79 cfs (95th percentile) was used in calculating the TMDL (Table 10). Higher or lower flows can carry higher or lower loads as long as concentrations do not violate state standards.

Table 10: TMDL calculation for mid-range conditions for Pipestone Creek.

	Flow Zone (expressed as cfu/day)	
	Mid-Range Conditions	
	48 – 82 cfs	
LA	1.94E+13	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	4.37E+10	
TMDL @ 126 cfu/100 ml	1.94E+13	Standard multiplied by 95th% flow by zone.
Current Load	5.86E+13	95th% of observed *E. coli* bacteria loads for each zone multiplied by 95th% flow for zone.
Load Reduction	67%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.0.4 Dry Conditions

Dry conditions encompass flows of 21 to 48 cfs. Eight samples were collected within the flow zone. One samples exceeded the chronic threshold but not the acute standard and five exceeded both the chronic threshold and the acute standard. A flow of 45 cfs (95th percentile) was used in calculating the TMDL (Table 11). A reduction of 94% is needed to meet the chronic threshold. We chose to use the chronic threshold as a target as it helps ensure that both the chronic and the acute standards will be met. Higher or lower flows within the dry condition zone may acceptably carry higher or lower loads as along as the concentration does not exceed state standards.

Table 11: TMDL calculation for dry conditions for Pipestone Creek.

	Flow Zone (expressed as cfu/day)	
	Dry Conditions	
	21 – 48 cfs	
LA	6.29E+12	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	3.14E+10	
TMDL @ 126 cfu/100 ml	6.32E+12	Standard multiplied by 95th% flow by zone.
Current Load	9.86E+13	95th% of observed *E. coli* bacteria loads for each zone multiplied by 95th% flow for zone.
Load Reduction	94%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.0.5 Low Flows

Low flows occur from 0 to 21 cfs. Eight samples were collected from this flow zone. Seven samples exceeded both the chronic threshold but the acute standard. An 81% reduction is needed to meet the chronic threshold based on the available data. A flow of 20 cfs (95th percentile) was used in calculating the TMDL (Table 12). Higher or lower flows within this zone may acceptably carry higher or lower loads as long as state standards are not violated.

Table 12: TMDL calculations for low flows for Pipestone Creek.

	Flow Zone (expressed as cfu/day)	
	Low Flows	
	< 21 cfs	
LA	1.20E+12	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	3.89E+10	
TMDL @ 126 cfu/100 ml	1.24E+12	Standard multiplied by 95th% flow by zone.
Current Load	6.57E+12	95th% of observed *E. coli* bacteria loads for each zone multiplied by 95th% flow for zone.
Load Reduction	81%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.1 Wasteload Allocations (WLAs)

There are no point sources within this watershed. A WLA of 0 was therefore used in the TMDL calculation.

6.2 Load Allocations (LAs)

Approximately 99% of the watershed is comprised of agricultural land use. *E. coli* loading is attributed to these sources. Site T29 occurs within the lower part of the watershed. In the high flow zone at this site a reduction of 99% will be needed to meet the chronic threshold. A 70% reduction is needed in the moist condition flow zone. A 67% reduction is needed in the mid-range flow zone. A reduction of 94% is needed in the dry condition zone. A reduction of 81% is needed in the low flow zone.

Much of the drainage area of Pipestone Creek occurring in South Dakota is located in Minnesota. Pipestone Creek within Minnesota is considered a Class 2C surface water and carries the following water quality standard for *E. coli* bacteria: "*Escherichia coli*. Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions within any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31." Minnesota's chronic standard is similar to South Dakota's *E. coli* standard for immersion recreation which carries a chronic value of 126 cfu/100 ml. Minnesota's acute standard is slightly higher than South Dakota's limited contact recreation *E. coli* standard of 1,178 cfu/100 ml. Minnesota's standard encompasses the range of South Dakota *E. coli* standards assigned to Pipestone Creek.

Minnesota's TMDL addressed fecal coliform bacteria; however the document states that it would address *E. coli* impairment as well by multiplying fecal coliform concentrations by a factor of 0.63. Load reductions needed in Minnesota to meet water quality standards in fecal coliform bacteria are similar to those needed in South Dakota (Minnesota Pollution Control Agency 2008; South Dakota Department of Environment and Natural Resources 2004). Much of the loading within Minnesota (95.1 %) is attributed to cattle (beef and dairy) and hogs. Practices such as livestock exclusion from the stream, grazing rotation, application of manure to only frozen ground, upgrading non-compliant septic systems, and correction of feedlots with runoff issues were among BMP's recommended to meet bacterial water quality standards within Minnesota (Minnesota Pollution Control Agency 2008).

7.0 Monthly Patterns

T28 and T29 displayed distinct monthly patterns in terms of *E. coli* concentrations and flow. Flow tended to rise in late winter and peak during the spring (Figure 12). *E. coli* concentrations were higher June through September with the highest concentration occurring at Site T28 in June. *E. coli* data from November to March do not exist for Pipestone Creek due to the assessment period occurring from May through September. Snow cover and spring runoff lead to increased flows during early spring. Spring showers create runoff which carries fecal matter into Pipestone Creek resulting in elevated *E. coli* concentrations. Summer is also a time of peak recreational use of Pipestone Creek. This fact coupled with elevated *E. coli* concentrations makes summer a critical time in which to reduce loading.

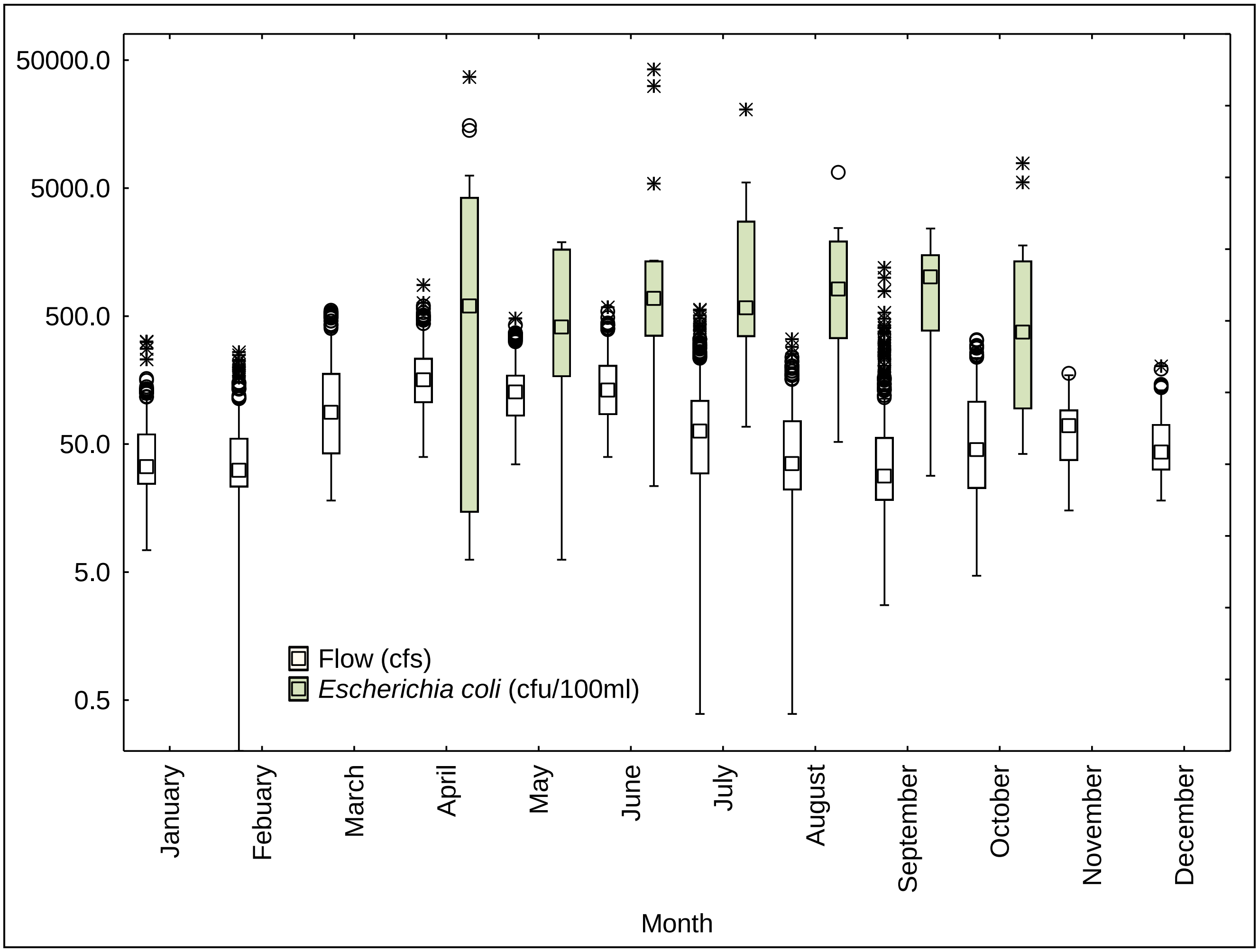

Figure 12: Seasonality of flow and E. coli concentrations.

On average *E. coli* concentrations were lower at T29 relative to T28 (Figure 13). T28 had the highest occurring value which was collected during June. The greatest amount of overlap between T28 and T29 occurred from April through July.

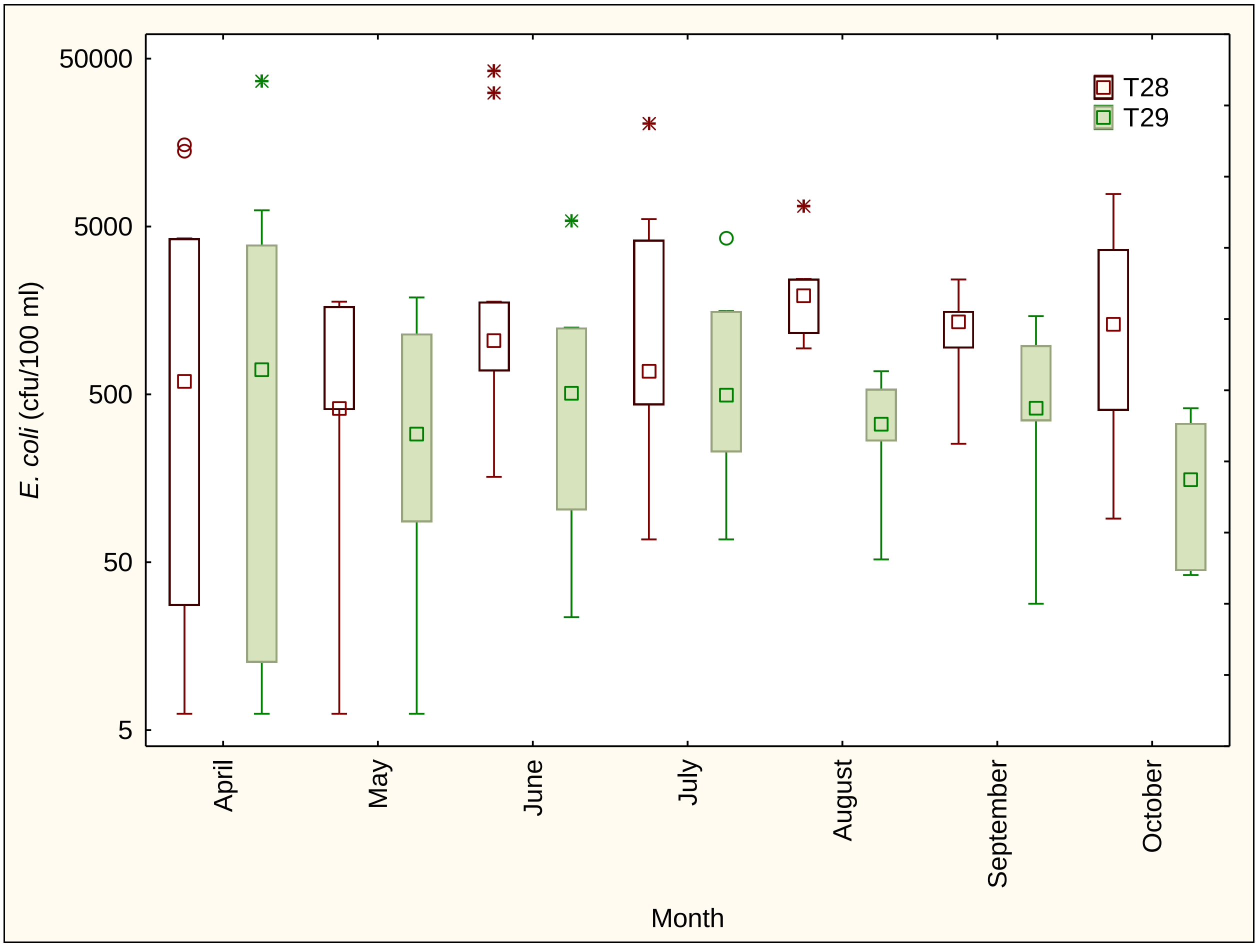

Figure 13: Comparison of monthly *E. coli* concentrations between sampling sites T28 and T29.

8.0 Margin of Safety (MOS)

An explicit MOS identified using a duration curve framework is basically unallocated assimilative capacity intended to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc.). An explicit MOS was calculated as the difference between the loading capacity at the mid-point of each of the flow zones and the loading capacity at the minimum flow in each zone. A substantial MOS is provided using this method, because the loading capacity is typically much less at the minimum flow of a zone as compared to the mid-point. Because the allocations are a direct function of flow, accounting for potential flow variability is an appropriate way to address the MOS.

9.0 Follow-Up Monitoring and TMDL Review

The department may adjust the load allocations in this TMDL to account for new information or circumstances that are developed or come to light during the implementation of the TMDL and a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment of the load allocation will only be made following an opportunity for public participation. New information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information and land use information. The department will propose adjustments only in the event that any adjusted LA will not result in a change to the loading capacity; the adjusted TMDL, including load allocations, will be set at a level necessary to implement the applicable water quality standards. The department will notify EPA of any adjustments to this TMDL within 30 days of their adoption.

The Central Big Sioux River Implementation Project is currently assessing project effectiveness with models such as AnnAGNPS, RUSLE2, and STEPL. Water quality monitoring is not currently being done on this stream although occasional sampling may occur.

10.0 Restoration Strategy

Currently there is an implementation project targeting areas outlined by the Central Big Sioux River Implementation Project. Project goals for improving *E. coli* bacteria impairment include: reduced access to streams for livestock, increase alternative watering sources for livestock, rotational grazing, riparian management, and 33 waste management systems.

If the above mentioned BMPs are implemented in the Pipestone Creek watershed there is likelihood that the TMDL can be achieved.

11.0 Public Participation

Efforts were taken to gain public education, review, and comment during the development of the TMDL involved:

1. Various public meetings were held during the Central Big Sioux River Assessment phase.
2. A webpage was developed and used during the course of the assessment.
3. Presentations were given to local groups on findings of the assessment.
4. 30-day public notice (PN) period for public review and comment was used. A Public Notice was published in the Sioux Falls Argus Leader, Brookings Register, and the Moody County Enterprise.

12.0 Literature Cited

Huxoll, Cory. 2002. South Dakota Game Fish and Parks; South Dakota Game Report No. 2003-11; 2002 Annual Report County Wildlife Assessments with a summary of the 1991-2002 Assessments.

MPCA (Minnesota Pollution Control Agency. 2008. Pipestone Creek Fecal Coliform Bacteria and Turbidity Total Maximum Daily Load Report. WQ-iw7-07b.

