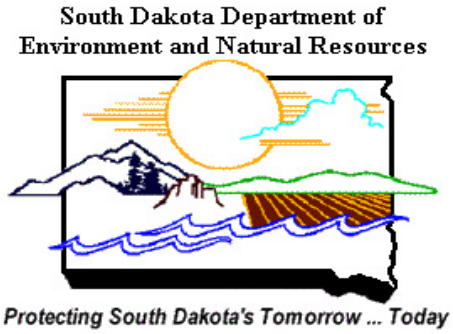
FECAL COLIFORM BACTERIA TOTAL MAXIMUM DAILY LOAD EVALUATION OF BEAVER CREEK, LINCOLN COUNTY, SOUTH DAKOTA



Completed by Jesse Wilkens

SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

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Total Maximum Daily Load Summary

Entity ID:	SD-BS-R-BEAVER_01
Location:	HUC Code: 1017020319
Size of Watershed:	25,419 acres
Water body Type:	River/Stream
303(d) Listing Parameter:	Fecal Coliform Bacteria
Initial Listing date:	2008 IR
TMDL Priority Ranking:	1
Listed Stream Miles:	7.8 miles
Designated Use of Concern:	Limited Contact Recreation
Analytical Approach:	Load Duration Curve Framework
Target:	Meet applicable water quality standards 74:51:01:55
Indicators:	Fecal Coliform Bacteria
Threshold Value:	< 1000 colonies/100 ml geometric mean concentration with maximum single sample concentrations of <2000 colonies/100 ml
High Flow Zone LA:	$5.26E^{12}$ CFU/day
High Flow Zone WLA:	0 CFU/day
High Flow Zone MOS:	$2.00E^{11}$ CFU/day
High Flow Zone TMDL:	$5.46E^{12}$ CFU/day

1.0 Introduction

The intent of this document is to clearly identify the components of the 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 EPA. This TMDL document addresses the fecal coliform impairment of Beaver Creek, SD-BS-R-BEAVER_01

1.1 Watershed Characteristics

Beaver Creek runs in a northwest to southeast direction for 44 miles in Lincoln Country, South Dakota to its confluence with the Big Sioux River. The Beaver Creek watershed encompasses 81,863 acres and the landscape is predominantly agricultural. The segment of Beaver Creek that is listed for fecal coliform impairment is approximately 7.8 miles long and stretches from S9, T98N, R49W to the confluence with the Big Sioux River. The watershed area of the listed segment is 25,419 acres.

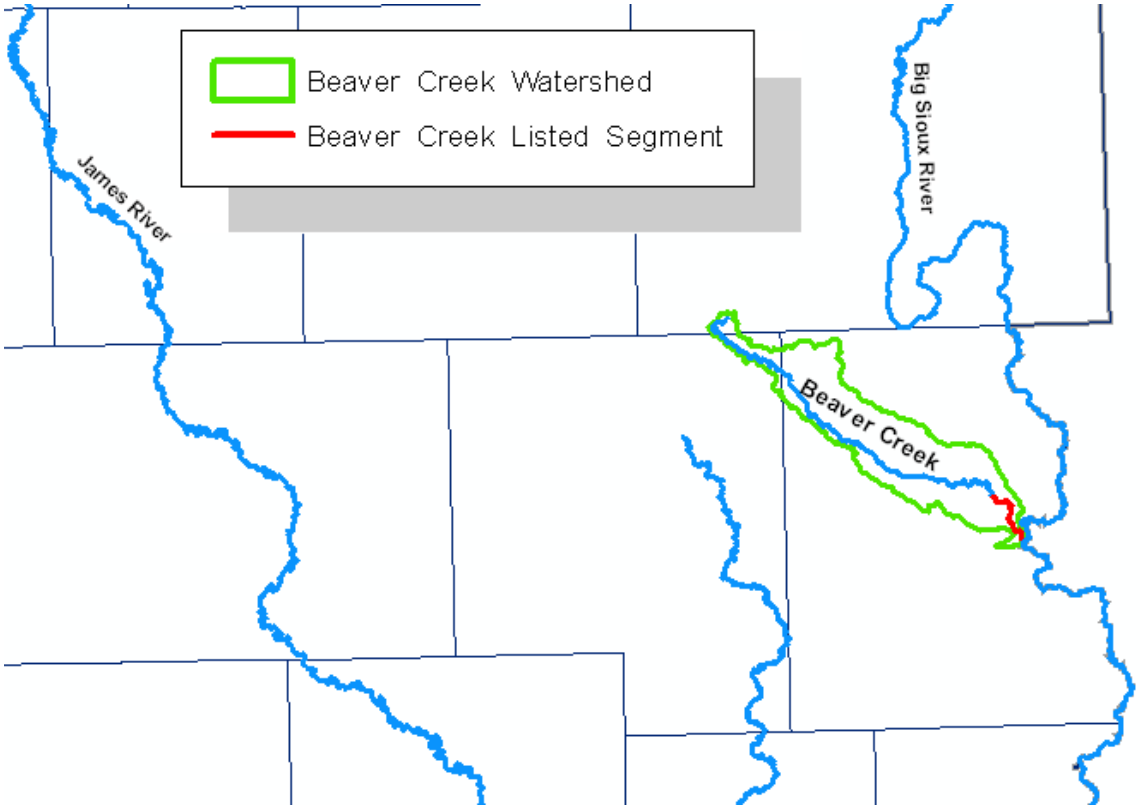

Figure 1. Beaver Creek watershed location in southeast South Dakota.

Table 1. Land use in the Beaver Creek watershed.

Land Use	Percent
Row Crop	73.6%
Water	0.1%
Small Grain	0.5%
Close Seeded	0.8%
Fallow	0.0%
Grass	10.8%
Wetland	0.5%
Woods	0.5%
Open Space	6.4%
Urban	0.9%
Herbaceous	2.1%
No data	0.0%

Table 1 lists the land uses present in the watershed and their percentages. The Beaver Creek watershed is predominantly row crops, which are mostly located on level soils. Grazing areas (grass and herbaceous land uses) make up a small portion of the watershed and are generally located near waterways on soils that are too steep for tillage.

The majority of upland soils in the Beaver Creek watershed are composed of the Wentworth-Chancellor soil association. These are deep, well drained, silty and loamy soils that formed in glacial drift and glacial till. They are typically located on the level areas and have few limitations for crop production (USDA, 1976).

Soils composed of the Nora-Moody-Crofton association are found in the sloping areas adjacent to Beaver Creek. Erosion has lowered the level of fertility in the soils in this association. Most of this association is cultivated. The Moody and Nora soils are well suited to all crops grown in the country. The strongly sloping Crofton and Nora soils are better suited to pasture and hay (USDA, 1976).

The majority of the soils located in bottom lands in close proximity to Beaver Creek are composed of the Lamo-Bon-Clamo association. These lands are mostly level but are broken by old channels, meander scars, and secondary flood channels. These soils are subject to flooding from stream overflow and have a high water table. Fertility is high, but wetness commonly delays farming operations. These areas are typically used for crops, pasture, and hay (USDA, 1976).

