

## **Fecal Coliform Bacteria Total Maximum Daily Load (TMDL) for the Belle Fourche River, Segment 1, Butte County, South Dakota**



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## Total Maximum Daily Load Summary

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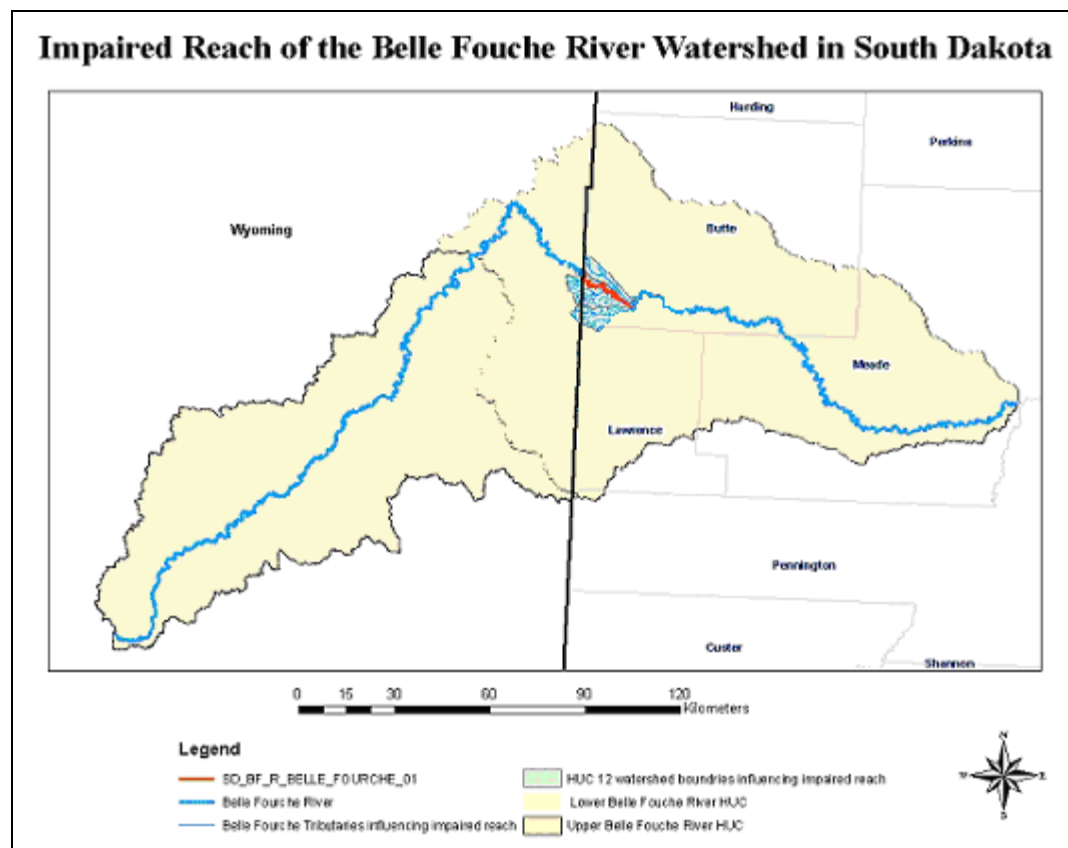
<b>Waterbody Type:</b>	Stream
<b>303(d) Listing Parameter:</b>	Fecal coliform bacteria
<b>Designated Uses:</b>	Warmwater permanent fish life propagation waters, immersion recreation waters, fish and wildlife propagation, recreation, and stock watering, and irrigation water
<b>Size of Impaired Waterbody:</b>	Approximately 64.2 km in length
<b>Size of Watershed:</b>	24,348 acres
<b>Indicator(s):</b>	Concentrations of fecal coliform bacteria
<b>Analytical Approach:</b>	Load Duration Curve
<b>Location:</b>	Hydrologic Unit Codes (12-digit HUC): 101202020109 101202020201
<b>Goal:</b>	Meet applicable water quality standards for fecal coliform bacteria
<b>Target (Water Quality Standards):</b>	Maximum daily concentration of $\leq 400$ cfu/100mL and a geometric mean of 5 samples over a 30 day period $\leq 200$ cfu/100mL. These criteria apply from May 1 <sup>st</sup> through September 30 <sup>th</sup> .
<b>Reach Number:</b>	SD-BF-R-BELLE_FOURCHE_01
<b>Load Allocations based on Geometric Mean:</b>	
<b>High Flow Zone WLA:</b>	0
<b>High Flow Zone LA:</b>	1.00E+12 cfu/day
<b>High Flow Zone MOS:</b>	8.39E+11 cfu/day
<b>High Flow Zone TMDL:</b>	1.83E+12 cfu/day

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## Objective

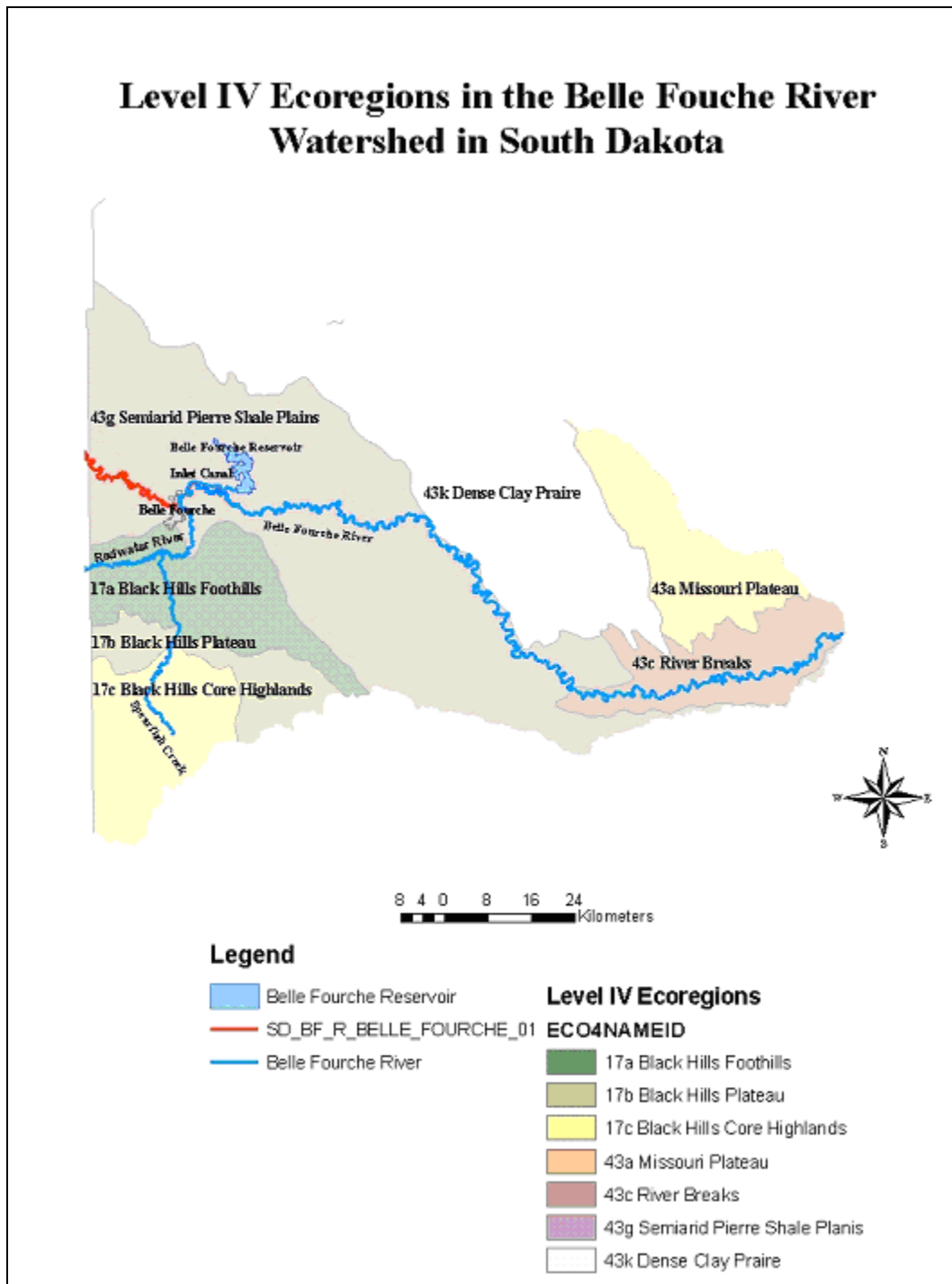
The intent of this document is to clearly identify the components of the TMDL, support adequate public participation, and facilitate the US Environmental Protection Agency (US EPA) review. The TMDL was developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by US EPA. This TMDL document addresses the fecal coliform bacteria impairment of Belle Fourche River from the Wyoming/South Dakota border to 1.9 river kilometers west of Fruitdale, South Dakota (SD-BF-R-BELLE\_FOURCHE\_01), which was assigned priority category 5 (high-priority) in the 2010 impaired waterbodies list (SDDENR, 2010).

## Watershed Characteristics



**Figure 1. Impaired reach of the Belle Fourche River watershed in South Dakota and Wyoming.**

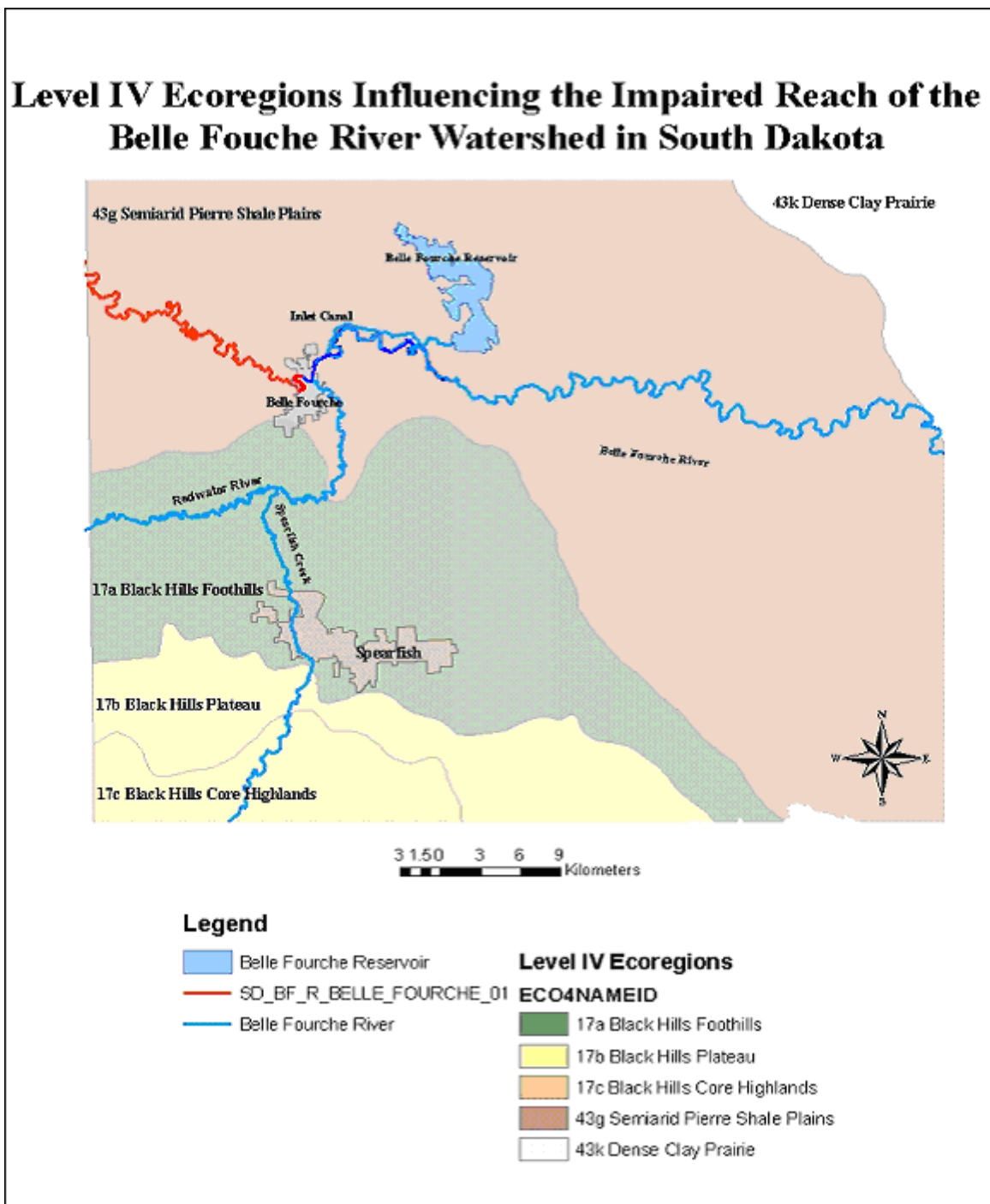
The Belle Fourche River is a natural stream that originates in Wyoming, drains parts of Butte, Lawrence and Meade Counties in South Dakota, and flows to the Cheyenne River in Meade County and ultimately to the Missouri River (Figure 1). The Belle Fourche River watershed is approximately 2,100,000 acres (3,300 sq. miles) in size in South Dakota and approximately 2,400,000 acres (3,700 sq. miles) in Wyoming.



