Pathogen Total Maximum Daily Load (TMDL) for Long Creek in Lincoln, Minnehaha, and Turner Counties South Dakota

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Total Maximum Daily Load Summary
Long Creek of the Vermillion River Basin - Segment SD-VM-R-LONG_01

Waterbody Type:	River/Stream
Reach Number:	SD-VM-R-LONG_01
303(d) Listing Parameter:	Pathogens (*Escherichia coli*)
Designated Uses of Concern:	Limited Contact Recreation Waters
Size of Impaired Waterbody:	Reach SD-VM-R-LONG_01 - Approximately 34.7 km Entire length – Approximately 81.1 km
Size of Watershed:	Watershed size for Reach SD-VM-R-LONG_01 - 50,266.7 hectares (ha) Entire Subwatershed Size - 50,266.7 ha
Indicator(s):	Concentration of *Escherichia coli* (colony forming units per 100ml)
Analytical Approach:	Load Duration Curve Framework
Location:	Hydrologic Unit Codes (12-digit HUC): 101701021001
TMDL Priority Ranking:	Priority 1 (2020IR)
Target (Water Quality Standards):	*Escherichia coli* (*E. coli*) - Maximum daily concentration of ≤ 1,178 CFUs/100mL and a geometric mean of ≤ 630 based on a minimum of five (5) samples obtained during separate 24-hour periods for any 30-day period.

E. coli (cfu/day)

	Extreme Flow Zone (0-10%)	**High Flow Zone (10-40%)**
Loading Allocation	6.78×10^{12}	1.01×10^{12}
Waste Load Allocation	2.14×10^{10}	2.14×10^{10}
Margin of Safety	7.56×10^{11}	1.15×10^{11}
TMDL	7.56×10^{12}	1.15×10^{12}

1.0 Objective

The intent of this document is to clearly identify the components of the TMDL, support adequate public participation, and facilitate the US Environmental Protection Agency (US EPA) review. The TMDL was developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by US EPA. This TMDL document addresses the pathogen impairment for Segment **SD-VM-R-LONG_01** of Long Creek in the Vermillion River Basin (Vermillion River to State Highway 44) (Figure 1). This impairment has been assigned a priority category 1 (high-priority) in the 2012, 2014, 2016, 2018, and 2020 impaired waterbodies list. Sufficient data was collected to determine that the beneficial use of limited contact recreation is not supported. The segment has been listed as nonsupporting for limited contact recreation use and has subsequently been included on the 2012, 2014, 2016, 2018, and 2020 §303(d) lists.

2.0 Watershed Characteristics

2.1 General

The project area for Long Creek is shown in Figure 1. Long Creek, which is located in the Vermillion River Basin, drains approximately 124,211.7 total acres (194.1 miles^2) in southeastern South Dakota (SD). It is divided into three different classified segments. The first segment runs from the confluence of Long Creek and the Vermillion River (approximately four miles north of Centerville, SD) to SD Highway 44 within the city of Lennox, SD. It has been assigned Beneficial Uses 5 8, 9, and 10 and is the only segment addressed by this TMDL. The second segment flows from SD Highway 44 to 276th St in Turner County and has been assigned Beneficial Uses 6, 8, 9, and 10**.** The remaining portion of Long Creek, which begins at 276th St. in Turner County and runs north into southwestern Minnehaha County, has been assigned only the Beneficial Uses 9 and 10. Only small intermittent tributaries merge with Long Creek prior to its confluence with the Vermillion River near Centerville, SD (Figure 1).

The Vermillion River watershed is located along the boundary between the James River Lowland and the Prairie Coteau Level IV ecoregions which are both part of the greater Northern Glaciated Plains. A flat to gently rolling landscape composed of glacial drift characterizes the Northern Glaciated Plains ecoregion. This ecoregion is also characterized by dense concentrations of temporary and seasonal wetlands. Native grasses include Eastern wheatgrass, green needlegrass, big bluestem, and blue grama but most areas are extensively tilled to corn and soybeans interspersed with pastureland (Bryce et al., 1996 and Chapman et al., 2001). Wildlife species present in the area include whitetail deer, red fox, beavers, raccoons, ring-necked pheasants, mourning doves, and numerous other species of songbirds, waterfowl, reptiles, and amphibians (SD Game, Fish, and Parks, 2002).

Livestock uses are also a significant landuse type within this watershed. During the animal feeding operation (AFO) inventory conducted during the Vermillion River Basin Watershed Assessment, 34 AFOs were found within 500 meters of Long Creek. Each one of the operations was ranked by the Agricultural Nonpoint Source Computer Model (AGNPS). Twenty two or 65% of the AFOs exhibited an AGNPS rating of 50 or greater. The annualized Agricultural

Nonpoint Source (AGNPS) Computer model is a modeling tool used by the South Dakota Department of Agriculture and Natural Resources (SDDANR) to analyze the contributions of nutrient and sediment runoff from watersheds to a receiving waterbody. A specific module also ranks the AFOs within the watershed on a scale from 0 (no impact) to 100 (significant impact). The SDDANR has used an AGNPS feedlot rating of 50 as a cutoff for targeting in implementation projects.

The impaired reach of Long Creek lies within west central Lincoln County (Figure 1). Silty soil associations formed in glacial drift and till on the uplands include Wentworth-Chancellor, Egan-Chancellor, Chancellor-Wakonda-Tetonka associations. Silty and loamy soils formed in alluvium on bottom lands include Lamo-Bon-Clamo and Delmont-Graceville-Talmo associations (NRCS, 1974).

There are two National Pollution Discharge Elimination System (NPDES) regulated wastewater treatment facilities within the Long Creek Watershed. These permitted facilities serve the communities of Lennox, SD and Worthing, SD and require a Waste Load Allocation (WLA) for the Long Creek TMDL (Figure 1). There is also an NPDES regulated ethanol plant within the Long Creek watershed located near Chancellor, SD. This ethanol facility does not emit any pathogens as part of its production process and, as such, the permit conditions do not outline any monitoring requirements for this parameter. These facilities are discussed further in Section 6.1 of this document.

The Vermillion River basin has a subhumid, continental climate characterized by pronounced seasonal differences in temperature, precipitation, and other climatic variables. Temperature varies slightly from the northern to the southern end of the basin. Annual temperatures are slightly cooler at the northern parts of the basin. January is typically the coldest month (14°F in the north and 18°F in the south). July is typically the warmest month (72°F in the north and 74°F in the south). Figure 1 shows that Long Creek watershed is located in the east central part of the Vermillion River Basin.

The frost free days at the northern end of the basin are typically from May 9th to September 28th, while the southern frost free days are from May 3rd to October 3rd. The average annual precipitation in the watershed is somewhat variable, both spatially and temporally. The average rainfall for Lincoln County, where most of the watershed resides, is approximately 27 inches per year with 74% falling during the April through September. The average annual snowfall is approximately 34 inches but varies widely from year to year (High Plains Regional Climate Center, 2017).

As shown on Figure 1 and Table 1, there was only one TMDL monitoring station located within the Long Creek watershed. Although Long Creek is approximately 56.8 miles in length, monitoring only occurred for the segment running from the Vermillion River (just north of Centerville, SD) to Highway 44 (just south of Lennox, SD) (approximately 21.7 miles long). The data used to determine impairment included the one TMDL station (Site VRT10) installed as part of the overall Vermillion River Basin Watershed Assessment. The water quality data for the period 2004-2006 indicated Segment R3 (2012, 2014, 2016, 2018, and 2020 IR) was impaired via pathogens and could not support the limited contact recreational use.

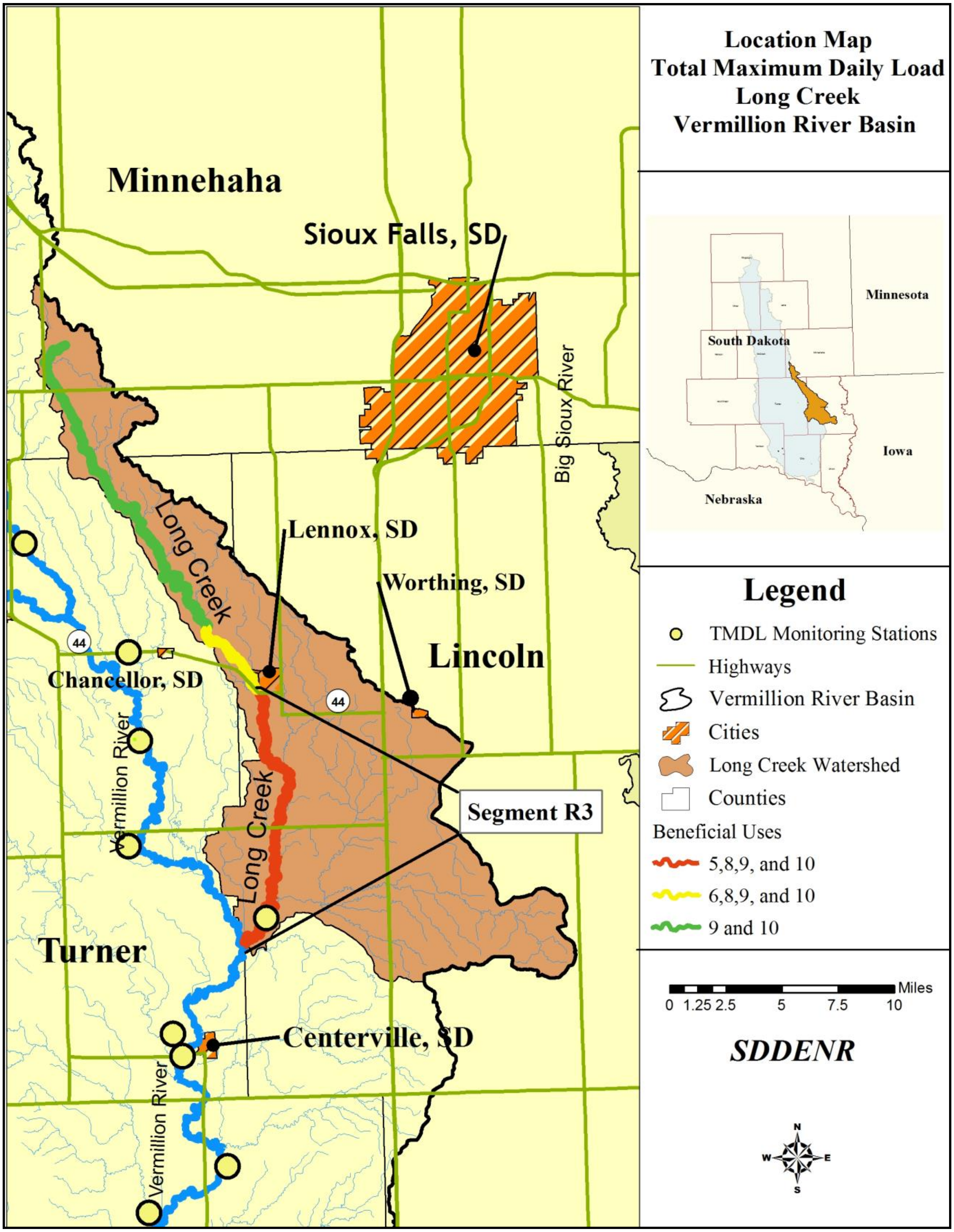

Figure 1. Location of Segment SD-VM-R-LONG_01, Long Creek of the Vermillion River (South Dakota)

Table 1. Long Creek of the Vermillion River Assessment, Reach and Segment Designations.

Segment	MAPID (2016 IR)	Length miles	Description	Monitoring Sites
SD-VM-R-LONG_01	R3	21.7	Vermillion River to SD Highway 44 near Lennox, SD	VRT10

Segment SD-VM-R-LONG_01 (Segment R1, 2020IR) was first listed in 2008 as impaired for the limited contact recreation (pathogens). The two latest IR reports (2018 and 2020), show non-support of the limited contact use. This TMDL will address the *E. coli* bacteria impairment for this segment only. Land use/land cover, livestock, wildlife, septic tanks and sewerage systems are a determinant in identifying and quantifying sources of pathogens within a watershed.

Table 2 shows the significant percentages of 11-land use categories taken from the 2001 and 2011 National Land Cover Data set (NLCD, 2001 and 2011) for the Long Creek Watershed in the Vermillion River Basin. Land use has remained relatively consistent over the last decade.

Table 2. 2001 and 2011 Landuse for the Long Creek Watershed.