SDDENR (South Dakota Department of Environment and Natural Resources). 2004. Phase 1 watershed assessment final report and TMDL: Central Big Sioux River; Brookings, Lake, Moody, and Minnehaha Counties, South Dakota. Pierre, SD.

SDDENR (South Dakota Department of Environment and Natural Resources). 2010. The 2010 South Dakota Integrated Report for Surface Water Quality Assessment Pierre, SD.

US Census Bureau 2010. United States Census 2010. http://2010.census.gov/2010census/data/

USDA (United States Department of Agriculture). 1989. Soil Survey of Moody County, South Dakota.

USDA (United States Department of Agriculture). 2004. Soil Survey of Minnehaha County, South Dakota.

USEPA (U.S. Environmental Protection Agency). 2006. An Approach for Using Load Duration Curves in Developing TMDLs. U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds, Washington, DC.

USEPA (U.S. Environmental Protection Agency). 2001. Protocol for Developing Pathogen TMDLs. EPA 841-R-00-002. Office of Water 4503F0, United States Environmental Protection Agency, Washington D.C. 132 pp.

EPA REGION 8 TMDL REVIEW

TMDL Document Info:

Document Name:	**Escherichia Coli Bacteria Total Maximum Daily Load Evaluation for Pipestone Creek Located in Moody and Minnehaha Counties, South Dakota**
Submitted by:	**South Dakota Department of Environment and Natural Resources**
Date Received:	**December 6, 2011**
Review Date:	**January 30, 2012**
Reviewer:	**Bonnie Lavelle, EPA**
Rough Draft / Public Notice / Final Draft?	**Public Notice Draft**
Notes:	

Reviewers Final Recommendation(s) to EPA Administrator (used for final draft review only):

- ☐ Approve
- ☐ Partial Approval
- ☐ Disapprove
- ☐ Insufficient Information

Approval Notes to Administrator:

This document provides a standard format for EPA Region 8 to provide comments to state TMDL programs on TMDL documents submitted to EPA for either formal or informal review. All TMDL documents are evaluated against the minimum submission requirements and TMDL elements identified in the following 8 sections:

1. Problem Description
    - 1.1. TMDL Document Submittal Letter
    - 1.2. Identification of the Waterbody, Impairments, and Study Boundaries
    - 1.3. Water Quality Standards
2. Water Quality Target
3. Pollutant Source Analysis
4. TMDL Technical Analysis
    - 4.1. Data Set Description
    - 4.2. Waste Load Allocations (WLA)
    - 4.3. Load Allocations (LA)
    - 4.4. Margin of Safety (MOS)
    - 4.5. Seasonality and variations in assimilative capacity
5. Public Participation
6. Monitoring Strategy
7. Restoration Strategy
8. Daily Loading Expression

Under Section 303(d) of the Clean Water Act, waterbodies that are not attaining one or more water quality standard (WQS) are considered "impaired." When the cause of the impairment is determined to be a pollutant, a TMDL analysis is required to assess the appropriate maximum allowable pollutant loading rate. A TMDL document consists of a technical analysis conducted to: (1) assess the maximum pollutant loading rate that a waterbody is able to assimilate while maintaining water quality standards; and (2) allocate that assimilative capacity among the known sources of that pollutant**.** A well written TMDL document will describe a path forward that may be used by those who implement the TMDL recommendations to attain and maintain WQS.

Each of the following eight sections describes the factors that EPA Region 8 staff considers when reviewing TMDL documents. Also included in each section is a list of EPA's minimum submission requirements relative to that section, a brief summary of the EPA reviewer's findings, and the reviewer's comments and/or suggestions. Use of the verb "must" in the minimum submission requirements denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable.

This review template is intended to ensure compliance with the Clean Water Act and that the reviewed documents are technically sound and the conclusions are technically defensible.

1. Problem Description

A TMDL document needs to provide a clear explanation of the problem it is intended to address. Included in that description should be a definitive portrayal of the physical boundaries to which the TMDL applies, as well as a clear description of the impairments that the TMDL intends to address and the associated pollutant(s) causing those impairments. While the existence of one or more impairment and stressor may be known, it is important that a comprehensive evaluation of the water quality be conducted prior to development of the TMDL to ensure that all water quality problems and associated stressors are identified. Typically, this step is conducted prior to the 303(d) listing of a waterbody through the monitoring and assessment program. The designated uses and water quality criteria for the waterbody should be examined against available data to provide an evaluation of the water quality relative to all applicable water quality standards. If, as part of this exercise, additional WQS problems are discovered and additional stressor pollutants are identified, consideration should be given to concurrently evaluating TMDLs for those additional pollutants. If it is determined that insufficient data is available to make such an evaluation, this should be noted in the TMDL document.

1.1 TMDL Document Submittal Letter

When a TMDL document is submitted to EPA requesting formal comments or a final review and approval, the submittal package should include a letter identifying the document being submitted and the purpose of the submission.

Minimum Submission Requirements.

- ☒ A TMDL submittal letter should be included with each TMDL document submitted to EPA requesting a formal review.
- ☒ The submittal letter should specify whether the TMDL document is being submitted for initial review and comments, public review and comments, or final review and approval.
- ☐ Each TMDL document submitted to EPA for final review and approval should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute**.** The submittal letter should contain such identifying information as the name and location of the waterbody and the pollutant(s) of concern, which matches similar identifying information in the TMDL document for which a review is being requested.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information ☐ N/A

<u>Summary:</u>

The public notice draft TMDL document was submitted to EPA via email on December 6, 2011 along with a copy of the public notice. The public notice contains information on how to obtain a copy of the

TMDL document and requests the submittal of comments to DENR by January 14, 2012. The transmittal email clearly indicates the document is a public notice draft and requests EPA review.

Comments:

No Comments.

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

The TMDL document should provide an unambiguous description of the waterbody to which the TMDL is intended to apply and the impairments the TMDL is intended to address. The document should also clearly delineate the physical boundaries of the waterbody and the geographical extent of the watershed area studied. Any additional information needed to tie the TMDL document back to a current 303(d) listing should also be included.

Minimum Submission Requirements:

☒ The TMDL document should clearly identify the pollutant and waterbody segment(s) for which the TMDL is being established. If the TMDL document is submitted to fulfill a TMDL development requirement for a waterbody on the state's current EPA approved 303(d) list, the TMDL document submittal should clearly identify the waterbody and associated impairment(s) as they appear on the State's/Tribe's current EPA approved 303(d) list, including a full waterbody description, assessment unit/waterbody ID, and the priority ranking of the waterbody. This information is necessary to ensure that the administrative record and the national TMDL tracking database properly link the TMDL document to the 303(d) listed waterbody and impairment(s).

☒ One or more maps should be included in the TMDL document showing the general location of the waterbody and, to the maximum extent practical, any other features necessary and/or relevant to the understanding of the TMDL analysis, including but not limited to: watershed boundaries, locations of major pollutant sources, major tributaries included in the analysis, location of sampling points, location of discharge gauges, land use patterns, and the location of nearby waterbodies used to provide surrogate information or reference conditions. Clear and concise descriptions of all key features and their relationship to the waterbody and water quality data should be provided for all key and/or relevant features not represented on the map

☒ If information is available, the waterbody segment to which the TMDL applies should be identified/geo-referenced using the National Hydrography Dataset (NHD). If the boundaries of the TMDL do not correspond to the Waterbody ID(s) (WBID), Entity_ID information or reach code (RCH_Code) information should be provided. If NHD data is not available for the waterbody, an alternative geographical referencing system that unambiguously identifies the physical boundaries to which the TMDL applies may be substituted.

Recommendation:
☐ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

***Physical Setting and Listing History**:*

Pipestone Creek begins north of Pipestone, Minnesota, flows to South Dakota through Moody County and Minnehaha County and re-enters Minnesota to eventually join Split Rock Creek in Rock County Minnesota. Split Rock Creek eventually flows into the Big Sioux River below the City of Brandon, South Dakota, just east of the city of Sioux Falls.

The portion of Pipestone Creek within South Dakota is 35.4 miles long and drains approximately 45,993 acres in eastern South Dakota. Land use within the Pipestone Creek watershed in South Dakota is mainly cropland (82%) interspersed with rangeland/grassland (17%). Approximately 1% of the land in the watershed is developed. Pipestone Creek receives runoff from agricultural operations. The potential *impacts of the municipality of Pipestone, Minnesota on the water quality of Pipestone Creek within South Dakota are not addressed in this TMDL document.*

The HUC Code for Pipestone Creek is 10170203.

Chapter 74:51:03:01 of the South Dakota Administrative Rules assigns all streams in South Dakota the beneficial uses of:

Beneficial Use Classification 9: Fish and wildlife propagation, recreation, and stock watering waters
Beneficial Use Classification 10: Irrigation waters

Chapter 74:51:03:07 of the South Dakota Administrative Rules assigns the following additional beneficial use classifications to Pipestone Creek from Split Rock Creek to the Minnesota border:

Beneficial Use Classification 5: Warmwater semi permanent fish life propagation waters
Beneficial Use Classification 7: Immersion recreation waters
Beneficial Use Classification 8: Limited contact recreation waters

Pipestone Creek was included in the Central Big Sioux River Watershed Assessment Project implemented in April 1999 through December 2003. The project was initiated in response to the Central Big Sioux River being placed on the 303(d) list of impaired waters in the year 1998. The final report, "Phase I Watershed Assessment Final Report and TMDL, Central Big Sioux River, Brookings, Lake, Moody, and Minnehaha Counties, South Dakota" was completed in March 2004.

The Central Big Sioux River Watershed Assessment Project identified the portion of Pipestone Creek within South Dakota for TMDL development based on water quality data collected as part of the assessment. Samples collected from two monitoring points during the period June 2000 to September 2001, indicated the immersion recreation beneficial use and the limited contact recreation use were not supported due to elevated fecal coliform bacteria concentrations. Of the 22 water samples that were collected (11 at each location), 19 exceeded the numeric water quality standards for fecal coliform bacteria. The frequency of sample collection in 2000 was monthly. Samples were collected more frequently in 2001. The frequency of sample collection in 2001 was 2-6 samples per month.

Pipestone Creek was not on any 303(d) State Waterbody lists prior to the Central Big Sioux River Watershed Assessment Project, including the 2006 303(d) list. A TMDL evaluation for fecal coliform bacteria for Pipestone Creek was included as Appendix EEE of the Central Big Sioux River Watershed Assessment Project final report.

***Impairment status**:*

The 2010 South Dakota Integrated Report for Surface Water Quality Assessment identifies Pipestone Creek segment SD-BS-R-PIPESTONE _01 as not supporting the following beneficial uses:

Stream Segment	*Data Source*	*Beneficial Use Not Supported*	*Cause*	*Source*	*Priority*
Pipestone Creek SD-BS-R-PIPESTONE_01	*DENR*	*Classification 7 Immersion Recreation*	*E. Coli* *Fecal Coliform*	*Livestock (Grazing or Feeding Operations)*	*1*
Pipestone Creek SD-BS-R-PIPESTONE_01	*DENR*	*Classification 8 Limited Contact Recreation*	*Fecal Coliform*	*Livestock (Grazing or Feeding Operations)*	*1*

Comments:

1. *Recommend that Section 1.1, Watershed Characteristics include additional information for completeness and context. The following information, based on information contained in the document "Phase I Watershed Assessment Final Report and TMDL, Central Big Sioux River", dated March 2004, would be useful. This information is in Appendix EEE, TMDL, Pipestone Creek (Fecal Coliform Bacteria) :*

Within South Dakota, Pipestone Creek is 35.4 miles in length and has a watershed of approximately 45,993 acres. Pipestone Creek begins in Pipestone County Minnesota then wraps through Moody and Minnehaha Counties in South Dakota and finally joins Split Rock Creek in Rock County Minnesota. Split Rock Creek eventually runs into the Big Sioux River below the City of Brandon. The portion of Pipestone Creek watershed in South Dakota lies within Moody and Minnehaha Counties. Pipestone Creek is influenced by two tributaries, South Branch Pipestone Creek and North Branch Pipestone Creek which are located in Minnesota. The municipality of Pipestone in Minnesota may be influencing this segment.

SD DENR Response: We paraphrased the suggested paragraph and added it to Section 1.1. The Municipality of Pipestone is mentioned and discharge periods noted.

2. *The TMDL summary table on page 3 of the document indicates the TMDL priority ranking is 5. This appears to be a mistake. The 303(d) list in the 2010 Integrated Report indicates the TMDL priority is 1. Please check and correct.*

SD DENR Response: The ranking priority was in error, this has been corrected to a priority ranking of 1.

3. *Figure 2 on page 6 could be improved by the following additions:*

   a. *Identify the boundary of South Dakota and Minnesota on the figure.*
   b. *Identify sampling points T28 and T29 on the figure.*
   c. *Identify the boundary of Moody and Minnehaha Counties on the figure.*

SD DENR Response: Appropriate labels are included in Figure 2.

1.3 Water Quality Standards

TMDL documents should provide a complete description of the water quality standards for the waterbodies addressed, including a listing of the designated uses and an indication of whether the uses are being met, not being met, or not assessed. If a designated use was not assessed as part of the TMDL analysis (or not otherwise recently assessed), the documents should provide a reason for the lack of assessment (e.g., sufficient data was not available at this time to assess whether or not this designated use was being met).

Water quality criteria (WQC) are established as a component of water quality standard at levels considered necessary to protect the designated uses assigned to that waterbody. WQC identify quantifiable targets and/or qualitative water quality goals which, if attained and maintained, are intended to ensure that the designated uses for the waterbody are protected. TMDLs result in maintaining and attaining water quality standards by determining the appropriate maximum pollutant loading rate to meet water quality criteria, either directly, or through a surrogate measurable target. The TMDL document should include a description of all applicable water quality criteria for the impaired designated uses and address whether or not the criteria are being attained, not attained, or not evaluated as part of the analysis. If the criteria were not evaluated as part of the analysis, a reason should be cited (e.g. insufficient data were available to determine if this water quality criterion is being attained).

Minimum Submission Requirements:

☒ The TMDL must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the anti-degradation policy. (40 C.F.R. §130.7(c)(1)).

☒ The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, <u>all TMDL documents must be written to meet the existing water quality standards</u> for that waterbody (CWA §303(d)(1)(C)). *Note: In some circumstances, the load reductions determined to be necessary by the TMDL analysis may prove to be infeasible and may possibly indicate that the existing water quality standards and/or assessment methodologies may be erroneous. However, the TMDL must still be determined based on existing water quality standards. Adjustments to water quality standards and/or assessment methodologies may be evaluated separately, from the TMDL.*

☒ The TMDL document should describe the relationship between the pollutant of concern and the water quality standard the pollutant load is intended to meet. This information is necessary for EPA to evaluate whether or not attainment of the prescribed pollutant loadings will result in attainment of the water quality standard in question.

☒ If a standard includes multiple criteria for the pollutant of concern, the document should demonstrate that the TMDL value will result in attainment of all related criteria for the pollutant. For example, both acute and chronic values (if present in the WQS) should be addressed in the document, including consideration of magnitude, frequency and duration requirements.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

<u>Summary</u>:

A complete description of the applicable State/Tribal water quality standard, including the designated use(s) of Pipestone Creek and the applicable numeric water quality criteria, is included in several places in the TMDL document.

Section 2.0, "Water Quality Standards" (page 7), describes the beneficial uses that have been assigned to Pipestone Creek. These are:

- *Beneficial Use Classification 9: Fish and wildlife propagation, recreation, and stock watering waters*
- *Beneficial Use Classification 10: Irrigation waters*
- *Beneficial Use Classification 5: Warmwater semi permanent fish life propagation waters*
- *Beneficial Use Classification 7: Immersion recreation waters*
- *Beneficial Use Classification 8: Limited contact recreation waters*

Table 2, "State Water Quality Standards for Pipestone Creek" (page 8), summarizes the Water Quality Criteria for Pipestone Creek. These criteria must be met to support the assigned beneficial uses.

