E. coli Bacteria TMDL for the Souris River in McHenry County, North Dakota

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1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

The Souris, or Mouse, River originates in the Yellow Grass Marshes north of Weyburn, Saskatchewan, Canada, and flows southeast, crossing the northern boundary of North Dakota west of Sherwood, North Dakota. It then forms a loop and flows back north, entering Manitoba, Canada near Westhope, North Dakota. The river eventually flows into the Assiniboine River near Brandon, Manitoba (Figure1). A map of the entire Souris River watershed can be found in Appendix A. Flow in the upper Souris River is regulated by three reservoirs in Canada (Boundary Reservoir, 48,990 acre-ft; Rafferty Reservoir, 356,400 acre-ft; and Alameda Reservoir, 85,560 acre-ft), as well as one reservoir in the United States managed by the U.S. Fish and Wildlife Service (Lake Darling Reservoir, 110,000 acre-ft). Additionally, some diversions for irrigation and municipal supply exist along the river.

The Total Maximum Daily Load (TMDL) listed segment (ND-09010003-001-S_00) of this river is located in McHenry County in north central North Dakota (Figure 2). It consists of 51 miles of the Souris River from the confluence with Oak Creek to the confluence with Wintering River. Its watershed has an area of approximately 139,709 acres (Figure 3). Table 1 summarizes some of the geographical, hydrological and physical characteristics of this TMDL listed segment of the Souris River.

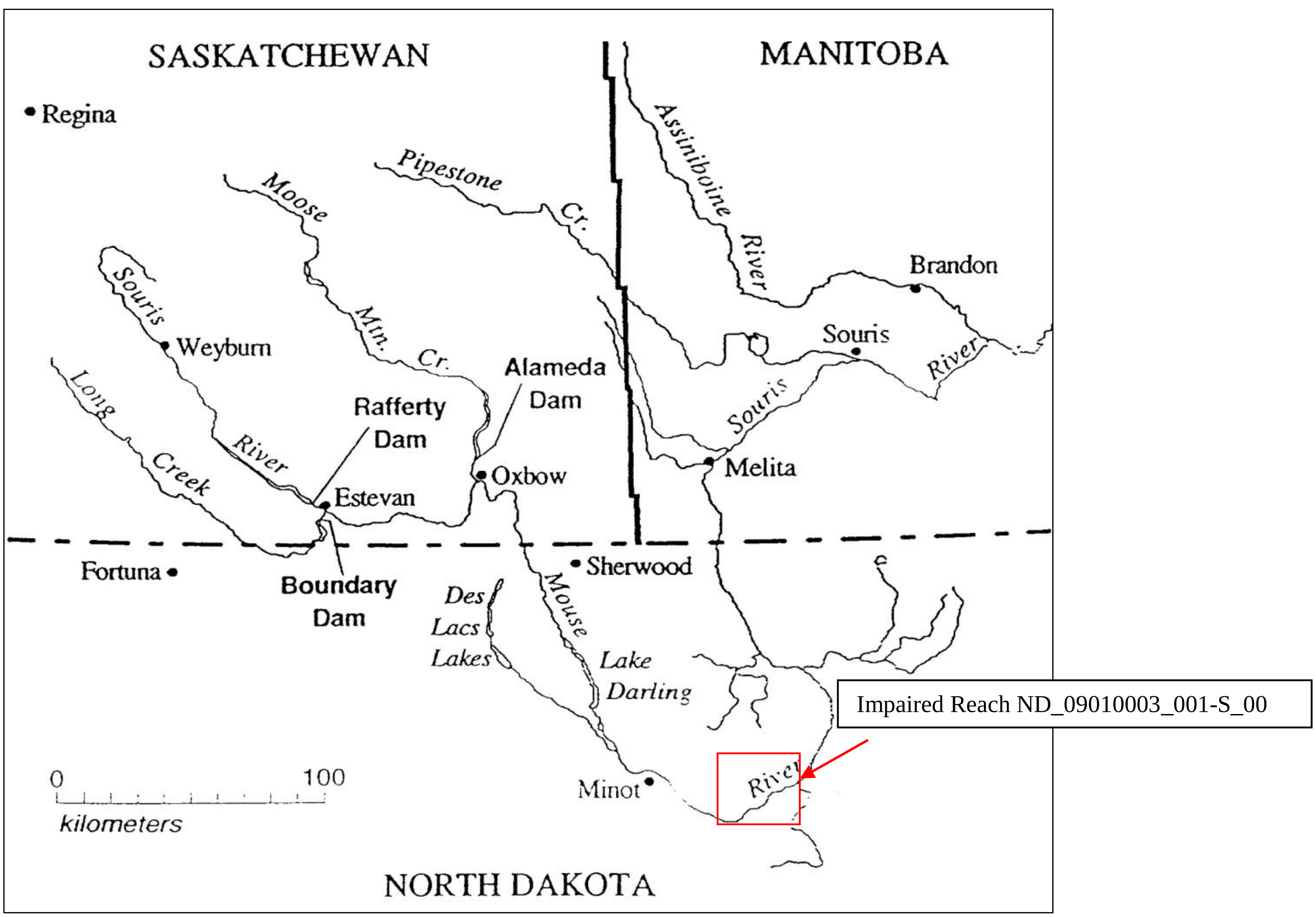

Figure 1. Souris River and TMDL Impaired Reach.

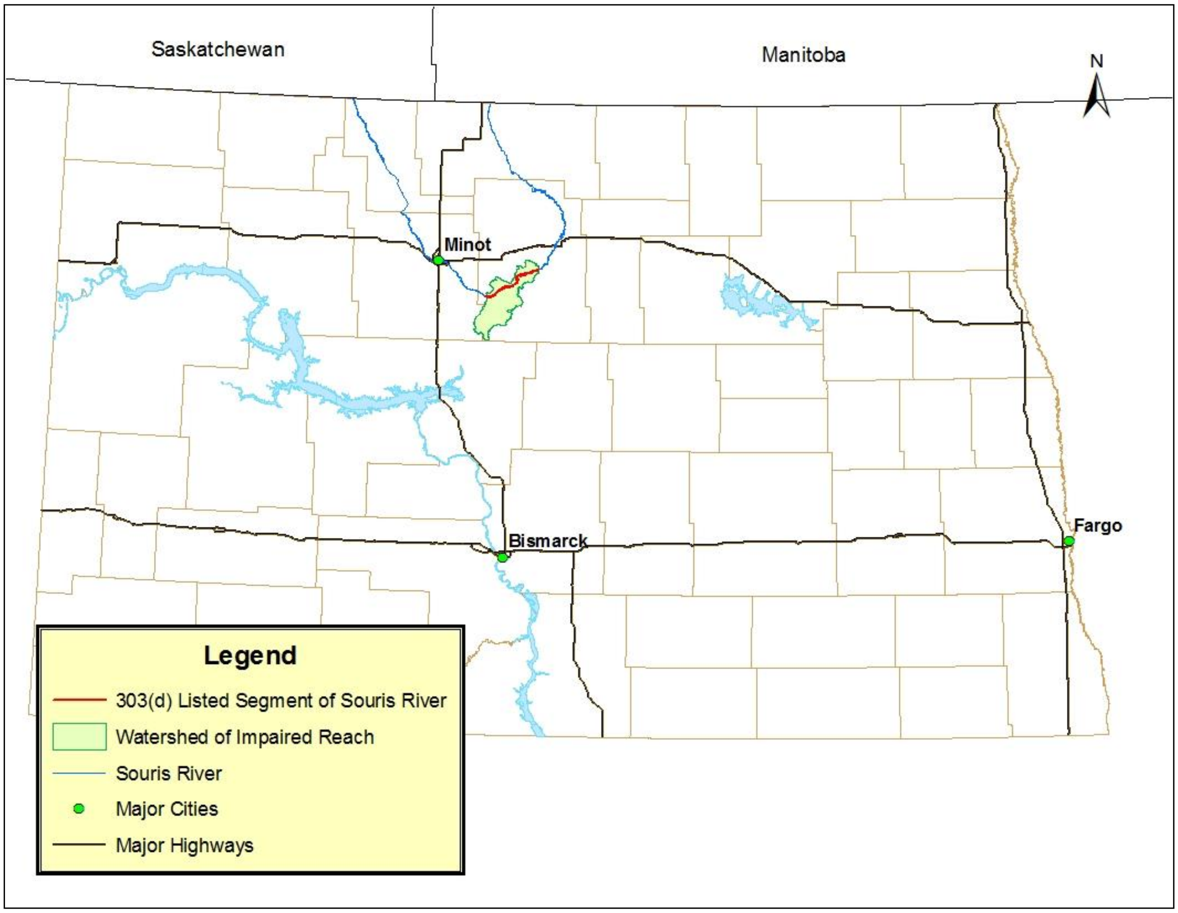

Figure 2. Location of Souris River in North Dakota.

Table 1. General Characteristics of the Souris River and Its Watershed.

Legal Name	Souris (Mouse) River[1]
Stream Classification	Class IA
Major Drainage Basin	Souris (Mouse) River[1]
8 Digit HUC	09010003
County	McHenry County, ND
Ecoregion: Level III	Level III: Northwestern Glaciated Plains (42) and Northern Glaciated Plains (46)
Ecoregion: Level IV	Level IV: Missouri Coteau (42a), Glacial Lake Basins (46c), Glacial Lake Deltas (46(d), Northern Black Prairie (46g), and Drift Plains (46i)
Watershed Area	139,709 acres
River Miles	51 miles

[1] Local legislation passed that determined the river shall be called Mouse River on all identifiable signs. It is also known as the Souris River in Canada and to many state and federal agencies within North Dakota

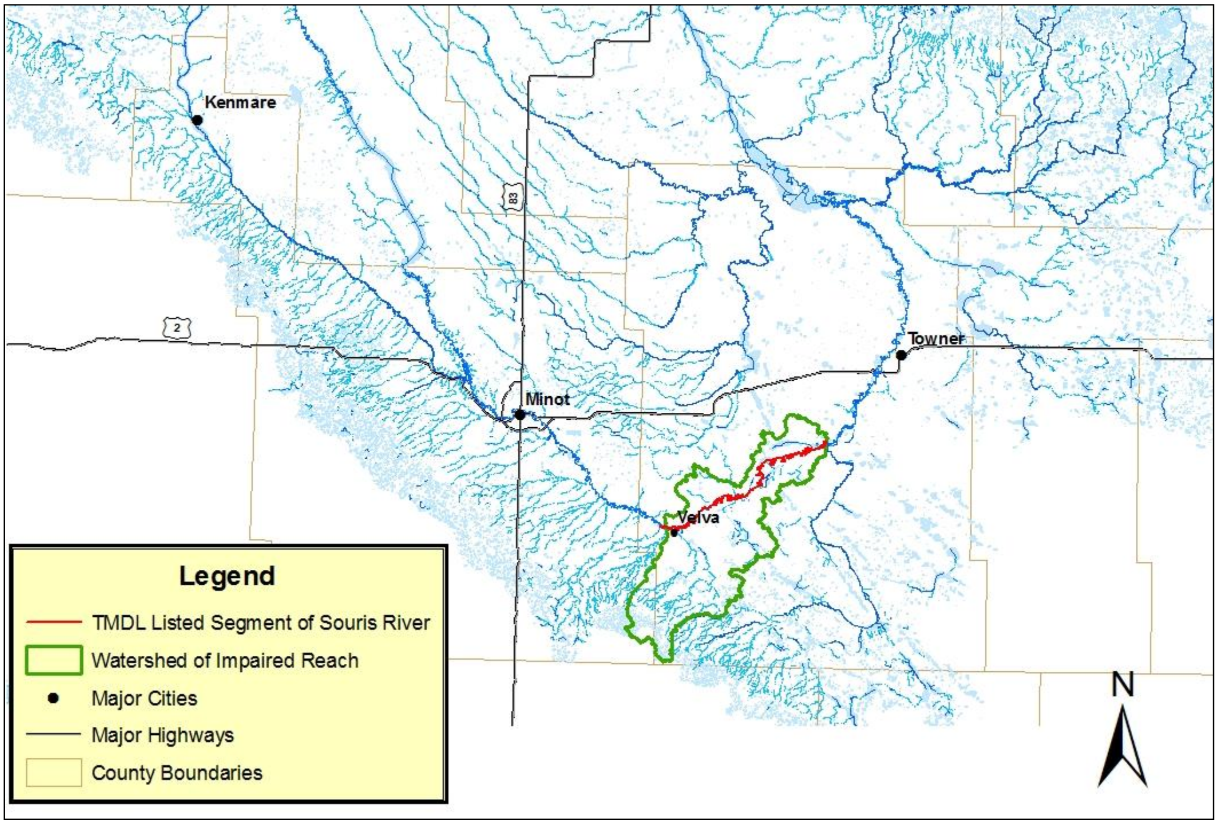

Figure 3. Location of the TMDL Listed Segment of the Souris River and Its Watershed.

