

ESCHERICHIA COLI (E. coli) ADDENDUM TO THE FECAL COLIFORM BACTERIA
TOTAL MAXIMUM DAILY LOAD (TMDL) FOR SPRING CREEK SEGMENT 01,
BROOKINGS AND MOODY COUNTIES, SOUTH DAKOTA



Watershed Protection Program
Division of Resource Conservation and Forestry
South Dakota Department of Agriculture and Natural Resources

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INTRODUCTION

The South Dakota Department of Agriculture and Natural Resources (SDDANR) adopted a conversion process to translate existing fecal coliform TMDLs and allocations to *E. coli* to satisfy Clean Water Act section 303(d) requirements. The 2020 bacteria TMDL translation included *E. coli* TMDLs for four impaired waterbodies. The conversion process and resulting *E. coli* TMDLs were formally approved by the United States Environmental Protection Agency (EPA) November 8, 2020, reissued following the correction of a minor clerical error on June 6, 2022 (SD DANR,2022).

Spring Creek Segment 01 (Big Sioux River to MN Border) or **SD-BS-R-SPRING_01** is considered impaired for the designated limited contact recreation use due to *E. coli* in South Dakota's most recent 303(d) list documented in the 2024 Integrated Report (IR) and is considered a high priority for TMDL development (SD DANR, 2024).

Several factors must be met to determine whether an existing fecal coliform TMDL can be converted to *E. coli* for a given waterbody in accordance with the methods and assumptions established in the 2020 bacteria TMDL translation:

- Waterbody must fall entirely within state jurisdiction,
- If jurisdiction is shared, TMDL only applies to portion of the water under South Dakota's jurisdiction,
- The TMDL will meet applicable water quality standards,
- Wastewater discharges to the stream are expected to meet effluent limits in accordance with an authorized NPDES permit, and
- The 2004 Central Big Sioux TMDL assumptions (e.g., source contributions, loading capacity, etc.) are still valid.

This addendum demonstrates the factors are met and it is appropriate to apply the process and rationale described in the 2020 bacteria translation TMDL (SD DANR,2022). Appendix B of the 2004 Central Big Sioux River TMDL document contains the bacteria sample data used for analysis. Appendix B of this addendum also contains *E.coli* data that has been sampled for Spring Creek segment 01 since, 2019, confirming the waterbody is still consistently demonstrating impairment for *E.coli*. Spring Creek segment 01 was listed as impaired for *E. coli* in 2022. The intent of this document is to convert the existing fecal coliform TMDL and allocations for Spring Creek segment 01 to *E. coli* using the conversion process and rationale described in the 2020 bacteria TMDL translation. Hereby, this document serves as an addendum to the Spring Creek fecal coliform TMDL (TMDL ID# 34505; approved by EPA in May 2008) by incorporating an *E. coli* TMDL and allocations for Spring Creek segment 01 (SD DANR, 2004).

JURISDICTION

Spring Creek segment 01 originates in Minnesota, extending 25.64 miles into South Dakota to its confluence with Big Sioux River segment 07. A majority of the Spring Creek Watershed is within South Dakota. SD-BS-R-SPRING-01 falls entirely within state jurisdiction (Figure 1 pg. 654 Central Big Sioux TMDL; SD DANR, 2004). Note that when the original Spring Creek Fecal Coliform TMDL was finalized the Administrative Rules of South Dakota (ARSD) erroneously listed the segment running from the Big Sioux River to Section 22, Township 116N, and Range 51W. That has since been corrected to running from the Big Sioux River to the Minnesota Border (SD DANR, 2024). The HUC and other watershed information in the original TMDL is still correct.

WATER QUALITY STANDARDS AND TMDL TARGETS

South Dakota *E. coli* criteria for immersion ([ARSD 74:51:01:50](#)) and limited contact recreation ([ARSD 74:51:01:51](#)) consist of a single sample maximum (SSM) and a monthly geometric mean (GM) both of which include distinct numeric limits. The SSM requires that no single daily sample exceed the associated numeric limit. The monthly GM also must not be exceeded and is calculated based on a minimum of 5 samples collected during separate 24-hr periods over a 30-day period. Former fecal coliform SSM and GM criteria were similar for *E. coli*, however, numeric limits deviate between the bacteria indicators (Table 1).