**Figure 2. Belle Fourche River watershed in South Dakota including Level IV ecoregions.**

The South Dakota portion of the Belle Fourche watershed, shown in Figure 2, is comprised of seven level IV ecoregions. Ecoregion designations include: Black Hills Foothills, Black Hills Plateau, Black Hills Core Highlands, River Breaks, Semiarid Pierre Shale Plains, Dense Clay Prairie, and Missouri Plateau Figure 2. Two level IV ecoregions (Semiarid Pierre Shale Plains

and Black Hills Foothills) directly influence the impaired reach of the Belle Fourche River (Figure 3).

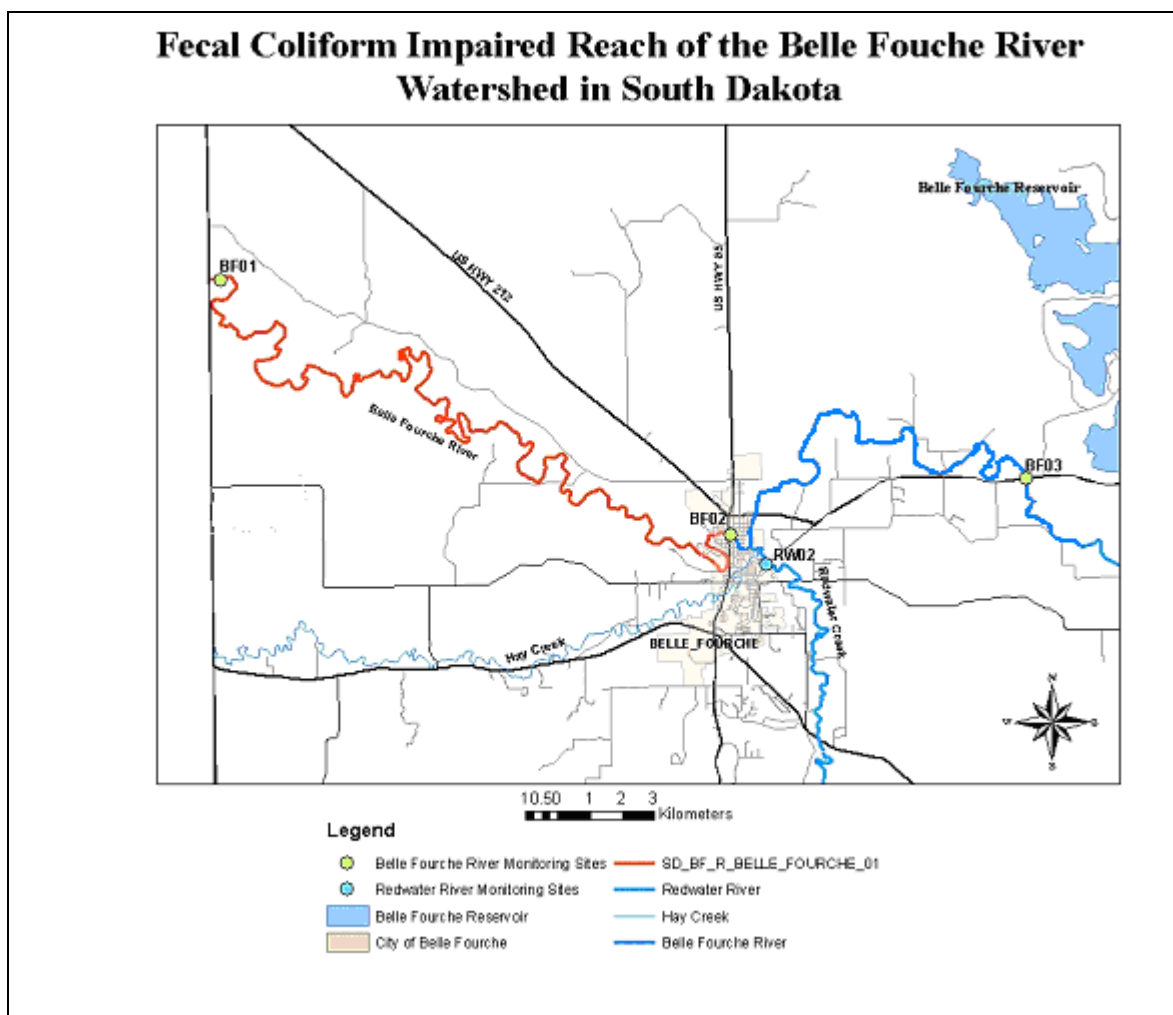


**Figure 3. Level IV ecoregions influencing the fecal coliform impaired reach of the Belle Fourche watershed in South Dakota.**

The Black Hills Foothills are un-glaciated features which comprise a ring of hills surrounding the Black Hills mountainous core. The Dakota Hogback separates the foothills from the plains and the Red Valley is inside the Hogback and encircles the Black Hills Dome. The geology is Mesozoic sandstone and shale. The Hogback is composed of Lakota Sandstone, Fall River Sandstone, Fuson Shale and Minnewasta Limestone. The Red Valley is composed of the Spearfish Formation and red sandy shale. The soil types are Butche, Canyon, Enning, Nevee, Spearfish, Grummit, Tilford, Vale and Rekop.

The mean annual precipitation in this area is 15-17 inches, supporting a vegetation cover of ponderosa pine woodlands with a grass under story of little bluestem, grama grasses, and leadplant.

Land use includes cattle grazing and ranching with low density suburban development.



**Figure 4. Monitoring sites.**

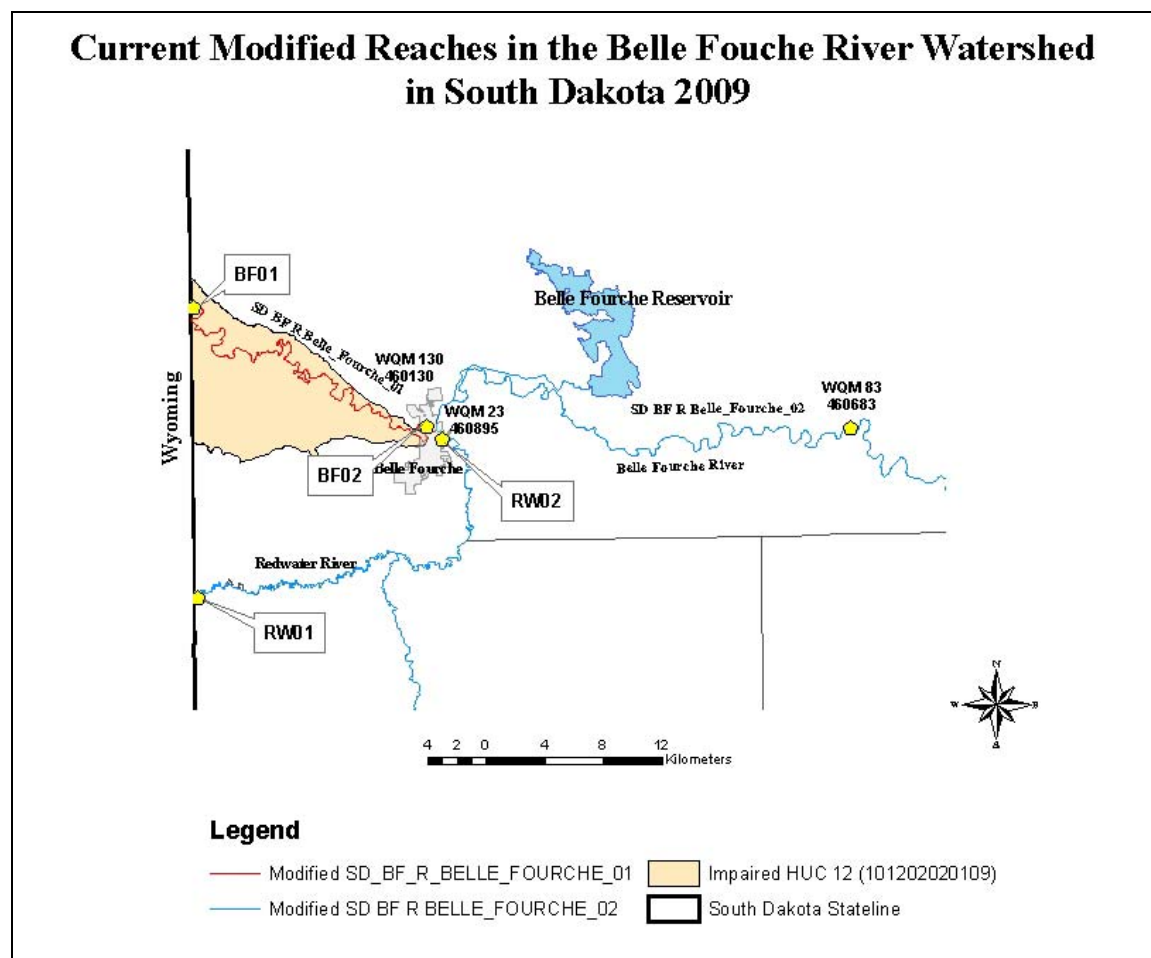


The Semiarid Pierre Shale Plains are undulating to rolling plains and is the dominant ecoregion within the watershed, representing 40% of the area. Steep-sided, incised stream channels dominate this ecoregion.

The geology is predominately Cretaceous Pierre Shale. The soils include Pierre, Samsil, Lismas, Satanta and Nunn.

The mean annual precipitation is 14 inches. Vegetation includes short grass prairie grasses such as western wheat grass, green needle grass, blue grama and buffalo grass. Land use is predominantly cattle grazing, rangeland and dry land farming.

The original impaired (303(d) listed) segment of the Belle Fourche River (SD-BF-R-BELLE\_FOURCHE\_01) has a length of 64.1 river kilometers (r-km), or 39.8 river miles (r-mi). The current 303(d) listed segment begins at the Wyoming border and ends at Fruitdale, South Dakota. Long-term USGS flow and data from this study indicated that average daily flows from the Redwater River exceed the average daily flows of the Belle Fourche River above the confluence 77 percent of the time. Flow characteristics in the Belle Fourche River below the confluence of the Redwater River are different based on volume.



**Figure 5. Reach changes applied to the Belle Fourche River in South Dakota.**

The reach segment from the Redwater River to near Fruitdale has been modified and incorporated into SD-BF-R-BELLE\_FOURCHE\_02 to better represent natural changes and conditions outlined above. SD-BF-R-BELLE\_FOURCHE\_01 reach length is now from the Wyoming border to the confluence with the Redwater River 43.2 r-km (26.8 r-mi). The downstream reach (SD-BF-R-BELLE\_FOURCHE\_02) was increased in length from the confluence of the Redwater River to the confluence of Whitewood Creek 58.8 r-km (36.5 r-mi). These reach changes have been incorporated into South Dakotas 2010 Integrated Report and the Assessment Data Base (ADB). Figure 5 shows the drainage area in South Dakota of the 303(d) listed segment, approximately 9853 hectares (24,348 acres).