1.1 Clean Water Act Section 303(d) Listing Information

Based on the 2010 Section 303(d) list of impaired waters needing TMDLs, the North Dakota Department of Health (NDDoH) has identified segment ND-09010003-001-S_00 of the Souris River as fully supporting, but threatened for recreational beneficial uses due fecal coliform bacteria (Table 2). It is also listed as fully supporting, but threatened for aquatic life beneficial uses due to sedimentation. This impairment will be addressed in a separate TMDL report.

While this segment of the Souris River is listed in the 303(d) report as being impaired due to fecal coliform bacteria, North Dakota water quality standards for bacteria have been changed since the listing to E. coli bacteria to reflect current information on human health hazards. Data in this report are provided to indicate that this segment is also impaired due to E. coli bacteria, and an E. coli TMDL target will be given to reflect compliance with current water quality standards. Meeting the E. coli target will result in having the recreation beneficial use restored to this segment of the Souris River.

Table 2. 2010 Section 303(d) TMDL Listing Information for Souris River, Assessment Unit ID ND-09010003-001-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-09010003-001-S_00
Waterbody Description	Souris River from the confluence with Oak Creek to the confluence with Wintering River, McHenry County, ND.
Size	51 miles
Impaired Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

1.2 Topography

This watershed is characterized as glaciated and generally flat, with occasional "washboard" undulations. High concentrations of temporary and seasonal wetlands are present and the drainage pattern is simple. Surficial material consists of glacial till over Cretaceous Pierre Shale. The soils present belong to the Order Mollisols and are typically Barnes, Svea, Hamerly, Cresbard, Buse, and Parnell. Though the till soil is very fertile, agricultural success is subject to annual climatic fluctuations (USEPA, et al. 1998). Elevation in the watershed ranges from 1,500 to 1,970 msl (USGS, 2006).

1.3 Land Use and Ecoregions in the Watershed

This segment of the Souris River watershed lies within the Northwestern Glaciated Plains (42) and Northern Glaciated Plains (46) level III ecoregions. These ecoregions are further subdivided into numerous level IV ecoregions as described below (Figure 4).

Within the Northwestern Glaciated Plains (42) level III ecoregion, the morainal landscape has significant surface irregularity and high concentrations of wetlands. Land use is transitional with intensive dryland farming to the east and a predominance of cattle ranching to the west. A small portion of the listed segment's watershed lies within the Missouri Coteau level IV ecoregion (42a). This area is comprised of numerous semi-permanent wetland depressions or potholes and is part of the major waterfowl production area in North America

Within the Northern Glaciated Plains (46) level III ecoregion, the subhumid conditions foster a grassland transition between the tall and short grass prairie. High concentrations of temporary and seasonal wetlands are found throughout the region as well. Most of the watershed for this TMDL listed segment lies within the Drift Plains (46i) level IV ecosystem. Composed of glacial till, this area is comprised of mostly temporary and seasonal wetlands. Because of the productive soil and level topography, this area is almost entirely cultivated with many wetlands drained or simply tilled and planted. Other level IV ecoregions within the water are Glacial Lake Basins (46c) and Glacial Lake Deltas (46d) which were occupied or deposited by Glacial Lake Souris. The deep soils of the Glacial Lake Basins are intensively cultivated, while the sandy, fine gravel soils of the Glacial Lake Deltas are used mainly for grazing or irrigated agriculture. While watersheds to the north are dominated by the Northern Black Prairie (46g) ecosystem, only a small portion of the watershed for this listed segment contains this transition zone with a northern boreal influence in climate.

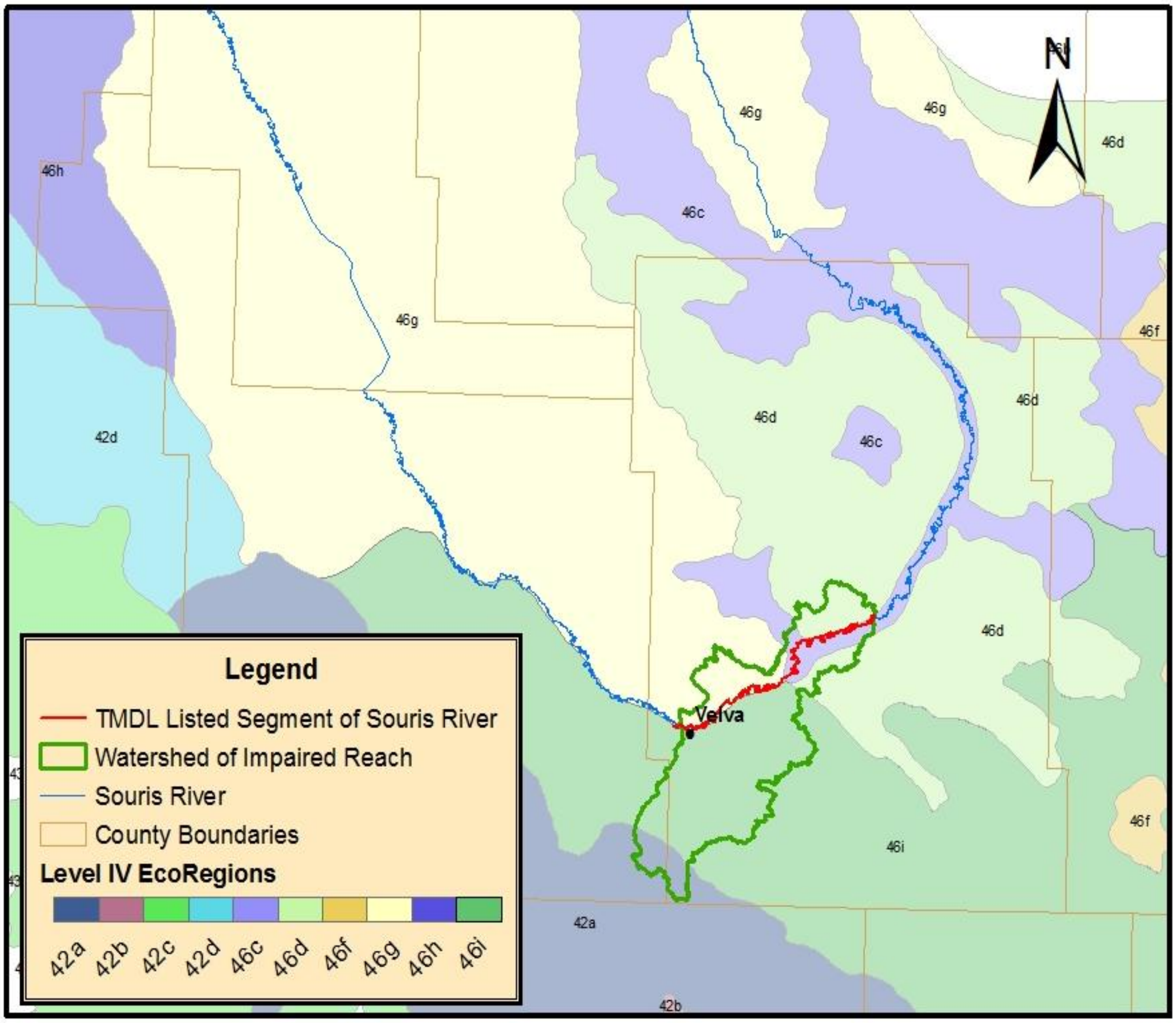

Figure 4. Level IV Ecoregions for the Souris River TMDL Listed Segment and Watershed.

Land use data from the National Agricultural Statistics Service (NASS, 2010) indicates that the listed segment's watershed is primarily agricultural (85.2 percent), consisting of crop production and livestock grazing. Almost 48 percent of the watershed is actively cultivated, tilled mainly for durum, spring wheat, and other small grains, but including a variety of crops. Thirty-seven percent is in pasture/range/haylands. Water and woods make up over 11 percent of the watershed (Tables 3 and 4, Figure 5). There is one permitted animal feeding operation (AFOs) which allows zero discharge, and no confined animal feeding operations (CAFOs). The number of non-permitted animal feeding operations within the watershed is unknown.

Table 3. Major Land Use Categories in the Watershed of the Section 303(d) Listed Souris River Segment (based on 2010 NASS data).

Major Category	Acres	Percent of Watershed
Agriculture/Cultivated	66,781	47.8
Pasture/Range/Hay	51,832	37.1
Barren/Fallow	419	0.3
Urban/Roads	3,074	2.2
Water	16,206	11.6
Woods	1,397	1.0

Table 4. Land Use Types in the Watershed of the Section 303 (d) Listed Souris River Segment (based on 2010 NASS data).

Land Use Type	Acres	Percent of Watershed
Wheat	28,082	20.1
Barley	4,750	3.4
Rye/Oats/Other Small Grains	559	0.4
Canola	9,500	6.8
Sunflowers	9,919	7.1
Corn	6,287	4.5
Beans/Peas	2,654	1.9
Flax	1,118	0.8
Soybeans	838	0.6
Barren/Fallow	419	0.3
Alfalfa	3,074	2.2
Pasture/Grass/CRP	51,832	37.1
Water	16,206	11.6
Woods	1,397	1.0
Urban/Roads	3,074	2.2
TOTAL	139,709	100

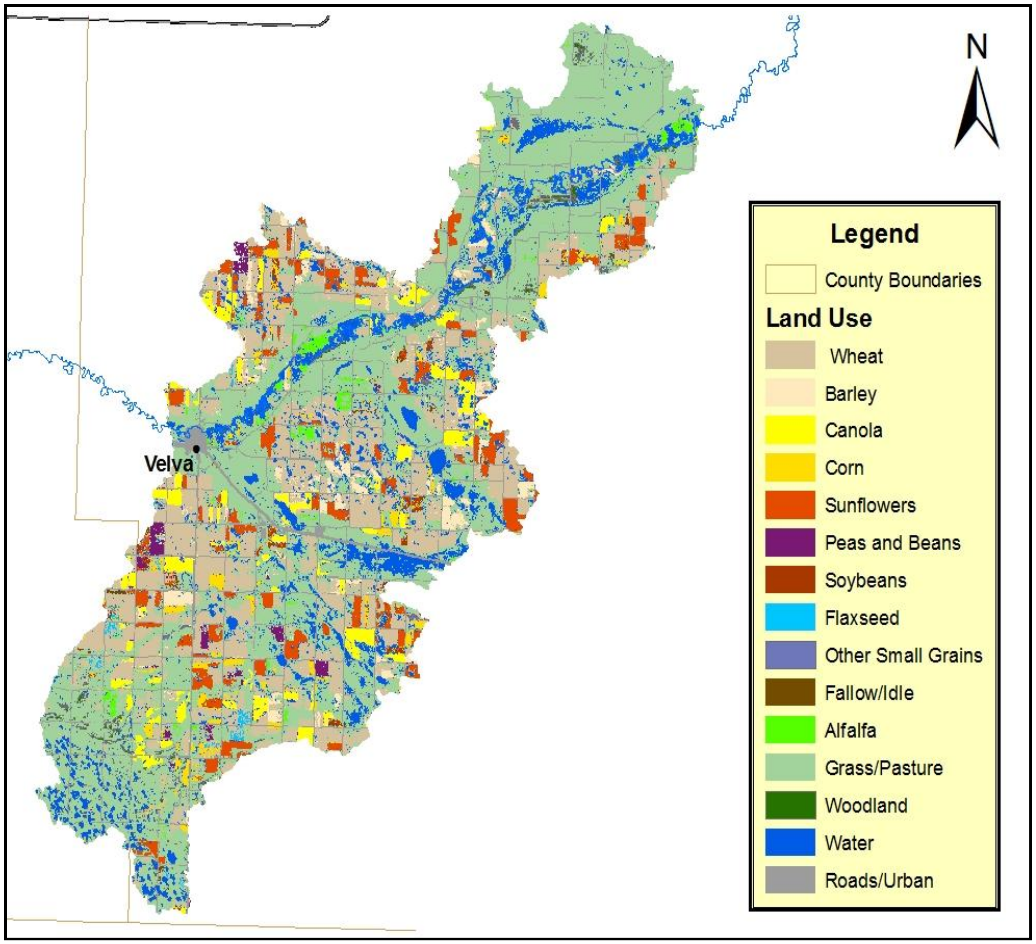

Figure 5. Land Use Map for the Watershed of the Souris River TMDL Segment (NASS, 2010).