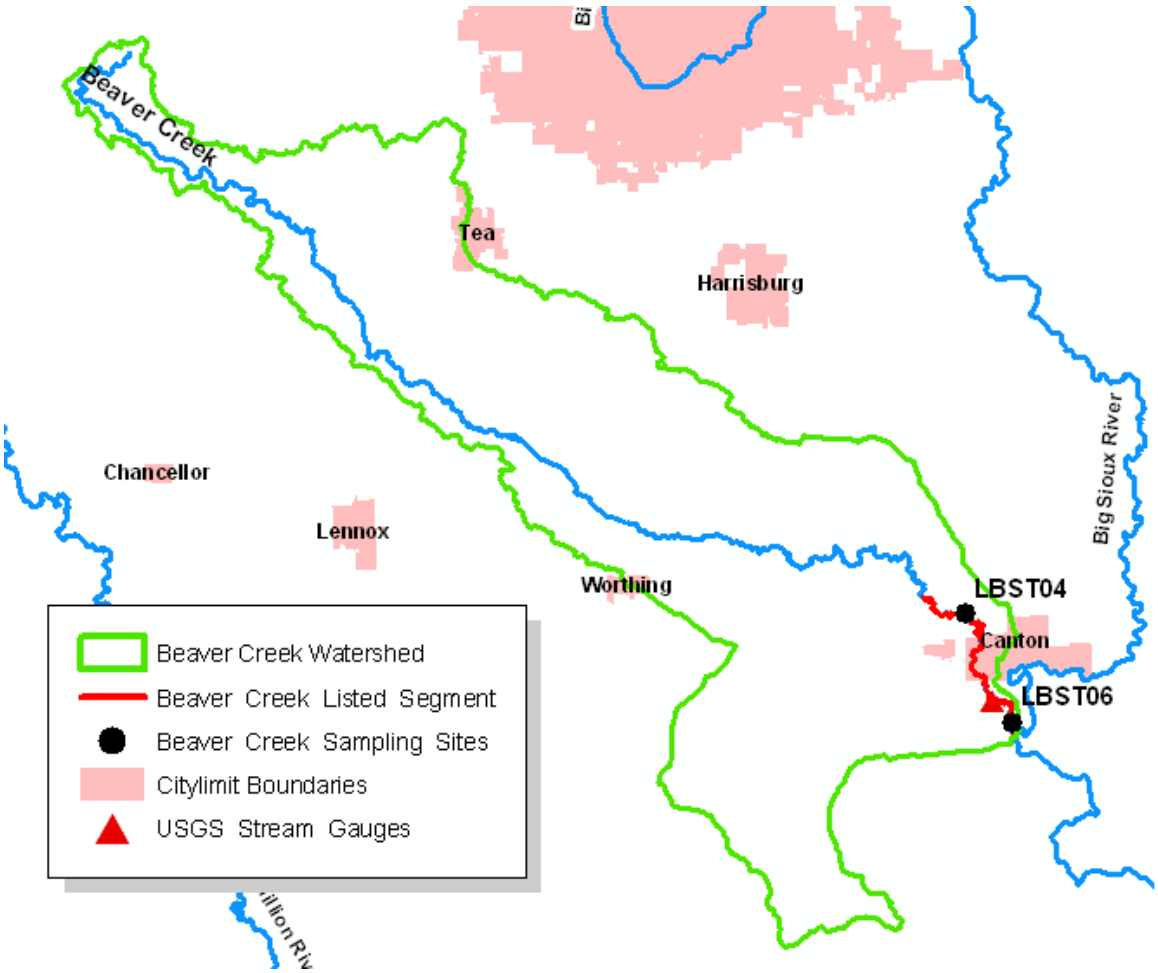

Figure 2. Beaver Creek Sampling Sites, USGS gauging stations, and location of municipalities in relation to the Beaver Creek watershed.

Beaver Creek flows through the municipality of Canton before entering the Big Sioux River. The municipalities of Tea and Worthing lie on the northern and southern boundaries of the Beaver Creek watershed, respectively. None of these municipalities discharge to Beaver Creek.

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.

Chronic standards, including geometric means and 30-day averages, are applied to a calendar month. While not explicitly described within the states water quality standards,

this is the method used in the states 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.

Beaver Creek has been assigned the beneficial uses of: warmwater marginal fish life propagation, irrigation waters, limited contact recreation, and fish and wildlife propagation, recreation, and stock watering. Table 2 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 Beaver Creek is 1000 CFU/100 ml, which is based on the chronic standard for fecal coliform. The fecal coliform criteria for the limited contact recreation beneficial use requires that 1) no sample exceeds 2000 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 1000 CFU/100 ml. These criteria are applicable from May 1 through September 30.

South Dakota has adopted *E. coli* criteria for the protection of the limited contact and immersion recreation uses. However, this segment of Beaver Creek does not require an *E. coli* TMDL because the parameter is not currently listed as a cause of impairment to this stream segment. Because the two indicators are closely related, the fecal coliform bacteria TMDL and associated implementation strategy described in the TMDL document are expected to address both the fecal coliform bacteria and possible future *E. coli* impairments. If a TMDL must be established for *E. coli* in the future, a separate TMDL document will be developed for this parameter.

Table 2. South Dakota water quality standards for Beaver 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/L 30 average March 1 to October 31	Warmwater Marginal Fish Life
	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 February 29	
	Equal to or less than the result from Equation c in Appendix A of Surface Water Quality Standards	mg/L Daily Maximum	
Dissolved Oxygen	≥4.0 Oct-Apr; >5.0 May-Sep	mg/L	Warmwater Marginal Fish Life
Total Suspended Solids	≤150 (mean) ≤263 (single sample)	mg/L	Warmwater Marginal Fish Life
Temperature	≤32	°C	Warmwater Marginal Fish Life
Fecal Coliform Bacteria (May 1- Sept 30)	≤1000 (geometric mean) ≤2000 (single sample)	CFU/100 mL	Limited Contact Recreation
Escherichia coli Bacteria (May 1- Sept 30)	≤630 (geometric mean) ≤1178 (single sample)	CFU/100 mL	Limited Contact Recreation
Alkalinity ($CaCO_3$)	≤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)	≥6.0 to ≤9.0	units	Warmwater Marginal Fish Life
Solids, total dissolved	≤2,500 (mean) ≤4,375 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Total Petroleum Hydrocarbon	≤10	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Oil and Grease	≤10		
Sodium Adsorption Ratio	<10	ratio	Irrigation Waters

3.0 Significant Sources

3.1 Point Sources

There are no point sources in the Beaver Creek watershed. The city of Canton discharges to the Big Sioux River, the city of Worthing discharges to Snake Creek, and the city of Tea discharges to Nine Mile Creek.

3.2 Non-point sources

Non-point sources of fecal coliform in the Beaver Creek watershed are primarily agricultural. Data from the 2010 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 was used to estimate relative source contributions of bacteria loads and is summarized in Table 3. The entire Beaver Creek watershed was assessed rather than just the listed segment watershed because primary sources of bacterial contamination to the listed segment are believed to be located upstream of the listed segment (Section 4.3). Total daily production for the basin is $4.24E^{14}$ CFU.

Table 3. Non-point source contributions in the Beaver Creek watershed.

Species	Number	Animals/acre	FC/Animal/Day	FC/day	FC/acre	Percent
Dairy Cow	427	0.00	4.46E+10	4.21E+12	5.14E+07	0.99%
Beef	36505	0.10	3.90E+10	3.15E+14	3.84E+09	74.15%
Hog	28302	0.08	1.08E+10	6.76E+13	8.25E+08	15.92%
Sheep	3920	0.01	1.96E+10	1.70E+13	2.07E+08	4.00%
Horse	924	0.00	5.15E+10	1.05E+13	1.29E+08	2.48%
Human1	1733	0.00	1.95E+09	7.47E+11	9.13E+06	0.18%
All Wildlife				9.67E+12	1.18E+08	2.28%
Turkey (Wild)2	420	0.00	1.10E+08	1.02E+10	1.25E+05	0.00%
Goose3	190	0.00	7.99E+08	3.36E+10	4.10E+05	0.01%
Deer2	1150	0.00	3.47E+08	8.82E+10	1.08E+06	0.02%
Beaver2	1950	0.01	2.00E+05	8.62E+07	1.05E+03	0.00%
Raccoon2	3200	0.01	5.00E+09	3.54E+12	4.32E+07	0.83%
Coyote/Fox3	2300	0.01	1.75E+09	8.90E+11	1.09E+07	0.21%
Muskrat1	1000	0.00	2.50E+07	5.53E+09	6.75E+04	0.00%
Opossum4	1000	0.00	1.15E+09	2.54E+11	3.11E+06	0.06%
Mink4	1700	0.00	1.15E+09	4.32E+11	5.28E+06	0.10%
Skunk4	2000	0.01	1.15E+09	5.08E+11	6.21E+06	0.12%
Badger4	800	0.00	1.15E+09	2.03E+11	2.48E+06	0.05%
Jackrabbit4	600	0.00	1.15E+09	1.53E+11	1.86E+06	0.04%
Cottontail4	7000	0.02	1.15E+09	1.78E+12	2.17E+07	0.42%
Squirrel4	7000	0.02	1.15E+09	1.78E+12	2.17E+07	0.42%
1 Yaggow et. al. 2001						
2 USEPA 2001						
3 Bacteria Indicator Tool Worksheet						
4 Best Professional Judgment based off of Dogs						
5 FC/Animal/Day averaged based on other species of Wildlife						

3.2.1 Natural Background Sources

Wildlife within the watershed is a natural background source of fecal coliform bacteria. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish, and Parks. Best estimates suggest wildlife account for approximately 2.28% of the fecal coliform bacteria produced in the watershed (Table 3).

3.2.2 Human Sources

The entire watershed has a population of 4,294 people according to the 2000 United States census. Of those 4,294 people, 2561 are located in municipalities and fecal bacteria contributions from these sources go to a wastewater treatment facility. Septic systems are assumed to be the primary human source for the remaining 1,733 people in the watershed. When included as a total load in the table, the remaining population produced fecal coliform bacteria accounting for approximately 0.18% of all fecal coliform bacteria in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no fecal coliform bacteria entering Beaver Creek.

3.2.3 Agricultural Sources

Manure from livestock is a potential source of fecal coliform bacteria to Beaver Creek. Livestock in the basin are predominantly beef cattle. Livestock can contribute fecal coliform directly by defecating while wading in the stream. They may also contribute by defecating while grazing on rangelands or in feeding areas, which is then washed off during precipitation events. Table 4 allocates the sources of bacteria production in the watershed into three primary categories. The summary is based on several assumptions. Feedlots 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.

Table 4. Fecal coliform contributions from feeding areas, grazing areas, and wildlife.