## **Problem Identification**

Belle Fourche River from the Wyoming border to near Fruitdale was first listed for pathogens (fecal coliform bacteria) in the 2002 South Dakota Report to Congress 305(b) Water Quality Assessment (SD DENR, 2002) and continued to be listed for fecal coliform in successive Integrated Report (combined 305(b) and 303(d) reports) listing cycles (SD DENR, 2004, 2006, 2008, and 2010). In 2001 through 2002, a watershed assessment and TMDL study of the Belle Fourche River in South Dakota was completed to evaluate existing and potential pollution problems and develop a TMDL for Total Suspended Solids (TSS) (SD DENR, 2005). During the assessment exceedences in the fecal coliform criteria were observed along the Belle Fourche River from the Wyoming border (monitoring sites BF01) to the assessment monitoring site (monitoring site BF02) just above the confluence with the Redwater River (Figure 3).

Since 1999, the South Dakota Department of Environment and Natural Resources (SD DENR) have collected fecal coliform bacteria samples at WQM 130 (460130) in Belle Fourche. Water quality monitoring during the fecal coliform season (May 1<sup>st</sup> to September 30<sup>th</sup>) from 1999 through 2008 showed that approximately 26 percent of samples collected on Belle Fourche River in Belle Fourche exceeded fecal coliform bacteria criteria. Across all sites, maximum concentrations ranged from 2 colony-forming units per 100 mL (cfu/100mL) up to 3,800 cfu/100mL. Fecal coliform sampling during the Belle Fourche River watershed assessment project in Belle Fourche similarly exceeded the fecal coliform criteria 43 percent of the time. Fecal coliform concentrations collected during the assessment project ranged from 10 cfu/100mL to 2,800 cfu/100mL. Fifty-six percent of the samples collected during the assessment that exceeded fecal coliform criteria were collected during runoff events.

## **Description of Applicable Water Quality Standards & Numeric Water Quality Targets**

Each waterbody within South Dakota is assigned beneficial uses. All waters (both lakes and streams) are designated with the use of fish and wildlife propagation, recreation, and stock watering, while all streams and select lakes (to include Belle Fourche Reservoir) are assigned the use of irrigation. Additional uses are 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 criteria that provide physical and chemical benchmarks from which management decisions can be developed.

Belle Fourche River has been assigned the following beneficial uses: warmwater permanent fish life propagation, immersion recreation, limited contact recreation, fish and wildlife propagation, recreation and stock watering, and irrigation. Table 1 lists the criteria that must be met to support the specified beneficial uses. When multiple criteria exist for a particular parameter, the most stringent criterion is used.

Individual parameters, determine the support of these beneficial uses. South Dakota has narrative standards that may be applied to the undesired eutrophication of lakes and streams. Administrative Rules of South Dakota (ARSD) Article 74:51 contains language that prohibits the presence of materials causing pollutants to form, visible pollutants, taste and odor producing materials, and nuisance aquatic life.

The numeric TMDL target established for SD-BF-R-BELLE\_FOURCHE\_01 reach of the Belle Fourche River is based on the current daily maximum criteria for fecal coliform bacteria. Water quality criteria for the immersion recreation beneficial use requires that 1) no sample exceeds 400 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 200 cfu/100 mL. This criterion is applicable from May 1 through September 30 (SD DENR, 2002b).

Of all the assessed parameters for which surface water quality criteria are established (Table 1), total suspended solids (TSS) and water temperature exceeded criteria for the warmwater permanent fish life propagation beneficial use, while fecal coliform exceeded immersion recreation beneficial use criteria for the Belle Fourche River. Thirty-one percent of all TSS and seven percent of all temperature samples collected in the impaired reach of the Belle Fourche River (SD-BF-R-BELLE\_FOURCHE\_01) exceeded beneficial use based standards for warmwater permanent fish life propagation waters. Immersion recreation standards for fecal coliform in the impaired reach of the Belle Fourche River were exceeded 32 percent of the time during the project.

The Belle Fourche River in South Dakota has a US EPA approved TMDL for TSS (SD DENR, 2005). Temperature excursion percentages were below the action threshold of 10 percent exceedence, thus sporadic violations in temperature standards are low enough not to be a concern in the impaired reach of the river. Exceedences in fecal coliform have been a concern in the impaired reach of the Belle Fourche River since 2002 and the focus of this TMDL summary document.

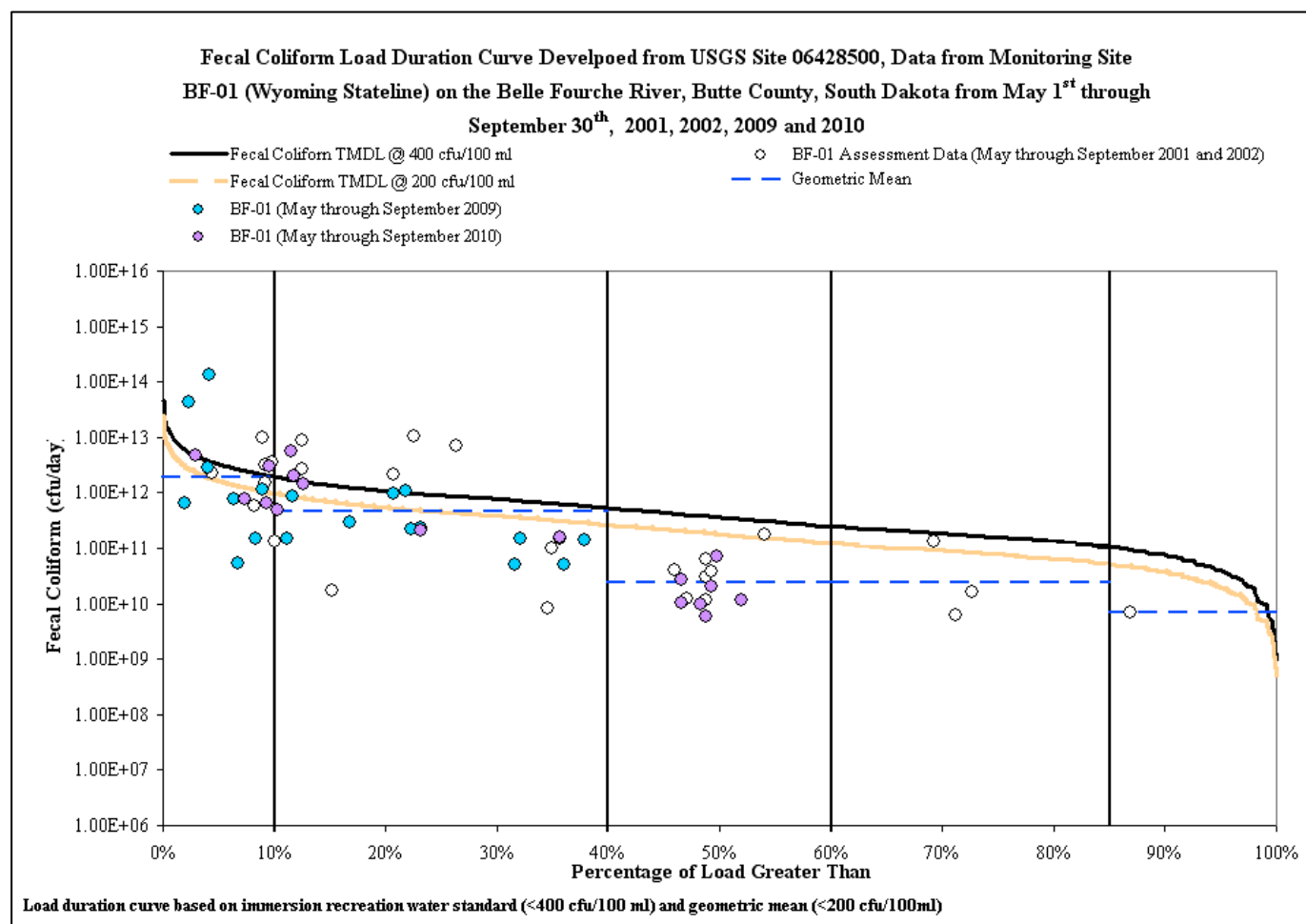
**Table 1. State surface water quality standards for the Belle Fourche River, Butte County, South Dakota.**

Parameter	Criteria	Unit of Measure	Special Conditions
<b>Total ammonia nitrogen as N</b> (Warmwater Permanent Fish Life Propagation)	Equal to or less than the result from Equation 3 in Appendix A	mg/L	30-day average March 1 - October 31
	Equal to or less than the result from Equation 4 in Appendix A	mg/L	30 day average November 1 - February 29
	Equal to or less than the result from Equation 2 in Appendix A	mg/L	daily maximum
<b>Fecal coliform</b> (May 1 – September 30) (Immersion Recreation)	$\leq 200$	/100 mL	geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period, and they may not exceed this value in more than 20 percent of the samples examined in this same 30-day period
	$\leq 400$		in any one sample
<b>Dissolved oxygen</b> (Warmwater Permanent)	$\geq 5.0$	mg/L	
<b>Undissociated hydrogen sulfide</b> (Warmwater Permanent Fish Life)	$\leq 0.002$	mg/L	
<b>pH</b> (Warmwater Permanent Fish Life)	$\geq 6.5 - \leq 9.0$	units	see § 74:51:01:07
<b>Total Suspended Solids</b> (Warmwater Permanent Fish Life)	$\leq 90$	mg/L	30-day average
	$\leq 158$	mg/L	daily maximum
<b>Total alkalinity as calcium carbonate</b> (Fish and Wildlife Propagation, Recreation and Stock Watering)	$\leq 750$	mg/L	30-day average
	$\leq 1313$	mg/L	daily maximum
<b>Total dissolved solids</b> (Fish and Wildlife Propagation, Recreation and Stock Watering)	$\leq 2,500$	mg/L	30-day average
	$\leq 4,375$	mg/L	daily maximum
<b>Conductivity at 25°C</b> (Irrigation)	$\leq 2,500$	micromhos/cm	30-day average
	$\leq 4,375$	micromhos/cm	daily maximum
<b>Nitrates as N</b> (Fish and Wildlife Propagation, Recreation and Stock Watering)	$\leq 50$	mg/L	30-day average
	$\leq 88$	mg/L	daily maximum
<b>Total petroleum hydrocarbon</b> (Fish and Wildlife Propagation, Recreation and Stock Watering)	$\leq 10$	mg/L	see § 74:51:01:10
<b>Oil and grease</b> (Fish and Wildlife Propagation, Recreation and Stock Watering)	$\leq 10$	mg/L	see § 74:51:01:10
<b>Sodium adsorption ratio</b>	$\leq 6$		see definition
<b>Temperature</b> (Warmwater Permanent Fish Life)	$\leq 80$	°F	see § 74:51:01:31

## Pollutant Assessment

### Boundary Conditions

BF01 is located along the Belle Fourche at the Wyoming/South Dakota border. Conditions at this site reflect land use within Wyoming and serve as a boundary condition for Segment 1 of the Belle Fourche River. Violations of the acute standard only occur in the upper 40% of the flow regime (Figure 6). Reductions to meet the acute standard in the high flow and moist condition were 77.8% and 79.3%, respectively. Wyoming’s response to conditions along the boundary includes “we have not made a recreational use support determination and it is not on our 303(d) list.” (Wyoming DEQ).