1.4 Climate and Precipitation

North Dakota's climate is characterized by large temperature variation across all time scales, light to moderate irregular precipitation, plentiful sunshine, low humidity, and nearly continuous wind. Its location at the geographic center of North America results in a strong continental climate, which is exacerbated by the mountains to the west. There are no barriers to the north or south so a combination of cold, dry air masses originating in the far north and warm humid air masses originating in the tropical regions regularly flow over the state. Movement of these air masses and their associated fronts cause near continuous wind and often result in large day to day temperature fluctuations in all seasons. The average last freeze in spring occurs in late May. In the fall, the first 32 degree or lower temperature occurs between September 10^{th} and 25^{th}. However, freezing temperatures have occurred as late as mid-June and as early as mid-August. About 75 percent of the annual precipitation falls during the period of April to September, with 50 to 60 percent occurring between April and July. Most of the summer rainfall is produced during thunderstorms, which occur on an average of 25 to 35 days per year. On the average, rains occur once every three or four days during the summer. Winter snowpack, although persistent from December through March, only averages around 15 inches (Enz, 2003). Historical average precipitation data for the climate station at Velva ND, which is within the watershed, were obtained from the High Plains Regional Climate Center (HPRCC) and can be seen in Figure 6.

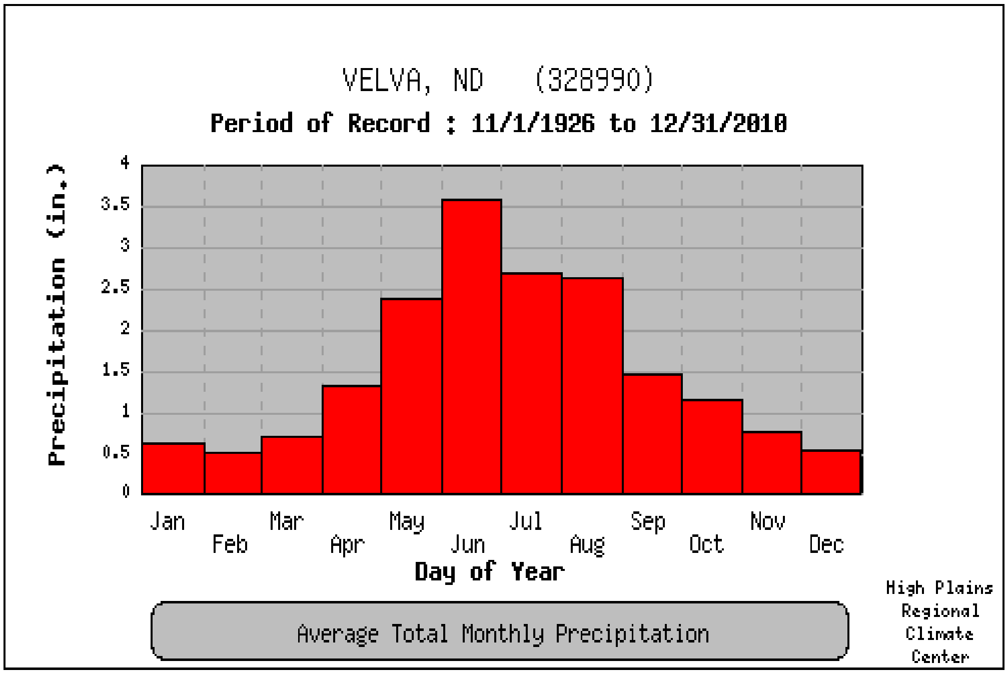

Figure 6. Average Total Monthly Precipitation Data for HPRCC Velva Station 328990, 1926 – 2010.

The average annual air temperature recorded at the Velva HPRCC station (328990) for the period of record (1926 – 2010) was 43.2^{o} F, with an average annual wind speed of 8.2 mph. Average annual precipitation for the period of record was 17.70 inches with 47 percent of that falling in the summer, 25 percent falling in spring, 19 percent falling in fall and 9 percent falling in winter. Average annual snowfall for the period of record was 39 inches. Average monthly temperatures are provided in Figure 7.

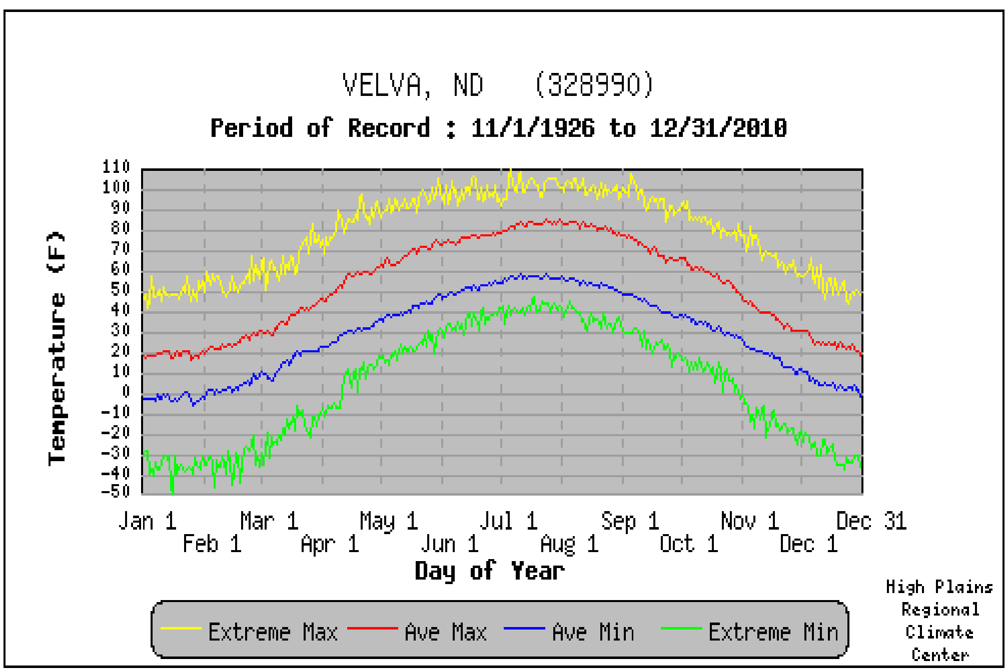

Figure 7. Average Monthly Temperatures at the Velva HPRCC Station 328990, Velva, ND (1926-2010).

1.5 Available Data

Fecal coliform and E. coli bacteria data were gathered from one station (380095) within the TMDL listed reach of the Souris River (Figure 8). This site is part of the NDDoH's Ambient Water Quality Monitoring Program network and is sampled every six weeks during the open water flow period and once or twice during the ice cover (NDDoH, 2009). Additional samples were also taken during a countywide monitoring project in 1997 and 1998.

While the state of North Dakota has moved from a fecal coliform bacteria standard to an E. coli bacteria standard (see Section 2.0), no E. coli data for the Velva lagoon discharge was available to assist with the wasteload allocation.

Flow data was provided by U.S. Geological Survey (USGS) stream gauging station (05120000), located just downstream of the NDDoH water quality sampling station (380095). Data from the two sites (380095 and 05120000) were used in the construction of the load duration curve.

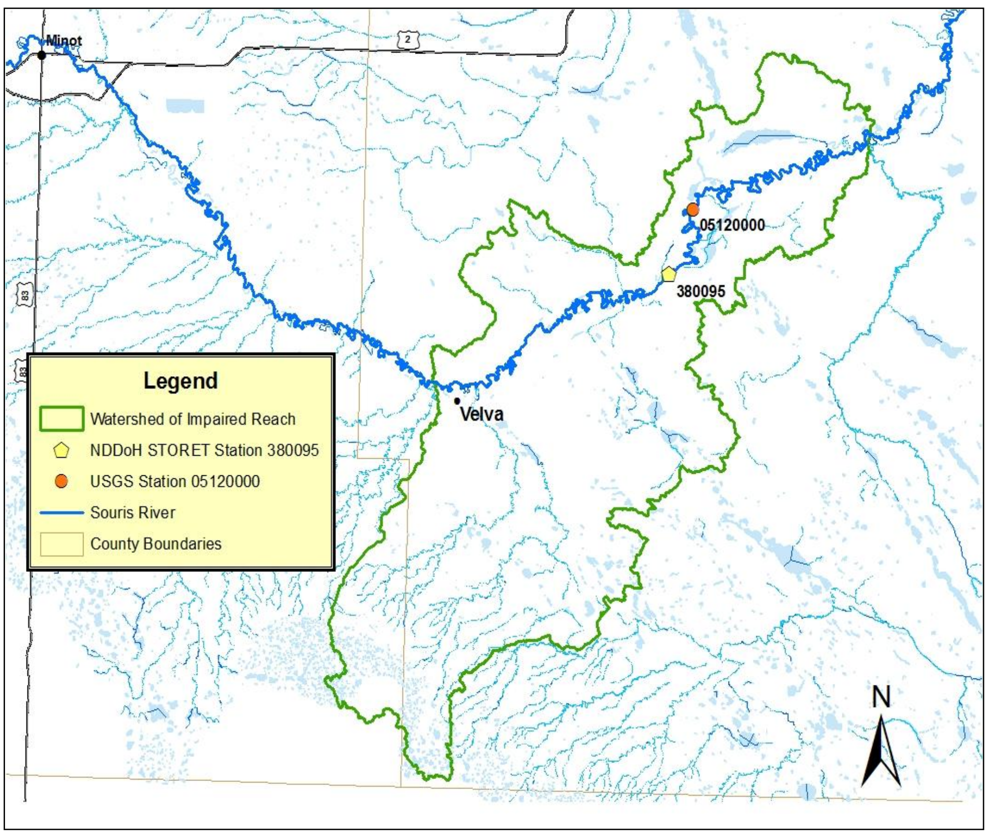

Figure 8. Sampling Site Locations for the TMDL Listed Segment of the Souris River.

1.5.1 E. coli Bacteria Data

In preparation for the change in State water quality standards as of January 2011 (discussed in Section 2.2) sample collection and analysis changed from primarily fecal coliform bacteria with some E. coli, to exclusively E. coli bacteria in May of 2010. E. coli data collected for site 380095 during the recreational season of May 1st through September 30th with the corresponding recreational use assessment based on E. coli bacteria is shown in Table 5 below. The full set of data is provided in Appendix B.

Table 5. Summary of E. coli Bacteria Data for Site 380095 for the Recreation Season of May 1st through September 30th (2001-2011).

Month	N	Geometric Mean* (CFU/100mL)	% Samples Exceeding 409 CFU/100mL	Recreational Use Assessment
May	9	17.58	11%	Fully Supporting, but Threatened
June	9	44.53	11%	Fully Supporting, but Threatened
July	6	16.8	0%	Fully Supporting
August	6	52.63	0%	Fully Supporting.
September	8	106.58	25%	Fully Supporting. But Threatened

*** The value of half the detection limit (5 CFU/100mL) is used for all Non-Detect values.**

1.5.2 Fecal Coliform Bacteria Data

Since significant fecal coliform bacteria data was available for both the TMDL listed reach and the discharge from the Velva lagoon, it is presented here. Samples were collected from May 1997 through October 2009(Appendix B). However, only data occurring during the recreational season of May 1st through September 30th is used in the table's recreational use assessment. Table 6 provides a summary of data used to calculate the recreational use assessment by month, which includes fecal coliform geometric mean concentrations and the percentage of samples exceeding 400 CFU/100mL for each month.

Table 6. Summary of Fecal Coliform Bacteria Data for Site 380095 for the Recreation Season of May 1st through September 30th (1997-2009).

Month	N	Geometric Mean* (CFU/100mL)	% Exceeding 400 CFU/100mL	Recreational Use Assessment
May	23	21.69	4%	Fully Supporting
June	19	64.25	16%	Fully Supporting, but Threatened
July	8	44.19	0%	Fully Supporting
August	9	54.89	0%	Fully Supporting.
September	11	104.83	18%	Fully Supporting. But Threatened

*** The value of half the detection limit (5 CFU/100mL) is used for all Non-Detect values.**

Based on the Discharge Monitoring Report (DMR) for the Velva, ND wastewater treatment facility, average fecal coliform bacteria concentrations for each discharge event only exceeded 200 CFUs/100mL in five of sixty samples taken from 1981 through 2010. A summary of fecal coliform bacteria data is provided in Table 7.