NLCD (National Land Cover Data Set**) Land Use Categories**	**2001**	**2011**
11-Open Water	**0.3%**	**0.5%**
21-Developed, Open Space	**5.1%**	**5.1%**
22-Developed, Low Intensity	**0.4%**	**0.5%**
23-Developed, Medium Intensity	**0.2%**	**0.2%**
24-Developed High Intensity	**0.0%**	**0.1%**
31-Barren Land, Rock, Sand, Clay	**0.1%**	**0.1%**
41-Deciduous Forest	**0.4%**	**0.4%**
71-Grassland, Herbaceous	**1.7%**	**1.7%**
81-Pasture, Hay	**10.1%**	**10.0%**
82-Cultivated Crops	**80.8%**	**80.6%**
90-Woody Wetlands	**0.1%**	**0.0%**
95-Emergent Herbaceous Wetlands	**0.9%**	**0.7%**
Total	**100.0%**	**100.0%**

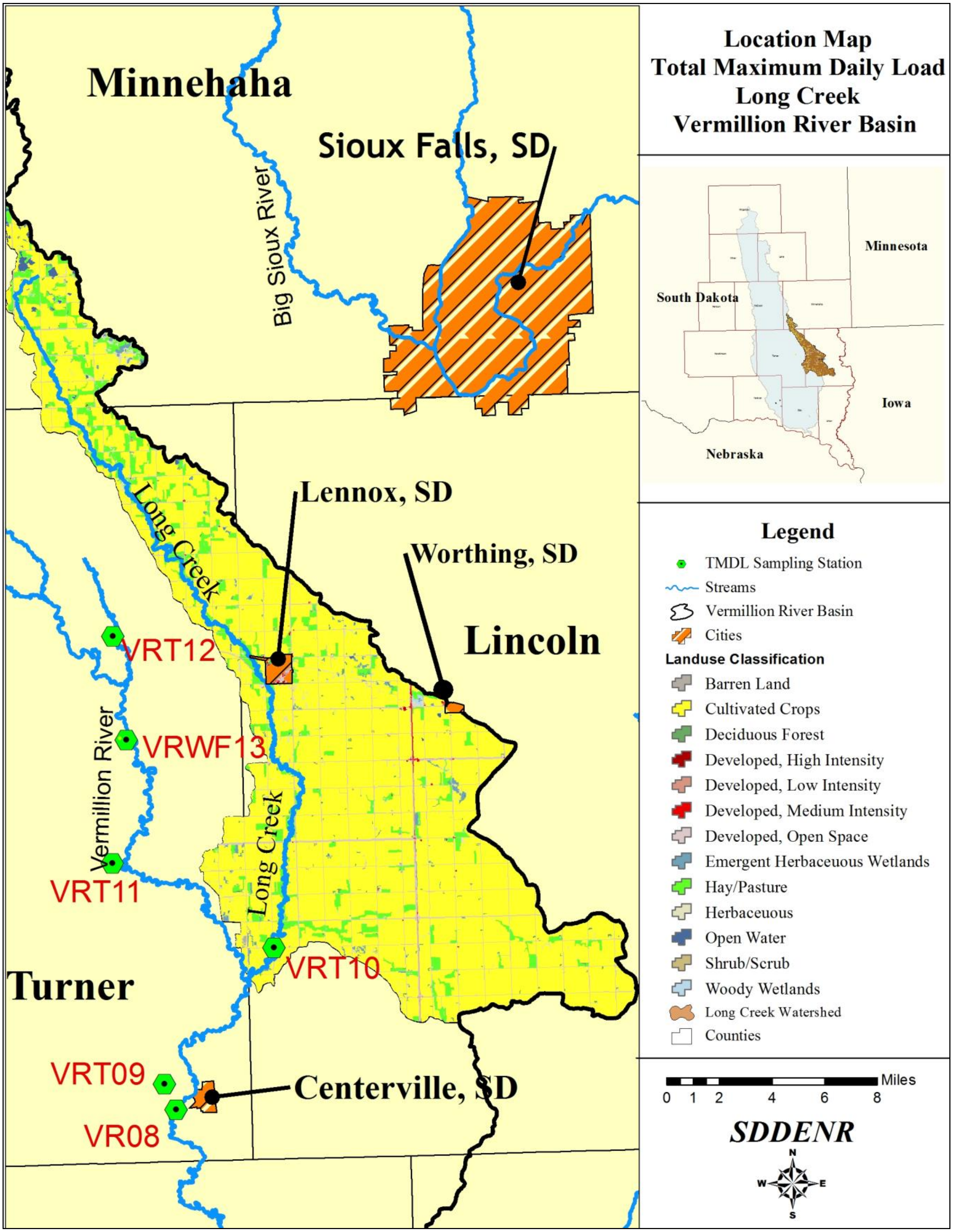

Figure 2. Landuse for Long Creek in the Vermillion River Basin (2001 and 2011 NLCD).

3.0 Description of Applicable Water Quality Standards & Numeric TMDL Targets

3.1 South Dakota Water Quality Standards

Water quality standards are comprised of three main parts as defined in the Federal Clean Water Act (33 U.S.C. §1251 et seq.) and Administrative Rules of South Dakota (ARSD) Chapter 74:51:01:

- Beneficial Uses – Functions or activities that reflect waterbody management goals
- Criteria – Numeric concentrations or narrative statements that represent the level of water quality required to support beneficial uses
- Antidegredation – Additional policies that protect high quality waters

Each individual waterbody within South Dakota is designated one or more of the following beneficial uses:

(1) Domestic water supply
(2) Coldwater permanent fish life propagation
(3) Coldwater marginal fish life propagation
(4) Warmwater permanent fish life propagation
(5) Warmwater semipermanent fish life propagation
(6) Warmwater marginal fish life propagation
(7) Immersion recreation
(8) Limited contact recreation
(9) Fish and wildlife propagation, recreation, and stock watering
(10) Irrigation
(11) Commerce and industry

All waters (both lakes and streams) within South Dakota are designated the use of fish and wildlife propagation, recreation, and stock watering (9). All streams are designated the uses of (9), and (10) irrigation. Additional uses are designated by the state based on a beneficial use analysis of each waterbody.

Long Creek from Highway 44 just south of Lennox, SD to the confluence with the Vermillion River has been designated the beneficial uses of: (5) warmwater semipermanent fish life propagation, (8) limited contact recreation, (9) fish and wildlife propagation, recreation, and stock watering and (10) irrigation waters. Table 4 lists all the numeric criteria that must be met to support the beneficial uses designated for Segment SD-VM-R-LONG_01. When multiple uses establish criteria for the same parameter, the most stringent criterion is used for regulatory purposes as indicated in the table with parentheses.

Table 3. South Dakota surface water quality standards for Long Creek in Lincoln, Minnehaha, and Turner Counties, South Dakota.

Parameter	Criteria	Unit of Measure	Special Conditions
Total alkalinity as calcium carbonate	≤ 750	mg/L	30-day average
	≤ 1313	mg/L	daily maximum
Dissolved oxygen (warmwater semipermanent)	≥ 5.0	mg/L	daily minimum
Total ammonia nitrogen as N (warmwater semipermanent)	Equal to or less than the result from Equation 3 in Appendix A	mg/L	30-day average March 1 - October 31
	Equal to or less than the result from Equation 4 in Appendix A	mg/L	30-day average November 1 – February 29
	Equal to or less than the result from Equation 2 in Appendix A	mg/L	daily maximum
E. coli (May 1 – September 30) (limited contact recreation)	*E. coli* ≤ 630	cfu/100 mL	geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period
	E. coli ≤ 1,178	cfu/100 mL	in any one sample
Conductivity at 25°C	≤ 2,500	micromhos/cm	30-day average
	≤ 4,375	micromhos/cm	daily maximum
pH (warmwater semipermanent)	≥ 6.5 and ≤ 9.0	standard units	see § 74:51:01:07
Nitrates as N	≤ 88	mg/L	daily maximum
	≤ 50	mg/L	30-day average
Total dissolved solids	≤ 2,500	mg/L	30-day average
	≤ 4,375	mg/L	daily maximum
Total suspended solids (warmwater semipermanent)	≤ 90	mg/L	30-day average
	≤ 158	mg/L	daily maximum
Temperature (warmwater semipermanent)	≤ 90	°F	see § 74:51:01:31
Undisassociated hydrogen sulfide	≤ 0.002	mg/L	daily maximum
Total petroleum hydrocarbon	≤ 10	mg/L	see § 74:51:01:10
Oil and grease	≤ 10	mg/L	see § 74:51:01:10
Sodium adsorption ratio	≤ 10		see definition

Additional “narrative” standards that may apply can be found in ARSD 74:51:01:05; 06; 08; and 09. These rules contain language that generally prohibits the introduction of materials into waterbodies causing pollutants to form, visible pollutants, undesirable odors and nuisance aquatic life which can all interfere with the biological integrity of a waterbody.

TMDLs must also consider downstream water quality standards. In this case, Long Creek (SD-VM-R-LONG_01) flows into Vermillion River segment SD-VM-R-VERMILLION_01 which is designated the same beneficial uses as Long Creek and thus is subject to the same criteria listed in Table 4. Because of this agreement, TMDLs established to meet Long Creek’s water quality standards will also be protective of downstream water quality standards.

3.2 *E. coli* Water Quality Standards

South Dakota has adopted numeric *E. coli* criteria for the protection of the immersion (7) and limited contact recreation uses (8). Immersion recreation waters are to be maintained suitable for activities such as swimming, bathing, water skiing and other similar activities with a high degree of water contact that make bodily exposure and ingestion more likely. Limited contact recreation waters are to be maintained suitable for boating, fishing, and other water-related recreation other than immersion recreation.

Through the 1970's and 1980's EPA epidemiological studies identified *E. coli* as a good predictor of gastrointestinal illnesses in fresh waters (USEPA, 1986). *E. coli* is a class of bacteria naturally found in the intestinal tract of humans and warm-blooded animals. The presence and concentration of *E. coli* in surface waters, typically measured in colony forming units (cfu) or counts (#) per 100ml, is used to identify fecal contamination and as an indicator for the likely presence of other pathogenic microorganisms. In 1986 EPA recommended states adopt *E. coli* criteria for immersion recreation based on a rate of 8 illnesses per 1,000 swimmers (USEPA, 1986). While it is generally understood that limited contact recreation is associated with a reduced illnesses risk and different routes of exposure, it is difficult to directly relate an illness rate to these activities from epidemiological studies based on immersion recreation. Therefore, to protect downstream uses and establish effluent limitations for limited contact recreation waters, EPA has suggested numeric criteria five times the immersion recreation values (USEPA, 2002). Because of the reduced risk, the multiplier was considered protective of the limited contact recreation use through the EPA and SDDANR water quality standards review and approval process.

The South Dakota *E. coli* criteria for the immersion recreation beneficial use requires that 1) no single sample exceed 235 cfu/100 ml and 2) during a 30-day period, the geometric mean of a minimum of 5 samples collected during separate 24-hr periods must not exceed 126 cfu/100 ml (ARSD 74:51:01:50). The *E. coli* criteria for the limited contact recreation beneficial use requires that 1) no single sample exceed 1,178 cfu/100 ml and 2) during a 30-day period, the geometric mean of a minimum of 5 samples collected during separate 24-hour periods must not exceed 630 cfu/100 ml (ARSD 74:51:01:51). As noted, these limited contact criteria are five times the corresponding immersion criteria. *E. coli* criteria apply from May 1 through September 30, which is considered the recreation season. The numeric *E. coli* criteria applicable to Long Creek (SD-VM-R-LONG_01) are the immersion recreation values listed in Table 4.

3.3 Numeric TMDL Targets

TMDLs are required to identify a numeric target to measure whether or not the applicable water quality standard is attained. A maximum allowable load, or TMDL, is ultimately calculated by multiplying this target with a flow value and a unit conversion factor. Generally, the pollutant causing the impairment and the parameter expressed as a numeric water quality criteria are the same. In these cases, selecting a TMDL target is as simple as applying the numeric criteria. Occasionally, an impairment is caused by narrative water quality criteria violations or by parameters that cannot be easily expressed as a load. When this occurs, the narrative criteria must be translated into a numeric TMDL target (e.g., nuisance aquatic life translated into a total phosphorus target) or a surrogate target established (e.g., a pH cause addressed through a total nitrogen target) and a demonstration should show how the chosen target is protective of water quality standards.

As seen from Table 4, there are two numeric *E. coli* criteria for TMDL target consideration. When multiple numeric criteria exist for a single parameter, the most stringent criterion is selected as the TMDL target. To judge whether one is more protective of the beneficial use, it is necessary to further elaborate how the criteria were derived.

South Dakota's *E. coli* criteria are based on EPA recommendations originally published in 1986 (USEPA, 1986). EPA issued slightly modified recommendations in 2012 that did not substantially change the underlying analysis or criteria values in South Dakota (USEPA, 2012). As recommended, SDDANR adopted *E. coli* criteria that contain two components: a geometric mean (GM) and a single sample maximum (SSM). The GM was established from epidemiological studies by comparing average summer exposure to an illness rate of 8:1,000. The SSM component was computed using the GM value and the corresponding variance observed in the epidemiological study dataset (i.e., log-standard deviation of 0.4). EPA provided four different SSM values corresponding to the 75th, 82nd, 90th, and 95th percentiles of the expected water quality sampling distribution around the GM to account for different recreational use intensities (Figure 3). South Dakota adopted the most stringent recommendation, the 75th percentile, into state water quality standard regulations as the SSM protective of designated beaches.

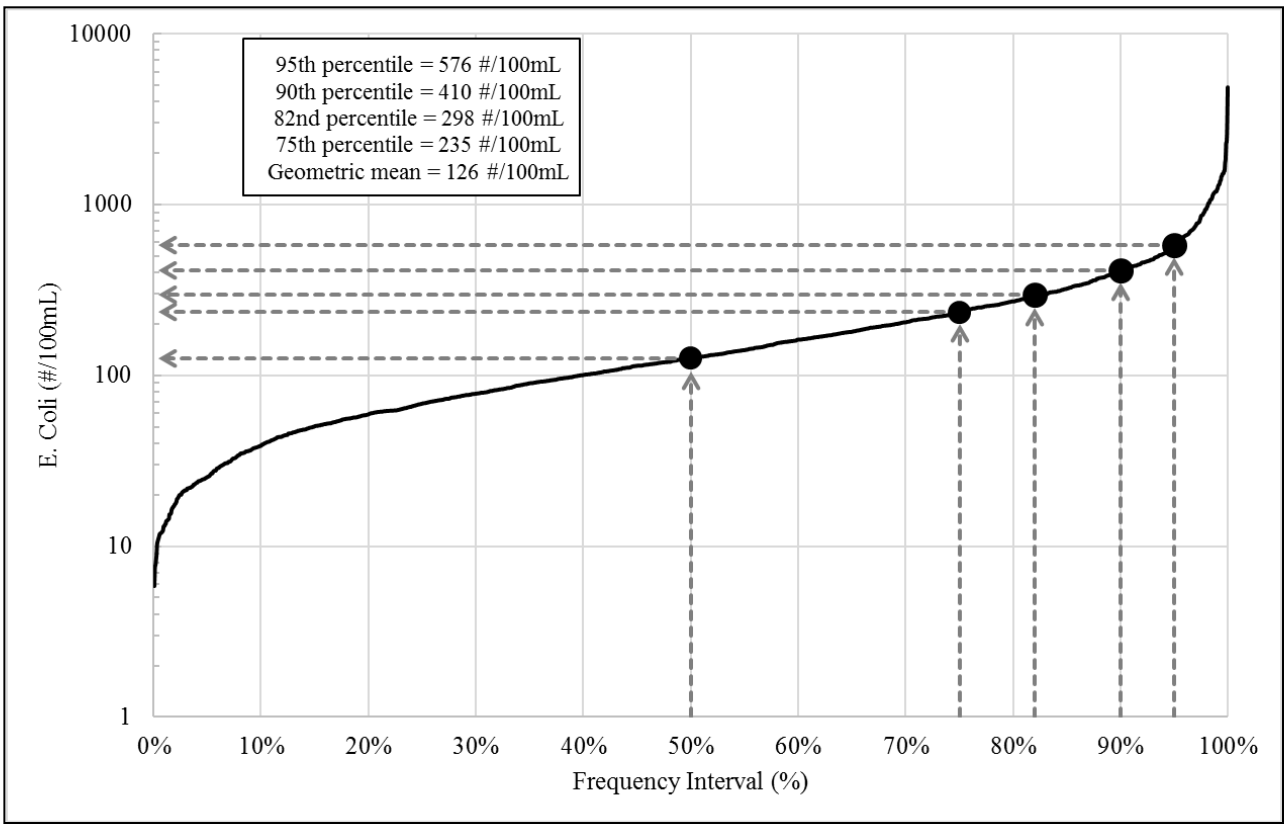

Figure 3. Log-Normal Frequency Distribution Used to Establish South Dakota's Immersion Recreation *E. coli* Criteria of 126 (GM) and 235 (SSM) #/100mL (EPA, 1986).