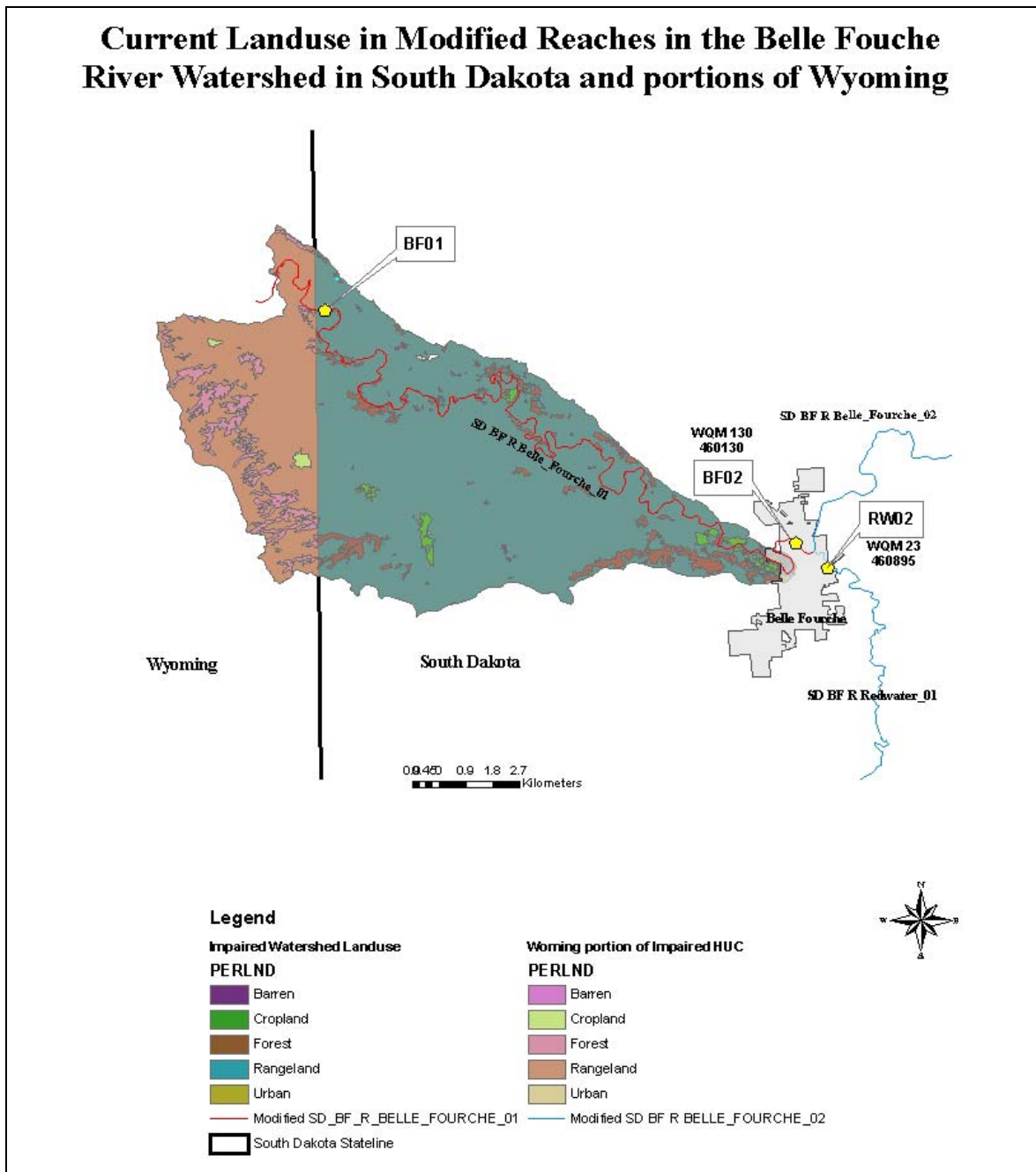
**Figure 6. Load duration curve of BF01.**

**Point Sources**

The City of Belle Fourche is located at the bottom of the impaired reach; approximately four river kilometers are in the city limits before the reach ends at the confluence with the Redwater River. The City of Belle Fourche uses a multiple lagoon municipal sewage treatment system located approximately 5 r-km below the end of the impaired reach at the confluence with the Redwater River. City of Belle Fourche has a no discharge permit (SD0021628) issued by the State of South Dakota and in an emergency would discharge into a man-made wetland. Allocations from this source were considered not a problem.

**Nonpoint Sources**

Based on review of available information and communication with local land owners and representatives from Belle Fourche, the primary nonpoint sources of fecal coliform within the impaired reach of the Belle Fourche River include agricultural (Figure 7) and urban runoff, as well as wildlife and human sources. Using the best available information, loadings were estimated from each of these sources based on the number of units (e.g. numbers of animals, failing septic systems, etc.) representative of each source.



**Figure 7. Land Use in impaired reach SD BF R Belle\_Fourche\_01 of the Belle Fourche River in South Dakota and Wyoming 2009.**

Rangeland is the largest land use followed by cropland, urban, forest and barren (Table 2).

**Table 2: Land Use characteristics for the Belle Fourche Segment 1 watershed.**

	Percent	Area (acres)
Range	90.7	22084
Cropland	6.5	1583
Urban	1.2	292
Forest	0.9	219
Barren	0.7	170

### Urban

Approximately 1.2 percent of the impaired study area is characterized as impervious area (urban). Most of the impervious area is located in the City of Belle Fourche; however, rural ranch areas located along the Belle Fourche River upstream of the City of Belle Fourche may also contribute to fecal coliform runoff to the Belle Fourche River during storm events.

Several water quality samples taken from storm drains during storm events which indicated a potential increase in fecal coliform bacteria levels in the Belle Fourche River downstream of Belle Fourche.

### Agriculture

Manure from livestock is a potential source of fecal coliform to the stream. Livestock in the basin are mainly beef cattle with sheep being the next abundant animals in the study area. Other livestock in the basin include dairy cattle, hogs, horses and chickens. Numbers of animals on private land were estimated through personal communication with landowners and agricultural statistics in the watershed (Table 3).

**Table 3. Fecal source allocation to Belle Fourche River Segment 1.**

Source	Percentage
Feedlots	2%
Livestock on Grass	97.70%
Wildlife	<0.1%

### Human

The impaired HUC drainage contains an estimated 44 septic systems that are mostly located near tributaries to the Belle Fourche River (SD DENR, unpublished data). Septic systems located near drainages in the study area provide potential sources of human fecal coliform to the impaired segment of the Belle Fourche River. Limited information is available on the age and condition of these systems.



**Natural background/wildlife**

Wildlife within the watershed is a natural source of fecal coliform bacteria in the study area. County wildlife assessments provided the best available estimate of wildlife population densities. The wildlife assessment for Butte County was obtained from the South Dakota Department of Game, Fish and Parks. SD GF&P population estimates included counts of whitetail deer, mule deer, elk, antelope and turkey (Table 4).

**Table 4. Belle Fourche River Segment 1 potential nonpoint sources of fecal coliform.**

Species	#/sq mile	#/acre	FC/Animal/Day	Fecal Coliform	Percent
Dairy Cow	0.506097	0.000791	4.46E+10	8.59E+11	2.03E-04
Cattle	28.43793	0.044434	3.90E+14	4.22E+17	9.97E+01
Bison <sub>6</sub>	0.017789	2.78E-05	3.90E+14	2.64E+14	6.24E-02
Hog	0.22592	0.000353	1.08E+10	9.28E+10	2.19E-05
Sheep	18.71714	0.029246	1.96E+10	1.40E+13	3.30E-03
Horse	1.066895	0.001667	5.15E+10	2.09E+12	4.94E-04
All Wildlife	Sum of all Wildlife			9.90E+14	2.34E-01
Deer <sub>3</sub>	3.780161	0.005907	3.47E+08	4.99E+10	
Elk <sub>6</sub>	0.066709	0.000104	3.90E+14	9.90E+14	
Antelope <sub>3</sub>	3.646744	0.005698	3.47E+08	4.81E+10	
Turkey <sub>1</sub>	1.556537	0.002432	9.50E+07	5.63E+09	
Mink <sub>5</sub>	0.444725	0.000695	2.50E+08	4.23E+09	
Beaver <sub>3</sub>	0.88945	0.00139	2.00E+05	6.77E+06	
Muskrat <sub>1</sub>	0.778269	0.001216	2.50E+07	7.40E+08	
Skunk <sub>5</sub>	1.334175	0.002085	2.50E+08	1.27E+10	
Badger <sub>5</sub>	0.444725	0.000695	2.50E+08	4.23E+09	
Coyote <sub>4</sub>	0.055591	8.69E-05	1.75E+09	3.70E+09	
Fox <sub>4</sub>	0.17789	0.000278	1.75E+09	1.18E+10	
Raccoon <sub>3</sub>	2.001262	0.003127	2.50E+08	1.90E+10	
Bobcat <sub>4</sub>	0.111181	0.000174	1.75E+09	7.40E+09	
Jackrabbit <sub>5</sub>	8.894497	0.013898	2.50E+08	8.46E+10	
Mountain Lion <sub>4</sub>	0.001334	2.08E-06	1.75E+09	8.88E+07	
Cottontail Rabbit <sub>5</sub>	1.334175	0.002085	2.50E+08	1.27E+10	
Squirrel <sub>5</sub>	0.444725	0.000695	2.50E+08	4.23E+09	
Grouse <sub>2</sub>	1.756663	0.002745	1.40E+08	9.36E+09	
Partridge <sub>2</sub>	1.111812	0.001737	1.40E+08	5.92E+09	
Canada Goose <sub>1</sub>	0.066709	0.000104	4.90E+10	1.24E+11	
1 USEPA 2001					
2 FC/Animal/Day copied from chicken (USEPA 2001) to provide an estimate of background affects of wildlife					
3 Bacteria Indicator Tool worksheet					
4 Best professional judgement based off of dogs					
5 FC/Animal/Day copied from raccoon to provide a more conservative estimate of background affects of wildlife					
6 Best professional judgement based off of cattle					

### Bacterial Source Tracking

Samples were collected on three different dates for bacteria source tracking: August 23, 2004; May 9, 2005; and July 5, 2005. These samples were not subject to runoff from storm events. In addition to sampling at WQM 130, samples were collected upstream and downstream of the city of Belle Fourche for bacteria source tracking on all three dates. Three different methods were

used for bacteria source tracking for this project. On August 23, 2004, an E. coli ID™ test was run on samples from all three locations. On May 9, 2005, a Human Bacteroidetes ID™ test was run on samples from all three locations. On July 5, 2005, a Human Bacteroidetes ID™ test and a Cow E. coli ID test was performed on samples collected from samples collected upstream and downstream of the city of Belle Fourche. No bacteria source tracking test was run on the sample collected at WQM 130 on July 5, 2005, since an additional test was run on samples from the other two sample locations. All bacteria source tracking samples were analyzed by Source Molecular located in Miami, Florida. Due to cost a limited number of bacterial source tracking samples were collected.

An E. coli ID™ test, often referred to as a ribotyping test, uses a genetic fingerprint that comes from genes that code for ribosomal ribonucleic acids of E. coli to identify the source as either human or animal. This test does not distinguish cattle from other animal sources. A Human Bacteroidetes ID™ test uses organisms from the phylum *Bacteroidetes* as indicator species, instead of E. coli to identify sources of bacteria. *Bacteroidetes* are anaerobes and are, therefore, indicative of recent fecal contamination. The Human Bacteroidetes ID™ test filters and identifies the bacteria from an entire sample versus identifying a sub-sample that is cultured on a Petri dish. Specifically, the Human Bacteroidetes ID™ test identifies contamination from human sources only. Similar to the E. coli ID™ test, the Cow E. coli ID test uses E. coli as indicator species. The Cow E. coli ID test specifically identifies certain strains of E. coli that are specifically pathogenic in cattle to identify fecal contamination from cattle.

Source tracking samples from August 23, 2004, from all three sample locations indicated no contamination from human sources. Two isolates, one from upstream and one from downstream of the city of Belle Fourche, were indeterminate. All other samples were identified as being from animal sources. Similar to the August 2004 samples, the source tracking samples from May 9, 2005, showed no human sources of contamination. The Cow E. coli ID test was added for the final source tracking sampling on July 5, 2005, in order to identify the loading originating from cattle. The samples from the final source tracking sampling indicated no contamination from cattle or human sources. The complete list of results is shown in Table 5.