Table 7. Summary of Fecal Coliform Bacteria Data for Velva, ND Wastewater Treatment System Discharge into the Souris River for the Recreation Season of May 1st through September 30th (1981-2010).

Month	N	Geometric Mean[1] (CFU/100mL)	% Exceeding 400 CFU/100mL
May	12	18.96	0%
June	7	33.64	0%
July	10	8.17	0%
August	1	40	0%
September	4	6.69	0%

[1] The value of half the detection limit (5 CFU/100mL) is used for all Non-Detect values.

1.5.3 Hydraulic Discharge

Flow in the upper portion of the Souris River is regulated by three reservoirs in Canada: the Boundary, Rafferty, and Alameda Reservoirs. Constructed by the Rafferty-Alameda Project (1988-1995), these reservoirs provide water to users in the area, as well as flood protection for residents downstream, including those in North Dakota. Water releases are governed in accordance with the Boundary Waters Treaty and determined by the International Souris River Board of Control (ISRB), under the International Joint Commission. Specifically, "the Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the international border crossing more than fifty percent of that which would have occurred in the state of nature, as calculated by the Board (ISRB 1992).

Flow in the reach of the Souris River just above this listed segment is also affected by Lake Darling Reservoir, which is managed by the US Fish and Wildlife Service for waterfowl production and recreation.

The discharge record from USGS site 05120000 was used to determine the flow curve for this TMDL. There are no major tributaries or streams flowing into the Souris River within the watershed of the listed reach. As such, it has been determined that flow is similar (i.e. not gaining or losing) all along the 51-mile TMDL listed reach. Discharge for USGS site 05120000 is shown in Figure 9.

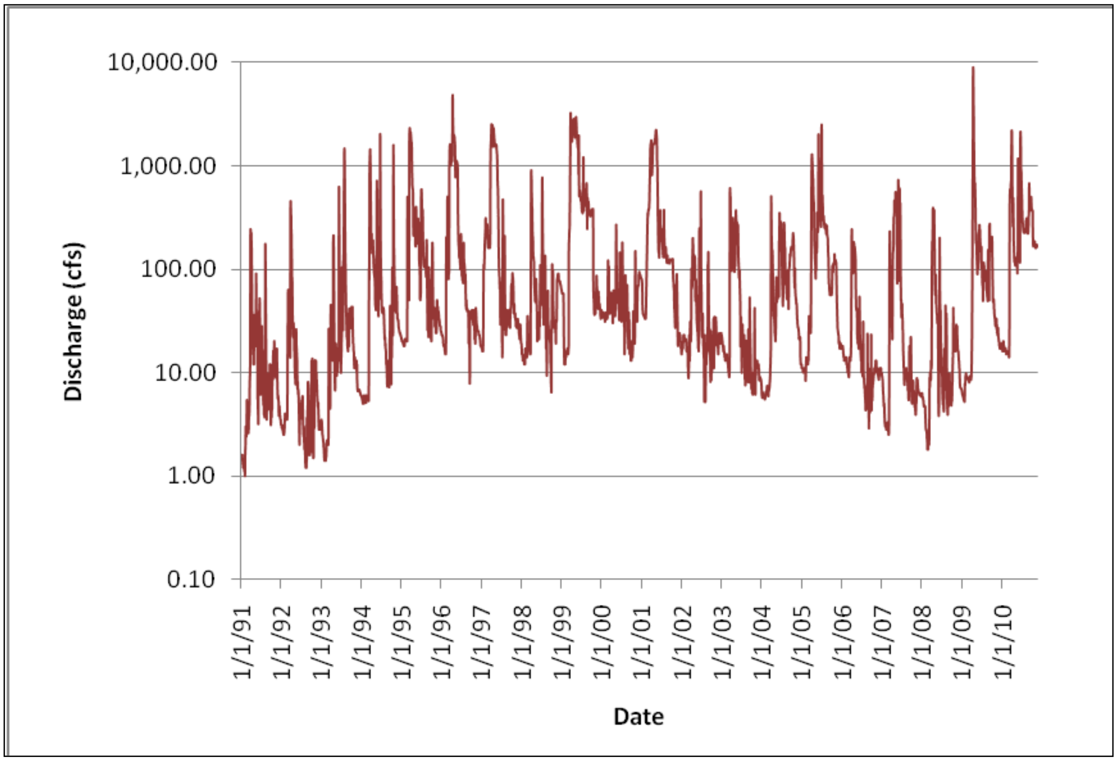

Figure 9. Discharge for USGS Site 05120000, 1991-2010.

2.0 WATER QUALITY STANDARDS

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

2.1 Narrative Water Quality Standards

The North Dakota Department of Health has set narrative water quality standards that apply to all surface waters in the State. The narrative general water quality standards are listed below (NDDoH, 2011).

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

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

    1. Cause a public health hazard or injury to environmental resources;

2. Impair existing or reasonable beneficial uses of the receiving waters; or

3. Directly or indirectly cause concentrations of pollutants to exceed applicable standards of the receiving waters.

In addition to the narrative standards, the NDDoH has set a biological goal for all surface waters in the State. The goal states that "the biological condition of surface waters shall be similar to that of sites or waterbodies determined by the department to be regional reference sites" (NDDoH, 2011).

2.2 Numeric Water Quality Standards

The Souris River is a Class IA stream. The NDDoH definition of a Class IA Stream is shown below (NDDoH, 2011)

> **Class IA** - The quality of waters in this class shall be suitable for the propagation or protection, or both, of resident fish species and other aquatic biota and for swimming, boating, and other water recreation. The quality of the waters shall be suitable for irrigation, stock watering, and wildlife without injurious effects. After treatment consisting of coagulation, settling filtration, and chlorination, or equivalent treatment processes, the water quality shall meet the bacteriological, physical, and chemical requirements of the Department for municipal or domestic use. Treatment for municipal use may also require softening to meet the drinking water requirements.

Effective January 2011, the NDDoH revised the State water quality standards. In these latest revisions the NDDoH eliminated the fecal coliform bacteria standard, retaining only the E. coli bacteria standard for the protection of recreational uses (Table 8). This change in water quality standard was recommended by the US Environmental Protection Agency as E. coli is believed to be a better indicator of recreational use risk (i.e. incidence of gastrointestinal disease).

Table 8. North Dakota E. coli Bacteria Standard for Class IA Streams.

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

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

3.0 TMDL TARGET

A TMDL target is the value that is measured to judge the success of the TMDL effort. TMDL targets must be based on state water quality standards, but can also include site specific values when no numeric criteria are specified in the standard. The following TMDL target for Souris River is based on the North Dakota water quality standard for E. coli bacteria. If the target is met, the recreation beneficial use will be fully supported.

3.1 Souris River Target Reductions in E. coli Bacteria Concentrations

The Souris River is impaired because of E. coli bacteria. The Souris River recreation beneficial use is identified as fully supporting, but threatened because E. coli bacteria counts exceed the State water quality standard. The State water quality standard for E. coli bacteria is a geometric mean concentration of 126 CFU/100 mL during the recreation season of May 1^{st} through September 30^{th}. Thus, the TMDL target for this report is 126 CFU/100 mL. In addition, no more than ten percent of samples collected for E. coli bacteria should exceed 409 CFU/100 mL.

While the standard is intended to be expressed as the 30-day geometric mean, the target is based on the 126 CFU/100 mL geometric mean standard. Expressing the target in this way will ensure the TMDL will result in both components of the standard being met and that recreational uses will be restored.

4.0 SIGNIFICANT SOURCES

4.1 Point Sources

Within the watershed of the TMDL listed reach of the Souris River, there is one wastewater treatment system permitted through the North Dakota Pollution Elimination System (NDPDES) Program. It is for the community of Velva, North Dakota (Figure 8). This system is allowed to discharge on an "as needed" basis, usually two to four times a year (Appendix C). Bacteria monitoring was switched in 2011 from fecal coliform to E. coli bacteria, so no E. coli data is currently available for the point source discharge. However, as the Table 7 indicates, the bacteria concentration entering this portion of the Souris River from the lagoon discharge is low, and not the primary cause of coliform bacteria impairment.

There is one permitted medium (301–999 animal units) animal feeding operation (AFO) in the watershed, however, they are zero discharge facilities and are not deemed a significant source for this report.

4.2 Nonpoint Sources

The E. coli bacteria pollution to this segment is primarily originating from nonpoint sources in the watershed. Unpermitted animal feeding operations (AFOs) and livestock grazing and watering in proximity to the Souris River are common along the TMDL listed reach.

This area of North Dakota typically experiences short duration but intense precipitation during the spring and early summer months. These storms can cause overland flooding and rising river levels. Due to the close proximity of livestock grazing and watering to the river (grassland areas on the land use map, Figure 5), it is likely that they contribute to the E. coli bacteria pollution in this listed segment of the Souris River.

These assessments are supported by the load duration curve analysis (Section 5.3) which shows exceedences of the E. coli bacteria standard occurring during high, moist, and dry conditions.

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

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

5.0 TECHNICAL ANALYSIS

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

The loading capacity, or TMDL, is the amount of pollutant (e.g. E. coli bacteria) a waterbody can receive and still meet and maintain water quality standards and beneficial uses. The following technical analysis addresses the E. coli bacteria reductions necessary to achieve the water quality standards target for E. coli bacteria of 126 CFU/100 mL with a margin of safety.

5.1 Mean Daily Stream Flow

In north-central North Dakota, rain events are variable, generally occurring during the months of April through August. Rain events can be sporadic and heavy or light, occurring over a short duration or over several days. Precipitation events of large magnitude, occurring at a faster rate than absorption, contribute to high runoff events. These events are represented by runoff in the high flow regime. The medium flow regime (wet and moist conditions as depicted in Figure 10 below) is represented by runoff that contributes to the stream over a longer duration. The low flow regime is characteristic of drought or precipitation events of small magnitude and do not contribute to runoff.

Flows for the TMDL list reach were obtained for gauging station 05120000 from the USGS Water Science Center website.

5.2 Flow Duration Curve Analysis

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

A basic flow duration curve runs from high to low (0 to 100 percent) along the x-axis with the corresponding flow value on the y-axis (Figure 10). Using this approach, flow duration intervals are expressed as a percentage, with zero corresponding to the highest flows in the record (i.e., flood conditions) and 100 to the lowest flows in the record (i.e., drought). Therefore, as depicted in Figure 10, a flow duration interval of 15 percent associated with a stream flow of 232 cfs, implies that 15 percent of all observed mean daily discharge values equal or exceed 232 cfs.

Once the flow duration curve is developed for the stream site, flow duration intervals can be defined which can be used as a general indicator of hydrologic condition (i.e., wet vs dry conditions and to what degree). These intervals, or regimes, provide additional insight about conditions and patterns associated with the impairment (USEPA, 2007). The flow duration curve (Figure 11) was divided into four flow regimes, one representing high flows (0-15 percent), one for moist conditions (15-47 percent), one for dry conditions (47-78 percent), and one for low flows (78-99 percent). Based on the flow duration curve analysis, no flow occurred only one percent of the time.

These flow intervals were defined by examining the range of flows for the site for the period of record and then by looking for natural breaks in the flow record based on the flow duration curve plot. A secondary factor in determining the flow intervals used in the analysis is the number of E. coli bacteria observations available for each flow interval.

