Fecal Coliform Bacteria TMDL for Shortfoot Creek in Sargent County, North Dakota

Final: September 2010

Prepared for:
US EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Prepared by:
Michael J. Hargiss
Environmental Scientist
North Dakota Department of Health
Division of Water Quality
Gold Seal Center, 4th Floor
918 East Divide Avenue
Bismarck, ND 58501-1947

North Dakota Department of Health
Division of Water Quality

Fecal Coliform Bacteria TMDL
for Shortfoot Creek in
Sargent County, North Dakota

John Hoeven, Governor
Terry Dwelle, M.D., State Health Officer

North Dakota Department of Health
Division of Water Quality
Gold Seal Center, 4th Floor
918 East Divide Avenue
Bismarck, ND 58501-1947

701.328.5210

List of Figures

List of Tables

Appendices

1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

The Shortfoot Creek watershed is a 55,203 acre watershed located in Sargent County in southeastern North Dakota (Figure 1) with the upstream portion of the watershed originating in South Dakota. Shortfoot Creek is a tributary of the Wild Rice River and lies within the Northern Glaciated Plains Ecoregion (46).

Table 1. General Characteristics of Shortfoot Creek and its Watershed.

Legal Name	Shortfoot Creek
Stream Classification	Class III
Major Drainage Basin	Red River
8-Digit Hydrologic Unit	09020105
Counties	Sargent County
Ecoregions	Northern Glaciated Plains (Level III), Glacial Lake Basin, Tewaukon Dead Ice Moraine, Drift Plains (Level IV)
Watershed Area (acres)	55,203

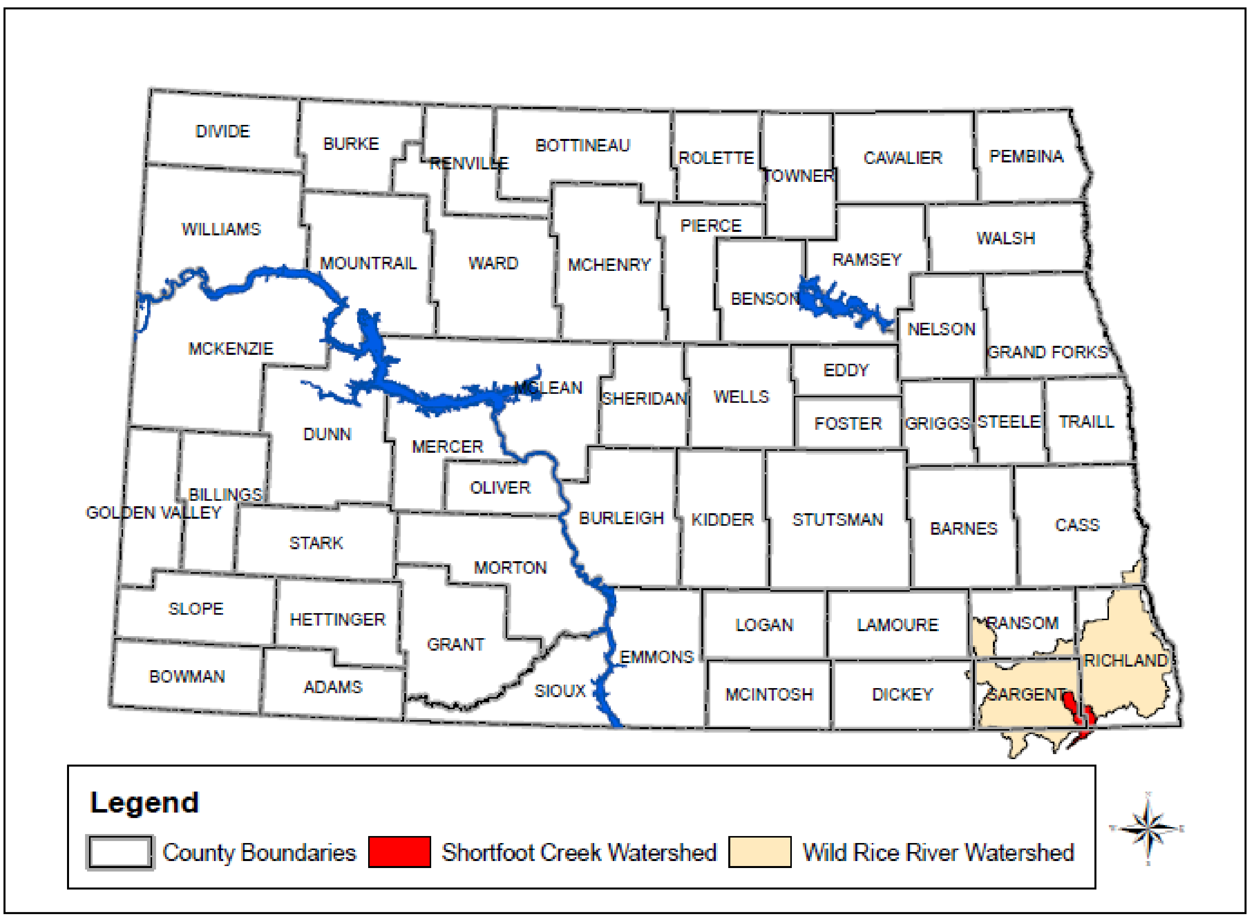


Figure 1. Shortfoot Creek and Wild Rice River Watershed in North Dakota.

1.1 Clean Water Act Section 303(d) Listing Information

Based on the 2010 Section 303 (d) List of Waters Needing TMDLs (NDDoH, 2010), the North Dakota Department of Health (NDDoH) has identified a 16.16 mile segment (ND-09020105-016-S_00) on Shortfoot Creek, in Sargent County, from its confluence with the Wild Rice River upstream to the ND-SD border, including all tributaries as not supporting, for recreational uses due to fecal coliform bacteria (Table 2).

According to the 2010 South Dakota Integrated Report of Surface Water Quality Assessment (SDDENR, 2010) Shortfoot Creek is not listed as impaired. Shortfoot Creek is classified for fish and wildlife propogation, recreation, and stock watering, and irrigation waters beneficial uses (see Section 2.3).

Table 2. Shortfoot Creek Section 303(d) Listing Information for Assessment Unit ID ND-09020105-016-S_00 (NDDoH, 2008).

Assessment Unit ID	ND-09020105-016-S_00
Waterbody Description	Shortfoot Creek, in Sargent County, from its confluence with the Wild Rice River upstream to the ND-SD border, including all tributaries
Size	16.16 miles
Designated Use	Recreation
Use Support	Not Supporting
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

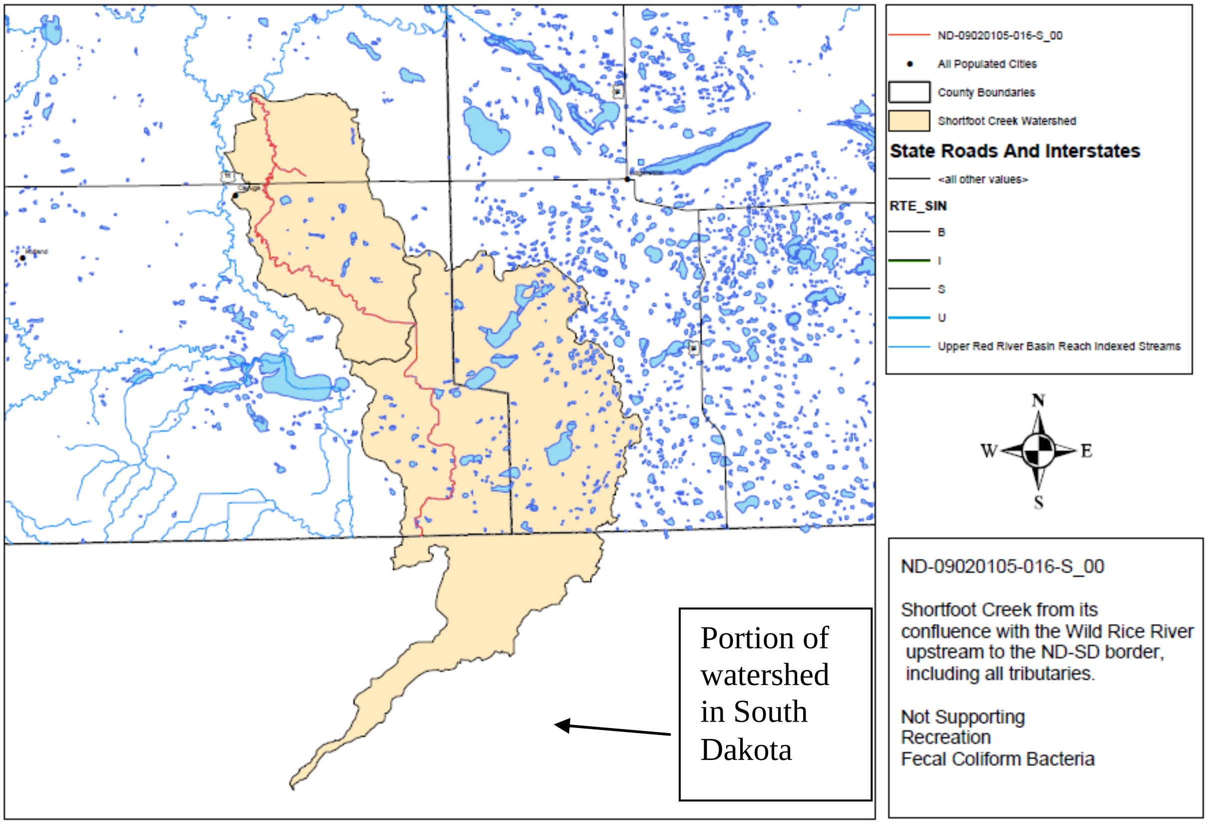


Figure 2. Shortfoot Creek TMDL Listed Segment.

1.2 Topography

Approximately seventy-five percent of the watershed for the Section 303(d) listed segment highlighted in this TMDL is within the Level IV Tewaukon Dead Ice Moraine ecoregion (46e), twenty percent located in the Drift Plains (46i), and the remaining five percent in the Glacial Lake Basin (46c) (Figure 3). The Tewaukon Dead Ice Moraine (46e) ecoregion is a continuation of the Prairie Coteau extending below the Prairie Coteau Escarpment. A large density of semipermanent wetlands provide feeding and nesting habitat for many species of waterfowl, with the remaining upland areas under cultivation. The Drift Plains (46i) ecoregion was formed by the retreating Wisconsinan glacier that left a thick mantle of glacial till. The landscape consists of temporary and seasonal wetlands. Due to the productive soil of this ecoregion almost all of the area is under cultivation. The Glacial Lake Basin (46c) ecoregion is characterized by smooth topography, deep soils on the lake plains, and is intensively cultivated (USGS, 2006).

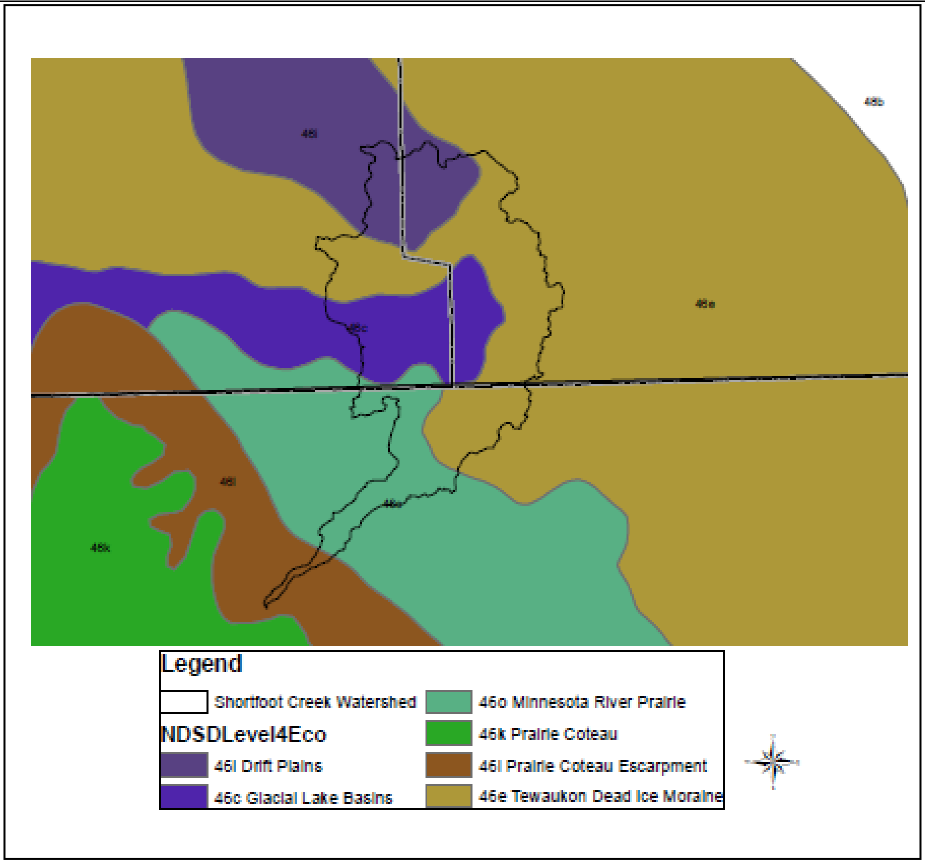


Figure 3. Level IV Ecoregions in the Shortfoot Creek Watershed.

1.3 Land Use

The dominant land use on the North Dakota side of the Shortfoot Creek watershed is row crop agriculture. According to the National Agricultural Statistical Service (NASS, 2007a) land survey data, approximately 53 percent of the land is active cropland, 9 percent is wetlands, 6 percent water, 6 percent grassland, and 26 percent is either CRP, pasture, woods, or open space (Figure 4).

The dominant land use on the South Dakota side of the Shortfoot Creek watershed is also row crop agriculture with 68.8 percent of the 9,814 acres of the watershed on the South Dakota side in corn (38.7 percent) and soybeans (31.1 percent) (NASS, 2007b). Another 6.1 percent is in other agricultural uses (e.g., small grains, alfalfa, and pastureland. The remaining acreage in the South Dakota portion of the watershed is wetlands (10.4 percent), grasslands (4.4 percent), and forest (2.1 percent). Less than 1 percent is developed. Based on information provided by the South Dakota Department of Natural Resources in there public comments to the draft TMDL report, there are two permitted CAFOs in the upper portion of the watershed (Appendix E).