Section 1.1," Watershed Characteristics" (page 4), states that the portion of Pipestone Creek within South Dakota, segment SD-BS-R-PIPESTONE_01, was listed as impaired in the 2010 Integrated Report and the cause is E. coli bacteria.

Section 2.0," Water Quality Standards" (page 7), describes the E. coli water quality criteria that support immersion recreation use:

1. *No sample may exceed 235 cfu/100ml;*
2. *During any 30-day period, the geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period may be equal to or less than 126 cfu/100ml; and*
3. *These criteria only apply during the period May 1 – September 30.*

This section also states that the TMDL target is based on the chronic standard for E. coli of ≤126 cfu/100ml to support immersion recreation use.

Comments:

Recommend that the last sentence on page 4 be modified slightly to include more information about the 303(d) listing of Pipestone Creek. Suggested revision is as follows:

> *In the 2010 Integrated Report, the portion of Pipestone Creek within South Dakota (Segment SD-BS-R-PIPESTONE_01) was listed as impaired for both limited contact and immersion recreation beneficial uses due to E. coli and Fecal Coliform . Livestock (Grazing or Feeding Operations) was identified as the source.*

SD DENR Response: The suggested wording was included.

Water Quality Targets

TMDL analyses establish numeric targets that are used to determine whether water quality standards are being achieved. Quantified water quality targets or endpoints should be provided to evaluate each listed pollutant/water body combination addressed by the TMDL, and should represent achievement of applicable water quality standards and support of associated beneficial uses. For pollutants with numeric water quality standards, the numeric criteria are generally used as the water quality target. For pollutants with narrative standards, the narrative standard should be translated into a measurable value. At a minimum, one target is required for each pollutant/water body combination. It is generally desirable, however, to include several targets that represent achievement of the standard and support of beneficial uses (e.g., for a sediment impairment issue it may be appropriate to include a variety of targets representing water column sediment such as TSS, embeddedness, stream morphology, up-slope conditions and a measure of biota).

Minimum Submission Requirements:

☒ The TMDL should identify a numeric water quality target(s) for each waterbody pollutant combination. The TMDL target is a quantitative value used to measure whether or not the applicable water quality standard is attained. *Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. Occasionally, the pollutant of concern is different from the parameter that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as a numerical dissolved oxygen criterion). In such cases, the TMDL should explain the linkage between the pollutant(s) of concern, and express the quantitative relationship between the TMDL target and pollutant of concern. In all cases, TMDL targets must represent the attainment of current water quality standards.*

☐ When a numeric TMDL target is established to ensure the attainment of a narrative water quality criterion, the numeric target, the methodology used to determine the numeric target, and the link between the pollutant of concern and the narrative water quality criterion should all be described in the TMDL document. Any additional information supporting the numeric target and linkage should also be included in the document.

Recommendation:
☐ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 2.0, Water Quality Standards (page 7), identifies the water quality target as the chronic standard for E.coli that supports the immersion recreation beneficial use. This target is:

E.coli concentrations $\leq$ *126 cfu/100mL.*

Load duration curves are developed in Section 3.0, "Technical Analysis" (pages 13-14), and Figure 7, "Load Duration Curve (LDC) for T29"(page 14) . Load duration curves are presented for both the Acute and Chronic water quality criteria for E. coli that supports immersion recreation use.

Comments:

Section 2.0, Water Quality Standards, Page 7, last paragraph: *The document should explain in the discussion of the TMDL target that the TMDL will be established, and loads will be allocated, so that individual samples in all flow regimes will achieve the water quality target of ≤ 126 cfu/mL E. Coli. This target, based on the chronic water quality criterion for E. coli that supports the immersion recreation beneficial use, is intended to be compared to a geometric mean of at least 5 samples obtained during separate 24-hour periods for any 30-day period. By establishing the TMDL target based on the chronic criterion and calculating necessary load reductions based on a comparison of individual samples to the LDC, there is increased confidence that both the acute and chronic standards for E. coli will be achieved by the load allocations and reductions.*

SD DENR Response: New wording explaining the target value for the TMDL was based on the *E. coli* chronic threshold for the immersion recreation was included in Section 2.0.

3. Pollutant Source Analysis

A TMDL analysis is conducted when a pollutant load is known or suspected to be exceeding the loading capacity of the waterbody. Logically then, a TMDL analysis should consider all sources of the pollutant of concern in some manner. The detail provided in the source assessment step drives the rigor of the pollutant load allocation. In other words, it is only possible to specifically allocate quantifiable loads or load reductions to each significant source (or source category) when the relative load contribution from each source has been estimated. Therefore, the pollutant load from each significant source (or source category) should be identified and quantified to the maximum practical extent. This may be accomplished using site-specific monitoring data, modeling, or application of other assessment techniques. If insufficient time or resources are available to accomplish this step, a phased/adaptive management approach may be appropriate. The approach should be clearly defined in the document.

Minimum Submission Requirements:

- ☐ The TMDL should include an identification of all potentially significant point and nonpoint sources of the pollutant of concern, including the geographical location of the source(s) and the quantity of the loading, e.g., lbs/per day. This information is necessary for EPA to evaluate the WLA, LA and MOS components of the TMDL.
- ☒ The level of detail provided in the source assessment should be commensurate with the nature of the watershed and the nature of the pollutant being studied. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of both the natural background loads and the nonpoint source loads.
- ☒ Natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g. measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified, characterized, and properly quantified.
- ☐ The sampling data relied upon to discover, characterize, and quantify the pollutant sources should be included in the document (e.g. a data appendix) along with a description of how the data were analyzed to characterize and quantify the pollutant sources. A discussion of the known deficiencies and/or gaps in the data set and their potential implications should also be included.

Recommendation:

☐ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 4.0, "Significant Sources" on page 14, provides the pollutant source analysis for Pipestone Creek within South Dakota. There are no point sources within the Pipestone Creek watershed. Nonpoint sources of E. coli are primarily agricultural (manure from livestock) with contributions from septic systems and natural background/wildlife. Livestock in the watershed are predominantly hogs and beef cattle but also include dairy cattle, sheep, horses and chicken. There are an estimated 33 septic systems along Pipestone Creek in South Dakota.

The number of livestock and wildlife animals per acre within the watershed was estimated based on the results of the 2003 and 2009 National Agricultural Statistic Survey (NASS) and the 2002 South Dakota Game Fish and Parks county wildlife assessment. The number of people was estimated from the 2010 census. Estimates of the amount of fecal coliform per animal(and human) per day were combined with the estimated number of animals per acre to arrive at an estimated daily load of fecal coliform in cfu of fecal coliform per acre per day for each species. Table 5, "Pipestone Creek Potential Nonpoint Sources" on page 16 summarizes these estimates.

The TMDL document also presents a percentage contribution of E.coli in the watershed for 4 primary categories. Table 4,"E.coli source allocation for Pipestone Creek" on page 15 presents this estimate:

- *Feedlots are estimated to contribute 37% of the E. coli,*
- *Livestock on Grass is estimated to contribute 63% of the E. coli,*
- *Wildlife is estimated to contribute <0.01% of the E.coli, and*
- *Humans are estimated to contribute <0.01% of the E.coli.*

Although Section 4.2, "Nonpoint Sources" states that animal density information was used to estimate relative source contributions of bacteria loads, these estimates could not be re-produced with the information provided in the TMDL document.

The geographic locations of the feedlots are not provided.

Comments:

1. *Table 5 provides a summary of the estimated daily load of fecal coliform in cfu/acre although the water quality target is E. coli. It would be useful to provide a short discussion in Section 4.0 of why the daily loading is expressed as fecal coliform and the whether E. Coli loads are expected to be higher or lower than the estimated values in Table 5. Also, it would be helpful to explain that the estimates are used to determine the relative contribution of each source to total loading in the watershed so the use of fecal coliform estimates will have a minor effect on the results.*

SD DENR Response: Wording was added to Section 4.2 explaining the use of fecal coliform in determining source contribution. Fecal coliform was used because of defined fecal coliform production rates for various warm blooded animals as illustrated in the EPA bacterial indicator tool. *E. coli* is assumed to be a portion of fecal coliform contributions and relative contributions are expected to be similar between *E. coli* and fecal coliform.

2. *We assumed that the allocation of E. coli sources among four primary nonpoint source categories in the watershed (feedlots, livestock on grass, wildlife, and human) was based on the estimates provided in Table 5. However, we could not re-produce the values in Table 4 using the Table 5 data. We'd like to discuss this with SD DENR to understand how the estimates in Table 4 were developed. Also, some additional text to clarify how the allocations were developed should be provided in Section 4.*

SD DENR Response: All cattle have been split to cattle on range and beef cattle on feed. Corrected some typographical errors in assumed fecal contribution rates derived from the EPA bacterial indicator tool. Recalculations were conducted and the results of Table 4 and 5 are consistent after doing so.

3. *The E. coli data collected at stream monitoring location T28 (located near the Minnesota border where Pipestone Creek enters South Dakota) indicate that E. coli concentrations exceed the water quality target. Section 5.0, "Boundary Conditions" states that load reductions are required in all flow zones in order to meet the target and that the E. coli largely originates in Minnesota. The discussion of sources should include some discussion of coordination with Minnesota regarding the potential sources that originate in Minnesota and their impacts.*

SD DENR Response: We referenced the Minnesota Pipestone Creek fecal coliform TMDL in section 6.2. Discussion of loading, source allocation, and suggested BMP's within the Minnesota TMDL was also mentioned.

4. *The geographic locations of the feedlots should be provided. Section 4.2.1 indicates that feedlots include beef and Table 5 indicates that beef contribute almost all of the bacterial loading. So, it's important to understand where the feedlots are located to have an understanding of where load reductions need to be targeted.*

SD DENR Response: A map indicating locations of feedlots was provided in Section 4.2.1.

5. *The estimated daily load for each nonpoint source is given as a concentration of fecal coliform bacteria per acre but no information is provided to predict the amount of this load that's expected to runoff into Pipestone Creek nor is an estimated daily load in the creek provided. Can an estimate of loading into the stream be generated using the Table 5 results? If so, please provide. If not, please provide some explanation of whether the loading into the stream is expected to be higher or lower than these estimates and discuss the uncertainty (land use, cover, distance from stream, precipitation, etc.)*

SD DENR Response: This table is meant to illustrate likely loadings based on fecal coliform deposition rates and animal numbers. It is likely that fecal matter deposited on land away from the stream will only contribute fecal matter during runoff events. This would include some feedlots and livestock on range. Some wildlife fecal matter will likely only enter the stream during runoff events. Others such as cattle occupying range adjacent to stream, deer, mink, beaver, muskrat, and goose may be deposited on both land and directly into the stream.

4. TMDL Technical Analysis

TMDL determinations should be supported by a robust data set and an appropriate level of technical analysis**.** This applies to **all** of the components of a TMDL document. It is vitally important that the technical basis for **all** conclusions be articulated in a manner that is easily understandable and readily apparent to the reader.

A TMDL analysis determines the maximum pollutant loading rate that may be allowed to a waterbody without violating water quality standards. The TMDL analysis should demonstrate an understanding of the relationship between the rate of pollutant loading into the waterbody and the resultant water quality impacts. This stressor → response relationship between the pollutant and impairment and between the selected targets, sources, TMDLs, and load allocations needs to be clearly articulated and supported by an appropriate level of technical analysis. Every effort should be made to be as detailed as possible, and to base all conclusions on the best available scientific principles.

The pollutant loading allocation is at the heart of the TMDL analysis. TMDLs apportion responsibility for taking actions by allocating the available assimilative capacity among the various point, nonpoint, and natural pollutant sources. Allocations may be expressed in a variety of ways, such as by individual discharger, by tributary watershed, by source or land use category, by land parcel, or other appropriate scale or division of responsibility.

The pollutant loading allocation that will result in achievement of the water quality target is expressed in the form of the standard TMDL equation:

$$TMDL = \sum LAs + \sum WLAs + MOS$$

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

MOS = the portion of the Load Capacity allocated to the Margin of Safety.

Minimum Submission Requirements:

☒ A TMDL must identify the loading capacity of a waterbody for the applicable pollutant, taking into consideration temporal variations in that capacity. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

☒ The total loading capacity of the waterbody should be clearly demonstrated to equate back to the pollutant load allocations through a balanced TMDL equation. In instances where numerous LA, WLA and seasonal TMDL capacities make expression in the form of an equation cumbersome, a table may be substituted as long as it is clear that the total TMDL capacity equates to the sum of the allocations.

☒ The TMDL document should describe the methodology and technical analysis used to establish and quantify the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

☒ It is necessary for EPA staff to be aware of any assumptions used in the technical analysis to understand and evaluate the methodology used to derive the TMDL value and associated loading allocations. Therefore, the TMDL document should contain a description of any important assumptions (including the basis for those assumptions) made in developing the TMDL, including but not limited to:

(1) the spatial extent of the watershed in which the impaired waterbody is located and the spatial extent of the TMDL technical analysis;
(2) the distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) a presentation of relevant information affecting the characterization of the pollutant of concern and its allocation to sources such as population characteristics, wildlife resources, industrial activities etc…;
(4) present and future growth trends, if taken into consideration in determining the TMDL and preparing the TMDL document (e.g., the TMDL could include the design capacity of an existing or planned wastewater treatment facility);
(5) an explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

☐ The TMDL document should contain documentation supporting the TMDL analysis, including an inventory of the data set used, a description of the methodology used to analyze the data, a discussion of strengths and weaknesses in the analytical process, and the results from any water quality modeling used. This information is necessary for EPA to review the loading capacity determination, and the associated load, wasteload, and margin of safety allocations.

☒ TMDLs must take critical conditions (e.g., steam flow, loading, and water quality parameters, seasonality, etc…) into account as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable critical conditions and describe the approach used to determine both point and nonpoint source loadings under such critical conditions. In particular, the document should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

☐ Where both nonpoint sources and NPDES permitted point sources are included in the TMDL loading allocation, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document must include a demonstration that nonpoint source loading reductions needed to implement the load allocations are actually practicable [40 CFR 130.2(i) and 122.44(d)].

Recommendation:
☐ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 3.0, "Technical Analysis" describes the collection of data used to support this TMDL. Water samples and flow measurements were collected at two stream locations:

- *T28, located near the Minnesota border where Pipestone Creek enters South Dakota; and*
- *T29, located near the Minnesota border where Pipestone Creek exits South Dakota.*

For this TMDL, data from monitoring point T28 represent boundary conditions.

Water samples were collected from T28 and T29 during the Big Sioux River Watershed Assessment from 2001 to 2008. These samples were collected during the months of April through October. Table 3, "Actual and modeled E. coli samples, modeled E. coli samples indicated by red text" (page 10) provides the station name, date of sample collection and E. Coli concentrations for each sampling event and each station.

E.coli was measured directly from only a subset of the samples collected. Most samples were analyzed for fecal coliform only. At station T28, 52 samples were collected of which 41 were analyzed for fecal coliform, 11 were analyzed for both E. coli and fecal coliform. At station T29, 40 samples were collected *of which 29 were analyzed for fecal coliform and 11 were analyzed for both E. coli and fecal coliform. The fecal coliform results were not provided in the TMDL document.*

The paired E. coli/fecal coliform results were used in a regression analysis to establish the relationship between the two concentrations in the same samples. Log transformed E. coli results were correlated with log transformed fecal coliform results from the same sample. The resulting relationship, Log E. coli = 1.0888(log fecal coliform) -0.2932, was used to predict the E.coli concentrations from fecal coliform results. Figure 3, "E. coli –fecal coliform regression relationship" (page 11) presents the linear regression.