Impaired waters require TMDL development based on the most protective criteria. Selecting the most protective numeric target for TMDL development ensures attainment with the water quality criteria. The fecal coliform TMDL for Spring Creek used the SSM as the TMDL target for Limited Contact Recreation (Table 1). Appendix A of the 2020 bacteria TMDL translation outlines that the GM and SSM *E. coli* criteria are equally protective. As a result, the *E. coli* TMDL and allocations can be translated based on the SSM *E. coli* criterion consistent with the 2004 Spring Creek TMDL. In addition to the daily load, the geometric mean criteria must be attained on a longer (i.e., monthly) basis.

Table 1. Designated recreation uses and associated bacteria criteria designated to Spring Creek.

Impaired Stream Segment AUID	Designated Recreation Use	Fecal Coliform Geomean CFU/100mL	Fecal Coliform SSM CFU/100mL	<i>E. coli</i> Geomean CFU/100 mL	<i>E. coli</i> SSM CFU/ 100mL
SD-BS-R-SPRING_01	Limited Contact Recreation	≤1,000	*≤2,000	≤630	*≤1,178

*Refers to numeric criteria used for TMDL development

SOURCE ASSESSMENT

Point Sources

Several National Pollutant Discharge Elimination System (NPDES) permits were identified in the watershed of Spring Creek Segment 01. These potential point sources of *E. coli* bacteria are documented here to provide a watershed scale account of the system’s operational characteristics (discharge permits etc.), potential impact, and Waste Load Allocation (WLA) consideration.

The City of Elkton Wastewater Treatment Facility (WWTF)

The city of Elkton is authorized to discharge directly into Spring Creek under NPDES permit SD0020788 (<https://danr.sd.gov/npdespdf/SD0020788/Elkton%20Permit.pdf>). This wastewater treatment facility is located southwest of the city in Brookings County. The WWTF consists of gravity flow collections system with three area lift stations that convey wastewater to a three-cell stabilization pond system followed by two artificial wetlands. The facility was upgraded in 2011, the facility removed a berm between cell 1 and 3 to create the artificial wetlands. This facility serves the community of 736 people (2010 census). Discharge from the facility must comply with effluent limits established for various pollutants including *E. coli*. *E. coli* concentrations must not exceed the SSM and GM criteria for limited contact recreation waters, which is consistent with the TMDL target. The *E. coli* TMDL would not add new requirements or implementation expectations to the permit. Per the SD DANR Integrated Compliance Information

System (ICIS) the last time the city of Elkton WWTF discharged was in April of 2021. This was due to having a few wet years causing the facility to discharge the excess water.

A Waste Load Allocation (WLA) from the City of Elkton Wastewater Treatment Facility was provided for Spring Creek. A WLA of $8.10E+10$ CFU/day was assigned in the fecal coliform TMDL. The WLA was based on the premise that the Elkton WWTF would discharge their maximum design capacity. This amount is unlikely since most dischargers operate well within their permit limits. The assumptions in the fecal coliform TMDL are still accurate today.

Construction Stormwater Permits

There are two active stormwater construction permits within the Spring Creek 01 segment. Paul Barthel ([SD10J673](#)) and the City of Elkton's Utility Improvement Phase II ([SDR10K772](#)). These permits are considered active by SD DANR until the permitted party opts to close the permit. All these permits authorize discharge but do not authorize discharge of non-stormwater. The permits also stipulate that they do not contribute to violations of surface water quality criteria. A Stormwater Pollution Protection Plan (SWPPP) is required for all permitted construction and Industrial stormwater sites. The SWPPP is a written document that outlines how contractors will ensure stormwater runoff leaving the site will not become contaminated with pollutants. A WLA is not assigned since these permits are not expected to be a source of bacteria pollution.