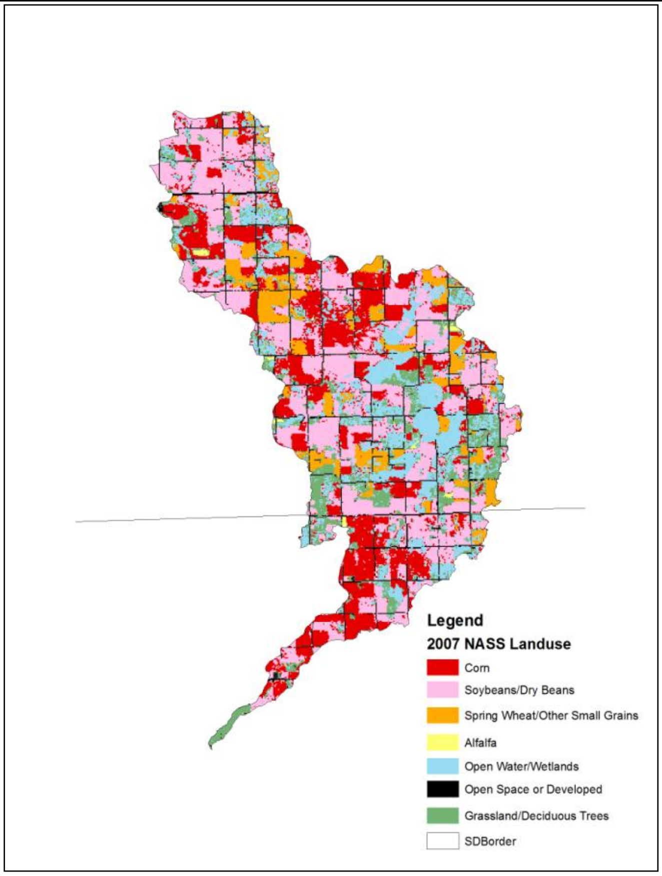


Figure 4. Land Use in the Shortfoot Creek Watershed (NASS, 2007a and NASS 2007b).

1.4 Climate and Precipitation

Figures 5 and 6 show the annual precipitation and average temperature for Britton, SD from 1999-2009. The town of Britton, South Dakota is located 20 miles west of the Shortfoot Creek watershed. Sargent County has a subhumid climate characterized by quite warm summers with frequent hot days and occasional cool days. Average temperatures range from 12º F in winter to 60º F in summer. Precipitation occurs primarily during the warm period and is normally heavy in later spring and early summer. Total annual precipitation is about 20 inches.

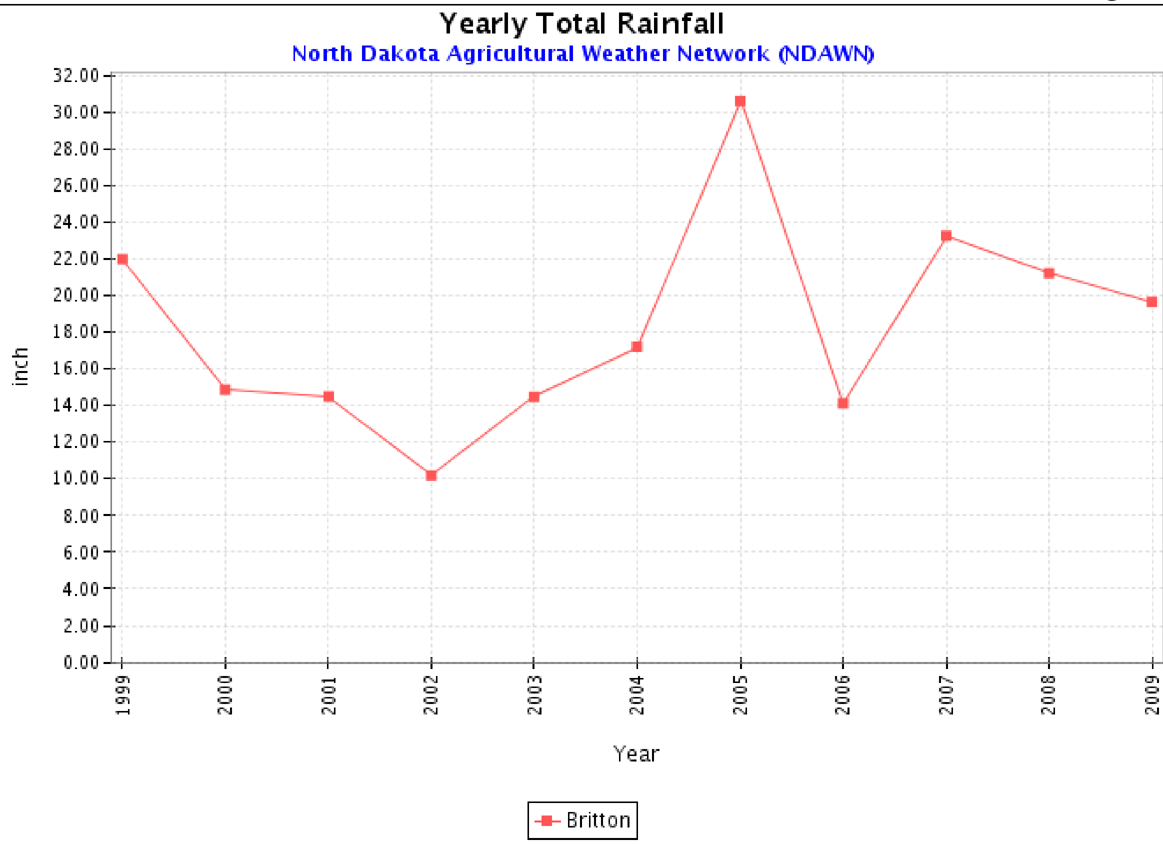


Figure 5. Annual Total Precipitation at Britton, South Dakota from 1999-2009. North Dakota Agricultural Weather Network (NDAWN).

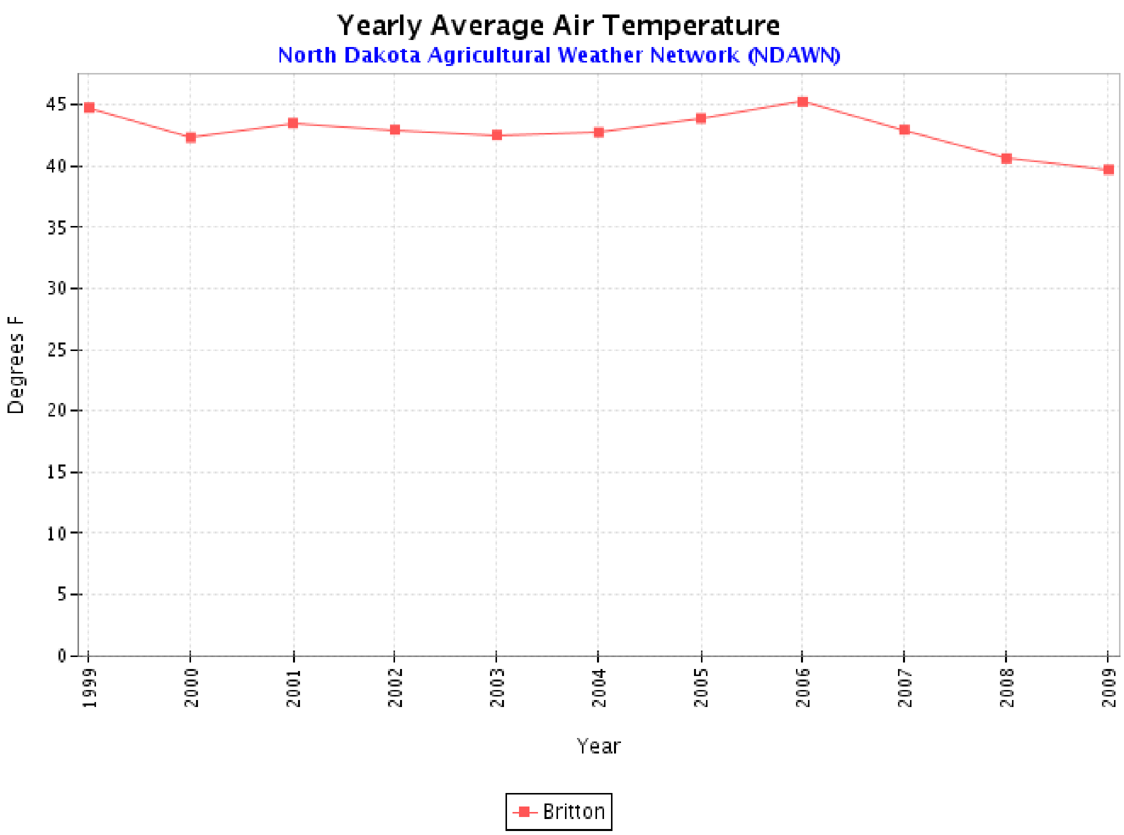


Figure 6. Annual Average Air Temperature at Britton, South Dakota from 1999-2009. North Dakota Agricultural Weather Network (NDAWN).

1.5 Available Data

1.5.1 Fecal Coliform Bacteria Data

Fecal coliform bacteria samples were collected at one location within the TMDL listed watershed (Figure 7). The monitoring site, station ID 384037, is located 0.8 miles east of Cayuga, ND on Highway 11. Site 384037 was monitored weekly or when flow conditions were present during the recreation season of 1996, 1998 and 2000-2009 by the Sargent County Soil Conservation District. While the state of North Dakota has an E. coli bacteria standard (see Section 2.2), no E. coli data are available for the TMDL reach or for Shortfoot Creek in North Dakota. The recreation season in North Dakota is May 1 to September 30 (NDDoH, 2006).

Table 3 provides a summary of fecal coliform geometric mean concentrations, the percentage of samples exceeding 400 CFU/100mL for each month and the recreational use assessment by month. The geometric mean fecal coliform bacteria concentration and the percent of samples over 400 CFU/100ml was calculated for each month (May-September) using those samples collected during each month in 1996, 1998, and 2000-2009.

Table 3. Summary of Fecal Coliform Bacteria Data for Site 384037 Collected in 1996, 1998, and 2000-2009.

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	55	72	11%	Fully Supporting but Threatened
June	43	267	42%	Not Supporting
July	32	381	50%	Not Supporting
August	18	406	50%	Not Supporting
September	18	508	72%	Not Supporting

According to the data collected in 1996, 1998, and 2000-2009 geometric mean and percent exceeded calculations determined that during the months of June through September Shortfoot Creek is not supporting recreational beneficial use because of fecal coliform bacteria. A table of raw fecal coliform bacteria data can be found in Appendix A.

1.5.2 Hydraulic Discharges

A discharge record was constructed for the listed segment using the Drainage Area Ratio Method (Ries et al., 2000) and the historical discharge measurements collected by the USGS at gauging station (05051600) from 1980-2009. Site 384037 is located in the adjacent Wild Rice Creek watershed, also a tributary to the Wild Rice River.

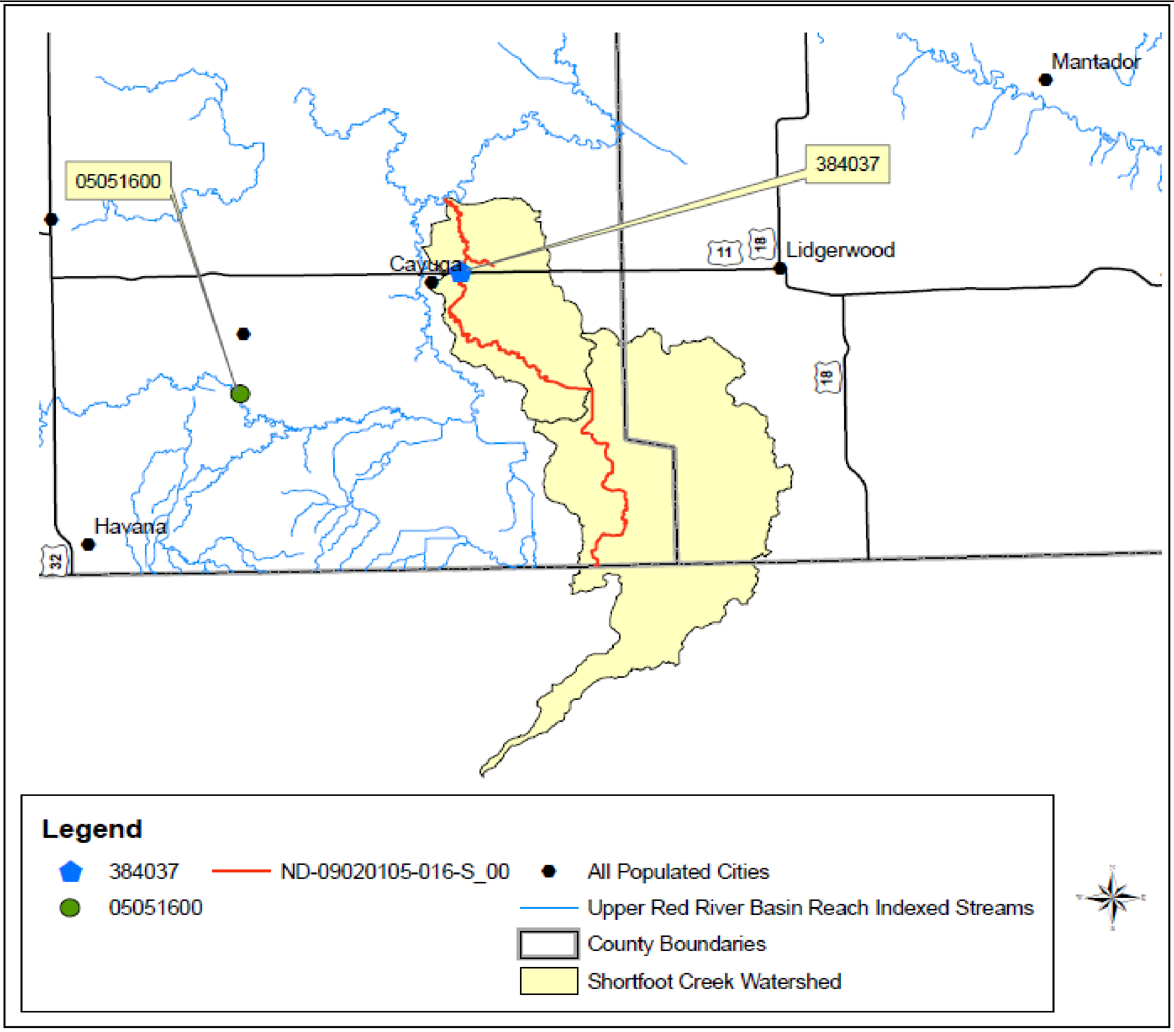


Figure 7. Fecal Coliform Bacteria Sample Site (384037) on the TMDL Listed Segment of Shortfoot Creek and USGS Gauge Station (05051600) located on the mainstem Wild Rice River.