Section 3.3, "Flow Analysis" (page 11)states that flow data were collected at both T28 and T29. Additionally, USGS operates a gaging station along Split Rock Creek near Corson, SD.

Comments

1. *Section 3.2,"Sample Data" (page 9), states that samples were collected from 2001 to 2008. There appears to be a typographical error here because Table 3 presents results from sampling events in 2000. Please check and correct. If the results from 2000 are not used in the LDCs, please provide an explanation.*

SD DENR Response: The typographical error was corrected

2. *Please provide the paired E. coli/fecal coliform data used in the regression analysis in electronic format – an Excel spreadsheet is preferred.*

SD DENR Response: Paired bacteria data were provided in Section 3.2.

3. *We suggest that you modify the format of Table 3 to present the sampling results in a way that's more understandable. Flow data collected during each sampling event should be provided as well as the results for both fecal coliform and E. coli. We also suggest separate tables for T28 and T29. A suggested table format is:*

	APRIL				MAY				Cont.		
2000	DATE	FLOW	FECAL COLIFORM	E. COLI	DATE	FLOW	FECAL COLIFORM	E. COLI			
2001											
2005											
2006											
2007											
2008											

Alternatively, or in addition to a revised summary table, the data could be displayed in box plots.

SD DENR Response: Paired bacteria and flow data were provided in Section 3.2.

4. *Table 3, " Actual and modeled E. coli samples, modeled E. coli samples indicated by red text", provides results for samples collected at locations T28 and T29. On several dates, multiple samples were collected at the same location. Were these duplicate samples for quality control to evaluate analytical or sampling variability? If so, the duplicate results should be removed from the LDC.*

SD DENR Response: These samples were duplicates and they are now excluded from the load duration curve analysis.

5. *Figures 4, 5 and 6 should include the time interval labels on the X-axis.*

SD DENR Response: Time intervals were included on the X-axis of these figures.

6. *Please indicate on a figure (we suggest Figure 2) the locations of the USGS gaging station 06482610 and stream sampling location T30.*

SD DENR Response: These sites were added to Figure 4 in Section 3.3.

7. *Section 3.3, Flow analysis states that " data collected from T30 overlapped with USGS flow data for the month of November 2001 and was corrected to better match USGS flow data within Aquarius." This seems incorrect or may just be unclear. Shouldn't the model results be corrected with data from field measurements – not the opposite? Let's discuss.*

SD DENR Response: Extra wording was added to Section 3.3 explaining the situation between T28, T30, and the USGS flow data. T30 data was adjusted to match USGS data and a relationship was generated between adjusted T30 data and T28 data. USGS data was then used as a surrogate for modeling an extended flow record for T28.

8. *Section 3.3, "Flow Analysis" (page 11), states that the modeled flow record for T28 was used to represent the impaired reach. There are at least two sources of uncertainty in this approach – the uncertainty associated with using a modeled versus measured flow at T28 and the uncertainty associated with using flow at T28 to represent the entire impaired reach which is over 35 miles in length. Was the modeled flow value combined with the measured fecal coliform concentration transformed to E. coli to determine the loading values plotted on the LDC? The uncertainty that this approach introduces should be discussed in the document.*

SD DENR Response: There are no major tributaries joining with the South Dakota Pipestone Creek segment. Flow dynamics are assumed to be largely constant throughout the reach due to the lack of tributary inputs. Yes, modeled flow was coupled with modeled *E. coli* data to generate a load duration curve. The regression relationship generated between fecal coliform and *E. coli* paired data gives an estimate of uncertainty through the r^2 value. A flow record for T28 using a T28/adjusted T30 flow data and using USGS flow data as a surrogate is likely to provide a good approximation for use in a load duration curve framework. Using an estimated flow record is preferred over using a short term flow record involving only real values which will not adequately capture yearly variations in flow dynamics. The results of a drought or deluge year would not be adequately represented with only short term data, whereas a model based on real data from a downstream USGS gaging station would allow for drought and deluge patterns to be represented. Please note that the Minnesota Pipestone Creek fecal coliform TMDL also used modeled flow data from USGS gaging station 06482610 (MPCA 2008). Wording was added to page 18 to better explain the origin of the flow data used in the load duration curve.

4.1 Data Set Description

TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis. An inventory of the data used for the TMDL analysis should be provided to document, for the record, the data used in decision making. This also provides the reader with the opportunity to independently review the data. The TMDL analysis should make use of all readily available data for the waterbody under analysis unless the TMDL writer determines that the data are not relevant or appropriate. For relevant data that were known but rejected, an explanation of why the data were not utilized should be provided (e.g., samples exceeded holding times, data collected prior to a specific date were not considered timely, etc…).

Minimum Submission Requirements:

- ☐ TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and appropriate water quality criteria.
- ☐ The TMDL document submitted should be accompanied by the data set utilized during the TMDL analysis. If possible, it is preferred that the data set be provided in an electronic format and referenced in the document. If electronic submission of the data is not possible, the data set may be included as an appendix to the document.

Recommendation:
☐ Approve ☒ Partial Approval ☐ Disapprove ☒ Insufficient Information

Summary:

Section 3.1," Data Collection Method" (page 9), states that water samples were collected from T28 and T29 during the Big Sioux River Watershed Assessment from 2001 to 2008. These samples were collected during the months of April through October and were analyzed for fecal coliform. A subset was analyzed for both E. coli and fecal coliform.

Table 3, "Actual and modeled E. coli samples, modeled E. coli samples indicated by red text" (page 10), provides the station name, date of sample collection and E. Coli concentrations for each sampling event and each station. The fecal coliform results are not included.

Section 3.3, "Flow Analysis" (page 11), states that flow data was collected at both T28 and T29. Figures 4 and 5 (page 12) display the flow records. Flow data from USGS gaging station 06482610 along Split Rock Creek near Corson, SD is displayed on Figure 6.

Comments:

The following comments pertain to Section 3.2, "Sample Data" (page 9):

1. *Please clarify the frequency of sample collection (monthly, weekly?) and indicate whether flow was measured at the time samples were collected. We assume that flow measurements were taken at the time of sample collection but this isn't clear. Please provide this information.*

SD DENR Response: Samples were collected monthly. Flow measurements were taken, however average daily flow is used in the load duration curve analysis and average daily flows on sampling dates are provided. The data used to model an extended flow record for Pipestone Creek was derived from a USGS gaging station that provided average daily flow rather than instantaneous flow and it was thought that using paired average daily flow to estimate loadings was appropriate.

2. *Since the majority of E. Coli concentrations are predicted from fecal coliform concentrations, please provide the results for the paired E/Coli /fecal coliform analyses.*

SD DENR Response: These results are now provided in section 3.2.

3. *If flow was measured at the time of sample collection, please provide the flow results along with the sample results.*

SD DENR Response: The average daily flows are provided.

4. *The last two sentences on page 9 state that 27 samples exceeded the chronic threshold at T29 and 45 samples exceeded the chronic threshold at T28. Since the chronic standard is intended to be compared to a geometric mean, we suggest you add some language to clarify that the chronic criterion was compared to individual sample results and this introduces some uncertainty and may overestimate the true exceedance of the chronic criterion.*

SD DENR Response: Wording was added on page 10 illustrating the difference between what is meant by a chronic *standard* and a chronic *threshold*.

5. *Figure 5 is labeled as the flow record from T30. The text on page 11 indicates that Figure 5 presents the flow record from T29. Please check this and correct as necessary. Flow data from all three locations, T28, T29, and T30 should be presented.*

SD DENR Response: The paragraph states that T28 flow data was used in place of T29 data because it was more reliable, T30 data overlapped with the USGS data and was adjusted to match the USGS flow record. Flow data from T29 is now provided.

4.2 Waste Load Allocations (WLA):

Waste Load Allocations represent point source pollutant loads to the waterbody. Point source loads are typically better understood and more easily monitored and quantified than nonpoint source loads. Whenever practical, each point source should be given a separate waste load allocation. All NPDES permitted dischargers that discharge the pollutant under analysis directly to the waterbody should be identified and given separate waste load allocations. The finalized WLAs are required to be incorporated into future NPDES permit renewals.

Minimum Submission Requirements:

☐ EPA regulations require that a TMDL include WLAs for all significant and/or NPDES permitted point sources of the pollutant. TMDLs must identify the portion of the loading capacity allocated to individual existing and/or future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit. If no allocations are to be made to point sources, then the TMDL should include a value of zero for the WLA.

☐ All NPDES permitted dischargers given WLA as part of the TMDL should be identified in the TMDL, including the specific NPDES permit numbers, their geographical locations, and their associated waste load allocations.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

There are no point sources within the Pipestone Creek watershed. The TMDL establishes a waste load allocation of 0 for all flow zones.

Comments:

No comments

4.3 Load Allocations (LA):

Load allocations include the nonpoint source, natural, and background loads. These types of loads are typically more difficult to quantify than point source loads, and may include a significant degree of uncertainty. Often it is necessary to group these loads into larger categories and estimate the loading rates based on limited monitoring data and/or modeling results. The background load represents a composite of all upstream pollutant loads into the waterbody. In addition to the upstream nonpoint and upstream natural load, the background load often includes upstream point source loads that are not given specific waste load allocations in this particular TMDL analysis. In instances where nonpoint source loading rates are particularly difficult to quantify, a performance-based allocation approach, in which a detailed monitoring plan and adaptive management strategy are employed for the application of BMPs, may be appropriate.

Minimum Submission Requirements:
☒ EPA regulations require that TMDL expressions include LAs which identify the portion of the loading capacity attributed to nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Load allocations may be included for both existing and future nonpoint source loads. Where possible, load allocations should be described separately for natural background and nonpoint sources.

☐ Load allocations assigned to natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g., measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified and given proper load or waste load allocations.

Recommendation:
☐ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

This TMDL was developed using the Load Duration Curve (LDC) approach. Separate LDCs were developed for T28 and T29. The LDC for T28 represents boundary conditions. The chronic water quality criterion for E. Coli that supports immersion recreation use was used as the water quality target. Separate summary tables of the TMDL calculations are presented for each of the flow zones: high flow, moist ,mid-range flows, dry, and low flow.

The Load Allocation is presented in Section 6.2, "Load Allocation" (page 21). Approximately 99% of the watershed is comprised of agricultural land use. E. Coli loading is attributed to these sources. The following load allocations are made:

- *8.45E+14 cfu/day during high flow conditions; a 99% reduction is needed*
- *1.23E+14 cfu/day during moist conditions; a 70% reduction is needed*
- *1.94E+13 cfu/day during mid-range conditions; a 67% reduction is needed*
- *6.29E+12 cfu/day during dry conditions; a 94% reduction is needed*
- *1.2E+12 cfu/day during low flow conditions; a 81% reduction is needed*

Comments:

1. *It appears that Table 6, "Boundary conditions at T28" is incorrectly named. We think this is the case because Table 6 summarizes information contained in Tables 7 through 11 which provide the TMDL and LA for Pipestone Creek at T29. Please check and correct as needed.*

SD DENR Response: T28 was located near the Minnesota/South Dakota border where Pipestone Creek flows into South Dakota from Minnesota. "Boundary conditions at T28" is the correct labeling for this table. Typographical errors were made within the table and these have been corrected to truly show LA, TMDL, MOS, and load reductions for the boundary conditions.

2. *Since Pipestone Creek may be influenced by sources in Minnesota, we suggest some discussion of allocation of load to the segment of Pipestone Creek in Minnesota be provided. Also, a review of the water quality standards for E. Coli established for Pipestone Creek in Minnesota should be completed. This will obviously require coordination/technical discussion with the appropriate representatives from Minnesota. We're not sure if these discussions have already occurred or not. As you probably know, a TMDL for fecal coliform in Pipestone Creek upstream of the border with South Dakota was approved by EPA in 2008. We suggest this TMDL is a good resource document for developing a rationale for allocating loading at T28 to Minnesota. EPA would like to help arrange and to participate in a discussion with the appropriate representatives of Minnesota to develop a rationale for allocation.*

SD DENR Response: Minnesota's Pipestone Creek fecal coliform TMDL and their water quality standards are discussed in Section 6.2.

4.4 Margin of Safety (MOS):

Natural systems are inherently complex. Any mathematical relationship used to quantify the stressor → response relationship between pollutant loading rates and the resultant water quality impacts, no matter how rigorous, will include some level of uncertainty and error. To compensate for this uncertainty and ensure water quality standards will be attained, a margin of safety is required as a component of each TMDL. The MOS may take the form of a explicit load allocation (e.g., 10 lbs/day), or may be implicitly built into the TMDL analysis through the use of conservative assumptions and values for the various factors that determine the TMDL pollutant load → water quality effect relationship. Whether explicit or implicit, the MOS should be supported by an appropriate level of discussion that addresses the level of uncertainty in the various components of the TMDL technical analysis, the assumptions used in that analysis, and the relative effect of those assumptions on the final TMDL. The discussion should demonstrate that the MOS used is sufficient to ensure that the water quality standards would be attained if the TMDL pollutant loading rates are met. In cases where there is substantial uncertainty regarding the linkage between the proposed allocations and achievement of water quality standards, it may be necessary to employ a phased or adaptive management approach (e.g., establish a monitoring plan to determine if the proposed allocations are, in fact, leading to the desired water quality improvements).

Minimum Submission Requirements:

☒ TMDLs must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS).

☐ If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS should be identified and described. The document should discuss why the assumptions are considered conservative and the effect of the assumption on the final TMDL value determined.

☒ If the MOS is explicit, the loading set aside for the MOS should be identified. The document should discuss how the explicit MOS chosen is related to the uncertainty and/or potential error in the linkage analysis between the WQS, the TMDL target, and the TMDL loading rate.

☐ If, rather than an explicit or implicit MOS, the TMDL relies upon a phased approach to deal with large and/or unquantifiable uncertainties in the linkage analysis, the document should include a description of the planned phases for the TMDL as well as a monitoring plan and adaptive management strategy.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 8.0, "Margin of Safety" (page 22) states that an explicit MOS is included in the TMDL. The MOS is the quantitative difference between the loading capacity at the mid-point of each of the flow zones and the loading capacity at the minimum flow in each zone on the LDC. A substantial MOS is provided using this method because the loading capacity is typically much less at the minimum flow compared to the mid-point. The MOS is intended to account for several sources of uncertainty including the loading from tributary streams and the effectiveness of controls.

The MOS is as follows:

- *2.55E+11 cfu/day during high flow conditions;*
- *1.33E+11 cfu/day during moist conditions;*
- *4.37 E+10 cfu/day during mid-range conditions;*
- *3.14E+10 cfu/day during dry conditions;*
- *3.89E+10 cfu/day during low flow conditions;*

Comments:

No comments.

4.5 Seasonality and variations in assimilative capacity:

The TMDL relationship is a factor of both the loading rate of the pollutant to the waterbody and the amount of pollutant the waterbody can assimilate and still attain water quality standards. Water quality standards often vary based on seasonal considerations. Therefore, it is appropriate that the TMDL analysis consider seasonal variations, such as critical flow periods (high flow, low flow), when establishing TMDLs, targets, and allocations.

Minimum Submission Requirements:

☒ The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variability as a factor. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Recommendation:
☐ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 7.0, "Seasonality" (page 21), discusses the variability in concentrations of E.coli in Pipestone Creek with seasons.
The data collected from monitoring points T28 and T29 indicate increased flow in late winter and peak flow in the spring. Figure 9, "seasonality of flow and E. coli concentrations" (page 22), displays the monitoring data. We assume that Figure 9 includes data from both T28 and T29 combined.

