Escherichia coli BACTERIA TOTAL MAXIMUM DAILY LOAD EVALUATIONS FOR THE NORTH AND SOUTH FORKS OF THE YELLOW BANK RIVER-GRANT, CODINGTON AND DEUEL COUNTIES, SOUTH DAKOTA

SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

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North Fork Yellow Bank River Total Maximum Daily Load

Entity ID's:	SD-MN-R-YELLOW_BANK_N_FORK_01
Location:	HUC Code: 07020001
Size of Watershed:	143,676 acres
Water body Type:	River/Stream
303(d) Listing Parameter:	*E. coli* Bacteria
Initial Listing date:	2012 IR
TMDL Priority Ranking:	1
Listed Stream Miles:	SD/MN border to S27,T120N, R48W
Designated Use of Concern:	Limited Contact Recreation
Analytical Approach:	Load Duration Curve Framework
Target:	Meet applicable water quality standards for South Dakota 74:51:01:51 and Minnesota-Class 2 waters.
Indicators:	*E. coli* Bacteria, Colony Forming Units (CFU)
Threshold Value:	$\leq$ 126 *E. coli* CFU/100 ml geometric mean concentration with maximum single sample concentrations of $\leq$ 1,178 *E. coli* CFU/100 ml
High Flow Zone LA:	1.8×10^{12} *E. coli* CFU/day
High Flow Zone WLA:	0
High Flow Zone MOS:	3.6×10^{11} *E. coli* CFU/ day
High Flow Zone TMDL:	2.2×10^{12} *E. col* CFU/ day

Total Maximum Daily Load Summary Table

South Fork Yellow Bank River Total Maximum Daily Load

***Entity ID's*:**	SD-MN-R-YELLOW_BANK_S_FORK_01
Location:	HUC Code: 07020001
Size of Watershed:	103,451 acres
Water body Type:	River/Stream
303(d) Listing Parameter:	*E. coli* Bacteria
Initial Listing date:	2012 IR
TMDL Priority Ranking:	1
Listed Stream Miles:	SD/MN border to S33, T118N, R49W
Designated Use of Concern:	Limited Contact Recreation
Analytical Approach:	Load Duration Curve Framework
Target:	Meet applicable water quality standards for South Dakota 74:51:01:51 and Minnesota-Class 2 waters.
Indicators:	*E. coli* Bacteria, Colony Forming Units (CFU)
Threshold Value:	$\leq$ 126 *E. coli* CFU/100 ml geometric mean concentration with maximum single sample concentrations of $\leq$ 1,178 *E. coli* CFU/100 ml
High Flow Zone LA:	1.5×10^{12} *E. coli* CFU/day
High Flow Zone WLA:	0
High Flow Zone MOS:	1.7×10^{11} *E. coli CFU*/day
High Flow Zone TMDL:	1.7×10^{12} *E. coli* CFU/day

1.0 Introduction

The intent of this document is to clearly identify the components of the TMDLs submitted to support adequate public participation and facilitate the United States Environmental Protection Agency (EPA) review and approval. These TMDLs were developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by EPA. This TMDL document addresses the *Escherichia coli* (*E. coli*) bacteria impairments of the classified segments of the North and South Forks of the Yellow Bank River. The impaired segments are identified as SD-MN-R-Yellow_Bank_N_Fork_01 and SD-MN-R-Yellow_Bank_S_Fork_01 in the 303(d) list of impaired waterbodies in South Dakota's 2016 Integrated Report (IR) for Surface Water Quality.

1.1 Watershed Characteristics

The North and South Forks of the Yellow Bank River drain the eastern flank of the Choteau des Prairies upland in Grant, Deuel and Codington Counties in northeastern South Dakota. Both systems flow into Minnesota where they merge to form the Yellow Bank River approximately 8 miles downstream of the South Dakota border. The Yellow Bank River, Whetstone River and outflow from Big Stone Lake constitute the headwaters of the Minnesota River.

The combined drainage area of the North and South Forks of the Yellow Bank River, in South Dakota, is approximately 274,000 acres. The individual North Fork and South Fork watersheds encompass approximately 143,676 acres and 103,451 acres, respectively. Land use in the combined watersheds is primarily agriculture. The headwaters of both systems originate along the Choteau des Prairies escarpment which is dominated by rangeland/pasture and grasslands with several wooded draws. The eastern portion of the watershed is a relatively flat valley dominated by row crops, in particular, corn and soy beans with some small grains and alfalfa. Numerous animal feeding areas are located within the watershed, although the trend is toward fewer operations with higher numbers of animals.

Hydrology of the North and South Fork can be variable due to the exceptional high relief along the Coteau des Prairies escarpment. Elevation changes in excess of 1,000 feet take place across the length of the watershed, much of which occurs within the initial third of the river system. The headwaters of most tributary streams begin at elevations over 2,000 feet above mean sea level, dropping to an elevation of roughly 960 feet where the rivers enter the Minnesota River. This elevation change takes place over as little as 30 miles.

The average annual precipitation in the watershed area is 22 inches, of which 75% typically falls April through September. Tornadoes and severe thunderstorms strike occasionally. These storms are often of local extent and duration, and occasionally produce heavy rainfall events. The average seasonal snowfall is 30 inches per year.

The surficial character of the watershed can be divided into four parts. The southwestern and northeastern edges of the watershed are dominated by poorly drained, depressions. These areas mark the location of ice-marginal deposits left behind during the last ice age. The northeast flank of the Coteau des Prairies is a well-drained area, with substantial relief. Many small tributary streams cross the area from the southwest to the northeast. The central part of the watershed is characterized by moderately well drained, low relief terrain sloping gently toward the northeast. In all three cases, the land surface is underlain by glacial till. Finally, the valleys of the Yellow Bank Forks are deeply incised into the land surface. Glacial outwash is found along these valleys. Shallow wells in the saturated sand and gravel (aquifer) are the drinking water source for some private wells. Discharge from the aquifer may also help maintain river levels during dry periods.

Soils within the study area are derived from a variety of parent materials. Uplands soils are relatively fine-grained, and have developed over glacial till, often with a thin loess (wind-blown silt) cover. Coarse-grained soils are found around the valley bottoms of the river and major tributaries, and are derived from glacial outwash or alluvial sediments.

A few small communities reside within the North and South Fork Yellow Bank watersheds. The population of these communities ranges anywhere from 300 to 10 people. Figure 1 depicts the location of the North and South Fork Yellow Bank watersheds with respect to location in South Dakota. Figure 2 depicts the individual North and South Fork Yellow Bank River watersheds with defined, county boundaries, roads, towns, tributaries, impaired segments (red) and monitoring stations.

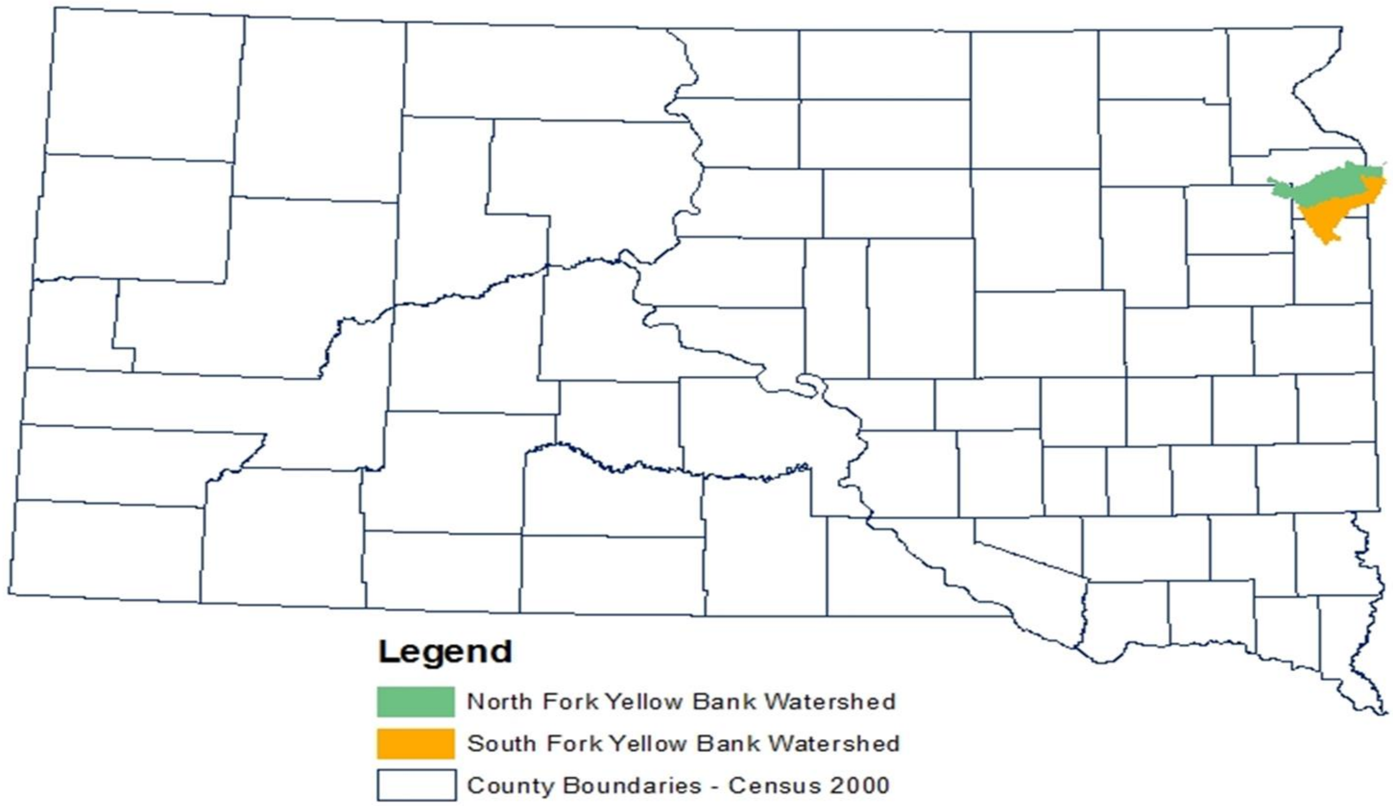

Figure 1. Location of the North and South Fork Yellow Bank River Watersheds in South Dakota.

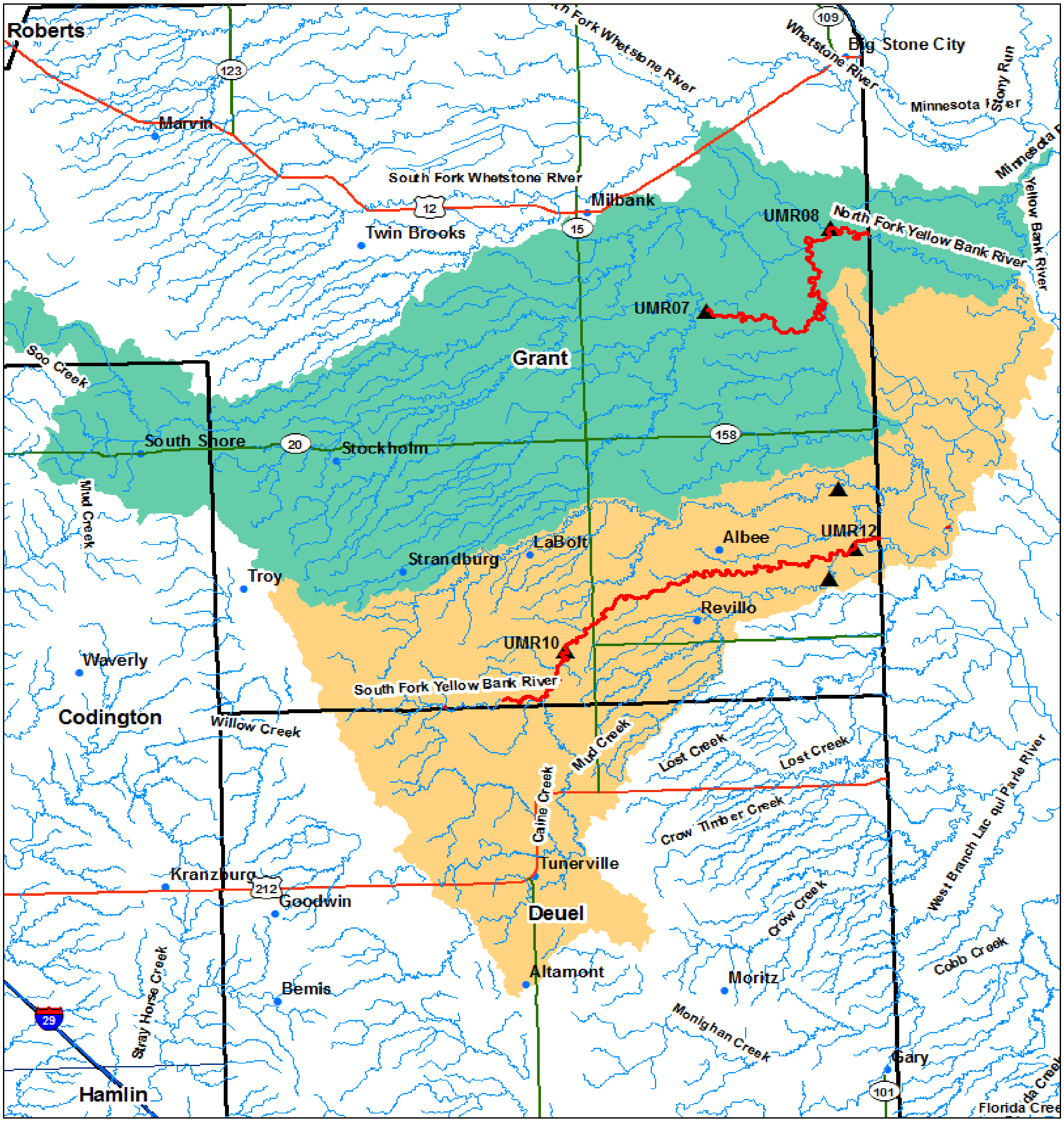

Figure 2. Watershed for the North and South Forks of the Yellow Bank River including locations of impaired segments (red) and monitoring stations.

2.0 Water Quality Standards

Waterbodies in South Dakota are assigned beneficial uses. All waters (lakes and streams) are designated the use of fish and wildlife propagation, recreation and stock watering (9). All streams are assigned the use of irrigation (10). Additional beneficial use designations may be assigned by the state based on a use attainability assessment of each waterbody. Water quality standard criteria have been defined in South Dakota state statutes in support of all beneficial uses. The standards consist of suites of numeric criteria that provide physical and chemical benchmarks from which support determinations and impairment decisions can be determined.

The geometric mean is based on a minimum of 5 samples collected during separate 24-hour periods over a 30-day period. While not explicitly described within the state's water quality standards, geometric means are applied to a calendar month. This method is documented in the listing methodology of South Dakota's most recent (2016) Integrated Report (IR) for Surface Water Quality and is used in permit development.

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

The impaired segment of the North Fork Yellow Bank River has been assigned the following beneficial use designations: warmwater permanent fish life propagation (4), limited contact recreation (8), fish and wildlife propagation, recreation, and stock watering (9), and irrigation (10). The impaired segment of the South Fork Yellow Bank River has been assigned the following beneficial use designations: coldwater marginal fish life propagation (3), limited contact recreation (8), fish and wildlife propagation, recreation, and stock watering (9), and irrigation (10). Tables 1 and 2 display the water quality standard criteria assigned to protect the designated beneficial uses of the North Fork and South Fork Yellow Bank Rivers, respectively. When multiple criteria exist for a particular parameter, the most stringent criterion is used.