2.0 WATER QUALITY STANDARDS

The Clean Water Act requires that Total Maximum Daily Loads (TMDLs) be developed for waters on a state's Section 303(d) list. A TMDL is defined as "the sum of the individual wasteload allocations for point sources and load allocations for non point sources and natural background" such that the capacity of the waterbody to assimilate pollutant loadings is not exceeded. The purpose of a TMDL is to identify the pollutant load reductions or other actions that should be taken so that impaired waters will be able to attain water quality standards. TMDLs are required to be developed with seasonal variations and must include a margin of safety that addresses the uncertainty in the analysis. Separate TMDLs are required to address each pollutant or cause of impairment, which in this case is fecal coliform bacteria.

2.1 Narrative North Dakota Water Quality Standards

The North Dakota Department of Health has set narrative water quality standards that apply to all surface waters in the State. The narrative general water quality standards are listed below (NDDoH, 2006).

- All waters of the State shall be free from substances attributable to municipal, industrial, or other discharges or agricultural practices in concentrations or combinations that are toxic or harmful to humans, animals, plants, or resident aquatic biota.

- No discharge of pollutants, which alone or in combination with other substances shall:

  a. Cause a public health hazard or injury to environmental resources;
  b. Impair existing or reasonable beneficial uses of the receiving water; or
  c. Directly or indirectly cause concentrations of pollutants to exceed applicable standards of the receiving waters.

In addition to the narrative standards, the NDDoH has set biological goal for all surface waters in the state. The goal states "the biological condition of surface waters shall be similar to that of sites or waterbodies determined by the department to be regional reference sites" (NDDoH, 2006).

2.2 Numeric North Dakota Water Quality Standards

Shortfoot Creek is a Class III stream. The NDDoH definition of a Class III stream is shown below (NDDoH, 2006).

Class III- The quality of the waters in this class shall be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation and fish and aquatic biota. The quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses.

Numeric criteria have been developed for Class III streams for both fecal coliform bacteria and E. coli (Table 4). Both bacteria standards apply only during the recreation season from May 1 to September 30.

Table 4. North Dakota Fecal Coliform and E. coli Bacteria Standards for Class III Streams.

Parameter	Water Quality Standard	
	Geometric Mean[1]	Maximum[2]
Fecal Coliform Bacteria	200 CFU/100 mL	400 CFU/100 mL
E. coli	126 CFU/100 mL	409 CFU/100 mL

[1] Expressed as a geometric mean of representative samples collected during any consecutive 30-day period.
[2] No more than 10 percent of samples collected during any consecutive 30-day period shall individually exceed the standard.

2.3 Narrative South Dakota Water Quality Standards

The South Dakota Department of Environment and Natural Resources has narrative standards that apply to all surface waters in the State. These narrative general water quality standards are reference below (SDDENR, 2009).

- Compliance with criteria for beneficial use.
  - A person may not discharge or cause to be discharged into surface waters of the state pollutants which cause the receiving water to fail to meet the criteria for its existing or designated use or uses.

- Restrictions for water with dual classifications.
  - If waters have more than one designated beneficial use and criteria are established for a parameter that is common to two or more uses, such as coliform organisms or pH, the more restrictive criterion for the common parameter applies.

- Application of criterion to contiguous water.
  - If pollutants are discharged into a segment and the criteria for that segment's designated beneficial use are not exceeded, but the waters flow into another segment whose designated beneficial use requires a more stringent parameter criterion, the pollutants may not cause the more stringent criterion to be exceeded.

- Materials causing pollutants to form in waters.
  - Wastes discharged into surface waters of the state may not contain a parameter which violates the criterion for the waters' existing or designated beneficial use or impairs the aquatic community as it naturally occurs. Where the interaction of materials in the wastes and the waters causes the existence of such a parameter, the material is considered a pollutant and the discharge of such pollutants may not cause the criterion for this parameter to be violated or cause impairment to the aquatic community.

- Visible pollutants prohibited.
  - Raw or treated sewage, garbage, rubble, unpermitted fill materials, municipal wastes, industrial wastes, or agricultural wastes which produce floating solids, scum, oil slicks, material discoloration, visible gassing, sludge deposits, sediments, slimes, algal blooms, fungus growths, or other offensive effects may not be discharged or caused to be discharged into surface waters of the state.

- Biological integrity of waters.
  - All waters of the state must be free from substances, whether attributable to human-induced point source discharge or nonpoint source activities, in concentrations or combinations which will adversely impact the structure and function of indigenous or intentionally introduced aquatic communities.

- Beneficial uses of waters established.
  - The beneficial use classification of surface waters of the state established in this section do not limit the actual use of such waters. The classification designated the minimum quality at which the surface waters of the state are to be maintained and protected. The following are the beneficial use classifications:
    1. Domestic water supply waters;
    2. Coldwater permanent fish life propagation waters;
    3. Coldwater marginal fish life propagation waters;
    4. Warmwater permanent fish life propagation waters;
    5. Warmwater semipermanent fish life propagation waters;
    6. Warmwater marginal fish life propagation waters;
    7. Immersion recreation waters;
    8. Limited contact recreation waters;
    9. Fish and wildlife propagation, recreation, and stock watering waters;
    10. Irrigation waters; and
    11. Commerce and industry waters.

2.4 Numeric South Dakota Water Quality Standards

Shortfoot Creek in South Dakota is identified under the beneficial use classification of fish and wildlife propagation, recreation, and stock watering and irrigation waters (SDDENR, 2009). The numeric criteria for these uses do not include a bacterial component (i.e., fecal coliform or E. coli bacteria).

3.0 TMDL TARGETS

A TMDL target is the value that is measured to judge the success of the TMDL effort. TMDL targets must be based on state water quality standards, but can also include site specific values when no numeric criteria are specified in the standard. The following TMDL target for Shortfoot Creek is based on the NDDoH water quality standard for fecal coliform bacteria.

3.1 Shortfoot Creek Target Reductions in Fecal Coliform Bacteria Concentrations

Shortfoot Creek in North Dakota is impaired due to fecal coliform bacteria. The North Dakota portion of Shortfoot Creek is not supporting recreational beneficial uses because of fecal coliform bacteria counts exceeding the North Dakota water quality standard. The North Dakota water quality standard for fecal coliform bacteria is a geometric mean concentration of 200 CFU/100 mL during the recreation season from May 1 to September 30. Recreation is not a designated use for the South Dakota portion of the Shortfoot Creek, nor does South Dakota have a fecal coliform or E. coli standard for Shortfoot Creek in South Dakota. Thus, the TMDL target for this report is 200 CFU/100 mL. In addition, no more than ten percent of samples collected for fecal coliform should exceed 400 CFU/100 mL. While the standard is intended to be expressed as the 30-day geometric mean, the target is based on the 200 CFU/100 mL geometric mean standard. Expressing the target in this way will ensure the TMDL will result in both components of the standard being met and recreational uses are restored.

It should be understood that the TMDL target and the resulting TMDL only applies to the North Dakota portion of the watershed. In order to ensure that North Dakota's water quality standards can be achieved through implementation of NPS BMPs within the North Dakota portion of the watershed, a boundary condition of 200 CFU/100 mL has been assumed for waters entering the state from South Dakota. This assumption is based on the expectation that the South Dakota Department of Environment and Natural Resources and local resource agencies in the South Dakota portion of the watershed will continue to work with landowners to implement NPS BMPs that will meet the 200 CFU/100 mL standard at the North Dakota-South Dakota border.

Due to the lack of water quality data at or near the North Dakota-South Dakota border, it is difficult to accurately assess the total load crossing into North Dakota from South Dakota. Therefore, the Shortfoot Creek TMDL technical analysis does not include a load duration curve that can be used to fairly allocate a percent of the loading capacity to South Dakota. North Dakota believes that setting a boundary condition is a reasonable alternative to having water quality information at the border, and encourages South Dakota to fund projects as necessary in the upper portion of the watershed to protect North Dakota's downstream uses.

Currently, the state of North Dakota has both a fecal coliform bacteria standard and an E. coli bacteria standard. During the current triennial water quality standards review period, the Department will be eliminating the fecal coliform bacteria standard and will only have the E. coli standard for bacteria. This standards change is recommended by the US EPA as E. coli is believe to be a better indicator of recreational use risk (i.e., incidence of gastrointestinal disease). During this transition period to an E. coli only bacteria standard, the fecal coliform bacteria target for this TMDL and the resulting load allocation is believe to be protective of the E. coli standard as well. This conclusion is based on the assumption that the ratio of E. coli to fecal coliform in the environment is equal to or less that the ratio of the E. coli bacteria standard to the fecal coliform bacteria standard, which is 63% (126:200). If the ratio of E. coli to fecal coliform in the environment is greater than 63%, then it is unlikely that the current TMDL will result in attainment of the E. coli standard. The department will assess attainment of the E. coli standard through additional monitoring consistent with the state’s water quality standards and beneficial use assessment methodology.

4.0 SIGNIFICANT SOURCES

4.1 Point Source Pollution Sources

There are no known point source discharges in the TMDL listed segment of Shortfoot Creek. The community of Cayuga is located within the Shortfoot Creek watershed and has a North Dakota Pollution Discharge Elimination System (NDPDES) permit for a three cell wastewater treatment system. Due to its small population and the size of its wastewater treatment ponds, NDPDES records show that the city as never discharged to Shortfoot Creek. It can therefore be assumed that the fecal coliform bacteria polluting the river are from nonpoint sources.

4.2 Non-point Source Pollution Sources

The TMDL listed segment on Shortfoot Creek is experiencing fecal coliform bacteria pollution from non-point sources in the watershed. While livestock production is not the dominant agricultural practice in the watershed, livestock grazing along and near Shortfoot Creek is believed to the major source of fecal coliform loading to Shortfoot Creek. For purposes of this TMDL, this assumption only applies to the North Dakota portion of the watershed. This assessment is also supported by the load duration curve analysis (Section 5.3) which shows exceedences of the fecal coliform bacteria standard occurring during high, moist, and dry condition flows.

Wildlife may also contribute to the fecal coliform bacteria found in the water quality samples, but most likely in a lower concentration. Wildlife are nomadic with fewer numbers concentrating in a specific area, thus decreasing the probability of their contribution of fecal matter in significant quantities.

Septic system failure might also contribute to the fecal coliform bacteria in the water quality samples. Failures can occur for several reasons, although the most common reason is improper maintenance (e.g. age, inadequate pumping). Other reasons for failure include improper installation, location, and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing.

5.0 TECHNICAL ANALYSIS

In TMDL development, the goal is to define the linkage between the water quality target and the identified source or sources of the pollutant (i.e. fecal coliform bacteria) to determine the load reduction needed to meet the TMDL target. To determine the cause and effect relationship between the water quality target and the identified source, the “load duration curve” methodology was used.

The loading capacity or total maximum daily load (TMDL) is the amount of a pollutant (e.g. fecal coliform bacteria) a waterbody can receive and still meet and maintain water quality standards and beneficial uses. The following technical analysis addresses the fecal coliform bacteria reductions necessary to achieve the water quality standards target of 200 CFU/100 mL with a margin of safety.

5.1 Mean Daily Stream Flow

In southeastern North Dakota, rain events are variable occurring during the months of April through August. Rain events can be sporadic and heavy or light, occurring over a short duration. Precipitation events of large magnitude, occurring at a faster rate than absorption, contribute to high runoff events. These events are represented by runoff in the high flow regime. The medium flow regime is represented by runoff that contributes to the stream over a longer duration. The low flow regime is characteristic of drought or precipitation events of small magnitude and do not contribute to runoff.

Flows for the watershed were determined by utilizing the Drainage-Area Ratio Method developed by the USGS (Ries et. al, 2000). The Drainage-Area Ratio Method assumes that the streamflow at the ungauged site is hydrologically similar (same per unit area) to the stream gauging station used as an index. Landuse was also compared for the two watersheds to determine similarities (i.e cropland, etc) see Table 5. Drainage area and landuse for the ungauged site (384037) and index station (05051600) were determined through GIS using digital elevation models (DEMs) and the 2006 NASS landuse database. Streamflow data for the index station (05051600) was obtained from the USGS Water Science Center website. The index station (05051600) streamflow data was then divided by the drainage area to determine streamflows per unit area at the index station. Those values are then multiplied by the drainage area for the ungauged site to obtain estimated flow statistics for the ungauged site.

Table 5. Landuse Comparison for the Wild Rice River and Shortfoot Creek Watersheds.

Index Station			Ungauged Site	
Wild Rice River Watershed			Shortfoot Creek Watershed[1]	
Acres	Watershed Percentage	Landuse Name	Watershed Percentage	Acres
59,550	23.5%	Corn	23.7%	13,111
45,658	18.0%	Soybeans	32.7%	18,077
176	0.1%	Sunflowers	0.0%	5
2	0.0%	Barley	0.0%	7
11,208	4.4%	Spring Wheat	8.5%	4,695
360	0.1%	Winter Wheat	0.3%	169
32	0.0%	Millet	0.0%	1
8	0.0%	Canola	0.0%	1
1,527	0.3%	Alfalfa	0.4%	250
877	0.1%	Dry Beans	0.0%	5
734	0.1%	Fallow/Idle Cropland	0.1%	58
10,811	1.6%	Grass and Pasture	1.3%	726
17,833	2.6%	Wetlands	1.5%	846
7,990	1.2%	Open Water	6.4%	3,512
13,222	1.9%	Open Space	5.7%	3,161
281	0.0%	Low Intensity Development	0.1%	78
43	0.0%	Medium Intensity Development	0.0%	2
35	0.0%	Barren	0.0%	6
2,543	0.4%	Deciduous Forest	1.1%	615
44,786	6.9%	Grassland Herbaceous	7.2%	3,951
335	0.1%	Woody Wetlands	0.2%	112
35,509	5.7%	Herbaceous Wetlands	8.8%	4,855
36,624	12.6%	Area in South Dakota	19.0%	9,835
149	0.0%	Other	0.0%	0
291,246		Total Acres		55,203

1 Based on 2007 NASS data for North Dakota and South Dakota.

5.2 Flow Duration Curve Analysis

The flow duration curve serves as the foundation for the load duration curve used in the TMDL. Flow duration curve analysis looks at the cumulative frequency of historic flow data over a specified time period. A flow duration curve relates flow (expressed as mean daily discharge) to the percent of time those mean daily flow values have been met or exceeded. The use of *"percent of time exceeded"* (i.e., duration) provides a uniform scale ranging from 0 to 100 percent, thus accounting for the full range of stream flows. Low flows are exceeded most of the time, while flood flows are exceeded infrequently (USEPA, 2007).

A basic flow duration curve runs from high to low (0 to 100 percent) along the x-axis with the corresponding flow value on the y-axis (Figure 8). Using this approach, flow duration intervals are expressed as a percentage, with zero corresponding to the highest flows in the record (i.e., flood conditions) and 100 to the lowest flows in the record (i.e., drought). Therefore, as depicted in Figure 8, a flow duration interval of ten (13) percent, associated with a stream flow of 10.6 cfs, implies that 13 percent of all observed mean daily discharge values equal or exceed 10.6 cfs.