Concentrated Animal Feeding Operations (CAFOs)

A recent search found that there are three facilities located within the Spring Creek segment 01. Each of the CAFOs facility name, type of operation, and permit number can be found in Table 2. All CAFO's are required to maintain compliance with provisions of the Water Pollution Control Act (SDCL 34A-2). SDCL 34A-2-36.2 requires each concentrated animal feeding operations, as defined by Title 40 Codified Federal Regulations Part 122.23 Dated January 1, 2007, to operate under a general or individual water pollution control permit issued pursuant to 34A-2-36. The general permit ensures that all CAFO's in SD have permit coverage regardless of if they meet conditions for coverage a NPDES permit.

All facilities with a general permit number that starts with SDG-01* are covered under the 2003 General Water Pollution Control Permit for Concentrated Animal Feeding Operations, which requires housed lots to have no discharge of solid or liquid manure to waters of the state, and allows open lots to only have a discharge of manure or process wastewaters from properly designed, constructed, operated and maintained manure management systems in the event of 25- years, 24-hour or 100-year, 24-hour storm event if they meet the permit conditions. The general permit was reissued and became effective on April 15, 2017. All CAFO's with coverage under the 2003 general permit have a deadline to apply for coverage under the 2017 general permit.

All facilities with a general permit number that starts with SDG-1* are covered under the 2017 General Water Pollution Control Permit for Concentrated Animal Feeding Operations. The 2017 general permit allows no discharge of manure or process wastewater from operations with state permit coverage or NPDES permit coverage for new source swine, poultry, and veal operations, and other housed lots with covered manure containment systems. Operations also have the option to apply for a state issued NPDES permit. Operations covered by the 2017 general permit or NPDES permit for open or housed lots

with uncovered manure containment systems can only discharge manure or process wastewater from properly designed, constructed, operated and maintained manure management systems in the event of 25-year, 24-hour storm event if they meet the permit conditions. Both the 2003 and 2017 general permits have nutrient management planning requirements based on EPA’s regulations and the South Dakota Natural Resources Conservation Services 590 Nutrient Management Technical Standard to ensure the nutrients are applied at agronomic rates with management practices to minimize the runoff of nutrients. Additionally, the general permits include design standards, operation, maintenance, inspection, record keeping, and reporting requirements.

(<https://danr.sd.gov/Agriculture/Livestock/FeedlotPermit/default.aspx>)

Table 2. CAFOs in Spring Creek Watershed.

Name of Facility	Type of Operations	SD General Permit #
Dakota Layers, LLC	layers (housed lot)	SDG-0100041
Golden Dakota Farms, LLC	dairy cattle (housed lot)	SDG-100211
Thornhills Feed Lot, LLC	beef cattle (open lot)	SDG-0100051

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

Nonpoint Sources

The nonpoint source assessment for Spring Creek segment 01 is document in the 2004 Spring Creek fecal coliform TMDL and the conclusions of that 2004 assessment are still accurate today. Fecal coliform source contributions are considered synonymous with *E.coli* based on the close statewide paired bacteria data relationship documented in the 2020 bacteria TMDL translation.

The 2004 TMDL breaks down Spring Creek's Watershed as follows, with 64% (20,360 acres) of the land being used for cropland, 34% (10,758 acres) being used for grasses, and finally, the last 2% of land falling under trees and artificial (i.e., urban or developed) uses. The exact land use percentages from the original fecal coliform TMDL were not able to be replicated, so land use from the 2004 fecal coliform TMDL was compared to land use derived from the Earth Resources Observation and Science's (EROS) National Land Cover Database (NLCD) for the years 2004 and 2021 (EROS Center, 2023). Looking at the 2004 NLCD GIS layer it shows the watershed as follows, 73.51% of land being used for cropland, 20.55% for grasses, and 5.94% falling under trees and artificial uses. The 2021 NLCD GIS layer showed similar percentages with 73.86% for cropland, 20.03% for grasses and 5.75% of land falling under trees and artificial uses. It is uncertain what data was used to show land use in the original fecal coliform TMDL. However, the NLCD layers show insignificant changes between the years 2004 and 2021. Land use and bacteria production characteristics in the impaired watersheds are expected to be similar to that documented during the respective Fecal Coliform TMDL assessment.