Beneficial use support determinations are based on methodologies described in South Dakota's IR (DENR, 2016). Stream water quality data for conventional parameters, such as bacteria, are evaluated based on a 10% exceedance rate of the water quality standard. During the 2016 reporting cycle, greater than 10% of the applicable *E. coli* data for segment SD-MN-R-Yellow_Bank_N_Fork_01 and SD-MN-R-Yellow_Bank_S_Fork_01 exceeded the single sample maximum (1,178/100mL) and geometric mean (630/100mL) standards. Both segments were considered not supporting the limited contact recreation use and placed on the 303(d) list of impaired waters, requiring *E. coli* TMDLs. Implementing these TMDLs for both impaired segments will result in compliance of the *E. coli* standards in accordance with South Dakota's 303(d) listing methods.

Table 1. Designated beneficial use and associated state water quality standards for the classified segment of the North Fork Yellow Bank River (SD-MN-R_Yellow_Bank_N_Fork_01).

Parameters	Criteria	Unit of Measure	Beneficial Use Requiring this Standard
Total ammonia nitrogen as N	Equal to or less than the result from Equation 3 in Appendix A of Surface Water Quality Standards	mg/L 30 average March 1 to October 31	Warmwater Permanent Fish Propagation
	Equal to or less than the result from Equation 4 in Appendix A of Surface Water Quality Standards	mg/L 30 average November 1 to February 29	
	Equal to or less than the result from Equation 2 in Appendix A of Surface Water Quality Standards	mg/L Daily Maximum	
Dissolved Oxygen	≥5.0	mg/L	Limited Contact Recreation
Total Suspended Solids	≤90 (30-day average) ≤158 (single sample)	mg/L	Warmwater Permanent Fish Propagation
Temperature	≤26.6	°C	Warmwater Permanent Fish Propagation
Escherichia coli Bacteria (May 1- Sept 30)	≤630 (geometric mean) ≤1178 (single sample)	count/100 mL	Limited Contact Recreation
Alkalinity ($CaCO_3$)	≤750 (mean) ≤1,313 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation and Stock Watering
Conductivity	≤2,500 (mean) ≤4,375 (single sample)	µmhos/cm @ 25° C	Irrigation Waters
Nitrogen, nitrate as N	≤50 (mean) ≤88 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation and Stock Watering
pH (standard units)	≥6.5 to ≤9.0	units	Warmwater Permanent Fish Propagation
Solids, total dissolved	≤2,500 (mean) ≤4,375 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation and Stock Watering
Total Petroleum Hydrocarbon Oil and Grease	≤10	mg/L	Fish and Wildlife Propagation, Recreation and Stock Watering
Sodium Adsorption Ratio	<10	ratio	Irrigation Waters

Table 2. Designated beneficial use and associated state water quality standards for the classified segment of the South Fork Yellow Bank River (SD-MN-R_Yellow_Bank_S_Fork_01).

Parameters	Criteria	Unit of Measure	Beneficial Use Requiring this Standard
Total ammonia nitrogen as N	Equal to or less than the result from Equation 3 in Appendix A of Surface Water Quality Standards	mg/L 30-day average	Coldwater Marginal Fish Propagation
	Equal to or less than the result from Equation 1 in Appendix A of Surface Water Quality Standards	mg/L Daily Maximum	
Dissolved Oxygen	≥5.0	mg/L	Limited Contact Recreation
Total Suspended Solids	≤90 (mean) ≤158 (single sample)	mg/L	Coldwater Marginal Fish Propagation
Temperature	≤23.9	°C	Coldwater Marginal Fish Propagation
Escherichia coli Bacteria (May 1- Sept 30)	≤630 (geometric mean) ≤1178 (single sample)	count/100 mL	Limited Contact Recreation
Alkalinity ($CaCO_3$)	≤750 (mean) ≤1,313 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation and Stock Watering
Conductivity	≤2,500 (mean) ≤4,375 (single sample)	µmhos/cm @ 25° C	Irrigation Waters
Nitrogen, nitrate as N	≤50 (mean) ≤88 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation and Stock Watering
pH (standard units)	≥6.5 to ≤9.0	units	Coldwater Marginal Fish Propagation
Solids, total dissolved	≤2,500 (mean) ≤4,375 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation and Stock Watering
Total Petroleum Hydrocarbon Oil and Grease	≤10	mg/L	Fish and Wildlife Propagation, Recreation and Stock Watering
Sodium Adsorption Ratio	<10	ratio	Irrigation Waters

Minnesota designates the North Fork and South Fork Yellow Bank Rivers as Class 2 waters. The single sample maximum *E. coli* water quality standard for Class 2 waters is 1,260 counts/100ml and the geometric mean standard is 126 counts/100ml. To protect the downstream uses of the North Fork and South Fork Yellow Bank Rivers the TMDL targets for both impaired segments in South Dakota will be based on Minnesota's geometric mean *E. coli* threshold for Class 2 waters. Minnesota's bacteria standards are applicable from April 1 through October 31. Implementing the TMDLs for both impaired segments will result in compliance of both states *E. coli* standards in accordance with 303(d) listing methods. MN's 303(d) listing methods document is available at the following web link: https://www.pca.state.mn.us/sites/default/files/wq-iw1-04j.pdf. The *E.coli* standards for both MN and SD are expressed as a count/100ml. Laboratory results for *E. coli* and fecal coliform were expressed as Most Probable Number (MPN) and Colony Forming Units (CFU), respectively. Both units are considered equivalent and representative of the number or count of bacteria/100mL. To standardize, all bacteria data and the TMDLs are expressed as CFUs.

3.0 Significant Sources

3.1 Point Sources

No point source discharges *E. coli* bacteria directly to the impaired segments of the North Fork and South Fork Yellow Bank River in South Dakota, however, there are several National Pollutant Discharge Elimination Permits (NPDES) for point sources that may indirectly contribute to the impaired segments via tributary loading. These indirect point sources were investigated further for their potential impact and WLA consideration. Several small communities and concentrated animal feeding operations (CAFOs) are present within the North Fork and South Fork Yellow Bank watersheds. These potential sources of *E. coli* bacteria are documented here to provide a watershed scale account of the entities operational characteristics (discharge permits etc.) and potential impact to the impaired segments, including downstream water quality in Minnesota.

There are four permitted CAFOs within the North Fork watershed and one permitted CAFO in the South Fork watershed (Table 3). All CAFO's are required to maintain compliance with provisions of the SD Water Pollution Control Act (SDCL 34A-2). SDCL 34A-2-36.2 requires each concentrated animal feeding operation, as defined by Title 40 Codified Federal Regulations Part 122.23 dated January 1, 2007, to operate under a general or individual water pollution control permit issued pursuant to § 34A-2-36. The general permit ensures that all CAFOs in SD have permit coverage regardless if they meet conditions for coverage under a NPDES permit. All five operations are covered under the 2003 *General Water Pollution Control Permit for Concentrated Animal Feeding Operations*, which requires housed lots to have no discharge of solid or liquid manure to waters of the state, and allows open lots to only have a discharge of manure or process wastewater from properly designed, constructed, operated and maintained manure management systems in the event of 25-year, 24-hour or 100-year, 24-hour storm event if they meet the permit conditions.

The general permit was reissued and became effective on April 15, 2017. All CAFOs with coverage under the 2003 general permit have a deadline to apply for coverage under the 2017 general permit. The 2017 general permit allows no discharge of manure or process wastewater from operations with state permit coverage or NPDES permit coverage for new source swine, poultry, and veal operations, and other housed lots with covered manure containment systems. Operations also have the option to apply for a state issued NPDES permit. Operations covered by the 2017 general permit or NPDES permit for open or housed lots with uncovered manure containment systems can only discharge manure or process wastewater from properly designed, constructed, operated and maintained manure management systems in the event of 25-year, 24-hour storm event if they meet the permit conditions.

Both the 2003 and 2017 general permits have nutrient management planning requirements based on EPA's regulations and the South Dakota Natural Resources Conservation Services 590 Nutrient Management Technical Standard to ensure the nutrients are applied at agronomic rates with management practices to minimize the runoff of nutrients. Additionally, the general permits include design standards, operation, maintenance, inspection, record keeping, and reporting requirements. For more information about South Dakota's CAFO requirements and general permits visit: http://denr.sd.gov/des/fp/cafo.aspx.

As long as these facilities comply with the general CAFO permit requirements ensuring their discharges are unlikely and indirect loading events, the TMDL assumes their *E. coli* contribution is minimal, and unless found otherwise, no additional permit conditions are required by this TMDL.

Table 3. Description of CAFOs within the South Fork and North Fork Yellow Bank Watersheds.

Name of Facility	Type of Operation	SD general Permit #
*Alban Dairy	Dairy (housed lot)	SDG-0100032
*Granite View Farms	Beef Cattle (open lot)	SDG-0100271
*Mill Valley Dairy	Dairy (housed lot)	SDG-0100314
*Victory Farms	Dairy (housed and open lot)	SDG-0100008
**Victory Farms South	Dairy (housed lot)	SDG-0100500

*Located in North Fork Watershed
**Located in South Fork Watershed

There are three small communities within the North Fork Yellow Bank River watershed (Figure 2). Communities in the North Fork watershed utilize retention pond systems as a mechanism to treat municipal wastewater. All facilities are regulated by NPDES/Surface Water Discharge permits that require no discharge unless in an emergency (Table 4). All communities in the North Fork Yellow Bank are in the headwaters of the watershed ranging from 20 to 30 linear kilometers from the upstream end of the impaired segment.

There are four small communities within the South Fork Yellow Bank River watershed (Figure 2). The communities of Altamont and Albee are too small to warrant a centralized collection system, therefore, residents are serviced exclusively by individual septic systems. The two remaining communities have central collection systems (pond systems) and are required to have NPDES permits (Table 4). The town of Labolt is the only community in the South Fork Yellow Bank watershed authorized to discharge wastewater under an NPDES permit.

Table 4. Wastewater discharge status of all communities in the North and South Fork Yellow bank River watershed.

Watershed	Community	Population	NPDES ID	Discharge Status
North Fork Yellow Bank	South Shore	270	SDG821725	no discharge
North Fork Yellow Bank	Stockholm	105	SDG824830	no discharge
North Fork Yellow Bank	Strandburg	69	SDG827723	no discharge
South Fork Yellow Bank	Altamont	34	N/A	Septic systems
South Fork Yellow Bank	Albee	10	N/A	Septic systems
South Fork Yellow Bank	Revillo	147	SDG820478	no discharge
South Fork Yellow Bank	**LaBolt**	**76**	**SD0026662**	**Intermittent discharge**

Wastewater discharge from the town of Labolt does not flow into the impaired segment of the South Fork Yellow Bank River in South Dakota. Rather, it flows to an unnamed tributary (9,10) of the South Fork Yellow Bank River approximately 21 kilometers upstream of the Minnesota border. Wastewater discharge from Labolt's pond system is intermittent and only permitted to occur twice annually, generally in the spring and fall outside the peak recreation season, when necessary. Actual discharge events are generally less than a week in duration and have occurred only five times in the last ten years. The LaBolt pond system provides a mechanism to reduce *E. coli* bacteria. Bacteria in the ponds are not likely viable for long periods due to extended retention time and resultant exposure to the sun's ultraviolet light. Any minor bacterial discharge from LaBolt's pond system will be degraded before it reaches the Class 2 segment of the Yellow Bank River in Minnesota.

No point source discharges *E. coli* bacteria directly to the impaired segments of the North Fork and South Fork Yellow Bank River. Point sources with a potential to indirectly contribute via tributary loading, such as CAFOs and community wastewater systems, have been reviewed here and found to rarely discharge or be covered by protective NPDES permit requirements. Therefore, a WLA of zero was given to both TMDLs. Meeting the intent of this WLA will be judged by compliance with existing permit conditions. All *E.coli* sources associated with the impaired segments are attributed to nonpoint sources.

3.2 Nonpoint Sources

Nonpoint sources of E. coli bacteria in the North and South Fork Yellow Bank River watersheds are attributed primarily to agricultural sources. Due to a lack of literature values for E. coli production of many livestock and wildlife species, source loading calculations were based on fecal coliform. The basis for using fecal coliform as a surrogate for E. coli is further described in Section 4.3. Data from the National Agricultural Statistic Survey (NASS) and from the most recent South Dakota Game Fish and Parks County Wildlife Assessment were used to estimate livestock and wildlife densities, respectively (USDA, 2012, Huxoll, 2002). Animal density information was used to estimate relative source contributions of bacteria loads for the North and South Fork Yellow Bank River watersheds (Tables 5 and 6). Production of bacteria in the North and South Fork Yellow Bank River watersheds is estimated at 1.33E+10 and 1.62E+09 colony forming units/acre/day, respectively.

Over 90% of the North Fork Yellow Bank Watershed resides in Grant County. Therefore, animal density estimates were based exclusively on the NASS estimates from Grant County. The total numbers of animals in Grant County were divided proportiona1 to the number of acres in the watershed. The same procedure was also used for human and wildlife.

Table 5. North Fork Yellow Bank watershed *E. coli* sources.

Species	#/acre	Bacteria /Animal/Day	Bacteria/Acre	Percent
Dairy cow3	2.05E-02	1.01E+11	2.07E+09	15.7%
Beef3	1.04E-01	2.08E+11	1.09E+10	82.2%
Hog3	7.14E-03	1.08E+10	7.71E+07	0.6%
Sheep3	6.09E-03	1.20E+10	7.30E+07	0.6%
Horse3	1.11E-03	4.20E+08	4.66E+05	0.004%
All Wildlife	**Sum of all wildlife**		9.89E+07	0.7%
Human3	1.68E-02	2.00E+09	3.37E+07	0.3%
Turkey (Wild)2	1.83E-03	9.30E+07	1.70E+05	
Goose3	1.60E-03	4.90E+10	7.85E+07	
Deer3	6.18E-03	5.00E+08	3.09E+06	
Beaver3	9.16E-04	2.50E+08	2.29E+05	
Raccoon3	9.16E-03	1.25E+08	1.14E+06	
Coyote/Fox4	1.60E-03	4.09E+09	6.55E+06	
Muskrat2	2.29E-02	1.25E+08	2.86E+06	
Opossom5	1.83E-04	1.25E+08	2.29E+04	
Mink5	1.14E-03	1.25E+08	1.43E+05	
Skunk5	3.66E-03	1.25E+08	4.58E+05	
Badger5	7.78E-04	1.25E+08	9.73E+04	
Jackrabbit5	3.43E-03	1.25E+08	4.29E+05	
Cottontail5	2.06E-02	1.25E+08	2.58E+06	
Squirrel5	2.06E-02	1.25E+08	2.58E+06	

2 USEPA 2001

3 Bacteria Indicator Tool Worksheet

4 Best Professional Judgment based off of Dogs

5 FC/Animal/Day copied from Raccoon to provide a more conservative estimate of background effects of wildlife

Approximately 60% and 40% of the South Fork Yellow Bank Watershed resides in Grant and Deuel counties, respectively. Animal density estimates were based exclusively on the NASS estimates for these counties. The total numbers of animals in each county were divided proportiona1 to the number of acres in the watershed. The same procedures were also used for human and wildlife.

