ESCHERICHIA COLI TOTAL MAXIMUM DAILY LOAD EVALUATION FOR THE KEYA PAHA RIVER, TRIPP COUNTY, SOUTH DAKOTA.

South Dakota Department of
Environment and Natural Resources

Protecting South Dakota's Tomorrow ... Today

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June 2011

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Keya Paha River Total Maximum Daily Load

Entity ID:	SD-NI-R-KEYA_PAHA_01
Location:	HUC Code: 10150006
Size of Watershed:	1,092,300 acres
Water Body Type:	River/Stream
303(d) Listing Parameter:	*Escherichia coli* bacteria
Initial Listing Date:	2010 IR
TMDL Priority Ranking:	5
Listed Stream Segment:	60 miles from the Nebraska border upstream to the Tripp and Todd County Line
Designated Use of Concern:	Warmwater Semipermanent Fish Life Propagation
Analytical Approach:	Load Duration Curve
Target:	Meet all applicable Water Quality Standards
Indicators:	*Escherichia coli* bacteria counts < 630
Threshold Value	colonies/100 ml geometric mean concentration with maximum single sample concentrations of < 1178 colonies/100 ml.

Load Allocations

High flow Zone WLA:	0
High Flow Zone LA:	1.32E+16 (cfu/day)
High Flow Zone MOS:	1.43E+12 (cfu/day)
High Flow Zone TMDL:	1.32E+16 (cfu/day)

1.0 Objective

The intent of this document is to clearly identify the components of the TMDL submittal to support adequate public participation and facilitate the US Environmental Protection Agency (EPA) review and approval. The TMDL was developed in accordance with Section 303(d) of the Federal Clean Water Act and guidance developed by EPA. This TMDL document addresses the *E. coli* bacteria impairment of the Keya Paha River from the Tripp and Todd County lines downstream to the Nebraska Border, SD-NIR-KEYA_PAHA_01.

2.0 Introduction

The Keya Paha River drains 1,092,300 acres in south-central South Dakota and drains to the Niobrara River in Nebraska (Figure 1). This river receives agricultural runoff and experiences periods of water quality degradation due to *Escherichia coli* bacteria. The watershed land use is primarily agricultural with cropland (42%) and grazing (57%) making up the majority. The remaining one percent of land use includes water, roads, housing, and forested lands. The drainage area in question is composed of 17% Nebraska lands, 50% Tripp County lands, and 33% Todd County lands.

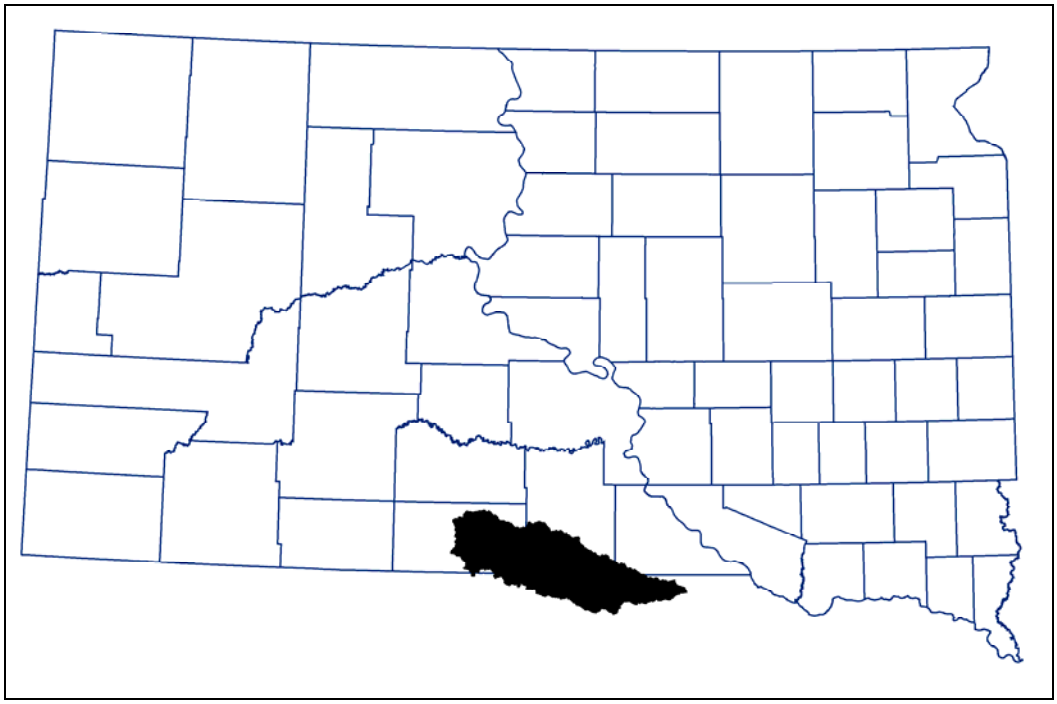

Figure 1. Location of the Keya Paha Watershed within South Dakota.

The climate in this area is sub-humid with hot summer and cold winters. Most of the soil types in the watershed support grazing and include Inavale-Cass, Anselmo-Tassel-Valentine, Anselmo-Valentine, Doger-Elsmare, and Okaton-Manter associations. Two

soil types within the watershed support about half cropland and half grazing and include Anselmo-Holt and Manter-Rosebud-Huggins associations (USDA 1979).

The Keya Paha Watershed was assessed as part of the Lewis and Clark Watershed Assessment which looked at individual tributaries such as the Keya Paha River along with the entire watershed area and the cumulative effects of smaller waterbodies.

Segment SD-NI-R-KEYA_PAHA_01 (Figure 2) is listed for fecal coliform, total suspended solids (TSS), and *Escherichia coli* bacteria. TMDLs have been approved for the fecal coliform and TSS impairments.

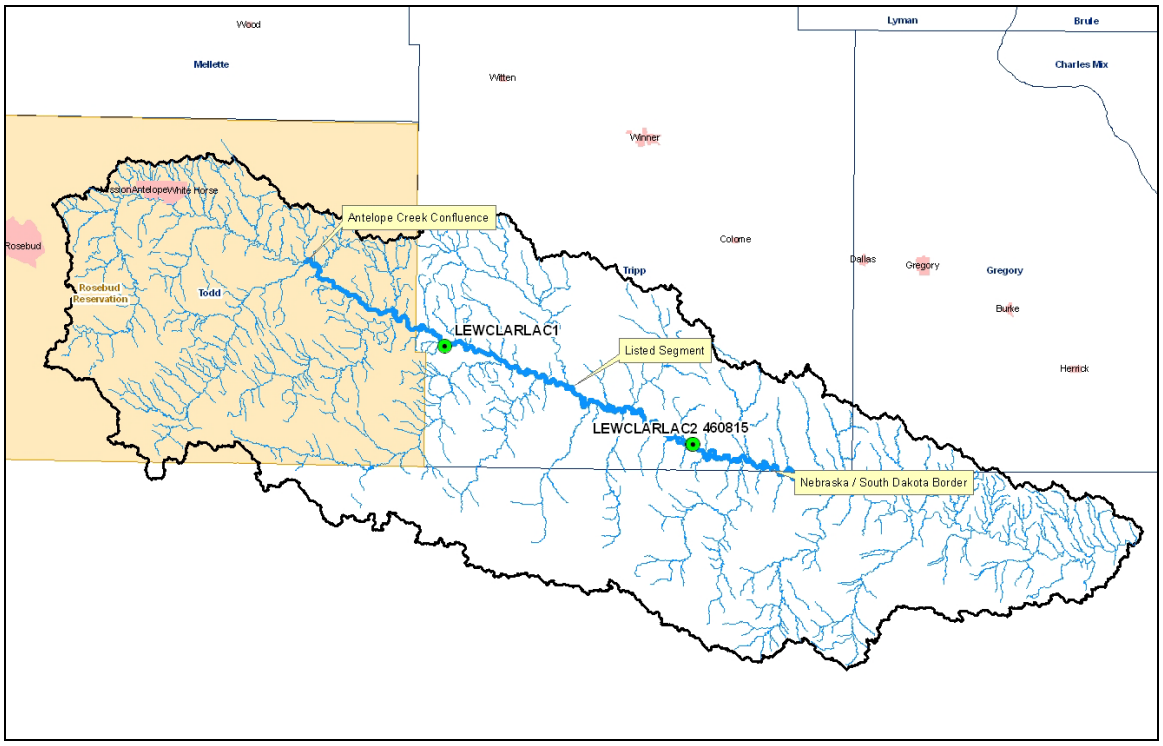

Figure 2. Location of study sites and the listed segment of the Keya Paha River.