TMDL AND ALLOCATIONS

A Load Duration Curve method was used to develop the fecal coliform bacteria loading, (concentration) x (flow), using zones based on hydrologic conditions to develop the fecal coliform TMDL for the 2004 Spring Creek segment. The criteria ratio approach was used to convert the existing fecal coliform TMDL and allocations to *E. coli* for each flow zone. The *E. coli* TMDL, WLA, load allocation (LA), and margin of safety (MOS) were calculated by multiplying the existing fecal coliform values by the ratio (EC:FC) for the SSM (Table 3). The *E. coli* TMDL allocations (TMDL=WLA+LA+MOS) were based on the same percent contribution as established for the fecal coliform TMDL allocations in each flow zone.

The fecal coliform current load from the Spring Creek 01 fecal coliform TMDL was converted to *E. coli* using the ratio (EC:FC) for the SSM. The percent reduction was then calculated as the converted *E. coli* current load minus the *E. coli* converted TMDL divided by the converted *E. coli* current load (Table 5). This calculation results in percent reductions identical to the Spring Creek 01 fecal coliform TMDL (Table 4).

Table 3. Applicable bacteria criteria and ratio for the immersion recreation use.

Fecal coliform criteria	<i>E. coli</i> criteria	EC:FC ratio
GM 1000	GM 630	0.63
SSM 2000	SSM 1178	0.589

The *E. coli* TMDL is protective of applicable criteria assigned to the limited contact recreation designated use for Spring Creek segment 01. The Spring Creek fecal coliform TMDL contains supporting information necessary to implement the *E. coli* TMDLs. The original fecal coliform and converted *E. coli* TMDL allocations and reductions are provided for Spring Creek segment 01 in tables 4 and 5, respectively. In addition to the daily load, the geometric mean criteria must be attained on a longer (i.e., monthly) basis.

Due to low number of samples per zone, all zones were combined to assess the overall fecal coliform bacteria in the Spring Creek fecal coliform TMDL. This addendum followed the same assumptions of the previous EPA approved TMDL document.

Table 4. Existing fecal coliform TMDL and allocations for Spring Creek segment 01 based on the applicable bacteria criteria for limited contact recreation from the 2004 fecal coliform TMDL.

Flow Zone	Fecal TMDL (CFU/day)	WLA (CFU/day)	LA (CFU/day)	MOS (CFU/day)	Current Load (CFU/day)	% Reduction
All	3.02E+11	8.10E+10	1.91E+11	3.02E+10	5.03E+11	40%

Table 5. *E. coli* TMDL and Load allocations for Spring Creek segment 01 based on the applicable bacteria criteria for immersion recreation.

Flow Zone	<i>E. coli</i> TMDL (CFU/day)	WLA (CFU/day)	LA (CFU/day)	MOS (CFU/day)	Current Load (CFU/day)	% Reduction
All	1.78E+11	4.77E+10	1.12E+11	1.78E+10	2.96E+11	40%

The TMDL analysis was performed using the best data available to specify the fecal coliform reductions necessary to achieve water quality criteria. Using the individual flow zones results in two flow zones with no samples and no reductions. A more conservative approach using the overall conditions was taken to support implementation efforts after the entire land use data and size of the watershed was considered. Tables 6 and 7 show what the data would look like if the document had used multiple flow zones for each fecal coliform and for *E. coli*, respectively.

Table 6. Flowzone Reduction Comparison for fecal coliform.