Once the flow duration curve is developed for the stream site, flow duration intervals can be defined which can be used as a general indicator of hydrologic condition (i.e. wet vs dry conditions and to what degree). These intervals (or zones) provide additional insight about conditions and patterns associated with the impairment (fecal coliform bacteria in this case) (USEPA, 2007). As depicted in Figure 8, the flow duration curve was divided into four zones, one representing high flows (0-2 percent), another for moist condition (2-13 percent), and one for dry condition (13-30 percent) and one for low flow (30-41 percent). These flows intervals were defined by examining the range of flows for the site for the period of record and then by looking for natural breaks in the flow record based on the flow duration curve plot (Figure 8). A secondary factor in determining the flow intervals used in the analysis is the number of fecal coliform bacteria observations available for each flow interval.

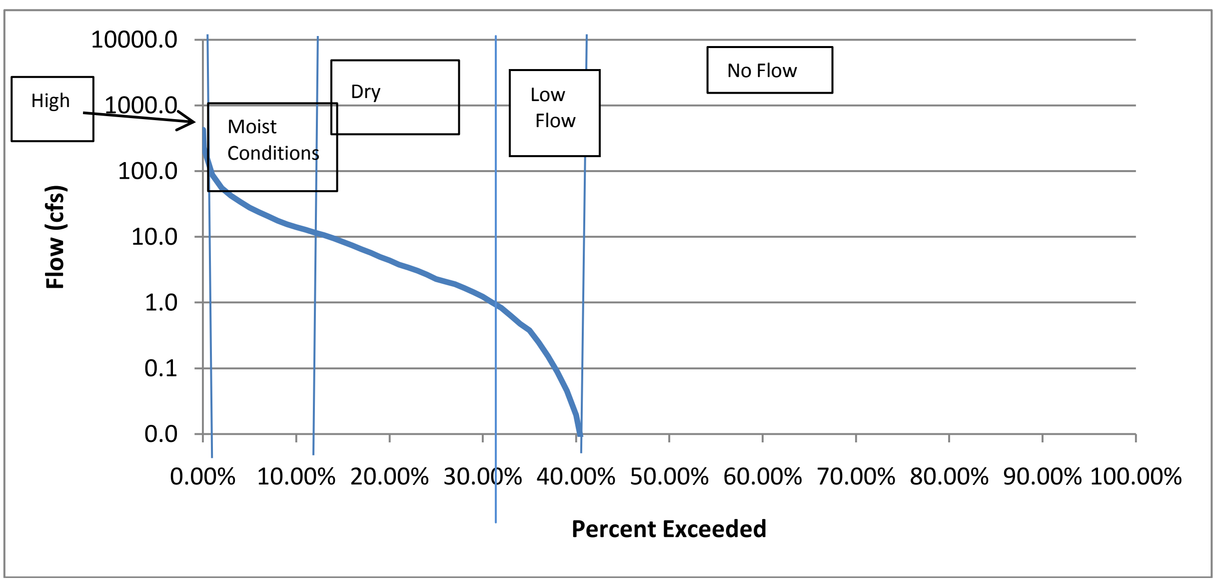


Figure 8. Flow Duration Curve for Shortfoot Creek Monitoring Station 384037 at Cayuga, North Dakota and USGS Station 05051600 near Rutland, North Dakota.

5.3 Load Duration Analysis

An important factor in determining NPS pollution loads is variability in stream flows and loads associated with high and low flow. To better correlate the relationship between the pollutant of concern and hydrology of the 303(d) listed segment, a load duration curve was developed for the TMDL listed segment in the Shortfoot Creek watershed. The load duration curve was derived using the 200 CFU/100mL State water quality standard and the flows generated as described in Section 5.1.
Observed in-stream total fecal coliform bacteria concentrations from monitoring site 384037 from 1996, 1998, and 2000-2009 (Appendix A) were converted to a pollutant load by multiplying total fecal coliform bacteria concentrations by the flow and a conversion factor. These loads are plotted against the percent exceeded of the flow on the day of sample collection (Figure 9). Points plotted above the 200 CFU/100 mL target curve exceed the water quality target. Points plotted below the curve are meeting the water quality target of 200 CFU/100 mL.

For each flow interval or zone and a regression relationship was developed between the samples which occur above the TMDL target (200 CFU/100 mL) curve and the corresponding percent exceeded flow. The load duration curves for site 384037 depicting a regression relationship for each flow interval are provided in Figure 9.

The regression lines for the high, moist condition, dry condition, and no flows were then used with the midpoint of the percent exceeded flow for that interval to calculate the existing total fecal coliform bacteria load for that flow interval. For example, in the example provided in Figure 9, the regression relationship between observed fecal coliform bacteria loading and percent exceeded flow for the high (0-2 percent), moist condition (2-13 percent), dry condition (13-30 percent) and low (30-41 percent) flow intervals are:

Fecal coliform load (expressed as 10^7 CFUs/day) = antilog (Intercept + (Slope*Percent Exceeded Flow))

Where the midpoint of the high flow interval from 0 to 2 percent is 1.0 percent, the existing fecal coliform load is:

Fecal coliform load (10^7 CFUs/day) = antilog (5.73 + (-51.87*0.01))
= 162,758 x 10^7 CFUs/day

Where the midpoint of the moist condition interval from 2 to 13 percent is 7.5 percent, the existing fecal coliform load is:

Fecal coliform load (10^7 CFUs/day) = antilog (4.98 + (-6.20*0.075))
= 32,835 x 10^7 CFUs/day

Where the midpoint of the dry condition interval from 13 to 30 percent is 21.5 percent, the existing fecal coliform load is:

Fecal coliform load (10^7 CFUs/day) = antilog (4.66 + (-3.85*0.215))
= 6,803 x 10^7 CFUs/day

Where the midpoint of the low flow interval from 30 to 41 percent is 35.5 percent, the existing fecal coliform load is:

Fecal coliform load (10^7 CFUs/day) = antilog (7.81+ (-13.96*0.355))
= 711 x 10^7 CFUs/day

The midpoint for the flow intervals is also used to estimate the TMDL target load. In the case of the previous examples, the TMDL target load for the midpoints or 1.0, 7.5, 21.5, and 35.5 percent exceeded flow derived from the 200 CFU/100 mL TMDL target curves are 43,358 x 10^7 CFUs/day, 9,276 x 10^7 CFUs/day, 1,762 x 10^7 CFUs/day and 148 x 10^7 CFUs/day, respectively.

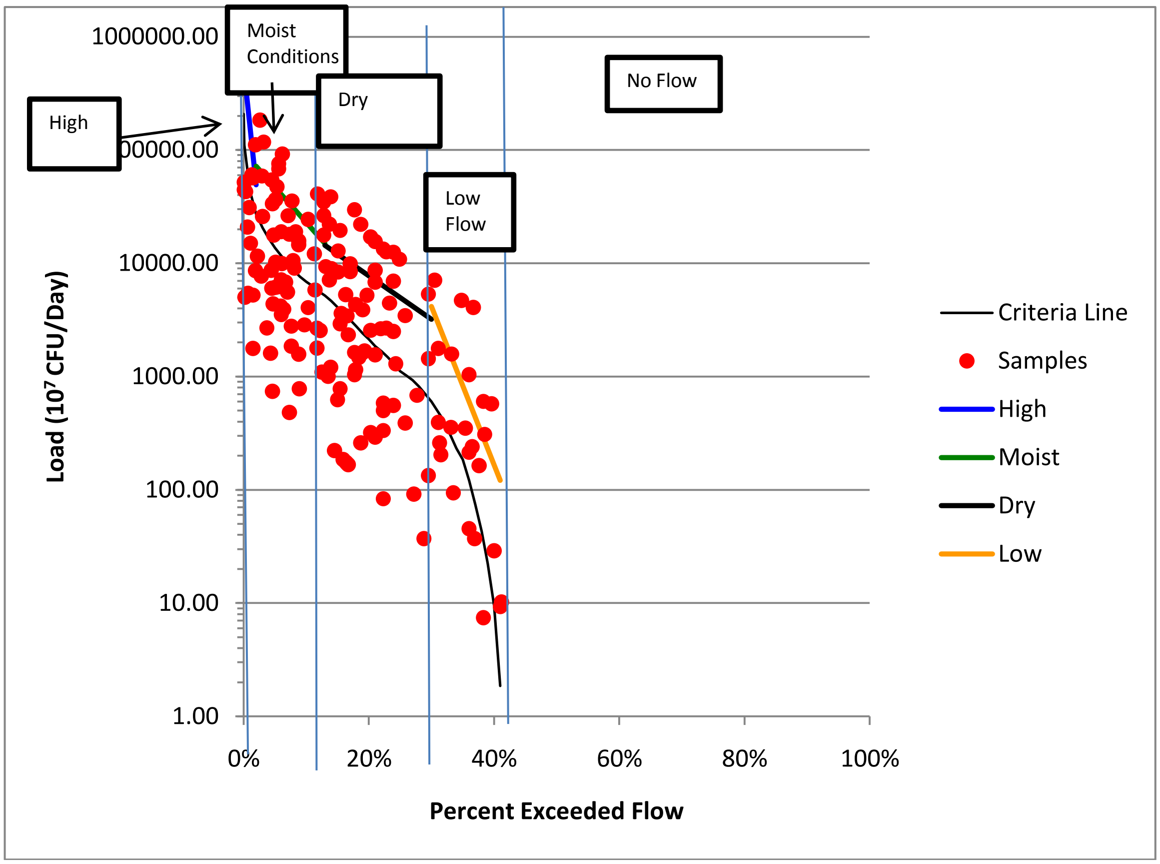


Figure 9. Load Duration Curve for Shortfoot Creek Monitoring Station 384037; (The curve reflects flows collected from 1980-2009).

5.4 Loading Sources

The load reductions needed for the Shortfoot Creek fecal coliform bacteria TMDL can generally be allotted to nonpoint sources. Based on the data available, the general focus of BMPs and load reductions for the listed segment should be on range/pasture land and riparian areas that are greatly disturbed. Higher priority should be given to animal feeding areas located in close proximity to Shortfoot Creek.

Significant sources of total fecal coliform bacteria loading were defined as non point source pollution originating from livestock. One of the more important concerns regarding non point sources is variability in stream flows. Variable stream flows often cause different source areas and loading mechanisms to dominate (Cleland, 2003). As previously described, four flow regimes (i.e., High and Moist and Dry Conditions, Low) were selected to represent the hydrology of the listed segment when applicable (Figure 7). The four flow regimes were used for sampling site 384037 because samples indicated exceedences of the water quality standard during periods of high, moist condition, dry condition, and low flows.

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to fecal coliform loading. Animals grazing in the riparian area contribute fecal coliform bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high, moist and dry condition flows (Table 6). In contrast, intensive grazing of livestock in the upland and not in the riparian area has a high potential to impact water quality at high flows and medium impact at moist flows (Table 6). Exclusion of livestock from the riparian area eliminates the potential of direct manure deposit and therefore is considered to be of high importance at all flows. However, intensive grazing in the upland creates the potential for manure accumulation and availability for runoff at high flows and a high potential for total fecal coliform bacteria contamination.

Table 6. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

Non point Sources	Flow Regime		
	High Flow	Moist Conditions	Dry Conditions
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L

Note: Potential importance of non point source area to contribute fecal coliform bacteria loads under a given flow regime. (H: High; M: Medium; L: Low)

6.0 MARGIN OF SAFETY AND SEASONALITY

6.1 Margin of Safety

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency (EPA) regulations require that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." The margin of safety (MOS) can be either incorporated into conservative assumptions used to develop the TMDL (implicit) or added to a separate component of the TMDL (explicit).

To account for the uncertainty associated with known sources and the load reductions necessary to reach the TMDL target of 200 CFU/100 mL, a ten percent explicit margin of safety was used for this TMDL. The MOS was calculated as ten percent of the TMDL. In other words ten percent of the TMDL is set aside from the load allocation as a MOS. The ten percent MOS was derived by taking the difference between the points on the load duration curve using the 200 CFU/100 mL standard and the curve using the 180 CFU/100 mL.

6.2 Seasonality

Section 303(d)(1)(C) of the Clean Water Act and associated regulations require that a TMDL be established with seasonal variations. The Shortfoot Creek TMDL addresses seasonality because the flow duration curve was developed using 29 years of USGS gage data encompassing all 12 months of the year. Additionally, the water quality standard is seasonally based on the recreation season from May 1 to September 30 and controls will be designed to reduce coliform loads during the seasons covered by the standard.

7.0 TMDL

Table 7 provides an outline of the critical elements of the waterbody specific fecal coliform bacteria TMDL. A TMDL for Shortfoot Creek (Waterbody ID ND-09020105-016-S_00 is represented in Table 8. The TMDL provides a summary of average daily loads necessary to meet the water quality target (i.e. TMDL). The TMDL summary provides an estimate of the existing daily load, an estimate of the average daily loads necessary to meet the water quality target (i.e. TMDL load). This TMDL load includes a load allocation from known nonpoint sources and a 10 percent margin of safety. It should be noted that the TMDL loads, load allocations, and the MOS are estimated based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reduction needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.

Table 7. TMDL Summary for Shortfoot Creek.

Category	Description	Explanation
Beneficial Use Impaired	Recreation	Contact Recreation (i.e. swimming, fishing)
Pollutant	Fecal Coliform Bacteria	See Section 2.1
TMDL Target	200 CFU/100 ml	Based on North Dakota water quality standards
Significant Sources	Non point Sources	No Point Sources in Sub-Watershed
Margin of Safety (MOS)	Explicit	10%

TMDL = LC = WLA + LA + MOS

where

LC = loading capacity, or the greatest loading a waterbody can receive without violating water quality standards;

WLA = wasteload allocation, or the portion of the TMDL allocated to existing or future point sources;

LA = load allocation, or the portion of the TMDL allocated to existing or future non point sources;

MOS = margin of safety, or an accounting of the uncertainty about the relationship between pollutant loads and receiving water quality. The margin of safety can be provided implicitly through analytical assumptions or explicitly by reserving a portion of the loading capacity.

Table 8. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for Shortfoot Creek, Waterbody ID ND-09020105-016-S_00, as Represented by Site 384037.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	162,758	32,835	6,803	711
TMDL	43,357	9,275	1,762	148
WLA	0	0	0	0
LA	39,201	8,347	1,586	133
MOS	4,336	928	176	15

8.0 ALLOCATION

There are no known point sources impacting the watershed in North Dakota or South Dakota. Therefore the entire total fecal coliform load for this TMDL was allocated to nonpoint sources in the watershed. The entire nonpoint source load is allocated as a single load because there is not enough detailed source data to allocate the load to individual uses (e.g., animal feeding, septic systems, riparian grazing, waste management). For the TMDL target to be met, the majority of the conservation measures will need to be implemented in the North Dakota portion of the Shortfoot Creek watershed.