Spring showers create runoff that carries fecal matter into Pipestone Creek, resulting in elevated E. Coli concentrations.

During the summer, recreational use of Pipestone Creek increases, influencing the concentrations of E. Coli. Summer is a critical time in which to reduce loading.

Comments:

1. *Please add labels and units to Figure 9 to indicate the magnitude of the E. coli concentrations. Also, indicate whether the data in Figure 9 are a combination of data from T28 and T29 or are something else.*

SD DENR Response: The data are a combination of T28 and T29 and the figure title was changed to indicate this. The units for *E. coli* were added to the figure.

2. *Since monitoring for fecal coliform /E.coli in Pipestone Creek at locations T28 and T29 occurred only during the months April through October, there isn't sufficient data to evaluate seasonality of loading over the entire year. This should be discussed in Section 7.0 with recognition that the water quality criteria only apply during the months May through September.*

SD DENR Response: The lack of data during winter months is acknowledged in Section 7.0. Also, figures were added depicting monthly patterns in *E. coli* concentrations with sites T28 and T29 treated separately. Section 7.0 was renamed to "Monthly Patterns" to more accurately reflect the nature of the data presented in this section.

3. *Section 7.0 should include a discussion that the mean concentrations of E.coli are similar during the months of April through October but due to the high variability of results, there appears to be a difference in the maximum concentrations, i.e., the highest concentrations were detected in June and July.*

SD DENR Response: The highest values occurring in June were noted in Section 7.0.

4. *It may be important to determine whether there is a difference in the seasonal variation of concentrations of E. coli at T28 and T29. Is there a different pattern at T28 and T29?*

SD DENR Response: A figure was created in Section 7.0 comparing Sites T28 and T29. Site T28 typically had higher concentrations than T29.

5. Public Participation

EPA regulations require that the establishment of TMDLs be conducted in a process open to the public, and that the public be afforded an opportunity to participate. To meaningfully participate in the TMDL process it is necessary that stakeholders, including members of the general public, be able to understand the problem and the proposed solution. TMDL documents should include language that explains the issues to the general public in understandable terms, as well as provides additional detailed technical information for the scientific community. Notifications or solicitations for comments regarding the TMDL should be made available to the general public, widely circulated, and clearly identify the product as a TMDL and the fact that it will be submitted to EPA for review. When the final TMDL is submitted to EPA for approval, a copy of the comments received by the state and the state responses to those comments should be included with the document.

Minimum Submission Requirements:

☒ The TMDL must include a description of the public participation process used during the development of the TMDL (40 C.F.R. §130.7(c)(1)(ii)).

☐ TMDLs submitted to EPA for review and approval should include a summary of significant comments and the State's/Tribe's responses to those comments.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 11.0, "Public Participation" (page 23), summarizes the public participation activities undertaken during the development of this TMDL.

- *Public meetings were held during the Central Big Sioux River Assessment*
- *A Webpage was developed for the Central Big Sioux River Assessment Project, information is still readily available on the internet*
- *Presentations were given to local groups on the findings of the assessment*
- *The public was invited to review and comment on this draft TMDL for Pipestone Creek. A 30-day review period was provided and public notices were published in the Sioux Falls Argus Leader, the Brookings Register, and the Moody County Enterprise.*
- *A copy of the public notice was provided to EPA with the transmittal of the draft TMDL document.*

Comments:

No comments.

6. Monitoring Strategy

TMDLs may have significant uncertainty associated with the selection of appropriate numeric targets and estimates of source loadings and assimilative capacity. In these cases, a phased TMDL approach may be necessary. For Phased TMDLs, it is EPA's expectation that a monitoring plan will be included as a component of the TMDL document to articulate the means by which the TMDL will be evaluated in the field, and to provide for future supplemental data that will address any uncertainties that may exist when the document is prepared.

Minimum Submission Requirements:

- ☐ When a TMDL involves both NPDES permitted point source(s) and nonpoint source(s) allocations, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring.
- ☐ Under certain circumstances, a phased TMDL approach may be utilized when limited existing data are relied upon to develop a TMDL, and the State believes that the use of additional data or data based on better analytical techniques would likely increase the accuracy of the TMDL load calculation and merit development of a second phase TMDL. EPA recommends that a phased TMDL document or its implementation plan include a monitoring plan and a scheduled timeframe for revision of the TMDL. These elements would not be an intrinsic part of the TMDL and would not be approved by EPA, but may be necessary to support a rationale for approving the TMDL. http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf

Recommendation:
☐ Approve ☐ Partial Approval ☐ Disapprove ☒ Insufficient Information

Summary:

Section 9.0, "Follow-Up Monitoring and TMDL Review" (page 22), states that monitoring and land use data and information on BMP effectiveness may be collected during implementation of the TMDL. SD DENR may adjust the LA in this TMDL to account for the new information. The public will be provided an opportunity to comment before adjustments to the LA are made. Additionally, SD DENR will propose adjustments only in the event that the adjusted LA will not result in a change to the loading capacity and will notify EPA of any adjustments to this TMDL within 30 days of adoption.

Water quality monitoring is not currently being done on this stream although occasion sampling may occur.

Comments:
See comments on Restoration Strategy below.

7. Restoration Strategy

The overall purpose of the TMDL analysis is to determine what actions are necessary to ensure that the pollutant load in a waterbody does not result in water quality impairment. Adding additional detail regarding the proposed approach for the restoration of water quality is not currently a regulatory requirement, but is considered a value added component of a TMDL document. During the TMDL analytical process, information is often gained that may serve to point restoration efforts in the right direction and help ensure that resources are spent in the most efficient manner possible. For example, watershed models used to analyze the linkage between the pollutant loading rates and resultant water quality impacts might also be used to conduct "what if" scenarios to help direct BMP installations to locations that provide the greatest pollutant reductions. Once a TMDL has been written and approved, it is often the responsibility of other water quality programs to see that it is implemented. The level of quality and detail provided in the restoration strategy will greatly influence the future success in achieving the needed pollutant load reductions.

Minimum Submission Requirements:

☐ EPA is not required to and does not approve TMDL implementation plans. However, in cases where a WLA is dependent upon the achievement of a LA, "reasonable assurance" is required to demonstrate the necessary LA called for in the document is practicable). A discussion of the BMPs (or other load reduction measures) that are to be relied upon to achieve the LA(s), and programs and funding sources that will be relied upon to implement the load reductions called for in the document, may be included in the implementation/restoration section of the TMDL document to support a demonstration of "reasonable assurance".

Recommendation:
☐ Approve ☒ Partial Approval ☐ Disapprove ☐ Insufficient Information ☐ Not Applicable

Summary:

Since there are no point sources discharging to this segment of Pipestone Creek, the TMDL does not include a WLA. Therefore, the requirement to demonstrate reasonable assurance that the LA will be met is not applicable to this TMDL.

Section 10.0, "Restoration Strategy" (page 23), briefly describes that there is an implementation plan in place with projects targeted in areas outlined by the Central Big Sioux River Implementation Project. The goal of the implementation projects is to improve E. coli impairment. Specific Best Management Practice (BMP)activities to be undertaken are identified:

- *Reducing access to streams for livestock*
- *Increasing alternative watering sources for livestock*
- *Rotational grazing*
- *Riparian management*
- *75 animal water management systems*

Successful implementation of the BMPs is expected to result in achieving the TMDL.

Comments:
There are several sources of uncertainty in the TMDL:

a. The TMDL is based on conditions at one monitoring point along a stream segment that is 35.4 miles long. There is uncertainty in how well the flow conditions, the loading capacity, the load allocation, and the required reductions at point T29 represent the entire length of the stream segment.

SD DENR Response: Fecal coliform and *E. coli* were found to exceed the water quality standards at sampling sites in Minnesota and South Dakota and over a period of several years suggesting that sources of bacterial pollution are widespread throughout the watershed. One sampling site near the end of the segment represents the cumulative effects of the pollutants and this was deemed sufficient to characterize this stream segment.

b. There is uncertainty in the accuracy of the E. coli concentrations at monitoring point T29 since the majority of the concentrations are not directly measured but are predicted from measured fecal coliform concentrations.

SD DENR Response: When one performs a regression analysis a measure of accuracy is provided in the form of an r^2 value. The log10 transformed fecal - *E. coli* relationship included in section 3.2 yielded an r^2 value of 0.7633. We can say that 76.33 percent of the variability in *E. coli* data is explained by fecal coliform concentrations using existing paired fecal coliform and *E. coli* data. The relationship is statistically significant with a p value of less than 0.01. The equation of the line of best fit, r value, p value, and r^2 value are all displayed in Figure 3 which should aid the reader in judging how accurate modeled *E. coli* concentrations are in this case.

c. There is uncertainty in the effectiveness of planned BMPs in achieving the TMDL. Without higher resolution of data along the length of the stream, there is uncertainty that the BMPs will be implemented in the most effective locations for achieving the required reductions in loading.

SD DENR Response: Areas of effective BMPs were/are being identified in the Central Big Sioux River Watershed Implementation Project. This project uses the knowledge and input of NRCS personnel and other local entities and we judge their capabilities as well as our current load reduction calculations as being sufficient to judge BMP effectiveness. The current techniques to track BMP and implementation project effectiveness are acceptable to the EPA and the SD DENR sees no need to add more sampling.

Since there is a significant amount of uncertainty in the TMDL, we recommend that a monitoring component be included in the implementation plan. This approach to implementation is referred to as "Adaptive Implementation" in the EPA guidance document "Clarification Regarding "Phased "Total Maximum Daily Loads", memorandum from Benita Best-Wong, Director, Assessment and Watershed Protection Division, dated August 2, 2006. The three major objectives for monitoring are:

a. Collect data to identify the optimum locations for implementing BMP projects. Data may include E. coli concentrations, flow, and observations of land use and access to stream and alternative watering sources.

b. Collect data to evaluate the effectiveness of BMPs. Data may include E. coli concentrations and flow upstream and downstream of BMPs over several years pre- and post implementation of BMPs.

c. Collect data to assess achievement of water quality criteria. Data may include E. coli concentrations and flow at several new monitoring points along stream chosen to represent average stream conditions and intended to be part of a long term monitoring program to evaluate trends and attainment of standards.

The TMDL document should, at a minimum, recognize the uncertainties and state a commitment to monitoring as part of an adaptive implementation approach.

SD DENR Response: The SD DENR is comfortable with the results of the Pipestone Creek assessment and the progress made by the Central Big Sioux River Watershed Implementation Project. We see no need to commit to an adaptive implementation approach in this watershed. No additional monitoring is scheduled for this watershed. The implementation project is currently using StepL to estimate pollutant load reductions and this technique appears to be acceptable by the EPA to judge project progress and success.

8. Daily Loading Expression

The goal of a TMDL analysis is to determine what actions are necessary to attain and maintain WQS. The appropriate averaging period that corresponds to this goal will vary depending on the pollutant and the nature of the waterbody under analysis. When selecting an appropriate averaging period for a TMDL analysis, primary concern should be given to the nature of the pollutant in question and the achievement of the underlying WQS. However, recent federal appeals court decisions have pointed out that the title TMDL implies a "daily" loading rate. While the most appropriate averaging period to be used for developing a TMDL analysis may vary according to the pollutant, a daily loading rate can provide a more practical indication of whether or not the overall needed load reductions are being achieved. When limited monitoring resources are available, a daily loading target that takes into account the natural variability of the system can serve as a useful indicator for whether or not the overall load reductions are likely to be met. Therefore, a daily expression of the required pollutant loading rate is a required element in all TMDLs, in addition to any other load averaging periods that may have been used to conduct the TMDL analysis. The level of effort spent to develop the daily load indicator should be based on the overall utility it can provide as an indicator for the total load reductions needed.

Minimum Submission Requirements:

☒ The document should include an expression of the TMDL in terms of a daily load. However, the TMDL may also be expressed in temporal terms other than daily (e.g., an annual or monthly load). If the document expresses the TMDL in additional "non-daily" terms the document should explain why it is appropriate or advantageous to express the TMDL in the additional unit of measurement chosen.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

The E.coli TMDL for Pipestone Creek is expressed as cfu/day for all flow zones.

Comments:

No comments.

Moody County Conservation District Comments

From: Brich, Sol - NRCS-CD, Flandreau, SD [mailto:Sol.Brich@sd.nacdnet.net]
Sent: Friday, January 13, 2012 11:02 AM
To: DENR INTERNET INFORMATION
Cc: Majeres, Jack
Subject: Pipestone Creek TMDL Comment

The following comments are from the Central Big Sioux River Watershed Project coordinator made at the suggestion of the Moody County Conservation District project sponsor.

Comments: The Section 10.0 restoration section of the TMDL states that seventy-five animal waste systems need to have best management practice implementation to reduce E. coli concentrations. Surveys of animal feeding operations done in 2002 and 2011 identified only 33 operations within the South Dakota portion of the watershed. Attached is a map showing the operations that were surveyed.

SD DENR Response: Correct number of animal waste systems (33) was inserted into Section 10.0 and included a modified version of the map provided by the conservation district.

Comments: Will E. coli monitoring continue at water quality sampling sites T28 and T29? From the limited E. coli data available and the use of fecal coliform as a surrogate for E. coli, it would appear that more E. coli sampling would be beneficial in quantifying the amount of contamination.

SD DENR Response: There is no active water quality monitoring sites on Pipestone Creek. The T28 and T29 sampling sites were used during the Central Big Sioux Assessment and Phase 1 Implementation Project. These sites are not currently being sampled as part of the Phase 2 Central Big Sioux Implementation Project. The resulting linear regression model based off of paired *E. coli*/fecal coliform data is strong $r^2 = 0.7633$ and is statistically significant ($p < 0.01$). Using available paired *E. coli*/fecal coliform data collected from the same segment provides the best method for assessing the current condition given that there is no continued monitoring on Pipestone Creek.

Thank you for the opportunity to comment on the Pipestone Creek TMDL. Regards,

Sol Brich

Central Big Sioux River Watershed Project Coordinator

202 E 3rd Ave

Flandreau, SD 57028

Email: sol.brich@sd.nacdnet.net

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

SEP 26 2012

Ref: 8EPR-EP

Steven M. Pirner
Secretary
South Dakota Department of Environment & Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Re: TMDL Approval
Pipestone Creek E. coli
SD-BS-R-PIPESTONE_01

Dear Mr. Pirner:

We have completed our review of the total maximum daily load as submitted by your office for the waterbody listed in the enclosure to this letter. In accordance with the Clean Water Act (33 U.S.C. 1251 *et. seq.*), we approve all aspects of the TMDL referenced above as developed for the water quality limited waterbody as described in Section 303(d)(1). Based on our review, we feel the separate elements of the TMDL as listed in the enclosed table adequately address the pollutant of concern as given in the table, taking into consideration seasonal variation and a margin of safety.

Thank you for submitting the TMDL for our review and approval. If you have any questions, the most knowledgeable person on my staff is Bonnie Lavelle and she may be reached at 303-312-6579.

Sincerely,

Howard M. Cantor, for
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Enclosures

ENCLOSURE 1: APPROVED TMDLs

Escherichia Coli Bacteria Total Maximum Daily Load Evaluation for Pipestone Creek Located in Moody and Minnehaha Counties, South Dakota (SD DENR, November 2011).

Submitted: 3/12/2012

1	Pollutant TMDLs completed.
1	Causes addressed from the 2012 303(d) list.
0	Determinations that no pollutant TMDL needed.