Table 6. South Fork Yellow Bank watershed *E. coli* sources

Species	#/acre	Bacteria/Animal/Day	Bacteria/Acre	Percent
Dairy cow3	2.19E-03	1.01E+11	2.21E+08	13.8%
Beef3	1.29E-02	1.04E+11	1.34E+09	83.6%
Hog3	4.47E-04	1.08E+10	4.83E+06	0.3%
Sheep3	9.47E-04	1.20E+10	1.14E+07	0.7%
Horse3	1.65E-04	4.20E+08	6.92E+04	0.004%
All Wildlife	**Sum of all wildlife**		2.18E+07	1.4%
Human3	1.682E-03	2.00E+09	3.36E+06	0.2%
Turkey (Wild)2	1.36E-04	9.30E+07	1.27E+04	
Goose3	3.88E-04	4.90E+10	1.90E+07	
Deer3	8.47E-04	5.00E+08	4.23E+05	
Beaver3	8.61E-05	2.50E+08	2.15E+04	
Raccoon3	9.33E-04	1.25E+08	1.17E+05	
Coyote/Fox4	3.09E-04	4.09E+09	1.26E+06	
Muskrat2	1.61E-03	1.25E+08	2.01E+05	
Opossom5	1.87E-05	1.25E+08	2.33E+03	
Mink5	1.44E-04	1.25E+08	1.79E+04	
Skunk5	5.74E-04	1.25E+08	7.18E+04	
Badger5	9.19E-05	1.25E+08	1.15E+04	
Jackrabbit5	3.59E-04	1.25E+08	4.49E+04	
Cottontail5	2.30E-03	1.25E+08	2.87E+05	
Squirrel5	2.44E-03	1.25E+08	3.05E+05	

2 USEPA 2001

3 Bacteria Indicator Tool Worksheet

4 Best Professional Judgment based off of Dogs

5 FC/Animal/Day copied from Raccoon to provide a more conservative estimate of background effects of wildlife

3.2.1 Agriculture

Manure from livestock is a potential source of *E. coli* bacteria to the North and South Fork Yellow Bank watersheds. Livestock in theses basins are predominantly beef and dairy cattle. Livestock can contribute bacteria directly to the stream by defecating while wading in the stream. They can also contribute by defecating while grazing on rangelands that get washed off during precipitation events. Table 7 allocates sources of bacteria production in both watersheds into three primary categories. The summary is based on several assumptions. Feedlot numbers were calculated as the sum of all dairy, hog, and the NASS estimate of beef in feeding areas. All remaining livestock were assumed to be on grass. DENR acknowledges that feedlot animals associated with the five permitted CAFOs in Table 3 are technically defined as point sources. Most of the bacteria production from these CAFOs is not transported to the impaired segments given discharge restrictions imposed by the general CAFO permit, as discussed in Section 3.1. Small feeding operations are present in the watershed and are included in the source percentage under feedlots. Manure generated from smaller operations is considered nonpoint source. Small feeding operations are not covered under the general CAFO permit.

Table 7. Bacteria source allocation for the North and South Fork Yellow Bank watersheds.

	Percentage	
Source	**North Fork**	**South Fork**
Feedlots	32%	29%
Livestock on Grass	67%	70%
Wildlife	1%	1%

The main source of *E. coli* bacteria in the North and South Fork Yellow Bank watersheds is livestock. Bacteria migration from small feeding areas and upland grazing is most likely occurring during major run-off events. Direct use of the stream by livestock is the most likely source of bacteria at lower flows. Evidence of this is available in the load duration curves which indicate that elevated counts of *E. coli* occur throughout different flow regimes. Beef and dairy cattle were found to contribute the most significant amount of bacteria to the North and South Fork Yellow Bank watersheds (Tables 5 and 6).

3.2.2 Human

Several communities are located in the North and South Fork Yellow Bank River watersheds. Wastewater treatment systems serve 444 of the approximate 3000 people in the North Fork Yellow Bank watershed. Wastewater treatment systems serve 267 of the approximate 1600 people in the South Fork Yellow Bank watershed. Septic systems are assumed to be the primary human source for the rural population in both watersheds. When included in the total load, this population produces less than 0.5% of all fecal coliform produced in both watersheds. Human fecal production may be estimated at 1.95E+9 (Yagow et al., 2001). These bacteria should all be delivered to a septic system, which if functioning correctly would result in no bacteria entering the river systems. Septic system failure was not identified as a source of concern during the field investigation conducted in the North and South Fork Yellow Bank River watersheds.

3.2.3 Natural background/wildlife

Wildlife within the watershed is a natural background source of *E. coli* bacteria. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish, and Parks (Huxoll, 2002). The estimated wildlife contribution of bacteria in the North and South Fork Yellow Bank watersheds (0.7% and 1.4%) was considered insignificant in comparison to livestock sources.

4.0 Technical Analysis

4.1 Data Collection Method

Data used to develop the *E. coli* TMDLs for the impaired segments of the North and South Fork Yellow Bank River were based on two primary sources. First, *E. coli* samples were collected during the Upper Minnesota River (UMR) Water Quality Assessment project in 2010 and 2011. Second, historic *E. coli* and fecal coliform data were obtained from SD DENR's ambient Water Quality Monitoring (WQM) network. Monitoring stations were established at the downstream end of the classified segments (limited contact recreation) of the North Fork (UMR08-WQM 460688) and South Fork (UMR12-WQM 460687) at pre-existing WQM sites near the Minnesota border. In addition, monitoring stations were established at the upstream end of both classified segments on the North Fork (UMR07) and South Fork (UMR10) during the UMR project. The upstream sites were established to better characterize bacteria variation in each segment and aid in determining potential upstream issues that may be contributing to the impaired segments. Additional monitoring sites were established on major tributaries in the South Fork watershed to provide Minnesota with a means to determine cumulative loading at the border and to help focus implementation efforts. Figure 2 depicts the monitoring station locations established during the UMR project in the North and South Fork Yellow Bank watersheds.

Environmental scientists from SD DENR's Watershed Protection Program installed long-term continuous stream stage recorders at UMR08 (North Fork) and UMR 12 (South Fork) during the early spring of 2010. The stage recorders measured stream height from a fixed position on the bridge deck to the water surface. The electronic gages were calibrated with fixed wire weight gages and tied to bridge deck elevation at mean sea level. The recorders were programmed to log stream stage at 15 minute intervals. Field personnel from East Dakota Water Development District (EDWDD) measured periodic stream discharge at varying stages of the hydrograph at both stations during the UMR Watershed Assessment project from May 2010 to October 2011. Mean Daily flow values generated from this effort were modeled against long-term USGS flow records to construct a flow frequency curve for the impaired segments. Unless otherwise noted, analysis was completed with modeling programs according to the most recent version of the Water Quality Modeling in South Dakota document (SDDENR, 2009).

4.2 Flow Analysis

The hydrologic modeling program Aquarius (version 3.00) was used to generate stage-discharge rating curves to estimate instantaneous flows at UMR08 and UMR12 over the period of record. Rating curve development involved using functions available in Aquarius to create the best fit line between paired stage and discharge points. The ensuing rating curve equations were used to estimate flow values for each corresponding stage measurement. A mean daily flow record was calculated from instantaneous flows for the period May 2010 to October 2011 at each site, respectively.

The mean daily flow record generated for UMR08 and UMR12 was used to extend the flow record. Model functions in Aquarius were used to mathematically relate the mean daily flow generated for UMR08 and UMR12 to long-term mean daily flow obtained from nearby USGS flow monitoring stations. Mean daily flow generated from UMR08 was related to the flow records from USGS 05292704 North Fork Yellow Bank River near Odessa, MN. This USGS gage station was in closest proximity (5 km) and offered the longest flow record. Modeled mean daily flow from 1991-2011 were used to construct the flow frequency curve for the impaired segment of the North Fork Yellow Bank.

Mean daily flow generated from UMR12 was related to the flow records from USGS 05293000 Yellow Bank River near Odessa, MN. This USGS station is located approximately 15 km downstream at the confluence of the North and South Forks of the Yellow Bank River. This USGS station offered the longest flow record and was chosen because as all other UGGS stations associated with the South Fork were inactive or presented limited flow data. The modeled mean daily flows from 1939-2011 were used to generate the flow frequency curve for the impaired segment of the South Fork Yellow Bank.

4.3 Sample Data

A total of 202 *E. coli* samples were collected during the UMR project at sites UMR08 (n=103) and UMR07 (n=99) for the impaired segment of the North Fork Yellow Bank. For the impaired segment of the South Fork Yellow Bank a total of 202 *E. coli* samples were collected from sites UMR12 (n=100) and UMR 10 (n=102). The daily maximum exceedance rate was evaluated based on South Dakota's *E. coli* standard (1178/100ml) for limited contact recreation waters as it is more stringent then the Minnesota daily maximum standard for Class 2 waters (1260/100ml). The daily maximum exceedance rate for the impaired segments of the North Fork and South Fork Yellow Bank was 8.9% and 15.3%, respectively. All *E. coli* data collected during the UMR project is available in Appendix A.

Distribution of the *E. coli* concentrations between the upstream (UMR07) and downstream (UMR08) sites of the North Fork Yellow Bank were relatively similar (Figure 3). The downstream site displays a slightly higher median, quartile range and maximum value in comparison to the upstream site. This is likely due more to the increased drainage area then local controls. The relative similarity between the two sites suggests *E. coli* concentrations are representative of the entire segment.

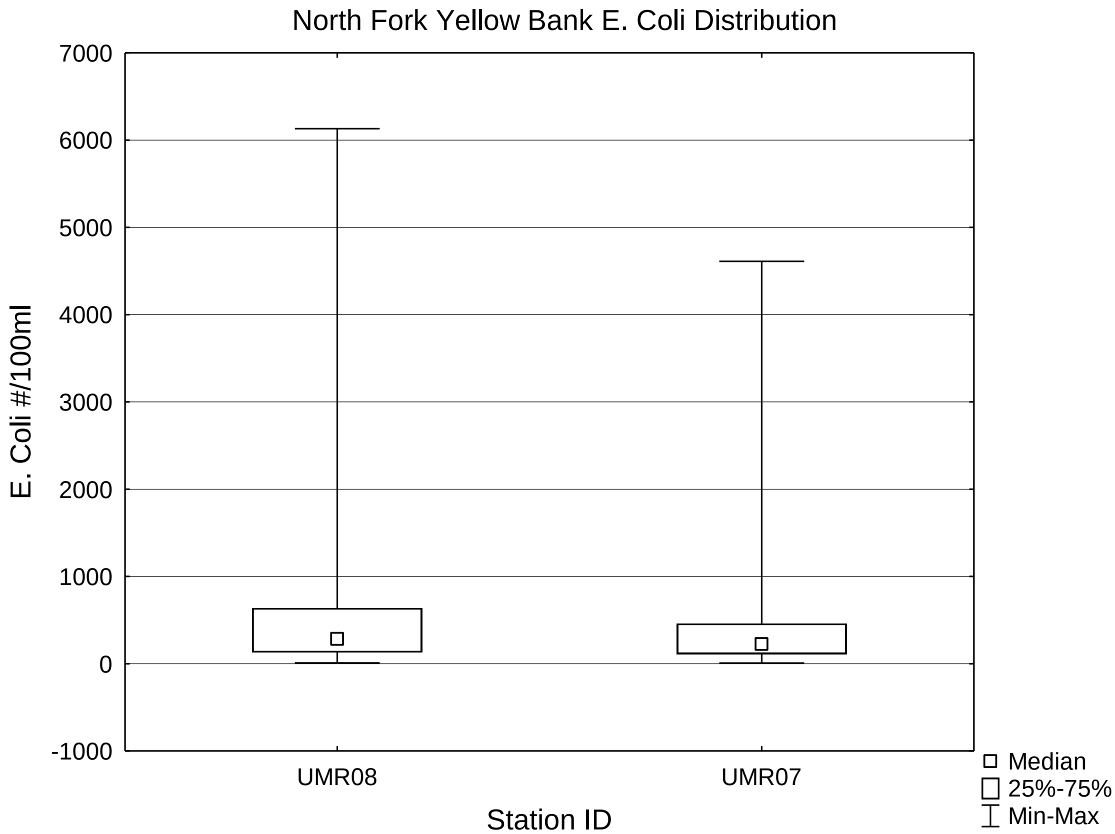

Figure 3. Distribution of *E. coli* between the two North Fork Yellow Bank sites.

Distribution of the *E. coli* concentrations between the upstream (UMR10) and downstream (UMR12) sites of the South Fork Yellow Bank are significantly different ($p<0.05$) (Figure 4). The upstream site displays a higher median, quartile range and maximum value in comparison to the downstream site. This is likely due to local controls in the upper portion of the watershed. The *E. coli* concentrations between the upstream site and downstream site characterize the variation of the impaired segment. The upper portion of the segment appears to be receiving elevated bacteria and is a prime target for implementation efforts focused on riparian and grazing management.

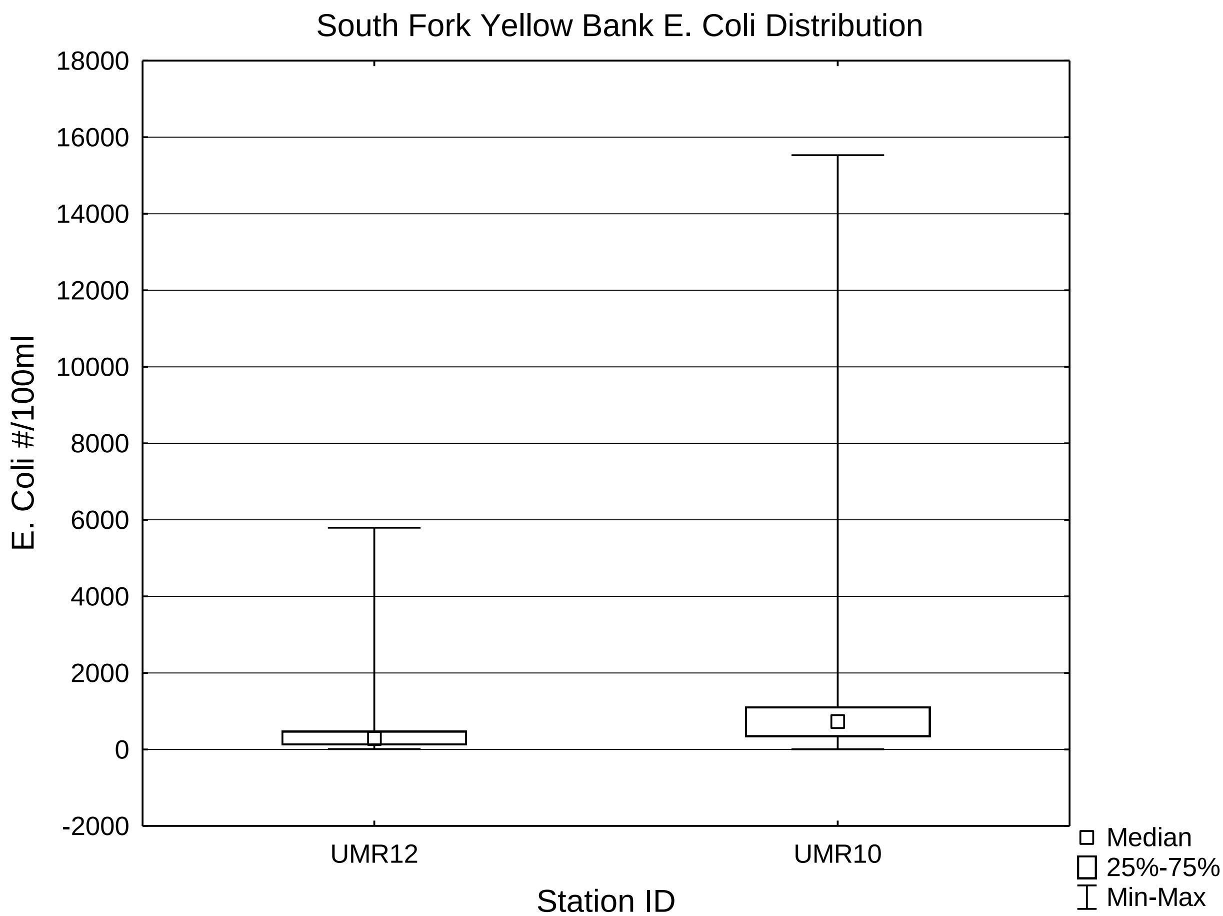

Figure 4. Distribution of *E. coli* between the two South Fork Yellow Bank sites.