To achieve the TMDL targets identified in the report, it will require the wide spread support and voluntary participation of landowners and residents in the watershed. The TMDL described in this report are a plan to improve water quality by implementing best management practices through non-regulatory approaches. “Best management practices” (BMPs) are methods, measures, or practices that are determined to be a reasonable and cost effective means for a land owner to meet non point source pollution control needs,” (USEPA, 2001). This TMDL plan is put forth as a recommendation for what needs to be accomplished for Shortfoot Creek and associated watershed to restore and maintain its recreational uses. Water quality monitoring should continue, in order to measure BMP effectiveness and determine through adaptive management if loading allocation recommendations need to be adjusted.

Non point source pollution is the sole contributor to elevated total fecal coliform bacteria levels in Shortfoot Creek. The fecal coliform bacteria samples and load duration curve analysis of the impaired reach identified the high, moist, dry condition, and low flow regimes as the time of fecal coliform bacteria exceedences of the 200 CFU/100 mL target. To reduce NPS pollution for the high, moist, and dry condition flow regimes, specific BMPs are described in Section 8.1 that will mitigate the effects of total fecal coliform bacteria loading to the impaired reach.

Table 9. Management Practices and Flow Regimes Affected by Implementation of BMPs.

Management Practice	Flow Regime and Expected Reduction		
	High Flow-70%	Moderate Flow-80%	Low Flow-74%
Livestock Exclusion From Riparian Area	X	X	X
Water Well and Tank Development	X	X	X
Prescribed Grazing	X	X	X
Waste Management System	X	X	
Vegetative Filter Strip		X	
Septic System Repair		X	X

Controlling non point sources is an immense undertaking requiring extensive financial and technical support. Provided that technical/financial assistance is available to stakeholders, these BMPs have the potential to significantly reduce total fecal coliform loading to Shortfoot Creek. The following describe in detail those BMPs that will reduce total fecal coliform bacteria levels in Shortfoot Creek.

8.1 Livestock Management Recommendations

Livestock management BMPs are designed to promote healthy water quality and riparian areas through management of livestock and associated grazing land. Fecal matter from livestock, erosion from poorly managed grazing, land and riparian areas can be a significant source of fecal coliform bacteria loading to surface water. Precipitation, plant cover, number of animals, and soils are factors that affect the amount of bacteria delivered to a waterbody because of livestock. These specific BMPs are known to reduce non point source pollution from livestock. These BMPs include:

Livestock exclusion from riparian areas- This practice is established to remove livestock from grazing riparian areas and watering in the stream. Livestock exclusion is accomplished through fencing. A reduction in stream bank erosion can be expected by minimizing or eliminating hoof trampling. A stable stream bank will support vegetation that will hold banks in place and serve a secondary function as a filter from non point source runoff. Added vegetation will create aquatic habitat and shading for macroinvertebrates and fish. Direct deposit of fecal matter into the stream and stream banks will be eliminated as a result of livestock exclusion by fencing.

Water well and tank development- Fencing animals from stream access requires and alternative water source. Installing water wells and tanks satisfies this need. Installing water tanks provides a quality water source and keeps animals from wading and defecating in streams. This will reduce the probability of pathogenic infections to livestock and the public.

Prescribed grazing- To increase ground cover and ground stability by rotating livestock throughout multiple fields. Grazing with a specified rotation minimizes overgrazing and resulting erosion. The Natural Resource Conservation Service (NRCS) recommends grazing systems to improve and maintain water quality and quantity. Duration, intensity, frequency, and season of grazing can be managed to enhance vegetation cover and litter, resulting in reduced runoff, improved infiltration, increased quantity of soil water for plant growth, and better manure distribution and increased rate of decomposition, (NRCS, 1998). In a study by Tiedemann et al. (1998), as presented by USEPA (1993), the effects of four grazing strategies on bacteria levels in thirteen watersheds in Oregon were studied during the summer of 1984. Results of the study (Table 10) showed that when livestock are managed at a stocking rate of 19 acres per animal unit month, with water developments and fencing, bacteria levels were reduced significantly.

Waste management system- Waste management systems can be effective in controlling up to 90 percent of fecal coliform loading originating from confined animal feeding areas (Table 11). A waste management system is made up of various components designed to control non point source pollution from concentrated animal feeding operations (CAFOs) and animal feeding operations (AFOs). Diverting clean water from the feeding area and containing dirty water from the feeding area in a pond are typical practices of a waste management system. Manure handling and application of manure is designed to be adaptive to environmental, soil, and plant conditions to minimize the probability of contamination of surface water.

Table 10. Bacterial Water Quality Response to Four Grazing Strategies (Tiedemann et al., 1988).

Grazing Strategy		Geometric Mean Fecal Coliform Count
Strategy A:	Ungrazed	40/L
Strategy B:	Grazing without management for livestock distribution; 20.3 ac/AUM.	150/L
Strategy C:	Grazing with management for livestock distribution: fencing and water developments; 19.0 ac/AUM	90/L
Strategy D:	Intensive grazing management, including practices to attain uniform livestock distribution and improve forage production with cultural practices such as seeding, fertilizing, and forest thinning; 6.9 ac/AUM	950/L

8.2 Other Recommendations

Vegetative filter strip- Vegetated filter strips are used to reduce the amount of sediment, particulate organics, dissolved contaminants, nutrients, and in the case of this TMDL, fecal coliform bacteria to streams. The effectiveness of filter strips and other BMPs in removing fecal coliform bacteria is quite successful. Results from a study by Pennsylvania State University (1992a) as presented by USEPA (1993) (Table 11), suggest that vegetative filter strips are capable of removing up to 55 percent of fecal coliform loading to rivers and streams (Table 11). The ability of the filter strip to remove contaminants is dependent on field slope, filter strip slope, erosion rate, amount and particulate size distribution of sediment delivered to the filter strip, density and height of vegetation, and runoff volume associated with erosion producing events (NRCS, 2001).

Table 11. Relative Gross Effectiveness[a] of Confined Livestock Control Measures (Pennsylvania State University, 1992a).

Practice[b] Category	Runoff[c] Volume	Total[d] Phosphorus (%)	Total[d] Nitrogen (%)	Sediment (%)	Fecal Coliform (%)
Animal Waste System[e]	-	90	80	60	85
Diversion System[f]	-	70	45	NA	NA
Filter Strips[g]	-	85	NA	60	55
Terrace System	-	85	55	80	NA
Containment Structures[h]	-	60	65	70	90

NA = Not Available.
a Actual effectiveness depends on site-specific conditions. Values are not cumulative between practice categories.
b Each category includes several specific types of practices.
c - = reduction; + = increase; 0 = no change in surface runoff.
d Total phosphorus includes total and dissolved phosphorus; total nitrogen includes organic-N, ammonia-N, and nitrate-N.
e Includes methods for collecting, storing, and disposing of runoff and process-generated wastewater.
f Specific practices include diversion of uncontaminated water from confinement facilities.
g Includes all practices that reduce contaminant losses using vegetative control measures.
h Includes such practices as waste storage ponds, waste storage structures, waste treatment lagoons.

Septic System – Septic systems provide an economically feasible way of disposing of household wastes where other means of waste treatment are unavailable (e.g., public or private treatment facilities). The basis for most septic systems involves the treatment and distribution of household wastes through a series of steps involving the following:

1. A sewer line connecting the house to a septic tank
2. A septic tank that allows solids to settle out of the effluent
3. A distribution system that dispenses the effluent to a leach field
4. A leaching system that allows the effluent to enter the soil

Septic system failure occurs when one or more components of the septic system do not work properly and untreated waste or wastewater leaves the system. Wastes may pond in the leach field and ultimately run off directly into nearby streams or percolate into groundwater. Untreated septic system waste is a potential source of nutrients (nitrogen and phosphorus), organic matter, suspended solids, and fecal coliform bacteria. Land application of septic system sludge, although unlikely, may also be a source of contamination.

Septic system failure can occur for several reasons, although the most common reason is improper maintenance (e.g. age, inadequate pumping). Other reasons for failure include improper installation, location, and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing (USEPA, 2002).

9.0 PUBLIC PARTICIPATION

To satisfy the public participation requirement of this TMDL, a hard copy of the TMDL for Shortfoot Creek and a request for comment was mailed to participating agencies, partners, and to those who requested a copy. Those included in the mailing of a hard copy are as follows:

- Sargent County Soil Conservation District;
- Sargent County Water Resource Board;
- Natural Resource Conservation Service (State Office);

- South Dakota Department of Natural Resources; and
- U.S. Environmental Protection Agency, Region VIII

In addition to mailing copies of this TMDL for Shortfoot Creek to interested parties, the TMDL was posted on the North Dakota Department of Health, Division of Water Quality web site at http://www.ndhealth.gov./WQ/SW/Z2 TMDL/TMDLs Under PublicComment/B Under Public Commment.html . A 30 day public notice soliciting comment and participation was also published in the following newspapers:

- Fargo Forum; and
- The Sargent County Teller

A public notice review was received from the US EPA Region VIII (Appendix D). Comments were also received from the South Dakota Department of Environment and Natural Resources (Appendix E). The NDDoH's response to these comments are provided in Appendix F.

10.0 MONITORING

As stated previously, it should be noted that the TMDL loads, load allocations, and the MOS are estimated based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reduction needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.

To ensure that the best management practices (BMPs) and technical assistance that are implemented as part of the Section 319 Wild Rice River Watershed Implementation Project (including Shortfoot Creek) are successful in reducing fecal coliform, as well as E. coli bacteria levels necessary to meet water quality standards, water quality monitoring is being conducted in accordance with an approved Quality Assurance Project Plan (QAPP). As prescribed in the QAPP (NDDoH, 2005), monitoring is being conducted for all variables that are currently causing impairments to the beneficial uses of the waterbody. These include, but are not limited to fecal coliform and E. coli bacteria. Sampling began in May 2005 and will continue through September 2015.

11.0 TMDL IMPLEMENTATION STRATEGY

In response to the Shortfoot Creek Watershed Assessment and in anticipation of this completed TMDL, local sponsors successfully applied for and received Section 319 funding for the Wild Rice River Watershed Implementation Project (including Shortfoot Creek). Since May 2005, local sponsors have been providing technical assistance and implementing BMPs designed to reduce fecal bacteria loadings and to help restore the beneficial uses of Shortfoot Creek (i.e., recreation). As the watershed restoration project progresses, water quality data are collected to monitor and track the effects of BMP implementation as well as to judge overall success of the project in reducing fecal coliform bacteria loadings. A QAPP (NDDoH, 2005) has also been developed as part of this watershed restoration project that details the how, when and where monitoring will be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s). As the data are gathered and analyzed, watershed restoration tasks will be adapted, if necessary, to place BMPs where they will have the greatest benefit to water quality and in meeting the TMDL goal(s).

12.0 REFERENCES

Cleland. 2003. *TMDL Development from the "Bottom Up" – Part III: Duration Curves and Wet Weather Assessment*. America's Clean Water Foundation, Washington, D.C.

NDASS. 2007a. *North Dakota Agricultural Statistics Service*. Available at **http://www.nass.usda.gov/Statistics_by_State/North_Dakota/index.asp.**

NDASS. 2007b. *North Dakota Agricultural Statistics Service*. Available at **http://www.nass.usda.gov/Statistics_by_State/South_Dakota/index.asp.**

NDAWN. 2009. Britton, South Dakota Weather Station. North Dakota Agriculture Weather Network. North Dakota State University, Fargo, North Dakota. Available at http://ndawn.ndsu.nodak.edu/index.html

NDDoH. 2000. Quality Assurance Project Plan for the Sargent County Shortfoot Creek Watershed Assessment Project in North Dakota. North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NDDoH. 2005. Quality Assurance Project Plan for the Wild Rice River Implementation Project Sargent County in North Dakota. North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NDDoH. 2006. *Standards of Quality for Waters of the State.* Chapter 33-16-02 of the North Dakota Century Code. North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NDDoH. 2010. *North Dakota 2010 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads.* North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NRCS. 1998. *Natural Resources Conservation Service Practice Specification* 528. USDA-Natural Resources Conservation Service, North Dakota. Available at http://efotg.nrcs.usda.gov

NRCS. 2001. *Natural Resources Conservation Service Practice Specification 393* – Filter Strip (Acres) [Online]. USDA – Natural Resources Conservation Service, North Dakota. Available at http://www.nd.nrcs.usda.gov/resources/section4/standards/Section4.html.

Pennsylvania State University. 1992. Non point Source Database. Pennsylvania State University, Department of Agricultural and Biological Engineering, University Park, PA.

Ries, K. G., III and P.J. Friesz.2000. *Methods for Estimating Low-Flow Statistics for Massachusetts Streams.* U.S. Geological Survey Water Resources Investigations Report 00-4135. U.S. Geological Survey, Reston, VA.

SDDENR, 2009. South Dakota Surface Water Quality Standards. Chapter 74:51:01 of the South Dakota Codified Laws. South Dakota Department of Environment and Natural Resources, Surface Water Quality Program. Pierre, South Dakota.

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

Tiedemann, A.R., D.A. Higgins, T.M. Quigley, H.R. Sanderson, and C. C. Bohn.1988. *Bacterial Water Quality Responses to Four Grazing Strategies – Comparison with Oregon Standards*.

U.S. Census Bureau. 2001. North Dakota Quick Facts. United States Census Bureau, USA Quickfacts. Available at http://quickfacts.census.gov/qfd/states/38/38037.html.

USEPA. 1993. Guidance Specifying Management Measures for Sources of Non point Pollution in Coastal Waters. EPA 840-B-92-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

USEPA. 2001. Protocol for Developing Pathogen TMDLs. EPA 841-R-00-002. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

USEPA. 2002. Onsite Wastewater Treatment Systems Manual. EPA/625/R-00/008. U. S. Environmental Protection Agency. Office of Water, Office of Research and Development.