The majority of the listed segment occurs within Tripp County and this analysis will concern that portion of the segment. The remaining portion occurs within the Rosebud Reservation. The portion examined for this TMDL includes the portion contained within Tripp County (Figure 3).

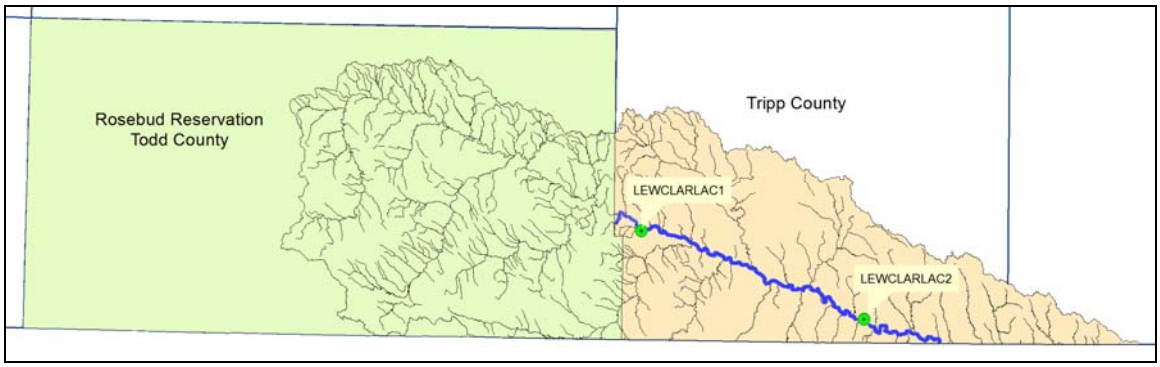

Figure 3. Keya Paha River watershed contained within Todd and Tripp counties, the examined segment is indicated in blue.

3.0 Water Quality Standards

Each waterbody within South Dakota is assigned beneficial uses. All waters (both lakes and streams) are designated the use of fish and wildlife propagation, recreation and stock watering. All streams are assigned the use of irrigation. Additional uses may be assigned by the state based on a beneficial use analysis of each waterbody. Water quality standards have been defined in South Dakota state statutes in support of these uses. These standards consist of suites of numeric criteria that provide physical and chemical benchmarks from which management decisions can be developed (Table 1).

Chronic standards, including geometric means and 30-day averages, are applied to a calendar month. While not explicitly described within the state's water quality standards, this is the method used in the South Dakota Integrated Water Quality Report (IR) as well as in permit development.

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

The Keya Paha River has been assigned the beneficial uses of: warm water semipermanent fish life propagation, irrigation waters, limited contact recreation, and fish and wildlife propagation, recreation, and stock watering. Table 1 lists the criteria that must be met to support the specified beneficial uses. When multiple criteria exist for a particular parameter, the most stringent criterion is used.

The numeric TMDL target established for the Keya Paha River is 630 cfu/100 ml, which is based on the chronic standard for *E. coli*. The *E. coli* for the limited contact recreation beneficial use requires that 1) no sample exceeds 1178 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. These criteria are applicable from May 1 through September 30.

Table 1. State Water Quality Standards for Brule Creek.

Parameters	Criteria	Unit of Measure	Beneficial Use Requiring this Standard
Total ammonia nitrogen as N	Equal to or less than the result from Equation 3 in Appendix A of Surface Water Quality Standards	mg/L30 average May 1 to October 31	Warmwater Marginal Fish Life Propagation
	Equal to or less than the result from Equation 4 in Appendix A of Surface Water Quality Standards	mg/L 30 average November 1 to April 30	
	Equal to or less than the result from Equation c in Appendix A of Surface Water Quality Standards	mg/L Daily Maximum	
Dissolved Oxygen	≥4.0	mg/L	Warmwater Marginal Fish Life Propagation
Total Suspended Solids	≤150 (mean) ≤263 (single sample)	mg/L	Warmwater Marginal Fish Life Propagation
Temperature	≤32	°C	Warmwater Marginal Fish Life Propagation
Fecal Coliform Bacteria (May 1 – Sept 30)	≤1,000 (geometric mean) ≤2,000 (single sample)	count/100 ml	Limited Contact Recreation
Escherichia coli Bacteria (May 1 – Sept 30)	≤630 (geometric mean) ≤1,178 (single sample)	count/100 ml	Limited Contact Recreation
Alkalinity (CaCO3)	≤750 (mean) ≤1,313 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Conductivity	≤2,500 (mean) ≤4,375 (single sample)	µmhos/cm @ 25° C	Irrigation Waters
Nitrogen, Nitrate as N	≤50 (mean) ≤88 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
pH (standard Units	≥6.0 to ≤9.0	units	Warmwater Marginal Fish Propagation
Solids, total dissolved	≤2,500 (mean) ≤4,375 (single sample)	mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Total Petroleum Hydrocarbon Oil and Grease	≤10 ≤10	mg/L mg/L	Fish and Wildlife Propagation, Recreation, and Stock Watering
Sodium Absorption Ratio	≤10	ratio	Irrigation Waters

4.0 Sample Data

Data on the Keya Paha River were collected during the Lewis and Clark Watershed Assessment. Data were collected from two sampling points, one near the Todd and Tripp County lines (LEWCLARLAC1) and the second located near the Nebraska border (LEWCLARLAC2). Data collected from LEWCLARLAC2 will be used to generate a load duration curve and in TMDL calculations. The data collected during the assessment were used to supplement existing ambient monitoring data from SD DENR ambient water quality monitoring site 460815 which was co-located at site LEWCLARLAC2. Flow data for the Keya Paha River was retrieved from the United States Geological

Survey (USGS). Paired fecal coliform and *E. coli* data were collected LEWCLARLAC2 during the Lewis and Clark Assessment project. Paired data from LEWCLARLAC2 was correlated with linear regression and the resulting relationship was used to model *E. coli* concentrations using fecal coliform data from ambient water quality data taken from monitoring site 460815 (Figure 4).

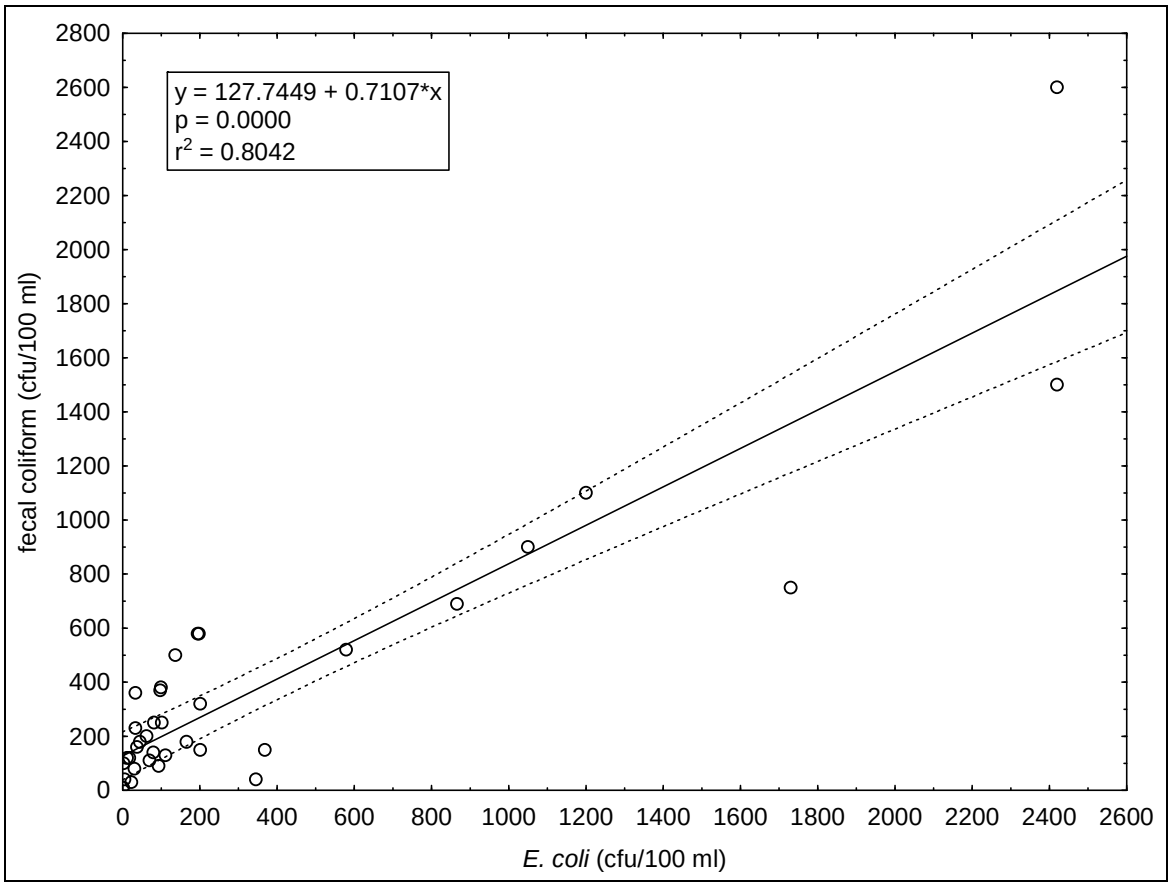

Figure 4. LEWCLARLAC2 relationship between fecal coliform and *E. coli* concentration.