During the UMR project an attempt was made to collect the minimum monthly number (n=5) of *E. coli* samples required to calculate a geometric mean. The geometric means calculated at both sites on the impaired segments of the North Fork and South Fork Yellow Bank demonstrate high exceedance rates in comparison to Minnesota's *E. coli* standard of 126 counts/100ml for Class 2 waters (Table 8). The exceedance rate for the North and South Fork Yellow Bank was calculated at 90% (19 out of 21) and 81% (18 out of 22) when compared to the Minnesota geometric mean standard, respectively. The exceedance rate was 10% (2 out of 21) and 36% (8 out of 22) for the North and South Fork Yellow Bank sites when compared to the South Dakota geometric mean standard (630/100ml) for limited contact recreation waters. These exceedance rates demonstrate impairment in accordance with each states standards and 303(d) listing methodologies.

Table 8. Monthly *E. coli* geometric means for the impaired segments of the North and South Fork Yellow Bank.

Month/Year	North Fork Yellow Bank (CFU/100ml)			South Fork Yellow Bank (CFU/100ml)	
	UMR07	UMR08		UMR10	UMR12
May-10	Na	220		395	78
Jun-10	242	174		922	342
Jul-10	257	431		1088	439
Aug-10	147	181		739	451
Sep-10	613	596		1527	694
Apr-11	31	31		16	21
May-11	130	107		128	81
Jun-11	374	383		1321	310
Jul-11	733	813		1003	470
Aug-11	167	270		448	198
Sep-11	374	544		1036	298

Monthly geometric means for *E. coli* appear to be relatively similar between the upstream (UMR8) and downstream (UMR7) sites on the impaired segment of the North Fork Yellow Bank. The geometric means appear to deviate significantly higher on the upstream site (UMR10) then the downstream site (UMR12) of impaired segment of the South Fork Yellow Bank. As described above this is likely due to local controls in the upper portion of the watershed.

A conservative approach was used to develop the load duration curve and *E. coli* TMDLs for the impaired segments of the North and South Forks of the Yellow Bank River. The individual bacteria loadings were plotted against the daily load frequency curve based on Minnesota's geometric mean threshold (126 counts/100ml) for Class 2 waters. This approach was considered acceptable to avoid confusion, facilitate interpretation and assure compliance with the daily maximum and geometric mean standards in South Dakota and Minnesota.

Fecal coliform bacteria can provide a useful surrogate for *E. coli* in TMDL development. *E. coli* is a fecal coliform bacterium and both indicators originate from common sources in relatively consistent proportions. A relational analysis was performed on paired fecal coliform and *E. coli* concentrations collected from streams in the North Glaciated Plains ecoregion (ecoregion 46), which includes the North and South Fork Yellow Bank River watersheds. Fecal coliform and *E. coli* concentrations from over 2,200 paired samples were logarithmically transformed and plotted. *E. coli* (Y-axis) was plotted as a function of fecal coliform (X-axis) and the result was a best fit linear relationship yielding an r^2 value of 0.64 (Figure 5). The slope equation yields nearly a 1:1 relationship suggesting that fecal coliform data may be directly substituted in an absence of adequate *E. coli* data in ecoregion 46. This relationship also justifies the use of fecal coliform based literature values for determining bacteria source allocations in Section 3.2

All available fecal coliform data collected within the applicable timeframe (April 1 to October 31) for Class 2 waters was used to supplement the *E. coli* data in the load duration curve framework. This approach allowed for a better distribution of bacteria loading across the entire flow frequency curve for both impaired segments. Historic fecal coliform data collected at WQM 460688 (UMR8) was used for the North Fork Yellow Bank and fecal coliform data from WQM 460687 (UMR12) was used for the South Fork Yellow Bank analysis.

Fecal coliform data for the impaired segment of the North Fork Yellow Bank comprised 5% (n=12) of the total bacteria dataset. Fecal coliform data consisted mostly of April and October samples collected from 1991-2003. All fecal coliform data was well within the range of the *E. coli* dataset. Fecal coliform data used for the impaired segment of the South Fork Yellow Bank comprised 18% (n=44) of the total bacteria dataset. Fecal coliform data was available for several months within the applicable timeframe from 1978 to 2008. Again, all fecal coliform data was well within the range of the *E. coli* dataset. All bacteria data used in the TMDL analysis are presented in Appendix A.

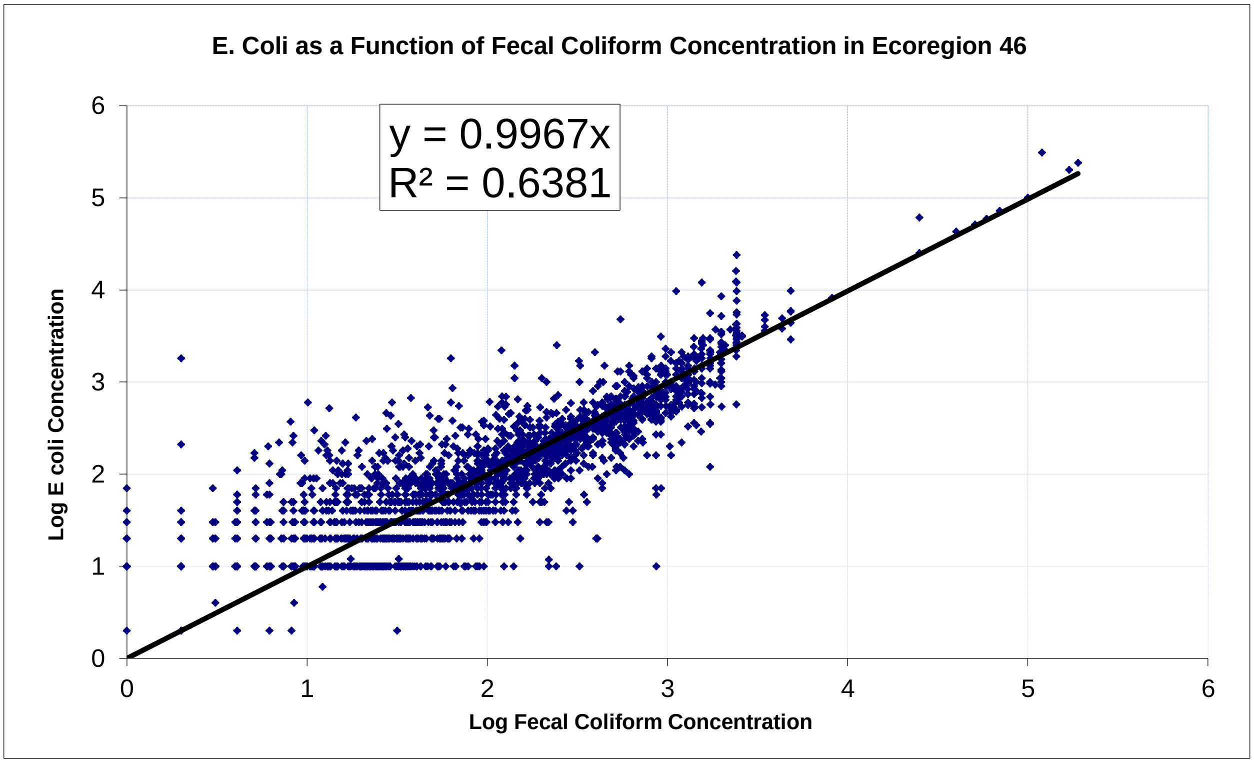

Figure 5. Linear relationship between paired *E. coli* and fecal coliform concentrations in ecoregion 46.

5.0 North Fork Yellow Bank TMDL and Allocations

The load duration curve generated for the impaired segment of the North Fork Yellow Bank was separated into five flow zones (Figure 6). Flow zones were defined according to the flow regime structure and distribution of the observed data following guidance recommended by EPA (USEPA, 2001). Five distinct flow zones were established to facilitate interpretation of the hydrologic conditions and patterns associated with the impairment. The zones were segmented by high flows (0-10 percent), moist conditions (10-40 percent), mid-range flows (40-60 percent), dry conditions (60-90 percent) and low flows (90-100 percent).

The bacteria data represents individual loadings calculated based on the flows constructed from the respective USGS gauge. Bacteria loads are plotted against the load frequency curve based on the Minnesota threshold for Class 2 waters of 126 counts/100mL (Figure 6). Sample data is well distributed across the flow regimes with the exception of the low flow zone. Lower flows (<1.9 cfs) can occur during the recreation season. Two samples have been collected which provides representation of these conditions.

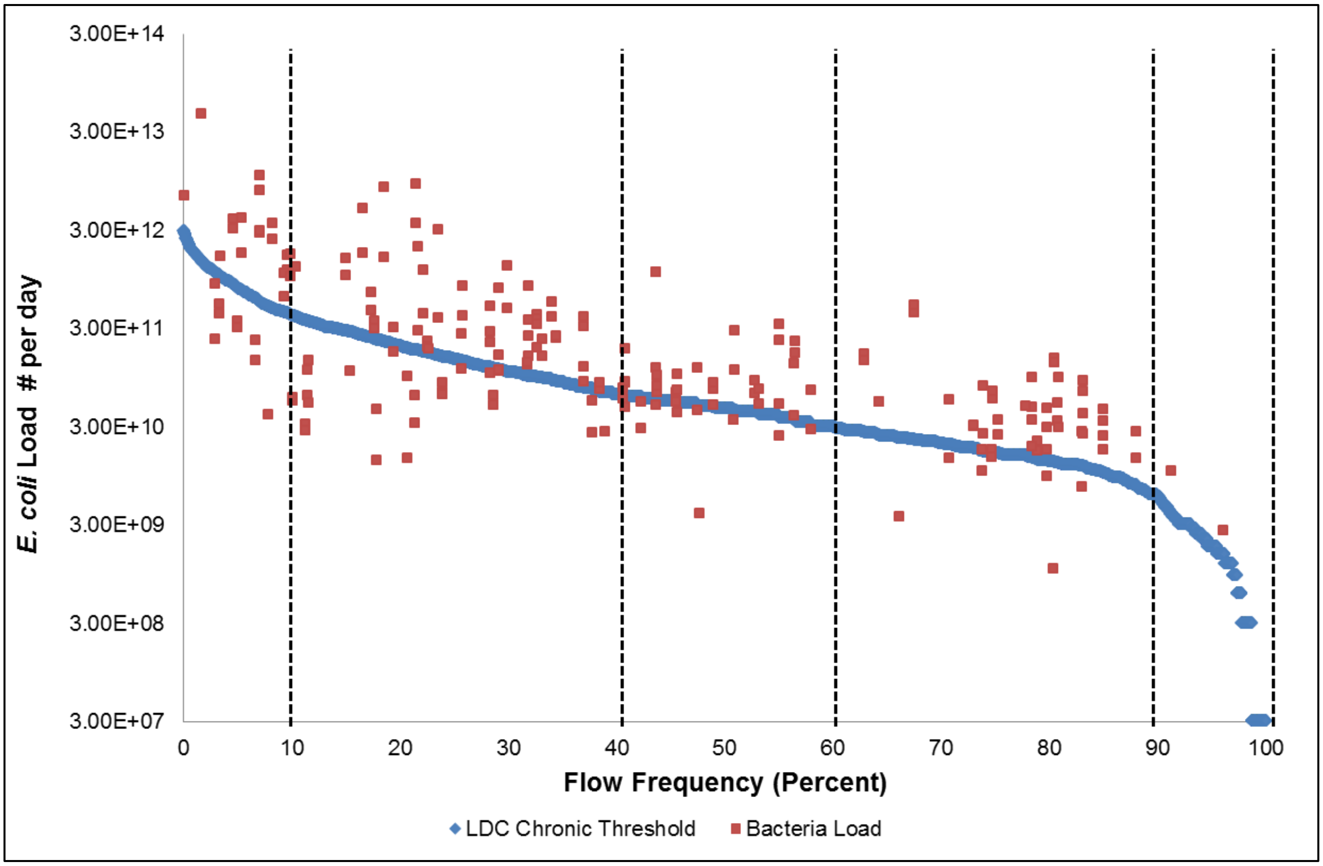

Figure 6. Load Duration Curve for the North Fork Yellow Bank impaired segment.

All TMDL components including numeric calculations for each flow zone associated with the impaired segment of the North Fork Yellow Bank are presented in Table 9. The current loads for all flow zones except the low flow zone were calculated by multiplying the 95th percentile flow and concentration. The current load for the low flow zone was calculated by multiplying the 95th percentile flow and maximum concentration. The max concentration was used due to the low density of samples available to represent this infrequent flow occurrence during the recreation season. Reduction calculations were based on reducing the current load to the geometric mean threshold (126 counts/100ml) to assure compliance with the Minnesota daily maximum and geometric mean standards for Class 2 waters. Meeting this threshold will also assure compliance with South Dakota standards for limited contact recreation waters. No point sources discharges contribute to the impaired segment so the WLA was zero for all flow zones. As a result, all reductions are required from nonpoint sources (LA). A description for the margin of safety (MOS) used for the TMDL is provided in section 6.1.

Table 9. *E. coli* TMDL and flow zone allocations for the North Fork Yellow Bank impaired segment.

TMDL Component	**North Fork Yellow Bank Flow Zones Expressed as (CFU/100ml)**				
	High Flows	**Moist Conditions**	**Mid-range Flows**	**Dry Conditions**	**Low Flows**
	>131.6 cfs	**>21 cfs**	**>9.8 cfs**	**>1.9 cfs**	**<1.9 cfs**
LA	**1.8E+12**	**2.7E+11**	**4.6E+10**	**1.7E+10**	**3.1E+09**
WLA	**0**	**0**	**0**	**0**	**0**
MOS	**3.6E+11**	**8.3E+10**	**1.6E+10**	**1.0E+10**	**1.8E+09**
TMDL @ 126 CFU/ 100 mL	**2.2E+12**	**3.6E+11**	**6.2E+10**	**2.7E+10**	**4.9E+09**
Current Load	**3.7E+13**	**6.6E+12**	**5.0E+11**	**3.0E+11**	**1.3E+10**
Load Reduction	**94%**	**95%**	**88%**	**91%**	**63%**

5.0.1 High Flows (<10% flow frequency)

The high flow zone represents the high flows in the North Fork Yellow Bank. The flow rate for this zone was widely variable ranging from 962 cfs to 131.6 cfs. Flows represented in this zone occur on an infrequent basis and are characteristic of significant run-off events typically during spring and early summer. High flows are commonly the product of spring snowmelt events but may be generated by intense rain events. Bacteria sources across the watershed have the potential to be conveyed to the stream channel during high flow conditions. The 95th percentile bacteria concentration was calculated at 2,179 counts/100ml. An *E. coli* load reduction of 94% is required to achieve compliance with the daily maximum and geometric mean thresholds.

5.0.2 Moist Conditions (10% to 40% flow frequency)

Moist conditions represent the portion of the flow regime that occurs following moderate storm events. Flows in this zone vary from 131.5 cfs to 21 cfs. The flows in this zone occur in early to mid-summer near the peak of the recreation season providing for optimal recreational opportunity. Sources of bacteria may be expected to be closer to the channel and somewhat easier to mitigate than those impacting the high flows. The 95th percentile bacteria concentration was calculated at 2,331 counts/100ml. An *E. coli* load reduction of 95% is required to achieve compliance with the daily maximum and geometric mean thresholds.