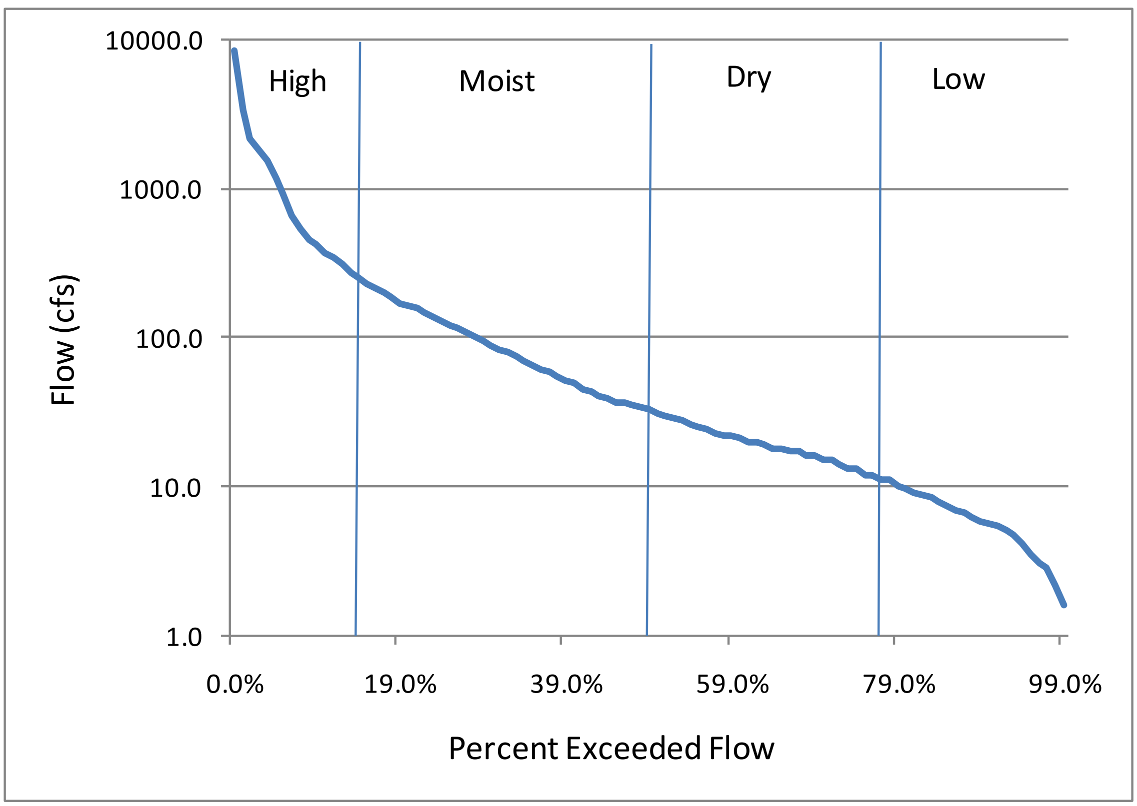

Figure 10. Flow Duration Curve for Souris River USGS Gauging Site 05120000, Based on Data Collected from 1991 – 2010.

5.3 E. coli Bacteria Load Duration Curve Analysis

An important factor in determining nonpoint source pollution loads is variability in stream flows and loads associated with high and low flow. To better correlate the relationship between the pollutant of concern and hydrology of the 303(d) TMDL listed segment, a load duration curve was developed for this impaired reach of the Souris River. The load duration curve was derived using the E. coli bacteria TMDL target of 126 CFU/100mL and flows generated as described in Sections 5.1 and 5.2.

Observed in-stream E. coli bacteria concentrations from monitoring site 380095 (Appendix B) was converted to a pollutant load by multiplying E. coli bacteria concentrations by the mean daily flow and a conversion factor. These loads are plotted against the percent exceeded of the flow on the day of sample collection (Figure 11). Points plotted above the 126 CFU/100 mL target curve exceed TMDL target. Points plotted below the curve are meeting the target of 126 CFU/100 mL.

For each flow interval or regime with more than one data point above the above the load duration curve (i.e., high and low), a regression relationship was developed between the samples which occur above the TMDL target (126 CFU/100 mL) curve and the corresponding percent exceeded flow. The load duration curve for site 380095 depicting a regression relationship for each flow interval is provided in Figure 11. The regression lines for high and low flow regimes for site 380095 were then used with the midpoint of the percent exceeded flow for each interval to calculate the existing E. coli bacteria load for that flow interval. The following equation is used by the load duration curve model to determine existing load:

E. coli bacteria load (10^7 CFU/day) for each flow interval =

antilog (Regression Line Intercept = (Regression Line Slope*Midpoint of Exceeded Flow))

Table 9 provides a summary of the data used with the above equation to determine the existing loads for each flow interval.

Table 9. Summary of Data Used to Determine Existing E. coli Bacteria Load Based on Flow Interval.

Interval	Regression Line Intercept	Regression Line Slope	Midpoint of Exceeded Flow	Existing Load
High	6.77618	-9.62770	7.5%	1,132,662
Low	3.17766	0.68143	88.5%	6,036

As there was only one E. coli bacteria concentration above the TMDL target in the moist flow regime for site 380095 the single data point was used to derive the existing load for that flow regime. As there were no E. coli samples above the load duration curve for the dry flow regime no existing load could be calculated.

The midpoint for each flow interval is also used to estimate the TMDL target load. Therefore the TMDL target load for the midpoints of 7.5, 31, 62.5, and 88.5 percent exceeded flow derived from the 126 CFU/100 mL TMDL target curves are 154,155 x 10^7 CFUs/day, 25,590 x 10^7 CFUs/day, 6,012 x 10^7 CFUs/day, and 1,850 x 10^7 CFUs/day, respectively.

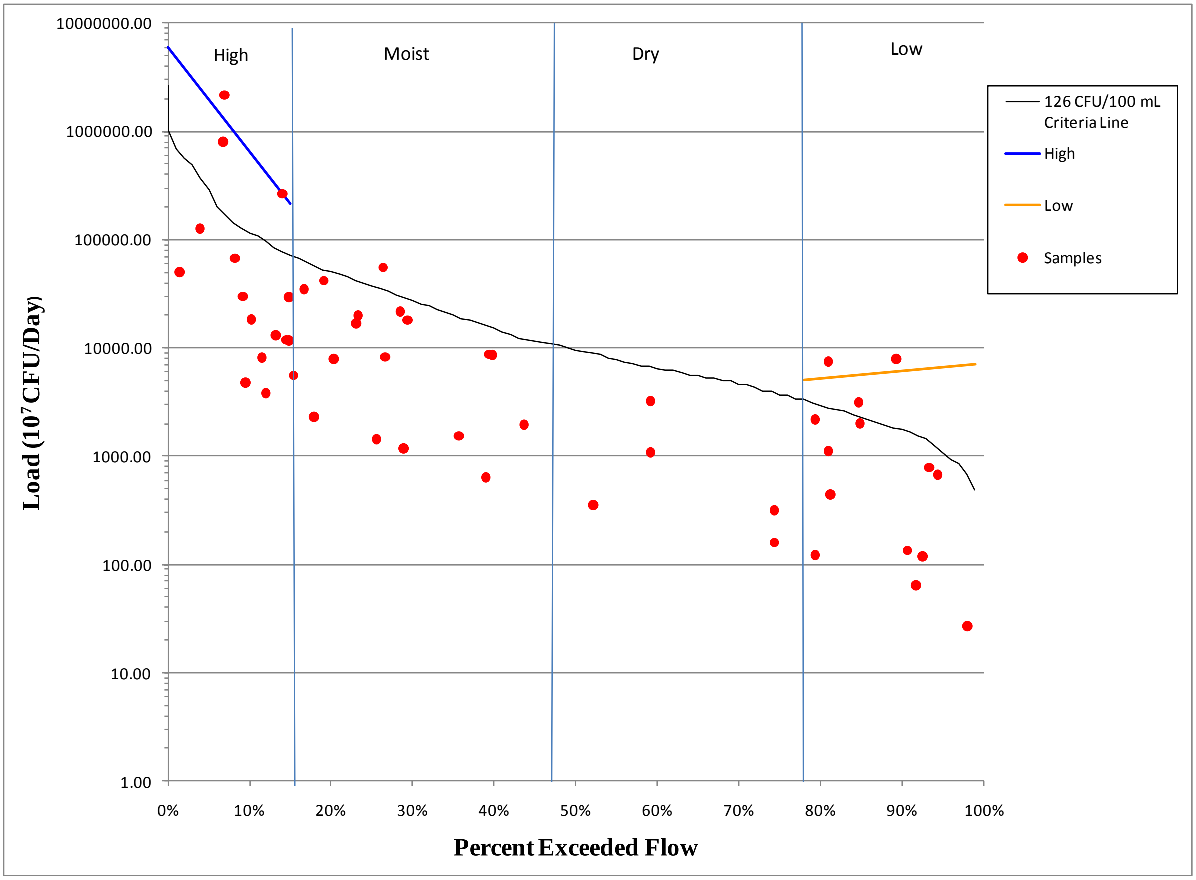

Figure 11. E. coli Bacteria Load Duration Curve with Regression Lines for Souris River Site 380095.

5.4 Wasteload Allocation Analysis

There is one town, Velva, ND, located within the watershed of this impaired reach of the Souris River. It contains a wastewater treatment system permitted through the NDPDES Program administered by the NDDoH. According to the permit, the Velva facility is allowed to discharge on an “as needed basis”. The Discharge Monitoring Report (DMR) indicates this system discharges between two and four times a year. Based on the DMR data (Appendix C), this system discharges 6.57 million gallons of treated wastewater over an average of eight days. This is equal to 821,000 gallons per day. Since no E. coli data are available, the system is assigned the water quality standards value of 126 CFU/100 mL for this TMDL.

The wasteload allocation for Velva was determined by taking the average daily discharge and multiplying it by the assumed E. coli bacteria maximum concentration of 126 CFU/100 mL, times appropriate conversion factors.

WLA = 821,000 gallons/day * 126 CFU/100 mL

= 821,000 gallons/day * 3.7854 L/gal * 1,000 mL/L * 126 CFU/100 mL

= 391.58 x 10^7 CFU/day

5.5 Loading Sources

The load reduction needed for this listed segment of the Souris River E. coli bacteria TMDL can primarily be allotted to nonpoint sources, with the one point source mentioned in Section 5.4 given a small portion of the allocation. Based on the data available, the general focus of BMPs and load reductions for the listed segment should be on unpermitted animal feeding operations, range/pastureland, and riparian areas that are greatly disturbed. Higher priority should be given to the animal feeding areas rated higher or located in close proximity to the Souris River.

Significant sources of E. coli bacteria loading were defined as nonpoint source pollution originating from livestock. One of the more important concerns regarding nonpoint sources is variability in stream flows. Variable stream flows often cause different source areas and loading mechanisms to dominate (Cleland, 2003). As previously described, four flow regimes (i.e. High, Moist, Dry and Low) were selected to represent the hydrology of the listed segment for the purposes of this TMDL. Two flow regimes (i.e., High and Low) were used in conjunction with water quality data for site 380085 because samples indicated exceedences of the E. coli water quality standard during these flows.

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to coliform bacteria loading. Animals grazing in the riparian area contribute coliform bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high, medium (moist and dry flow regimes) and low flows (Table 10). In contrast, intensive grazing of livestock in the upland and not in the riparian area has a high potential to impact water quality at high flows and medium impact at moderate flows. Exclusion of livestock from the riparian area eliminates the potential of direct manure deposit and therefore is considered to be of high importance at all flows. However, intensive grazing in the upland creates the potential for manure accumulation and availability for runoff at high flows and a high potential for coliform bacteria contamination.

Table 10. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

Nonpoint Sources	Flows		
	High Flow	Medium Flow	Low Flow
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L

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

6.0 MARGIN OF SAFETY AND SEASONALITY

6.1 Margin of Safety

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

To account for the uncertainty associated with known sources and the load reductions necessary to reach the TMDL target of 126 CFU/100 mL, a ten percent explicit margin of safety was used for this TMDL. The MOS was calculated as ten percent of the TMDL. In other words, ten percent of the TMDL is set aside from the load allocation as a MOS. The ten percent MOS was derived by taking the difference between the points on the load duration curve using the 126 CFU/100 mL standard and the curve using the 113 CFU/100 mL.

6.2 Seasonality

Section 303(d)(1)(C) of the Clean Water Act and associated regulations require that a TMDL be established with seasonal variations. The Souris River TMDL addresses seasonality because the flow duration curve was developed using 20 years of USGS gauge data encompassing 12 months of the year. Additionally, the water quality standard is seasonally based on the recreation season of May 1 through September 30 and controls will be designed to reduce E. coli bacteria loads during the seasons covered by the standard.

7.0 TMDL

Table 11 provides an outline of the critical elements of the Souris River E. coli bacteria TMDL. The TMDL for the Souris River impaired segment (ND-09010003-001-S_) is summarized in Table 12. The TMDL for each segment and flow regime provide an estimate of the existing daily load, and estimate of the average daily loads necessary to meet the water quality target (i.e. TMDL). This table provides an estimate of the existing daily loads and an estimate of the average daily loads necessary to meet the water quality target (i.e. TMDL load). This TMDL includes a load allocation for nonpoint sources, a wasteload allocation for a point source, and a ten percent margin of safety.

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

While there were no exceedences of the 126 CFU/100 mL E. coli bacteria standard for the low flow regime for the TMDL listed segment, a TMDL load, load allocation, waste load allocation and margin of safety has been provided for this flow regime as a guide to future watershed management. Based on available data, it can be assumed that this segment of the Souris River is currently meeting the water quality standard for this flow regime.

Table 11. TMDL Summary for the Souris River Impaired Reach ND-09010003-001-S_00.