A total of 47 paired *E. coli* and fecal coliform samples were collected from LEWCLARLAC2 during the Lewis and Clark Assessment Project. Modeled *E. coli* concentrations based on fecal coliform data collected at monitoring site 460815 added an additional 89 samples to LEWCLARLAC2 (Table 2).

Table 2. Samples collected from LEWCLARLAC2. Modeled concentrations indicated by red text.

Date	*E. coli* (cfu/100 ml)	Flow	Flow Zone	Date	*E. coli* (cfu/100 ml)	Flow	Flow Zone
07/23/1974	554.2	6	Low	10/17/1984	269.9	42	Mid-range
08/27/1974	179.6	5.9	Low	10/22/1985	156.2	38	Mid-range
09/23/1974	137	14	Low	01/22/1986	149.1	40	Mid-range
08/19/1975	277	7.4	Low	07/14/1986	234.3	46	Mid-range
09/22/1975	433.3	13	Low	10/19/1987	163.3	46	Mid-range
10/15/1975	154	15	Low	07/20/1993	433.3	51	Mid-range
11/25/1975	191.7	3	Low	06/05/2003	80.8	51	Mid-range
12/16/1975	151.2	6	Low	06/11/2003	102	47	Mid-range
01/08/1976	132	10	Low	06/16/2003	2420	42	Mid-range
06/24/1976	831.3	11	Low	05/12/2004	1	38	Mid-range
07/22/1976	341	1.2	Low	05/12/2004	201	38	Mid-range
09/16/1976	1620.2	11	Low	06/09/2004	111	49	Mid-range
10/21/1976	284.1	11	Low	07/12/2005	33.6	41	Mid-range
11/04/1976	149.1	14	Low	07/12/2005	33.7	41	Mid-range
12/22/1976	205.9	8	Low	07/12/2005	33.7	41	Mid-range
01/19/1977	149.1	3	Low	07/23/2008	368	51	Mid-range
01/17/1979	139.8	3.5	Low	07/23/2008	368	51	Mid-range
08/07/2003	5.2	13	Low	05/22/1968	188.2	72	Moist Conditions
08/13/2003	17.9	13	Low	04/23/1974	156.2	77	Moist Conditions
08/26/2003	12	9.4	Low	03/18/1975	129.9	65	Moist Conditions
07/25/2006	137	15	Low	07/23/1975	17184.5	74	Moist Conditions
07/25/2006	137	15	Low	05/19/1977	191.7	124	Moist Conditions
12/13/1972	142	18	Dry Conditions	06/23/1977	184.6	97	Moist Conditions
06/04/1974	149.1	31	Dry Conditions	05/16/1978	139.8	111	Moist Conditions
10/29/1974	191.7	22	Dry Conditions	06/20/1978	227.2	57	Moist Conditions
11/19/1974	129.9	26	Dry Conditions	05/15/1979	213	105	Moist Conditions
01/27/1975	144.1	17	Dry Conditions	07/05/1979	603.9	75	Moist Conditions
02/25/1975	137	16	Dry Conditions	04/15/1980	139.8	84	Moist Conditions
04/21/1976	158.3	34	Dry Conditions	04/20/1982	132	70	Moist Conditions
09/20/1977	227.2	26	Dry Conditions	10/19/1982	220.1	90	Moist Conditions
01/18/1978	132.7	19	Dry Conditions	04/26/1983	149.1	89	Moist Conditions
02/27/1978	144.1	19	Dry Conditions	04/16/1985	184.6	94	Moist Conditions
08/29/1978	184.6	24	Dry Conditions	10/21/1986	177.5	67	Moist Conditions
09/19/1978	660.8	23	Dry Conditions	07/18/1995	305.4	75	Moist Conditions
10/18/1978	198.8	26	Dry Conditions	07/10/1996	269.9	63	Moist Conditions
11/29/1978	156.2	26	Dry Conditions	07/22/1997	3610.2	79	Moist Conditions
12/19/1978	151.2	24	Dry Conditions	07/20/1998	1122.7	65	Moist Conditions
08/22/1979	355.2	29	Dry Conditions	07/21/1999	341	78	Moist Conditions

Table 2. Samples collected from LEWCLARLAC2 continued.

Date	*E. coli* (cfu/100 ml)	Flow	Flow Zone	Date	*E. coli* (cfu/100 ml)	Flow	Flow Zone
01/17/1984	170.4	35	Dry Conditions	05/29/2003	69.5	57	Moist Conditions
09/19/1979	412	19	Dry Conditions	07/19/2000	383.6	75	Moist Conditions
10/12/1979	305.4	25	Dry Conditions	07/09/2001	97.7	144	Moist Conditions
07/16/1985	746.1	17	Dry Conditions	07/01/2003	37.6	92	Moist Conditions
07/15/2002	22.8	22	Dry Conditions	07/01/2003	62.2	92	Moist Conditions
07/15/2002	22.8	22	Dry Conditions	03/29/2004	579	157	Moist Conditions
07/15/2003	93.3	26	Dry Conditions	05/13/2004	1200	71	Moist Conditions
07/15/2003	93.3	26	Dry Conditions	04/13/2005	1730	114	Moist Conditions
07/17/2003	30.5	22	Dry Conditions	05/12/2009	1200	103	Moist Conditions
07/23/2003	3	19	Dry Conditions	05/12/2009	1200	103	Moist Conditions
07/30/2003	45.2	17	Dry Conditions	05/26/2010	345	112	Moist Conditions
08/20/2003	198	17	Dry Conditions	05/26/2010	345	112	Moist Conditions
07/13/2004	166	28	Dry Conditions	03/27/1969	127.7	450	High
07/13/2004	166	28	Dry Conditions	03/31/1977	205.9	239	High
07/18/2007	195	28	Dry Conditions	04/21/1977	6666.2	605	High
07/18/2007	195	28	Dry Conditions	03/29/1978	134.9	249	High
08/13/2009	99.6	31	Dry Conditions	04/19/1978	1335.9	595	High
08/13/2009	99.6	31	Dry Conditions	03/28/1979	149.1	199	High
08/24/2010	80	35	Dry Conditions	04/12/1979	262.8	188	High
08/24/2010	80	35	Dry Conditions	06/19/1979	1335.9	197	High
10/30/1973	134.9	46	Mid-range	07/19/1983	838.4	620	High
05/25/1976	980.6	54	Mid-range	04/17/1984	149.1	481	High
07/21/1977	838.4	43	Mid-range	04/13/1987	341	387	High
08/18/1977	1549.1	36	Mid-range	07/13/1987	1122.7	185	High
10/18/1977	170.4	40	Mid-range	06/25/2003	2420	220	High
07/19/1978	234.3	40	Mid-range	06/10/2004	1200	170	High
01/28/1980	129.9	40	Mid-range	04/26/2005	1050	330	High
05/06/1982	133.4	47	Mid-range	04/27/2005	1	259	High
10/18/1983	298.3	42	Mid-range	06/15/2005	866	606	High
07/17/1984	241.5	51	Mid-range				

4.1 Flow Data

USGS gaging station 06464500 located at LEXCLARLAC2 provided continuous daily discharge data from 1937 until present (Figure 5).