5.0.3 Mid-range Flows (40% to 60% flow frequency)

Mid-range flow conditions represent flow rates between 21 cfs and 9.8 cfs. This portion of the flow regime likely occurs in mid to late summer. Run-off from storm events is likely minimized by mature vegetative growth present during the peak of the growing season. Flows in this zone may also represent conditions that occur in the fall during recovery periods of dryness. Mid-range flows represent the transition from run-off based flow to base flows. Bacteria sources in this flow zone likely originated near the channel or within the riparian zone. The 95th percentile bacteria concentration was calculated at 1,029 counts/100ml. An *E. coli* load reduction of 88% is required to achieve compliance with the daily maximum and geometric mean thresholds.

5.0.4 Dry Conditions (60% to 90% flow frequency)

Dry conditions represent flow rates between 9.8 cfs and 1.9 cfs. Dry condition flows are best characterized as base flow conditions influenced by ground water sources. Bacteria sources likely originate in the stream channel during dry flow conditions. The 95th percentile bacteria concentration was calculated at 1,357 counts/100ml. An *E. coli* load reduction of 91% is required to achieve compliance with the daily maximum and geometric mean thresholds.

5.0.5 Low Flows (90% to 100% flow frequency)

The low flow zone represents minimal to no flow conditions of less than 1.9 cfs. Recreation uses and associated standards are applicable to all flow conditions. However, lower flows result in reduced recreational opportunities. Bacteria sources likely originate in the stream channel during low flow conditions. Limited data availability (n=2) for the lowest flow zone is a product of reduced frequency of these flows during the recreational season. Nonetheless, the maximum concentration of 340 counts/100ml was used to derive the current load at the standard resulting in an *E. coli* load reduction of 63% required to achieve compliance with the daily maximum and geometric mean thresholds. Mitigation efforts affecting preceding flow zones are expected to result in reductions in the low zone to achieve compliance with daily maximum and geometric mean standards.

5.1 South Fork Yellow Bank TMDL and Allocations

The load duration curve generated for the impaired segment of the South Fork Yellow Bank was separated into five flow zones (Figure 7). Flow zones were defined according to the flow regime structure and distribution of the observed data following guidance recommended by EPA (USEPA, 2001). Five distinct flow zones were established to facilitate interpretation of the hydrologic conditions and patterns associated with the impairment. The zones were segmented by high flows (0-10 percent), moist conditions (10-40 percent), mid-range flows (40-60 percent), dry conditions (60-90 percent) and low flows (90-100 percent).

Individual *E. coli* concentrations were multiplied by corresponding mean daily modeled flows to generate bacteria loadings across the flow frequency. Bacteria loads are plotted against the load duration curve based on the Minnesota geometric mean threshold for Class 2 waters of 126 counts/100mL (Figure 7). Bacteria data is relatively dense and well distributed across the high and moist (0% to 40%) flow zones of the load duration curve. Bacteria data was more sparsely distributed across the remaining flow regimes. Low flow (<1.9 cfs) conditions are relatively infrequent, but can occur during the recreation season. One sample was available to represent the bacteria loading for the low flow zone condition.

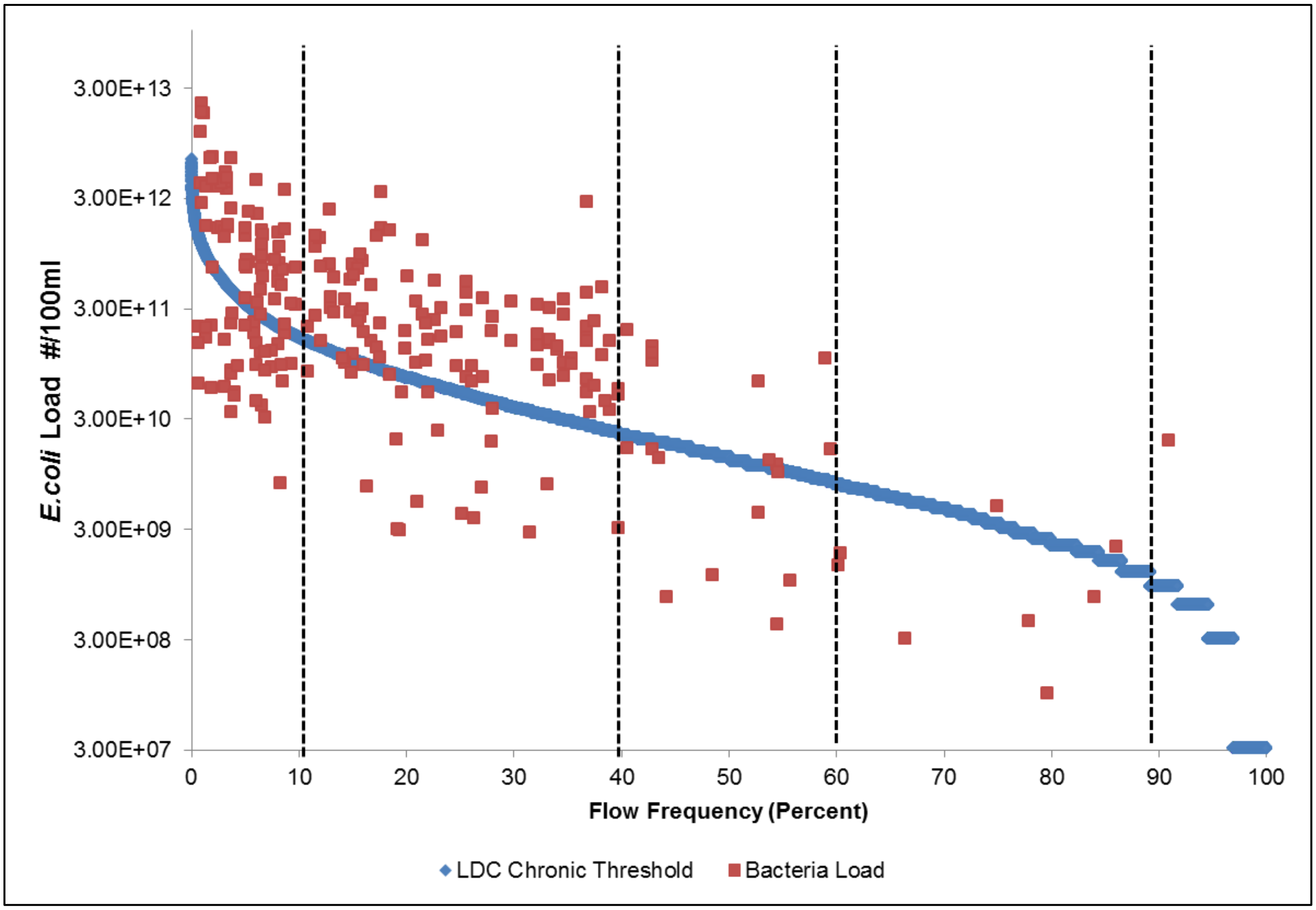

Figure 7. Load Duration Curve for the South Fork Yellow Bank impaired segment.

All TMDL components including numeric calculations for each flow zone associated with the impaired segment of the South Fork Yellow Bank are presented in Table 10. The current loads for all flow zones except the dry and low flow zone were calculated by multiplying the 95th percentile flow and concentration. The current load for the dry and low flow zones were calculated by multiplying the 95th percentile flow and maximum concentration. The maximum concentration was used due to the low density of samples available to represent these infrequent flow occurrences during the recreation season. Reduction calculations were based on reducing the current load in each flow zone to the geometric mean threshold (126 counts/100ml) to assure compliance with the Minnesota daily maximum and geometric mean standards for Class 2 waters. Meeting this threshold will also assure compliance with South Dakota standards for limited contact recreation waters. No point sources discharges contribute to the impaired segment so the WLA was zero for all flow zones. As a result, all reductions are required from nonpoint sources (LA). A description for the margin of safety (MOS) used for the TMDL is provided in section 6.1.

Table 10. *E. coli* TMDL and flow zone allocations for the South Fork Yellow Bank impaired segment.

TMDL Component	South Fork Yellow Bank Flow Zones Expressed as (CFU/100ml)				
	High Flows	Moist Conditions	Mid-range Flows	Dry Conditions	Low Flows
	>53.3 cfs	>7 cfs	>2.5 cfs	>0.3 cfs	<0.3 cfs
LA	**1.5E+12**	**1.1E+11**	**1.6E+10**	**4.9E+09**	**6.2E+08**
WLA	**0**	**0**	**0**	**0**	**0**
MOS	**1.7E+11**	**2.8E+10**	**4.6E+09**	**2.2E+09**	**3.1E+08**
TMDL @ 126 CFU/ 100 mL	**1.7E+12**	**1.4E+11**	**2.1E+10**	**7.1E+09**	**9.3E+08**
Current Load	**2.9E+13**	**2.7E+12**	**2.0E+11**	**1.0E+10**	**1.9E+10**
Load Reduction	**94%**	**95%**	**89%**	**30%**	**95%**

5.1.1 High Flows (<10% flow frequency)

The high flow zone represents the high flows in the South Fork Yellow Bank. The flow rate for this zone was widely variable ranging from 2,224 cfs to 53.3 cfs. Flows represented in this zone occur on an infrequent basis and are characteristic of significant run-off events typically during spring and early summer. High flows are commonly the product of spring snowmelt events but may be generated by intense rain events. Bacteria sources across the watershed have the potential to be conveyed to the stream channel during high flow conditions. The 95th percentile bacteria concentration was calculated at 2,134 counts/100ml. An *E. coli* load reduction of 94% is required to achieve compliance with the daily maximum and geometric mean thresholds.

5.1.2 Moist Conditions (10% to 40% flow frequency)

Moist conditions represent the portion of the flow regime that occurs following moderate storm events. Flows in this zone vary from 53.3 cfs to 7 cfs. The flows in this zone occur in early to mid-summer near the peak of the recreation season providing for optimal recreational opportunity. Sources of bacteria may be expected to be closer to the channel and somewhat easier to mitigate than those impacting the high flows. The 95th percentile bacteria concentration was calculated at 2,419 counts/100ml. An *E. coli* load reduction of 95% is required to achieve compliance with the daily maximum and geometric mean thresholds.

5.1.3 Mid-range Flows (40% to 60% flow frequency)

Mid-range flow conditions represent flow rates between 7 cfs and 2.5 cfs. This portion of the flow regime likely occurs in mid to late summer. Run-off from storm events is likely minimized by mature vegetative growth present during the peak of the growing season. Flows in this zone may also represent conditions that occur in the fall during periods of recovery from dryness. Mid-range flows represent the transition from run-off based flow to base flows. Bacteria sources in this flow zone likely originated near the channel or within the riparian zone. The 95th percentile bacteria concentration was calculated at 1,192 counts/100ml. An *E. coli* load reduction of 89% is required to achieve compliance with the daily maximum and geometric mean thresholds.

5.1.4 Dry Conditions (60% to 90% flow frequency)

Dry conditions represent flow rates between 9.8 cfs and 1.9 cfs. Dry condition flows are best characterized as base flow conditions influenced by ground water sources. Bacteria sources likely originate in the stream channel during dry flow conditions. The maximum bacteria concentration was 180 counts/100ml. An *E. coli* load reduction of 30% is required to achieve compliance with the daily maximum and geometric mean thresholds. The current load and reduction is based on a limited (n=8) dataset. Reducing bacteria sources within the stream channel is warranted to assure compliance with daily maximum and geometric mean standards for the dry flow condition.

5.1.5 Low Flows (90% to 100% flow frequency)

The low flow zone represents minimal to no flow conditions of less than 0.3 cfs. Recreation uses and associated standards are applicable to all flow conditions. However, lower flows result in reduced recreational opportunities. Bacteria sources likely originate in the stream channel during low flow conditions. Limited data availability (n=1) for the lowest flow zone is a product of reduced frequency of these flows during the recreational season. Nonetheless, the maximum concentration of 2,600 counts/100ml was used to derive the current load at the standard resulting in an *E. coli* load reduction of 95% required to achieve compliance with the daily maximum and geometric mean thresholds. Mitigation efforts directed towards preceding flow zones are expected to result in reductions in the low zone to achieve compliance with daily maximum and geometric mean standards.

5.2 Load Allocations (LAs)

The *E. coli* load capacity for the impaired segments of the North and South Forks of the Yellow Bank River is exclusively attributed to nonpoint source load allocation. The majority of bacteria production in the North Fork (99%) and South Fork (98%) Yellow Bank River watersheds originate from livestock sources. Human and wildlife bacteria production in both watersheds was considered negligible. The majority of the bacteria produced by livestock can be attributed to beef and dairy cattle. Approximately 70% of the livestock in both watersheds were estimated to be on grass or rangeland/pasture. Approximately 30% of the livestock were estimated to be in feedlots. Restoration efforts focused on grazing management and manure management in feedlots may yield the greatest bacteria reduction benefits.

The impaired segments of the North and South Forks of the Yellow Bank River flow directly into Minnesota and form the Yellow Bank River. To protect the downstream uses, bacteria load reductions were based on the 126 CFU/100ml geometric mean threshold to assure compliance with daily maximum and geometric mean standards for Minnesota Class 2 waters. This conservative approach will also assure attainment of daily maximum and geometric mean standards for the limited contact recreation use assigned to both impaired segments in South Dakota. The impaired segment of the North Fork Yellow Bank requires a 94% reduction in *E. coli* bacteria from nonpoint sources in the high flow zone. A 95% reduction in *E. coli* bacteria is required in the moist conditions flow zone. An 88% reduction in *E. coli* bacteria is required in the mid-range flow zone. A 91% and 63% reduction in *E. coli* bacteria is required in the dry and low flow zones, respectively. Reducing bacteria concentrations below the geometric mean threshold in each flow zone provides assurance that both daily maximum and geometric mean standards will be met. To achieve the specified reductions, primary focus should be placed on reducing bacteria inputs from livestock grazing and feeding areas.

The impaired segment of the South Fork Yellow Bank requires a 94% in *E. coli* bacteria from nonpoint sources in the high flow zone. A 95% reduction in *E. coli* bacteria is required in the moist conditions flow zone. An 89% reduction in *E. coli* bacteria is required in the mid-range flow zone. A 30% and 95% reduction in *E. coli* bacteria is required in the dry and low flow zones, respectively. Reducing bacteria concentrations below the geometric mean threshold in each flow provides assurance that both daily maximum and geometric mean standards will be met. To achieve the specified reductions, primary focus should be placed on reducing bacteria inputs from livestock grazing and feeding areas.

5.3 Waste Load Allocations (WLAs)

No point source discharges contribute directly to the impaired segments of the North and South Forks of the Yellow Bank River. As a result, the WLA for both TMDLs were assigned a zero value.

6.0 Margin of Safety (MOS) and Seasonality

6.1 Margin of Safety

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

6.2 Seasonality

Seasonality is an important factor when considering patterns associated with bacteria contamination. Bacteria samples used in the TMDL analysis were collected from April to October to cover seasonal differences and satisfy the criterion associated with the standards for Minnesota Class 2 waters. Seasonal variation is also a component of the load duration curve framework through the establishment of individual flow zones and associated TMDL load allocations. Daily bacteria loads exceed the geometric mean TMDL threshold consistently throughout the flow regimes of both the impaired segments of the North Fork and South Fork Yellow Bank. The implications of this pattern suggest bacteria contamination in both systems is continual. Bacteria conveyance in the spring and early summer is likely to occur watershed wide during high, moist and mid-range flows. Bacteria contamination is more likely to be localized to the riparian zone and direct stream channels in the summer and fall during dry and low flow conditions. Focusing restoration efforts to account for these seasonal patterns is warranted to achieve attainment goals.

7.0 Public Participation

STATE AGENCIES

The South Dakota Department of Environment and Natural Resources (SD DENR) formed a partnership with the Minnesota Pollution Control Agency (MPCA) to provide technical support for project activities and coordination of the Upper Minnesota River Watershed Water Quality Assessment (i.e. UMR project). SD DENR also provided financial support for the UMR project and was the primary agency involved in the completion of this TMDL document. Bacteria data collected during the UMR project was supplemented with bacteria data available from SD DENR's ambient water quality monitoring stations in the Yellow Bank watershed.