Segment: Pipestone Creek from Split Rock Creek to the Minnesota border

303(d) ID: SD-BS-R-PIPESTONE 01

Parameter/Pollutant (303(d) list cause): E. COLI - 227

Water Quality Targets: <126 cfu/100mL geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period; <235 cfu/100mL in any one sample

Allocation*	Value	Units	State Permits	Permits
WLA	0	CFU/DAY		
MOS	2.55E+11	CFU/DAY		
LA	8.24E+14	CFU/DAY		
TMDL	8.24E+14	CFU/DAY		

Notes:

* LA = Load Allocation, WLA = Wasteload Allocation, MOS = Margin of Safety, TMDL = sum(WLAs) + sum(LAs) + MOS

ENCLOSURE 2: EPA REGION 8 TMDL REVIEW

TMDL Document Info:

Document Name:	**Escherichia Coli Bacteria Total Maximum Daily Load Evaluation for Pipestone Creek Located in Moody and Minnehaha Counties, South Dakota**
Submitted by:	**South Dakota Department of Environment and Natural Resources**
Date Received:	**March 12, 2012**
Review Date:	**September 21, 2012**
Reviewer:	**Bonnie Lavelle, EPA**
Rough Draft / Public Notice / Final Draft?	**Final**
Notes:	

Reviewers Final Recommendation(s) to EPA Administrator (used for final draft review only):

☒ Approve
☐ Partial Approval
☐ Disapprove
☐ Insufficient Information

Approval Notes to Administrator: Based on the review presented below, I recommend approval of the TMDL submitted in this document.

This document provides a standard format for EPA Region 8 to provide comments to state TMDL programs on TMDL documents submitted to EPA for either formal or informal review. All TMDL documents are evaluated against the minimum submission requirements and TMDL elements identified in the following 8 sections:

1. Problem Description
   1.1. TMDL Document Submittal Letter
   1.2. Identification of the Waterbody, Impairments, and Study Boundaries
   1.3. Water Quality Standards
2. Water Quality Target
3. Pollutant Source Analysis
4. TMDL Technical Analysis
   4.1. Data Set Description
   4.2. Waste Load Allocations (WLA)
   4.3. Load Allocations (LA)
   4.4. Margin of Safety (MOS)
   4.5. Seasonality and variations in assimilative capacity
5. Public Participation
6. Monitoring Strategy
7. Restoration Strategy
8. Daily Loading Expression

Under Section 303(d) of the Clean Water Act, waterbodies that are not attaining one or more water quality standard (WQS) are considered "impaired." When the cause of the impairment is determined to be a pollutant, a TMDL analysis is required to assess the appropriate maximum allowable pollutant loading rate. A TMDL document consists of a technical analysis conducted to: (1) assess the maximum pollutant loading rate that a waterbody is able to assimilate while maintaining water quality standards; and (2) allocate that assimilative capacity among the known sources of that pollutant**.** A well written TMDL document will describe a path forward that may be used by those who implement the TMDL recommendations to attain and maintain WQS.

Each of the following eight sections describes the factors that EPA Region 8 staff considers when reviewing TMDL documents. Also included in each section is a list of EPA's minimum submission requirements relative to that section, a brief summary of the EPA reviewer's findings, and the reviewer's comments and/or suggestions. Use of the verb "must" in the minimum submission requirements denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable.

This review template is intended to ensure compliance with the Clean Water Act and that the reviewed documents are technically sound and the conclusions are technically defensible.

1. Problem Description

A TMDL document needs to provide a clear explanation of the problem it is intended to address. Included in that description should be a definitive portrayal of the physical boundaries to which the TMDL applies, as well as a clear description of the impairments that the TMDL intends to address and the associated pollutant(s) causing those impairments. While the existence of one or more impairment and stressor may be known, it is important that a comprehensive evaluation of the water quality be conducted prior to development of the TMDL to ensure that all water quality problems and associated stressors are identified. Typically, this step is conducted prior to the 303(d) listing of a waterbody through the monitoring and assessment program. The designated uses and water quality criteria for the waterbody should be examined against available data to provide an evaluation of the water quality relative to all applicable water quality standards. If, as part of this exercise, additional WQS problems are discovered and additional stressor pollutants are identified, consideration should be given to concurrently evaluating TMDLs for those additional pollutants. If it is determined that insufficient data is available to make such an evaluation, this should be noted in the TMDL document.

1.1 TMDL Document Submittal Letter

When a TMDL document is submitted to EPA requesting formal comments or a final review and approval, the submittal package should include a letter identifying the document being submitted and the purpose of the submission.

Minimum Submission Requirements.

☒ A TMDL submittal letter should be included with each TMDL document submitted to EPA requesting a formal review.

☒ The submittal letter should specify whether the TMDL document is being submitted for initial review and comments, public review and comments, or final review and approval.

☒ Each TMDL document submitted to EPA for final review and approval should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute**.** The submittal letter should contain such identifying information as the name and location of the waterbody and the pollutant(s) of concern, which matches similar identifying information in the TMDL document for which a review is being requested.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information ☐ N/A

Summary:
The final version of the e. coli TMDL for Pipestone Creek segment SD-BS-R-PIPESTONE_01 was transmitted to EPA via email on March 12, 2012 with a submittal letter requesting EPA final review and approval.

Comments*:* *No comments.*

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

The TMDL document should provide an unambiguous description of the waterbody to which the TMDL is intended to apply and the impairments the TMDL is intended to address. The document should also clearly delineate the physical boundaries of the waterbody and the geographical extent of the watershed area studied. Any additional information needed to tie the TMDL document back to a current 303(d) listing should also be included.

Minimum Submission Requirements:

☒ The TMDL document should clearly identify the pollutant and waterbody segment(s) for which the TMDL is being established. If the TMDL document is submitted to fulfill a TMDL development requirement for a waterbody on the state's current EPA approved 303(d) list, the TMDL document submittal should clearly identify the waterbody and associated impairment(s) as they appear on the State's/Tribe's current EPA approved 303(d) list, including a full waterbody description, assessment unit/waterbody ID, and the priority ranking of the waterbody. This information is necessary to ensure that the administrative record and the national TMDL tracking database properly link the TMDL document to the 303(d) listed waterbody and impairment(s).

☒ One or more maps should be included in the TMDL document showing the general location of the waterbody and, to the maximum extent practical, any other features necessary and/or relevant to the understanding of the TMDL analysis, including but not limited to: watershed boundaries, locations of major pollutant sources, major tributaries included in the analysis, location of sampling points, location of discharge gauges, land use patterns, and the location of nearby waterbodies used to provide surrogate information or reference conditions. Clear and concise descriptions of all key features and their relationship to the waterbody and water quality data should be provided for all key and/or relevant features not represented on the map

☒ If information is available, the waterbody segment to which the TMDL applies should be identified/geo-referenced using the National Hydrography Dataset (NHD). If the boundaries of the TMDL do not correspond to the Waterbody ID(s) (WBID), Entity_ID information or reach code (RCH_Code) information should be provided. If NHD data is not available for the waterbody, an alternative geographical referencing system that unambiguously identifies the physical boundaries to which the TMDL applies may be substituted.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

***Physical Setting and Listing History*:**

Pipestone Creek begins north of Pipestone, Minnesota, flows to South Dakota through Moody County and Minnehaha County and re-enters Minnesota to eventually join Split Rock Creek in Rock County Minnesota. Split Rock Creek eventually flows into the Big Sioux River below the City of Brandon, South Dakota, just east of the city of Sioux Falls. Pipestone Creek is influenced by two tributaries, South Branch Pipestone Creek and North Branch Pipestone Creek which are located in Minnesota. The municipality of Pipestone in Minnesota may be influencing this segment. The municipality discharges only during specified days of the year: April 1 through June 15 and September 15 through December 15.

The portion of Pipestone Creek within South Dakota is 35.4 miles long and drains approximately 45,993 acres in eastern South Dakota. Land use within the Pipestone Creek watershed in South Dakota is mainly cropland (82%) interspersed with rangeland/grassland (17%). Approximately 1% of the land in the watershed is developed. Pipestone Creek receives runoff from agricultural operations.

The HUC Code for Pipestone Creek is 10170203.

Chapter 74:51:03:01 of the South Dakota Administrative Rules assigns all streams in South Dakota the beneficial uses of:

Beneficial Use Classification 9: Fish and wildlife propagation, recreation, and stock watering waters
Beneficial Use Classification 10: Irrigation waters

Chapter 74:51:03:07 of the South Dakota Administrative Rules assigns the following additional beneficial use classifications to Pipestone Creek from Split Rock Creek to the Minnesota border:

Beneficial Use Classification 5: Warmwater semi permanent fish life propagation waters
Beneficial Use Classification 7: Immersion recreation waters
Beneficial Use Classification 8: Limited contact recreation waters

Pipestone Creek was included in the Central Big Sioux River Watershed Assessment Project implemented in April 1999 through December 2003. The project was initiated in response to the Central Big Sioux River being placed on the 303(d) list of impaired waters in the year 1998. The final report, "Phase I Watershed Assessment Final Report and TMDL, Central Big Sioux River, Brookings, Lake, Moody, and Minnehaha Counties, South Dakota" was completed in March 2004.

The Central Big Sioux River Watershed Assessment Project identified the portion of Pipestone Creek within South Dakota for TMDL development based on water quality data collected as part of the assessment. Water quality data were collected on Pipestone Creek during the Big Sioux River Watershed Assessment from two sampling points: T28, located near the Minnesota Border where Pipestone Creek enters South Dakota; and T29, located near the Minnesota Border were Pipestone Creek exits South Dakota. For the TMDL analysis, T28 was considered to be a boundary condition site and T29 represented the South Dakota reach.

Samples were collected monthly during the recreation season starting in June 2000 until October 2001. Monthly sampling resumed during the period October 2005 through October 2008 during the recreation season. Instantaneous flow measurements were taken for each sampling date.

From site T29, 40 samples were collected. E. coli was measured directly in 11 of the 40 samples. For the remaining 29 samples, E. coli concentrations were modeled from the fecal coliform results.

From site T29, concentrations of E. coli exceeded the chronic (or geometric mean) water quality criterion (WQC) for immersion recreation use in 27 samples. Concentrations of E. coli exceeded the acute (or daily maximum) WQC in 24 samples.

From site T28, 52 samples were collected. E. coli was measured directly in 11 of the 52 samples. For the remaining 41 samples, E. coli concentrations were modeled from the fecal coliform results.

From site T28, concentrations of E. coli exceeded the chronic (or geometric mean) WQC for immersion recreation use in 45 samples. Concentrations of E. coli exceeded the acute (or daily maximum) WQC in 42 samples.

These results indicated the immersion recreation beneficial use and the limited contact recreation use were not supported due to elevated E. coli bacteria concentrations.

Pipestone Creek was not on any 303(d) State Waterbody lists prior to the Central Big Sioux River Watershed Assessment Project, including the 2006 303(d) list. A TMDL evaluation for fecal coliform bacteria for Pipestone Creek was included as Appendix EEE of the Central Big Sioux River Watershed Assessment Project final report.

Impairment status:

The 2010 South Dakota Integrated Report for Surface Water Quality Assessment identifies Pipestone Creek segment SD-BS-R-PIPESTONE _01 as not supporting the following beneficial uses:

Stream Segment	*Data Source*	*Beneficial Use Not Supported*	*Cause*	*Source*	*Priority*
Pipestone Creek SD-BS-R-PIPESTONE_01	*DENR*	*Classification 7 Immersion Recreation*	*E. Coli* *Fecal Coliform*	*Livestock (Grazing or Feeding Operations)*	*1*
Pipestone Creek SD-BS-R-PIPESTONE_01	*DENR*	*Classification 8 Limited Contact Recreation*	*Fecal Coliform*	*Livestock (Grazing or Feeding Operations)*	*1*

Comments: *No comments.*

1.3 Water Quality Standards

TMDL documents should provide a complete description of the water quality standards for the waterbodies addressed, including a listing of the designated uses and an indication of whether the uses are being met, not being met, or not assessed. If a designated use was not assessed as part of the TMDL analysis (or not otherwise recently assessed), the documents should provide a reason for the lack of assessment (e.g., sufficient data was not available at this time to assess whether or not this designated use was being met).

Water quality criteria (WQC) are established as a component of water quality standard at levels considered necessary to protect the designated uses assigned to that waterbody. WQC identify quantifiable targets and/or qualitative water quality goals which, if attained and maintained, are intended to ensure that the designated uses for the waterbody are protected. TMDLs result in maintaining and attaining water quality standards by determining the appropriate maximum pollutant loading rate to meet water quality criteria, either directly, or through a surrogate measurable target. The TMDL document should include a description of all applicable water quality criteria for the impaired designated uses and address whether or not the criteria are being attained, not attained, or not evaluated as part of the analysis. If the criteria were not evaluated as part of the analysis, a reason should be cited (e.g. insufficient data were available to determine if this water quality criterion is being attained).

Minimum Submission Requirements:

☒ The TMDL must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the anti-degradation policy. (40 C.F.R. §130.7(c)(1)).

☒ The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, all TMDL documents must be written to meet the existing water quality standards for that waterbody (CWA §303(d)(1)(C)). *Note: In some circumstances, the load reductions determined to be necessary by the TMDL analysis may prove to be infeasible and may possibly indicate that the existing water quality standards and/or assessment methodologies may be erroneous. However, the TMDL must still be determined based on existing water quality standards. Adjustments to water quality standards and/or assessment methodologies may be evaluated separately, from the TMDL.*

☒ The TMDL document should describe the relationship between the pollutant of concern and the water quality standard the pollutant load is intended to meet. This information is necessary for EPA to evaluate whether or not attainment of the prescribed pollutant loadings will result in attainment of the water quality standard in question.

☒ If a standard includes multiple criteria for the pollutant of concern, the document should demonstrate that the TMDL value will result in attainment of all related criteria for the pollutant. For example, both acute and chronic values (if present in the WQS) should be addressed in the document, including consideration of magnitude, frequency and duration requirements.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

A complete description of the applicable State/Tribal water quality standard, including the designated use(s) of Pipestone Creek and the applicable numeric water quality criteria, is included in several places in the TMDL document.

Section 2.0, "Water Quality Standards" (page 8), describes the beneficial uses that have been assigned to Pipestone Creek. These are:

- *Beneficial Use Classification 9: Fish and wildlife propagation, recreation, and stock watering waters*
- *Beneficial Use Classification 10: Irrigation waters*
- *Beneficial Use Classification 5: Warmwater semi permanent fish life propagation waters*
- *Beneficial Use Classification 7: Immersion recreation waters*
- *Beneficial Use Classification 8: Limited contact recreation waters*

Table 2, "State Water Quality Standards for Pipestone Creek" (page 9), summarizes the Water Quality Criteria for Pipestone Creek. These criteria must be met to support the assigned beneficial uses.

Section 1.1," Watershed Characteristics" (page 5), states that the portion of Pipestone Creek within South Dakota, segment SD-BS-R-PIPESTONE_01, was listed as impaired for both limited contact recreation use and immersion recreation use in the 2010 Integrated Report due to E. coli and fecal coliform. Livestock grazing or feeding operations was identified as the source.

Section 2.0," Water Quality Standards" (page 8), describes the E. coli water quality criteria that support immersion recreation use:

1. *No sample may exceed 235 cfu/100ml;*
2. *During any 30-day period, the geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period may be equal to or less than 126 cfu/100ml; and*
3. *These criteria only apply during the period May 1 – September 30.*

This section also states that the TMDL target is based on the chronic standard for E. coli of ≤126 cfu/100ml to support immersion recreation use.