USEPA. 2007. An Approach for Using Load Duration Curves in the Development of TMDLs. EPA-841-B-07-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. Available at http://www.epa.gov/owow/tmdl/techsupp.html

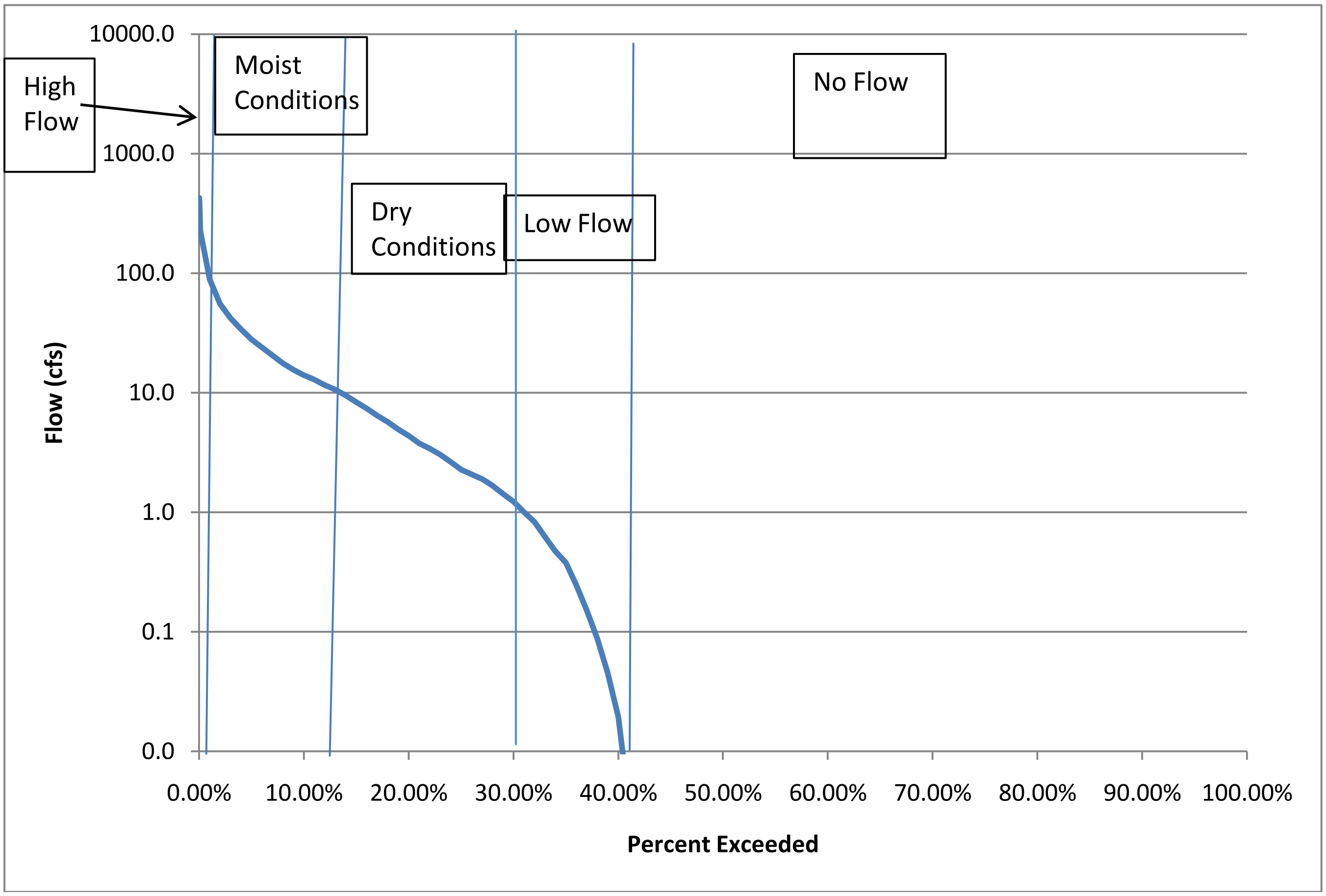
USGS. 2006. *Ecoregions of North Dakota and South Dakota*. United States Geological Survey. Available at http://www.npwrc.usgs.gov/resource/habitat/ndsdeco/nodak.html.

Appendix A
Fecal Coliform Bacteria Data Collected for Site 384037
(1996, 1998, and 2000-2009)

STORET 384037					
Date of Collection	**CFU/100 mL**	**Date of Collection**	**CFU/100 mL**	**Date of Collection**	**CFU/100 mL**
5/1/1996	10	5/30/2001	60	7/19/2004	80
5/6/1996	10	6/5/2001	120	7/26/2004	90
5/13/1996	30	6/12/2001	90	8/2/2004	240
5/20/1996	130	6/19/2001	370	8/9/2004	330
5/28/1996	10	7/24/2001	1600	8/17/2004	40
6/11/1996	10	5/2/2002	20	9/7/2004	1100
6/25/1996	300	5/7/2002	40	9/14/2004	90
9/25/1996	1600	5/9/2002	40	9/21/2004	420
5/4/1998	110	5/14/2002	110	9/27/2004	160
5/6/1998	70	5/16/2002	30	5/2/2005	10
5/11/1998	540	5/21/2002	360	5/10/2005	620
5/13/1998	1600	5/28/2002	110	5/16/2005	110
5/18/1998	10	6/24/2002	720	5/23/2005	20
5/20/1998	70	5/1/2003	10	6/1/2005	240
5/27/1998	90	5/5/2003	30	6/6/2005	140
6/1/1998	80	5/8/2003	10	6/13/2005	450
6/8/1998	110	5/13/2003	10	6/20/2005	550
6/15/1998	170	5/15/2003	80	6/28/2005	50
6/22/1998	100	5/20/2003	40	6/30/2005	680
6/29/1998	80	5/22/2003	40	7/6/2005	20
7/6/1998	110	5/27/2003	40	7/12/2005	60
7/13/1998	30	6/3/2003	80	7/19/2005	60
7/20/1998	250	6/10/2003	340	7/25/2005	1100
7/27/1998	90	6/17/2003	430	7/31/2005	1600
8/3/1998	1200	6/25/2003	720	8/8/2005	370
5/2/2000	40	7/1/2003	70	8/14/2005	20
5/9/2000	240	7/24/2003	70	8/24/2005	130
5/23/2000	390	8/20/2003	70	8/31/2005	210
5/30/2000	980	5/3/2004	160	9/6/2005	330
6/6/2000	380	5/10/2004	70	9/12/2005	450
6/27/2000	1600	5/17/2004	70	9/19/2005	60
7/12/2000	780	5/26/2004	200	9/26/2005	150
7/25/2000	90	6/1/2004	1600	6/19/2006	600
5/1/2001	30	6/7/2004	530	7/6/2006	2500
5/3/2001	20	6/14/2004	200	7/10/2006	1100
5/8/2001	780	6/21/2004	130	5/1/2007	40
5/10/2001	70	6/28/2004	60	5/8/2007	80
5/15/2001	60	7/6/2004	1600	5/14/2007	70
5/22/2001	120	7/13/2004	310	5/22/2007	1200

STORET 384037			
Date of Collection	**CFU/100 mL**	**Date of Collection**	**CFU/100 mL**
5/29/2007	150	7/13/2009	1700
6/7/2007	310	7/21/2009	900
6/13/2007	7200	7/27/2009	450
6/21/2007	10	8/3/2009	1000
6/27/2007	10	8/10/2009	2000
7/5/2007	190	8/17/2009	300
7/10/2007	290	8/24/2009	700
7/17/2007	410	9/1/2009	1800
7/25/2007	300	9/14/2009	610
7/30/2007	1600	9/28/2009	520
8/6/2007	1400		
8/13/2007	1300		
8/22/2007	720		
9/26/2007	470		
5/5/2008	190		
5/12/2008	140		
5/19/2008	160		
5/27/2008	70		
6/3/2008	890		
6/10/2008	630		
6/18/2008	660		
6/24/2008	1600		
6/30/2008	1800		
7/7/2008	4600		
7/15/2008	3100		
7/21/2008	7300		
8/18/2008	1600		
8/25/2008	1900		
9/2/2008	8800		
9/8/2008	670		
9/15/2008	570		
9/22/2008	770		
9/29/2008	520		
6/1/2009	320		
6/9/2009	400		
6/15/2009	360		
6/23/2009	720		
6/30/2009	250		
7/6/2009	1000		

Appendix B
Flow Duration Curve for Site 384037

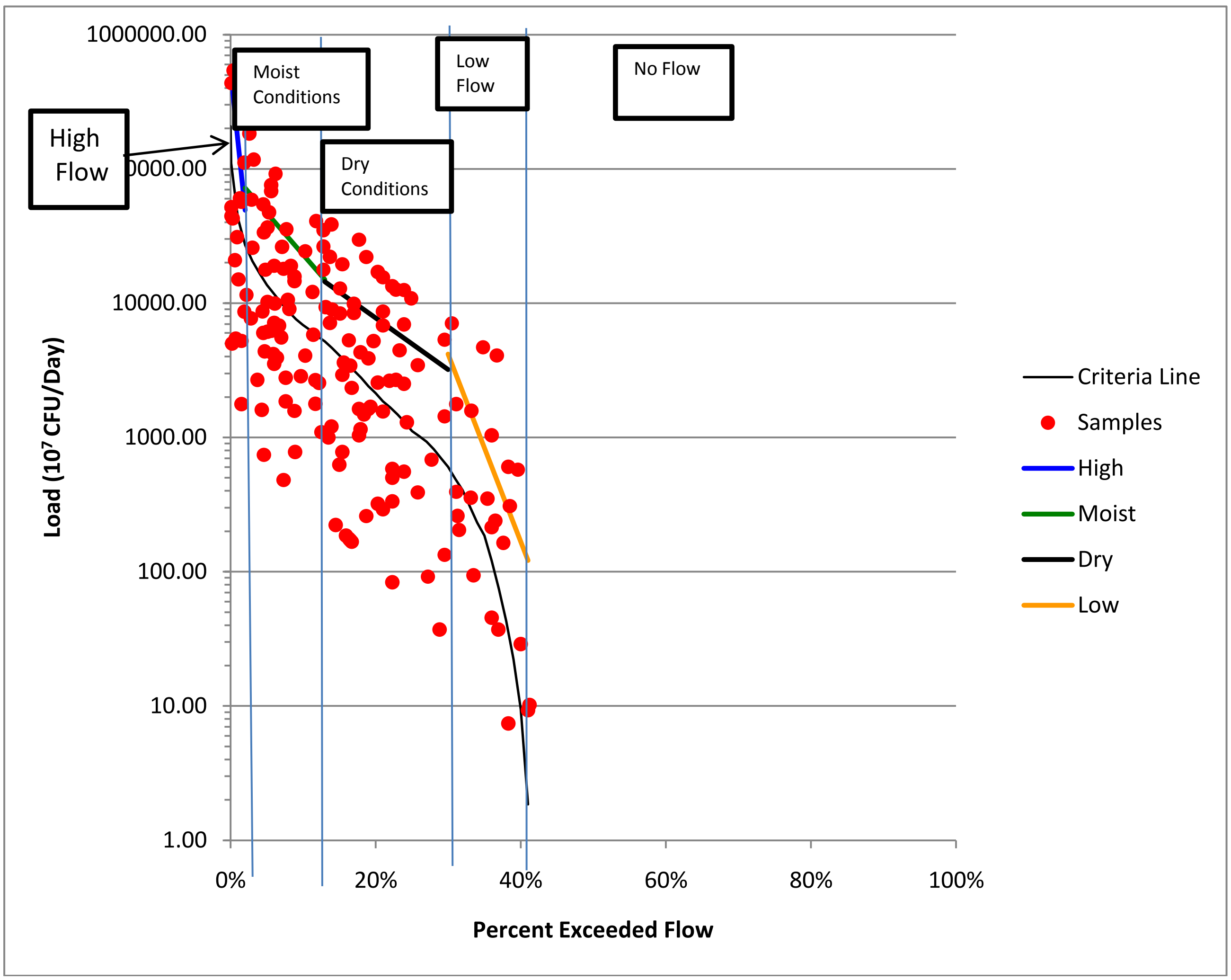


10000.0
1000.0
100.0
10.0
1.0
0.1
0.0
Flow (cfs)
High Flow
Moist Conditions
Dry Conditions
Low Flow
No Flow
0.00%
10.00%
20.00%
30.00%
40.00%
50.00%
60.00%
70.00%
80.00%
90.00%
100.00%
Percent Exceeded

Appendix C
Load Duration Curve, Estimated Loads, TMDL Targets, and Percentage of Reduction Required for Site 384037

384037 Shortfoot Creek near Cayuga, ND

	Load (10^7 CFU/Day)			Load (Million CFU/Period)			
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	1.00%	162758.18	43357.61	7.30	1188134.74	316510.53	73.36%
Moist	7.50%	32835.50	9275.74	40.15	1318345.25	372421.09	71.75%
Dry	21.50%	6803.39	1762.39	62.05	422150.64	109356.37	74.10%
Low	35.50%	711.09	148.41	40.15	28550.21	5958.74	79.13%
			Total	150	2957181	804247	72.80%



Appendix D
US EPA Region VIII Public Notice Review

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Fecal Coliform Bacteria TMDL for Shortfoot Creek in Sargent County, North Dakota**
Submitted by:	**Mike Ell, North Dakota Department of Health**
Date Received:	**August 3, 2010**
Review Date:	**August 19, 2010**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Public Notice**
Notes:	

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

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

Approval Notes to Administrator:

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

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

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

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

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

1. Problem Description

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

1.1 TMDL Document Submittal Letter

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

Minimum Submission Requirements.

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

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

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

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

SUMMARY: The public notice draft Shortfoot Creek fecal coliform TMDL was submitted to EPA for review via an email from Mike Ell, NDDoH on August 3, 2010. The email included the draft TMDL document and a request to review and comment on the TMDL document.

COMMENTS: None.

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The Shortfoot Creek watershed is a 55,203 acre watershed located in Sargent County, in south eastern North Dakota. The listed segment of Shortfoot Creek goes from its confluence with the Wild Rice River upstream to the ND-SD border, including all tributaries (16.16 miles; ND-09020105-016-S_00). It is part of the larger Red River basin in the Western Wild Rice sub-basin (HUC 09020105). This segment is listed as impaired for fecal coliform in North Dakota. On the South Dakota side of the border, Shortfoot Creek is not listed as impaired by the South Dakota Department of Environment and Natural Resources.

The designated uses for this segment of Shortfoot Creek are based on the Class III stream classification in the ND water quality standards (NDCC 33-15-02.1-09).

COMMENTS: None.

1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

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

☒ The purpose of a TMDL analysis is to determine the assimilative capacity of the waterbody that corresponds to the existing water quality standards for that waterbody, and to allocate that assimilative capacity between the significant sources. Therefore, <u>all TMDL documents must be written to meet the existing water quality standards</u> for that waterbody (CWA §303(d)(1)(C)).

Note: In some circumstances, the load reductions determined to be necessary by the TMDL analysis may prove to be infeasible and may possibly indicate that the existing water quality standards and/or assessment methodologies may be erroneous. However, the TMDL must still be determined based on existing water quality standards. Adjustments to water quality standards and/or assessment methodologies may be evaluated separately, from the TMDL.

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

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

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

SUMMARY: The Shortfoot Creek segment addressed by this TMDL document is impaired based on fecal coliform concentrations for secondary contact recreational uses. Shortfoot Creek is a Class III stream. The quality of the waters in this class shall be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation and fish and aquatic biota. Also, the quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses. Numeric criteria for fecal coliforms and E. coli in North Dakota, Class III streams have been established and are presented in the excerpted Table 4 shown below. The beneficial use classification for Shortfoot Creek in South Dakota does not include numeric criteria for bacteria. Discussion of additional applicable water quality standards for Shortfoot Creek can be found on pages 8 – 11 of the TMDL.