FEDERAL AGENCIES

The Environmental Protection Agency (EPA) provided a significant portion of the funding for the UMR project. Long-term daily stream flow data was obtained from United States Geologic Survey (USGS) gauge sites. This data was used in conjunction with flow data collected during the UMR project to construct long-term flow frequency curves for the impaired segments.

LOCAL GOVERNMENT, INDUSTRY, ENVIRONMENTAL, AND OTHER GROUPS AND PUBLIC AT LARGE

East Dakota Water Development District (EDWDD) was the primary South Dakota local sponsor for the UMR project. The district provided significant funding, field support and administrative processing during the UMR project. Two local watershed districts in Minnesota also provided support for the UMR project. The Upper Minnesota River Watershed District provided in-kind services and technical support to the local project coordinator responsible for sample collection. The Lac qui Parle-Yellow Bank River Watershed District also provided field support, funding and other in-kind services.

Public interest in the UMR project was a result of communications between EDWDD, local South Dakota conservation districts (Grant and Roberts), local Minnesota watershed districts, Citizens for Big Stone Lake and other stakeholder groups concerned with water quality in the Whetstone and Yellow Bank watersheds. Public involvement was encouraged through several multi-media networks during the UMR project.

This TMDL document was placed on public notice in June 2012 and again in March 2018. Several participating entities in South Dakota and Minnesota were notified and the notices were published in several local newspapers from both states in close proximity to the Yellow Bank watershed. The TMDL document was made available for review on the SD DENR website home page. Comments received following the 2012 public notice period were placed in Appendix B and addressed accordingly. DENR did not receive comments during the 2018 public notice period.

8.0 Adaptive Management and Monitoring Strategy

The Department (or EPA) 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 follow EPA guidance for revising or withdrawing TMDLs in accordance with considerations documented in EPA's 2012 draft memo before taking action (http://www.epa.gov/sites/production/files/2015-10/documents/draft-tmdl_32212.pdf).

Long-term *E. coli* bacteria monitoring will continue for both impaired segments through DENR's Ambient Water Quality Monitoring Program. *E. coli* bacteria monitoring will be conducted monthly at monitoring stations consistent with those used for TMDL development, in particular, UMR08 (WQM88) and UMR 12 (WQM87) located at the downstream end of the impaired segments of the North and South Forks of the Yellow Bank. In addition, EDWDD collects *E. coli* samples bi monthly during the recreation season at both of the aforementioned sites as part of the districts routine monitoring efforts. Sampling has been conducted since 2014 and is expected to continue indefinitely depending on resource availability. DENR Watershed Protection staff continues to maintain long-term stream gages at UMR08 and UMR12. Data collected as part of these monitoring efforts will be used to determine beneficial use support in accordance with 303(d) listing methods, evaluate TMDL effectiveness following BMP implementation and to make potential future adjustments to the TMDLs, if necessary.

9.0 Restoration Strategy

The TMDLs for the North Fork (SD-MN-R-Yellow_Bank_N_Fork_01) and South Forks (SD-MN-R-Yellow_Bank_S_Fork_01) of the Yellow Bank River correspond exclusively to the 303(d) listed segments identified in South Dakota's 2016 Integrated Report for Surface Water Quality. During the planning process for the Upper Minnesota River Watershed Water Quality Assessment project (UMR project) monitoring sites were established to determine potential impairment of beneficial uses in South Dakota and to allow quantification of loadings at the South Dakota/Minnesota border for use in TMDL development in Minnesota.

A significant portion of the Yellow Bank watershed resides in South Dakota. Therefore, future implementation efforts will be directed to the entire Yellow Bank River watershed in South Dakota with priority to the sub-watersheds of the impaired segments. In June 2012, South Dakota received EPA 319 funding to incorporate the North Fork and South Fork watersheds into the Northeast Glacial Lakes Implementation Project boundary. The project coordinator is targeting grazing management in the first phase of this multiple phase project. The coordinator has established relationships with federal, state and local entities as well as stakeholders in the watershed to increase project awareness and seek additional sources of funding to assure long-term project success. Bacteria data from monitoring efforts and a digital feedlot layer will be used as tools to identify potential target areas. The long-term goal of this implementation effort is to achieve the TMDL reductions derived in this document on both impaired segments and ultimately reduce bacteria inputs to the Yellow Bank River drainages to protect the upstream and downstream uses.

10.0 Literature Cited

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Appendix A

Bacteria data used in the TMDL Development

Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)	Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)
UMR07	05/19/2010	65.7	61.1	UMR10	06/08/2010	687	29.1
UMR07	05/24/2010	238.2	45.8	UMR10	06/10/2010	1203	31.8
UMR07	05/26/2010	125.9	37.2	UMR10	06/15/2010	1986	144.1
UMR07	06/01/2010	145	20.9	UMR10	06/17/2010	326	104.2
UMR07	06/02/2010	111.9	19.7	UMR10	06/22/2010	1203	46.2
UMR07	06/07/2010	95.9	20.3	UMR10	06/24/2010	1203	44.2
UMR07	06/09/2010	261.3	18.8	UMR10	06/29/2010	649	34.5
UMR07	06/14/2010	1410	58.6	UMR10	07/01/2010	1986	28.1
UMR07	06/16/2010	461.1	92.8	UMR10	07/06/2010	770	82.7
UMR07	06/21/2010	435.2	31.3	UMR10	07/08/2010	1986	371.9
UMR07	06/23/2010	365.4	28.3	UMR10	07/13/2010	326	66
UMR07	06/28/2010	172.3	32.1	UMR10	07/15/2010	1203	46.2
UMR07	06/30/2010	95.9	23.8	UMR10	07/20/2010	2420	25.8
UMR07	07/06/2010	123.6	17.9	UMR10	07/22/2010	1046	23.1
UMR07	07/07/2010	2419.6	18.8	UMR10	07/27/2010	1300	16.4
UMR07	07/12/2010	365.4	45.8	UMR10	07/29/2010	548	14.1
UMR07	07/14/2010	248.9	31.3	UMR10	08/03/2010	649	11.1
UMR07	07/19/2010	228.2	15.3	UMR10	08/05/2010	411	9.4
UMR07	07/21/2010	325.5	14.2	UMR10	08/10/2010	727	8.7
UMR07	07/26/2010	81.6	12.2	UMR10	08/12/2010	613	10.4
UMR07	07/28/2010	113.7	10.1	UMR10	08/17/2010	276	7.4
UMR07	08/02/2010	275.5	8.1	UMR10	08/19/2010	1120	12.7
UMR07	08/04/2010	90.6	6.5	UMR10	08/24/2010	727	8.7
UMR07	08/09/2010	77.6	5.6	UMR10	08/26/2010	866	6.4
UMR07	08/11/2010	110.6	5.5	UMR10	08/31/2010	2420	8
UMR07	08/16/2010	190	4.6	UMR10	09/02/2010	12997	8.7
UMR07	08/19/2010	76.7	3.9	UMR10	09/08/2010	1120	19.8
UMR07	08/23/2010	517.2	5.5	UMR10	09/09/2010	2420	21.1
UMR07	08/25/2010	85.7	4.5	UMR10	09/14/2010	1046	16.4
UMR07	08/30/2010	235.9	2.5	UMR10	09/15/2010	5172	27.1
UMR07	09/01/2010	275.5	5.3	UMR10	09/21/2010	291	38.9
UMR07	09/08/2010	770.1	12.2	UMR10	09/23/2010	2420	40.5
UMR07	09/09/2010	816.4	11.2	UMR10	09/28/2010	387	40.2
UMR07	09/14/2010	676.7	8.7	UMR10	09/30/2010	866	32.5
UMR07	09/15/2010	2914.6	7.3	UMR10	10/05/2010	649	22.1
UMR07	09/21/2010	770.1	29.8	UMR10	10/07/2010	313	20.4
UMR07	09/23/2010	517.2	24.8	UMR10	10/11/2010	435	17.4
UMR07	09/28/2010	290.9	39.7	UMR10	10/14/2010	236	15.7
UMR07	09/30/2010	307.6	30.9	UMR10	04/06/2011	5	489.1

Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)	Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)
UMR07	10/07/2010	167	17.6	UMR10	04/12/2011	27	308.2
UMR07	10/11/2010	133.3	15.3	UMR10	04/14/2011	10	245.9
UMR07	10/14/2010	191.8	14	UMR10	04/18/2011	14	169.8
UMR07	04/06/2011	96	366.2	UMR10	04/21/2011	22	144.7
UMR07	04/07/2011	51.2	339.2	UMR10	04/25/2011	63	144.4
UMR07	04/11/2011	49.6	253.9	UMR10	04/28/2011	15	134.7
UMR07	04/13/2011	29.2	199.4	UMR10	05/03/2011	20	89.8
UMR07	04/18/2011	18.7	131.6	UMR10	05/05/2011	43	78.4
UMR07	04/20/2011	18.5	115.5	UMR10	05/09/2011	99	92.8
UMR07	04/25/2011	9.6	118.2	UMR10	05/11/2011	131	83.4
UMR07	04/27/2011	39.9	116.8	UMR10	05/17/2011	71	72
UMR07	05/02/2011	7.5	75.1	UMR10	05/19/2011	314	64
UMR07	05/04/2011	22.6	59.6	UMR10	05/23/2011	1046	162.8
UMR07	05/09/2011	2419.6	51.8	UMR10	05/26/2011	285	107.2
UMR07	05/11/2011	146.7	55.1	UMR10	06/01/2011	1120	255.6
UMR07	05/16/2011	52	50.8	UMR10	06/02/2011	770	204.4
UMR07	05/18/2011	67	38.4	UMR10	06/06/2011	1983	90.5
UMR07	05/23/2011	2419.6	83.7	UMR10	06/09/2011	914	66
UMR07	05/25/2011	160	76.2	UMR10	06/13/2011	2420	61.3
UMR07	06/01/2011	1732.9	181.5	UMR10	06/15/2011	1046	62
UMR07	06/02/2011	488.4	139.7	UMR10	06/20/2011	687	65.7
UMR07	06/06/2011	185	67.4	UMR10	06/23/2011	12997	1276.4
UMR07	06/08/2011	226	39.3	UMR10	06/28/2011	520	303.5
UMR07	06/13/2011	471	32.1	UMR10	06/30/2011	882	188.9
UMR07	06/15/2011	1046	32.1	UMR10	07/05/2011	15531	338.4
UMR07	06/20/2011	155	22.2	UMR10	07/07/2011	1281	388.6
UMR07	06/28/2011	298	239.5	UMR10	07/12/2011	318	171.9
UMR07	06/29/2011	179	143.4	UMR10	07/13/2011	448	157.5
UMR07	07/05/2011	2419.6	59.1	UMR10	07/19/2011	1017	87.4
UMR07	07/07/2011	457	275.7	UMR10	07/21/2011	496	69
UMR07	07/12/2011	676	181.5	UMR10	07/25/2011	1153	162.1
UMR07	07/13/2011	520	133.8	UMR10	07/28/2011	620	106.9
UMR07	07/19/2011	238	78.5	UMR10	08/01/2011	712	80.7
UMR07	07/20/2011	309	56.1	UMR10	08/04/2011	909	101.2
UMR07	07/25/2011	630	156.5	UMR10	08/08/2011	520	55.3
UMR07	07/27/2011	4611	72.3	UMR10	08/11/2011	670	43.9
UMR07	08/01/2011	175	37.6	UMR10	08/15/2011	408	36.2
UMR07	08/04/2011	563	35.2	UMR10	08/18/2011	243	31.2
UMR07	08/08/2011	145	24.5	UMR10	08/22/2011	327	27.5
UMR07	08/10/2011	171	20.6	UMR10	08/25/2011	228	23.5

Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)	Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)
UMR07	08/17/2011	97	17.9	UMR10	09/01/2011	650	19.1
UMR07	08/22/2011	109	16.4	UMR10	09/06/2011	1050	14.7
UMR07	08/24/2011	98	14.8	UMR10	09/08/2011	728	14.1
UMR07	08/29/2011	228	13.2	UMR10	09/12/2011	1203	11.1
UMR07	09/01/2011	457	11.9	UMR10	09/14/2011	1120	9.7
UMR07	09/06/2011	160	4.8	UMR10	09/19/2011	1203	10.4
UMR07	09/07/2011	161	4.5	UMR10	09/21/2011	1553	9.7
UMR07	09/12/2011	435	3.9	UMR10	09/27/2011	980	8.7
UMR07	09/14/2011	547.5	3.4	UMR10	09/28/2011	1120	8.4
UMR07	09/19/2011	410.6	4.8	UMR10	10/03/2011	1120	7
UMR07	09/20/2011	1299.7	4.3	UMR10	10/05/2011	770	6.4
UMR07	09/27/2011	336	4.2	UMR10	10/10/2011	816	7.7
UMR07	09/28/2011	288	4.2	UMR10	10/11/2011	548	10.1
UMR07	10/03/2011	269	3.9	UMR12	05/13/2010	770	241.2
UMR07	10/05/2011	211	3.4	UMR12	05/18/2010	20	82.7
UMR07	10/10/2011	213	6	UMR12	05/20/2010	42	63.7
UMR07	10/11/2011	185	5.6	UMR12	05/25/2010	68	57.6
UMR08	05/19/2010	9.7	61.1	UMR12	05/27/2010	67	49.2
UMR08	05/24/2010	104.6	45.8	UMR12	06/01/2010	140	33.8
UMR08	05/26/2010	122.3	37.2	UMR12	06/03/2010	387	31.5
UMR08	06/01/2010	114.5	20.9	UMR12	06/08/2010	214	29.1
UMR08	06/02/2010	60.2	19.7	UMR12	06/10/2010	326	31.8
UMR08	06/07/2010	172.3	20.3	UMR12	06/15/2010	687	144.1
UMR08	06/09/2010	108.1	18.8	UMR12	06/17/2010	276	104.2
UMR08	06/14/2010	201	58.6	UMR12	06/22/2010	228	46.2
UMR08	06/16/2010	686.7	92.8	UMR12	06/24/2010	1203	44.2
UMR08	06/21/2010	547.5	31.3	UMR12	06/29/2010	328	34.5
UMR08	06/23/2010	344.8	28.3	UMR12	07/01/2010	194	28.1
UMR08	06/28/2010	166.4	32.1	UMR12	07/06/2010	345	82.7
UMR08	06/30/2010	45.2	23.8	UMR12	07/08/2010	2420	371.9
UMR08	07/06/2010	155.3	17.9	UMR12	07/13/2010	365	66
UMR08	07/07/2010	2419.6	18.8	UMR12	07/15/2010	977	46.2
UMR08	07/12/2010	727	45.8	UMR12	07/20/2010	2420	25.8
UMR08	07/14/2010	488.4	31.3	UMR12	07/27/2010	181	16.4
UMR08	07/19/2010	218.7	15.3	UMR12	07/29/2010	55	14.1
UMR08	07/21/2010	816.4	14.2	UMR12	08/03/2010	517	11.1
UMR08	07/26/2010	172	12.2	UMR12	08/05/2010	461	9.4
UMR08	07/28/2010	290.6	10.1	UMR12	08/10/2010	246	8.7
UMR08	08/02/2010	275.5	8.1	UMR12	08/12/2010	265	10.4
UMR08	08/04/2010	357.8	6.5	UMR12	08/17/2010	313	7.4

Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)	Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)
UMR08	08/11/2010	129.6	5.5	UMR12	08/24/2010	866	8.7
UMR08	08/16/2010	152	4.6	UMR12	08/26/2010	649	6.4
UMR08	08/19/2010	285.1	3.9	UMR12	08/31/2010	579	8
UMR08	08/23/2010	435.2	5.5	UMR12	09/02/2010	1986	8.7
UMR08	08/25/2010	272.3	4.5	UMR12	09/08/2010	488	19.8
UMR08	08/30/2010	435.2	2.5	UMR12	09/09/2010	517	21.1
UMR08	09/01/2010	193.5	5.3	UMR12	09/14/2010	727	16.4
UMR08	09/08/2010	1119.9	12.2	UMR12	09/15/2010	2420	27.1
UMR08	09/09/2010	613.1	11.2	UMR12	09/21/2010	613	38.9
UMR08	09/14/2010	770.1	8.7	UMR12	09/23/2010	770	40.5
UMR08	09/15/2010	2419.6	7.3	UMR12	09/28/2010	308	40.2
UMR08	09/21/2010	547.5	29.8	UMR12	09/30/2010	291	32.5
UMR08	09/23/2010	648.8	24.8	UMR12	10/05/2010	178	22.1
UMR08	09/28/2010	517.2	39.7	UMR12	10/07/2010	105	20.4
UMR08	09/30/2010	209.8	30.9	UMR12	10/11/2010	214	17.4
UMR08	10/05/2010	218.7	18.5	UMR12	10/14/2010	173	15.7
UMR08	10/07/2010	166.4	17.6	UMR12	04/06/2011	17	489.1
UMR08	10/11/2010	195.6	15.3	UMR12	04/07/2011	19	445.6
UMR08	10/14/2010	261.3	14	UMR12	04/12/2011	22	308.2
UMR08	04/06/2011	25.9	366.2	UMR12	04/14/2011	35	245.9
UMR08	04/07/2011	64	339.2	UMR12	04/18/2011	38	169.8
UMR08	04/12/2011	57.1	253.9	UMR12	04/21/2011	23	144.7
UMR08	04/14/2011	47.1	199.4	UMR12	04/25/2011	10	144.4
UMR08	04/18/2011	17.3	131.6	UMR12	04/28/2011	16	134.7
UMR08	04/21/2011	50.4	115.5	UMR12	05/03/2011	42	89.8
UMR08	04/25/2011	11	118.2	UMR12	05/05/2011	16	78.4
UMR08	04/28/2011	21.8	116.8	UMR12	05/09/2011	79	92.8
UMR08	05/03/2011	24.6	75.1	UMR12	05/11/2011	59	83.4
UMR08	05/05/2011	42.8	59.6	UMR12	05/17/2011	50	72
UMR08	05/09/2011	307.6	51.8	UMR12	05/19/2011	59	64
UMR08	05/11/2011	167	55.1	UMR12	05/23/2011	1300	162.8
UMR08	05/17/2011	67.7	50.8	UMR12	05/26/2011	144	107.2
UMR08	05/19/2011	53.6	38.4	UMR12	06/01/2011	1120	255.6
UMR08	05/23/2011	866.4	83.7	UMR12	06/02/2011	326	204.4
UMR08	05/26/2011	193.5	76.2	UMR12	06/06/2011	66	90.5
UMR08	06/01/2011	2419.6	181.5	UMR12	06/09/2011	88	66
UMR08	06/02/2011	344.8	139.7	UMR12	06/13/2011	120	61.3
UMR08	06/06/2011	104.3	67.4	UMR12	06/15/2011	142	62
UMR08	06/09/2011	110	39.3	UMR12	06/20/2011	488	65.7
UMR08	06/13/2011	199	32.1	UMR12	06/23/2011	5794	1276.4

Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)	Site	Date	*E. coli* (CFU/100ml)	Flow (cfs)
UMR08	06/20/2011	134	22.2	UMR12	06/30/2011	359	188.9
UMR08	06/23/2011	3873	481.2	UMR12	07/05/2011	2142	338.4
UMR08	06/28/2011	683	239.5	UMR12	07/07/2011	435	388.6
UMR08	06/30/2011	313	143.4	UMR12	07/12/2011	355	171.9
UMR08	07/05/2011	6131	59.1	UMR12	07/13/2011	428	157.5
UMR08	07/07/2011	583	275.7	UMR12	07/19/2011	161	87.4
UMR08	07/12/2011	638	181.5	UMR12	07/21/2011	216	69
UMR08	07/13/2011	313	133.8	UMR12	07/25/2011	932	162.1
UMR08	07/19/2011	364	78.5	UMR12	07/28/2011	520	106.9
UMR08	07/21/2011	862	56.1	UMR12	08/01/2011	301	80.7
UMR08	07/25/2011	934	156.5	UMR12	08/04/2011	318	101.2
UMR08	07/28/2011	908	72.3	UMR12	08/08/2011	241	55.3
UMR08	08/01/2011	833	37.6	UMR12	08/11/2011	144	43.9
UMR08	08/04/2011	1529	35.2	UMR12	08/15/2011	110	36.2
UMR08	08/08/2011	203	24.5	UMR12	08/18/2011	121	31.2
UMR08	08/11/2011	368	20.6	UMR12	08/22/2011	161	27.5
UMR08	08/15/2011	148	18.5	UMR12	08/25/2011	331	23.5
UMR08	08/18/2011	295	16.4	UMR12	08/29/2011	199	20.8
UMR08	08/22/2011	98	14.8	UMR12	09/01/2011	359	19.1
UMR08	08/25/2011	161	13.2	UMR12	09/06/2011	199	14.7
UMR08	08/29/2011	134	11.9	UMR12	09/08/2011	108	14.1
UMR08	09/06/2011	305	4.8	UMR12	09/12/2011	345	11.1
UMR08	09/08/2011	420	4.5	UMR12	09/14/2011	411	9.7
UMR08	09/12/2011	920.8	3.9	UMR12	09/19/2011	579	10.4
UMR08	09/14/2011	410.6	3.4	UMR12	09/21/2011	308	9.7
UMR08	09/19/2011	816.4	4.8	UMR12	09/27/2011	326	8.7
UMR08	09/21/2011	1413.6	4.3	UMR12	09/28/2011	291	8.4
UMR08	09/27/2011	517.2	4.2	UMR12	10/03/2011	96	7
UMR08	09/28/2011	920.8	4.2	UMR12	10/05/2011	102	6.4
UMR08	10/03/2011	727	3.9	UMR12	10/10/2011	192	7.7
UMR08	10/05/2011	290.9	3.4	UMR12	10/11/2011	517	10.1
UMR08	10/10/2011	206.4	6	WQM87	05/12/2009	32	24.8
UMR08	10/11/2011	579.4	5.6	WQM87	08/17/2009	141	3.7
UMR10	05/13/2010	1203	241.2	WQM87	05/13/2010	770	241.2
UMR10	05/18/2010	453	82.7	WQM87	08/17/2010	17	7.4
UMR10	05/20/2010	435	63.7	WQM87	05/12/2011	64	78.7
UMR10	05/25/2010	236	57.6	WQM87	08/16/2011	93	34.2
UMR10	05/27/2010	173	49.2	WQM88	08/17/2010	10.4	4.3
UMR10	06/01/2010	921	33.8	WQM88	05/12/2011	54.6	50.4
UMR10	06/03/2010	1046	31.5	WQM88	08/16/2011	238	17.9

Site	Date	FC (CFU/100ml)	Flow(cfs)	Site	Date	FC (CFU/100ml)	Flow(cfs)
WQM87	10/17/1978	23	2.5	WQM87	04/12/1988	10	11.4
WQM87	04/24/1979	30	123.3	WQM87	04/18/1989	10	16.8
WQM87	10/10/1979	47	3.7	WQM87	04/10/1990	5	3.4
WQM87	05/15/1979	10	30.2	WQM87	04/09/1991	10	4.7
WQM87	06/12/1979	230	7.7	WQM87	10/17/1991	140	3.4
WQM87	07/10/1979	170	8.4	WQM87	04/15/1992	10	15.4
WQM87	08/14/1979	730	33.5	WQM87	10/08/1992	120	3.4
WQM87	09/11/1979	730	3.7	WQM87	04/14/1993	120	239.9
WQM87	04/23/1980	30	10.4	WQM87	10/06/1993	50	19.4
WQM87	05/15/1980	7	1.8	WQM87	04/18/1994	5	64.7
WQM87	06/10/1980	570	82.1	WQM87	10/18/1994	120	25.8
WQM87	07/15/1980	1600	2.7	WQM87	04/17/1995	300	371.9
WQM87	08/13/1980	180	1.1	WQM87	10/16/1995	220	83.8
WQM87	09/11/1980	2600	0.3	WQM87	04/16/1996	80	140
WQM87	04/09/1981	13	3.2	WQM87	With flow	30	2.5
WQM87	05/12/1981	20	0.9	WQM87	10/15/2008	5	6
WQM87	06/09/1981	170	0.5	WQM88	10/17/1991	20	7.5
WQM87	04/15/1982	5	24.1	WQM88	04/15/1992	10	16
WQM87	05/13/1982	90	6	WQM88	10/08/1992	410	4.9
WQM87	06/17/1982	250	2.6	WQM88	04/14/1993	200	331
WQM87	04/19/1983	5	24.5	WQM88	10/06/1993	50	22
WQM87	04/11/1984	80	106.9	WQM88	04/18/1994	50	90
WQM87	10/10/1984	50	0.6	WQM88	10/18/1994	140	55
WQM87	04/15/1985	10	21.8	WQM88	04/17/1995	290	949
WQM87	10/16/1985	120	36.5	WQM88	10/16/1995	400	129
WQM87	10/15/1986	20	14.7	WQM88	04/16/1996	10	163
WQM87	04/13/1987	90	23.8	WQM88	07/15/2002	340	1.3
WQM87	10/20/1987	5	0.8	WQM88	07/16/2003	220	0.5

WQM87=WQM460687 (UMR12)
WQM88=WQM460688 (UMR08)
FC=Fecal Coliform
CFU=colony forming units

Appendix B

Public Comments from 2012 review period

Minnesota Pollution Control Agency

Marshall Office | 504 Fairgrounds Road | Suite 200 | Marshall, MN 56258-1688 | 507-537-7146

800-657-3864 | 651-282-5332 TTY | www.pca.state.mn.us | Equal Opportunity Employer

June 28, 2012

Mr. Rich Hanson
South Dakota Department of Environment and Natural Resources
Joe Foss Building
523 E Capitol Avenue
Pierre, SD 57501

RE: Comments regarding the Draft *Escherichia coli* Bacteria Total Maximum Daily Load Evaluations for the North and South Forks of the Yellow Bank River – Grant, Codington and Deuel Counties, South Dakota Report

Dear Mr. Rich Hanson,

The Minnesota Pollution Control Agency (MPCA) appreciates the opportunity to comment on the report. Since the Yellow Bank River watershed crosses over the state boundary, ongoing communication and cooperation will be instrumental in continuing efforts to improve this watershed.

However, we did not learn of this Total Maximum Daily Load (TMDL) until the state requested comments. It is critical that both states communicate with each other early in projects for waters shared between them, so that potential problems or disparities in standards or allocations can be addressed as effectively and efficiently as possible. Both Environmental Protection Agency (EPA) regional offices also need to be involved in this upfront communication. We look forward to working with South Dakota on mutual watersheds. Please let us know if you would like to discuss how we can improve communications between the states in the future.

We appreciate the use of the Minnesota standard of 126 colony forming units per 100 milliliters, in the development of the TMDL. It is more stringent than South Dakota's standard of 630 counts per 100 milliliters, for the beneficial use of limited contact recreation. The use of the Minnesota standard will help ensure that the waters in both states will meet the standards and the TMDL goals.

On page 12, table 3 states that the community of LaBolt has a waste load allocation (WLA), and then the paragraph below this table explains why LaBolt was not given a WLA. Further, on page 13, a WLA was calculated for LaBolt and displayed in table 5. This is very confusing to the reader due to inconsistency. It is suggested to revise this section by removing the WLA development for the community of LaBolt.

When adding the Load Allocation (LA), WLA, and Margin of Safety (MOS) for dry conditions in table 10, this equals out to 2.7E+10 and the total in the table is 2.8E+10. Also, when adding the LA, WLA, and MOS for low flows in table 11, this equals out to 9.3E+08 and the total in the table is 9.2E+08.

Mr. Rich Hanson
Page 2
June 28, 2012

The numbering format on pages 25 and 28 should be revised to read as follows, 5.0.4 Dry Conditio (60% to 90% flow frequency), 5.0.5 Low Flows (90% to 100% flow frequency), 5.1.4 Dry Conditions (60% to 90% flow frequency) and 5.1.5 Low Flows (90% to 100% flow frequency).

Again, thank you for the opportunity to comment.

Sincerely,

Katherine Pekarek-Scott

Katherine Pekarek-Scott
Pollution Control Specialist
Marshall Office
Watershed Division

cc: Lee Ganske, MPCA
Jeff Risberg, MPCA

DENR Response:

Paragraph 1-3: DENR agrees that communication between two states is imperative when impaired waters cross state borders. DENR engaged in a partnership with East Dakota Water Development District, the Upper Minnesota River Watershed District (UMRWD) and MPCA to conduct a TMDL assessment of the North and South Fork Yellow Bank River watersheds in South Dakota. Both MN agencies were involved in all aspects of the TMDL assessment. DENR and EDWDD communicated with representatives from both MN agencies on a regular basis to discuss progress. Discussions commonly involved TMDL development and implementation. Representatives from the UMRWD and MPCA were aware that DENR intended to use MN's geometric mean standard for *E. coli* early in the TMDL development process. DENR participates in annual meetings with MPCA and its partners to stay abreast of activities being conducted in the Upper MN River Basin. DENR has used those meetings as a forum to update MPCA and its partners of delays experienced with finalizing the TMDLs at EPA Region 8. DENR intends to conduct a second public notice period as aspects of the TMDLs have changed as a result of subsequent EPA region 8 reviews. DENR will formally notify MPCA of the second review period. DENR also expects that the EPA regions will communicate during a second public notice period. It is clear that not all communication channels were considered between the two state agencies during TMDL development. DENR is certainly open to discussing ways to better strengthen communication especially where TMDL development impacts the protection of downstream water quality across state borders.

Paragraph 4: The point source section was considerably revised based on comments provided by EPA Region 8 during an informal review following the 2012 public notice period. The revised section addresses MPCA's comments involving the WLA for the community of LaBolt. MPCA will be given an opportunity to review and comment on the TMDL document during a second public notice period prior to finalization.

Paragraph 5:

The discrepancy in TMDL calculations (LA+WLA+MOS) for the Dry Flow Condition in Table 9 (formerly Table 10) and Low Flow Condition in Table 10 (formerly Table 11) described by MPCA is based on rounding error. The TMDL values were rounded down in both instances to equate to the sum of LA+WLA+MOS as recommended. MPCA will be given a second opportunity to review and comment on the TMDL document during a second public notice period prior to finalization.

Paragraph 6:

The numbering format for the identified sections was corrected in the document as per MPCA's comment. MPCA will be given a second opportunity to review and comment on the TMDL document during a second public notice period prior to finalization.

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

MAY 2 1 2018

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MAY 2 5 2018
Dept. of Environment and Natural Resources Secretary's Office

Ref: 8WP-CWP

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

Re: Approval of North and South Fork Yellow Bank River *E. coli* Total Maximum Daily Loads

Dear Mr. Pirner,

The U.S. Environmental Protection Agency (EPA) has completed review of the total maximum daily loads (TMDLs) submitted by your office on April 26, 2018. In accordance with the Clean Water Act (33 U.S.C. §1251 *et. seq.*) and the EPA's implementing regulations at 40 C.F.R Part 130, the EPA hereby approves South Dakota's *E. coli* TMDLs for the North and South Forks of the Yellow Bank River. The EPA has determined that the separate elements of the TMDLs listed in the enclosure adequately address the pollutant of concern, are designed to attain and maintain applicable water quality standards, consider seasonal variation and include a margin of safety. The EPA's rationale for this action is contained in the enclosure.