Area	Percentage
Feeding Areas	51.30%
Grazing Areas	46.42%
Wildlife	2.28%

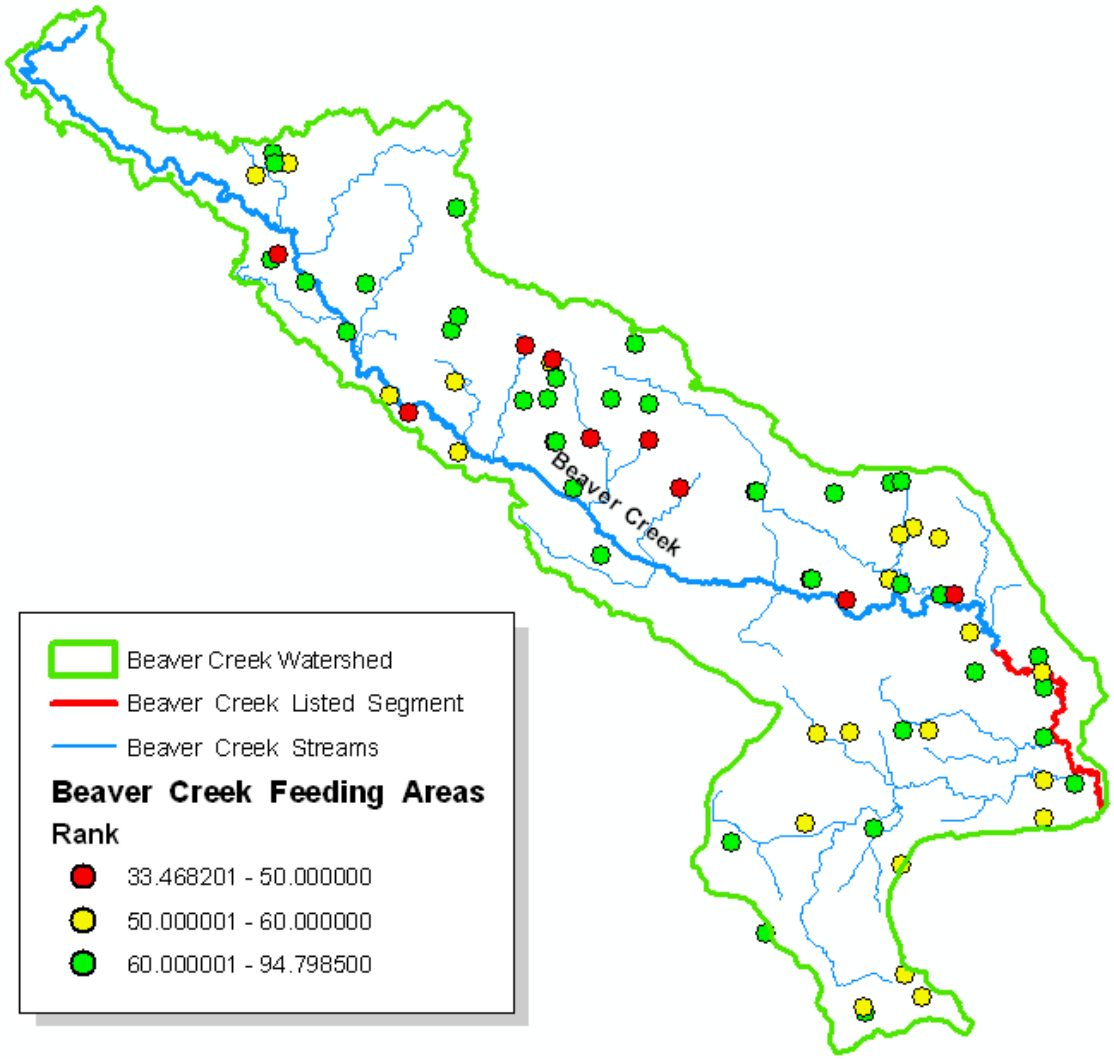

Figure 3. Feeding area locations and rankings in the Beaver Creek watershed.

SDDENR maintains a priority list of feeding areas that is available to implementation coordinators. There are 71 feeding areas in the Beaver Creek watershed (Figure 9). Nine of these 71 feeding areas were considered high priority for future implementation work. These feeding areas are represented by a red symbol. All 9 high priority feeding areas are located upstream of the listed segment of Beaver Creek. Reducing the contributions of these 9 feeding areas will result in the most efficient use of implementation resources to reduce fecal coliform bacteria loadings to the listed segment of Beaver Creek. Reductions from other feeding areas in the watershed will also aid in attaining water quality standards.

4.0 Technical Analysis

4.1 Data Collection Method

Data from sites LBST04 and LBST06 from the Lower Big Sioux River Assessment Project were used to develop the TMDL. Site locations can be viewed in Figure 2. Flow data for Beaver Creek was collected at site LBST06 from 2002 to 2004.

Unless otherwise noted, analysis was completed with modeling programs according to the most recent version of the Water Quality Modeling in South Dakota document (SDDENR, 2009).

4.2 Flow Analysis

Flow data was collected at LBST06 from the spring of 2002 until the fall of 2004. This dataset was used to calculate loadings and develop the TMDL.

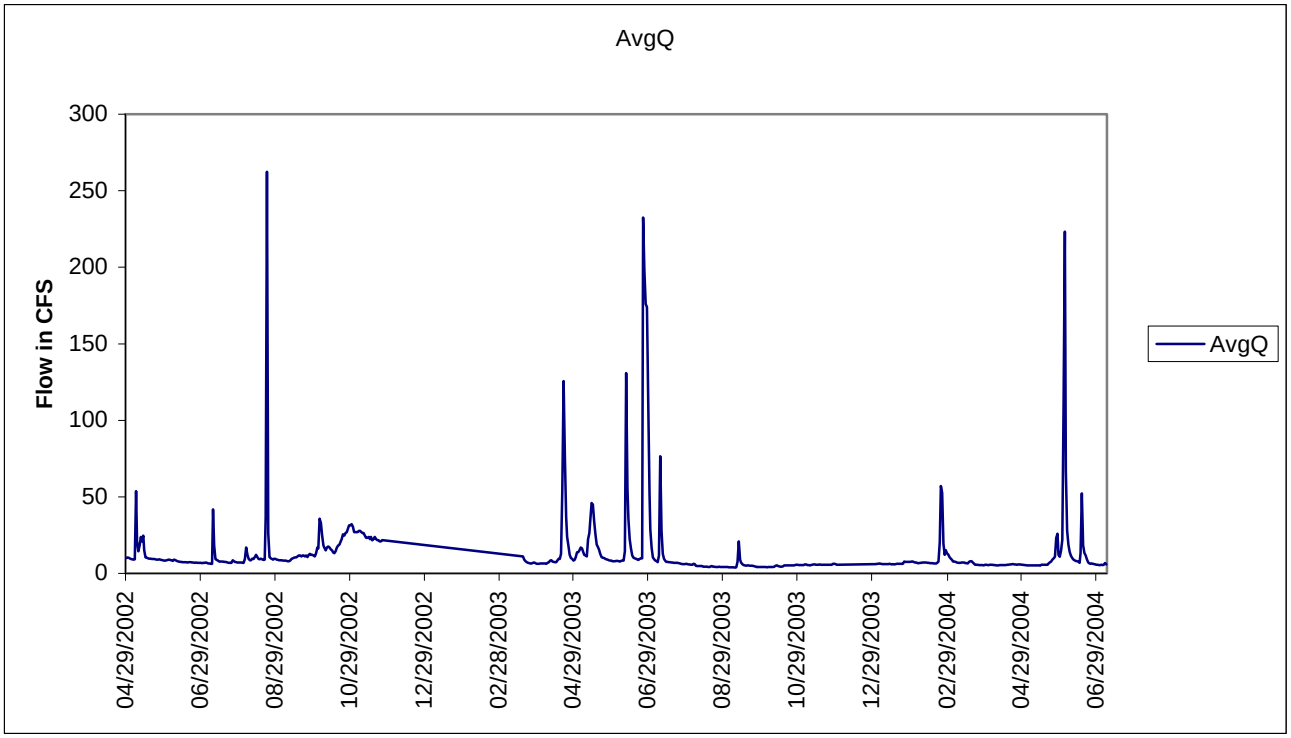

Figure 4. Beaver Creek daily streamflow at LBST06.

4.3 Sample Data

A total of 43 fecal coliform samples were collected at LBST06, of which 32 were collected during the recreation season between May and September. A total of 28 fecal coliform samples were collected at LBST04, of which 20 were collected between May and September. Data from both sites, which combine for a total of 71 samples, was used to develop the TMDL and load duration curve.

Table 5. Fecal coliform sample data for Beaver Creek.