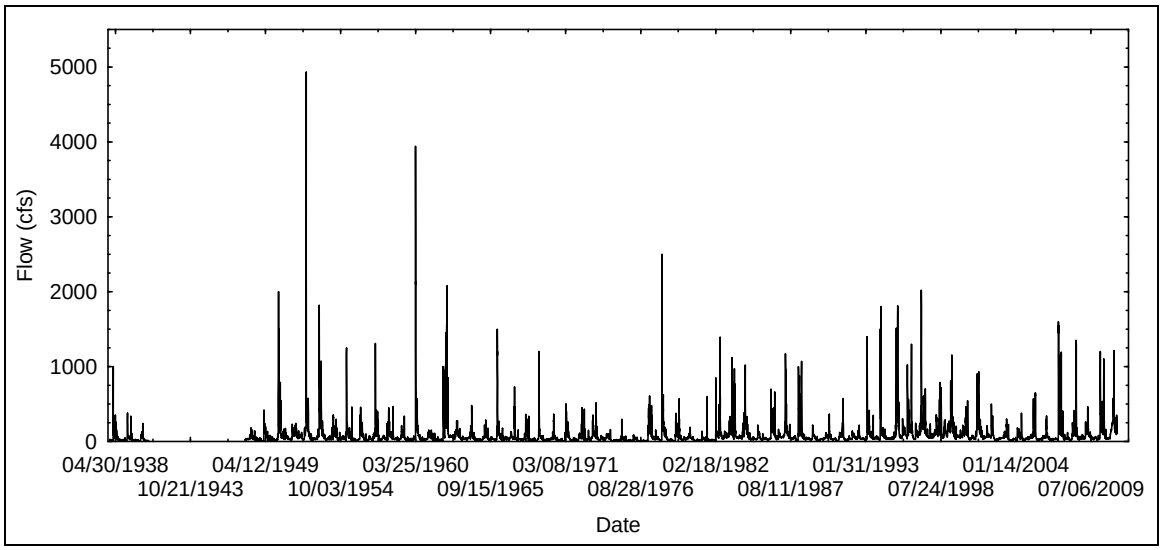

Figure 5. USGS gaging station 06464500 (LEWCLARLAC2) flow record

Flow data used in creating the load duration curve for LEWCLARLAC2 (Figure 6) and calculating total maximum daily loads were collected from USGS gage stations. Samples were paired up with corresponding average daily discharge for the sample date. All samples collected from both the Lewis and Clark Assessment Project or from ambient water quality monitoring were able to be paired up with average daily discharges.

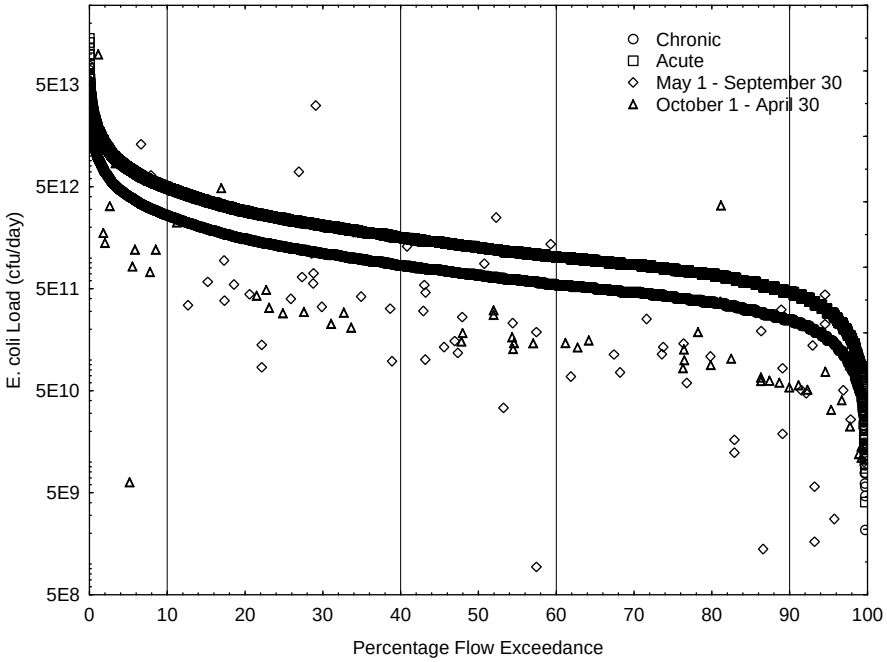

Figure 6. LEWCLARLAC2 Load Duration Curve.

5.0 Significant Sources

5.1 Point Sources

There are no point sources to the Keya Paha River within South Dakota.

5.2 Nonpoint Sources

Nonpoint sources of *E. coli* bacteria come primarily from agricultural land use. Table 3 allocates the sources for bacteria production in the watershed into three primary categories. These categories were derived from the use of the National Agricultural Statistics (NASS) data and the South Dakota Game Fish and Parks wildlife data (Huxoll, 2002). These data are further expanded in Table 6 on the following page. 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.

Table 3. *E. coli* source allocation for the Keya Paha River.

Source	Percentage
Feedlots	33.1%
Livestock on Grass	64.3%
Wildlife	1.2%

Animal feeding operations are present within the watershed. Tripp County has an estimated 140,000 head of cattle with permitted animal feeding operations having the potential of holding a maximum population of over 40,000 animals. The permitted (zero discharge) facilities account for the majority of the animals allocated to the feedlots in Table 3. It is possible that some smaller operations do contribute to the bacteria counts measured in the river; but it is more likely that livestock utilizing the stream are the primary source of bacteria. Evidence of this is available in the load duration curve located in Figure 6 which indicates that elevated counts occur throughout all flow regimes. There are no municipalities or other point sources that discharge to the Keya Paha River. Septic systems were determined to be an insignificant contributing source to the *E. coli* loads in the river based on the following information. Human *E. coli* production may be estimated at 1.95E+9 (Yagow et al, 2001). The human population of Keya Paha watershed from the 2000 census was estimated at 3,500 people, or 2 people/square mile. When included as a total load in the table, human produced *E. coli* account for less than 0.1% of all *E. coli* produced in the watershed. These bacteria should all be delivered to a septic system, which if functioning correctly would result in no *E. coli* entering the river. Table 4 on the following page lists most animal sources of *E. coli* in the Keya Paha River Watershed. Wildlife densities were generated by the SD Game Fish and Parks in the 2002 County Wildlife Assessment. Livestock data were gathered from the National Agricultural Statistics publication for 2004.

Table 4. Keya Paha River potential non-point sources of *E. coli* bacteria.

Species	#/mile	#/acre	FC/Animal/Day	FC/acre	Percent
Dairy Cow	0.8	1.30E-03	4.46E+10	5.80E+07	0.8%
Beef	110	1.70E-01	3.90E+10	6.63E+09	89.8%
Hog	24	3.80E-02	1.08E+10	4.10E+08	5.6%
Sheep	3	4.70E-03	1.96E+10	9.21E+07	1.2%
Horse	1.3	2.00E-03	5.15E+10	1.03E+08	1.4%
All Wildlife	**Sum of all Wildlife**			9.32E+07	1.3%
Turkey (Wild)[1]	1.1	1.70E-03	1.10E+08	1.87E+05	
Goose[2]	0.43	6.70E-04	7.99E+08	5.35E+05	
Deer[2]	5.09	8.00E-03	3.47E+08	2.78E+06	
Beaver[2]	1.23	1.90E-03	2.00E+05	3.80E+02	
Raccoon[2]	1.23	1.90E-03	5.00E+09	9.50E+06	
Coyote/Fox[3]	1.04	1.60E-03	1.75E+09	2.80E+06	
Muskrat[1]	0.55	8.60E-04	2.50E+07	2.15E+04	
Opossom[4]	0.61	9.50E-04	5.00E+09	4.75E+06	
Mink[4]	0.29	4.50E-04	5.00E+09	2.25E+06	
Skunk[4]	0.37	5.80E-04	5.00E+09	2.90E+06	
Badger[4]	0.21	3.30E-04	5.00E+09	1.65E+06	
Jackrabbit[4]	1.84	2.90E-03	5.00E+09	1.45E+07	
Cottontail[4]	6.14	9.60E-03	5.00E+09	4.80E+07	
Squirrel[4]	0.43	6.70E-04	5.00E+09	3.35E+06	
1 USEPA 2001					
2 Bacteria Indicator Tool Worksheet					
3 Best Professional Judgment based off of Dogs					
4 FC/animal/day copied from Raccoon to provide more conservative estimate of background effects of wildlife					

6.0 TMDL and Calculations

6.0.1 High Flows

The high flow zone includes flows that exceed 170 cfs. Seventeen samples were collected in the high flow zone. Of these two exceeded the chronic threshold but not the acute standard and three exceeded the chronic threshold and acute standard. A loading reduction of 64% is needed to bring *E. coli* concentrations into compliance with the chronic threshold. Table 5 depicts a TMDL for a flow of 924 cfs, which is the 95th percentile flow for high flows. Higher or lower flows within this zone may acceptably carry higher or lower flows as long as the concentration does not exceed the state standard.

The concentration of 1178 cfu/100 ml represents the acute standard threshold. This may make an appropriate target because flows in excess of 924 cfs typically last for short periods of time.

While the acute threshold would have made an appropriate goal, a chronic threshold of 630 cfu/100 ml was used. Chronic exceedences are not likely in this flow zone but using the chronic threshold helps to ensure that water quality violations will be less likely.