Category	Description	Explanation
Beneficial Use Impaired	Recreation	Contact Recreation (i.e. swimming, fishing)
Pollutant	E. coli Bacteria	See Section 2.1
E. coli TMDL Target	126 CFU/100 mL	Based on North Dakota water quality standards
WLA	Velva Wastewater Treatment Lagoon	This permitted point source discharges on "as needed" basis
LA	Nonpoint Source Contributions	Loads are a result of nonpoint sources (i.e., rangeland, pasture land, etc.)
Margin of Safety (MOS)	Explicit	10 percent

The TMDL can be described by the following equation**:**

TMDL = LC = WLA + LA + MOS where:

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

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

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

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

Table 12. E. coli Bacteria TMDL (10^7 CFU/day) for Souris River ND-09010003-001-S_00.

	Loads Expressed as Average 10^7 CFU/day			
	High Flow	**Moist Flow**	**Dry Flow**	**Low Flow**
Existing Load	1,132,662	55,300		6,036
TMDL	154,155	25,590[a]	6,012[a]	1,850
WLA[b]	392	392	392	392
LA	138,347	22,639	5,019	1,273
MOS	15,416	2,559	601	185

[a] TMDL load is provided as a guideline for watershed management and BMP implementation.
[b]A wasteload allocation is given for both flow regimes as discharge has been recorded during all 12 months of the year.

8.0 ALLOCATION

The one point source in the watershed is given a small wasteload allocation based on its historic and future projected discharges and State water quality standards. The remaining E. coli bacteria load allocation for this TMDL is given to nonpoint sources in the watershed. The entire nonpoint source load is allocated as a single load because there is not enough detailed source data to allocate the load to individual uses (e.g., animal feeding, septic systems, riparian grazing, upland grazing).

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

Controlling nonpoint sources is a difficult undertaking requiring extensive financial and technical support. Provided that technical and financial assistance is available to stakeholders, these BMPs have the potential to significantly reduce E. coli bacteria loading to the Souris River. The following describe in detail those BMPs that will reduce E. coli bacteria levels in the Souris River.

Table 13. Management Practices and Flow Regimes Affected by Implementation of BMPs.

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

8.1 Livestock Management Recommendations

Livestock management BMPs are designed to promote healthy water quality and riparian areas through management of livestock and associated grazing land. Fecal matter from livestock and erosion from poorly managed grazing land and riparian areas can be a significant source of E. coli bacteria loading to surface water. Precipitation, plant cover, number of animals, and soils are factors that affect the amount of bacteria delivered to a waterbody as a result of livestock. The following specific BMPs are known to reduce NPS pollution from livestock.

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

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

Prescribed grazing – This practice provides increased ground cover and ground stability by rotating livestock throughout multiple fields. Grazing with a specified rotation minimizes overgrazing and resulting erosion. The Natural Resources Conservation Service (NRCS) recommends grazing systems to improve and maintain water quality and quantity. Duration, intensity, frequency, and season of grazing can be managed to enhance vegetation cover and litter, resulting in reduced runoff, improved infiltration, increased quantity of soil water for plant growth, and better manure distribution and increased rate of decomposition, (NRCS, 1998).

In a study by Tiedemann et al. (1988), as presented by USEPA, (1993), the effects of four grazing strategies on bacteria levels in thirteen watersheds in Oregon were studied during the summer of 1984. Results of the study show that when livestock are managed at a stocking rate of 19 acres per animal unit month with water developments and fencing, bacteria levels were reduced significantly (Table 14).

Waste management system - Waste management systems can be effective in controlling up to 90 percent of bacteria loading originating from confined animal feeding areas (Table 15). A waste management system is made up of various components designed to control NPS pollution from concentrated animal feeding operations (CAFOs) and animal feeding operations (AFOs). Diverting clean water around the feeding area and containing dirty water from the feeding area in a pond are typical practices of a waste management system. Manure handling and application procedures are also integral to the waste management system. The application of manure is designed to be adaptive to environmental, soil, and plant conditions to minimize the probability of contamination of surface water.

Table 14. Bacterial Water Quality Response to Four Grazing Strategies (Tiedemann et al., 1988)

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

Table 15. Relative Gross Effectiveness of Confined Livestock Control Measures (Pennsylvania State University, 1992a)

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

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

8.2 Other Recommendations

Vegetated filter strip – Vegetated filter strips are used to reduce the amount of sediment, particulate organics, dissolved contaminants, nutrients, and in the case of this TMDL, E. coli bacteria to streams. The effectiveness of filter strips and other BMPs in removing bacteria is quite successful. Results from a study by Pennsylvania State University (1992a) as presented by USEPA (1993), suggest that vegetative filter strips are capable of removing up to 55 percent of bacteria loading to rivers and streams (Table 14). The ability of the filter strip to remove contaminants is dependent on field slope, filter strip slope, erosion rate, amount and particulate size distribution of sediment delivered to the filter strip, density and height of vegetation, and runoff volume associated with erosion producing events (NRCS, 2001).

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

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

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

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

9.0 PUBLIC PARTICIPATION

To satisfy the public participation requirement of this TMDL, a hard copy of the TMDL report and request for comment was mailed to participating agencies, partners, and to those requesting a copy. Those included in the hard copy mailing were:

- South McHenry County Soil Conservation District;
- McHenry County Water Resource Board; and
- US EPA - Region VIII

In addition to mailing copies of this TMDL to interested parties, the TMDL was posted on the North Dakota Department of Health, Division of Water Quality web site at http://www.ndhealth.gov/WQ/SW/Z2_TMDL/TMDLs_Under_PublicComment/B_Under_Public_Comment.htm . A 30 day public notice soliciting comment and participation was also be published in the following newspapers:

- Minot Daily News; and
- Mouse River Journal

Comments were only received from US EPA Region 8, which were provided as part of their normal public notice review (Appendix E). The NDDoH's response to these comments are provided in Appendix F.

10.0 MONITORING

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

To ensure that the BMPs that are implemented and the technical assistance that is provided as a part of any watershed restoration program are successful in reducing E. coli bacteria loadings to levels prescribed in this TMDL, water quality monitoring will be conducted in accordance with an approved Quality Assurance Project Plan (QAPP).

Specifically, monitoring will be conducted for all variables that are currently causing impairments to the beneficial uses of the waterbody. This includes, but is not limited to E. coli bacteria. Once a watershed restoration plan (e.g. Section 319 Non point Source Project Implementation Plan [PIP]) is implemented, monitoring will be conducted in the watershed beginning two years after implementation and extending five years after the implementation project is complete.

11.0 TMDL IMPLEMENTATION STRATEGY

Implementation of TMDLs is dependent upon the availability of Section 319 NPS funds or other watershed restoration programs (e.g. USDA Environmental Quality Incentive Program), as well as securing a local project sponsor and required matching funds. Provided these three requirements are in place, a project implementation plan (PIP) is developed in accordance with the TMDL and submitted to the ND Nonpoint Source Pollution Task Force and US EPA for approval. The implementation of the BMPs contained in the NPS PIP is voluntary. Therefore, success of any TMDL implementation project is ultimately dependant on the ability of the local project sponsor to find cooperating producers.

Monitoring is an important and required component of any PIP. As a part of the PIP, data are collected to monitor and track the effects of BMP implementation as well as to judge overall project success. Quality Assurance Project Plans (QAPPs) detail the strategy of how, when, and where monitoring will be conducted to gather the data needed to document the TMDL implementation goal(s). As data are gathered and analyzed, watershed restoration tasks are adapted to place BMPs where they will have the greatest benefit to water quality.

Also, as a part of any implementation plan for this TMDL, it is recommended that permitted point sources (i.e. CAFOs, AFOs, and NDPDES permit holders) in the watershed be inspected to ensure that they are being operated in compliance with their permit conditions, and to verify that they are not a significant E. coli bacteria source. Currently, it is the policy of the NDDoH that all permitted CAFOs (greater than or equal to 1000 animal units) be inspected annually. Permitted AFOs (<1000 animal units) in the Souris River watershed are inspected on an as needed basis.

Included in the implementation strategy for this TMDL, the city of Velva's NDPDES permit will be modified to include effluent limits and monitoring requirements for E. coli bacteria consistent with the waste load allocation provided for in this TMDL. This will be done when the permit comes up for renewal in September 2013.

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Appendix A
Map of Entire Souris River Watershed


Map of the Souris River Drainage Basin
International Joint Commission • Commission Mixte Internationale
Miles
Kilometres
North
Legend
Souris River Basin
Indian / Native Reserve
Provincial Park
US Fish and Wildlife
Gauging Stations
City
Town, Village
Highway
River
Lake or Reservoir
Datum: NAD 1983
Projection: Lambert Conformal Conic
Latitude of Origin: 49'
Central Meridian: -104'
Standard Parallel 1: 49'
Standard Parallel 2: 77'
Date: September 2007
Contact: M.R. Gilchrist, 306-780-6411
Environment Canada
SASKATCHEWAN
MANITOBA
MONTANA
NORTH DAKOTA
Regina
Weyburn
Estevan
Brandon
Minot
Bottineau
Rugby
Mohall
Williston
Culbertson
Sidney
New Town
Parshall
Garrison
Harvey
Fessenden
Devils Lake
Moose Mountain Provincial Park
Turtle Mountain Provincial Park
Spruce Woods Provincial Park
Riding Mountain National Park
FORT PECK INDIAN RESERVATION
FORT BERTHOLD INDIAN RESERVATION
SPIRIT LAKE INDIAN RESERVATION
TURTLE MOUNTAIN INDIAN RESERVATION
Des Lacs NWR
Upper Souris NWR
J. Clark Salyer NWR
Lostwood NWR
Saskatchewan
Manitoba
Canada
U.S.A.
Montana
North Dakota

Appendix B
Fecal Coliform and E. coli Bacteria Data
For STORET Site 380095

Fecal coliform Bacteria Data

STORET	DATE	TIME	LONG NAME	Result	Result as Number	Units
380095	3/31/1997	09:50	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	4/2/1997	15:00	Fecal Coliform, Memb Filt	40	40	#/100 mL
380095	4/9/1997	14:30	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	4/14/1997	16:15	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	4/16/1997	18:30	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	4/21/1997	17:50	Fecal Coliform, Memb Filt	10	10	#/100 mL
380095	4/23/1997	17:16	Fecal Coliform, Memb Filt	50	50	#/100 mL
380095	4/23/1997	16:30	Fecal Coliform, Memb Filt	50	50	#/100 mL
380095	4/28/1997	13:50	Fecal Coliform, Memb Filt	10	10	#/100 mL
380095	4/30/1997	11:15	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	5/5/1997	14:15	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	5/12/1997	10:00	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	5/21/1997	11:00	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	5/21/1997	17:10	Fecal Coliform, Memb Filt	20	20	#/100 mL
380095	5/28/1997	16:33	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	6/5/1997	10:55	Fecal Coliform, Memb Filt	10	10	#/100 mL
380095	6/5/1997	13:30	Fecal Coliform, Memb Filt	70	70	#/100 mL
380095	6/11/1997	14:00	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	6/18/1997	10:00	Fecal Coliform, Memb Filt	40	40	#/100 mL
380095	6/23/1997	15:25	Fecal Coliform, Memb Filt	680	680	#/100 mL
380095	7/14/1997	13:10	Fecal Coliform, Memb Filt	370	370	#/100 mL
380095	7/17/1997	12:15	Fecal Coliform, Memb Filt	130	130	#/100 mL
380095	8/13/1997	11:45	Fecal Coliform, Memb Filt	30	30	#/100 mL