Site	Date	Fecal Colonies/ 100mL	Site	Date	Fecal Colonies/ 100mL	Site	Date	Fecal Colonies/ 100mL
LBST04	05/30/2002	550	LBST04	09/10/2003	**110000**	LBST06	05/21/2003	150
LBST04	06/25/2002	730	LBST04	09/23/2003	320	LBST06	06/11/2003	590
LBST04	07/02/2002	**1100**	LBST04	09/23/2003	320	LBST06	06/19/2003	550
LBST04	07/17/2002	190	LBST04	10/20/2003	730	LBST06	06/25/2003	**17000**
LBST04	07/25/2002	**1700**	LBST06	04/18/2002	10	LBST06	06/25/2003	**9900**
LBST04	08/19/2002	490	LBST06	05/30/2002	450	LBST06	07/09/2003	**9700**
LBST04	09/09/2002	790	LBST06	06/25/2002	520	LBST06	07/10/2003	900
LBST04	09/09/2002	750	LBST06	07/02/2002	280	LBST06	07/22/2003	150
LBST04	09/24/2002	110	LBST06	07/02/2002	280	LBST06	07/29/2003	670
LBST04	03/19/2003	10	LBST06	07/17/2002	120	LBST06	08/18/2003	30
LBST04	03/26/2003	6	LBST06	08/15/2002	260	LBST06	08/20/2003	680
LBST04	04/01/2003	6	LBST06	08/19/2002	200	LBST06	09/02/2003	800
LBST04	04/10/2003	64	LBST06	09/09/2002	90	LBST06	09/10/2003	**13000**
LBST04	04/16/2003	160	LBST06	09/24/2002	150	LBST06	09/11/2003	**16000**
LBST04	04/21/2003	649	LBST06	03/19/2003	20	LBST06	09/23/2003	440
LBST04	04/30/2003	340	LBST06	03/26/2003	2	LBST06	09/24/2003	**4200**
LBST04	05/14/2003	410	LBST06	03/26/2003	2	LBST06	10/20/2003	140
LBST04	05/21/2003	310	LBST06	04/01/2003	2	LBST06	04/04/2004	30
LBST04	06/11/2003	340	LBST06	04/10/2003	26	LBST06	05/03/2004	40
LBST04	06/25/2003	**27000**	LBST06	04/16/2003	400	LBST06	05/11/2004	80
LBST04	07/10/2003	800	LBST06	04/21/2003	860	LBST06	05/24/2004	**3800**
LBST04	07/22/2003	290	LBST06	04/30/2003	380	LBST06	06/03/2004	420
LBST04	07/28/2003	430	LBST06	05/14/2003	320	LBST06	06/14/2004	600
LBST04	09/02/2003	**1500**				LBST06	06/29/2004	130

Of the 28 samples collected at LBST04, 5 exceeded the chronic standard of 1000 CFU/100mL and 2 exceeded the single sample standard of 2000 CFU/100mL. Of the 43 samples collected at LBST06, 7 exceeded both the chronic and daily standards.

Table 6. Beaver Creek fecal coliform data statistics.

Site	Samples	Mean	Median	Minimum	Maximum	Std. Dev.
LBST04	28	5361	420	6	110000	21113
LBST06	43	1962	320	2	17000	4305

The average fecal coliform concentration at LBST04 was 173% higher than the average concentration at LBST06. Extreme concentrations influenced the average value for LBST04. Median values also differed, though not as significantly.

The maximum fecal coliform concentration of 110,000 CFU/100mL was recorded at LBST04 on 9/10/2003. LBST06 was also sampled that day (13,000 CFU/100mL) and on 9/11/2003 (16,000 CFU/100mL). Fecal bacteria may die off, be diluted, or both before reaching LBST06. The second highest concentration was recorded at LBST04 on 6/25/2003 (27,000 CFU/100mL). A replicate sample (two samples taken simultaneously)

was taken at LBST06 that day with concentrations of 9,900 and 17,000 CFU/100mL, indicating that bacteria concentrations diminished between LBST04 and LBST06. The presence of higher concentrations collected at the upstream site during common flow events indicate that the most significant sources of fecal bacteria are located upstream of LBST04. The analysis of livestock feeding areas in the watershed in section 3.2.3 of this report also indicates that the primary sources of bacterial contamination are located upstream of the listed segment.

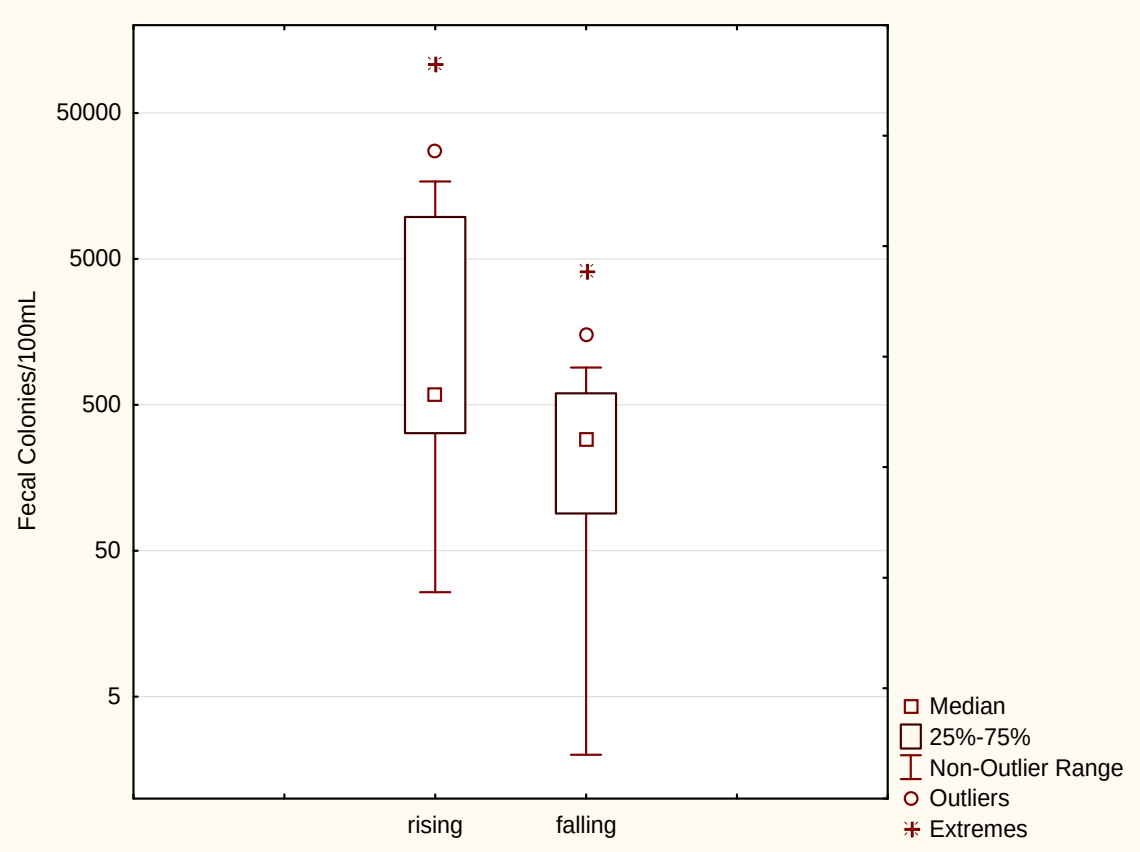

Figure 5. Fecal coliform sample data from rising and falling limbs of the hydrograph.

A comparison of samples collected on the rising limb of the hydrograph and samples collected on the falling limb of the hydrograph (Figure 5) yielded insight into potential sources of fecal coliform bacteria in Beaver Creek. Samples collected on the rising limb had a median of 590 CFU/100mL and an average of 7979 CFU/100mL. Samples collected on the falling limb had a median of 290 CFU/100mL and an average of 443 CFU/100mL.

Higher average and median values on the rising limb indicate that bacteria sources are located in areas some distance from the stream where fecal bacteria are washed from feeding and grazing areas into Beaver Creek during precipitation events. Relatively low concentrations in the falling limb suggest that sources of bacteria are not present in the water itself in great abundance, for example livestock defecating directly into the stream. This analysis suggests that the majority of fecal coliform bacteria are located some

distance from the stream. Implementation resources should be directed toward these areas.

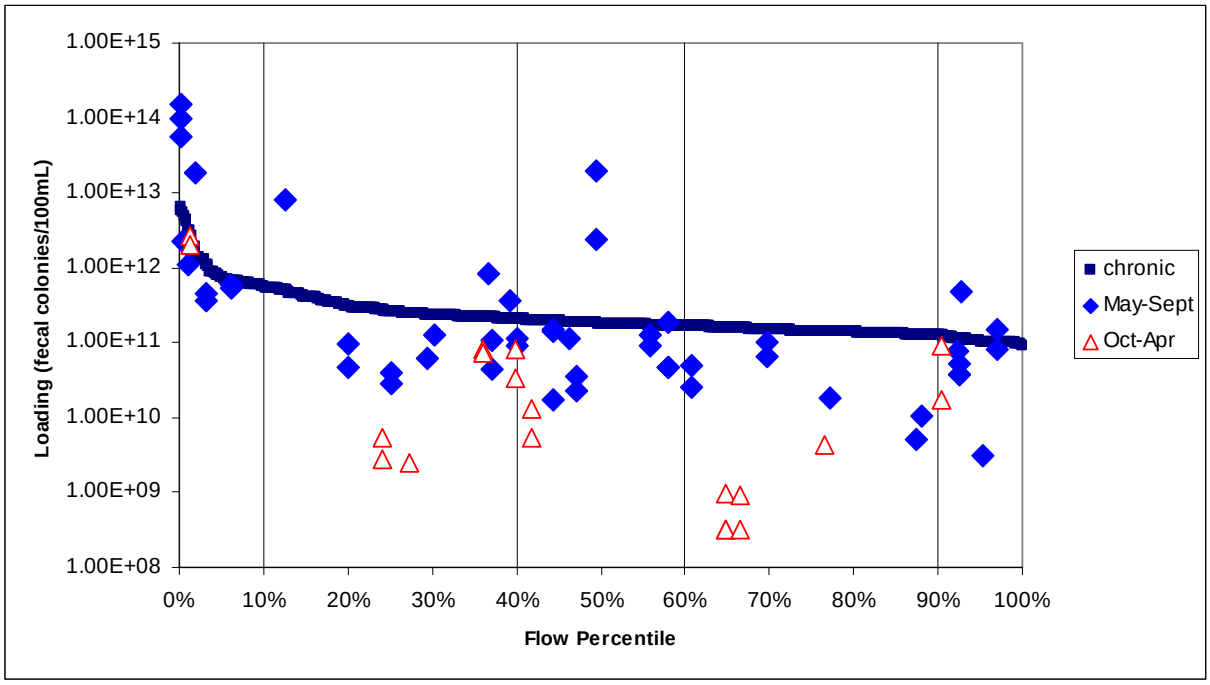

Figure 6. Beaver Creek load duration curve.