Table 5. TMDL calculation for high flows of the Keya Paha River.

	Flow Zone (expressed as CFU/Day)	
	High Flows	
	>170 cfs	
LA	1.3E+16	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	1.4E+12	
TMDL @ 1000 cfu/100 ml	1.3E+16	Standard multiplied by 95th% flow by zone.
Current Load	3.6E+16	95th% of observed *E. coli* bacteria load for each zone multiplied by 95th% flow for zone.
Load Reduction	64%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.0.2 Moist Conditions

The moist condition flow zone occurs from 170 cfs to 55 cfs. Within this flow zone 35 samples were collected. One sample exceeded the chronic threshold but not the acute standard and six samples exceeded both the chronic threshold and the acute standard. At a flow of 154 cfs (95th percentile flow) a load reduction of 57% will be needed to bring *E. coli* concentrations into compliance with the chronic standard (Table 6). Using the chronic threshold as a target helps to ensure that both the acute and chronic standards will not be violated. Flows higher or lower than 154 cfs can acceptably carry higher or lower loads as long as the concentration does not exceed the state standard.

Table 6. TMDL calculation for moist conditions of the Keya Paha River.

	Flow Zone (expressed as CFU/Day)	
	Moist Conditions 170 - 55 cfs	
LA	3.7E+14	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	4.5E+11	
TMDL @ 1000 cfu/100 ml	3.7E+14	Standard multiplied by 95th% flow by zone.
Current Load	8.5E+14	95th% of observed *E. coli* bacteria load for each zone multiplied by 95th% flow for zone.
Load Reduction	57%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.0.3 Mid-range Flows

The mid-range flow zone is characterized by discharges ranging from 55 to 36 cfs. Twenty seven samples were collected within the mid-range flow zone. Two of these samples exceeded the chronic threshold but not the acute standard. Two samples exceeded both the chronic threshold and the acute standard. A reduction of 38% will be needed to meet the chronic threshold. A flow of 54 cfs (95th percentile) was used in calculating the TMDL (Table 7). Higher or lower flows can carry higher or lower loads as long as concentrations do not violate state standards.

Table 7. TMDL calculation of mid-range flows of the Keya Paha River.

	Flow Zone (expressed as CFU/Day)	
	Mid-range Flows 55 - 36 cfs	
LA	4.5E+13	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	1.2E+11	
TMDL @ 1000 cfu/100 ml	4.5E+13	Standard multiplied by 95th% flow by zone.
Current Load	7.3E+13	95th% of observed *E. coli* bacteria load for each zone multiplied by 95th% flow for zone.
Load Reduction	38.06%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.0.4 Dry Conditions

Dry conditions encompass flows of 36 to 16 cfs. Thirty eight samples were collected within the flow zone. Two samples exceeded the chronic threshold but not the acute

standard and one exceeded both the chronic threshold and the acute standard. A flow of 35 cfs (95th percentile) was used in calculating the TMDL (Table 8). No reduction is needed to meet the chronic threshold despite the three samples that violated the chronic threshold. We chose to use the chronic threshold as a target as it helps ensure that both the chronic and the acute standards will be met. Higher or lower flows within the dry condition zone may acceptably carry higher or lower loads as along as the concentration does not exceed state standards.

Table 8. TMDL calculation of dry conditions of the Keya Paha River.

	Flow Zone (expressed as CFU/Day)	
	Dry Conditions 36 - 16 cfs	
LA	1.9E+13	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	1.7E+11	
TMDL @ 1000 cfu/100 ml	1.9E+13	Standard multiplied by 95th% flow by zone.
Current Load	1.1E+13	95th% of observed *E. coli* bacteria load for each zone multiplied by 95th% flow for zone.
Load Reduction	0.00%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.0.5 Low Flows

Low flows occur from 16 to 0 cfs. Twenty two samples were collected from this flow zone. One sample exceeded the chronic threshold but not the acute standard and one sample exceeded both the chronic threshold but not the acute standard. No reduction in current loading is required to meet the chronic threshold based on the available data. A flow of 16 cfs (95th percentile) was used in calculating the TMDL (Table 9). Higher or lower flows within this zone may acceptably carry higher or lower loads as long as state standards are not violated.

Table 9. TMDL calculation for dry conditions of the Keya Paha River.

	Flow Zone (expressed as CFU/Day)	
	Dry Conditions	
	16 - 0 cfs	
LA	3.8E+12	Remaining load after deducting MOS and WLA from TMDL.
WLA	0	
MOS	1.5E+11	
TMDL @ 1000 cfu/100 ml	3.9E+12	Standard multiplied by 95th% flow by zone.
Current Load	3.5E+12	95th% of observed *E. coli* bacteria load for each zone multiplied by 95th% flow for zone.
Load Reduction	0.00%	Reduction of *E. coli* loading required of current loads to equal the load at the standard.

6.1 Wasteload Allocations (WLAs)

There are no point sources within this watershed. A WLA of 0 was therefore used in the TMDL calculation.

6.2 Load Allocations (LAs)

Approximately 99% of the watershed is comprised of agricultural land use. *E. coli* loading is attributed to these sources.

Site LEWCLARLAC2 occurs within the lower part of the watershed. In the high flow zone at this site a reduction of 64% will be needed to meet the chronic threshold. A 57% reduction is needed in the moist condition flow zone. A 38% reduction is needed in the mid-range flow zone. No reduction is needed in the dry condition or the low flow zone.

7.0 Seasonality

LEWCLARLAC2 displayed distinct seasonality in terms of *E. coli* concentrations and flow. Flow tended to rise in late winter and peak during the spring (Figure 7). *E. coli* concentrations were highest during May and June and declined later on in the summer. Snow cover and spring runoff lead to increased flows during late winter and early spring. Spring showers create runoff which carries fecal matter into the Keya Paha River resulting in elevated *E. coli* concentrations. Spring and early summer is also a time of peak recreational use of the Keya Paha River. This fact coupled with elevated *E. coli* concentrations makes spring and early summer a critical time in which to reduce loading.

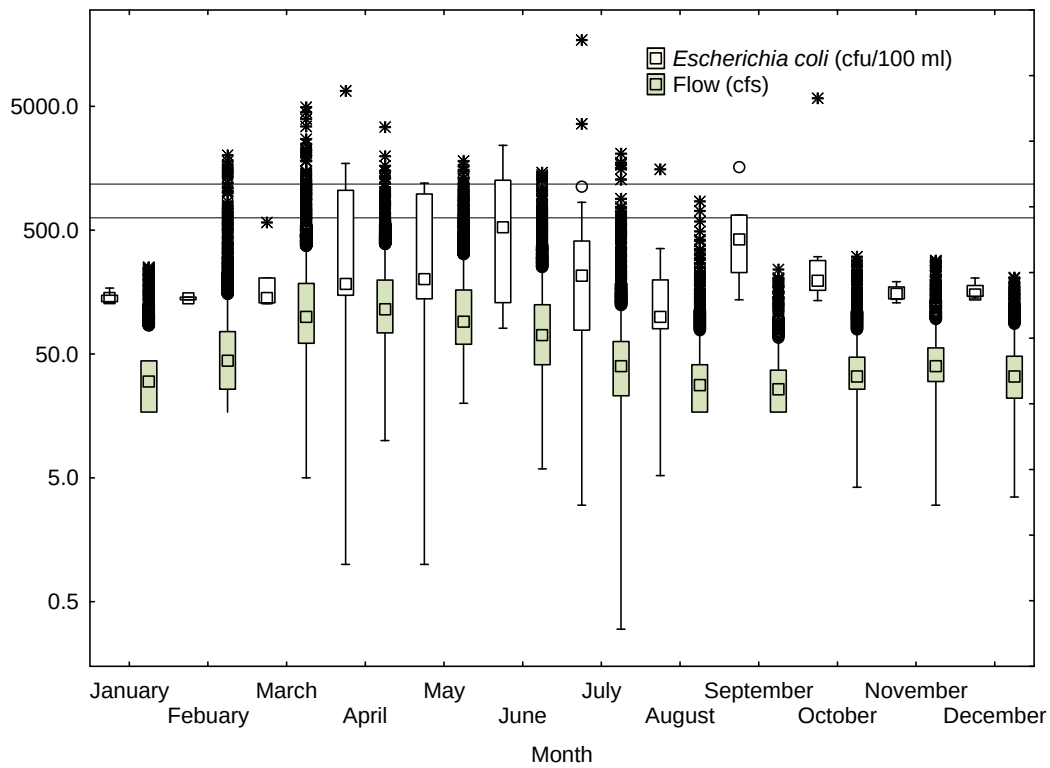

Figure 7. LEWCLARLAC2 flow and *E. coli* seasonality.