Table 4. North Dakota Fecal Coliform and E. coli Bacteria Standards for Class III Streams.

Parameter	Water Quality Standard	
	Geometric Mean[1]	Maximum[2]
Fecal Coliform Bacteria	200 CFU/100 mL	400 CFU/100 mL
E. coli	126 CFU/100 mL	409 CFU/100 mL

[1] Expressed as a geometric mean of representative samples collected during any consecutive 30-day period

[2] No more than 10 percent of samples collected during any consecutive 30-day period shall individually exceed the standard.

COMMENTS: None.

2. Water Quality Targets

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

Minimum Submission Requirements:

☒ The TMDL should identify a numeric water quality target(s) for each waterbody pollutant combination. The TMDL target is a quantitative value used to measure whether or not the applicable water quality standard is attained.

Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. Occasionally, the pollutant of concern is different from the parameter that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as a numerical dissolved oxygen criterion). In such cases, the TMDL should explain the linkage between the pollutant(s) of concern, and express the quantitative relationship between the TMDL target and pollutant of concern. In all cases, TMDL targets must represent the attainment of current water quality standards.

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

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

SUMMARY: The water quality targets for these TMDLs are based on the numeric water quality standards for fecal coliform bacteria based on the primary contact recreational beneficial use for Shortfoot Creek. The target for the Shortfoot Creek segment included in the TMDL document is the fecal coliform standard expressed as the 30-day geometric mean of 200 CFU/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standard.

In order to ensure that North Dakota's water quality standards can be achieved through implementation of NPS BMPs within the North Dakota portion of the watershed, a boundary condition of 200 CFU/100 mL has been assumed for waters entering the state from South Dakota. Due to the lack of water quality data at or near the North Dakota-South Dakota border, it is difficult to accurately assess the total load crossing into North Dakota from South Dakota. Therefore, the Shortfoot Creek TMDL technical analysis does not include a load duration curve that can be used to fairly allocate a percent of the loading capacity to South Dakota. North Dakota believes that setting a boundary condition is a reasonable alternative to having water quality information at the border, and encourages South Dakota to fund projects as necessary in the upper portion of the watershed to protect North Dakota's downstream uses.

North Dakota currently has both a fecal coliform bacteria standard and an E. coli bacteria standard. During the next triennial water quality standards review period, the Department will be eliminating the fecal coliform bacteria standard and will only have the E. coli standard for bacteria. During this transition period to an E. coli only bacteria standard, the fecal coliform bacteria target for this TMDL and the resulting load allocation is believed to be protective of the E. coli standard as well. The department will assess attainment of the E. coli standard through additional monitoring consistent with the state's water quality standards and beneficial use assessment methodology.

COMMENTS: None.

3. Pollutant Source Analysis

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

Minimum Submission Requirements:

☒ The TMDL should include an identification of all potentially significant point and nonpoint sources of the pollutant of concern, including the geographical location of the source(s) and the quantity of the loading, e.g., lbs/per day. This information is necessary for EPA to evaluate the WLA, LA and MOS components of the TMDL.

☒ The level of detail provided in the source assessment should be commensurate with the nature of the watershed and the nature of the pollutant being studied. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of both the natural background loads and the nonpoint source loads.

☒ Natural background loads should not be assumed to be the difference between the sum of known and quantified anthropogenic sources and the existing *in situ* loads (e.g. measured in stream) unless it can be demonstrated that all significant anthropogenic sources of the pollutant of concern have been identified, characterized, and properly quantified.

☒ The sampling data relied upon to discover, characterize, and quantify the pollutant sources should be included in the document (e.g. a data appendix) along with a description of how the data were analyzed to characterize and quantify the pollutant sources. A discussion of the known deficiencies and/or gaps in the data set and their potential implications should also be included.

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

SUMMARY: The TMDL document includes the landuse breakdown for the watershed based on the 2006 National Agricultural Statistics Service data. The dominant land use on the North Dakota side of the Shortfoot Creek watershed is row crop agriculture. Approximately 53 percent of the land is active cropland, 9 percent is wetlands, 6 percent water, 6 percent grassland, and 26 percent is either CRP, pasture, woods, or open space. Detailed landuse in South Dakota is unknown, but information from the South Dakota Department of Natural Resources indicates that most of the watershed on the South Dakota side of the border consists of livestock grazing and CAFOs.

Within the ND portion of Shortfoot Creek watershed there are no point sources permitted through the North Dakota Pollutant Discharge Elimination System (NDPDES) Program.

The listed segment of Shortfoot Creek is experiencing fecal coliform bacteria pollution from non point sources in the watershed. Livestock production ***is not*** the dominant agricultural practice in the North Dakota side of the watershed. However, based on communication with South Dakota Department of Environment and Natural Resources staff, the presence of large CAFOs (1,000+ animal units (AUs)) were indicated within the watershed as well as riparian grazing near the ND-SD border on the South Dakota (SD) portion of the Shortfoot Creek watershed. The data collected during the watershed assessment indicates that the primary contributors of fecal coliform bacteria for the watershed are livestock grazing and watering directly in and adjacent to Shortfoot Creek, with a majority of these occurring in the South Dakota side of the watershed.

Wildlife may also contribute to the fecal coliform bacteria found in the water quality samples, but most likely in a lower concentration. Wildlife is nomadic with fewer numbers concentrating in a specific area, thus decreasing the probability of their contribution of fecal matter in significant quantities.

Septic system failure might also contribute to the fecal coliform bacteria in the water quality samples. Failures can occur for several reasons, although the most common reason is improper maintenance (e.g. age, inadequate pumping). Other reasons for failure include improper installation, location, and choice of system. Harmful household chemicals can also cause failure by killing the bacteria that digest the waste. While the number of systems that are not functioning properly is unknown, it is estimated that 28 percent of the systems in North Dakota are failing.

COMMENTS: None.

4. TMDL Technical Analysis

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

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

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

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

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

MOS = The portion of the Load Capacity allocated to the Margin of safety.

Minimum Submission Requirements:

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

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

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

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

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

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

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

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

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

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

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. To better correlate the relationship between the pollutant of concern and the hydrology of the Section 303(d) listed waterbody, a LDC was developed for monitoring site 384037. The LDC was derived using the 200 CFU/100 mL TMDL target (i.e., state water quality standard), a daily flow record recorded synthesized from a nearby USGS flow gage, and the observed fecal coliform data collected from the site (see Figure 9 of the TMDL document) from 1996, 1998 and 2000-2009.

Mean daily flows from the Wild Rice River for the period 1980 through 2009 were used to construct a discharge record for Shortfoot Creek. Flows for the watershed were determined by utilizing the Drainage-Area Ratio Method developed by the USGS (Ries et. al, 2000). The Drainage-Area Ratio Method assumes that the streamflow at the ungauged site (i.e., Shortfoot Creek) is hydrologically similar to the stream gauging station used as an index. Landuse was also compared for the two watersheds to determine similarities (i.e cropland, etc). Drainage area and landuse for the ungauged site (384037) and index station (05051600) were determined through GIS using digital elevation models (DEMs) and the 2006 NASS landuse database. Streamflow data for the index station (05051600) was obtained from the USGS Water Science Center website. The index station (05051600) streamflow data was then divided by the drainage area to determine streamflows per unit area at the index station. Those values are then multiplied by the drainage area for the ungauged site to obtain estimated flow statistics for the ungauged site.

The load duration curve plots the allowable fecal coliform load (using the 200 CFU/100 mL standard) across the four flow regimes. Single grab sample fecal coliform concentrations were converted to loads by multiplying by flow and a conversion factor to produce CFU/day values. Each value was plotted individually on the load duration curve. Values falling above the curve indicate exceedance of the TMDL at that flow value while values falling below the curve indicate attainment of the TMDL at that flow.

To estimate the required percent reductions in loading needed to achieve the TMDL, a linear regression line through the fecal coliform load data above the TMDL curve in each flow regime was plotted. The required percent reductions needed under the three flow regimes were determined using the linear regression line.

The LDC represents flow-variable TMDL targets across the flow regimes shown in the TMDL document. For the Shortfoot Creek segment covered by the TMDL document, the LDC is a dynamic expression of the allowable load for any given daily flow. Loading capacities were derived from this approach for the entire listed segment at each flow regime. Table 8 shows the loading capacity load (i.e., TMDL load) for the listed segment of the Shortfoot Creek.

COMMENTS: None.

4.1 Data Set Description

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Shortfoot Creek TMDL data description and summary are included tables throughout the document and in the data tables in Appendix A. Recent water quality monitoring was conducted over the period from 2000-2009 and included 141 fecal coliform samples at station 384037. The data set also includes approximately 29 years of flow record using the USGS gauging site data (05051600). The flow data, along with the TMDL target, were used to develop the fecal coliform load duration curve for Shortfoot Creek.

COMMENTS: None.

4.2 Waste Load Allocations (WLA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: Within the North Dakota portion of the Shortfoot Creek watershed there are no point sources permitted through the North Dakota Pollutant Discharge Elimination System (NDPDES) Program. Therefore, the WLA for this fecal coliform TMDL is zero.

COMMENTS: None.

4.3 Load Allocations (LA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The TMDL document includes the landuse breakdown for the North Dakota portion of the watershed based on the 2006 National Agricultural Statistics Service data. In 2006, approximately 53 percent of the land was active cropland, 9 percent was wetlands, 6 percent water, 6 percent grassland, and 26 percent was either CRP, pasture, woods, or open space. Detailed landuse in South Dakota is unknown, but information from the South Dakota Department of Natural Resources indicates that most of the watershed on the South Dakota side of the border consists of livestock grazing and CAFOs. There are no significant point sources of fecal coliform loading located in the watershed (i.e., the WLA = 0). Therefore, the entire TMDL has been allocated to nonpoint sources as a load allocation (LA). Source specific data are limited so an aggregate LA is assigned to nonpoint sources with a ranking of important contributors under various flow regimes provided as seen in the following excerpted table.

Table 6. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

Non point Sources	Flow Regime		
	High Flow	Moist Conditions	Dry Conditions
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L

Note: Potential importance of non point source area to contribute fecal coliform bacteria loads under a given flow regime. (H: High; M: Medium; L: Low)

COMMENTS: None.

4.4 Margin of Safety (MOS):

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

Minimum Submission Requirements:

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

- ☐ If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS should be identified and described. The document should discuss why the assumptions are considered conservative and the effect of the assumption on the final TMDL value determined.
- ☒ If the MOS is explicit, the loading set aside for the MOS should be identified. The document should discuss how the explicit MOS chosen is related to the uncertainty and/or potential error in the linkage analysis between the WQS, the TMDL target, and the TMDL loading rate.
- ☐ If, rather than an explicit or implicit MOS, the TMDL relies upon a phased approach to deal with large and/or unquantifiable uncertainties in the linkage analysis, the document should include a description of the planned phases for the TMDL as well as a monitoring plan and adaptive management strategy.

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

SUMMARY: The Shortfoot Creek TMDL includes an explicit MOS for the listed segment derived by calculating 10 percent of the loading capacity. The explicit MOS for the Shortfoot Creek segment is included in Table 8.

COMMENTS: None.

4.5 Seasonality and variations in assimilative capacity:

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

Minimum Submission Requirements:

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

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

SUMMARY: By using the load duration curve approach to develop the TMDL allocations, seasonal variability in fecal coliform loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months. Also, the TMDL is seasonal since the fecal coliform criteria are in effect from May 1 to September 30, therefore the TMDL is only applicable during that period.

COMMENTS: None.

5. Public Participation

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

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

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

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

SUMMARY: The TMDL document includes a summary of the public participation process that has occurred. It describes the opportunities the public had to be involved in the TMDL development process. Copies of the draft TMDL document were mailed to stakeholders in the watershed during public comment. Also, the draft TMDL document was posted on NDoDH's Water Quality Division website, and a public notice for comment was published in local newspapers.

COMMENTS: None.

6. Monitoring Strategy

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

Minimum Submission Requirements:

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

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

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

SUMMARY: To insure that the best management practices (BMPs) and technical assistance that are implemented as part of the Section 319 Wild Rice River Watershed Implementation Project (including Shortfoot Creek) are successful in reducing fecal coliform bacteria loadings to levels prescribed in the TMDL document, water quality monitoring is being conducted in accordance with an approved Quality Assurance Project Plan (QAPP). As prescribed in the QAPP (NDDoH, 2005), weekly monitoring is being conducted at two sites for fecal coliform bacteria. Sampling began in May 2005 and will continue through September 2015.

COMMENTS: None.

7. Restoration Strategy

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

Minimum Submission Requirements:

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

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

SUMMARY: The Allocation section (Section 8.0) of the TMDL document includes a list of BMPs that are recommended to meet the TMDL loads. A Section 319 grant has been awarded to fund the Wild Rice River Watershed Implementation Project (including Shortfoot Creek). Beginning in May 2005, local sponsors have been providing technical assistance and implementing BMPs designed to reduce fecal bacteria loadings and to help restore the beneficial uses of Shortfoot Creek (i.e., recreation). Water quality data are being collected to monitor and track the effects of BMP implementation as well as to judge overall success of the project in reducing fecal coliform bacteria loadings to the watershed. A QAPP (NDDoH, 2005) has also been developed as part of this watershed restoration project that details the how, when and where monitoring will be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s). As the data are gathered and analyzed, watershed restoration tasks will be adapted, if necessary, to place BMPs where they will have the greatest benefit to water quality and in meeting the TMDL goal(s).

There are no significant permitted point sources in the watershed so it's not necessary to fully document reasonable assurance demonstrating that the nonpoint source loadings are practicable.

COMMENTS: None.

8. Daily Loading Expression

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

Minimum Submission Requirements:

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

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

SUMMARY: The Shortfoot Creek fecal coliform TMDL document includes daily loads expressed as colonies per day for the listed segment of the river. The daily TMDL loads are included in TMDL section (Section 7.0) of the document.

COMMENTS: None.

Appendix E
South Dakota Department of Environment and Natural Resources Public Comment Letter

DEPARTMENT of ENVIRONMENT and NATURAL RESOURCES
PMB 2020
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
denr.sd.gov

South Dakota
GREAT FACES. GREAT PLACES.

September 8, 2010

Michael J. Ell
North Dakota Department of Health
Division of Water Quality
Gold Seal Center
918 E Divide Ave, 4th Floor
Bismarck, ND 58501-1947

Dear Michael,

Thank your for the opportunity to comment on the draft Shortfoot Creek Fecal Coliform Bacteria TMDL report. Please find the enclosed comments from the South Dakota Department of Environment and Natural Resources regarding the Shortfoot Creek report.