Dual criteria were established to balance the inherent variability of bacteria data and provide flexibility for handling different sampling routines. Together, the GM and SSM describe a water quality distribution expected to be protective of immersion contact recreation. The GM and SSM are equally protective of the beneficial use because they are based on the same illness rate and differ simply representing different statistical values and sampling timeframes. While this investigation has revealed the GM and SSM *E. coli* criteria to be equally protective of the immersion recreation use, a likewise conclusion can be made for the GM and SSM criteria associated with the limited contact recreation use since those values were simply derived as five times the immersion values.

As described in EPA's *Protocol for Developing Pathogen TMDLs*, the availability of data may dictate which criterion should be used as the TMDL target (EPA, 2001). When a geometric mean of the sampling dataset can be calculated as defined by South Dakota Administrative Rules (i.e., at least five samples separated by a minimum of 24-hours over a 30-day period) and compared to the GM criterion, SDDANR uses the GM criterion as the TMDL target. This establishes a smaller overall loading capacity and is considered a conservative approach to setting the TMDL.

When a proper GM cannot be calculated, as in this case for Long Creek (SD-VM-R-LONG_01), SDDANR uses the SSM as the TMDL target. This is permissible because the SSM is equally protective of the beneficial use as discussed above. Although this target selection leads to the establishment of a larger allowable load, in some respects it is more appropriate because timeframes align better (i.e., the SSM is associated with a single day and TMDLs establish daily loads, versus the 30-day GM). Additionally, certain aspects of SDDANR's *E. coli* assessment method, when combined with a SSM TMDL target, result in an expected dataset GM more protective than the GM criterion. SDDANR uses assessment methods to define how to interpret and apply water quality standards to 303(d) impairment decisions. These methods are further discussed in Section 4.4, however for this discussion, it is important to note that SDDANR allows a 10% exceedance frequency of both the SSM and GM. In other words, as long as the *E. coli* dataset meets other age and size requirements, a waterbody is considered impaired (i.e., not meeting water quality standards) when greater than 10% of samples exceed either the SSM or GM. Water quality standards are met if the exceedance frequency is 10% or less.

Returning to the original distribution used to establish South Dakota's Immersion Recreation *E. coli* criteria in Figure 3, remember that SDDANR chose to adopt a SSM concentration based on the most stringent recommendation (75th percentile). According to assessment methods in South Dakota, however, the SSM concentration is treated as a 90th percentile (i.e., 10% exceedance frequency). Step #1 in Figure 4 shows how doing so effectively moves the SSM point to the right. If the original log-normal frequency distribution with a log-standard deviation of 0.4 is subsequently re-fitted to this new 90th percentile point at 235 #/100mL (red dotted line), the corresponding 50th percentile (GM) is 72 #/100mL as shown in Step #2 of Figure 4.

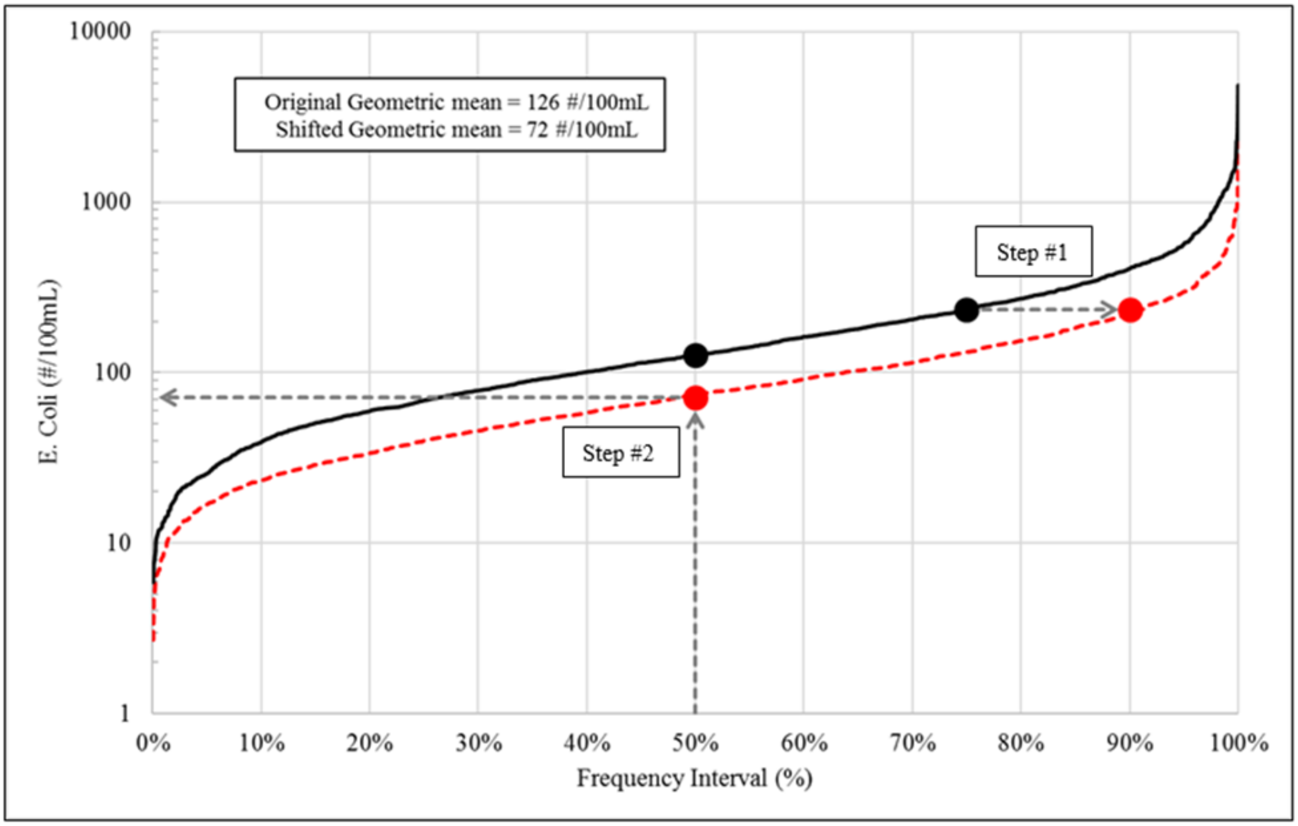

Figure 4. The Effective Impact of South Dakota's *E. coli* Assessment Method on the Criteria's Original Log-Normal Frequency Distribution (Black line = original; red dotted line = shifted)

The GM associated with this shifted distribution is more stringent than the GM of the original distribution (126 #/100mL), thus this demonstrates that attaining a maximum daily SSM target in a TMDL will also achieve the 30-day GM criterion when following South Dakota's assessment method. A similar conclusion was determined by EPA in *An Approach for Using Load Duration Curves in the Development of TMDLs* (USEPA, 2007) using Michigan criteria as an example. Once again this outcome holds true for South Dakota's limited contact recreation *E. coli* criteria since they were simply derived as five times the immersion values.

Finally, while the SSM is associated with a single day of sampling and the GM is associated with 30 days of sampling, it is not technically appropriate to refer to them as "acute" and "chronic" criteria. Those terms distinguish timeframes over which harm-to-use impacts develop, not the sampling or averaging timeframe as with the SSM and GM. Acute refers to an effect that comes about rapidly over short periods of time. Chronic refers to an effect that can build up over longer periods, sometimes as long as the lifetime of a subject. In the case of *E. coli*, gastrointestinal illness develops within a matter of hours to days. Both the SSM and GM are derived from this same timeframe and based on the same underlying illness rate, thus treating the SSM as an acute criterion and assuming it to be less stringent is incorrect. EPA recommends states use the GM and SSM together, rather than just the GM or just the SSM, to judge whether water quality is protective of recreational uses. SDDANR follows these guidelines and only relies on one criterion when forced by data availability.

The limited contact recreation SSM *E. coli* criterion of 1,178 cfu/100mL was selected as the numeric TMDL target for Long Creek because a proper geometric mean could not be calculated from the available monitoring dataset. Refer to Section 5.0 for a thorough review of Long Creek sampling and results.

3.4 Assessment Methods

Assessment methods document the decision making process used to define whether water quality standards are met. SDDANR evaluates monitoring data following these established procedures to determine if: 1) one or more beneficial use is not supported, 2) the waterbody is impaired, and 3) it should be placed on the next 303(d) list. Waterbodies impaired by pollutants require TMDLs and these assessment methods are commonly used again in the process sometime after TMDLs have been established and restoration efforts have been implemented. In select cases, attainment is judged instead by comparing current conditions to TMDL loading limits. For example, when certain characteristics of the pollutant (e.g., bioaccumulative) or waterbody (e.g., a reservoir filling with sediment) prioritize loading concerns. Table 4 presents South Dakota's assessment method for *E. coli*, and describes what constitutes a minimum sample size and how an impairment decision is made.

Table 4. Assessment Methods for Determining Support Status for Section 303(d) (SDDANR 2018).

Description	Minimum Sample Size	Impairment Determination Approach
FOR CONVENTIONAL PARAMETERS (such as dissolved oxygen, TSS, *E. coli* bacteria, pH, water temperature, etc.)	STREAMS: a minimum of 10 samples for any one parameter are required within a waterbody reach. A minimum of two chronic (calculated) results are required for chronic criteria (30-day averages and geomeans). LAKES: at least two independent years of sample data and at least two sampling events per year.	STREAMS: >10% exceedance for daily maximum criteria (or 3 or more exceedances between 10 and 19 samples) or >10% exceedance for chronic criteria (or 2 or more exceedances between 2 and 19 samples) LAKES: >10% exceedance when 20 or more samples were available. If < 20 samples were available, 3 exceedances were considered impaired. See lakes listing methodology section for specifics on parameters associated with a vertical profile (i.e., dissolved oxygen, water temperature, pH, and specific conductance).

The assessment method mentions chronic and acute criteria. Although these terms do not directly relate to *E. coli* criteria for reasons previously discussed, the assessment method is organized together with other conventional parameters in the Integrated Report to show that a consistent approach is applied to many pollutants. In this limited definition, chronic refers to the GM and acute refers to the SSM *E. coli* criteria. Different assessment methods have been established for toxic parameters and mercury in fish tissue. In the next section, data collection activities are summarized and monitoring results are evaluated using this assessment method.

4.0 Data Collection and Results

4.1 Water Quality Data and Discharge Information

Personnel from the Vermillion Basin Water Development District, supported and trained by SDDANR, collected water quality data from Long Creek as part of the larger Vermillion River Basin Watershed TMDL Assessment that occurred in 2004-2006. The river basin sampling was designed to identify impairments and better understand sediment, nutrient and bacteria loading throughout the mainstem river and major tributary system. The information gathered has been used to develop TMDLs and to locate critical areas for restoration activities. One site, VRT10, was established on Long Creek near the near the confluence with the Vermillion River (Figure 2) and is the primary source of information used to write this TMDL. SDDANR returned to VRT10 in 2016 and 2017 to collect monthly *E. coli* samples from May-September.

In addition to *E. coli* grab samples, a continuous stage record of the creek's water elevation was logged for only the original river basin project period, except during winter months (2004-2006). This stage record was supplemented by discrete discharge measurements, taken with a hand-held current velocity meter under wadeable conditions, so that a stage-discharge relationship could be derived for Long Creek. Furthermore, SDDANR extended the available two-year period of record by relating the discharge information to a downstream USGS station using a three step process. Since 1983, the USGS has operated a gaging station on the mainstem Vermillion River (USGS Gage #06479010) located approximately three miles north of the city of Vermillion, SD. The first step was to use the USGS information to characterize the long-term discharge for Site VR08 which is a mainstem sites on the Vermillion River located near Centerville, SD (Figure 2). Once that record was established for VR08, a two-year daily discharge record for Site VRT10 was calculated using the stage record, field discharge measurements, and the AQUARIUS software. The third step involved comparing the discharge records from Site VRT10 and VR08. Through this process a long-term discharge record was created Site VRT10. The resulting equation shown below was used to predict a long-term flow record for Long Creek and establish the TMDL's load duration curve.

$$VRT10Q = (0.2743*VR08Q) + 3.3672 \quad (R^2 = 0.62, p<0.05)$$

All sampling and discharge data collection conducted during this project were done with methods in accordance with the South Dakota *Standard Operating Procedures for Field Samplers* developed by the Watershed Protection Program. Samples were sent to the State Health Laboratory in Pierre, SD for analysis. All samples and their estimated corresponding flows can be found in Appendix A.

4.2 Existing Conditions and Assessment Results

E. coli in Long Creek was first identified as impairing limited contract recreation uses on the 2010 303(d) List using data collected during the 2004-2006 Vermillion River Basin Watershed TMDL Assessment. Additional data collected as part since (2016-2017) has indicated verified the impairment.

According to the conventional parameters assessment method presented in Table 5 the Long Creek data set exceeded the minimum data requirement with 24 samples. Water quality monitoring showed that approximately 17% of the *E. coli* samples exceeded the daily maximum (SSM) standard for Segment R3. Samples were collected too infrequently to determine compliance with the geometric mean standard which requires the collection of five samples during separate 24-hour periods for any 30-day period (Table 4). The maximum concentration observed from Site VRT10 for *E. coli* was >2,420 colony forming units per 100 mL (CFU/100mL). Table 5 summarizes the sampling results for Segment R1.

Table 5. Summary Table of Sampling Results for Segment R1 (Site VRT10).