8.0 Margin of Safety (MOS)

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

9.0 Follow-Up Monitoring and TMDL Review

It is critical that monitoring of the *E. coli* concentrations be conducted during the implementation of best management practices at both the start and end of the listed segment. These data will provide information on the effectiveness of the BMPs.

The Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances that are developed or come to light during the implementation of the TMDL and a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment of the load and waste load allocation will only be made following an opportunity for public participation. New

information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information and land use information. The Department will propose adjustments only in the event that any adjusted LA or WLA will not result in a change to the loading capacity; the adjusted TMDL, including its WLAs and LAs, will be set at a level necessary to implement the applicable water quality standards; and any adjusted WLA will be supported by a demonstration that load allocations are practicable. The Department will notify EPA of any adjustments to this TMDL within 30 days of their adoption.

The Lewis and Clark Watershed Implementation Project will continue to monitor the water quality of the Keya Paha River at Site 460815. In addition, project effectiveness will be measured by using models such as AnnAGNPS, RUSLE2, and STEPL.

10.0 Public Participation

The project was presented at various meetings during the assessment period. A website was also developed. The project was not limited by state boundaries and had many partners from both South Dakota and Nebraska. Randall Resource, Conservation, and Development Associated, INC, (RC&D) was a lead sponsor. Other sponsors include:

- *South Dakota Conservation Districts*: Aurora, Bennett, Bon Homme, Charles Mix,Clearfield-Keya Paha, Douglas, Gregory, Hutchinson, Todd, Yankton

- *Nebraska Natural Resource Districts:* Lewis and Clark, Lower Niobrara, Middle Niobrara, Upper Elkhorn

- *Government:* National Park Service, Nebraska DEQ, NRCS, SD DENR, SD Department of Agriculture, SD GF&P, USACOE, USGS

- *Organizations:* Bon Homme - Yankton Rural Water, Cedar-Knox Rural Water, Cities of Yankton and Springfield, Knox Co. Commission, Lewis and Clark SD-NE Preservation Association, Rosebud Cattlemen's Association, Spring/Bull Creek Watershed District, So. Central Water Development District, Village of Niobrara, Yankton and Rosebud Sioux Tribes

- *R.C.&D's:* Badlands, Lower James, Northeast Nebraska, North Central Nebraska, South Central SD

- *Industry*: Natural Resource Solutions, Brookings, South Dakota

The findings from these public meetings and comments have been taken into consideration in development of the Keya Paha River *E. coli* TMDL.

This TMDL document will be public noticed in the following newspapers; Rapid City Journal, Burke Gazette, and Yankton Daily Press and Dakotan.

11.0 Implementation Plan

Implementation activities for the Keya Paha River watershed were incorporated within the Lewis and Clark implementation Project which covers all of the subwatersheds that drain to Lewis and Clark Lake on the Missouri River.

Best management practices that would help meet load reductions include riparian fencing, livestock rotation, off stream livestock watering, and locating feedlots away from waterways. If the above mentioned practices are implemented then it is likely that water quality standards will be met.

12.0 Literature Cited

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Huxoll, Cory, 2002, South Dakota Game Fish and Parks; South Dakota Game Report No. 2003-11; 2002 Annual Report County Wildlife Assessments with a summary of the 1991- 2002 Assessments.

SDDENR (South Dakota Department of Environment and Natural Resources). 2009. Water Quality Modeling in South Dakota, May, 2009 Revision; Pierre, SD. USEPA, 2001; Protocol for Developing Pathogen TMDLs EPA 841-R-00-002. Office of Water (4503F), United States Environmental Protection Agency, Washington DC. 132 pp.

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USDA (United States Department of Agriculture). 1979. Soil Survey of Tripp County, South Dakota.

Yagow, G., Dillaha, T., Mostaghimi, S., Brannan, K., Heatwole, C. and Wolfe, M.L. (2001). *TMDL modeling of fecal coliform bacteria with HSPF*. ASAE meeting paper No.01-2066. St.Joseph, Mich.

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Escherichia Coli Total Maximum Daily Load Evaluation for the Keya Paha River, Tripp County, South Dakota**
Submitted by:	**Cheryl Saunders, SD DENR**
Date Received:	**July 13, 2011**
Review Date:	**August 8, 2011**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Public Notice Draft**
Notes:	

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

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

Approval Notes to Administrator:

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

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

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

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

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

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

1. Problem Description

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

1.1 TMDL Document Submittal Letter

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

Minimum Submission Requirements.

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

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

☐ Each TMDL document submitted to EPA for final review and approval should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent

to submit, and EPA's duty to review, the TMDL under the statute**.** The submittal letter should contain such identifying information as the name and location of the waterbody and the pollutant(s) of concern, which matches similar identifying information in the TMDL document for which a review is being requested.

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

SUMMARY: The Keya Paha River E. coli TMDL was submitted to EPA for review via an email from Cheryl Saunders, SD DENR on July 13, 2011. The email included the draft TMDL document and a request to review and comment on the TMDL.

COMMENTS: None.

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The Keya Paha River is a stream located in Tripp County, South Dakota and is a tributary of the Niobrara River in the Keya Paha sub-basin (HUC 10150006). The River has a

total drainage area of over 1 million acres in south central South Dakota. The 303(d) listed segment of Keya Paha River includes 60 miles of the river from the Tripp and Todd County line to the Nebraska border (SD-NI-R-KEYA_PAHA_01). It is listed as high priority for TMDL development. The headwaters of the Keya Paha River are located on the Rosebud Indian Reservation in Todd County, South Dakota. However, the TMDL document only addresses the portion of the River that is located in Tripp County (see Figure 2 of the TMDL). Likewise, EPA's approval of the TMDL for the Keya Paha River is applicable only to that portion of the watershed that is not located within Indian Country.

The designated uses for Keya Paha River include warmwater semi-permanent fish life propagation waters, limited-contract recreation waters, fish and wildlife propagation, recreation, and stock watering. The segment was listed on the 2010 303(d) list for total suspended solids (TSS) which is impairing the warmwater fish life propagation uses, and for fecal coliform and E. coli bacteria which are impairing the limited contact recreation uses. The TSS and fecal coliform impairments in this segment were addressed by SDDENR in separate TMDL documents which were approved by EPA in September 2009 and February 2010 respectively.

COMMENTS: None.

1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

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

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

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

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

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

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

SUMMARY: The Keya Paha River is listed as impaired based on E. coli concentrations that are impairing the limited contact recreation beneficial uses. South Dakota has numeric standards for E. coli that are applicable to this stream segment. The E. coli numeric standards being implemented in this TMDL are: a daily maximum value of E. coli of 1178 cfu/100mL in any one sample, or a maximum geometric mean of 630 cfu/100mL during a 30-day period. Discussion of additional applicable water quality standards for Keya Paha River can be found on pages 5 and 6 of the TMDL.

COMMENTS: None.

2. Water Quality Targets

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

Minimum Submission Requirements:

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

Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. Occasionally, the pollutant of concern is different from the

parameter that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as a numerical dissolved oxygen criterion). In such cases, the TMDL should explain the linkage between the pollutant(s) of concern, and express the quantitative relationship between the TMDL target and pollutant of concern. In all cases, TMDL targets must represent the attainment of current water quality standards.

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

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

SUMMARY: The water quality target for this TMDL is based on the numeric water quality standards for E. coli established to protect the limited contact recreation beneficial use for the Keya Paha River. The target for the Keya Paha River segment included in the TMDL document is the E. coli standard expressed as the 30-day geometric mean of 630 cfu/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standards.

COMMENTS: None.

3. Pollutant Source Analysis

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

Minimum Submission Requirements:

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

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

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

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

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

SUMMARY: The TMDL document identifies the land use in the watershed as predominately agricultural consisting of cropland (42%) and grazing or pasture land (57%), with the remaining 1% of the watershed composed of water, wetlands, roads, housing and forested lands.

Table 3 allocates the sources for bacteria production in the watershed into three primary categories. These categories were derived from the use of the National Agricultural Statistics (NASS) data and the South Dakota Game Fish and Parks wildlife data. 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. There are no municipal or other point source discharges to the Keya Paha River.

Several animal feeding operations are present within the watershed. Tripp County has an estimated 140,000 head of cattle with permitted animal feeding operations having the potential of holding a maximum population of over 40,000 animals. The permitted (zero discharge) facilities account for the majority of the animals allocated to the feedlots in Table 3. It is possible that some smaller operations do contribute to the bacteria counts measured in the river, but it is more likely that livestock utilizing the stream are the primary source of bacteria. Evidence of this is shown on the load duration curve located which indicates that elevated counts occur throughout all flow regimes. Septic systems were determined to be an insignificant contributing source to the E. coli loads in the river based on the information provided in the TMDL document.