The load duration curve in Figure 6 represents the 71 samples collected, with those collected during the May to September growing season as blue diamonds and those collected outside the growing season as hollow red triangles. The line represents the chronic standard for limited contact recreation of 1000 CFU/100mL. TMDL reductions will be based on the chronic standard to ensure the TMDL meets all applicable water quality standards.

Samples exceeded the chronic standard in 4 of 5 flow zones. The greatest number and magnitude of exceedences occurred in the high flow zone (0-10%). Zone 4 (60-90%) did not have any samples that exceeded the chronic standard. The focus of restoration efforts should be placed on contributions in the first three flow zones.

5.0 TMDL and Allocations

5.0.1 Flow Zone 1 (<10% flow frequency exceedence)

Flow zone 1 represents the high flows in Beaver Creek. The lower limit of this zone is the 10th percentile, which corresponds to a flow rate of 23 CFS. Flows in this zone are typically short in duration, only lasting for a few days. Flows in this zone were most commonly the product of spring snowmelt events but may be generated by large rain events.

Table 7 depicts the components of the TMDL for this flow zone. Data in this zone will be used as the overall TMDL load for the segment. The current load is based on the 95th percentile flow in this flow zone and the 95th percentile fecal coliform concentration in this flow zone. The current load suggests a 94% reduction in loading is necessary to attain the standard.

The high flow zone is the most difficult zone in which to attain reductions. Elevated concentrations may be the result of upstream influences as well as contributions from numerous sources dispersed throughout the watershed. Animal feeding areas are a probable source of contamination within this flow zone, but manure spread on fields and livestock in pastures may also contribute. As a result of using the chronic standard to establish the TMDL target, reductions of less than 94% may fully attain the water quality standard. Reductions from sources contributing to other flow zones should help reduce concentrations within this flow zone.

Table 7. Flow zone 1 TMDL and allocations.

TMDL Component	High Flows (expressed as CFU/Day)
	>23 CFS
LA	5.26E+12
WLA	0.00E+00
MOS	2.00E+11
TMDL @ 1000 CFU/100mL	5.46E+12
Current Load**	9.29E+13
Load Reduction	94.12%
**Current Load is based on the 95th sample and flow in each flow zone.	

5.0.2 Flow Zone 2 (10% to 40% flow frequency exceedence)

Flow zone 2 consists of flows that occur under moist conditions. For Beaver Creek, zone 2 consists of the flows ranging from 8.5 to 23 CFS. These flows are associated with runoff events. Water velocities during these conditions are significantly slower than during high flows, reducing the distance fecal coliform bacteria may travel before dying off.

Table 8 depicts the components of the TMDL for this flow zone. The current load is based on the 95th percentile flow in this flow zone and the 95th percentile fecal coliform concentration in this flow zone. The current load suggests a 74% reduction in loadings will be necessary to attain the standard in this flow zone.

Potential sources of impairment in this flow zone include feeding areas, pastures, and crop land with manure spread on it. Due to the reduced transport velocities, impairments within this zone are less likely to be the result of loadings from upstream segments.

Targeting impairments to this flow zone may also help provide reductions for the high flow zone. Addressing feeding areas should be an implementation priority to attain full support of the water quality standards for this flow zone.

Table 8. Flow zone 2 TMDL and allocations.

TMDL Component	Moist Flows (expressed as CFU/Day)
	8.5-23 CFS
LA	4.77E+11
WLA*	0.00E+00
MOS	5.31E+10
TMDL @ 1000 CFU/100mL	5.30E+11
Current Load**	2.01E+12
Load Reduction	73.68%
**Current Load is based on the 95th sample and flow in each flow zone.	

5.0.3 Flow Zone 3 (40% to 60% flow frequency exceedence)

Flow zone 3 consists of mid-range flows. For Beaver Creek, these flows range from 6.8 to 8.5 CFS. These flows may be associated with small runoff events or occur at the trailing end of a runoff event. Table 9 depicts the components of the TMDL for this flow zone. The current load is based on the 95th percentile flow in this flow zone and the 95th percentile fecal coliform concentration in this flow zone. A 92% reduction is necessary to attain the standard in this flow zone.

Potential sources of bacteria in this flow zone include areas within a short distance from the stream corridor or in the stream itself, such as cattle defecating directly into the stream. Feeding areas and pastures in close proximity to the stream may also contribute to loadings in this flow zone during small runoff events.

Targeting impairments in this zone can be accomplished by addressing potential areas contributing to bacterial contamination within a short distance of the stream corridor.

Table 9. Flow zone 3 TMDL and allocations.

TMDL Component	Mid-range Flows (expressed as CFU/Day)
	6.8-8.5 CFS
LA	1.90E+11
WLA*	0.00E+00
MOS	1.52E+10
TMDL @ 1000 CFU/100mL	2.05E+11
Current Load**	2.66E+12
Load Reduction	92.31%
**Current Load is based on the 95th sample and flow in each flow zone.	

5.0.4 Flow Zone 4 (60% to 90% flow frequency exceedence)

Flow zone 4 consists of flows that occur during dry conditions. For Beaver Creek, these flows range from 5.1 to 6.8 CFS. These flows are indicative of drought conditions. Table 10 depicts the components of the TMDL for this flow zone. The current load is

based on the 95th percentile flow in this flow zone and the 95th percentile fecal coliform concentration in this flow zone. No reductions are necessary in this flow zone because water quality standards were not exceeded by any samples.

Table 10. Flow zone 4 TMDL and allocations.

TMDL Component	Dry Flows (expressed as CFU/Day)
	5.1-6.8 CFS
LA	1.48E+11
WLA*	0.00E+00
MOS	1.67E+10
TMDL @ 1000 CFU/100mL	1.65E+11
Current Load**	7.10E+10
Load Reduction	0.00%
**Current Load is based on the 95th sample and flow in each flow zone.	

5.0.5 Flow Zone 5 (90% to 100% flow frequency exceedence)

Flow zone 5 consists of the lowest flows recorded on the stream. They are representative of severe drought conditions both locally and regionally. Flows in this zone range from the lowest measured of less than 3.7 to 5.1 CFS.

Table 11 depicts the components of the TMDL for this flow zone. The current load is based on the 95th percentile flow in this flow zone and the 95th percentile fecal coliform concentration in this flow zone. A 33% reduction is necessary to attain the standard in this flow zone.

Impairments in this flow zone are in direct contact with the waterway and are located in close proximity. Low flows also have low velocities, which allows for bacterial die off rates to take effect without the load traveling a significant distance. Out of 10 samples collected in this flow zone, 1 exceeded the daily standard and 1 exceeded the chronic standard, suggesting the existence of bacterial sources with direct access to the river are contributing to the loadings in this flow zone. The most likely source of bacteria in this flow zone is livestock defecating directly into the stream. Implementation efforts for this flow zone should focus on areas where livestock have direct access to Beaver Creek.

Table 11. Flow zone 5 TMDL and allocations.

TMDL Component	Dry Flows (expressed as CFU/Day)
	5.1-6.8 CFS
LA	1.12E+11
WLA*	0.00E+00
MOS	1.38E+10
TMDL @ 1000 CFU/100mL	1.25E+11
Current Load**	1.88E+11
Load Reduction	33.33%
**Current Load is based on the 95th sample and flow in each flow zone.	

5.1 Load Allocations (LAs)

Approximately 92% of land use in the watershed is agricultural. All of the TMDL load has been allocated to these non-point source loads. A 94% reduction in fecal coliform bacteria from anthropogenic sources (livestock) is required in the high flow zone to fully attain the current water quality standards. A 74% reduction in fecal coliform is required in the moist conditions flow zone to fully attain current water quality standards. A 92% reduction is required in the mid range flow zone, and a 33% reduction is required in the dry flow zone. No reduction is required in the low flow zone because flows in this zone are meeting water quality standards. Reducing the 95^{th} percentile samples in each impaired flow zone below the chronic standards provides assurance that both acute and chronic standards will be met.