Statistic	Site VRT10
Count of *E. coli* (CFU/100mL)	24
Average of *E. coli* (CFU/100mL)	486
Max of *E. coli* (CFU/100mL)	>2,420
Min of *E. coli* (CFU/100mL)	1
Max of Flow Rank (Higher Flows)	81.5%
Min of Flow Rank (Lower Flows)	1.4%
# of *E. coli* Samples >630 CFU/100ml (Chronic)	6
# of *E. coli* Samples >1,178 CFU/100ml (Daily)	4
Date of First Sample	3/21/2005
Date of Last Sample	9/26/2006
Baseflow Sampling	Yes
Event Base Sampling	Yes
Monthly Sampling	Yes

Figure 4 shows *E. coli* concentrations categorized by flow. Four flowzones are shown: Extreme, High, Mid-Range, and Low/Dry. Violations of the pathogen criterion occurred across the three higher flow conditions. The most significant violations were sampled during storm events (>50% stormflow). Additional violations were found within higher flow zones (Figure 3). Mid-Range flowzone violations are indicative of streambank erosion in both the mainstem and tributaries along with sheet and rill erosion from farm field and feedlot runoff during moist conditions (Cleland, 2003). Lower flow violations can be attributed to bacteria delivered from tributaries from smaller storm events, cattle standing in the stream, and septic tank inputs.

Four flowzones were used for Long Creek because of the natural breaks with the flow distribution and the limited number of samples collected in the dry zone (90-100%). For the lowest flow zones reductions for *E. coli* are not needed. Creating an additional lower zone will not change the source allocation nor will it change the targeted remediation efforts.

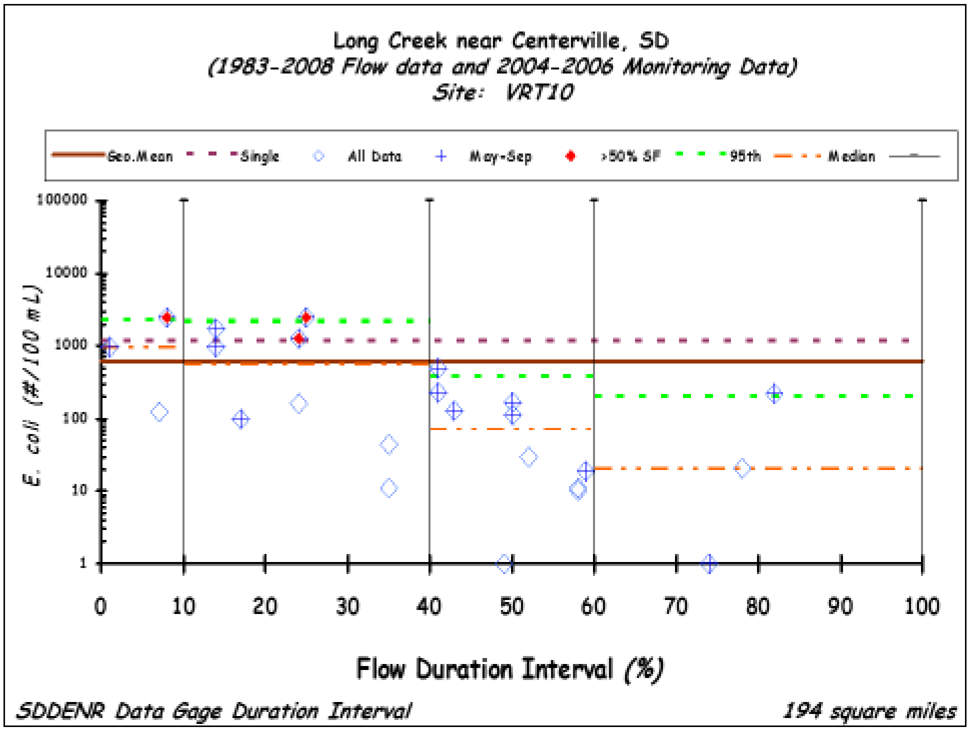

Figure 5. Site VRT10 *E. coli* concentrations for each of the four flowzones.

Table 6 shows the impairment was a persistent problem in at least two flowzones. In most instances in small rural streams there is typically a significant relationship between high flows (storm events) and high bacteria concentrations and this was exhibited by the Long Creek data.

Table 6. Exceedance Rates of the *E. coli* Daily Maximum Criterion for Long Creek (Segment SD-VM-R-LONG_01) of the Vermillion River Basin (1,178 cfu/100ml).

			High	Moist	Mid	Low
Segment R3	VRT10	Samples per Zone	3	8	10	3
		Exceedances per Zone	1	2	0	0
		%Violation	33%	25%	0%	0%

5.0 Source Assessment and Allocation

5.1 Point Sources

There are several documented point sources within this 124,211.7 acre subwatershed (SDDANR, Surface Water Quality Program) (Table 7). These include three National Pollutant Discharge Elimination Permitted (NPDES) facilities that may directly or indirectly contribute to the impaired segment of Long Creek. These point sources were investigated further for their potential impact and WLA consideration. Additionally, there are three concentrated animal feeding operations (CAFOs) present within the watershed as well. These potential sources of *E. coli* bacteria are documented here to provide a watershed scale account of the entities operational characteristics (discharge permits etc.) and potential impact to the impaired segment of Long Creek.

5.1.1 Wastewater Treatment Facilities

The city of Lennox, SD wastewater treatment facility (WWTF) (NPDES Permit# SD0021768) is located on the most upstream part of Segment R1 just ½ mile southwest of the city. Lennox serves a population of 2,111 (2010 census). The city invested in the construction of a new sequencing batch reactor mechanical aeration system treatment facility, including ultraviolet disinfection of effluent prior to discharge and 2.4 acres of infiltration basins in 2009. The disinfection system has two UV banks with four rows of four bulbs each which are used during the recreation season (May 1 through September 30). Treated wastewater is discharged through the UV channel to Long Creek, and effluent flow is measured with a flow meter. This new mechanical plant is authorized to continuously discharge to Long Creek. The statement of basis for the most current NPDES permit states that the facility has been submitting Discharge Monitoriong Reports (DMRs) as required. It also noted that there were numerous violations of the 5-day biochemical oxygen demand, pH, TSS, ammonia-nitorgen, fecal coliform standards prior to the installation of the upgrades. However, no violations have occurred since the initiation of the new WWTF in October 2011. To calculate a waste load allocation (WLA) for Lennox the 80th percentile of DMR-reported daily maximum flows during the current permit cycle (July 2017 to present) was used. This reported flow of 0.75 cfs (0.48 MGD) was multiplied by the daily maximum criteria for *E. coli* (1,178 cfu/100 ml).

The city of Worthing, SD WWTF (NPDES Permit# SD0021474) is located on a small intermittent tributary of Snake Creek which eventually merges with Long Creek (Figure 2). This gravity-flow collection system consists of three-ponds operated in series. The system began operating in 1997 and serves a population of 877 people (2010 census). The WWTF has a single controlled discharge structure equipped with a 60^{o} V-notch weir located on the south side of cell 3. The weir has an average design discharge of 80,000 gallons per day but actual wastewater discharge is infrequent. Typically, a lagoon system that is allowed to discharge will be designed for 180 days of storage and will discharge twice annually, generally in the spring and fall outside the peak recreation season (May-September). The caveat is the assigned beneficial uses of the receiving water. In this case, the receiving water is an intermittent tributary that has been assigned beneficial uses 9) fish and wildlife propagation, and 10) irrigation waters; and is, therefore, not subject to *E. coli* limits as part of their permit. Although the goal is to discharge outside of the recreation season, Worthing did discharge approximately 36% of the time within this period (May 1 – Oct 15) (Table 8). It should be noted that bacteria in these ponds are not likely viable for long periods due to extended retention time and resultant exposure to the sun's ultraviolet light. The decay rate of bacteria via the sunlight will be such that insignificant amounts would reach the confluence point with Long Creek approximately 17 miles downstream. During the 17 mile journey the intermittent stream also flows through a large wetland complex also exhibiting a significant retention time further minimizing the final bacterial load reaching Long Creek. Taking these factors into consideration it is readily apparent that the indirect waste load contribution from this facility (as covered under NPDES Permit# SD0021474) is negligible and is, therefore, considered de mimimis to Long Creek.

The third NPDES regulated facility in the watershed is an ethanol plant near Chancellor, SD (NPDES Permit # SD0027901). This minor industrial facility is not regulated for bacteria and is not permitted to discharge *E. coli*. The most recent Surface Water Discharge Compliance Inspection (2015) indicated a facility in good standing and indicated that only minor corrective actions be taken, i.e. updating the facility map. The facility's discharge point is located on Long Creek approximately 3.5 miles upstream of Segment SD-VM-R-Long_01. The Statement of Basis indicates that a process wastewater stream is generated throughout the ethanol production process. However, the system is designed to recycle the entire process wastestream. There is no discharge of process wastewater. The wastewater that is permitted to discharge is a combined stream of non-contact cooling water, reverse osmosis (RO) reject water, and RO permeate polisher/softener reject water. POET-Chancellor's discharge does not contain domestic wastewater and is not expected to contain *E. coli*. The results of the TMDL should not affect POET-Chancellor. There is no WLA from this facility as part of this pathogen TMDL.

Table 7. Permitted Facilities within the Long Creek Drainage.

Permit Number	Facility Name	System Description	Flow used for WLA (cfs)
SD0021768	Lennox – City of	mechanical	0.75
SD0021474	Worthing – City of	Pond system	n/a
SD0027901	Ethanol Plant near the City of Chancellor	n/a	n/a

Table 8 includes the information used by SDDANR to calculate a maximum allowable discharge for each facility. The WLA calculation was calculated by multiplying the threshold of the daily max standard (1,178 cfus/100ml) with the observed 80th percentile maximum flow rate observed from the DMR data submitted by the Lennox facility. The normal operation of these smaller municipal systems would typically result in only a small portion of the calculated daily amounts actually being discharged to the receiving waterbody. The maximum (total or sum) *E. coli* waste load for the system is 2.14 x 10^{10} cfu/day based on the 80th percentile flow of 0.75 cfs. Using the 80th percentile flow to calculate the WLA for the Lennox facility is both conservative and protective. For Long Creek, a flow of 0.75 cfs would be met or exceeded approximately 100% of the time, i.e. >1% of the time the discharge falls below this flow level. The indirect discharge from the city of Worthing has been determined to be de minimis for Long Creek and has not been assigned a WLA. See above paragraph describing the Worthing WWTF.

The *E. coli* wasteload contributed by these two treatment facilities are insignificant and not contributing to the impairment of the classified segment of the Long Creek.

Table 8. Discharge Monitoring Report Data for two WWTF in the Long Creek Watershed.

Facility	Total # of Discharges (2010-2018)	# of Discharges within recreation Season (over 8 years)	% of Discharges within recreation season	Avg. Concentration of available E. coli Daily Max Samples (cfu/100ml)
Worthing	22	8	36%	n/a
Lennox	continuous	n/a	n/a	1,051

Flow data used to develop the flow frequency curve includes daily flow data. The flow record provided over approximately 30 years of daily flow data which included all wastewater treatment facility discharges during that time period. The flow variability, as a result of the daily operation of the Lennox facility, is fully accounted for in the flow frequency curve.

5.1.2 Concentrated Animal Feeding Operations

There are three permitted CAFOs within the Long Creek watershed (Table 9). All CAFO's are required to maintain compliance with provisions of the SD Water Pollution Control Act (SDCL 34A-2). SDCL 34A-2-36.2 requires each concentrated animal feeding operation, as defined by Title 40 Codified Federal Regulations Part 122.23 dated January 1, 2007, to operate under a general or individual water pollution control permit issued pursuant to § 34A-2-36. The general permit ensures that all CAFOs in SD have permit coverage regardless if they meet conditions for coverage under a NPDES permit. All three operations are covered under the 2003 *General Water Pollution Control Permit for Concentrated Animal Feeding Operations*, which requires housed lots to have no discharge of solid or liquid manure to waters of the state, and allows open lots to only have a discharge of manure or process wastewater from properly designed, constructed, operated and maintained manure management systems in the event of 25-year, 24-hour or 100-year, 24-hour storm event if they meet the permit conditions.

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

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

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

Table 9. Description of CAFOs within the Long Creek Watershed.

Name of Facility	Type of Operation	SD general Permit #
Opportunities Farm (SDSU Foundation)	Beef Cattle (housed and open lots)	SDG-0100073
West Edge Land and Cattle	Beef Cattle (open lot)	SDG-0100042
Sioux Falls Regional Livestock	Livestock auction (housed and open lots)	SDG-0100326

The city of Lennox WWTF is the only point source that discharges *E. coli* bacteria directly to the impaired segment of Long Creek. The city of Worthing indirectly contributes via tributary loading from a small intermittent tributary discharging 1-3 times per year. However, this facility has been determined to have a negligible impact on Long Creek. The Lennox WWTF was given a WLA based on the 80th percentile flow recorded in their DMR reports. The CAFOs and the ethanol plant near Chancellor, SD (Permit # SD0027901) have been reviewed here and found to rarely discharge or be considered protective as part of their NPDES permit requirements. Therefore, a WLA of zero was given to both the CAFOs and the ethanol plant. Meeting the intent of this WLA will be judged by compliance with existing permit conditions. All *E.coli* sources associated with the impaired segments are attributed to nonpoint sources.

5.2 Nonpoint Sources

Nonpoint sources of fecal coliform bacteria for the Long Creek Watershed come primarily from agricultural sources. County wide livestock data, from the 2007 and 2009 National Agricultural Statistic Survey (NASS), and wildlife data, from the 2002 South Dakota Game Fish and Parks county wildlife assessment, were used to derive density estimates for livestock and wildlife densities, respectively. The 2007 livestock data reflects the "on the ground" conditions exhibited in the water quality data collected during the watershed assessment. The 2002 SDGFP Wildlife data was the most current available for each county within the State of South Dakota.

Statistically derived livestock estimates (beef cattle, hogs, etc.) from the NASS 2007 Agricultural Census was used for each county involved in the Segment R3 watershed (Appendix B). Livestock animals per acre for each county were then multiplied by the acres from each county within the watershed. Table 9 shows the acres of Long Creek watershed that are located within each county. The animals listed in Table 9 (wildlife and livestock) are the largest animals and most densely populated within the involved counties (Lincoln, Minnehaha, and Turner). The density estimates were then multiplied by the acres of watershed found within each county, which is also found in Table 9.

The animal density information was used to estimate relative source contributions of bacteria loads.

For example, based on the 2007 density estimates there were 425 dairy cows in the watershed resulting in an estimated input of 3.17E+13 cfus per day (425 cows X 7.45E+10 cfus). Daily outputs from each animal type were taken from the reference worksheet found on the Bacterial Indicator Tool (BIT). The EPA BIT tool is a spreadsheet that estimates the bacteria contribution from multiple sources.