Table 3. *E. coli* source allocation for the Keya Paha River.

Source	Percentage
Feedlots	33.1%
Livestock on Grass	64.3%
Wildlife	1.2%

COMMENTS: None.

4. TMDL Technical Analysis

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

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

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

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

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

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

Minimum Submission Requirements:

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

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

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

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

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

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

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

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

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

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

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

Data on Keya Paha River was collected during the Lewis and Clark Watershed Assessment. A total of 47 paired E. coli and fecal coliform samples were collected from LEWCLARLAC2 during the Lewis and Clark Assessment Project. Modeled E. coli concentrations based on fecal coliform data collected at monitoring site 460815 added an additional 89 samples. The downstream site is where the USGS flow gage is located. The Elevation Derivatives for National Applications software was used to calculate the mean daily flow for Keya Paha River. Mean daily E. coli loadings were calculated through the use of the mean E. coli concentration, and the mean daily flow.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. The LDC was divided into 5 distinct flow regimes – high flow (≥ 170 cfs), moist flow (between 170 cfs and 55 cfs), midrange flow (between 55 cfs and 36 cfs), dry flow (between 36 cfs and 16 cfs) and low flow (< 16 cfs). The result is a flow-variable TMDL target across the flow regime shown in Figure 6 of the TMDL document. The LDC is a dynamic expression of the allowable load for any given daily flow. Loading capacities were derived from this approach at

the midpoint of each flow regime: high flow = 1.3E+16 cfu/day; moist flow = 3.7E+14 cfu/day; midrange flow = 4.5E+13 cfu/day; dry flow = 1.9E+13 cfu/day and low flow = 3.9E+12 cfu/day.

COMMENTS: None.

4.1 Data Set Description

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Keya Paha River TMDL data description and summary are included mostly in the Technical Analysis section of the document. The recent water quality monitoring was conducted over the period from May 2003 to July 2005, but the full data set includes an additional 89 fecal coliform samples collected from 1974 to the present. The data set also includes the 61 years of flow record on the Keya Paha River that was used by the Aquarius program to develop a load duration curve for this TMDL.

COMMENTS: None.

4.2 Waste Load Allocations (WLA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Keya Paha River TMDL document says that there are no municipal or other point source discharges to Keya Paha River. Therefore, the WLA for this TMDL is zero.

COMMENTS: None.

4.3 Load Allocations (LA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Load Allocations section of the TMDL explains that the landuse in the watershed is 99% agricultural. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. Tables 5 - 9 include the load allocations at each of the five flow regimes – 1.3E+16 cfu/day at high flows; 3.7E+14 cfu/day at moist flows; 4.5E+13 cfu/day at midrange flows; 1.9E+13 cfu/day at dry flows and 3.8E+12 cfu/day at low flow.

COMMENTS: None.

4.4 Margin of Safety (MOS):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Keya Paha River TMDL includes an explicit MOS derived by calculating the difference between the loading capacity at the mid-point of each of the five flow zones and the loading capacity at the minimum flow in each zone. The explicit MOS values are included in Tables 5 - 9 of the TMDL.

COMMENTS: None.

4.5 Seasonality and variations in assimilative capacity:

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

Minimum Submission Requirements:

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

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

SUMMARY: By using the load duration curve approach to develop the TMDL allocations seasonal variability in E. coli loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months. Also, the E. coli standard only applies to streams from May 1 through September 30, which is the season that the TMDL addresses.
COMMENTS: None.

5. Public Participation

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

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

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

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

SUMMARY: The State's submittal includes a summary of the public participation process that has occurred which describes the ways the public has been given an opportunity to be involved in the TMDL development process so far. In particular, the State has encouraged participation through public meetings in the watershed, and a website was developed and maintained throughout the project. The TMDL was available for a 30-day public notice period prior to finalization. The final document included a summary of the comments received and the State's response to each comment.

COMMENTS: None.

6. Monitoring Strategy

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

Minimum Submission Requirements:

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

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

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

SUMMARY: Keya Paha River should continue to be monitored as part of the Lewis and Clark Implementation Project. Post-implementation monitoring will be necessary to assure the TMDL has been reached and maintenance of the beneficial use occurs.

COMMENTS: None.

7. Restoration Strategy

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

Minimum Submission Requirements:

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

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

SUMMARY: The Implementation Plan section of the TMDL document says that an implementation plan has already been developed for all of the subwatersheds that drain to Lewis and Clark Lake. Since there are no point sources in the Keya Paha River watershed there is no need to include a discussion of reasonable assurance in this TMDL document.

COMMENTS: None.

8. Daily Loading Expression

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

the TMDL analysis. The level of effort spent to develop the daily load indicator should be based on the overall utility it can provide as an indicator for the total load reductions needed.

Minimum Submission Requirements:

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

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

SUMMARY: The Keya Paha River E. coli TMDL includes daily loads expressed as colonies per day. The daily TMDL loads are included in TMDL and Allocations section of the TMDL document.

COMMENTS: None.

Kay

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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RECEIVED

SEP 22 2011

SEP 26 2011

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

Ref: 8EPR-EP

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

Re: TMDL Approvals
Keya Paha River, E. coli;
SD-NI-R-KEYA_PAHA_01

Dear Mr. Pirner:

We have completed our review of the total maximum daily loads (TMDLs) as submitted by your office for the waterbodies listed in the enclosure to this letter. In accordance with the Clean Water Act (33 U.S.C. 1251 *et. seq.*), we approve all aspects of the TMDL(s) referenced above as developed for the water quality limited waterbodies as described in Section 303(d)(1). Based on our review, we feel the separate elements of the TMDL(s) listed in the enclosed table adequately address the pollutants of concern as given in the table, taking into consideration seasonal variation and a margin of safety.

Thank you for submitting these TMDLs for our review and approval. If you have any questions, the most knowledgeable person on my staff is Vern Berry and he may be reached at 303-312-6234.

Sincerely,

Carol L. Campbell

Carol L. Campbell
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Enclosures

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ENCLOSURE 1: APPROVED TMDLs

Escherichia Coli Total Maximum Daily Load Evaluation for the Keya Paha River, Trip County, South Dakota (SD DENR, June 2011)

Submitted: 8/9/2011

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

Segment: Keya Paha River from the Nebraska border upstream to the Tripp and Todd County line

303(d) ID: SD-NI-R-KEYA PAHA 01

Parameter/Pollutant (303(d) list cause): E. COLI - 227

Water Quality Targets: <= 630 cfu/100 mL

Allocation*	Value	Units	Permits
WLA	0	CFU/DAY	
LA	3.7E+14	CFU/DAY	
TMDL	3.7E+14	CFU/DAY	
MOS	4.5E+11	CFU/DAY	

Notes: Loads shown represent the loads during the moist flow regime as defined by the load duration curve for the Keya Paha River (see Table 6 in the TMDL document). The moist range flows are when significant differences occur between the existing loads and the target loads, and represent the flow regime that is most likely to be targeted for BMP implementation.

* LA = Load Allocation, WLA = Wasteload Allocation, MOS = Margin of Safety, TMDL = sum(WLAs) + sum(LAs) + MOS

ENCLOSURE 2

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Escherichia Coli Total Maximum Daily Load Evaluation for the Keya Paha River, Tripp County, South Dakota**
Submitted by:	**Rich Hanson, SD DENR**
Date Received:	**August 9, 2011**
Review Date:	**September 20, 2011**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Final**
Notes:	

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

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

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

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

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

Under Section 303(d) of the Clean Water Act, waterbodies that are not attaining one or more water quality standard (WQS) are considered "impaired." When the cause of the impairment is determined to be a pollutant, a TMDL analysis is required to assess the appropriate maximum allowable pollutant loading rate. A TMDL

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

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

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

1. Problem Description

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

1.1 TMDL Document Submittal Letter

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

Minimum Submission Requirements.

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

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

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

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

SUMMARY: The Keya Paha River E. coli TMDL was submitted to EPA for review and approval via an email from Rich Hanson, SD DENR on August 9, 2011. The email included the final TMDL document and a letter requesting approval of the TMDL.

COMMENTS: None.