STORET	DATE	TIME	LONG NAME	RESULT	RESULT AS NUMBER	UNITS
380095	9/11/1997	09:30	Fecal Coliform, Memb Filt	70	70	#/100 mL
380095	9/24/1997	10:40	Fecal Coliform, Memb Filt	50	50	#/100 mL
380095	11/6/1997	12:45	Fecal Coliform, Memb Filt	50	50	#/100 mL
380095	4/8/1998	09:50	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	4/13/1998	14:20	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	4/16/1998	11:20	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	4/27/1998	14:30	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	4/29/1998	17:40	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	5/4/1998	17:20	Fecal Coliform, Memb Filt	20	20	#/100 mL
380095	5/6/1998	17:13	Fecal Coliform, Memb Filt	140	140	#/100 mL
380095	5/11/1998	17:35	Fecal Coliform, Memb Filt	40	40	#/100 mL
380095	5/13/1998	17:20	Fecal Coliform, Memb Filt	30	30	#/100 mL
380095	5/18/1998	17:40	Fecal Coliform, Memb Filt	80	80	#/100 mL
380095	5/20/1998	08:45	Fecal Coliform, Memb Filt	30	30	#/100 mL
380095	5/20/1998	17:20	Fecal Coliform, Memb Filt	20	20	#/100 mL
380095	5/27/1998	10:10	Fecal Coliform, Memb Filt	80	80	#/100 mL
380095	6/8/1998	13:55	Fecal Coliform, Memb Filt	40	40	#/100 mL
380095	6/10/1998	10:17	Fecal Coliform, Memb Filt	70	70	#/100 mL
380095	6/16/1998	13:40	Fecal Coliform, Memb Filt	10	10	#/100 mL
380095	6/22/1998	11:07	Fecal Coliform, Memb Filt	120	120	#/100 mL
380095	6/30/1998	11:00	Fecal Coliform, Memb Filt	80	80	#/100 mL
380095	4/14/1999	09:00	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	5/26/1999	10:30	Fecal Coliform, Memb Filt	30	30	#/100 mL
380095	7/7/1999	09:10	Fecal Coliform, Memb Filt	110	110	#/100 mL

STORET	DATE	TIME	LONG NAME	RESULT	RESULT AS NUMBER	UNITS
380095	8/17/1999	17:50	Fecal Coliform, Memb Filt	260	260	#/100 mL
380095	9/28/1999	11:00	Fecal Coliform, Memb Filt	10	10	#/100 mL
380095	5/24/2000	11:00	Fecal Coliform, Memb Filt	140	140	#/100 mL
380095	6/27/2000	17:00	Fecal Coliform, Memb Filt	140	140	#/100 mL
380095	8/15/2000	17:20	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	9/27/2000	07:33	Fecal Coliform, Memb Filt	80	80	#/100 mL
380095	5/9/2001	09:20	Fecal Coliform, Memb Filt	10	10	#/100 mL
380095	6/19/2001	16:38	Fecal Coliform, Memb Filt	150	150	#/100 mL
380095	8/1/2001	13:09	Fecal Coliform, Memb Filt	70	70	#/100 mL
380095	9/12/2001	09:39	Fecal Coliform, Memb Filt	390	390	#/100 mL
380095	5/22/2002	09:12	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	6/26/2002	06:55	Fecal Coliform, Memb Filt	640.	640	#/100 mL
380095	7/31/2002	08:57	Fecal Coliform, Memb Filt	50.	50	#/100 mL
380095	9/4/2002	15:10	Fecal Coliform, Memb Filt	90.	90	#/100 mL
380095	5/14/2003	14:30	Fecal Coliform, Memb Filt	*Non-detect	5	#/100 mL
380095	8/6/2003	14:57	Fecal Coliform, Memb Filt	120.	120	#/100 mL
380095	10/28/2003	11:51	Fecal Coliform, Memb Filt	280.	280	#/100 mL
380095	3/22/2004	11:15	Fecal Coliform, Memb Filt	30.	30	#/100 mL
380095	3/30/2004	11:24	Fecal Coliform, Memb Filt	30.	30	#/100 mL
380095	5/4/2004	10:05	Fecal Coliform, Memb Filt	10.	10	#/100 mL
380095	6/16/2004	10:46	Fecal Coliform, Memb Filt	410.	410	#/100 mL
380095	7/26/2004	13:38	Fecal Coliform, Memb Filt	20.	20	#/100 mL
380095	9/8/2004	12:07	Fecal Coliform, Memb Filt	130.	130	#/100 mL
380095	10/18/2004	14:48	Fecal Coliform, Memb Filt	70.	70	#/100 mL

STORET	DATE	TIME	LONG NAME	RESULT	RESULT AS NUMBER	UNITS
380095	4/5/2005	12:16	Fecal Coliform, Memb Filt	40.	40	#/100 mL
380095	5/16/2005	12:34	Fecal Coliform, Memb Filt	20.	20	#/100 mL
380095	6/20/2005	12:45	Fecal Coliform, Memb Filt	60.	60	#/100 mL
380095	8/9/2005	15:04	Fecal Coliform, Memb Filt	30.	30	#/100 mL
380095	9/19/2005	15:41	Fecal Coliform, Memb Filt	10.	10	#/100 mL
380095	11/2/2005	11:15	Fecal Coliform, Memb Filt	30.	30	#/100 mL
380095	1/25/2006	10:00	Fecal Coliform, Memb Filt	*NON-DETECT	5	#/100 mL
380095	4/5/2006	13:39	Fecal Coliform, Memb Filt	*NON-DETECT	5	#/100 mL
380095	5/15/2006	13:30	Fecal Coliform, Memb Filt	20.	20	#/100 mL
380095	6/27/2006	11:50	Fecal Coliform, Memb Filt	10.	10	#/100 mL
380095	8/7/2006	11:47	Fecal Coliform, Memb Filt	20.	20	#/100 mL
380095	9/18/2006	13:21	Fecal Coliform, Memb Filt	690	690	#/100 mL
380095	11/1/2006	09:51	Fecal Coliform, Memb Filt	*NON-DETECT	5	#/100 mL
380095	1/18/2007	10:30	Fecal Coliform, Memb Filt	20.	20	#/100 mL
380095	4/2/2007	09:27	Fecal Coliform, Memb Filt	*NON-DETECT	5	#/100 mL
380095	5/9/2007	09:13	Fecal Coliform, Memb Filt	COMMENT	1600.00	#/100 mL
380095	6/11/2007	14:44	Fecal Coliform, Memb Filt	110	110	#/100 mL
380095	7/24/2007	13:30	Fecal Coliform, Memb Filt	110	110	#/100 mL
380095	8/21/2007	13:01	Fecal Coliform, Memb Filt	230	230	#/100 mL
380095	9/24/2007	10:11	Fecal Coliform, Memb Filt	70.	70	#/100 mL
380095	10/30/2007	10:06	Fecal Coliform, Memb Filt	70.	70	#/100 mL
380095	2/20/2008	09:00	Fecal Coliform, Memb Filt	*NON-DETECT	5	#/100 mL
380095	4/22/2008	10:25	Fecal Coliform, Memb Filt	20.	20	#/100 mL
380095	6/2/2008	10:45	Fecal Coliform, Memb Filt	60.	60	#/100 mL

STORET	DATE	TIME	LONG NAME	RESULT	RESULT AS NUMBER	UNIT
380095	7/15/2008	12:22	Fecal Coliform, Memb Filt	*NON-DETECT	5	#/100 mL
380095	8/26/2008	14:00	Fecal Coliform, Memb Filt	100	100	#/100 mL
380095	10/7/2008	13:46	Fecal Coliform, Memb Filt	180	180	#/100 mL
380095	5/6/2009	11:31	Fecal Coliform, Memb Filt	*NON-DETECT	5	#/100 mL
380095	6/16/2009	12:07	Fecal Coliform, Memb Filt	40.	40	#/100 mL
380095	7/27/2009	11:50	Fecal Coliform, Memb Filt	*NON-DETECT	5	#/100 mL
380095	9/8/2009	14:13	Fecal Coliform, Memb Filt	70.	70	#/100 mL
380095	10/19/2009	11:39	Fecal Coliform, Memb Filt	70.	70	#/100 mL

E. coli Bacteria Data

STORET	DATE	TIME	LONG NAME	Result	Result as Number	Units
380095	5/9/2001	09:20	E Coli, Memb Filt	10	10	#/100 mL
380095	6/19/2001	16:38	E Coli, Memb Filt	50	50	#/100 mL
380095	8/1/2001	13:09	E Coli, Memb Filt	60	60	#/100 mL
380095	9/12/2001	09:39	E Coli, Memb Filt	200	200	#/100 mL
380095	5/22/2002	09:12	E Coli, Memb Filt	*Non-detect	5	#/100 mL
380095	6/26/2002	06:55	E Coli, Memb Filt	580.	580	#/100 mL
380095	7/31/2002	08:57	E Coli, Memb Filt	50.	50	#/100 mL
380095	9/4/2002	15:10	E Coli, Memb Filt	80.	80	#/100 mL
380095	5/14/2003	14:30	E Coli, Memb Filt	*Non-detect	5	#/100 mL
380095	8/6/2003	14:57	E Coli, Memb Filt	110.	110	#/100 mL
380095	3/30/2004	11:24	E Coli, Memb Filt	30.	30	#/100 mL
380095	5/4/2004	10:05	E Coli, Memb Filt	20.	20	#/100 mL
380095	7/26/2004	13:38	E Coli, Memb Filt	20.	20	#/100 mL
380095	9/8/2004	12:07	E Coli, Memb Filt	90.	90	#/100 mL
380095	10/18/2004	14:48	E Coli, Memb Filt	70.	70	#/100 mL
380095	4/5/2005	12:16	E Coli, Memb Filt	40.	40	#/100 mL
380095	5/16/2005	12:34	E Coli, Memb Filt	20.	20	#/100 mL
380095	6/20/2005	12:45	E Coli, Memb Filt	60.	60	#/100 mL
380095	8/9/2005	15:04	E Coli, Memb Filt	20.	20	#/100 mL
380095	9/19/2005	15:41	E Coli, Memb Filt	10.	10	#/100 mL
380095	11/2/2005	11:15	E Coli, Memb Filt	30.	30	#/100 mL
380095	1/25/2006	10:00	E Coli, Memb Filt	*Non-detect	5	#/100 mL
380095	4/5/2006	13:39	E Coli, Memb Filt	*Non-detect	5	#/100 mL
380095	5/15/2006	13:30	E Coli, Memb Filt	20.	20	#/100 mL
380095	6/27/2006	11:50	E Coli, Memb Filt	10.	10	#/100 mL
380095	8/7/2006	11:47	E Coli, Memb Filt	10.	10	#/100 mL
380095	9/18/2006	13:21	E Coli, Memb Filt	640	640	#/100 mL
380095	11/1/2006	09:51	E Coli	*NON-DETECT	5	#/100 mL
380095	1/18/2007	10:30	E Coli, Memb Filt	10.	10	#/100 mL
380095	4/2/2007	09:27	E Coli	*NON-DETECT	5	#/100 mL
380095	5/9/2007	09:13	E Coli, Memb Filt	COMMENT	1600	#/100 mL
380095	6/11/2007	14:44	E Coli, Memb Filt	50.	50	#/100 mL
380095	7/24/2007	13:30	E Coli, Memb Filt	90.	90	#/100 mL
380095	8/21/2007	13:01	E Coli, Memb Filt	230	230	#/100 mL
380095	9/24/2007	10:11	E Coli, Memb Filt	60.	60	#/100 mL
380095	10/30/2007	10:06	E Coli, Memb Filt	70.	70	#/100 mL

STORET	DATE	TIME	LONG NAME	Result	Result as Number	Units
380095	2/20/2008	09:00	E Coli, Memb Filt	*NON-DETECT	5	#/100 mL
380095	4/22/2008	10:25	E Coli, Memb Filt	20.	20	#/100 mL
380095	6/2/2008	10:45	E Coli, Memb Filt	20.	20	#/100 mL
380095	7/15/2008	12:22	E Coli, Memb Filt	*NON-DETECT	5	#/100 mL
380095	8/26/2008	14:00	E Coli, Memb Filt	70.	70	#/100 mL
380095	10/7/2008	13:46	E Coli, Memb Filt	170	170	#/100 mL
380095	5/6/2009	11:31	E Coli, Memb Filt	*NON-DETECT	5	#/100 mL
380095	6/16/2009	12:07	E Coli, Memb Filt	20.	20	#/100 mL
380095	7/27/2009	11:50	E Coli, Memb Filt	*NON-DETECT	5	#/100 mL
380095	9/8/2009	14:13	E Coli, Memb Filt	70.	70	#/100 mL
380095	10/19/2009	11:39	E Coli, Memb Filt	70.	70	#/100 mL
380095	4/27/2010	11:04	E Coli, Memb Filt	*NON-DETECT	5	#/100 mL
380095	6/8/2010	10:16	E Coli, Memb Filt	100	100	#/100 mL
380095	7/20/2010	10:47	E Coli, Memb Filt	10.	10	#/100 mL
380095	9/1/2010	10:45	E Coli, Memb Filt	430	430	#/100 mL
380095	10/11/2010	11:35	E Coli, Memb Filt	10.	10	#/100 mL
380095	5/4/2011	10:45	E Coli, Memb Filt	10.	10	#/100 mL
380095	6/8/2011	12:12	E Coli, Memb Filt	20.	20	#/100 mL

Appendix C
Discharge Monitoring Report (DMR) for Velva Wastewater Treatment System