**Table 5. Results of fecal coliform source tracking analysis.**

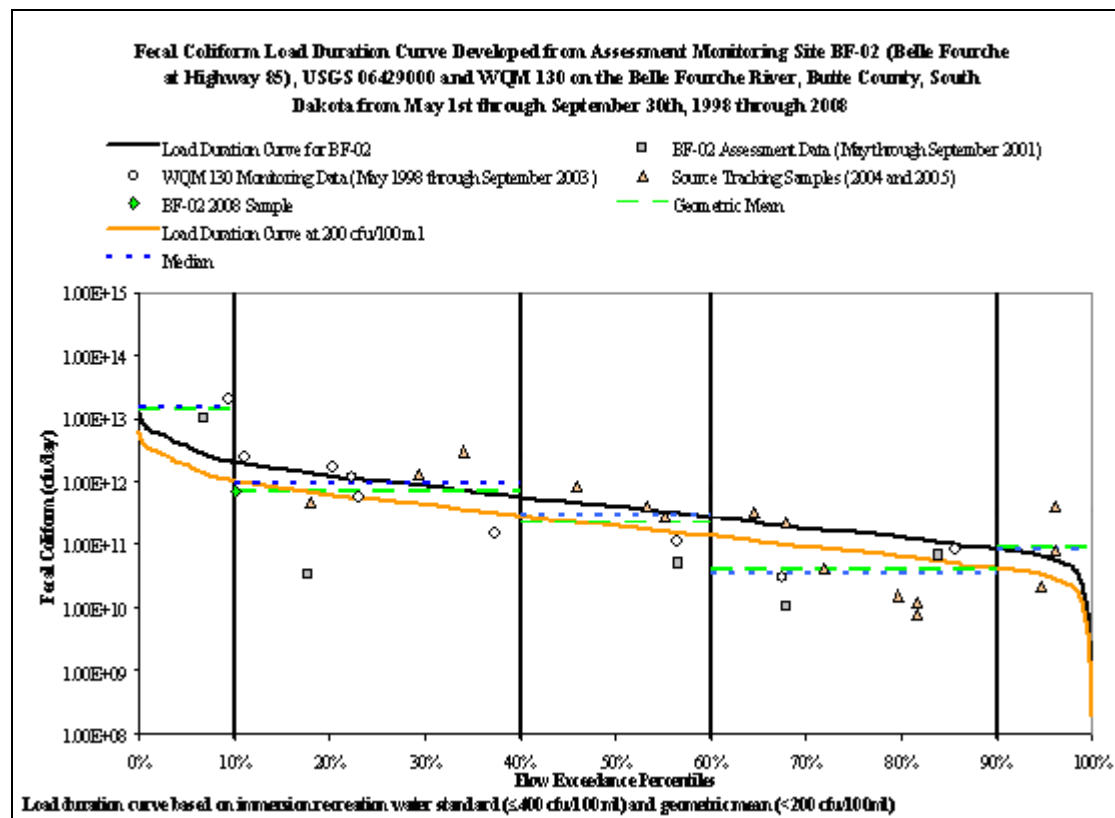
Bacterial Source Tracking	Location	Energy Lab Fecal Coliform (CFU/100 ml)	Fecal Coliform (mpn/100ml)	Type of Test	Probable Source
08/23/2004	WQM 130	2,800	1,100	E. coli. ID™	5 isolates animal
08/23/2004	U/S B.F.	–	93	E. coli. ID™	4 isolates animal and 1 isolate indeterminate
08/23/2004	D/S B.F.	–	1,100	E. coli. ID™	4 isolates animal and 1 isolate indeterminate
05/09/2005	WQM 130	46	–	Human Bacteroidetes ID™	No Human Gene Biomarker Detected
05/09/2005	U/S B.F.	–	–	Human Bacteroidetes ID™	No Human Gene Biomarker Detected
05/09/2005	D/S B.F.	–	–	Human Bacteroidetes ID™	No Human Gene Biomarker Detected
07/05/2005	WQM 130	460	–	–	–
07/05/2005	U/S B.F.	–	455 (E.coli)	Cow E. coli ID	No Cattle Gene Biomarker Detected
07/5/2005	D/S B.F.	–	293 (E.coli)	Cow E. coli ID	No Cattle Gene Biomarker Detected
07/5/2005	U/S B.F.	–	–	Human Bacteroidetes “Quatification” ID™	No Human Gene Biomarker Detected
07/5/2005	D/S B.F.	–	–	Human Bacteroidetes “Quatificatio” ID™	No Human Gene Biomarker Detected

Based on the results of the bacteria source tracking, it appears that human sources of fecal coliform bacteria are not a major portion of the fecal coliform load in the Belle Fourche River. No samples were identified from either human or cattle sources. However, because of the small sample size, the results do not mean that there is no loading of fecal coliform bacteria from either human or cattle sources. Possible sources of fecal contamination within samples tested for source tracking may come from domestic animals (pets) from the city of Belle Fourche as well as waterfowl and other avian life such as swallows occurring around bridges. Based on South Dakota agricultural bulletins, cattle make up the majority of the fecal source loading within the watershed. This data should be considered over bacteria source tracking in this case due to the small sample size of source tracking samples.

## Linkage Analyses

### Load Duration Curve Analysis

The TMDL was developed using the Load Duration Curve (LDC) approach that results in a flow-variable target that considers the entire flow regime (Figure 8). In the Belle Fourche River, fecal coliform concentrations are positively related to stream flow. Thus, the LDC approach was deemed an appropriate method for setting a flow-variable fecal coliform bacteria TMDL for the Belle Fourche River.



**Figure 8. Load duration curve representing allowable daily fecal coliform loads based on the daily maximum fecal coliform criteria ( $\leq 400$  mg/L) and observed stream flow for a period of record of 1998 through 2008. Measured fecal coliform loads for the same time period are also displayed.**

The LDC is a dynamic expression of the allowable load for any given day. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into five flow zones representing high flows (0–10 percent), moist conditions (10–40 percent), moderate flows (40–60 percent), dry conditions (60–90 percent), and low flows (90–100 percent) according to EPA's *An Approach for Using Load Duration Curves in the Development of TMDLs* (USEPA, 2006).

Instantaneous loads were calculated by multiplying fecal coliform sample concentrations from SD DENR ambient water quality data (site number 460130, WQM 130), the USGS daily average flow (gage number 06429000) and average daily discharge developed for watershed assessment monitoring site BF02 on the date of the sample and a unit conversion factor. The SD DENR water quality monitoring site, USGS flow gaging station and Belle Fourche River assessment monitoring site BF02 are co-located near the Highway 85 Bridge in the City of Belle Fourche (Figure 4).

When the instantaneous loads are plotted on the LDC, characteristics of the water quality impairment are shown (Figure 8). Instantaneous loads that plot above the curve are exceeding the TMDL, while those below the curve are in compliance. As the plot shows, the 95<sup>th</sup> percentile of fecal coliform samples collected from Belle Fourche River exceed the geometric mean criterion in the high, moist, moderate, dry and low flow conditions. Loads exceeding the criteria in the low flow zone typically indicate point source load contributions, while those further left on the plot generally reflect potential nonpoint source contributions (USEPA, 2006).

## **TMDL Allocations**

### **Waste Load Allocation (WLA)**

There are no point discharges within the watershed of Segment 1. Belle Fourche has multi-cell ponded wastewater treatment facility (WWTF) with a no discharge permit (permit number SD0021628) located downstream of the listed segment. Any overflow discharges go directly into a constructed wetland with no connection to the Belle Fourche River.

The LDC (Figure 5) represents the dynamic expression of the fecal coliform bacteria TMDL for the Belle Fourche River, resulting in a unique maximum daily load that corresponds to a measured average daily flow. To aid in the implementation of the TMDL and estimation of needed bacteria load reductions, Table 3 presents a combination of allocations for each of five flow zones. Methods used to calculate the TMDL components are discussed below. This TMDL is in effect from May 1 through September 30, as the fecal coliform criteria are applicable only during this period.

### **Load Allocation (LA)**

To develop the fecal coliform bacteria load allocation (LA), the loading capacity (LC) was first determined. The LC for the Belle Fourche River was calculated by multiplying the daily maximum fecal coliform bacteria criterion by the daily average flow measured at USGS gaging station 06429000 Belle Fourche River at Belle Fourche and assessment monitoring site BF02 in Belle Fourche.

The more stringent geometric mean criterion (200 cfu/100ml) was used, rather than the daily maximum criterion (400 cfu/100ml), because observed fecal coliform loads exceed the geometric mean criterion by flow zone (Table 6). The geometric mean, as defined in ARSD § 74:51:01:01, is the n<sup>th</sup> root of a product of n factors. The geometric mean fecal coliform criteria (ARSD § 74:51:01:50) applies only under special conditions, where a minimum of five samples are

obtained during separate 24-hour periods for any 30-day period, and the calculated geometric mean may not exceed the criterion in more than 20% of the samples collected in this same 30-day period. Since only one or two samples were collected during any 30-day period, the geometric mean criterion does not apply. However, a geometric mean concentration was calculated using all the samples within each flow zone to assess whether or not the geometric mean criterion would be exceeded within a flow zone if a sufficient number of samples are taken. Table 7 shows that geometric mean values exceeded the 200 cfu/100ml criterion in the high, moist, moderate and low flow zones; while the geometric mean of the dry condition was below the 200 cfu/100ml standard based on available data.

**Table 6. Total Maximum Daily Load (TMDL) (cfu/day) allocations by flow zone\*\*.**

<b>Belle Fourche River @ Belle Fourche*</b>		<b>Load Duration Curve Zone</b>				
		<b>High Flows</b>	<b>Moist Conditions</b>	<b>Moderate Flows</b>	<b>Dry Conditions</b>	<b>Low Flows</b>
<b>WLA</b> (Belle Fourche)	<b>(CFU/Day)</b>	0	0	0	0	0
<b>Load Allocation (LA)</b>	<b>(CFU/Day)</b>	1.00E+12	2.69E+11	1.36E+11	3.89E+10	2.01E+08
<b>Margin of Safety (Explicit)</b>	<b>(CFU/Day)</b>	8.33E+11	2.33E+11	5.92E+10	3.77E+10	2.80E+10
<b>TMDL</b>	<b>(CFU/Day)</b>	<b>1.83E+12</b>	<b>5.02E+11</b>	<b>1.95E+11</b>	<b>7.66E+10</b>	<b>2.82E+10</b>
<b>Current Loading</b>	<b>(CFU/Day)</b>	1.94E+13	2.69E+12	7.38E+11	2.84E+11	3.66E+11
<b>Fecal Coliform TMDL Attainment</b>		FALSE	FALSE	FALSE	FALSE	FALSE
<b>Reduction needed</b>		90.5%	81.4%	73.6%	73.0%	92.3%
<b>Flows</b>		≥ 204 cfs	< 204 through 55 cfs	< 55 through 28 cfs	<28 through 7.9 cfs	< 7.9 cfs

\*Based on immersion recreation standard geometric mean 200 cfu/100 ml)

\*\* Current load is the 95<sup>th</sup> percentile of observed fecal coliform bacteria loads for each flow zone.

**Table 7. Geometric mean of samples by flow zone. The geometric mean criterion ( $\leq 200$  CFU/100 ml) applies under special conditions described in ARSD § 74:51:01:50.**

	<b>Flow Zone</b>				
	<b>High Flows</b>	<b>Moist Conditions</b>	<b>Moderate Flows</b>	<b>Dry Conditions</b>	<b>Low Flows</b>
<b>Number of samples (n)</b>	2	10	5	10	3
<b>Geometric Mean Concentration (CFU/100ml)</b>	2,387	236	260	104	563



Since the geometric mean criteria are exceeded in most flow zones, it was decided to use the geometric mean criterion to develop the loading capacity of the stream in order to ensure that the most stringent water quality standards are met. For each of the five flow zones, the 95<sup>th</sup> percentile of the range of assimilative capacity within a zone was set as the flow zone goal. Bacteria loads experienced during the largest stream flows (e.g. top 5 percent) cannot be feasibly controlled by practical management practices. Setting the flow zone goal at the 95<sup>th</sup> percentile of the range of LCs will protect the immersion recreation beneficial use and allow for the natural variability of the system.

In this TMDL the WLA was zero. A portion of the LC was allocated to nonpoint sources as a load allocation (LA). A fraction of the LC was also reserved as a margin of safety (MOS) to account for uncertainty in the calculations of these load allocations. The method used to calculate the MOS is discussed below. The LA was determined by subtracting the MOS from the LC. Thus, the TMDL (and LC) is the sum of LA, and MOS.