Comments: *No comments.*

2.0 Water Quality Targets

TMDL analyses establish numeric targets that are used to determine whether water quality standards are being achieved. Quantified water quality targets or endpoints should be provided to evaluate each listed pollutant/water body combination addressed by the TMDL, and should represent achievement of applicable water quality standards and support of associated beneficial uses. For pollutants with numeric water quality standards, the numeric criteria are generally used as the water quality target. For pollutants with narrative standards, the narrative standard should be translated into a measurable value. At a minimum, one target is required for each pollutant/water body combination. It is generally desirable, however, to include several targets that represent achievement of the standard and support of beneficial uses (e.g., for a sediment impairment issue it may be appropriate to include a variety of targets representing water column sediment such as TSS, embeddedness, stream morphology, up-slope conditions and a measure of biota).

Minimum Submission Requirements:

- ☒ The TMDL should identify a numeric water quality target(s) for each waterbody pollutant combination. The TMDL target is a quantitative value used to measure whether or not the applicable water quality standard is attained. *Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. Occasionally, the pollutant of concern is different from the parameter that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as a numerical dissolved oxygen criterion). In such cases, the TMDL should explain the linkage between the pollutant(s) of concern, and express the quantitative relationship between the TMDL target and pollutant of concern. In all cases, TMDL targets must represent the attainment of current water quality standards.*
- ☐ When a numeric TMDL target is established to ensure the attainment of a narrative water quality criterion, the numeric target, the methodology used to determine the numeric target, and the link between the pollutant of concern and the narrative water quality criterion should all be described in the TMDL document. Any additional information supporting the numeric target and linkage should also be included in the document.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 2.0, Water Quality Standards (page 8), identifies the water quality target as the chronic standard for E.coli that supports the immersion recreation beneficial use. This target is:

E.coli concentrations $\leq$ 126 cfu/100mL.

Loads are allocated so that individual samples in all flow regimes will achieve the water quality target of $\leq$ 126 cfu/100 mL E. Coli. This target, based on the chronic water quality criterion for E. coli that supports the immersion recreation beneficial use, is intended to be compared to a geometric mean of at least 5 samples obtained during separate 24-hour periods for any 30-day period. By establishing the TMDL target based on the chronic criterion and calculating necessary load reductions based on a comparison of individual samples to the LDC, there is increased confidence that both the acute and chronic standards for E. coli will be achieved by the load allocations and reductions.

Load duration curves are developed in Section 3.0, "Technical Analysis" and Figure 9, "Load Duration Curve for Pipestone Creek (SD-BS-R-PIPESTONE_01) based on data from sites T28 and T29 " (page

19) . Load duration curves are presented for both the Acute and Chronic water quality criteria for E. coli that supports immersion recreation use.

Comments: *No comments.*

3. Pollutant Source Analysis

A TMDL analysis is conducted when a pollutant load is known or suspected to be exceeding the loading capacity of the waterbody. Logically then, a TMDL analysis should consider all sources of the pollutant of concern in some manner. The detail provided in the source assessment step drives the rigor of the pollutant load allocation. In other words, it is only possible to specifically allocate quantifiable loads or load reductions to each significant source (or source category) when the relative load contribution from each source has been estimated. Therefore, the pollutant load from each significant source (or source category) should be identified and quantified to the maximum practical extent. This may be accomplished using site-specific monitoring data, modeling, or application of other assessment techniques. If insufficient time or resources are available to accomplish this step, a phased/adaptive management approach may be appropriate. The approach should be clearly defined in the document.

Minimum Submission Requirements:

- ☒ The TMDL should include an identification of all potentially significant point and nonpoint sources of the pollutant of concern, including the geographical location of the source(s) and the quantity of the loading, e.g., lbs/per day. This information is necessary for EPA to evaluate the WLA, LA and MOS components of the TMDL.
- ☒ The level of detail provided in the source assessment should be commensurate with the nature of the watershed and the nature of the pollutant being studied. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of both the natural background loads and the nonpoint source loads.
- ☒ Natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g. measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified, characterized, and properly quantified.
- ☒ The sampling data relied upon to discover, characterize, and quantify the pollutant sources should be included in the document (e.g. a data appendix) along with a description of how the data were analyzed to characterize and quantify the pollutant sources. A discussion of the known deficiencies and/or gaps in the data set and their potential implications should also be included.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 4.0, "Significant Sources" on page 19, provides the pollutant source analysis for Pipestone Creek within South Dakota. There are no point sources within the Pipestone Creek watershed. For nonpoint sources, fecal coliform is used as a measure of bacterial contribution. E. coli contribution rates are expected to be a portion of fecal coliform rates and the relative contribution of livestock, human, and wildlife to the total nonpoint source load of fecal coliform is expected to be similar to the relative contribution rates of each to the E. coli load. Nonpoint sources of fecal coliform are primarily agricultural (manure from livestock) with contributions from septic systems and natural background/wildlife. Livestock in the watershed are predominantly hogs and beef cattle but also include *dairy cattle, sheep, horses and chicken. There are an estimated 33 septic systems along Pipestone Creek in South Dakota. No data exists on the condition of the septic systems.*

The number of livestock and wildlife animals per acre within the watershed was estimated based on the results of the 2003 and 2009 National Agricultural Statistic Survey (NASS) and the 2002 South Dakota Game Fish and Parks county wildlife assessment. The number of people was estimated from the 2010 census. Estimates of the amount of fecal coliform per animal(and human) per day were combined with the estimated number of animals per acre to arrive at an estimated daily load of fecal coliform in cfu of fecal coliform per acre per day for each species. Table 6, "Pipestone Creek Potential Nonpoint Sources" on page 23 summarizes these estimates.

The TMDL document also presents a percentage contribution of fecal coliform in the watershed for 4 primary categories. Table 4,"Fecal coliform source allocation for Pipestone Creek" on page 20 presents this estimate:

- *Feedlots are estimated to contribute 42.15% of the fecal coliform,*
- *Livestock on range is estimated to contribute 56.8% of the fecal coliform,*
- *Wildlife is estimated to contribute 0.8% of the fecal coliform, and*
- *Humans are estimated to contribute 0.25% of the fecal coliform.*

Figure 10, "Animal feeding operation locations throughout the Pipestone Creek watershed" (page 21) indicates the locations of feedlots in "best management practices priority areas" in the watershed.

***Comments**: No comments.*

4. TMDL Technical Analysis

TMDL determinations should be supported by a robust data set and an appropriate level of technical analysis**.** This applies to **all** of the components of a TMDL document. It is vitally important that the technical basis for **all** conclusions be articulated in a manner that is easily understandable and readily apparent to the reader.

A TMDL analysis determines the maximum pollutant loading rate that may be allowed to a waterbody without violating water quality standards. The TMDL analysis should demonstrate an understanding of the relationship between the rate of pollutant loading into the waterbody and the resultant water quality impacts. This stressor → response relationship between the pollutant and impairment and between the selected targets, sources, TMDLs, and load allocations needs to be clearly articulated and supported by an appropriate level of technical analysis. Every effort should be made to be as detailed as possible, and to base all conclusions on the best available scientific principles.

The pollutant loading allocation is at the heart of the TMDL analysis. TMDLs apportion responsibility for taking actions by allocating the available assimilative capacity among the various point, nonpoint, and natural pollutant sources. Allocations may be expressed in a variety of ways, such as by individual discharger, by tributary watershed, by source or land use category, by land parcel, or other appropriate scale or division of responsibility.

The pollutant loading allocation that will result in achievement of the water quality target is expressed in the form of the standard TMDL equation:

$$TMDL = \sum LAs + \sum WLAs + MOS$$

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

MOS = the portion of the Load Capacity allocated to the Margin of Safety.

Minimum Submission Requirements:

☒ A TMDL must identify the loading capacity of a waterbody for the applicable pollutant, taking into consideration temporal variations in that capacity. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

☒ The total loading capacity of the waterbody should be clearly demonstrated to equate back to the pollutant load allocations through a balanced TMDL equation. In instances where numerous LA, WLA and seasonal TMDL capacities make expression in the form of an equation cumbersome, a table may be substituted as long as it is clear that the total TMDL capacity equates to the sum of the allocations.

☒ The TMDL document should describe the methodology and technical analysis used to establish and quantify the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

☒ It is necessary for EPA staff to be aware of any assumptions used in the technical analysis to understand and evaluate the methodology used to derive the TMDL value and associated loading allocations. Therefore, the TMDL document should contain a description of any important assumptions (including the basis for those assumptions) made in developing the TMDL, including but not limited to:

(1) the spatial extent of the watershed in which the impaired waterbody is located and the spatial extent of the TMDL technical analysis;
(2) the distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) a presentation of relevant information affecting the characterization of the pollutant of concern and its allocation to sources such as population characteristics, wildlife resources, industrial activities etc…;
(4) present and future growth trends, if taken into consideration in determining the TMDL and preparing the TMDL document (e.g., the TMDL could include the design capacity of an existing or planned wastewater treatment facility);
(5) an explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

☒ The TMDL document should contain documentation supporting the TMDL analysis, including an inventory of the data set used, a description of the methodology used to analyze the data, a discussion of strengths and weaknesses in the analytical process, and the results from any water quality modeling used. This information is necessary for EPA to review the loading capacity determination, and the associated load, wasteload, and margin of safety allocations.

☒ TMDLs must take critical conditions (e.g., steam flow, loading, and water quality parameters, seasonality, etc…) into account as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable critical conditions and describe the approach used to determine both point and nonpoint source loadings under such critical conditions. In particular, the document should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

☐ Where both nonpoint sources and NPDES permitted point sources are included in the TMDL loading allocation, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document must include a demonstration that nonpoint source loading reductions needed to implement the load allocations are actually practicable [40 CFR 130.2(i) and 122.44(d)].

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 3.0, "Technical Analysis" describes the collection of data used to support this TMDL. Water samples and flow measurements were collected at two stream locations:

- *T28, located near the Minnesota border where Pipestone Creek enters South Dakota; and*
- *T29, located near the Minnesota border where Pipestone Creek exits South Dakota.*

For this TMDL, data from monitoring point T28 represent boundary conditions.

Water samples were collected from T28 and T29 during the Big Sioux River Watershed Assessment from 2001 to 2008. These samples were collected during the months of April through October. Table 3, "T28 Actual and modeled E. coli samples, modeled E. coli samples indicated by red text" (page 11) and Table 4, "T29 Actual and modeled E. coli samples, modeled E. coli samples indicated by red text" (page 12) provide the station name, date of sample collection, flow, fecal coliform and E. Coli concentrations for each sampling event and each station.

E.coli was measured directly from only a subset of the samples collected. Most samples were analyzed for fecal coliform only.

The paired E. coli/fecal coliform results were used in a regression analysis to establish the relationship between the two concentrations in the same samples. Log transformed E. coli results were correlated with log transformed fecal coliform results from the same sample.

The resulting relationship, Log E. coli = 1.0888(log fecal coliform) -0.2932, was used to predict the E.coli concentrations from fecal coliform results. Figure 3, "E. coli –fecal coliform regression relationship" (page 13) presents the linear regression.

Section 3.3, "Flow Analysis" (page 13) states that flow data were collected at both T28 and T29. Flow data were also collected at site T30 from Split Rock Creek near Sherman. Additionally, USGS operates a gaging station (06482610) along Split Rock Creek near Corson, SD.

An Aquarius model was built using flow data from T28, T30, and the USGS gaging station 06482610 flow data. T30 data were adjusted in Aquarius to match well with USGS data. Then, corrected T30 data were correlated with T28 data and a non-linear artificial neural model was created from the relationship. By adjusting T30 flow data to match well with USGS flow data, a relationship between T28 and T30 was created allowing the use of USGS long term flow data as the basis for estimating a long term flow record for T28. The modeled flow record for T28 was used to represent the impaired reach.

Comments *: No comments.*

4.1 Data Set Description

TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis. An inventory of the data used for the TMDL analysis should be provided to document, for the record, the data used in decision making. This also provides the reader with the opportunity to independently review the data. The TMDL analysis should make use of all readily available data for the waterbody under analysis unless the TMDL writer determines that the data are not relevant or appropriate. For relevant data that were known but rejected, an explanation of why the data were not utilized should be provided (e.g., samples exceeded holding times, data collected prior to a specific date were not considered timely, etc…).

Minimum Submission Requirements:

- ☒ TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and appropriate water quality criteria.
- ☒ The TMDL document submitted should be accompanied by the data set utilized during the TMDL analysis. If possible, it is preferred that the data set be provided in an electronic format and referenced in the document. If electronic submission of the data is not possible, the data set may be included as an appendix to the document.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☒ Insufficient Information

Summary:

Section 3.1," Data Collection Method" (page 10), states that water quality data were collected on Pipestone Creek during the Big Sioux River Watershed Assessment from two sampling points: T28, located near the Minnesota Border where Pipestone Creek enters South Dakota; and T29, located near the Minnesota Border were Pipestone Creek exits South Dakota. For the TMDL analysis, T28 was considered to be a boundary condition site and T29 represented the South Dakota reach.

Samples were collected monthly during the recreation season starting in June 2000 until October 2001. Monthly sampling resumed during the period October 2005 through October 2008 during the recreation season. Instantaneous flow measurements were taken for each sampling date.

From site T29, 40 samples were collected. E. coli was measured directly in 11 of the 40 samples. For the remaining 29 samples, E. coli concentrations were modeled from the fecal coliform results.

From site T29, concentrations of E. coli exceeded the chronic (or geometric mean) water quality criterion (WQC) for immersion recreation use in 27 samples. Concentrations of E. coli exceeded the acute (or daily maximum) WQC in 24 samples.

From site T28, 52 samples were collected. E. coli was measured directly in 11 of the 52 samples. For the remaining 41 samples, E. coli concentrations were modeled from the fecal coliform results.

From site T28, concentrations of E. coli exceeded the chronic (or geometric mean) WQC for immersion recreation use in 45 samples. Concentrations of E. coli exceeded the acute (or daily maximum) WQC in 42 samples.

Table 3, "T28 Actual and modeled E. coli samples, modeled E. coli samples indicated by red text" (page 11) and Table 4, "T29 Actual and modeled E. coli samples, modeled E. coli samples indicated by red text" (page 12) provide the station name, date of sample collection, flow, fecal coliform and E. Coli concentrations for each sampling event and each station.

Section 3.3, "Flow Analysis" (page 13), states that flow data was collected at T28, T29, and T30. Figures 5, 6, and 7 (pages 15-17) display the flow records. Flow data from USGS gaging station 06482610 along Split Rock Creek near Corson, SD is displayed on Figure 8.

***Comments**: No comments.*

4.2 Waste Load Allocations (WLA):

Waste Load Allocations represent point source pollutant loads to the waterbody. Point source loads are typically better understood and more easily monitored and quantified than nonpoint source loads. Whenever practical, each point source should be given a separate waste load allocation. All NPDES permitted dischargers that discharge the pollutant under analysis directly to the waterbody should be identified and given separate waste load allocations. The finalized WLAs are required to be incorporated into future NPDES permit renewals.

Minimum Submission Requirements:

- ☐ EPA regulations require that a TMDL include WLAs for all significant and/or NPDES permitted point sources of the pollutant. TMDLs must identify the portion of the loading capacity allocated to individual existing and/or future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit. If no allocations are to be made to point sources, then the TMDL should include a value of zero for the WLA.
- ☐ All NPDES permitted dischargers given WLA as part of the TMDL should be identified in the TMDL, including the specific NPDES permit numbers, their geographical locations, and their associated waste load allocations.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

***Summary**:*
There are no point sources within the Pipestone Creek watershed. The TMDL establishes a waste load allocation of 0 for all flow zones.