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The Keya Paha River is a stream located in Tripp County, South Dakota and is a tributary of the Niobrara River in the Keya Paha sub-basin (HUC 10150006). The River has a total drainage area of over 1 million acres in south central South Dakota. The 303(d) listed segment of Keya Paha River includes 60 miles of the river from the Tripp and Todd County line to the Nebraska border (SD-NI-R-KEYA_PAHA_01). It is listed as high priority for TMDL development. The headwaters of the Keya Paha River are located on the Rosebud Indian Reservation in Todd County, South Dakota. However, the TMDL document only addresses the portion of the River that is located in Tripp County (see Figure 2 of the TMDL). Likewise, EPA's approval of the TMDL for the Keya Paha River is applicable only to that portion of the watershed that is not located within Indian Country.

The designated uses for Keya Paha River include warmwater semi-permanent fish life propagation waters, limited-contract recreation waters, fish and wildlife propagation, recreation, and stock watering. The segment was listed on the 2010 303(d) list for total suspended solids (TSS) which is impairing the warmwater fish life propagation uses, and for fecal coliform and E. coli bacteria which are impairing the limited contact recreation uses. The TSS and fecal coliform impairments in this segment were addressed by SDDENR in separate TMDL documents which were approved by EPA in September 2009 and February 2010 respectively.

COMMENTS: None.

1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

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

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

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

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

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

Recommendation:

☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

SUMMARY: The Keya Paha River is listed as impaired based on E. coli concentrations that are impacting the limited contact recreation beneficial uses. South Dakota has numeric standards for E. coli that are applicable to this stream segment. The E. coli numeric standards being implemented in this TMDL are: a daily maximum value of E. coli of 1178 cfu/100mL in any one sample, or a maximum geometric mean of 630 cfu/100mL during a 30-day period. Discussion of additional applicable water quality standards for Keya Paha River can be found on pages 5 and 6 of the TMDL.

COMMENTS: None.

2. Water Quality Targets

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The water quality target for this TMDL is based on the numeric water quality standards for E. coli established to protect the limited contact recreation beneficial use for the Keya Paha River. The TMDL target for the impaired stream segment is: 630 cfu/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standards.

COMMENTS: None.

3. Pollutant Source Analysis

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

Minimum Submission Requirements:

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

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

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

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

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

SUMMARY: The TMDL document identifies the land use in the watershed as predominately agricultural consisting of cropland (42%) and grazing or pasture land (57%), with the remaining 1% of the watershed composed of water, wetlands, roads, housing and forested lands.

Table 3, excerpted from the TMDL document below, allocates the sources for bacteria production in the watershed into three primary categories. These categories were derived from the use of the National Agricultural Statistics (NASS) data and the South Dakota Game Fish and Parks wildlife data. 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. There are no municipal or other point source discharges to the Keya Paha River.

Several animal feeding operations are present within the watershed. Tripp County has an estimated 140,000 head of cattle with permitted animal feeding operations (AFOs) having the potential of holding a maximum population of over 40,000 animals. The permitted (zero discharge) facilities account for the majority of the animals allocated to the feedlots in Table 3. It is possible that smaller AFOs also contribute to the bacteria counts measured in the river, but it is more likely that livestock utilizing the stream are the primary source of bacteria. Evidence of this is shown on the load duration curve located which indicates that elevated counts occur throughout all flow regimes. Septic systems were determined to be an insignificant contributing source to the E. coli loads in the river based on the information provided in the TMDL document.

Table 3. *E. coli* source allocation for the Keya Paha River.

Source	Percentage
Feedlots	33.1%
Livestock on Grass	64.3%
Wildlife	1.2%

COMMENTS: None.

4. TMDL Technical Analysis

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

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

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

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

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

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

Minimum Submission Requirements:

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

☒ The total loading capacity of the waterbody should be clearly demonstrated to equate back to the pollutant load allocations through a balanced TMDL equation. In instances where numerous LA, WLA and seasonal TMDL capacities

make expression in the form of an equation cumbersome, a table may be substituted as long as it is clear that the total TMDL capacity equates to the sum of the allocations.

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

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

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

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

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

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

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

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

Data on Keya Paha River was collected during the Lewis and Clark Watershed Assessment. A total of 47 paired E. coli and fecal coliform samples were collected from monitoring site LEWCLARLAC2 during the Lewis and Clark Assessment Project. Modeled E. coli concentrations derived from fecal coliform data collected at monitoring site 460815 added an additional 89 samples. The Elevation Derivatives for National Applications software was used to calculate the mean daily flow for Keya Paha River. Mean daily E. coli loadings were calculated through the use of the mean E. coli concentration, and the mean daily flow.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. The LDC was divided into 5 distinct flow regimes – high flow (≥ 170 cfs), moist flow (between 170 cfs and 55 cfs), midrange flow (between 55 cfs and 36 cfs), dry flow (between 36 cfs and 16 cfs) and low flow (< 16 cfs). The result is a flow-variable TMDL target across the flow regime shown in Figure 6 of the TMDL document. The LDC is a dynamic expression of the allowable load for any given daily flow. Loading capacities were derived from this approach at the midpoint of each flow regime: high flow = 1.3E+16 cfu/day; moist flow = 3.7E+14 cfu/day; midrange flow = 4.5E+13 cfu/day; dry flow = 1.9E+13 cfu/day and low flow = 3.9E+12 cfu/day.

COMMENTS: None.

4.1 Data Set Description

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Keya Paha River TMDL data description and summary are included mostly in the Technical Analysis section of the document. The recent water quality monitoring was conducted over the period from May 2003 to July 2005, but the full data set includes an additional 89 fecal coliform samples collected from 1974 to the present. The data set also includes the 61 years of flow record on the Keya Paha River that was used by the Aquarius program to develop a load duration curve for this TMDL.

COMMENTS: None.

4.2 Waste Load Allocations (WLA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Keya Paha River TMDL document says that there are no municipal or other point source discharges to Keya Paha River. Therefore, the WLA for this TMDL is zero.

COMMENTS: None.

4.3 Load Allocations (LA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Load Allocations section of the TMDL explains that the landuse in the watershed is 99% agricultural. Therefore the majority of the loading capacity has been allocated to the nonpoint sources in the form of load allocations. Tables 5 - 9 include the load allocations at each of the five flow regimes – 1.3E+16 cfu/day at high flows; 3.7E+14 cfu/day at moist flows; 4.5E+13 cfu/day at midrange flows; 1.9E+13 cfu/day at dry flows and 3.8E+12 cfu/day at low flow.

COMMENTS: None.

4.4 Margin of Safety (MOS):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Keya Paha River TMDL includes an explicit MOS derived by calculating the difference between the loading capacity at the mid-point of each of the five flow zones and the loading capacity at the minimum flow in each zone. The explicit MOS values are included in Tables 5 - 9 of the TMDL.

COMMENTS: None.

4.5 Seasonality and variations in assimilative capacity:

The TMDL relationship is a factor of both the loading rate of the pollutant to the waterbody and the amount of pollutant the waterbody can assimilate and still attain water quality standards. Water quality standards often vary

based on seasonal considerations. Therefore, it is appropriate that the TMDL analysis consider seasonal variations, such as critical flow periods (high flow, low flow), when establishing TMDLs, targets, and allocations.

Minimum Submission Requirements:

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

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

SUMMARY: By using the load duration curve approach to develop the TMDL allocations seasonal variability in E. coli loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months. Also, the E. coli standard only applies to streams from May 1 through September 30, which is the season that the TMDL addresses.

COMMENTS: None.

5. Public Participation

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

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

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

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

SUMMARY: The Public Participation section of the TMDL document describes the public participation process that has occurred during the development of the TMDL. In particular, the State has encouraged participation through public meetings in the watershed, and a website was developed and maintained throughout the project. The TMDL was available for a 30-day public notice period prior to finalization. The final document included a summary of the comments received and the State's response to each comment.

COMMENTS: None.

6. Monitoring Strategy

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

Minimum Submission Requirements:

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

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

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

SUMMARY: Keya Paha River should continue to be monitored as part of the Lewis and Clark Implementation Project. Post-implementation monitoring will be necessary to assure the TMDL has been reached and maintenance of the beneficial use occurs.

COMMENTS: None.

7. Restoration Strategy

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

Minimum Submission Requirements:

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

for in the document, may be included in the implementation/restoration section of the TMDL document to support a demonstration of "reasonable assurance".

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

SUMMARY: The Implementation Plan section of the TMDL document says that an implementation plan has already been developed for all of the subwatersheds that drain to Lewis and Clark Lake. Since there are no point sources in the Keya Paha River watershed there is no need to include a discussion of reasonable assurance in this TMDL document.

COMMENTS: None.

8. Daily Loading Expression

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

Minimum Submission Requirements:

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

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

SUMMARY: The Keya Paha River E. coli TMDL includes daily loads expressed as colonies per day. The daily TMDL loads are included in TMDL and Allocations section of the TMDL document.

COMMENTS: None.