Human inputs were determined through several GIS county wide feature datasets provided by the SD Dept. of Transportation (SDDOT). The dataset was used primarily for assessing county roads and structures along roads, such as rural residences (both occupied and unoccupied), were documented. The number of occupied residences for the acres of watershed within each county were used to estimate how many septic tanks were located in the watershed in each county. It was assumed on average that each residence contained two people. It was assumed that 25% of these septic tanks were failing. The daily human output of 1.88E+11 fecal coliform per human was taken from the BIT Tool Reference worksheet which lists the USGS as the source of the human output estimate (EPA BIT tool). The total estimate of 5.97E+13 fecal coliform from humans was used in Table 7 and Table 8. The percent contribution for *E. coli* was considered equivalent as part of this TMDL.

Table 10. Human Input Estimates

County	Occupied
Lincoln	472
Minnehaha	61
Turner	102
Total Occupied Residences	635
# per household	2
Total Population	1,270
25% Failure Rate for Septic Tank	0.25
USGS Human Daily Estimate	1.88E+11
Total Human Contribution	**5.97E+13**

5.2.1 Agriculture

Manure from livestock is a potential source of fecal coliform to the stream. Livestock in the basin are predominantly hogs and beef cattle. Livestock can contribute fecal coliform bacteria directly to the stream by defecating while wading in the stream. They also can contribute by defecating while grazing on rangelands that may wash off during precipitation events. Table 8 allocates the sources for bacteria production in the watershed into four primary categories. The summary is based on several assumptions. Feedlot numbers were calculated as the sum of all dairy, hog, and the NASS estimate of beef in feeding areas. All remaining livestock were assumed to be on grass. Permitted CAFOs were addressed in the Point Sources section (Section 6.1.2).

Table 11. *E. coli* Nonpoint Source Allocations for Long Creek, Vermillion River Basin.

Source	Percentage
Feedlots (AFOs)	79.8%
Livestock on Grass	10.1%
Wildlife	1.5%
Septic Tanks	8.5%

5.2.2 Human

There are two separate point sources within the Long Creek watershed which were previously described. Failing onsite septic systems are assumed to be the primary human source not served by the POTW within the watershed. Human fecal production was estimated at 1.88E+11 (Bacterial Indicator Tool Reference Worksheet - USGS estimate). When included as a total load in the table, the remaining population accounted for about 8.5% of all fecal coliforms/*E. coli* produced in the watershed assuming a 25% failure rate for the onsite wastewater systems.

5.2.3 Natural background/wildlife

Wildlife within the watershed is a natural background source of fecal coliform bacteria. Wildlife population density estimates were obtained from the South Dakota Department of Game, Fish, and Parks (Table 12). The contribution of bacteria from wildlife in the Long Creek watershed was insignificant (1.5%) in comparison to livestock sources.

Table 12. Long Creek Potential Nonpoint Sources and Percent Contribution (animal density is individuals per acre).

			Animal Density Estimnate per County (NASS, 2007)			
Animal Type	Fecal Coliform (#/animal/day)	Animal Type Used for Estimate	LINCOLN (animals/acre)	MINNEHAHA (animals/acre)	TURNER (animals/acre)	Total Fecal Coliform
CATTLE ON GRASS	4.57E+09	Cow	0.0518	0.0923	0.0676	3.32E+13
CATTLE, COWS, MILK - INVE	7.45E+10	Dairy Cow	0.0012	0.0099	0.0163	4.20E+13
CATTLE, ON FEED - INVENTO	7.27E+10	Beef Cow	0.0456	0.0405	0.0403	3.99E+14
CHICKENS, BROILERS - INVE	1.81E+08	Broilers	0.0006	0.0012	0.0001	1.26E+10
EQUINE, HORSES & PONIES -	2.59E+10	Horse	0.0025	0.0044	0.0019	8.31E+12
HOGS - INVENTORY	1.02E+10	Hog	0.0764	0.1178	0.1554	1.19E+14
SHEEP, INCL LAMBS - INVEN	1.66E+10	Sheep	0.0106	0.0107	0.0333	2.97E+13
TURKEYS - INVENTORY	1.04E+08	Turkey (Wild)	0.0000	0.0000	0.0001	7.12E+08
Whitetail Deer	5.00E+08	Deer	0.0031	0.0056	0.0043	2.22E+11
Turkey	1.04E+08	Turkey (Wild)	0.0011	0.0012	0.0006	1.38E+10
Opossum	1.25E+08	Raccooon	0.0027	0.0048	0.0030	4.63E+10
Mink	2.50E+07	Muskrat	0.0046	0.0031	0.0019	1.25E+10
Beaver	2.50E+08	Beaver	0.0053	0.0035	0.0028	1.47E+11
Muskrat	2.50E+07	Muskrat	0.0027	0.0207	0.0020	1.35E+10
Skunk	1.25E+08	Raccoon	0.0054	0.0058	0.0035	8.01E+10
Badger	1.25E+08	Raccoon	0.0022	0.0010	0.0014	3.00E+10
Coyote	4.09E+09	Dog	0.0030	0.0008	0.0013	1.27E+12
Fox	1.25E+08	Raccoon	0.0033	0.0031	0.0018	4.66E+10
Raccoon	1.25E+08	Raccoon	0.0087	0.0067	0.0058	1.25E+11
Jackrabbit	1.25E+08	Raccoon	0.0016	0.0021	0.0009	2.44E+10
Cottontail Rabbit	1.25E+08	Raccoon	0.0191	0.0345	0.0127	3.03E+11
Squirrel	1.25E+08	Raccoon	0.0191	0.0307	0.0203	3.17E+11
Partridge	1.37E+08	Layers	0.0068	0.0021	0.0006	9.07E+10
Nest Canada Geese	4.90E+10	Goose	0.0005	0.0071	0.0013	7.84E+12
Septic Tanks in each county	1.88E+11	Human	236	31	51	5.97E+13
County Acres in Long Creek Watershed =====>			91,378	12,063	20,770	

Table 12 cont.

Source	Total Contribution	Percent Contribution
Cattle on Grass	3.32E+13	4.7%
Beef Cattle on Feed	3.99E+14	56.9%
Dairy Cow	4.20E+13	6.0%
Chickens, Turkeys, Goats	1.33E+10	0.0%
Hogs	1.19E+14	17.0%
Sheep	2.97E+13	4.2%
Horses	8.31E+12	1.2%
All Wildlife	1.04E+13	1.5%
Septic Tanks	5.97E+13	8.5%
Total	7.01E+14	100%

5.2.4 Tributary Contributions

Long Creek has several smaller unnamed tributaries which intermittently drain during the year. These tributaries drain mainly portions of central Lincoln County (Figure 1). The significance of these smaller intermittent streams on Long Creek was not determined. The monitoring site (Site VRT10) was located at the mouth of Long Creek so the tributary contributions were included in the load duration curve.

6.0 TMDL Loading Analysis

The TMDL was developed using a Load Duration Curve (LDC) approach resulting in a flow-variable target that considers the entire flow regime. For Long Creek, Figures 3 and 4 show violations occurring within the two highest flowzones. The LDC approach was deemed an appropriate method for identifying possible sources of bacteria based on the flow zone.

The LDC is a dynamic expression of the allowable load for any given day. To aid in interpretation and implementation of the TMDL, the LDC flow intervals were grouped into four flow zones representing extreme flows (0–10 percent), high flows (10-40 percent), mid-range flows (40–60 percent), and low-dry conditions (60–100 percent). According to EPA's *An Approach for Using Load Duration Curves in the Development of TMDLs* (USEPA, 2006) five zones are usually recommended but for this particular dataset four flow zones were chosen. These zones were based on 28 years of flow data (1983-2011), and 2.5 years of sampling data collected from Vermillion River as part of the watershed assessment.

For Long Creek instantaneous loads were calculated by multiplying the *E. coli* concentrations collected from SDDANR TMDL Site VRT10 relating the daily average flow from VR08 to the daily average flow from USGS Gage No. 06479010 for the same period. Flow was then predicted using the long-term record from the USGS gage, and a unit's conversion factor.

When the instantaneous loads are plotted on the LDC, characteristics of the water quality impairment are shown. Instantaneous loads that plot above the curve are exceeding the TMDL, while those below the curve are in compliance. As the plot shows, pathogen samples collected from Long Creek exceed the daily maximum and geometric mean criterion within the two upper flow zones (Figure 5 and 6). Loads exceeding the criteria in the high flow zones imply storm runoff from animal feeding operations or storm sewer runoff. Loads shown in the low flow zone typically indicate a point source load or livestock defecating in the stream.

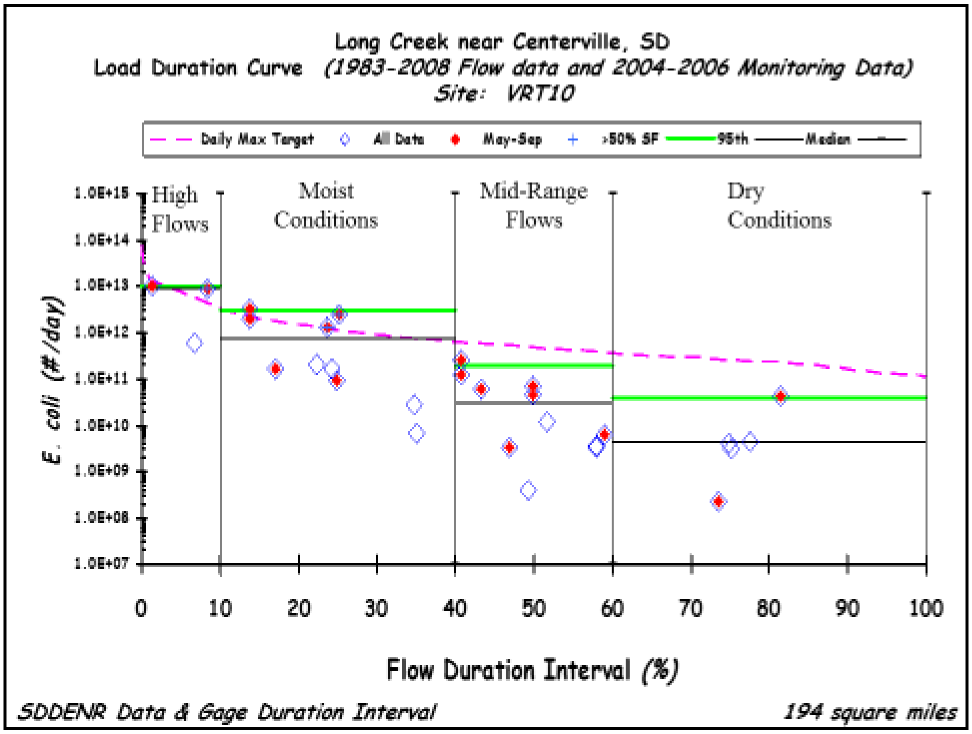

Figure 6. Long Creek (Segment R3, 2012 IR) - Load duration curve representing allowable daily *E. coli* loads based on the daily maximum criteria (<1,178 cfu/100ml). Plot showing median and 95th percentiles, and daily loads for each flow zone. The daily maximum (1,178 cfu/100ml) was used to determine the loading capacity for Long Creek and the TMDL. Observed concentrations are also displayed.

6.1 TMDL Load Duration Curve

The LDC (Figure 6 and Table 13) represents the dynamic expression of the TMDL for Long Creek, resulting in a unique maximum daily load for *E. coli* that corresponds to a measured average daily flow. To aid in the implementation of the TMDL and estimation of needed *E. coli* load reductions, Table 13 presents a combination of allocations for each of four flow zones. Methods used to calculate the TMDL components are discussed below. This TMDL is in effect from year round and is based on daily flow and the SSM threshold from the water quality standard as outlined in Section 4.3.

6.1.1 Extreme Flows (0-10%)

The extreme flow zone is composed of the highest flows exceeding 110 cfs. The flows in this range are greater than 110 cfs only 10% of the time. Although a total of 24 samples were used in the development of the LDC, only three samples were collected in this zone and one exceeded the *E. coli* chronic standard (630 cfu/100ml). Using the 95^{th} percentile flow with the chronic standard (630 cfu/100 ml) from this zone to calculate the TMDL goal is appropriate and provides assurance that the water quality criteria will not be exceeded.

6.1.2 High Range Flows (10-40%)

The estimated discharge record for Long Creek indicated that the 10-40% flows ranged between 110 cfs and 22 cfs. Out of the eight samples collected in this zone four exceeded the chronic standard. The 95th percentile load from this zone was 2.96E+13cfu/day which was used to set the TMDL goal for this zone (Table 12).

The violation rate from this zone (50%) requires a 79% reduction to achieve full support of the limited contact beneficial use (Table 12).

6.1.3 Mid-Range Flows (40-60%)

Mid-Range flows ranged from 22 cfs to 13 cfs. Ten samples were collected in this flow zone with no violations of the chronic water quality standard. The flows from this zone are expected to persist longer throughout the year and are low enough within Long Creek where livestock are able to enter the side channels to drink or cool down during hot summer periods (Table 12).

6.1.4 Low and dry Flows (60-100%)

Low flows ranged below 13 cfs. The flows typically occur during late summer and can persist through late fall. None of three samples collected from this zone exhibited concentrations higher than 218 cfus/100ml. No reductions were required for these zones (Table 12).

Table 13. Long Creek – *E. coli* Total Maximum Daily Load (TMDL) allocations by flow zone (Site VRT10).

Station ID:	Site VRT10 - Long Creek			
Station name:	DENR Gaging Station upstream of USGS Gage 06479010			
Parameter of Concern	Flow Zone (expressed as tons/day)			
E. coli	Extreme Flows (0-10)	High-Range (10-40)	Mid Range Flows (40-60)	Low Flows (60-100)
Flow Range	**<2786 >110**	**<110 >22**	**<22 >13**	**<13**
Median Flow Per Zone	262	40	16	8
Load Allocation	6.78E+12	1.01E+12	3.99E+11	1.91E+11
WLA - Lennox, SD (SD0021768)	2.14E+10	2.14E+10	2.14E+10	2.14E+10
WLA - Worthing, SD (SD0021474)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MOS (10% Explicit)	7.56E+11	1.15E+11	4.67E+10	2.36E+10
TMDL	**7.56E+12**	**1.15E+12**	**4.67E+11**	**2.36E+11**
	Existing Condition per Zone (expressed as cfus/day)			
95th Percentile Load per Zone	9.74E+12	2.96E+12	1.94E+11	3.85E+10
Load Reduction	**22.4%**	**61.3%**	**0.0%**	**0.0%**
95th Percentile Concentration per Zone	2,276	2,180	371	199
Number of Values	3	8	10	3
Current Load or existing Condition is the 95th Percentile of the observed *E. coli* Load for each flow zone.				