If you have any questions on our comments, please contact me or Shannon Minerich by phone at 605.773.3351 or email at Jeanne.Goodman@state.sd.us.

Sincerely,

Jeanne Goodman

Jeanne Goodman, P.E.
Administrator
Surface Water Quality Program

Enclosure

DENR Comments

1.3 Land Use

Section 1.3 on page 4 of the TMDL states, *"Currently, detailed landuse in South Dakota is unknown, but in conversations with the South Dakota Department of Natural Resources it was noted that most of the watershed on the South Dakota side of the border consists of livestock grazing and CAFOs (Kruger, personal communication)."*

This statement suggests that there was a miscommunication of information. South Dakota has the same level of land use data available as the state of North Dakota. In 2006, the National Agricultural Statistic Service (NASS) began making detailed georeferenced land use data available for a number of states in the Midwest, including both North and South Dakota. This public data should be included in this TMDL to give a complete and unbiased picture of the entire watershed. South Dakota does have two permitted CAFOs located within the upper reaches of the drainage; however, CAFOs are not the primary land use.

1.5.1 Fecal Coliform Bacteria Data

It is unclear how far the one sampling site used in this TMDL is located from the border; however, it appears to be eight or more stream miles downstream. When addressing loads of living organisms such as fecal coliform, travel distances are an important consideration. Bacterial decay rates are based on hourly calculations, thus increasing the impact of sources located closest to the source. This is an increased consideration during low flows when stream velocities are slower. The TMDL states that the heaviest runoffs occur in spring and early summer. The data in Table 3 clearly indicate that violations are more likely to occur during the later part of the summer and early fall, when stream flows are lower, suggesting that sources are relatively close to the sampling location.

The community of Cayuga appears to be located within the watershed area and near the sampling site. While the TMDL states that there are no point sources, it would be helpful if this community was identified in the narrative and the narrative included a discussion on municipal or individual on-site wastewater treatment system(s).

3.1 Shortfoot Creek Target Reductions in Fecal Coliform Bacteria Concentrations

From a TMDL development standpoint, the desire to avoid allocating a load to an upstream state has a number of appealing characteristics. In the case of Shortfoot Creek, it appears that a number of available options were overlooked during the analysis which would have helped better define the bacteria load allocation, and possibly have led to developing allocations for both states. As mentioned previously, land use data for the entire watershed is available. The TMDL uses NASS data from 2007 for the North Dakota portion. This data is also available for South Dakota. The inclusion of this data from the same source for both portions of the watershed would provide a better understanding of the land use of the entire watershed. In addition to the georeferenced land use data, NASS also provides an annual publication addressing the number of livestock in each county. While it is unreasonable to use this data to generate loadings, it may be used as circumstantial evidence to help verify conclusions that are drawn regarding the sources of the bacteria.

4.2 Non point Source Pollution Sources

The first paragraph of section 4.2 explains that livestock production is not the dominant agricultural practice on the North Dakota side of the watershed, and then continues by stating that there are large CAFOs on the South Dakota portion of the watershed. The interpretation of this paragraph leads the reader to believe that North Dakota is not contributing to the fecal load and that the problem originates with South Dakota CAFOs. Livestock production on the North Dakota side of the watershed may not be the dominant agricultural practice; however, there appears to be livestock production within the North Dakota portion of the watershed, and along the banks of Shortfoot Creek (Google Earth) within close proximity to the one sample location 384037 used in this TMDL. In addition, two permitted CAFOs in South Dakota are required to have manure management systems to contain all manure and process wastewater and to follow approved nutrient management plans to minimize the probability of runoff to surface waters.

"The data collected during the watershed assessment indicates that the primary contributions of fecal coliform bacteria for the watershed are livestock grazing and watering directly in and adjacent to Shortfoot Creek, with a majority of these occurring in the South Dakota side of the watershed." The scientific basis for this statement is not included in the report. There is no mention of DNA ribotyping to identify livestock as the fecal coliform source, and no mention of how the assessment differentiated between North Dakota fecal coliform and South Dakota fecal coliform. There is no identification of the data, its sources, or any rationale for this interpretation. Without defensible rationale, this statement should be removed from the report.

This section also identifies both wildlife and septic systems as potential sources of fecal coliform loading. It states that *"it is estimated that 28 percent of the systems in North Dakota are failing."* It would be helpful if some quantification of the estimated number of systems in the watershed were included. Nationally, census data is available on a county wide basis, which would provide a reasonable estimate of the potential contributions by these systems.

5.1 Mean Daily Stream Flow (Table 5)

As indicated in our comments on section 3.1, we recommend the TMDL, including this table, use NASS data from 2007 for both North and South Dakota.

5.4 Loading Sources

Figure 9 on page 17 clearly indicates the quantity of samples that exceed the numeric criteria and illustrates that dry conditions and low flow conditions contribute the greatest percent of exceedance. Table 6 on page 18 ranks the potential importance of nonpoint sources and their ability to contribute fecal coliform bacteria based on the flow regime. The dry conditions flow regime is ranked low for animal feeding operations, manure application to crop and range land, and intensive upland grazing (livestock). Riparian area grazing (livestock) ranks high in the dry condition flow regime as a potential source of fecal coliform contribution. As previously mentioned, based on bacterial decay rates, fecal contamination due to riparian area grazing is more likely to be a local source of contamination and is likely occurring in close proximity to the sample location.

8.0 Allocation

This paragraph states that *"The entire nonpoint source load is allocated as a single load because there is not enough detailed source data to allocate the load to individual uses (e.g., animal feeding, septic systems, riparian grazing, waste management). For the TMDL target to be met, the majority of the conservation measures will need to be implemented in the upstream portion of the watershed in South Dakota."* The TMDL acknowledges that there is not enough detailed source data to allocate the load to individual uses. In addition, the area of watershed located in North Dakota from the border to the sample site at Cayuga is far greater than the size of the watershed located in South Dakota. Without enough detailed source data to allocate a load to individual uses, the TMDL should not place the burden on South Dakota without appropriate, defensible information.

Appendix F
North Dakota Department of Health Response to Public Comments

SD DENR Comment on Section 1.3 Land Use: Section 1.3 on page 4 of the TMDL states, "Currently, detailed landuse in South Dakota is unknown, but in conversations with the South Dakota Department of Natural Resources it was noted that most of the watershed on the South Dakota side of the border consists of livestock grazing and CAFOs (Kruger, personal communication)."

This statement suggest that there was a miscommunication of information. South Dakota has the same level of land use data available as the state of North Dakota. In 2006, the National Agricultural Statistics Service (NASS) began making detailed georeferenced land use data available for a number of states in the Midwest, including both North and South Dakota. This public data should be included in this TMDL to give a complete and unbiased picture of the entire watershed. South Dakota does have two permitted CAFOs located within the upper reaches of the drainage; however, CAFOs are not the primary land use.

NDDoH Response to Comment: At the suggestion of the SDDENR, the NDDoH has obtained and analyzed the 2007 NASS land use/land cover data for the South Dakota portion of the watershed in addition to that obtained for the North Dakota portion of the watershed. Based on this analysis and GIS data, section 1.3 has been revised and Figure 4 updated to include the South Dakota portion of the watershed. In addition, section 1.3 has been updated to reflect information provided by the SDDENR on the number and location of CAFOs.

SD DENR Comment on Section 1.5.1 Fecal Coliform Bacteria Data: It is unclear how far the one sampling site used in this TMDL is located from the border, however, it appears to be eight or more stream miles downstream. When addressing loads of living organisms such as fecal coliform, travel distances are an important consideration. Bacterial decay rates are based on hourly calculations, thus increasing the impact of sources located closest to the source. This is an increased consideration during low flows when stream velocities are slower. The TMDL states that the heaviest runoffs occur in spring and early summer. The data in Table 3 clearly indicate that violations are more likely to occur during the later part of the summer and early fall, when stream flows are lower, suggesting that sources are relatively close to the sampling location.

The community of Cayuga appears to be located within the watershed area and near the sampling site. While the TMDL states that there are no point sources, it would be helpful if this community was identified in the narrative and the narrative included a discussion on municipal or individual on-site wastewater treatment systems(s).

NDDoH Response to Comment: As stated in section 1.5.1, Fecal Coliform Bacteria Data, and depicted in Figure 7, the data used to develop this TMDL is located 0.8 miles east of Cayuga and is located near the downstream end of the watershed. It is assumed that this site reflects fecal coliform loadings from the majority of the watershed.

With regards to the wastewater treatment for the city of Cayuga, language has been added to Section 4.1, Point Source Pollution Sources, describing the city of Cayuga's current wastewater treatment facility. The city of Cayuga has a three cell wastewater treatment system. Based on North Dakota Pollution Discharge Elimination System records, the city has never discharge nor is it expected that they ever will.

SD DENR Comment on Section 3.1 Shortfoot Creek Target Reductions in Fecal Coliform Bacteria Concentrations: From a TMDL development standpoint, the desire to avoid allocating a load to an upstream state has a number of appealing characteristics. In the case of Shortfoot Creek, it appears that a number of available options were overlooked during the analysis which would have helped better define the bacteria load allocation, and possibly have lead to developing allocations for both states. As mentioned previously, land use data for the entire watershed is available. The TMDL uses NASS data from 2007 for the North Dakota portion. This data is also available for South Dakota. The inclusion of this data from the same source for both portions of the watershed would provide a better understanding of the land use of the entire watershed. In addition to the georeferenced land use data, NASS also provides an annual publication addressing the number of livestock in each county. While it is unreasonable to use this data to generate loadings, it may be used as circumstantial evidence to help verify conclusions that are drawn regarding the sources of the bacteria.

NDDoH Response to Comment: As indicated previously, South Dakota NASS data for 2007 has been included in the landuse analysis. This analysis supports the SD DENR's statement that cropland is the dominant landuse in both North and South Dakota. While it is not the dominant landuse the Department believes that livestock grazing and unpermitted animal feeding operations along and near Shortfoot Creek is the major source of fecal coliform bacteria loading. While this assumption may also be made for the South Dakota portion of the watershed, for purposes of this TMDL this assumption is only made for the North Dakota portion of the watershed. As stated in Section 3.1, the Department simply assumes that the state of North Dakota's fecal coliform standard of 200 CFUs/100 mL will be met at the border. This does not suggest that the standard is not currently being met at the border. Section 3.1 has been rewritten to clarify the Department's intention to only apply the TMDL to the North Dakota portion of the watershed.

SD DENR Comment on Section 4.2 Non Point Source Pollution Sources: The first paragraph of Section 4.2 explains that livestock production is not the dominant agricultural practice on the North Dakota side of the South Dakota portion of the watershed, and then continues by stating that there are large CAFOs on the South Dakota portion of the watershed. The interpretation of this paragraph leads the reader to believe that North Dakota is not contributing to the fecal load and that the problem originates with South Dakota CAFOs. Livestock production on the North Dakota side of the watershed may not be the dominant agricultural practice; however, there appears to be livestock production with the North Dakota portion of the watershed, and along the banks of Shortfoot Creek (Google Earth) within close proximity to the one sample location 384037 used in this TMDL. In addition, two permitted CAFOs in South Dakota are required to have manure management systems to contain all manure and process wastewater and to follow approved nutrient management plans to minimize the probability of runoff to surface waters.

"The data collected during the watershed assessment indicates that the primary contributions of fecal coliform bacteria for the watershed are livestock grazing and watering directly in and adjacent to Shortfoot Creek, with a majority of these occurring in the South Dakota side of the watershed." The scientific basis for this statement is not included in the report. There is no mention of DNA ribotyping to identify livestock as the fecal coliform source, and no mention of how the assessment differentiated between North Dakota fecal coliform and South Dakota fecal coliform. There is no identification of the data, its sources, or any rationale for this interpretation. Without defensible rational, this statement should be removed from the report.

This section also identifies both wildlife and septic systems as potential sources of fecal coliform loading. It states that "it is estimated that 28 percent of the systems in North Dakota are failing." It would be helpful if some quantification of the estimated number of systems in the watershed were included. Nationally, census data is available on a county wide basis, which would provide a reasonable estimate of the potential contributions by these systems.

NDDoH Response to Comments: As stated previously, while not the dominant landuse throughout the watershed, the Department believes that livestock grazing along and near Shortfoot Creek along with unpermitted animal waste systems are the primary source of fecal coliform bacteria loading to Shortfoot Creek. While this assumption may be made for the South Dakota portion of the watershed, it is the Department intention that this assumption only applies to the North Dakota portion of the watershed. The Department also believes that it is valid to assume that failed septic systems may also be contributing fecal coliform bacteria to the creek. Section 4.2 has been rewritten to clarify the Department's intention to only apply the TMDL and these sources to the North Dakota portion of Shortfoot Creek.

SD DENR Comment on Section 5.1 Mean Daily Stream Flow (Table 5): As indicated in our comments on section 3.1, we recommend the TMDL, including this table, use NASS data from 2007 for North and South Dakota.

NDDoH Response to Comments: Table 5 has been updated to include landuse acreage and percentage estimates for the Shortfoot Creek watershed using both SD and ND NASS data for 2007. These data are also presented in the revised Figure 4, landuse map.

SD DENR Comment on Section 5.4 Loading Sources: Figure 9 on page 17 clearly indicates the quantity of samples that exceed the numeric criteria and illustrates that dry conditions and low flow conditions contribute the greatest percent of exceedance. Table 6 on page 18 ranks the potential importance of nonpoint sources and their ability to contribute fecal coliform bacteria based on the flow regime. The dry conditions flow regime is ranked low for animal feeding operations, manure application to crop and range land, and intensive upland grazing (livestock). Riparian area grazing (livestock) ranks high in the dry condition flow regime as a potential source of fecal coliform contribution. As previously mentioned, based on bacterial decay rates, fecal contamination due to riparian area grazing is more likely to be a local source of contamination and is likely occurring in close proximity to the sample location.

NDDoH Response to Comments: The Department supports this conclusion.

SD DENR Comment on Section 8.0 Allocation: This paragraph states that "The entire nonpoint source load is allocated as a single load because there is not enough detailed source data to allocate the load to individual uses (e.g., animal feeding, septic systems, riparian grazing, waste management). For the TMDL target to be met, the majority of the conservation measures will need to be implemented in the upstream portion of the watershed in South Dakota." The TMDL acknowledges that there is not enough detailed source data to allocate the load to individual usese. In addition, the area of (the) watershed located in North Dakota from the border to the sample site at Cayuga is far greater than the size of the watershed located in South Dakota. Without enough detailed source data to allocate a load to individual uses, the TMDL should not place the burden on South Dakota without appropriate, defensible information.

NDDoH Response to Comments: The paragraph in Section 8.0 to which the comment refers to has been rewritten to clarify the intent of the TMDL to only apply to the North Dakota portion of the watershed. As stated in Section 3.1 the Department assumes that the fecal coliform standard has, and will be met at the border.