5.2 Waste Load Allocations (WLAs)

No point sources are located in the Beaver Creek watershed, therefore the WLA for Beaver Creek was assigned a value of zero.

6.0 Margin of Safety (MOS) and Seasonality

6.1 Margin of Safety

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.

6.2 Seasonality

Seasonality is important when considering bacteria contamination. Sample data was collected between the months of March and October. Peak use is typically late in the season after temperatures increase. Monthly evaluations of the data showed higher concentrations in the months of June and September (Figure 7).

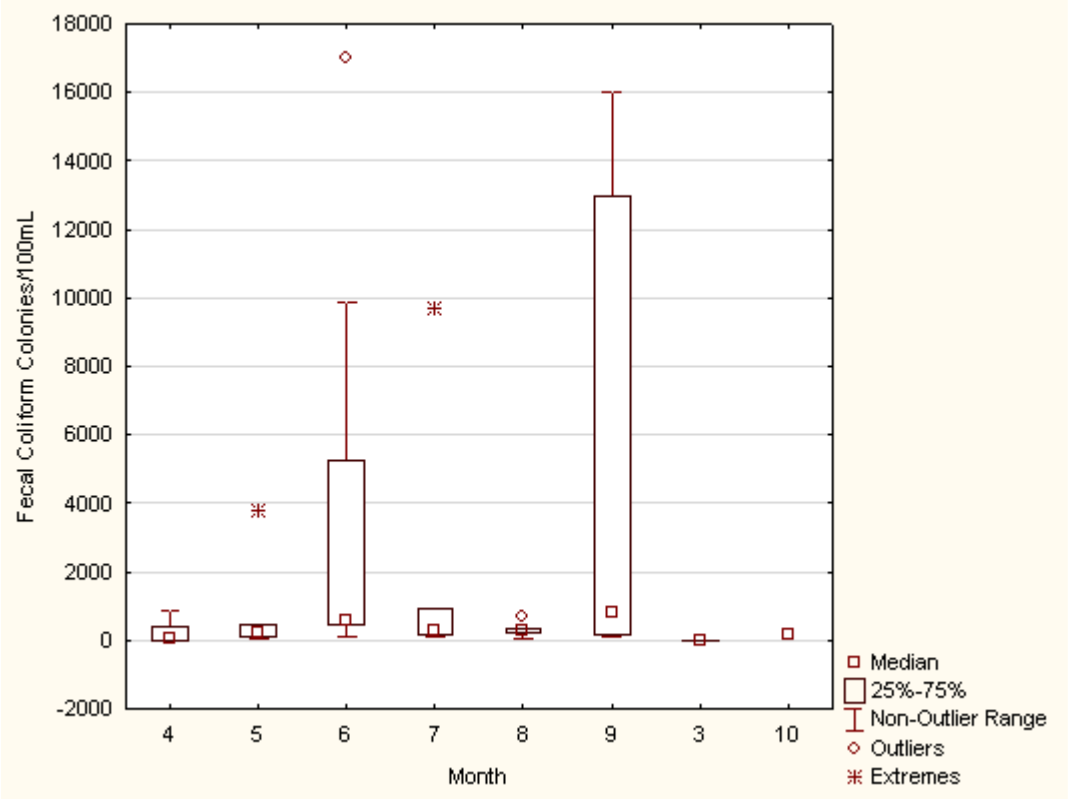

Figure 7. Beaver Creek fecal coliform concentrations by month.

7.0 Public Participation

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

1. Various public meetings were held during the assessment phase.
2. A webpage was developed and used during the course of the assessment.
3. Presentations to local groups on the findings of the assessment.
4. 30-day public notice (PN) period for public review and comment were printed in the Sioux Falls Argus Leader, and the Canton/Sioux Valley News.

The findings from these public meetings, the webpage, newspapers, and 30-day PN comments have been taken into consideration in development of the Big Sioux River TMDL.

8.0 Monitoring Strategy

The Department may adjust the load and/or waste 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 and waste 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 or WLA will not result in a change to the loading capacity; the adjusted TMDL, including its WLAs and LAs, will be set at a level necessary to implement the applicable water quality standards; and any adjusted WLA will be supported by a demonstration that load allocations are practicable. The Department will notify EPA of any adjustments to this TMDL within 30 days of their adoption.

Monitoring will continue in the Beaver Creek watershed. Beaver Creek will be monitored as part of the Lower Big Sioux River Implementation Project. The results from this monitoring cycle can be used to supplement the modeling to judge project effectiveness or TMDL adjustments. The Lower Big Sioux River Implementation Project is currently assessing project effectiveness with models such as AnnAGNPS, RUSLE2, and STEPL.

9.0 Restoration Strategy

The Lower Big Sioux River Implementation Project is currently underway in the Beaver Creek watershed. The primary focus of restoration efforts should be directed at flows in the 10 to 60th percentile range (flow zones 1, 2, and 3). Elevated bacteria concentrations in these flow zones indicate upland sources of fecal coliform bacteria. Because grazing areas only make up a small portion of the watershed (16%), efforts should concentrate primarily on high priority livestock feeding areas that contribute bacteria during runoff events. Reductions in the highest flow zone (flow zone 1) will be particularly difficult to achieve, but restoration efforts for this flow zone will aid in attaining the TMDL goals for other flow zones. A secondary focus of restoration efforts may be directed at the low flow zone, where restricting livestock access to the stream will likely achieve the TMDL goal for flow zone 5. Restoration efforts should focus on potential bacteria sources upstream of LBST04, as this area has been identified as the most significant source of fecal coliform bacteria.

10.0 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.

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USDA (United States Department of Agriculture). 1976. *Soil Survey of Lincoln County*, South Dakota.

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Yagow, G., Dillaha, T., Mostaghimi, S., Brannan, K., Heatwole, C., and Wolfe, M.L. 2001. *TMDL modeling of fecal coliform bacteria with* HSPF. ASAE meeting paper No.01-2006. St. Joseph, Mich.

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Fecal Coliform Bacteria Total Maximum Daily Load Evaluation of Beaver Creek, Lincoln County, South Dakota**
Submitted by:	**Cheryl Saunders, SD DENR**
Date Received:	**May 17, 2011**
Review Date:	**June 20, 2011**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Public Notice Draft**
Notes:	

Reviewers Final Recommendation(s) to EPA Administrator (used for final 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

SUMMARY: The Beaver Creek fecal coliform TMDL was submitted to EPA for review via an email from Cheryl Saunders, SD DENR on May 17, 2011. The email included the draft TMDL document and a request to review and comment on the TMDL.

COMMENTS: None

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: Beaver Creek is a stream located in Lincoln County, South Dakota and is part of the larger Big Sioux River watershed in the Lower Big Sioux sub-basin (HUC 10170203). The listed river segment contains a small portion of the watershed drainage area of approximately 79,900 acres in south eastern South Dakota, and includes approximately 7.8 miles of the stream from S9, T98N, R49W to its mouth (i.e., to the confluence with Big Sioux River; SD-BS-R-BEAVER_01). It is listed as a high priority for TMDL development.

The designated uses for Beaver Creek include warmwater marginal fish life propagation waters, limited-contract recreation waters, irrigation, fish and wildlife propagation, recreation, and stock watering. The segment was listed on the 2010 303(d) list for fecal coliform which is impairing the recreational use.

COMMENTS: The portion of Beaver Creek that is on the SD 303(d) list as impaired only includes approximately 7.8 miles from the Big Sioux River to S9, T98N, R49W. The TMDL document sections (e.g., 1 and 3) should be revised to focus on the impaired segment description and sources rather than the entire watershed unless the entire Creek is known or suspected to be impaired.

DENR Response: *Information in the TMDL Summary table has been corrected to show that the listed segment is the 7.8 mile reach between S9, T98N, R49W and the confluence with the Big Sioux River. All relevant maps were changed to show the extent of the listed segment. The Beaver Creek watershed boundary and related information was also altered to include a tributary that was previously not included.*

Because sources of impairment are suspected to be located higher in the watershed than the upstream boundary of the listed segment, information for the entire watershed was included in TMDL document sections 1 and 3. Section 3.2.3 was changed to include a map with the locations of feeding areas of primary concern to more adequately show the primary sources of impairment are located outside the watershed of the listed segment.

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: The Beaver Creek segment addressed by this TMDL is impaired based on fecal coliform concentrations for limited contact recreation. South Dakota has applicable numeric standards for fecal coliform that may be applied to this stream segment. The fecal coliform numeric standards being implemented in this TMDL are: a single sample maximum value of ≤ 2000 cfu/100 mL, and a 30-day geometric mean of ≤ 1000 cfu/ 100 mL. Discussion of additional applicable water quality standards for Beaver Creek can be found on pages 8 - 10 of the TMDL document.