6.2 TMDL Allocations

6.2.1 Waste Load Allocation (WLA)

The WLA is constant across all flow conditions and the NPDES permits ensure that water quality standards will be attained. The WLA calculation was based on the SSM, multiplied by the 80th percentile flow rate recorded in the discharge monitoring reports (DMR) from each municipal WWTF identified in this TMDL. A third facility is permitted to discharge to Long Creek but only noncontact cooling water associated with its industrial processes. No *E. coli* bacteria is permitted to discharge from this minor industrial facility. The normal operation of both municipal systems would typically result in only a small portion of the calculated daily amounts actually being discharged. It is important to note any facility discharging to Long Creek must, at a minimum, meet the water quality standards associated with beneficial uses 5,8, 9, and 10.

The Worthing, SD WWTF consists of a three retention pond system that may periodically require a portion of the final pond to be discharged into an unnamed tributary of Snake Creek which is not assigned a recreational beneficial use. Although it is authorized to discharge it is not required to monitor for bacteria as part of its permit. It has been assigned a WLA of 0 cfu/day. Reasons for assigning this WLA to this indirect discharge are explained in Section 5.1.1.

The Lennox, SD WWTF is a continuous discharger into the upper portion of the impaired segment of Long Creek. It is required to monitor bacteria and must meet the SSM criteria (1,178 cfu/100ml) as outlined in Section 3.7 of its NPDES permit. The *E. coli* WLA for this facility is 2.14E+10 cfu/day. This facility has an insignificant impact within the flowzones that require a 22.4% and 61.3% reduction accounting for only 0.28% and 1.87% of the load in those zones, respectively. Since the installation of the WWTF upgrades in 2011 there have been no reported violations of the NPDES permit based on the discharge monitoring reports.

All NPDES facilities identified in this TMDL have mechanical and operational practices in place to minimize their *E. coli* bacterial load. Bacteria in the wastewater lagoons and ponds are viable for short periods due to extended retention time and resultant exposure to the ultraviolet light. The Lennox facility also relies on a bank of UV lights as another level of disinfection fromk May 1 to September 30. This is evident in the bacteria data collected required by the permit. The relative assumption is *E. coli* bacteria contributions from the Worthing and Lennox facilities are minor and not causing impairment. Emphasis should be placed on reducing bacteria inputs from livestock sources (feedlots and grazing) to bring Long Creek back into compliance with its recreational use.

The WLAs established in this TMDL are not intended to add load limits to NPDES permits. Permits will be deemed consistent with the assumptions and requirements of the WLAs by adhering to permit requirements, primarily by meeting end-of-pipe *E. coli* concentrations consistent with the applicable water quality criteria and concentration-based TMDL target where applicable. The existing Lennox permit includes a daily maximum (1,178 cfu/100 ml) and a 30-day average (630 cfu/100 ml) *E. coli* effluent limit. Meeting both permit limits will also meet the

Lennox daily maximum WLA which is calculated based on meeting 1,178 cfu/100 ml at the 80th percentile flow. If the effluent flow increases, then the Lennox WLA also increases proportional to the increase in discharge while the concentration limit is maintained. The current Worthing permit does not contain *E. coli* or fecal coliform (older pathogen indicator) effluents limits. This permit is due for renewal and the facility should undergo a reasonable potential analysis to determine whether *E. coli* effluent limits or monitoring requirements are appropriate in the next permit. Load limits for Worthing are not necessary with the information available at this time given the facility's minor and intermittent discharge that travels 17 miles before entering Long Creek (see discussion in Section 5.1.1). As long as wastewater discharges from both facilities do not exceed peak design flows and *E. coli* effluent limits, any variable flow rates from these facilities is not expected to impact the TMDL. The TMDL allocations (i.e., WLAs) would need to be adjusted in the future if either facility increases peak flow capacity (expansion) or a new waste load(s) is added to the stream segment and there is insufficient remaining WLA to assign to the new source."

6.2.2 Margin of Safety (MOS) – *E. coli*

In accordance with the regulations, a margin of safety was established to account for uncertainty in the data analyses. A margin of safety may be provided (1) by using conservative assumptions in the calculation of the loading capacity of the waterbody and (2) by establishing allocations that in total are lower than the defined loading capacity. In the case of Long Creek (Segment R3 2012 IR), the latter approach was used to establish a safety margin.

An explicit MOS was calculated within the duration curve framework to account for uncertainty (e.g., loads from tributary streams, effectiveness of controls, etc.). Ten percent (10%) of the overall load capacity was allocated to each flowzone to the MOS as part of the TMDL. The remaining assimilative capacity was allocated to nonpoint sources (LA).

6.2.3 Load Allocation (LA)

To develop the bacterial load allocation (LA), the loading capacity (LC) was first determined. The LC for Long Creek (Highway 44 to the Vermillion River) was calculated by multiplying the daily maximum concentration (1,178 cfu/100 ml) *E. coli* threshold by the daily average flow estimated for Site VRT10, which was the only monitoring site within this segment and watershed (Figure 6).

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

7.0 Seasonal Variation

Discharge in the Vermillion River (USGS gage# 06478600 - near Parker, SD; USGS gage# 06479010 – near Vermillion, SD; and Site VRT10 – near Centerville, SD) all displayed seasonal variation for the period of record (10/1/83 to 9/30/11). Highest stream flows typically occur during spring with highest monthly average stream flow reported in April. The lowest observed stream flows occur during the winter months with the lowest monthly average stream flow reported in January. *Escherichia coli* concentrations also displayed seasonal variation relative to flow with most exceedances occurring with the lower three flow zones. During the lower flows livestock have access to the stream allowing them to cool during warmer temperatures of the summer. By using the LDC approach to develop the TMDL allocations, seasonal variability in both types of bacteria loads is taken into account.

Although the TMDL displays seasonality through flow, it is effective throughout the entire year.

8.0 Critical Conditions

Critical conditions occur within the basin during the spring and summer storm events as well as low flow during the summer and fall. Typically, during severe thunderstorms the largest concentrations are highest in the basin during the summer months. However, higher concentrations for Long Creek can occur at lower flows when livestock have access to the streams. At this time, only the higher flow regimes have been targeted for implementation.

9.0 Monitoring Strategy

During and after the implementation of management practices, monitoring will be necessary to assure attainment of the TMDL. Stream water quality monitoring will be accomplished through SDDANR's ambient water quality monitoring stations found within the river basin especially for the segment addressed in this report. As of 2016 monthly water quality samples have been collected from Site WQM182 – Long Creek at 289th St. (SDDANR_WQX-460182), which is the same location as the original site (VRT10) used to develop the load duration curve.

Additional monitoring and evaluation efforts will be targeted toward the effectiveness of implemented BMPs. Sample sites will be based on BMP site selection and parameters will be based on a product-specific basis.

The Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances identified during the implementation of the TMDL. If a review of the new information or circumstances indicates that an adjustment to the LA and WLA is appropriate than the TMDL will be updated following SDDANR programmatic steps including public participation. The Department will propose adjustments only in the event that any adjusted LA or WLA will not result in a change to the loading capacity and will reflect the water quality standards found in the ARSD. The Department will notify EPA of any adjustments to this TMDL within 30 days of their adoption.

10.0 Public Participation

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

1. Monthly meetings were held during the assessment phase (2004-2006) through the Vermillion Basin Water Development District (VBWDD) which was the local sponsor for the TMDL project. Meetings minutes are available upon request.
2. A webpage was developed and used during the course of the assessment.
3. Presentations to local groups on the findings of the assessment.
4. 30-day public notice (PN) period for public review and comment.
5. After significant revisions to the first draft a 2nd round of public comment occurred.

The findings from these public meetings, the webpage, and 30-day PN comments have been taken into consideration in development of the previous Vermillion River Basin TMDLs as well as this TMDL targeting Long Creek.

A 30-day public comment period was issued for the draft TMDL. A public notice letter was published in the following local newspapers: Argus Leader, Centerville Journal, Lennox Independent and New Era. The draft TMDL document and ability to comment was made available on DENRs One-Stop Public Notice Page at: https://danr.sd.gov/public/default.aspx. The public comment period began April 16th and ended May 18th, 2021. No public comments were received during the 30-day comment period.

11.0 Reasonable Assurance

Long Creek Segment 01 (SD-VM-R-LONG_01) receives *E. coli* loadings from both point and non-point sources. When a TMDL is developed for impaired waters that receive pollutant loadings from both point and nonpoint sources and the WLA is based on an assumption that nonpoint source load reductions will occur, the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions. Reasonable assurance ensures that a TMDL's WLA and load allocations are properly calibrated to meet the applicable water quality standards.

Reasonable assurance of the TMDL established for Segment 01 of Long Creek will require a comprehensive approach that addresses:

- Wastewater discharges under NPDES permits.
- Non-point source pollution.
- Existing and potential future sources, and
- Regulatory and voluntary approaches.

There is reasonable assurance that the goals of the TMDL established for Segment 01 of Long Creek can be met with proper planning between state and local regulatory agencies, stakeholders, BMP implementation, and access to adequate financial resources. The waste load allocations used in the TMDL were obtained from regulations defined in the NPDES permits administratively assigned to the City of Lennox and Worthing waste water treatment facilities (WWTF).

11.1 Point Sources

The City of Lennox and Worthing WWTFs are located in the watershed for Long Creek and Lennox discharges directly to the impaired segment. It is imperative that both facilities operate in compliance with their NPDES permits and WLA's set forth in the TMDL. Below are some recommendations for both facilities to consider to ensure high operational effectiveness of wastewater treatment.

City of Lennox WWTF

- Continue scheduled sanitary sewer lines and storm sewer replacement and repairs.
- Continue upgrading treatment system as new technologies become available.
- Continue *E. coli* monitoring to assure compliance with water quality standards.
- Encourage WWTF Personnel to attend annual wastewater training courses sponsored by the state.

City of Worthing WWTF

- Continue scheduled replacement of sanitary pumps, replacing riprap, and repairing inter-pond valves.
- Continue scheduled sanitary sewer lines and storm sewer replacement and repairs.
- Continued maintenance of the existing facility.
- Continue upgrading treatment system as new technologies become available.
- Encourage WWTF Personnel to attend annual wastewater training courses sponsored by the state.

11.2 Non-point Source

There are several entities that provide watershed stewardship and have vested interest in a Vermillion River Basin Watershed Implementation Project which includes Long Creek. These include the various municipalities within the river basin including the cities of Lennox and Worthing. The various county conservation districts, South Dakota GFP, Natural Resource Conservation Service, Vermillion Basin and East Dakota Water Development Districts will also be involved in any kind of restoration project that involves Long Creek.

There is one project currently engaged with the Vermillion Basin and the Lower James River Watersheds that focuses on implementation efforts to reduce bacteria loading from nonpoint sources. These projects provide reasonable assurance that bacteria loading from nonpoint sources will be targeted through measures outlined in Section 13.0 Implementation Strategy.

12.0 Implementation Strategy

Currently, there is an implementation project targeting areas of sediment and bacterial sources within the Vermillion River Basin. During the next Section 319 funding round an increase in funding will be requested for additional BMPs targeting more areas of streambank erosion, animal waste management systems, and grazing management.

Several types of BMPs have been considered in the development of a water quality management implementation plan for the impaired segments of the Vermillion River Basin as well as Long

Creek. The results shown in the Load Duration Curves indicate significant reductions are required in the higher two flow zones. Because of the rural area and the lack of point sources (WWTF) most of the implementation measures should focus on the following:

- Livestock access to streams should be reduced, and livestock should be provided sources of water away from streams.
- Unstable stream banks should be protected by enhancing the riparian vegetation that provides erosion control and filters runoff of pollutants into the stream.
- Filter strips should be installed along the stream bordering cropland and pastureland.
- Animal confinement facilities should implement proper animal waste management systems.
- An assessment of progress will be part of every Section 319 implementation segment, and revisions to the plan will be made as appropriate, in cooperation with basin stakeholders.

Funds to implement watershed water quality improvements can be obtained through SDDANR. SDDANR administers three major funding programs that provide low interest loans and grants for projects that protect and improve water quality in South Dakota. They include: Consolidated Water Facilities Construction program, Clean Water State Revolving Fund (SRF) program, and the Section 319 Nonpoint Source program.