### **Margin of Safety (MOS)**

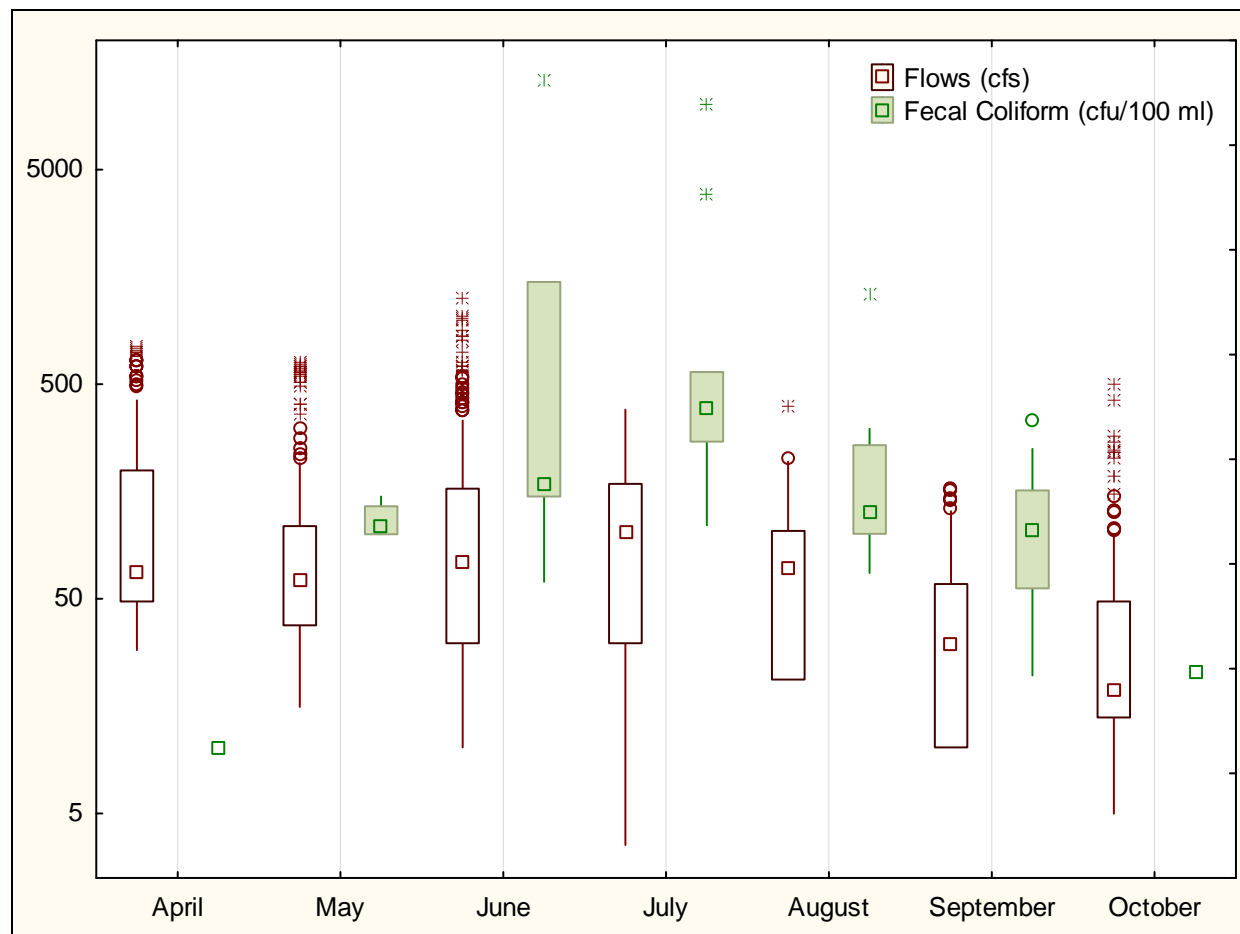
An explicit MOS identified using a duration curve framework is basically unallocated assimilative capacity intended to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc). An explicit MOS was calculated as the difference between the loading capacity at the mid-point of each of the five 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. As new information becomes available and the TMDL is revisited, this unallocated capacity may be attributed to nonpoint sources and added to the load allocation, or the unallocated capacity may be attributed to point sources and become part of the waste load allocation.

### **Seasonal Variation**

Fecal coliform concentrations also displayed seasonal variation (Figure 9). By using the LDC approach to develop the TMDL allocations, seasonal variability in fecal coliform loads is taken into account.

In addition, the TMDL is seasonal, as it is effective only during the period of May 1 through September 30. Since the fecal coliform criteria are in effect from May 1 through September 30, the TMDL is also applicable only during this time period.



**Figure 9. Seasonality in flow and fecal coliform concentration.**

### Critical Conditions

Critical conditions occur within the basin during the summer. Typically, greatest numbers of livestock and tourist activities are highest in the basin during the summer months. Combined with the peak in bacteria sources, high-intensity rainstorm events are common during the summer and produce a significant amount of fecal coliform load due to bacterial wash-off from the watershed.

### Follow-Up Monitoring

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 throughout the Belle Fourche River watershed and SDDENR WQM sites 460130 and 460683 will provide data for the upper reach of the river. Five other sites on the Belle Fourche River downstream of Segment 01 and one on Redwater Creek may also provide data to be used to judge the effectiveness of implementation activities. And the United States Geological Survey also has five sites within the Belle Fourche watershed that may provide additional water quality data.

## **Public Participation**

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

1. Presentations to local groups on the findings of the assessment.
2. A webpage was developed and used during the course of the assessment.
3. 30-day public notice period for public review and comment. A public notice was published in the Rapid City Journal, Black Hills Pioneer, and Belle Fourche Post.

The findings from these public meetings and comments have been taken into consideration in development of the Belle Fourche Segment 1 TMDL.

## **Implementation**

Several types of BMPs should be considered in the development of a water quality management implementation plan for watershed draining the impaired segment of the Belle Fourche River.

- Livestock access to streams should be reduced, and livestock should be provided sources of water away from streams.
- Unstable stream banks should be protected by enhancing the riparian vegetation that provides erosion control and filters runoff of pollutants into the stream.
- Filter strips should be installed along the stream bordering cropland and pastureland.
- Animal confinement facilities should implement proper animal waste management systems.

Funds to implement watershed water quality improvements can be obtained through SD DENR. This includes the Section 319 Nonpoint Source program.

## Literature Cited

- SDDENR (South Dakota Department of Environment and Natural Resources). 2002. South Dakota Total Maximum Daily Load Waterbody List 2002. Pierre, SD.
- SDDENR (South Dakota Department of Environment and Natural Resources). 2004. The 2004 South Dakota Integrated Report for Surface Water Quality Assessment. South Dakota Department of Environment and Natural Resources. Pierre, SD.
- SDDENR (South Dakota Department of Environment and Natural Resources). 2006. The 2006 South Dakota Integrated Report for Surface Water Quality Assessment. South Dakota Department of Environment and Natural Resources. Pierre, SD.
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- USEPA (U.S. Environmental Protection Agency). 2006. *An Approach for Using Load Duration Curves in Developing TMDLs*. U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds, Washington, DC.

### EPA REGION VIII TMDL REVIEW

TMDL Document Info:

<b>Document Name:</b>	<b>Fecal Coliform Bacteria Total Maximum Daily Load (TMDL) for the Belle Fourche River, Segment 1, Butte County, South Dakota</b>
<b>Submitted by:</b>	<b>Rich Hanson, SD DENR</b>
<b>Date Received:</b>	<b>August 3, 2011</b>
<b>Review Date:</b>	<b>September 9, 2011</b>
<b>Reviewer:</b>	<b>Vern Berry, EPA</b>
<b>Rough Draft / Public Notice / Final?</b>	<b>Public Notice Draft</b>
<b>Notes:</b>	

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
  - a. .... TMDL Document Submittal Letter
  - b. Identification of the Waterbody, Impairments, and Study Boundaries
  - c. Water Quality Standards
2. Water Quality Target
3. Pollutant Source Analysis
4. TMDL Technical Analysis
  - a. Data Set Description
  - b. Waste Load Allocations (WLA)
  - c. Load Allocations (LA)
  - d. Margin of Safety (MOS)
  - e. 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 Belle Fourche River, Segment 1, fecal coliform TMDL was submitted to EPA for review via an email from Rich Hanson, SD DENR on August 3, 2011. The email included the draft TMDL document for review and comment.

**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:** The Belle Fourche River is a natural stream that originates in Wyoming and drains parts of Butte, Lawrence and Meade Counties in South Dakota. The Belle Fourche River is part of the larger Cheyenne River basin in the Lower Belle Fourche sub-basin (HUC 10120202). The impaired segment of the Belle Fourche River begins at the Wyoming/South Dakota border and ends at the confluence with the

Redwater River near Belle Fourche, South Dakota (26.8 miles; SD-BF-R-BELLE\_FOURCHE\_01), and is listed as a high priority for TMDL development.

This segment is identified on the 2010 South Dakota 303(d) waterbody list as impaired due to elevated fecal coliform and total suspended solids (TSS) concentrations. The TSS impairment was addressed in a separate TMDL document developed by SD DENR and approved by EPA in February 2005.

The designated uses for Segment 1 of the Belle Fourche River include: warmwater permanent fish life propagation waters, immersion recreation waters, limited-contact recreation waters, irrigation waters, fish and wildlife propagation, recreation, and stock watering.

**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 Belle Fourche River, Segment 1, is listed as impaired based on fecal coliform concentrations that are impairing the limited contact recreation beneficial uses. South Dakota has applicable numeric standards for fecal coliform that may be applied to this stream. The fecal coliform numeric standards being implemented in this TMDL are: a daily maximum value of 400 cfu/100mL in any one sample, and a maximum geometric mean of 200 cfu/100mL during a 30-day period. The standards for fecal coliform are applicable from May 1 to September 30. Discussion of additional applicable water quality standards for Belle Fourche River can be found on pages 7 – 9 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, embeddness, 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 targets for this TMDL are based on the numeric water quality standards for fecal coliform to protect the limited contact recreation beneficial uses the impaired segment of the Belle Fourche River. The fecal coliform targets are: daily maximum of  $\leq 400$  cfu/100mL in any one sample, and maximum geometric mean of  $\leq 200$  cfu/100mL during a 30-day period. The fecal coliform standards are applicable from May 1 to September 30.

**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 uses in the watershed as predominately agriculture in the form of rangeland with a small amount of other uses. The specific landuse breakdown for the watershed is not included in the document.

The City of Belle Fourche is located near the end of the impaired segment. The City of Belle Fourche uses a multiple lagoon municipal sewage treatment system located approximately 5 km below the end of the impaired segment. The wastewater discharge permit issued to the City of Belle Fourche is a “no discharge permit,” and in an emergency the discharge would flow into a man-made wetland. Therefore, the wasteload allocation for this TMDL is zero.

A small percent (approximately 1.2%) of the drainage area is impervious area, primarily located in the City of Belle Fourche. However, rural ranch areas located along the Belle Fourche River upstream of the City of Belle Fourche may also contribute to fecal coliform runoff to the Belle Fourche River during storm events. Several water quality samples taken from storm drains during storm events which indicated a potential increase in fecal coliform bacteria in the Belle Fourche River downstream of Belle Fourche.

Manure from livestock is a potential source of fecal coliform to the stream. Livestock in the basin are mainly beef cattle with sheep being the next abundant animals in the study area. Other livestock in the basin include dairy cattle, hogs, horses and chickens. Numbers of animals on private land were estimated through personal communication with landowners and agricultural statistics in the watershed.

Within the drainage area of the impaired segment, there are an estimated 44 septic systems that are mostly located near tributaries to the Belle Fourche River. Septic systems located near drainages in the study area provide potential sources of human fecal coliform to the impaired segment of the Belle Fourche River.

Wildlife within the watershed is a natural source of fecal coliform bacteria in the study area. County wildlife assessments provided the best available estimate of wildlife population densities. The wildlife assessment for Butte County was obtained from the South Dakota Department of Game, Fish and Parks. SD GF&P population estimates included counts of whitetail deer, mule deer, elk, antelope and turkey.

Based on review of available information and communication with local land owners and representatives from Belle Fourche, the primary nonpoint sources of fecal coliform within the impaired reach of the Belle Fourche River include agricultural and urban runoff, as well as wildlife and human sources. Table 2, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. The main source of fecal coliform bacteria is likely overland runoff from livestock grazing in pastures.