COMMENTS: The Beaver Creek fecal coliform TMDL needs to include some discussion of SD's E. coli WQS. Similar SD TMDLs have included language such as: "South Dakota has adopted Escherichia coli criteria for the protection of the limited contact and immersion recreation uses. However, this segment of Beaver Creek does not require an E. coli TMDL because the parameter is not currently listed as a cause of impairment to this stream segment. Because the two indicators are closely related, the fecal coliform bacteria TMDL and associated implementation strategy described in the TMDL document are expected to address both the fecal coliform bacteria and possible future E. coli impairments. If a TMDL must be established for E. coli in the future, a separate TMDL document will be developed for this parameter."

We suggest that similar language be added to this TMDL.

***DENR Response**: Language similar to that described above has been included in the Water Quality Standards section.*

2. 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, embeddeness, 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: The water quality target for this TMDL is based on the numeric water quality standards for fecal coliform to achieve the limited contact recreation beneficial use for Beaver Creek. The target for the Beaver Creek segment included in the TMDL document is the fecal coliform standard expressed as the 30-day geometric mean of 1000 CFU/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standards.

COMMENTS: None.

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: The TMDL document identifies the land use in the watershed as predominately agricultural consisting of cropland (76%), grassland / rangeland (17%), herbaceous (4%) and water/wetlands, developed or forest land (3%).

There are no point sources that discharge to the impaired segment of Beaver Creek. The City of Canton discharges to the Big Sioux River, the City of Worthing discharges to Snake Creek, and the City of Tea discharges to Nine Mile Creek.

Nonpoint sources of fecal coliform bacteria in Beaver Creek come primarily from agricultural sources. Data from the 2010 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 was used to estimate relative source contributions of bacteria loads as summarized in Table 3 of the TMDL document.

Livestock in the basin are predominantly beef cattle. Livestock can contribute fecal coliform bacteria directly to the stream by defecating while wading in the stream. They may also contribute by defecating while grazing on rangelands, which then get washed off during precipitation events. Table 4, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. 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.

Table 4. Fecal coliform contributions from feeding areas, grazing areas, and wildlife.

Area	Percentage
Feeding Areas	51.30%
Grazing Areas	46.42%
Wildlife	2.28%

There are 58 feeding areas in the Beaver Creek watershed. Nine of these 58 feeding areas were considered high priority for future implementation work. Reducing the contributions of these 9 feeding areas will result in the most efficient use of implementation resources to reduce fecal coliform bacteria loadings to Beaver Creek. Reductions from other feeding areas in the watershed will also aid in attaining water quality standards.

The entire watershed has a population of 4,294 people according to the 2000 United States census. Of those 4,294 people, 2561 are located in municipalities and fecal bacteria contributions from these sources go to a wastewater treatment facility. Septic systems are assumed to be the primary human source for the remaining 1,733 people in the watershed. When included as a total load in the table, the remaining population produced fecal coliform bacteria accounting for approximately 0.18% of all fecal coliform bacteria in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no fecal coliform bacteria entering Beaver Creek.

COMMENTS: None.

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: The technical analysis should describe the cause and effect relationship between the identified pollutant sources, the numeric targets, and achievement of water quality standards. It should also include a description of the analytical processes used, results from water quality modeling, assumptions and other pertinent information. The technical analysis for the Beaver Creek TMDL describes how the fecal coliform loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

Data for Beaver Creek was collected during the lower Big Sioux River watershed assessment from two sampling points (LBST04, LBST06 – see Figure 2 of the TMDL document). Flow data for the Beaver Creek was collected at site LBST06 for two years from 2002 until 2004.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. The LDC was divided into 5 distinct flow regimes – high flow ($\geq$ 23 cfs), moist flow (between 23 cfs and 8.5 cfs), midrange flow (between 8.5 cfs and 6.8 cfs), dry flow (between 6.8 cfs and 5.1 cfs), and low flow (< 5.1 cfs). The result is a flow-variable TMDL target across the flow regime shown in Figure 5 of the TMDL document. The LDC is a dynamic expression of the allowable load for any given daily flow. Loading capacities were derived from this approach at the 95th percentile of the observed fecal coliform bacteria load for each flow regime: high flow = 5.46E+12 CFU/day; moist flow = 5.30E+11 CFU/day; midrange flow = 2.05E+11 CFU/day; dry flow = 1.65E+11 CFU/day; and low flow = 1.25E+11 CFU/day.

COMMENTS: None.

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: The Beaver Creek TMDL data description and summary are included mostly in the Technical Analysis section of the document. Data for Beaver Creek was collected during the lower Big Sioux River watershed assessment from two sampling points identified as site LBST04 and LBST06. A total of 71 samples were available for analysis from the TMDL segment. The TMDL is based on seasonal data collected from May through September in each year, limiting the data set to 52 samples. The full data set is included in Table 5 of the TMDL document. Flow data for the Beaver Creek was collected at site LBST06 for two years from 2002 until 2004.

COMMENTS: None.

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 that discharge to the impaired segment of Beaver Creek. The City of Canton discharges to the Big Sioux River, the City of Worthing discharges to Snake Creek, and the City of Tea discharges to Nine Mile Creek. Therefore, the WLA for this TMDL is zero.

COMMENTS: None.

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: The Watershed Characteristics section of the TMDL explains that the landuse in the watershed is predominately agricultural consisting of cropland (76%), grassland / rangeland (17%), herbaceous (4%) and water/wetlands, developed or forest land (3%). Livestock in the basin are predominantly beef cattle. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. Tables 7 - 11 include the load allocations at each of the flow regimes – 5.26E+12 CFU/day at high flows; 4.77E+11 CFU/day during moist flows; 1.90E+11 CFU/day at midrange flows; 1.48E+11 CFU/day during dry conditions; and 1.12E+11 CFU/day at low flows.

COMMENTS: None.

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: The Beaver Creek TMDL includes an explicit MOS derived by calculating the difference between the loading capacity at the mid-point of each of the five flow zones and the loading capacity at the minimum flow in each zone. The explicit MOS values are included in Tables 7 - 11 of the TMDL.

COMMENTS: None.

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: By using the load duration curve approach to develop the TMDL allocations, seasonal variability in fecal coliform loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months.

COMMENTS: None.

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: The Public Participation section of the TMDL document describes the public participation process that has occurred during the development of the TMDL. In particular, the State has encouraged participation through public meetings in the watershed, and a website was developed and maintained throughout the project. The TMDL was available for a 30-day public notice period prior to finalization.

COMMENTS: None.

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: The Monitoring Strategy section makes no mention of future monitoring efforts.

Post-implementation monitoring will be necessary to assure the TMDL has been reached and maintenance of the beneficial use occurs.

COMMENTS: We assume that monitoring will continue in this drainage. We recommend adding a brief description of future monitoring efforts in the TMDL document.

***DENR Response**: Language has been included describing monitoring activities in the Beaver Creek watershed.*

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

SUMMARY: The Restoration Strategy section of the TMDL document mentions the flow zones that should be the focus of future restoration efforts. Since there are no significant point sources in the Beaver Creek watershed there is no need to include a discussion of reasonable assurance in this TMDL document.

COMMENTS: The Restoration Strategy section should briefly describe those restoration efforts that have been initiated or planned for the impaired segment of Beaver Creek – perhaps as part of a larger lower Big Sioux River bacteria restoration project.

DENR Response*: Language has been included mentioning the Lower Big Sioux Implementation Project, which is currently underway.*

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 Beaver Creek fecal coliform TMDL includes daily loads expressed as cfu/day. The daily TMDL loads are included in TMDL and Allocations section of the TMDL document.

COMMENTS: None.

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

Ref: 8EPR-EP

AUG 10 2011

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

Re: TMDL Approvals
Beaver Creek, Fecal Coliform;
SD-BS-R-BEAVER_01

Dear Mr. Pirner:

We have completed our review of the total maximum daily loads (TMDLs) as submitted by your office for the waterbodies 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(s) referenced above as developed for the water quality limited waterbodies as described in Section 303(d)(1). Based on our review, we feel the separate elements of the TMDL(s) listed in the enclosed table adequately address the pollutants of concern as given in the table, taking into consideration seasonal variation and a margin of safety.

Thank you for submitting these TMDLs for our review and approval. If you have any questions, the most knowledgeable person on my staff is Vern Berry and he may be reached at 303-312-6234.

Sincerely,

Carol L. Campbell

Carol L. Campbell
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Enclosures

ENCLOSURE 1: APPROVED TMDLs

Fecal Coliform Bacteria Total Maximum Daily Load Evaluation of Beaver Creek, Lincoln County, South Dakota (SD DENR, May 2011)

Submitted: 7/11/2011

1 Pollutant TMDLs completed.

1 Causes addressed from the 2010 303(d) list.

0 Determinations that no pollutant TMDL needed.

Segment: Beaver Creek

303(d) ID: SD-BS-BEAVER_01

Parameter/Pollutant (303(d) list cause): FECAL COLIFORM - 259

Water Quality Targets: <= 1000 cfu/100mL

Allocation*	Value	Units	Permits
WLA	0	CFU/DAY	
MOS	1.52E+10	CFU/DAY	
LA	1.90E+11	CFU/DAY	
TMDL	2.05E+11	CFU/DAY	

Notes: The loads shown represent the loads during the midrange flow regime as defined by the load duration curve for Beaver Creek (see Figure 6 of the TMDL). The midrange flows are when significant differences occur between the existing loads and the target loads, and represent the flow regime that is most likely to be targeted for BMP implementation.