***Comments**: No comments*

4.3 Load Allocations (LA):

Load allocations include the nonpoint source, natural, and background loads. These types of loads are typically more difficult to quantify than point source loads, and may include a significant degree of uncertainty. Often it is necessary to group these loads into larger categories and estimate the loading rates based on limited monitoring data and/or modeling results. The background load represents a composite of all upstream pollutant loads into the waterbody. In addition to the upstream nonpoint and upstream natural load, the background load often includes upstream point source loads that are not given specific waste load allocations in this particular TMDL analysis. In instances where nonpoint source loading rates are particularly difficult to quantify, a performance-based allocation approach, in which a detailed monitoring plan and adaptive management strategy are employed for the application of BMPs, may be appropriate.

Minimum Submission Requirements:

☒ EPA regulations require that TMDL expressions include LAs which identify the portion of the loading capacity attributed to nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Load allocations may be included for both existing and future nonpoint source loads. Where possible, load allocations should be described separately for natural background and nonpoint sources.

☐ Load allocations assigned to natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g., measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified and given proper load or waste load allocations.

Recommendation:

☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

This TMDL was developed using the Load Duration Curve (LDC) approach. Figure 9 "Load duration curve for Pipestone Creek (SD-BS-R-PIPESTONE_01) based on data from sites T28 and T29 " is presented on page 19 and includes the loading capacity for both the acute and chronic E. coli WQC protective of immersion recreation use. Figure 11 "Boundary condition load duration curve" presents the load duration curve for the boundary condition at the location of sampling site T28. Separate summary tables of the TMDL calculations are presented for each of the flow zones: high flow, moist, mid-range flows, dry, and low flow.

The Load Allocation is presented in Section 6.2, "Load Allocation" (page 21). Approximately 99% of the watershed is comprised of agricultural land use. E. Coli loading is attributed to these sources. Site T29 occurs within the lower part of the watershed. The following load allocations are necessary to meet the water quality target at this site:

- *8.24E+14 cfu/day during high flow conditions (>213 cfs); a 99% reduction is needed*
- *1.23E+14 cfu/day during moist conditions(83-213 cfs); a 70% reduction is needed*
- *1.94E+13 cfu/day during mid-range conditions(48-82 cfs); a 67% reduction is needed*
- *6.29E+12 cfu/day during dry conditions (21-48 cfs); a 94% reduction is needed*
- *1.2E+12 cfu/day during low flow conditions(<21 cfs); an 81% reduction is needed*

Much of the area draining to the segment of Pipestone Creek within South Dakota is located in Minnesota. Pipestone Creek within Minnesota is considered a Class 2C surface water and carries the following water quality standard for E. coli bacteria:

"Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions within any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31."

Minnesota's chronic standard for E. coli is similar to South Dakota's chronic E. coli standard for immersion recreation use (geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period) of 126cfu/100 ml. Minnesota's acute standard is slightly higher than South Dakota's limited contact recreation E. coli acute standard of 1,178 cfu/100 ml in any one sample.

Minnesota's standard encompasses the range of South Dakota E. coli standards assigned to Pipestone Creek.

Minnesota's TMDL addressed fecal coliform bacteria. An overall reduction of 77% of the fecal coliform loading is needed in the impaired segments of Pipestone Creek located in Minnesota to meet water quality standards in fecal coliform bacteria. This reduction is similar to those needed in South Dakota. Much of the loading within Minnesota (95.1 %) is attributed to cattle (beef and dairy) and hogs. Practices such as livestock exclusion from the stream, grazing rotation, application of manure to only frozen ground, upgrading non-compliant septic systems, and correction of feedlots with runoff issues were among BMP's recommended to meet bacterial water quality standards within Minnesota.

Comments: *No comments.*

4.4 Margin of Safety (MOS):

Natural systems are inherently complex. Any mathematical relationship used to quantify the stressor → response relationship between pollutant loading rates and the resultant water quality impacts, no matter how rigorous, will include some level of uncertainty and error. To compensate for this uncertainty and ensure water quality standards will be attained, a margin of safety is required as a component of each TMDL. The MOS may take the form of a explicit load allocation (e.g., 10 lbs/day), or may be implicitly built into the TMDL analysis through the use of conservative assumptions and values for the various factors that determine the TMDL pollutant load → water quality effect relationship. Whether explicit or implicit, the MOS should be supported by an appropriate level of discussion that addresses the level of uncertainty in the various components of the TMDL technical analysis, the assumptions used in that analysis, and the relative effect of those assumptions on the final TMDL. The discussion should demonstrate that the MOS used is sufficient to ensure that the water quality standards would be attained if the TMDL pollutant loading rates are met. In cases where there is substantial uncertainty regarding the linkage between the proposed allocations and achievement of water quality standards, it may be necessary to employ a phased or adaptive management approach (e.g., establish a monitoring plan to determine if the proposed allocations are, in fact, leading to the desired water quality improvements).

Minimum Submission Requirements:

☒ TMDLs must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS).

☐ If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS should be identified and described. The document should discuss why the assumptions are considered conservative and the effect of the assumption on the final TMDL value determined.

☒ If the MOS is explicit, the loading set aside for the MOS should be identified. The document should discuss how the explicit MOS chosen is related to the uncertainty and/or potential error in the linkage analysis between the WQS, the TMDL target, and the TMDL loading rate.

☐ If, rather than an explicit or implicit MOS, the TMDL relies upon a phased approach to deal with large and/or unquantifiable uncertainties in the linkage analysis, the document should include a description of the planned phases for the TMDL as well as a monitoring plan and adaptive management strategy.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 8.0, "Margin of Safety" (page 31) states that an explicit MOS is included in the TMDL. The MOS is the quantitative difference between the loading capacity at the mid-point of each of the flow zones and the loading capacity at the minimum flow in each zone on the LDC. A substantial MOS is provided using this method because the loading capacity is typically much less at the minimum flow compared to the mid-point. The MOS is intended to account for several sources of uncertainty including the loading from tributary streams and the effectiveness of controls.

The MOS is as follows:

- *2.55E+11 cfu/day during high flow conditions;*
- *1.33E+11 cfu/day during moist conditions;*
- *4.37 E+10 cfu/day during mid-range conditions;*
- *3.14E+10 cfu/day during dry conditions;*
- *3.89E+10 cfu/day during low flow conditions;*

Comments: *No comments.*

4.5 Seasonality and variations in assimilative capacity:

The TMDL relationship is a factor of both the loading rate of the pollutant to the waterbody and the amount of pollutant the waterbody can assimilate and still attain water quality standards. Water quality standards often vary based on seasonal considerations. Therefore, it is appropriate that the TMDL analysis consider seasonal variations, such as critical flow periods (high flow, low flow), when establishing TMDLs, targets, and allocations.

Minimum Submission Requirements:

☒ The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variability as a factor. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 7.0, "Monthly Patterns" (page 29), discusses the variability in concentrations of E.coli in Pipestone Creek with seasons.

The data collected from monitoring points T28 and T29 indicate increased flow in late winter and peak flow in the spring. Figure 12, "Seasonality of flow and E. coli concentrations" (page 30), displays the monitoring data.

Spring showers create runoff that carries fecal matter into Pipestone Creek, resulting in elevated E. Coli concentrations.

During the summer, recreational use of Pipestone Creek increases, influencing the concentrations of E. Coli. Summer is a critical time in which to reduce loading.

On average, E. coli concentrations were lower at T29 relative to T28. This is illustrated in Figure 13 "Comparison of monthly E. coli concentrations between sampling site T28 and T29" (page 31). The highest E. coli concentration measured was at T28 in a sample collected in June. The greatest overlap of concentrations between T28 and T29 occurred from April through July.

***Comments**: No comments.*

5. Public Participation

EPA regulations require that the establishment of TMDLs be conducted in a process open to the public, and that the public be afforded an opportunity to participate. To meaningfully participate in the TMDL process it is necessary that stakeholders, including members of the general public, be able to understand the problem and the proposed solution. TMDL documents should include language that explains the issues to the general public in understandable terms, as well as provides additional detailed technical information for the scientific community. Notifications or solicitations for comments regarding the TMDL should be made available to the general public, widely circulated, and clearly identify the product as a TMDL and the fact that it will be submitted to EPA for review. When the final TMDL is submitted to EPA for approval, a copy of the comments received by the state and the state responses to those comments should be included with the document.

Minimum Submission Requirements:

☒ The TMDL must include a description of the public participation process used during the development of the TMDL (40 C.F.R. §130.7(c)(1)(ii)).

☒ TMDLs submitted to EPA for review and approval should include a summary of significant comments and the State's/Tribe's responses to those comments.

Recommendation:

☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

***Summary**:*

Section 11.0, "Public Participation" (page 32), summarizes the public participation activities undertaken during the development of this TMDL.

- *Public meetings were held during the Central Big Sioux River Assessment*
- *A Webpage was developed for the Central Big Sioux River Assessment Project, information is still readily available on the internet*
- *Presentations were given to local groups on the findings of the assessment*
- *The public was invited to review and comment on this draft TMDL for Pipestone Creek. A 30-day review period was provided and public notices were published in the Sioux Falls Argus Leader, the Brookings Register, and the Moody County Enterprise. A copy of comments received and SD DENR responses were included in the final TMDL submitted to EPA for approval.*

- *A copy of the public notice was provided to EPA with the transmittal of the draft TMDL document.*

Comments: *EPA agrees with the comment of the Moody County Conservation District that additional E. coli monitoring at sites T28 and T29 would be beneficial in quantifying the amount of contamination. We support collecting the data to aid in implementation of the TMDL.*

6. Monitoring Strategy

TMDLs may have significant uncertainty associated with the selection of appropriate numeric targets and estimates of source loadings and assimilative capacity. In these cases, a phased TMDL approach may be necessary. For Phased TMDLs, it is EPA's expectation that a monitoring plan will be included as a component of the TMDL document to articulate the means by which the TMDL will be evaluated in the field, and to provide for future supplemental data that will address any uncertainties that may exist when the document is prepared.

Minimum Submission Requirements:

☒ When a TMDL involves both NPDES permitted point source(s) and nonpoint source(s) allocations, and attainment of the TMDL target depends on reductions in the nonpoint source loads, the TMDL document should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring.

☒ Under certain circumstances, a phased TMDL approach may be utilized when limited existing data are relied upon to develop a TMDL, and the State believes that the use of additional data or data based on better analytical techniques would likely increase the accuracy of the TMDL load calculation and merit development of a second phase TMDL. EPA recommends that a phased TMDL document or its implementation plan include a monitoring plan and a scheduled timeframe for revision of the TMDL. These elements would not be an intrinsic part of the TMDL and would not be approved by EPA, but may be necessary to support a rationale for approving the TMDL. http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

Section 9.0, "Follow-Up Monitoring and TMDL Review" (page 31), states that the Central Big Sioux River Implementation Project is currently assessing project effectiveness with models such as AnnAGNPS, RUSLE2, and STEPL. Water quality monitoring is not currently being done on this stream although occasional sampling may occur.

Land use data and information on BMP effectiveness may be collected during implementation of the TMDL. SD DENR may adjust the LA in this TMDL to account for the new information. The public will be provided an opportunity to comment before adjustments to the LA are made. Additionally, SD DENR will propose adjustments only in the event that the adjusted LA will not result in a change to the loading capacity and will notify EPA of any adjustments to this TMDL within 30 days of adoption.

Comments: *No comments.*

7. Restoration Strategy

The overall purpose of the TMDL analysis is to determine what actions are necessary to ensure that the pollutant load in a waterbody does not result in water quality impairment. Adding additional detail regarding the proposed approach for the restoration of water quality is not currently a regulatory requirement, but is considered a value added component of a TMDL document. During the TMDL analytical process, information is often gained that may serve to point restoration efforts in the right direction and help ensure that resources are spent in the most efficient manner possible. For example, watershed models used to analyze the linkage between the pollutant loading rates and resultant water quality impacts might also be used to conduct "what if" scenarios to help direct BMP installations to locations that provide the greatest pollutant reductions. Once a TMDL has been written and approved, it is often the responsibility of other water quality programs to see that it is implemented. The level of quality and detail provided in the restoration strategy will greatly influence the future success in achieving the needed pollutant load reductions.

Minimum Submission Requirements:

☒ EPA is not required to and does not approve TMDL implementation plans. However, in cases where a WLA is dependent upon the achievement of a LA, "reasonable assurance" is required to demonstrate the necessary LA called for in the document is practicable). A discussion of the BMPs (or other load reduction measures) that are to be relied upon to achieve the LA(s), and programs and funding sources that will be relied upon to implement the load reductions called for in the document, may be included in the implementation/restoration section of the TMDL document to support a demonstration of "reasonable assurance".

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information ☐ Not Applicable

Summary:

Since there are no point sources discharging to this segment of Pipestone Creek, the TMDL does not include a WLA. Therefore, the requirement to demonstrate reasonable assurance that the LA will be met is not applicable to this TMDL.

Section 10.0, "Restoration Strategy" (page 32), briefly describes that there is an implementation plan in place with projects targeted in areas outlined by the Central Big Sioux River Implementation Project. The goal of the implementation projects is to improve E. coli impairment. Specific Best Management Practice (BMP)activities to be undertaken are identified:

- *Reducing access to streams for livestock*
- *Increasing alternative watering sources for livestock*
- *Rotational grazing*
- *Riparian management*
- *33 animal water management systems*

Successful implementation of the BMPs is expected to result in achieving the TMDL.

Comments:
EPA recommends that a monitoring component be included in the implementation plan. The three major objectives for monitoring are:

a. *Collect data to identify the optimum locations for implementing BMP projects. Data may include E. coli concentrations, flow, and observations of land use and access to stream and alternative watering sources.*

b. *Collect data to evaluate the effectiveness of BMPs. Data may include E. coli concentrations and flow upstream and downstream of BMPs over several years pre- and post implementation of BMPs.*

c. *Collect data to assess achievement of water quality criteria. Data may include E. coli concentrations and flow at several new or existing monitoring points along stream chosen to represent average stream conditions and intended to be part of a long term monitoring program to evaluate trends and attainment of standards.*

8. Daily Loading Expression

The goal of a TMDL analysis is to determine what actions are necessary to attain and maintain WQS. The appropriate averaging period that corresponds to this goal will vary depending on the pollutant and the nature of the waterbody under analysis. When selecting an appropriate averaging period for a TMDL analysis, primary concern should be given to the nature of the pollutant in question and the achievement of the underlying WQS. However, recent federal appeals court decisions have pointed out that the title TMDL implies a "daily" loading rate. While the most appropriate averaging period to be used for developing a TMDL analysis may vary according to the pollutant, a daily loading rate can provide a more practical indication of whether or not the overall needed load reductions are being achieved. When limited monitoring resources are available, a daily loading target that takes into account the natural variability of the system can serve as a useful indicator for whether or not the overall load reductions are likely to be met. Therefore, a daily expression of the required pollutant loading rate is a required element in all TMDLs, in addition to any other load averaging periods that may have been used to conduct the TMDL analysis. The level of effort spent to develop the daily load indicator should be based on the overall utility it can provide as an indicator for the total load reductions needed.

Minimum Submission Requirements:

☒ The document should include an expression of the TMDL in terms of a daily load. However, the TMDL may also be expressed in temporal terms other than daily (e.g., an annual or monthly load). If the document expresses the TMDL in additional "non-daily" terms the document should explain why it is appropriate or advantageous to express the TMDL in the additional unit of measurement chosen.

Recommendation:
☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary:

The E.coli TMDL for Pipestone Creek is expressed as cfu/day for all flow zones.

Comments: *No comments.*