**Table 2. Fecal Source Allocation to Belle Fourche River Segment 1.**

Source	Percentage
Feedlots	2%
Livestock on Grass	97.70%
Wildlife	<0.1%

During the assessment three sampling events were analyzed for bacterial genetic fingerprinting (i.e., bacterial source tracking). Based on these results, it appears that human sources of fecal coliform bacteria are not a major portion of the fecal coliform load in the Belle Fourche River. It also appears that cattle are a small portion of the total fecal coliform load. However, because of the small sample size, the results do not mean that there is no loading of fecal coliform bacteria from either human or cattle sources. It's likely that neither humans nor cattle are a majority source of fecal contamination. Some evidence exists that the city of Belle Fourche has a potentially large impact on fecal coliform loading. Probable sources of fecal contamination may come from domestic animals, other than cattle, from the city of Belle Fourche.

**COMMENTS:** Based on the map included in Figure 7, it appears that rangeland makes up nearly the entire landuse in the watershed. However, it would be helpful to include a table with the breakdown of landuse by land area and/or percentage.

As part of the bacterial source tracking analysis there is mention of evidence that the city of Belle Fourche has a large impact on fecal loading. Please explain in a bit more detail what that evidence consists of and what the possible sources from the city could be (e.g., could it be cracked, broken or leaking sewer lines, cross connections with the storm sewers?). Also, it would be helpful to know if any of the bacterial source tracking samples were collected during storm events.

**Comments Addressed:** A table (Table 2) indicating land use by percent and area was made to compliment Figure 7. Source tracking samples were not collected during runoff events and that is now stated. We removed the statements “It also appears that cattle are a small portion of the total fecal coliform load”, “It’s likely that neither humans nor cattle are a majority source of fecal coliform contamination. Some evidence exists that the city of Belle Fourche has a potentially large impact on fecal coliform loading.” We added statements further indicating that the sample size for bacteria source tracking was small so broad conclusions should be avoided. We stated that potential sources of fecal coliform contamination for non-storm runoff related samples could come from pets, waterfowl, and swallows occurring around bridges. The storm sewer system of the City of Belle Fourche was not mentioned because the samples were not collected during storm events. Given the small sample size of source tracking samples, data from agricultural bulletins should be more strongly considered in this case.

## 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., stream 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 TMDL technical analysis for Segment 1 of the Belle Fourche River describes how the fecal coliform loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

The South Dakota Department of Environment and Natural Resources (SD DENR) has collected fecal coliform bacteria samples at WQM 130 (460130) in Belle Fourche since 1999. Historical data collected from May 1 to September 30 (applicable dates for the fecal coliform water quality standards) from WQM 130 monitoring station were used in the TMDL technical analysis. Belle Fourche River flow data were available from U.S. Geological Survey (USGS) Station 06429000 located near the Highway 85 Bridge in the City of Belle Fourche.

The TMDLs were developed using the Load Duration Curve (LDC) approach, resulting in a flow-variable target that considers the entire flow regime within the recreational season (May 1st – September 30th). The LDC is a dynamic expression of the allowable load for any given day within the recreation season. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into five flow zones: high flows (0–10%), moist conditions (10–40%), mid-range flows (40–60%), dry conditions (60–90%), and low flows (90–100%) according to EPA’s LDC guidance.

Instantaneous bacteria loads were calculated by multiplying fecal coliform sample concentrations from ambient water quality site WQM 130, the USGS daily average flow and average daily discharge developed for watershed assessment monitoring site BF02 on the date of the sample and a unit conversion factor. The SD DENR water quality monitoring site, USGS flow gaging station and the Belle Fourche River assessment monitoring site BF02 are co-located near the Highway 85 Bridge in the City of Belle Fourche. The LDC shown in Figure 8 of the TMDL document represents a dynamic expression of the TMDL for Segment 1 of the Belle Fourche River that is based on the daily maximum and 30-day geometric mean fecal coliform criteria, resulting in unique loads that correspond to measured and simulated average daily flows.

When the instantaneous loads are plotted on the LDC, characteristics of the water quality impairment are shown. Instantaneous loads that plot above the curve are exceeding the TMDL, while those below the curve are in compliance. As the plot shows, the 95th percentile of fecal coliform samples collected from Segment 1 of the Belle Fourche River exceed the geometric mean criterion in the high, moist, moderate, dry and low flow conditions. Loads exceeding the criteria in the low flow zone typically indicate point source load contributions, while those further left on the plot generally reflect potential nonpoint source contributions.

**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 Belle Fourche River TMDL data description and summary are included text and tables throughout the document. The full data set is not included in the TMDL. SD DENR has collected fecal coliform bacteria samples at WQM 130 in Belle Fourche since 1999. Water quality monitoring during the fecal coliform season (May 1st to September 30th) from 1999 through 2008 showed that approximately 26 percent of samples collected on Belle Fourche River in Belle Fourche exceeded fecal coliform bacteria criteria. Across all sites, maximum concentrations ranged from 2 cfu/100mL up to 3,800 cfu/100mL. Fecal coliform sampling during the Belle Fourche River watershed assessment project in Belle Fourche similarly exceeded the fecal coliform criteria 43 percent of the time. Fecal coliform concentrations collected during the assessment project ranged from 10 cfu/100mL to 2,800 cfu/100mL. Fifty-six percent of the samples collected during the assessment that exceeded fecal coliform criteria were collected during runoff events. The data set also includes the flow record on Belle Fourche River that was used to create the load duration curves for the listed segment included in the TMDL document.

**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:** The City of Belle Fourche is located near the end of the impaired segment. The City of Belle Fourche uses a multiple lagoon municipal sewage treatment system located approximately 5 km below the end of the impaired segment. The wastewater discharge permit issued to the City of Belle Fourche is a “no discharge permit,” and in an emergency the discharge would flow into a man-made wetland. Therefore, the wasteload allocation 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:** Nonpoint sources of fecal coliform bacteria in Segment 1 of the Belle Fourche River come primarily from agricultural sources. 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. To develop the fecal coliform bacteria load allocation (LA), the loading capacity (LC) was first determined. The LC for the Belle Fourche River was calculated by multiplying the daily maximum fecal coliform bacteria criterion by the daily average flow measured at USGS gaging station 06429000 Belle Fourche River at Belle Fourche and assessment monitoring site BF02 in Belle Fourche. The more stringent geometric mean criterion (200 cfu/100ml) was used, rather than the daily maximum criterion



(400 CFU/100ml), because observed fecal coliform loads exceed the geometric mean criterion by flow zone. Table 5 includes the load allocations at each of the flow regimes – 1.00E+12 cfu/day at high flows; 2.69E+11 cfu/day during moist flows; 1.396E+11 cfu/day at midrange flows; 3.89E+10 cfu/day at dry flows and 2.01E+08 cfu/100mL at low flow conditions. The resulting LAs were allocated to the various nonpoint sources identified in the watershed.

**COMMENTS:** The text on page 21, second paragraph mentions allocating a portion of the LC to point sources as a WLA. However, as explained in the TMDL document the WLA is zero because Belle Fourche’s wastewater facility is located downstream of this segment. The wording on page 21 should be revised to remove reference to a WLA in this context.

**Comments Addressed:** The reference to a WLA was removed from the text in the above mentioned paragraph. We also stated earlier in the report that there are no point source discharges within the Segment 1 watershed. We left the description of the waste water facility in the document, however we explicitly state that this facility is located downstream of the listed segment.

#### 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 Belle Fourche River TMDL includes an explicit MOS derived by calculating 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. The explicit MOS values are included in Table 5 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 State's submittal includes a summary of the public participation process that has occurred which describes the ways the public has been given an opportunity to be involved in the TMDL development process so far. 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 has been available for a 30-day public notice period prior to finalization.

**COMMENTS:** The Public Participation section, the Follow-Up Monitoring section and the References section all include erroneous references to the Spring Creek TMDL. Also, the Implementation section mentions a litter control program for Hill City, SD and HSPF modeling results. HSPF modeling was not mentioned anywhere else in the document or in the previous draft versions of the Belle Fourche bacteria TMDL. Please correct those references so that they reflect the work done for the Belle Fourche River.

**Comments Addressed:** The Public Participation section was corrected to apply to the Belle Fourche River Segment 01 TMDL rather than the Spring Creek TMDL. The Follow-Up monitoring section was changed and reference to Spring Creek was removed. The References section was corrected and references pertaining to the Spring Creek TMDL were removed. And the Implementation section now reflects BMP's that address fecal loading due to cattle, based on agricultural bulletins cattle are the source for the majority of fecal loadings within the Section 1 watershed.

## 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](http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf)

Recommendation:

Approve  Partial Approval  Disapprove  Insufficient Information

**SUMMARY:** The impaired segment of Belle Fourche River will continue to be monitored through SD DENR's ambient water quality monitoring stations in the Belle Fourche River watershed. Stream water-quality monitoring will be accomplished through SD DENR's ambient water-quality monitoring stations which are sampled on a monthly basis during the recreational season. During the recreation season bacterial monitoring should be increased to collect at least 5 samples per month to assess the geometric mean criterion. Additional monitoring and evaluation efforts should be targeted toward designed BMPs to document the effectiveness of implemented BMPs. Post-implementation monitoring will be necessary to assure the TMDL has been reached and maintenance of the beneficial use occurs.

**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 says that a variety of BMPs could be considered in the development of a water-quality management implementation plan for the impaired segment of the Belle Fourche River watershed. Several types of control measures are available for reducing fecal coliform bacteria loads, and recommendations to address the identified sources are included in the TMDL document. It is recommended that an in-depth BMP scenario analysis be performed before developing a future BMP implementation plan. Funds to implement watershed water quality improvements can be obtained through the SD DENR.

**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 Belle Fourche River, Segment 1, fecal coliform TMDL includes daily loads expressed as colonies forming units (cfu) per day. The daily TMDL loads are included in TMDL Section of the document.

**COMMENTS:** None.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 8

1595 Wynkoop Street  
DENVER, CO 80202-1129  
Phone 800-227-8917  
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RECEIVED

OCT 24 2011

Ref: 8EPR-EP

OCT 17 2011

DEPT. OF ENVIRONMENT AND  
NATURAL RESOURCES,  
SECRETARY'S OFFICE

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


Re: TMDL Approvals  
*Belle Fourche River, Segment 1, Fecal Coliform;*  
*SD-BF-R-BELLE\_FOURCHE\_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  
Assistant Regional Administrator  
Office of Ecosystems Protection  
and Remediation

Enclosures



ENCLOSURE 1: APPROVED TMDLs

**Fecal Coiform Bacteria Total Maximum Daily Load (TMDL)  
for the Belle Fourche River, Segment 1, Butte County, South  
Dakota (June 2011)**

Submitted: 9/29/2011

- 1 Pollutant TMDLs completed.
- 1 Causes addressed from the 2010 303(d) list.
- 0 Determinations that no pollutant TMDL needed.

**Segment:** Belle Fourche River from the Woming border to the Redwater River (near Fruitdale, SD)

**303(d) ID:** SD-BF-R-BELLE FOURCHE 01

Parameter/Pollutant (303(d) list cause):	259 - FECAL COLIFORM	Water Quality <= 200 cfu/100mL 30-day geometric mean; <= 400 cfu/100mL single sample Targets: maximum			
	Allocation*	Value	Units		Permits
	WLA	0	CFU/DAY		
	MOS	2.33E+11	CFU/DAY		
	LA	2.69E+11	CFU/DAY		
	TMDL	5.02E+11	CFU/DAY		

**Notes:** The loads shown represent the loads during the moist flow regime as defined by the load duration curve for the Belle Fourche River, Segment 1 (see Figure 8 of the TMDL). The moist range 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

## EPA REGION VIII TMDL REVIEW

TMDL Document Info:

<b>Document Name:</b>	<b>Fecal Coliform Bacteria Total Maximum Daily Load (TMDL) for the Belle Fourche River, Segment 1, Butte County, South Dakota</b>
<b>Submitted by:</b>	<b>Rich Hanson, SD DENR</b>
<b>Date Received:</b>	<b>September 29, 2011</b>
<b>Review Date:</b>	<b>October 3, 2011</b>
<b>Reviewer:</b>	<b>Vern Berry, EPA</b>
<b>Rough Draft / Public Notice / Final?</b>	<b>Final</b>
<b>Notes:</b>	

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

- Approve  
 Partial Approval  
 Disapprove  
 Insufficient Information

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

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

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

Under Section 303(d) of the Clean Water Act, waterbodies that are not attaining one or more water quality standard (WQS) are considered "impaired." When the cause of the impairment is determined to be a pollutant, a



TMDL analysis is required to assess the appropriate maximum allowable pollutant loading rate. A TMDL document consists of a technical analysis conducted to: (1) assess the maximum pollutant loading rate that a waterbody is able to assimilate while maintaining water quality standards; and (2) allocate that assimilative capacity among the known sources of that pollutant. A well written TMDL document will describe a path forward that may be used by those who implement the TMDL recommendations to attain and maintain WQS.