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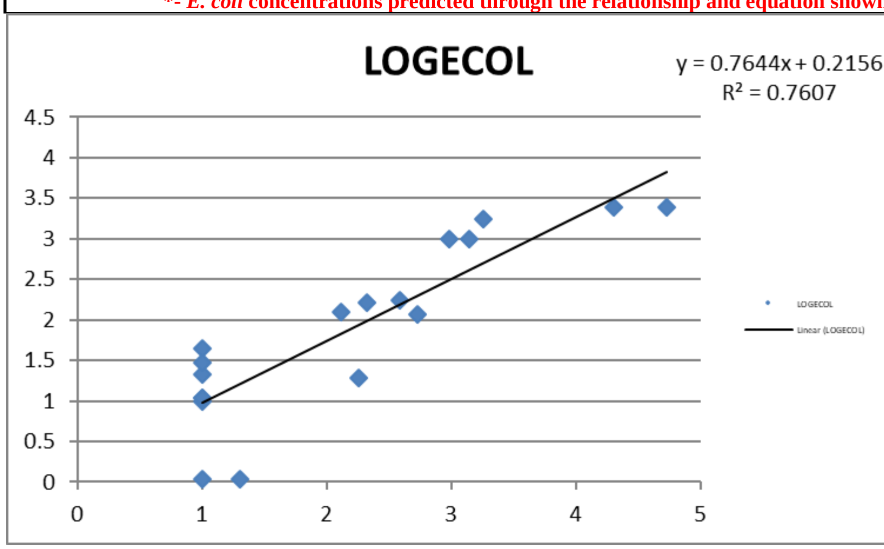
APPENDIX A: Water Quality Data

Station	Date	Time	Flow *(cfs)*	Flow Rank	1-day Change in Flow *(mm)*	Stormflow *(%)*	1-day Change in Flow *(cfs)*	Fecal Coliform (cfu/100mL)	*Escherichia Coli* (cfu/100mL)
VRT10	3/21/2005	15:00	11.4	64%	0.001	2%	0.3		
VRT10	4/4/2005	11:20	26.4	35%	-0.017	18%	0.0	10	44.1
VRT10	4/21/2005	11:00	41.5	24%	-0.009	0%	0.0	210	162.0
VRT10	5/12/2005	13:30	39.8	25%	0.098	51%	20.1	53000	2420.0
VRT10	6/1/2005	12:30	145.0	8%	0.447	72%	91.9	20000	2420.0
VRT10	6/6/2005	17:15	411.5	1%	-0.205	50%	0.0	970	980.0
VRT10	6/29/2005	12:30	77.7	14%	0.008	23%	1.6	1800	1733.0
VRT10	6/29/2005	13:00	77.7	14%	0.008	23%	1.6	1400	980.0
VRT10	8/10/2005	16:10	13.1	59%	-0.002	2%	0.0	180	19.4
VRT10	9/22/2005	16:00	9.6	74%	-0.002	4%	0.0	20	1.0
VRT10	11/2/2005	14:00	8.7	78%	-0.001	0%	0.0	10	**21.3***
VRT10	1/25/2006	14:00	15.8	52%	0.001	1%	0.1	10	29.8
VRT10	2/28/2006	12:00	13.6	58%	0.001	5%	0.3	10	9.8
VRT10	2/28/2006	12:15	13.6	58%	0.001	5%	0.3	10	11.0
VRT10	3/14/2006	16:30	16.6	49%	-0.003	5%	0.0	10	1.0
VRT10	3/29/2006	10:00	26.2	35%	0.015	21%	3.1	10	10.9
VRT10	4/12/2006	15:00	194.8	7%	-0.164	41%	0.0	130	126.0
VRT10	5/4/2006	14:30	63.2	17%	-0.017	13%	0.0	220	**101.4***
VRT10	5/25/2006	15:30	21.4	41%	-0.003	0%	0.0	650	**232.2***
VRT10	5/25/2006	15:45	21.4	41%	-0.003	0%	0.0	1700	**484.1***
VRT10	6/19/2006	14:15	42.5	24%	0.109	67%	22.3	5900	**1253.3***
VRT10	6/27/2006	17:00	16.3	50%	-0.004	13%	0.0	540	115
VRT10	6/27/2006	17:15	16.3	50%	-0.004	13%	0.0	390	173.0
VRT10	8/11/2006	11:30	7.9	82%	0.000	8%	0.0	600	**218.4***
VRT10	9/26/2006	13:30	19.6	43%	0.005	18%	1.0	300	**128.6***

***- *E. coli* concentrations predicted through the relationship and equation shown below via log transformation.**



SampleDate	SampleTime	SpecimenNumber	StationID	Waterbody	*Escherichia coli* (cfu/100mL)
05/15/2018	14:10	E18EC002107	460182	Long Creek	96
06/05/2018	12:05	E18EC002719	460182	Long Creek	301
09/06/2016	12:25	E16EC005826	460182	Long Creek	727
08/07/2018	14:05	E18EC004568	460182	Long Creek	24200
08/09/2016	10:50	E16EC004880	460182	Long Creek	74
07/13/2016	10:30	E16EC004118	460182	Long Creek	431
05/17/2016	11:10	E16EC002521	460182	Long Creek	41
09/13/2017	11:50	E17EC005860	460182	Long Creek	187
08/08/2017	13:50	E17EC004360	460182	Long Creek	85
07/11/2017	11:20	E17EC003462	460182	Long Creek	328
06/06/2017	12:05	E17EC002571	460182	Long Creek	132
05/03/2017	13:15	E17EC001739	460182	Long Creek	960
07/19/2018	14:10	E18EC003987	460182	Long Creek	216
09/18/2018	11:25	E18EC006084	460182	Long Creek	123
06/14/2016	11:30	E16EC003419	460182	Long Creek	1240

APPENDIX B: County Livestock Data

NASS Progam	Year	Domain	Domain Category	County	Total County Acres	Livestock Data Item	Total Animal Number	# per acre
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	CATTLE, COWS - INVENTORY	26,813	0.051
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	CATTLE, COWS, BEEF - INVENTORY	21,656	0.042
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	CATTLE, COWS, MILK - INVENTORY	5,157	0.010
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	CATTLE, INCL CALVES - INVENTORY	74,307	0.143
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	CATTLE, ON FEED - INVENTORY	21,096	0.041
				MINNEHAHA	520,746	CATTLE ON GRASS	48,054	0.092
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	CHICKENS, BROILERS - INVENTORY	630	0.001
				MINNEHAHA	520,746	EQUINE, HORSES & PONIES - INVENTORY	2284	0.004
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	HOGS - INVENTORY	61,333	0.118
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	SHEEP, INCL LAMBS - INVENTORY	5,583	0.011
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	TURKEYS - INVENTORY	10	0.000
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	CATTLE, COWS - INVENTORY	26,813	0.051
CENSUS	2007	TOTAL	NOT SPECIFIED	MINNEHAHA	520,746	CATTLE, COWS, BEEF - INVENTORY	21,656	0.042
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	CATTLE, COWS, BEEF - INVENTORY	7,064	0.019
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	CATTLE, COWS, MILK - INVENTORY	427	0.001
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	CATTLE, INCL CALVES - INVENTORY	36,505	0.099
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	CATTLE, ON FEED - INVENTORY	16,884	0.046
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	cattle on grass	19,194	0.052
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	CHICKENS, BROILERS - INVENTORY	210	0.001
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	CHICKENS, LAYERS - INVENTORY	986	0.003
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	EQUINE, HORSES & PONIES - INVENTORY	924	0.002
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	GOATS - INVENTORY	574	0.002
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	HOGS - INVENTORY	28,302	0.076
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	SHEEP, INCL LAMBS - INVENTORY	3920	0.011
CENSUS	2007	TOTAL	NOT SPECIFIED	LINCOLN	370,310	TURKEYS - INVENTORY	14	0.000
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	CATTLE, COWS - INVENTORY	19,503	0.049
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	CATTLE, COWS, BEEF - INVENTORY	13,068	0.033
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	CATTLE, COWS, MILK - INVENTORY	6,435	0.016
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	CATTLE, INCL CALVES - INVENTORY	49,050	0.124
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	CATTLE, ON FEED - INVENTORY	15,904	0.040
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	cattle on grass	26,711	0.068
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	CHICKENS, BROILERS - INVENTORY	35	0.000
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	EQUINE, HORSES & PONIES - INVENTORY	732	0.002

NASS Progam	Year	Domain	Domain Category	County	Total County Acres	Livestock Data Item	Total Animal Number	# per acre
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	HOGS - INVENTORY	61,412	0.155
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	SHEEP, INCL LAMBS - INVENTORY	13,145	0.033
CENSUS	2007	TOTAL	NOT SPECIFIED	TURNER	395,067	TURKEYS - INVENTORY	41	0.000

APPENDIX C: EPA Approval Letter and Decision Document

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

June 16, 2021

Ref: 8WD-CWS

SENT VIA EMAIL
DIGITAL READ RECEIPT REQUESTED

Hunter Roberts, Secretary
South Dakota Department of Agriculture and Natural Resources
Hunter.Roberts@state.sd.us

Re: Approval of Pathogen Total Maximum Daily Load (TMDL) for Long Creek in Lincoln, Minnehaha, and Turner Counties South Dakota

Dear Mr. Roberts,

The U.S. Environmental Protection Agency (EPA) has completed review of the total maximum daily load (TMDL) submitted by your office on May 20th, 2021. In accordance with the Clean Water Act (33 U.S.C. §1251 *et. seq.*) and the EPA's implementing regulations at 40 C.F.R. Part 130, the EPA hereby approves South Dakota's TMDL for Long Creek. The EPA has determined that the separate elements of the TMDL listed in the enclosure adequately address the pollutant of concern, are designed to attain and maintain applicable water quality standards, consider seasonal variation and include a margin of safety. The EPA's rationale for this action is contained in the enclosure.

Thank you for submitting this TMDL for our review and approval. If you have any questions, please contact Peter Brumm on my staff at (406) 457-5029.

Sincerely,

Judy Bloom, Manager
Clean Water Branch

Enclosure:

Pathogen TMDL for Long Creek in Lincoln, Minnehaha, and Turner Counties South Dakota - EPA Decision Rationale

Cc: Barry McLaury, Administrator, South Dakota Department of Environment and Natural Resources

Paul Lorenzen, Environmental Scientist III, South Dakota Department of Environment & Natural Resources

EPA TOTAL MAXIMUM DAILY LOAD (TMDL) REVIEW SUMMARY

TMDL: Pathogen TMDL for Long Creek in Lincoln, Minnehaha, and Turner Counties South Dakota

ATTAINS TMDL ID: R8-SD-2021-02

LOCATION: Lincoln, Minnehaha, and Turner Counties, South Dakota

IMPAIRMENTS/POLLUTANTS: The TMDL submittal addresses one river segment with an immersion recreation use that is impaired due to high concentrations of *E. coli* bacteria.

Waterbody/Pollutant Addressed in this TMDL Action

Assessment Unit ID	Waterbody Description	Pollutants Addressed
SD-VM-R-LONG_01	Long Creek (Vermillion River to Highway 44)	Escherichia coli (*E. coli*)

BACKGROUND: The South Dakota Department of Agriculture and Natural Resources (DANR) submitted to EPA the final *E. coli* TMDL for Long Creek with a letter requesting review and approval dated May 20, 2021.

The submittal included:
- Letter requesting EPA's review and approval of the TMDL
- Final TMDL report
- Data appendices

APPROVAL RECOMMENDATIONS: Based on the review presented below, the reviewer recommends approval of the final Long Creek *E. coli* TMDL. All the required elements of an approvable TMDL have been met.

TMDL Approval Summary	
Number of TMDLs Approved:	1
Number of Causes Addressed by TMDLs:	1

REVIEWERS: Peter Brumm, EPA

The following review summary explains how the TMDL submission meets the statutory and regulatory requirements of TMDLs in accordance with Section 303(d) of the Clean Water Act (CWA), and EPA's implementing regulations in 40 C.F.R. Part 130.

EPA TMDL REVIEW FOR LONG CREEK E. COLI TMDL

This TMDL review document includes EPA's guidelines that summarize the currently effective statutory and regulatory requirements relating to TMDLs (CWA Section 303(d) and 40 C.F.R. Part 130). These TMDL review guidelines are not themselves regulations. Any differences between these guidelines and EPA's regulations should be resolved in favor of the regulations themselves. The italicized sections of this document describe the information generally necessary for EPA to determine if a TMDL submittal fulfills the legal requirements for approval. The sections in regular type reflect EPA's analysis of the state's compliance with these requirements. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal must clearly identify (40 C.F.R. §130.7(c)(1)):

- *the waterbody as it appears on the State's/Tribe's 303(d) list;*
- *the pollutant for which the TMDL is being established; and*
- *the priority ranking of the waterbody.*

The TMDL submittal must include (40 C.F.R. §130.7(c)(1); 40 C.F.R. §130.2):

- *an identification of the point and nonpoint sources of the pollutant of concern, including location of the source(s) and the quantity of the loading (e.g., lbs. per day);*
- *facility names and NPDES permit numbers for point sources within the watershed; and*
- *a description of the natural background sources, and the magnitude and location of the sources, where it is possible to separate natural background from nonpoint sources.*

This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

- *the spatial extent of the watershed in which the impaired waterbody is located;*
- *the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);*
- *population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;*
- *present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and*
- *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.*

Long Creek is located in southeastern South Dakota and is part of the larger Vermillion River Basin. The impaired waterbody segment subject to this TMDL extends upstream from its confluence with the Vermillion River to the State Highway 44 crossing and is identified as SD-VM-R-LONG_01. Figure 1 displays the general location of the Long Creek Watershed with the impaired segment shown in red. Figure 2 shows land use and the monitoring location where data was collected to support TMDL development.

This segment was first listed as impaired by pathogens (fecal coliform) on South Dakota's 2008 303(d) List. The cause was refined to *E. coli* on the 2010 303(d) List which remained an impairment on subsequent list cycles. It was assigned a high priority (i.e., 1) for TMDL development on the most recent 303(d) list in 2020. This priority ranking information is contained on Page 1. Long Creek is also listed for Total Suspended Solids (TSS), which impairs the Creek's fish propagation use, however a TSS TMDL is not included in this submittal and the TSS impairment will be addressed by a future TMDL effort. No previous TMDLs have been developed for Long Creek.

Section 2.1 (Watershed Characteristics - General) and Table 2 summarize the land use distribution draining into the impaired segment which is predominantly cultivated crops (80.6%) with portions of pasture hay (10.0%) and developed open space (5.1%) centered around transportation corridors. Section 5.2 (Source Assessment and Allocation – Nonpoint Sources) characterizes nonpoint sources into categories of agriculture (i.e., livestock), human (i.e., septic systems), natural background/wildlife, and tributary contributions. DANR quantified *E. coli* production from these sources using population estimates, Geographic Information System (GIS) analysis, and the Bacterial Indicator Tool (EPA, 2000) with information provided by South Dakota Game Fish and Parks and Department of Transportation.

Traditional point sources are identified and described in Table 7 by facility name, permit number and discharge characteristics. A single permit (SD0021768), held by the City of Lennox, allows treated wastewater discharges into Long Creek within the stream segment subject to this TMDL. Two additional permits are described and were ultimately determined to be unlikely sources of *E. coli* due to their facility characteristics and discharge location in the watershed. Additionally, there are three permitted Concentrated Animal Feeding Operations (CAFOs) in the Long Creek Watershed as identified in Table 9. Discharges from permitted CAFOs are rare and indirect events because South Dakota requires various design, operation, and maintenance standards at these sites, therefore, the TMDL assumes *E. coli* contributions from the three CAFOs is minimal, and unless found otherwise, requires no additional permit conditions.

Assessment: EPA concludes that DANR adequately identified the impaired waterbody, the pollutant of concern, the priority ranking, the identification, location and magnitude of the pollutant sources, and the important assumptions and information used to develop the TMDL.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal 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 antidegradation policy (40 C.F.R. §130.7(c)(1)); and*
- *a numeric water quality target for each TMDL. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression must be developed from a narrative criterion and a description of the process used to derive the target must be included in the submittal (40 C.F.R. §130.2(i)).*

EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

Section 3.1 (South Dakota Water Quality Standards) describes the water quality standards applicable to the impaired segment with citations to relevant South Dakota regulations. SD-VR-R-LONG_01 is designated the following beneficial uses:

- warmwater semipermanent fish life propagation,
- limited contact recreation,
- fish and wildlife propagation, recreation, and stock watering, and
- irrigation waters.