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

ENCLOSURE 2

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Fecal Coliform Bacteria Total Maximum Daily Load Evaluation of Beaver Creek, Lincoln County, South Dakota**
Submitted by:	**Cheryl Saunders, SD DENR**
Date Received:	**July 11, 2011**
Review Date:	**August 3, 2011**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Final**
Notes:	

Reviewers Final Recommendation(s) to EPA Administrator (used for final 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

SUMMARY: The Beaver Creek fecal coliform TMDL was submitted to EPA for review and approval via an email from Cheryl Saunders, SD DENR on July 11, 2011. The email included the final TMDL document and a letter requesting approval of the TMDL.

COMMENTS: None.

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: Beaver Creek is a stream located in Lincoln County, South Dakota and is part of the larger Big Sioux River watershed in the Lower Big Sioux sub-basin (HUC 10170203). The listed stream segment drains approximately 25,419 acres, and is a small portion of the larger watershed drainage area of approximately 81,863 acres in south eastern South Dakota. The listed stream segment includes approximately 7.8 miles of the stream from S9, T98N, R49W to its mouth (i.e., to the confluence with the Big Sioux River; SD-BS-R-BEAVER_01). It is listed as a high priority for TMDL development.

The designated uses for Beaver Creek include warmwater marginal fish life propagation waters, limited-contract recreation waters, irrigation, fish and wildlife propagation, recreation, and stock watering. The segment was listed on the 2010 303(d) list for fecal coliform which is impairing the recreational use.

COMMENTS: None.

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: The Beaver Creek segment addressed by this TMDL is impaired based on fecal coliform concentrations for limited contact recreation. South Dakota has applicable numeric standards for fecal coliform that may be applied to this stream segment. The fecal coliform numeric standards being implemented in this TMDL are: a single sample maximum value of $\leq$ 2000 cfu/100 mL, and a 30-day geometric mean of $\leq$ 1000 cfu/100 mL. Discussion of additional applicable water quality standards for Beaver Creek can be found on pages 8 - 10 of the TMDL document.

COMMENTS: None.

2. 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, embeddeness, 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: The water quality target for this TMDL is based on the numeric water quality standards for fecal coliform which were established to protect the limited contact recreation beneficial use for Beaver Creek. The target for the Beaver Creek segment included in the TMDL document is the fecal coliform

standard expressed as the 30-day geometric mean of 1000 cfu/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standards.

COMMENTS: None.

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: The TMDL document identifies the land use in the watershed as predominately agricultural consisting of cropland (76%), grassland / rangeland (17%), herbaceous (4%) and water/wetlands, developed or forest land (3%).

There are no point sources that discharge to the impaired segment of Beaver Creek. The City of Canton discharges to the Big Sioux River, the City of Worthing discharges to Snake Creek, and the City of Tea discharges to Nine Mile Creek.

Nonpoint sources of fecal coliform bacteria in Beaver Creek come primarily from agricultural sources. Data from the 2010 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 was used to estimate relative source contributions of bacteria loads as summarized in Table 3 of the TMDL document.

Livestock in the basin are predominantly beef cattle. Livestock can contribute fecal coliform bacteria directly to the stream by defecating while wading in the stream. They may also contribute by defecating while grazing on rangelands, which then get washed off during precipitation events. Table 4, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. 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.

Table 4. Fecal coliform contributions from feeding areas, grazing areas, and wildlife.

Area	Percentage
Feeding Areas	51.30%
Grazing Areas	46.42%
Wildlife	2.28%

There are 58 feeding areas in the Beaver Creek watershed. Nine of these 58 feeding areas were considered high priority for future implementation work. Reducing the contributions of these 9 feeding areas will result in the most efficient use of implementation resources to reduce fecal coliform bacteria loadings to Beaver Creek. Reductions from other feeding areas in the watershed will also aid in attaining water quality standards.

The entire watershed has a population of 4,294 people according to the 2000 United States census. Of those 4,294 people, 2561 are located in municipalities and fecal bacteria contributions from this population are connected to a wastewater treatment facility. Septic systems are assumed to be the primary human source for the remaining 1,733 people in the watershed. When included as a total load, the remaining population produced fecal coliform bacteria accounting for approximately 0.18 percent of all fecal coliform bacteria in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no fecal coliform bacteria entering Beaver Creek.

COMMENTS: None.

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: The technical analysis should describe the cause and effect relationship between the identified pollutant sources, the numeric targets, and achievement of water quality standards. It should also include a description of the analytical processes used, results from water quality modeling, assumptions and other pertinent information. The technical analysis for the Beaver Creek TMDL describes how the fecal coliform loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

Data for Beaver Creek was collected during the lower Big Sioux River watershed assessment from two sampling points (LBST04, LBST06 – see Figure 2 of the TMDL document). Flow data for the Beaver Creek was collected at site LBST06 for two years from 2002 until 2004.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. The LDC was divided into 5 distinct flow regimes – high flow (≥ 23 cfs), moist flow (between 23 cfs and 8.5 cfs), midrange flow (between 8.5 cfs and 6.8 cfs), dry flow (between 6.8 cfs and 5.1 cfs), and low flow (< 5.1 cfs). The result is a flow-variable TMDL target across the flow regime shown in Figure 5 of the TMDL document. The LDC is a dynamic expression of the allowable load for any given daily flow. Loading capacities were derived from this approach at the 95th percentile of the observed fecal coliform bacteria load for each flow regime: high flow = 5.46E+12 CFU/day; moist flow = 5.30E+11 CFU/day; midrange flow = 2.05E+11 CFU/day; dry flow = 1.65E+11 CFU/day; and low flow = 1.25E+11 CFU/day.

COMMENTS: None.

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: The Beaver Creek TMDL data description and summary are included mostly in the Technical Analysis section of the document. Data for Beaver Creek was collected during the lower Big Sioux River watershed assessment from two sampling points identified as site LBST04 and LBST06. A total of 71 samples were available for analysis from the TMDL segment. The TMDL is based on seasonal data collected from May through September in each year, limiting the data set to 52 samples. The full data set is included in Table 5 of the TMDL document. Flow data for the Beaver Creek was collected at site LBST06 for two years from 2002 until 2004.

COMMENTS: None.

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 that discharge to the impaired segment of Beaver Creek. The City of Canton discharges to the Big Sioux River, the City of Worthing discharges to Snake Creek, and the City of Tea discharges to Nine Mile Creek. Therefore, the WLA for this TMDL is zero.

COMMENTS: None.

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: The Watershed Characteristics section of the TMDL explains that the landuse in the watershed is predominately agricultural consisting of cropland (76%), grassland / rangeland (17%), herbaceous (4%) and water/wetlands, developed or forest land (3%). Livestock in the basin are predominantly beef cattle. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. Tables 7 - 11 include the load allocations at each of the flow regimes – 5.26E+12 cfu/day at high flows; 4.77E+11 cfu/day during moist flows; 1.90E+11 cfu/day at midrange flows; 1.48E+11 cfu/day during dry conditions; and 1.12E+11 cfu/day at low flows.

COMMENTS: None.

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: The Beaver Creek TMDL includes an explicit MOS derived by calculating the difference between the loading capacity at the mid-point of each of the five flow zones and the loading capacity at the minimum flow in each zone. The explicit MOS values are included in Tables 7 - 11 of the TMDL.

COMMENTS: None.

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: By using the load duration curve approach to develop the TMDL allocations, seasonal variability in fecal coliform loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months.

COMMENTS: None.

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: The Public Participation section of the TMDL document describes the public participation process that has occurred during the development of the TMDL. In particular, the State has encouraged participation through public meetings in the watershed, and a website was developed and maintained throughout the project. The TMDL was available for a 30-day public notice period prior to finalization.

COMMENTS: None.

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: The Monitoring Strategy section mentions that monitoring will continue in the Beaver Creek watershed. Beaver Creek will be monitored as part of the Lower Big Sioux River implementation project. The results from this monitoring cycle will be used to supplement the modeling to judge project effectiveness or to make adjustments to the TMDL. The Lower Big Sioux River implementation project is currently assessing project effectiveness with models such as AnnAGNPS, RUSLE2, and STEPL.

COMMENTS: None.

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

SUMMARY: The Restoration Strategy section of the TMDL document mentions that the Lower Big Sioux River implementation project is currently underway in the Beaver Creek watershed. The primary focus of restoration efforts should be directed towards BMP implementation that address loading at flows in the 10 to 60th percentile range. Restoration efforts should also focus on potential bacteria sources upstream of LBST04, as this area has been identified as the most significant source of fecal coliform bacteria.

Since there are no significant point sources in the Beaver Creek watershed there is no need to include a discussion of reasonable assurance in this TMDL document.

COMMENTS: None.

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 Beaver Creek fecal coliform TMDL includes daily loads expressed as cfu/day. The daily TMDL loads are included in TMDL and Allocations section of the TMDL document.

COMMENTS: None.