Thank you for submitting these TMDLs for our review and approval. The EPA supports TMDLs that account for downstream impacts and commends South Dakota for establishing these TMDLs in a manner that protect Minnesota's downstream water quality standards. If you have any questions, please contact Peter Brumm on my staff at 406-457-5029.

Sincerely,

Darcy O'Connor
Assistant Regional Administrator
Office of Water Protection

Enclosure
EPA Region 8 TMDL Review Form and Decision Document

ENCLOSURE

EPA REGION 8 TMDL REVIEW FORM AND DECISION DOCUMENT

TMDL Document Info:

Document Name:	*Escherichia coli* Bacteria Total Maximum Daily Load (TMDL) for the North and South Forks of the Yellow Bank River-Grant, Codington and Deuel Counties, South Dakota
Submitted by:	South Dakota Department of Environment and Natural Resources (DENR)
Date Received:	4/26/2018
Review Date:	5/1/2018
Reviewer:	Peter Brumm
Rough Draft / Public Notice / Final Draft?	Final
Notes:	

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

☒ Approve
☐ Partial Approval
☐ Disapprove
☐ Insufficient Information

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

TMDL Summary	
Number of TMDLs:	*2*
Number of Causes Addressed by TMDL:	*2*
Number of Pathogen TMDLs:	*2*

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 TMDL review elements identified in the following 8 sections:

1. Problem Description
    1.1. TMDL Document Submittal
    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 can 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 review elements 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 this review form 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 form 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 Document Submittal

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

Review Elements:

☒ Each TMDL document submitted to EPA should include a notification of the document status (e.g., pre-public notice, public notice, final), and a request for EPA review.

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

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

Summary: This TMDL document was electronically submitted to EPA for final review and approval on April 26th, 2018. An adequate submittal letter was included.

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.

Review Elements:

☒ 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: This TMDL document was written to address *E. coli* impairments for the North and South Forks of the Yellow Bank River. DENR originally identified these impairments on the 2012 303(d) List. With the completion of these TMDLs, the first for either waterbody, all known causes of impairments have been addressed by TMDLs.

TMDL Waterbody Impairment Summary Table

Waterbody Description	Waterbody ID	Cause of Impairment	Pollutant Addressed	Resolution
North Fork Yellow Bank River, SD/MN border to S27,T120N, R48W	SD-MN-R-YELLOW_BANK_N_FORK_01	*E. coli*	*E. coli*	TMDL Approved*
South Fork Yellow Bank River, SD/MN border to S33, T118N, R49W	SD-MN-R-YELLOW_BANK_S_FORK_01	*E. coli*	*E. coli*	TMDL Approved*

*Indicates TMDL recommended for approval as part of this EPA action

The TMDL document's watershed characteristics Section 1.1 briefly describes the boundaries, land use, climate, and geology of the watershed. Figure 1 and 2 display the general location of the project area and monitoring stations where water quality data was collected for TMDL analyses.

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).

Review Elements:

☒ 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 identified 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: Section 2.0 of the TMDL document introduces South Dakota water quality standards and references state regulations that establish beneficial uses, numeric, and narrative water quality criteria (ARSD 74:51). The unsupported South Dakota beneficial use addressed by these TMDLs is a limited contact recreation use. Excessive amounts of fecal bacteria in surface waters used for recreation increases the risk of pathogen-induced illness to humans such as gastrointestinal, respiratory, and skin issues. *E. coli*, a subset of fecal bacteria, is a commonly used indicator of water quality and human health risk. A direct relationship exists between the pollutant of concern and the numeric criteria; both are *E. coli*. According to the South Dakota water quality standards and assessment methods, a stream is deemed impaired if greater than 10% of the *E. coli* samples exceed 630 cfu/100ml or a 30-day geometric mean value of 1,178 cfu/100ml. The existing North and South Fork Yellow Bank River data sets exceed both criteria. South Dakota's *E. coli* water quality standard applies during the recreation season from May 1st to September 30th.

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, embeddedness, stream morphology, up-slope conditions and a measure of biota).

Review Elements:

☒ 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 South Dakota waterbody segments subject to these TMDLs end at the state line where the waters continue into Minnesota. Accordingly, as part of the TMDL process DENR reviewed downstream water quality standards to ensure protectiveness of the chosen TMDL targets.

Minnesota designates the North and South Fork Yellow Bank Rivers as primary contact recreation waters and has established numeric *E. coli* criteria. To support Minnesota's designated use, the geometric mean *E. coli* concentration must not exceed 126 cfu/100ml and no more than 10% of the samples shall exceed 1,260 cfu/100ml. Minnesota's criteria apply from April 1st to October 31st. Compared to South Dakota's criteria ($\leq$ 10% of samples exceed geomean $\leq$ 630 or single sample of 1,178), Minnesota's geometric mean criteria of 126 cfu/100ml is the most stringent. Therefore, to ensure protection with Minnesota's water quality standards at the state line, DENR selected a target of 126 cfu/100ml for the North and South Fork Yellow Bank TMDLs. This selection rationale is described in Section 2.0 of the TMDL document.

Minnesota received EPA-approval in 2013 for *E. coli* TMDLs established for the Minnesota portions of these waterbodies. The Minnesota TMDLs did not assign allocations to South Dakota sources but did stress that Minnesota water quality standards can only be achieved if upstream reductions occur given that significant portions of the watersheds reside within South Dakota's jurisdiction (>80%). This South Dakota TMDL, when fully implemented, should achieve water quality standards in both states.

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 identified source (or source category) when the relative load contribution from each source has been estimated. Therefore, the pollutant load from each identified source (or source category) should be specified and quantified. 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.

Review Elements:

☒ The TMDL should include an identification of the 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 the anthropogenic sources of the pollutant of concern have been identified, characterized, and 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: Land use in the North and South Fork Yellow Bank River basins is similar and primarily agricultural with numerous animal feeding operations and some row cropping. DENR began the source assessment by reviewing permitted point sources in Section 3.1 of the TMDL document. No facilities have NPDES permits that authorize discharges directly into the North or South Fork Yellow Bank River, however, there are several municipalities and Concentrated Animal Feeding Operations (CAFOs) that were investigated for potential indirect contributions via tributary loading. Seven small communities are located within the watersheds of interest. The largest, South Shore, has a population of 270 people. As displayed in Table 4 of the TMDL document, two of these communities are serviced by individual septic systems and therefore do not require permitting, four are permitted to discharge only in an emergency, and the remaining community, LaBolt (SD0026662), is permitted to discharge twice a year. DENR goes on to characterize LaBolt's discharge and existing permit requirements, ultimately concluding the facility is an unlikely contributor to the downstream South Fork Yellow Bank River *E. coli* impairment.

Table 3 of the TMDL document provides information about the other class of point sources in the watersheds of interest: CAFOs. Five facilities operate under the state's general CAFO permit. All but one of them is located in the North Fork basin. Three CAFOs are housed operation types which are not allowed to discharge solid or liquid manure to state waters. The remaining two use open lot systems and are only allowed to discharge under rare conditions (i.e., 25-year, 24-hour precipitation event). Additionally, these CAFOs must follow several other design, operation, maintenance, and record keeping requirements of the general permit. There are also a number of smaller, unpermitted, feedlots that were characterized as part of the nonpoint source analysis.

DENR investigated potential *E. coli* loading from various livestock and wildlife species using species-specific bacterial production rates from literature and animal population densities from the U.S. Dept. of Agriculture's 2012 National Agricultural Statistics Service (NASS) and South Dakota Game Fish and Park's (SD GFP) County Wildlife Assessments. Human loading was similarly estimated (population density x bacterial production rate), which is an overestimation representing no treatment by community wastewater systems and 100% septic failure rate. The results, shown in Tables 5 and 6 of the TMDL document, were then used to compare amongst species and provide insight into what source-types introduce the most *E. coli* to the landscape. In both watersheds, this analysis concluded that beef cows were by far the largest source of *E. coli* (>82% of total production) followed by dairy cows (>13%). Furthermore, most production occurs on rangeland (~65%) versus feedlots (~35%), especially considering that a portion of the feedlot production is controlled through CAFO permits and therefore not expected to reach the river. Less significant contributors include wildlife (1%), which was considered natural, and human (<1%). No microbial source tracking studies were mentioned.

<u>Comments:</u> None.

4. TMDL Technical Analysis

TMDL determinations should be supported by an analysis of the available data, discussion of the known deficiencies and/or gaps in the data set, and an appropriate level of technical analysis. This applies to **<u>all</u>** of the components of a TMDL document. It is vitally important that the technical basis for **<u>all</u>** 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:

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

Where:

TMDL	=	Total Maximum Daily Load (also called the Loading Capacity)
LAs	=	Load Allocations
WLAs	=	Wasteload Allocations
MOS	=	Margin Of Safety

Review Elements:

☒ 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:

- the spatial extent of the watershed in which the impaired waterbody is located and the spatial extent of the TMDL technical analysis;
- the distribution of land use in the watershed (e.g., urban, forested, agriculture);

- 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…;
- 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);
- an explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

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

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

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

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

Summary: These TMDLs follow a load duration curve approach based largely on EPA's 2007 technical support document titled "*An Approach for Using Load Duration Curves in the Development of TMDLs.*" To develop load duration curves DENR first constructed a long-term discharge data set for each waterbody by recording continuous stage, or water elevation, at one lower site on each fork of the river (UMR08 and UMR12). East Dakota Water Development District, in coordination with DENR, manually measured discharge at these same sites periodically from May 2010 to October 2011. DENR then used these paired stage and discharge values within the hydrologic time-series computer program *Aquarius* to generate continuous stage-discharge rating curves for each segment as described in Section 4.2 of the TMDL document. Lastly, to extend the discharge data sets beyond the 2010-2011 timeframe, DENR mathematically related these estimations of mean daily flow to measured data at nearby USGS gages and extrapolated those estimations for the gage's entire period of record. Thus, a long-term discharge data set for the North Fork Yellow Bank River at UMR08 was derived using 1999-2011 data from USGS gage 05292704 located three miles downstream and the South Fork Yellow Bank River discharge at UMR12 was derived using 1939-2011 data from USGS gage 05293000, which is located ten miles downstream just below the confluence of the North and South Forks.

DENR grouped these discharge data sets into five zones: high flows, moist conditions, mid-range flows, dry conditions, and low flows. Next, this ranked flow data set was multiplied by the *E. coli* TMDL target (126 cfu/100ml) and a unit conversion factor (2.44×10^7) to produce a dynamic expression of the allowable load for any given flow in the form of a load duration curve. On top of this curve in Figures 6 and 7, DENR plotted existing conditions as instantaneous loads using the bacteria concentration data set presented in Appendix A.

TMDLs and allocations are presented separately for each of the five flow zones and set at the 95th percentile flow of each zone in Sections 5.0 and 5.1 of the TMDL document. Point sources are given a WLA of zero for all zones. An explicit MOS is reserved and the remaining assimilative capacity is allocated to a combined nonpoint source LA. Required reductions are presented based on the difference between the 95th percentile of the existing condition load and the TMDL load. Significant reductions are needed during all flows zones. All TMDL components clearly relate back to a balanced TMDL equation.

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…).

Review Elements:

☒ TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and appropriate water quality criteria.

☒ The TMDL document submitted should be accompanied by the data set utilized during the TMDL analysis. If possible, it is preferred that the data set be provided in an electronic format and referenced in the document. If electronic submission of the data is not possible, the data set may be included as an appendix to the document.

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

Summary: Section 4.3 of the TMDL document discusses the *E. coli* data set and presents several summary tables and figures. Here DENR also calculates geometric means of the monitoring data set to compare against water quality standards and the TMDL target. DENR justifies using fecal coliform data to supplement much larger *E. coli* data sets, all of which is contained in Appendix A.

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.

Review Elements:

☒ EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and 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: No point sources discharge *E. coli* bacteria directly to the impaired segments of the North Fork and South Fork Yellow Bank River. Point sources with a potential to indirectly contribute via tributary loading, such as CAFOs and community wastewater systems, were reviewed and found to rarely discharge or be covered by protective NPDES permit requirements that make point sources an unlikely source of *E. coli* impairment. Therefore, a WLA of zero was given to both TMDLs across all flow zones as shown in Tables 9 and 10 of the TMDL document. Meeting the intent of this WLA will be judged by compliance with existing permit conditions.

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.

Review Elements:

☒ 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 the 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: Load allocations are established separately for each of the five flow zones (see Tables 9 and 10 of the TMDL document) and are defined as the remaining TMDL load after subtracting the explicit MOS. While the source assessment characterized natural background loading from wildlife separately, the load allocations ultimately established represent all nonpoint sources, both natural and anthropogenic, as one combined load per flow zone. TMDL loading reductions are entirely assigned to these combined LAs which, according to the current monitoring data set, require a 30% to 95% reduction depending on flow zone. To understand the components of this composite LA and guide restoration efforts, refer to the source analysis findings.

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).

Review Elements:

☒ 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: 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 which results in a substantial MOS. This process is explained in Section 6.1 of the TMDL document. Additionally, numerous conservative assumptions were made such as choosing not to incorporate an *E. coli* die-off rate and selecting the 30-day geometric mean criterion as the TMDL target to establish daily load limits.

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.

Review Elements:

☒ 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: The load duration curve approach inherently accounts for seasonal variation in streamflow patterns and changes in water quality because the resulting dynamic expression provides the allowable load for any given flow. Additionally, basing the analysis on a long-term data set ensures a more representative assessment, opposed to a short-term data set that may capture an abnormally wet or dry period. DENR also provides insight into annual loading variations by analyzing conditions and assigning loads separately for the five flow zones. Significant loading reductions are needed during all flows zones on both waterbodies. Section 6.2 of the TMDL document discusses these concepts and encourages restoration activities that address both diffuse landscape loading sources that contribute mostly during higher flow zones and riparian or direct channel loading sources that dominate during lower flow zones.

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.

Review Elements:

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

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

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

Summary: The public participation process is summarized in Section 7.0 of TMDL document. The draft TMDL was initially released for a 30-day public comment period in June, 2012. Following significant revisions, the TMDL was public noticed again from March 2, 2018 to April 9, 2018. Both opportunities for public review and comment were posted on DENR's website and announced in local newspapers.

One set of comments was submitted in 2012 by the Minnesota Pollution Control Agency seeking clarification on several items and encouraging additional interstate coordination. DENR's responses are provided in Appendix B with the original comment letter. No comments were received during the 2018 public notice period.

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.

Review Elements:

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

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

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

Summary: DENR and East Dakota Watershed Development District have partnered to continue collecting monthly *E. coli* data and recording stage at stations consistent with those used for TMDL development (UMR08 and UMR12). Section 8.0 of the TMDL document notes this effort will continue as long as resources allow. Results of this future monitoring will be used to judge implementation effectiveness and to help determine whether TMDL revisions are needed. No action has been taken on this review element because these are not phased TMDLs, however, EPA encourages future data collection and effectiveness monitoring as described in this TMDL document.

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.

Review Elements:

☐ 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 ☒ N/A

Summary: Section 9.0 of the TMDL document briefly introduces DENR's strategy for achieving TMDL reductions which primarily involves the continued use of Clean Water Act §319 grants to implement agriculturally-based water quality improvement projects. A local project coordinator has already begun developing stakeholder relationships and has started targeting grazing management improvements. No action has been taken on this review element because EPA does not approve the restoration strategy or implementation plan aspects of TMDLs, however, EPA encourages the planning of future actions as contained in this TMDL document.

Comments: None.

8. Daily Loading Expression

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

Review Elements:

☒ 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 TMDL and allocations are expressed in terms of colony-forming units (CFU) of *E. coli* per day.

Comments: None.