	Median	Overall (0-100)	High/ Moist (0-40)	Mid-Range (40-60)	Dry/Low (60-100)
X	Median Concentration (counts/day)	8.15E+10	4.33E+10	2.45E+10	0.00E+00
	Flow Median (cfs)	6.17	15.46	6.17	2.60
=	Existing	5.03E+11	6.69E+11	1.51E+11	00.0E+00
	Target Load (at 2,000 cfu/100mL)	3.02E+11	7.57E+11	3.02E+11	1.27E+11
	% Reduction w/MOS	45	-2.79	-81.87	0.00
Note: units are counts/day					
	Median Flow Percentile	50	20	50	80
	Number of Samples per Zone	11	8	3	0

Table 7. Flowzone Reduction Comparison *E. Coli* Translation.

	Median	Overall (0-100)	High/ Moist (0-40)	Mid-Range (40-60)	Dry/Low (60-100)
X	Median Concentration (counts/day)	4.80E+10	2.55E+10	1.44E+10	0.00E+00
	Flow Median (cfs)	6.17	15.46	6.17	2.60
=	Existing	2.96E+11	3.94E+11	8.90E+10	00.0E+00
	Target Load (at 1,178 cfu/100mL)	1.78E+11	4.46E+11	1.78E+11	7.48E+10
	% Reduction w/MOS	45	0	0	0
Note: units are counts/day					
	Median Flow Percentile	50	20	50	80
	Number of Samples per Zone	11	8	3	0

SUMMARY

The 2020 bacteria TMDL translation provided a framework to convert fecal coliform TMDLs and allocations to *E. coli* to address impaired streams with recreation uses in South Dakota. This framework was used to convert the existing fecal coliform TMDLs and allocations set forth in the 2008 fecal coliform TMDL Spring Creek segment 01 (**SD-BS-R-SPRING_01**) to *E. coli*. Therefore, this document serves as an *E. coli* TMDL addendum to the 2004 fecal coliform Spring Creek segment 01 (TMDL # 34505). The addended *E. coli* TMDL and allocations follow the assumptions of the 2004 fecal coliform TMDL. The fecal coliform and *E. coli* TMDLs for Spring Creek segment 01 were developed in accordance with Section 303(d) of the federal Clean Water Act and guidance provided by the US EPA.

The South Dakota DANR partners with East Dakota Water Development District, helping implement the Big Sioux River Project (BSRP) with section 319 funds to help landowners with Best Management Practices (BMP) within the Big Sioux River Watershed. Spring Creek Segment 01 is located in this watershed, and the project is working to reduce *E. coli* numbers within the watershed.

PUBLIC COMMENT

This TMDL addendum was made available for public comment in accordance with section 303(d) requirements. A public notice letter was published in the Brookings Register, Moody County Enterprise, and the Sioux Falls Argus Leader to announce the availability of the addendum for public comment. The TMDL addendum document and comment process was made available on the South Dakota Department of Agriculture and Natural Resources webpage at <https://danr.sd.gov/public/default.aspx>. The public comment period began May 9th, 2024.

LITERATURE CITED

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APPENDIX A: EPA APPROVAL LETTER AND DECISION DOCUMENT

APPENDIX B: *E. COLI* DATA

SampleDate	<i>E. coli</i> (CFU/100mL)
05/21/2019	428
06/03/2019	866
06/17/2019	2400
07/01/2019	4110
07/15/2019	2190
08/19/2019	687
09/16/2019	1120
09/23/2019	579
10/07/2019	727
06/08/2020	1990
06/22/2020	69.1
07/06/2020	6870
07/20/2020	6020
08/03/2020	1510
08/17/2020	2600
09/08/2020	8160
09/21/2020	5480
10/19/2020	3870
04/19/2021	3.1
05/03/2021	179
05/25/2021	63.8
06/07/2021	14100
06/23/2021	250
07/12/2021	2420
07/19/2021	1090
07/19/2021	1120
07/19/2021	<1
08/02/2021	52.8
08/16/2021	1120
08/16/2021	1300
09/14/2021	>24200
09/20/2021	2380
10/18/2021	2100