All numeric criteria applicable to these uses are presented in Table 3. DANR determined that *E. coli* is preventing the creek's limited recreation use from being supported. The numeric *E. coli* criteria for immersion recreation waters are applied directly as water quality targets for the TMDL and are comprised of a 30-day geometric mean criterion (≤ 630 cfu/100mL) and a single sample maximum criterion (≤ 1,178 cfu/100mL). These criteria are seasonally applicable from May 1 to September 30. DANR expects that meeting the numeric *E. coli* criteria will lead to conditions necessary to support the relevant narrative criteria discussed in Section 3.2 (Narrative Standards).

The TMDL and allocations were calculated using the single sample maximum criterion because the monitoring dataset did not allow for the proper calculation of a geometric mean value according to state water quality standards regulations. DANR demonstrates in Section 3.3 (Numeric TMDL Targets) that attaining the single sample maximum target will also achieve the geometric mean criterion.

Assessment: EPA concludes that DANR adequately described the applicable water quality standards and numeric water quality target for this TMDL.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

The TMDL submittal must include the loading capacity for each waterbody and pollutant of concern. 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 TMDL submittal must:

- *describe the method used to establish 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;*
- *contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling; and*
- *include a description and summary of the water quality data used for the TMDL analysis.*

EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation (40 C.F.R. §130.2).

The full water quality dataset should be made available as an appendix to the TMDL or as a separate electronic file. Other datasets used (e.g., land use, flow), if not included within the TMDL submittal, should be referenced by source and year. The TMDL analysis should make use of all readily available data for the waterbody unless the TMDL writer determines that the data are not relevant or appropriate.

The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). Most TMDLs should be expressed as daily loads (USEPA. 2006a). If the TMDL is expressed *in terms other than a daily load (e.g., annual load), the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen.*

The TMDL submittal must describe the critical conditions and related physical conditions in the waterbody as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). The critical condition can be thought of as the "worst case" scenario of environmental conditions (e.g., stream flow, temperature, loads) in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. TMDLs should define the applicable critical conditions and describe the approach used to estimate both point and nonpoint source loads under such critical conditions.

DANR relied on the load duration curve approach to define the *E. coli* loading capacity for Long Creek. A load duration curve is a graphic representation of pollutant loads across various flows. The approach helps correlate water quality conditions to stream flow and provides insight into the variability of source contributions. EPA has published guidance on the use of duration curves for TMDL development (USEPA, 2007) and the practice is well established. Using this approach, DANR set the TMDL equivalent to the loading capacity and expressed the TMDL in colony forming units (CFU) per day at four different flow zones (i.e., extreme, high, mid-range and low), as listed in Table 13. The load duration curve, and TMDL based on the curve, is shown visually in Figure 6 with instantaneous loads calculated from the monitoring dataset.

All water quality data used in the analysis is contained in Appendix A (Water Quality Data). Some older fecal coliform data was transformed into *E. coli*, as described in an Appendix A footnote, to ensure a broad distribution of *E. coli* data across the entire flow frequency curve.

While the loading capacity is defined for multiple stream flow conditions, DANR determined critical conditions in Long Creek occur during spring and summer storm events when the highest *E. coli* concentrations were measured.

Assessment: EPA concludes that the loading capacity was calculated using an acceptable approach, used a water quality target consistent with water quality criteria, and has been appropriately set at a level necessary to attain and maintain the applicable water quality standards. The pollutant loads have been expressed as daily loads. The critical conditions were described and factored into the calculations and were based on a reasonable approach to establish the relationship between the target and pollutant sources.

4. Load Allocation

The TMDL submittal must include load allocations (LAs). EPA regulations define LAs as the portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution and to natural background sources. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, separate LAs should be provided for natural background and for nonpoint sources.

In the rare instance that a TMDL concludes that there are no nonpoint sources or natural background for a pollutant, the load allocation must be expressed as zero and the TMDL should include a discussion of the reasoning behind this decision.

As described in Section 6.2.3 (Load Allocation), DANR established a single LA as the allowable load remaining after the WLA and explicit MOS have been accounted for (i.e., LA = TMDL – WLA – MOS). Table 13 presents the LA across the TMDL's four flow zones. This composite LA represents all nonpoint source contributions, both human and natural, as one allocation, however, individual nonpoint source categories were characterized in greater depth in Section 5.2 (Nonpoint Sources).

Assessment: EPA concludes that the LA provided in the TMDL is reasonable and will result in attainment of the water quality standards.

5. Wasteload Allocations

The TMDL submittal must include wasteload allocations (WLAs). EPA regulations define WLAs as the portion of a receiving water's loading capacity that is allocated to existing and future point sources (40 C.F.R. §130.2(h)). If no point sources are present or if the TMDL recommends a zero WLA for point sources, the WLA must be expressed as zero. If the TMDL recommends a zero WLA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero WLA implies an allocation only to nonpoint sources and natural background will result in attainment of the applicable water quality standards, and all point sources have no measurable contribution.

The individual WLAs may take the form of uniform percentage reductions or individual mass based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. In some cases, WLAs may cover more than one discharger (e.g., if the source is contained within a general permit).

There is one permitted point source facility assigned a WLA that discharges to Long Creek: the City of Lennox Wastewater Treatment Facility (SD0021768). As described in Section 6.2.1 (Waste Load Allocation), Lennox is assigned a WLA based on meeting the single sample maximum criterion (1,178 cfu/100ml) at the facility's 80^{th} percentile discharge. The existing Lennox permit includes a daily maximum (1,178 cfu/100 ml) and a 30-day average (630 cfu/100 ml) *E. coli* effluent limit. The submittal states that the WLA is not intended to add load limits to the permit and that the permit is deemed consistent with the assumptions and requirements of the WLA by meeting end-of-pipe concentrations equivalent to the applicable water quality standard.

The City of Worthing Wastewater Treatment Facility (SD0021474) was not assigned a WLA given its discharge location relative to Long Creek (i.e., 17 miles upstream), however, the submittal notes the permit is due for renewal and contains outdated fecal coliform limits. Page 27 further states the facility should undergo a reasonable potential analysis to determine whether *E. coli* effluent limits or monitoring requirements are appropriate. All other permitted point sources in the basin have been assigned a WLA of zero.

Assessment: EPA concludes that the WLA provided in the TMDL is reasonable, will result in the attainment of the water quality standards and will not cause localized impairments. The TMDL accounts for all point sources contributing loads to the impaired segment.

6. Margin of Safety

*The TMDL submittal must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load allocations, wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). The MOS may be **implicit** or **explicit**.*

*If the MOS is **implicit**, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is **explicit**, the loading set aside for the MOS must be identified.*

The Long Creek *E. coli* TMDL includes an explicit MOS derived as 10% of the TMDL. The explicit MOS is included in Table 13 and varies by flow zone.

Assessment: EPA concludes that the TMDL incorporates an adequate explicit margin of safety.

7. Seasonal Variation

The TMDL submittal must be established with consideration of seasonal variations. The method chosen for including seasonal variations in the TMDL must be described (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

The load duration curve method used to establish the TMDL incorporates variations in stream flow, which in turn, is influenced by other climatic and human factors that change throughout the year. To account for these variations, DANR developed the TMDL at four different flow zones (i.e., extreme, high, mid-range, and low) as listed in Table 13.

The variability of measured stream flows and monitored *E. coli* concentrations are summarized in Section 7.0 (Seasonal Variation). The greatest loading reductions necessary occur in high (61.3%) and extreme flow zones (22.4%), however, criterion exceedances were most often observed during the lower three flow zones and are thought to be associated with livestock access.

Assessment: EPA concludes that seasonal variations were adequately described and considered to ensure the TMDL allocations will be protective of the applicable water quality standards throughout any given year.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by both point and nonpoint sources, EPA guidance (USEPA. 1991) and court decisions say that the TMDL must provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement the applicable water quality standards (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

EPA guidance (USEPA. 1997) also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by nonpoint sources. However, EPA cannot disapprove a TMDL for nonpoint source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

As verified through the TMDL analysis, Long Creek is impaired by both point and nonpoint sources of *E. coli* therefore DANR provided reasonable assurances that source control measures will be achieved. These assurances include recommendations listed in Section 11.0 (Reasonable Assurance).

The WLA was established based on the Lenox Wastewater Treatment Facility meeting *E. coli* water quality criteria in their effluent (i.e., criteria end-of-pipe). Reasonable assurances are addressed for point sources through NPDES permits, which require facilities to have effluent limits consistent with the assumptions and requirements of WLAs.

Nonregulatory, voluntary-based reasonable assurances are provided for the LA where the submittal discusses DANR's adaptive management approach to the TMDL process, the monitoring strategy that will be used to gage TMDL effectiveness in the future, and the core aspects of a TMDL implementation strategy. These assurances include the more detailed characterization of nonpoint sources that will guide restoration planning beyond what is summarized in the composite LA representing all nonpoint source categories, a description of local restoration partners and the recommendation of specific activities to focus implementation. The submittal also mentions one implementation project addressing bacteria already underway (i.e., the Vermillion River Basin Watershed Implementation Project).

Assessment: EPA considered the reasonable assurances contained in the TMDL submittal and concludes that they are adequate to meet the load reductions.

9. Monitoring Plan

The TMDL submittal should include a monitoring plan for all:

- *Phased TMDLs; and*
- *TMDLs with both WLA(s) and LA(s) where reasonable assurances are provided.*

Under certain circumstances, a phased TMDL should be developed when there is significant uncertainty associated with the selection of appropriate numeric targets, estimates of source loadings, assimilative capacity, allocations or when limited existing data are relied upon to develop a TMDL. EPA guidance (USEPA. 2006b) recommends that a phased TMDL submittal, or a separate document (e.g., implementation plan), include a monitoring plan, an explanation of how the supplemental data will be used to address any uncertainties that may exist when the phased TMDL is prepared and a scheduled timeframe for revision of the TMDL.

For TMDLs that need to provide reasonable assurances, the monitoring plan should describe the additional data to be collected to determine if the load reductions included in the TMDL are occurring and leading to attainment of water quality standards.

EPA guidance (USEPA. 1991) recommends post-implementation monitoring for all TMDLs to determine the success of the implementation efforts. Monitoring plans are not a required part of the TMDL and are not approved by EPA but may be necessary to support the decision rationale for approval of the TMDL.

In Section 9.0 (Monitoring Strategy) DANR commits to supporting future monitoring activities to judge progress towards achieving the goals outlined in the TMDL through the ambient water quality monitoring station network. Additional monitoring and evaluation efforts will be targeted toward the effectiveness of restoration activities.

DANR also maintains the ability to modify the TMDL and allocations as new data becomes available using an adaptive management approach in accordance with the TMDL revision process previously recommended by EPA.

Assessment: Monitoring plans are not a required element of EPA's TMDL review and decision-making process. The TMDL submitted by DANR includes a commitment to monitor progress toward attainment of water quality standards. EPA is taking no action on the monitoring strategy included in the TMDL submittal.

10. Implementation

EPA policy (USEPA. 1997) encourages Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired by nonpoint sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that nonpoint source LAs established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. The policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

EPA encourages States/Tribes to include restoration recommendations (e.g., framework) in all TMDLs for stakeholder and public use to guide future implementation planning. This could include identification of a range of potential management measures and practices that might be feasible for addressing the main loading sources in the watershed (see USEPA. 2008b, Chapter 10). Implementation plans are not a required part of the TMDL and are not approved by EPA but may be necessary to support the decision rationale for approval of the TMDL.

In Section 12.0 (Implementation Strategy), based on the makeup of contributing pollutant sources, DANR encourages future implementation activities focus on:

- Reducing livestock access to streams by providing alternative watering sources,
- Protecting unstable stream banks by enhancing the riparian vegetation,
- Installing filter strips along the stream bordering cropland and pastureland,
- Properly implementing waste management systems at animal confinement facilities, and
- Assessing the impact of CWA Section 319 projects and revising plans in cooperation with basin stakeholders whenever necessary.

The submittal also briefly summarizes three funding programs that can provide financial assistance help implement the TMDL recommendations.

Assessment: Although not a required element of the TMDL approval, DANR discussed how information derived from the TMDL analysis process can be used to support implementation of the TMDL. EPA is taking no action on the implementation portion of the TMDL submittal.

11. Public Participation

EPA policy is that there must be full and meaningful public participation in the TMDL development process. Each State/Tribe must, therefore, provide for public participation consistent with its own continuing planning process and public participation requirements (40 C.F.R. §25.3 and §130.7(c)(1)(ii)).

The final TMDL submittal must describe the State/Tribe's public participation process, including a summary of significant comments and the State/Tribe's responses to those comments (40 C.F.R. §25.3 and §25.8). Inadequate public participation could be a basis for disapproving a TMDL; however, where EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

Section 10.0 (Public Participation) explains the public engagement process DANR followed during development of the TMDL. Starting in the mid-2000s, several meetings were held to discuss assessment conclusions with the Vermillion Basin Water Development District. An initial draft TMDL report was released for public comment in 2013. Following significant revisions, a second draft TMDL report was released for public comment from April 16, 2021 to May 18, 2021. No public comments were submitted during either comment period. The 2021 opportunity for public review and comment was posted on DANR's website and announced in three area newspapers: Argus Leader, Centerville Journal, Lennox Independent and New Era.

Assessment: EPA has reviewed DANR's public participation process and concludes that DANR involved the public during the development of the TMDL and provided adequate opportunities for the public to comment on the draft report.

12. Submittal Letter

The final TMDL submittal must 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 (40 C.F.R. §130.7(d)(1)). The final submittal letter should contain such identifying information as the waterbody name, location, assessment unit number and the pollutant(s) of concern.

A transmittal letter with the appropriate information was included with the final TMDL report submission from DANR, dated May 20, 2021 and signed by Paul Lorenzen, Environmental Scientist Manager-TMDL Team Leader, Water Protection Program.

On April 19, 2021, while the draft TMDL was posted for public comment, the South Dakota Department of Environment and Natural Resources (DENR) was officially renamed the South Dakota Department of Agriculture and Natural Resources (DANR). Earlier drafts of the TMDL referred to the authoring state agency as DENR.

Assessment: EPA concludes that the state's submittal package clearly and unambiguously requested EPA to act on the TMDL in accordance with the Clean Water Act and the submittal contained all necessary supporting information.

References

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