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

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

## 1. Problem Description

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

### 1.1 TMDL Document Submittal Letter

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

Minimum Submission Requirements.

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

Recommendation:

Approve  Partial Approval  Disapprove  Insufficient Information

**SUMMARY:** The Belle Fourche River, Segment 1, fecal coliform TMDL was submitted to EPA for review and approval via an email from Rich Hanson, SD DENR on September 29, 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:** The Belle Fourche River is a natural stream that originates in Wyoming and drains parts of Butte, Lawrence and Meade Counties in South Dakota. The Belle Fourche River is part of the larger Cheyenne River basin in the Lower Belle Fourche sub-basin (HUC 10120202). The impaired segment of the Belle Fourche River begins at the Wyoming/South Dakota border and ends at the confluence with the Redwater River near Belle Fourche, South Dakota (26.8 miles; SD-BF-R-BELLE\_FOURCHE\_01), and is listed as a high priority for TMDL development.

This segment is identified on the 2010 South Dakota 303(d) waterbody list as impaired due to elevated fecal coliform and total suspended solids (TSS) concentrations. The TSS impairment was addressed in a separate TMDL document developed by SD DENR and approved by EPA in February 2005.

The designated uses for Segment 1 of the Belle Fourche River include: warmwater permanent fish life propagation waters, immersion recreation waters, limited-contact recreation waters, irrigation waters, fish and wildlife propagation, recreation, and stock watering.

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 Belle Fourche River, Segment 1, is listed as impaired based on fecal coliform concentrations that are impairing the limited contact recreation beneficial uses. South Dakota has applicable numeric standards for fecal coliform that may be applied to this stream. The fecal coliform numeric standards being implemented in this TMDL are: a daily maximum value of 400 cfu/100mL in any one sample, and a maximum geometric mean of 200 cfu/100mL during a 30-day period. The standards for fecal coliform are applicable from May 1 to September 30. Discussion of additional applicable water quality standards for Belle Fourche River can be found on pages 7 – 9 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 targets for this TMDL are based on the numeric water quality standards for fecal coliform to protect the limited contact recreation beneficial uses the impaired segment of the Belle Fourche River. The fecal coliform targets are: daily maximum of  $\leq 400$  cfu/100mL in any one sample, and maximum geometric mean of  $\leq 200$  cfu/100mL during a 30-day period. The fecal coliform standards are applicable from May 1 to September 30.

**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 uses in the watershed as predominately agriculture in the form of rangeland (91 percent), cropland (6.5 percent), and a small percent of urban, forest and barren.

The City of Belle Fourche is located near the end of the impaired segment. The City of Belle Fourche uses a multiple lagoon municipal sewage treatment system located approximately 5 km below the end of the impaired segment. The wastewater discharge permit issued to the City of Belle Fourche is a “no discharge permit,” and in an emergency the discharge would flow into a man-made wetland. Therefore, the wasteload allocation for this TMDL is zero.

A small percent (approximately 1.2%) of the drainage area is impervious area, primarily located in the City of Belle Fourche. However, rural ranch areas located along the Belle Fourche River upstream of the City of Belle Fourche may also contribute to fecal coliform runoff to the Belle Fourche River during storm events. Several water quality samples taken from storm drains during storm events which indicated a potential increase in fecal coliform bacteria in the Belle Fourche River downstream of Belle Fourche.

Manure from livestock is a potential source of fecal coliform to the stream. Livestock in the basin are mainly beef cattle with sheep being the next abundant animals in the study area. Other livestock in the basin include dairy

cattle, hogs, horses and chickens. Numbers of animals on private land were estimated through personal communication with landowners and agricultural statistics in the watershed.

Within the drainage area of the impaired segment, there are an estimated 44 septic systems that are mostly located near tributaries to the Belle Fourche River. Septic systems located near drainages in the study area provide potential sources of human fecal coliform to the impaired segment of the Belle Fourche River.

Wildlife within the watershed is a natural source of fecal coliform bacteria in the study area. County wildlife assessments provided the best available estimate of wildlife population densities. The wildlife assessment for Butte County was obtained from the South Dakota Department of Game, Fish and Parks. SD GF&P population estimates included counts of whitetail deer, mule deer, elk, antelope and turkey.

Based on review of available information and communication with local land owners and representatives from Belle Fourche, the primary nonpoint sources of fecal coliform within the impaired reach of the Belle Fourche River include agricultural and urban runoff, as well as wildlife and human sources. Table 2, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. The main source of fecal coliform bacteria is likely overland runoff from livestock grazing in pastures.

**Table 2. Fecal Source Allocation to Belle Fourche River Segment 1.**

Source	Percentage
Feedlots	2%
Livestock on Grass	97.70%
Wildlife	<0.1%

During the assessment three sampling events were analyzed for bacterial genetic fingerprinting (i.e., bacterial source tracking). Based on these results, it appears that human sources of fecal coliform bacteria are not a major portion of the fecal coliform load in the Belle Fourche River. However, because of the small sample size, the results do not mean that there is no loading of fecal coliform bacteria from either human or cattle sources. Possible sources of fecal contamination, from the samples tested for source tracking, may come from domestic animals (pets) from the city of Belle Fourche as well as waterfowl and other avian life such as swallows occurring around bridges. Based on South Dakota agricultural bulletins, cattle make up the majority of the fecal source loading within the watershed. This data should be considered over bacteria source tracking in this case due to the small sample size of source tracking samples.

**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., stream 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 TMDL technical analysis for Segment 1 of the Belle Fourche River describes how the fecal coliform loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

The South Dakota Department of Environment and Natural Resources (SD DENR) has collected fecal coliform bacteria samples at WQM 130 (460130) in Belle Fourche since 1999. Historical data collected from May 1 to September 30 (applicable dates for the fecal coliform water quality standards) from WQM 130 monitoring station were used in the TMDL technical analysis. Belle Fourche River flow data were available from U.S. Geological Survey (USGS) Station 06429000 located near the Highway 85 Bridge in the City of Belle Fourche.

The TMDLs were developed using the Load Duration Curve (LDC) approach, resulting in a flow-variable target that considers the entire flow regime within the recreational season (May 1st – September 30th). The LDC is a dynamic expression of the allowable load for any given day within the recreation season. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into five flow zones: high flows (0–10%), moist conditions (10–40%), mid-range flows (40–60%), dry conditions (60–90%), and low flows (90–100%) according to EPA's LDC guidance.

Instantaneous bacteria loads were calculated by multiplying fecal coliform sample concentrations from ambient water quality site WQM 130, the USGS daily average flow and average daily discharge developed for watershed assessment monitoring site BF02 on the date of the sample and a unit conversion factor. The SD DENR water quality monitoring site, USGS flow gaging station and the Belle Fourche River assessment monitoring site BF02 are co-located near the Highway 85 Bridge in the City of Belle Fourche. The LDC shown in Figure 8 of the TMDL document represents a dynamic expression of the TMDL for Segment 1 of the Belle Fourche River that is based on the daily maximum and 30-day geometric mean fecal coliform criteria, resulting in unique loads that correspond to measured and simulated average daily flows.

When the instantaneous loads are plotted on the LDC, characteristics of the water quality impairment are shown. Instantaneous loads that plot above the curve are exceeding the TMDL, while those below the curve are in compliance. As the plot shows, the 95th percentile of fecal coliform samples collected from Segment 1 of the Belle Fourche River exceed the geometric mean criterion in the high, moist, moderate, dry and low flow conditions. Loads exceeding the criteria in the low flow zone typically indicate point source load contributions, while those further left on the plot generally reflect potential nonpoint source contributions.



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 Belle Fourche River TMDL data description and summary are included text and tables throughout the document. The full data set is not included in the TMDL. SD DENR has collected fecal coliform bacteria samples at WQM 130 in Belle Fourche since 1999. Water quality monitoring during the fecal coliform season (May 1st to September 30th) from 1999 through 2008 showed that approximately 26 percent of samples collected on Belle Fourche River in Belle Fourche exceeded fecal coliform bacteria criteria. Across all sites, maximum concentrations ranged from 2 cfu/100mL up to 3,800 cfu/100mL. Fecal coliform sampling during the Belle Fourche River watershed assessment project in Belle Fourche similarly exceeded the fecal coliform criteria 43 percent of the time. Fecal coliform concentrations collected during the assessment project ranged from 10 cfu/100mL to 2,800 cfu/100mL. Fifty-six percent of the samples collected during the assessment that exceeded fecal coliform criteria were collected during runoff events. The data set also includes the flow record on Belle Fourche River that was used to create the load duration curves for the listed segment included in the TMDL document.

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:** The City of Belle Fourche is located near the end of the impaired segment. The City of Belle Fourche uses a multiple lagoon municipal sewage treatment system located approximately 5 km below the end of the impaired segment. The wastewater discharge permit issued to the City of Belle Fourche is a “no discharge permit,” and in an emergency the discharge would flow into a man-made wetland. Therefore, the wasteload allocation 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:** Nonpoint sources of fecal coliform bacteria in Segment 1 of the Belle Fourche River come primarily from agricultural sources. 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. To develop the fecal coliform bacteria load allocation (LA), the loading capacity (LC) was first determined. The LC for the Belle Fourche River was calculated by multiplying the daily maximum fecal coliform bacteria criterion by the daily

average flow measured at USGS gaging station 06429000, Belle Fourche River at Belle Fourche, and assessment monitoring site BF02 in Belle Fourche. The more stringent geometric mean criterion (200 cfu/100ml) was used, rather than the daily maximum criterion (400 cfu/100ml), because observed fecal coliform loads exceed the geometric mean criterion by flow zone. Table 6 includes the load allocations at each of the flow regimes – 1.00E+12 cfu/day at high flows; 2.69E+11 cfu/day during moist flows; 1.396E+11 cfu/day at midrange flows; 3.89E+10 cfu/day at dry flows and 2.01E+08 cfu/100mL at low flow conditions. The resulting LAs were allocated to the various nonpoint sources identified in the watershed.

**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 an 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 Belle Fourche River TMDL includes an explicit MOS derived by calculating 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. The explicit MOS values are included in Table 6 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 stream 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 State's submittal includes a summary of the public participation process that has occurred which describes the ways the public has been given an opportunity to be involved in the TMDL development process so far. 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 has been 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](http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.pdf)

Recommendation:

- Approve    Partial Approval    Disapprove    Insufficient Information

**SUMMARY:** The impaired segment of Belle Fourche River will continue to be monitored at SD DENR WQM sites 460130 and 460683, which will provide data for the upper reach of the river. Five other sites on the Belle Fourche River downstream of Segment 1 and one on Redwater Creek may also provide data to help judge the effectiveness of implementation activities. The US Geological Survey also has five sites within the Belle Fourche watershed that may provide additional water quality data.

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

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 says that a variety of BMPs could be considered in the development of a water-quality management implementation plan for the impaired segment of the Belle Fourche River. Several types of control measures are available for reducing fecal coliform bacteria loads, and recommendations to address the identified sources are included in the TMDL document. It is recommended that an in-depth BMP scenario analysis be performed before developing a future BMP implementation plan. Funds to implement watershed water quality improvements can be obtained through the SD DENR.

**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 Belle Fourche River, Segment 1, fecal coliform TMDL includes daily loads expressed as colonies forming units (cfu) per day. The daily TMDL loads are included in TMDL Section of the document.

**COMMENTS:** None.