DMR Discharge Data

EI Name	Trt Name	Dschg Loc	Parameter	Start	End	Days	LMax	Load Units
Velva City Of	Cell 2	Effluent	Drain MG	1981-9-30 12:00 AM	1981-10-14 12:00 AM	15	5.7	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1982-7-15 12:00 AM	1982-7-30 12:00 AM	16	6.5	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1982-11-4 12:00 AM	1982-11-11 12:00 AM	8	6.5	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1983-5-10 12:00 AM	1983-5-25 12:00 AM	16	9	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1983-9-7 12:00 AM	1983-9-30 12:00 AM	24	7.1	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1984-5-30 12:00 AM	1984-6-11 12:00 AM	13	7.8	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1984-10-30 12:00 AM	1984-11-14 12:00 AM	16	7.3	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1985-6-21 12:00 AM	1985-7-8 12:00 AM	18	7.8	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1985-11-7 12:00 AM	1985-11-15 12:00 AM	9	5.5	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1986-4-30 12:00 AM	1986-5-19 12:00 AM	20	7.1	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1986-10-31 12:00 AM	1986-11-7 12:00 AM	8	7.8	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1987-4-29 12:00 AM	1987-5-5 12:00 AM	7	11.7	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1987-5-6 12:00 AM	1987-5-10 12:00 AM	5	2.6	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1987-9-5 12:00 AM	1987-9-11 12:00 AM	7	9.1	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1987-9-12 12:00 AM	1987-9-18 12:00 AM	7	5.2	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1988-7-1 12:00 AM	1988-7-8 12:00 AM	8	3.9	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1988-10-25 12:00 AM	1988-11-2 12:00 AM	9	3.9	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1989-7-18 12:00 AM	1989-7-24 12:00 AM	7	3.9	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1989-12-8 12:00 AM	1989-12-14 12:00 AM	7	3.9	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1990-5-5 12:00 AM	1990-5-11 12:00 AM	7	5.2	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1990-11-12 12:00 AM	1990-11-18 12:00 AM	7	7.8	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1991-7-23 12:00 AM	1991-8-6 12:00 AM	15	3.1	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1991-11-4 12:00 AM	1991-11-10 12:00 AM	7	6.5	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1992-3-20 12:00 AM	1992-3-26 12:00 AM	7	5.2	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1992-10-4 12:00 AM	1992-10-10 12:00 AM	7	7.8	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1993-4-23 12:00 AM	1993-4-30 12:00 AM	8	6.5	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1993-7-21 12:00 AM	1993-7-28 12:00 AM	8	6.53	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1993-10-1 12:00 AM	1993-10-8 12:00 AM	8	7.84	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1994-4-9 12:00 AM	1994-4-15 12:00 AM	7	6.53	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1994-7-19 12:00 AM	1994-7-25 12:00 AM	7	5.44	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1994-11-12 12:00 AM	1994-11-18 12:00 AM	7	9.6	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1995-3-28 12:00 AM	1995-4-3 12:00 AM	7	5.44	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1995-5-9 12:00 AM	1995-5-15 12:00 AM	7	8.23	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1995-7-20 12:00 AM	1995-7-26 12:00 AM	7	6.53	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1995-11-15 12:00 AM	1995-11-22 12:00 AM	8	9.6	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1996-4-10 12:00 AM	1996-4-16 12:00 AM	7	5.45	MGAL

EI Name	Trt Name	Dschg Loc	Parameter	Start	End	Days	LMax	Load Units
Velva City Of	Cell 2	Effluent	Drain MG	1996-5-30 12:00 AM	1996-6-7 12:00 AM	9	5.45	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1996-7-22 12:00 AM	1996-7-28 12:00 AM	7	5.44	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1996-11-7 12:00 AM	1996-11-13 12:00 AM	7	8.23	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1997-4-25 12:00 AM	1997-5-2 12:00 AM	8	5.49	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1997-7-8 12:00 AM	1997-7-15 12:00 AM	8	5.49	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1997-8-1 12:00 AM	1998-1-31 12:00 AM	8	5.23	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1998-2-1 12:00 AM	1998-7-31 12:00 AM	7	6.53	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1998-8-1 12:00 AM	1999-1-1 12:00 AM	8	6.53	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1998-8-6 12:00 AM	1998-8-13 12:00 AM	8	7.84	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1999-4-27 12:00 AM	1999-5-4 12:00 AM	8	6.53	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1999-6-16 12:00 AM	1999-6-23 12:00 AM	8	6.53	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1999-9-1 12:00 AM	1999-9-8 12:00 AM	7	6.534	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	1999-11-19 12:00 AM	1999-11-26 12:00 AM	7	6.534	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2000-5-23 12:00 AM	2000-5-30 12:00 AM	8	6.534	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2000-10-18 12:00 AM	2000-10-25 12:00 AM	8	6.534	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2001-5-12 12:00 AM	2001-5-20 12:00 AM	9	6.534	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2001-10-12 12:00 AM	2001-10-19 12:00 AM	8	6.534	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2002-6-11 12:00 AM	2002-6-17 12:00 AM	7	6.538	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2002-10-8 12:00 AM	2002-10-14 12:00 AM	7	6.534	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2003-5-16 12:00 AM	2003-5-23 12:00 AM	7	6.534	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2003-9-25 12:00 AM	2003-10-1 12:00 AM	6	6.86	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2004-5-18 12:00 AM	2004-5-24 12:00 AM	6	6.86	MGAL
Velva City Of	Cell 2		Drain MG	2004-12-2 12:00 AM	2004-12-8 12:00 AM	7	6.86	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2005-5-13 12:00 AM	2005-5-20 12:00 AM	8	6.86	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2005-9-16 12:00 AM	2005-9-23 12:00 AM	8	6.86	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2006-4-27 12:00 AM	2006-5-4 12:00 AM	8	6.86	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2006-7-21 12:00 AM	2006-7-31 12:00 AM	11	6.86	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2007-6-23 12:00 AM	2007-6-30 12:00 AM	8	6.86	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2007-6-23 12:00 AM	2007-6-29 12:00 AM	7	6.87	MGAL
Velva City Of	Cell 2	Effluent	Drain MG	2008-7-9 12:00 AM	2008-7-16 12:00 AM	8	6.87	MGAL
Velva City Of	Cell 2	Effluent	Drain/Month	2009-4-22 12:00 AM	2009-4-29 12:00 AM	8	6.87	MGAL
Velva City Of	Cell 2	Effluent	Drain/Month	2009-11-6 12:00 AM	2009-11-13 12:00 AM	8	6.87	MGAL
Velva City Of	Cell 2	Effluent	Drain/Month	2010-6-24 12:00 AM	2010-6-30 12:00 AM	7	6.87	MGAL
Velva City Of	Cell 2	Effluent	Drain/Month	2010-10-28 12:00 AM	2010-11-4 12:00 AM	8	6.87	MGAL

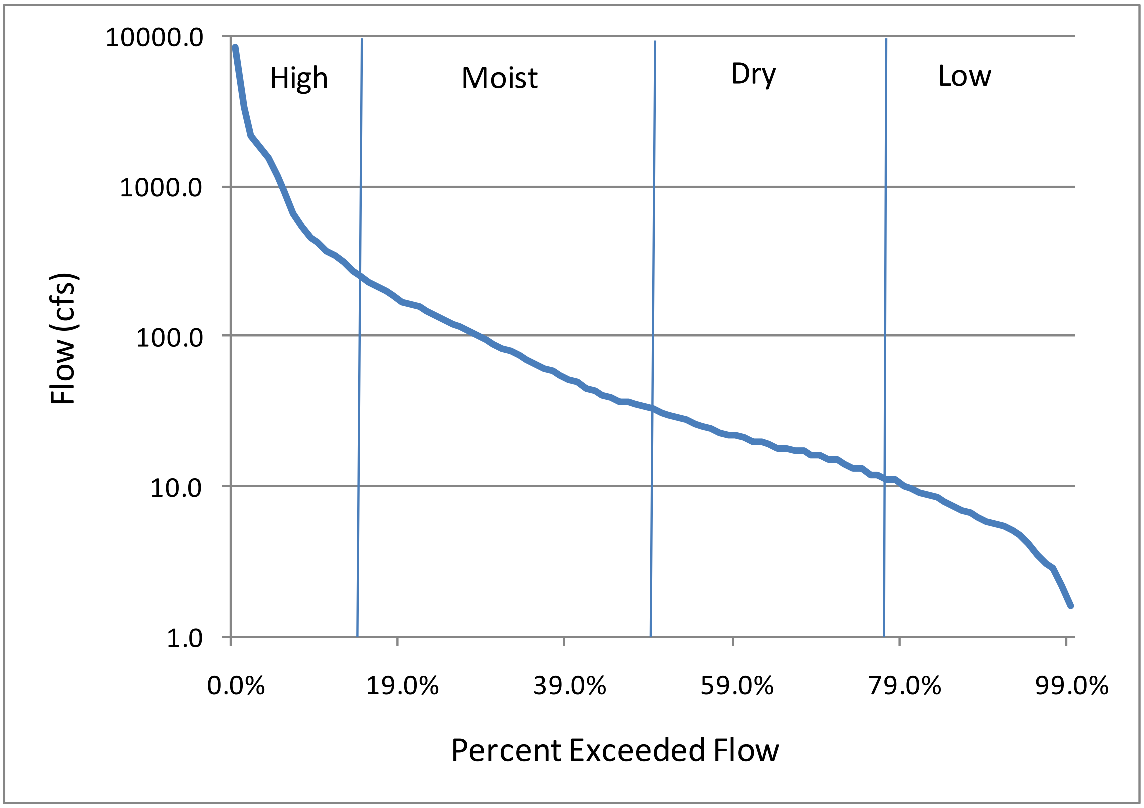
DMR Fecal Coliform Bacteria Data

EI Name	Trt Name	Dschg Loc	Parameter	Start	End	Days	PAvg	Conc Units
Velva City Of	Cell 2	Effluent	Fecal	1981-9-30 12:00 AM	1981-10-14 12:00 AM	15	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1982-7-15 12:00 AM	1982-7-30 12:00 AM	16	33	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1982-11-4 12:00 AM	1982-11-11 12:00 AM	8	20	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1983-5-10 12:00 AM	1983-5-25 12:00 AM	16	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1984-5-30 12:00 AM	1984-6-11 12:00 AM	13	130	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1984-10-30 12:00 AM	1984-11-14 12:00 AM	16	5	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1985-6-21 12:00 AM	1985-7-8 12:00 AM	18	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1985-11-7 12:00 AM	1985-11-15 12:00 AM	9	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1986-4-30 12:00 AM	1986-5-19 12:00 AM	20	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1986-10-31 12:00 AM	1986-11-7 12:00 AM	8	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1987-4-29 12:00 AM	1987-5-5 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1987-5-6 12:00 AM	1987-5-10 12:00 AM	5	40	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1987-9-5 12:00 AM	1987-9-11 12:00 AM	7	2	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1987-9-12 12:00 AM	1987-9-18 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1988-7-1 12:00 AM	1988-7-8 12:00 AM	8	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1988-10-25 12:00 AM	1988-11-2 12:00 AM	9	2	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1989-7-18 12:00 AM	1989-7-24 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1989-12-8 12:00 AM	1989-12-14 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1990-5-5 12:00 AM	1990-5-11 12:00 AM	7	30	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1990-11-12 12:00 AM	1990-11-18 12:00 AM	7	0	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1991-7-23 12:00 AM	1991-8-6 12:00 AM	15	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1991-11-4 12:00 AM	1991-11-10 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1992-3-20 12:00 AM	1992-3-26 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1992-10-4 12:00 AM	1992-10-10 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1993-4-23 12:00 AM	1993-4-30 12:00 AM	8	2700	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1993-7-21 12:00 AM	1993-7-28 12:00 AM	8	2	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1993-10-1 12:00 AM	1993-10-8 12:00 AM	8	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1994-4-9 12:00 AM	1994-4-15 12:00 AM	7	30	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1994-7-19 12:00 AM	1994-7-25 12:00 AM	7	2	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1994-11-12 12:00 AM	1994-11-18 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1995-5-9 12:00 AM	1995-5-15 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1995-7-20 12:00 AM	1995-7-26 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1996-4-10 12:00 AM	1996-4-16 12:00 AM	7	6000	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1996-5-30 12:00 AM	1996-6-7 12:00 AM	9	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1996-7-22 12:00 AM	1996-7-28 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1996-11-7 12:00 AM	1996-11-13 12:00 AM	7	10	#/100 ml

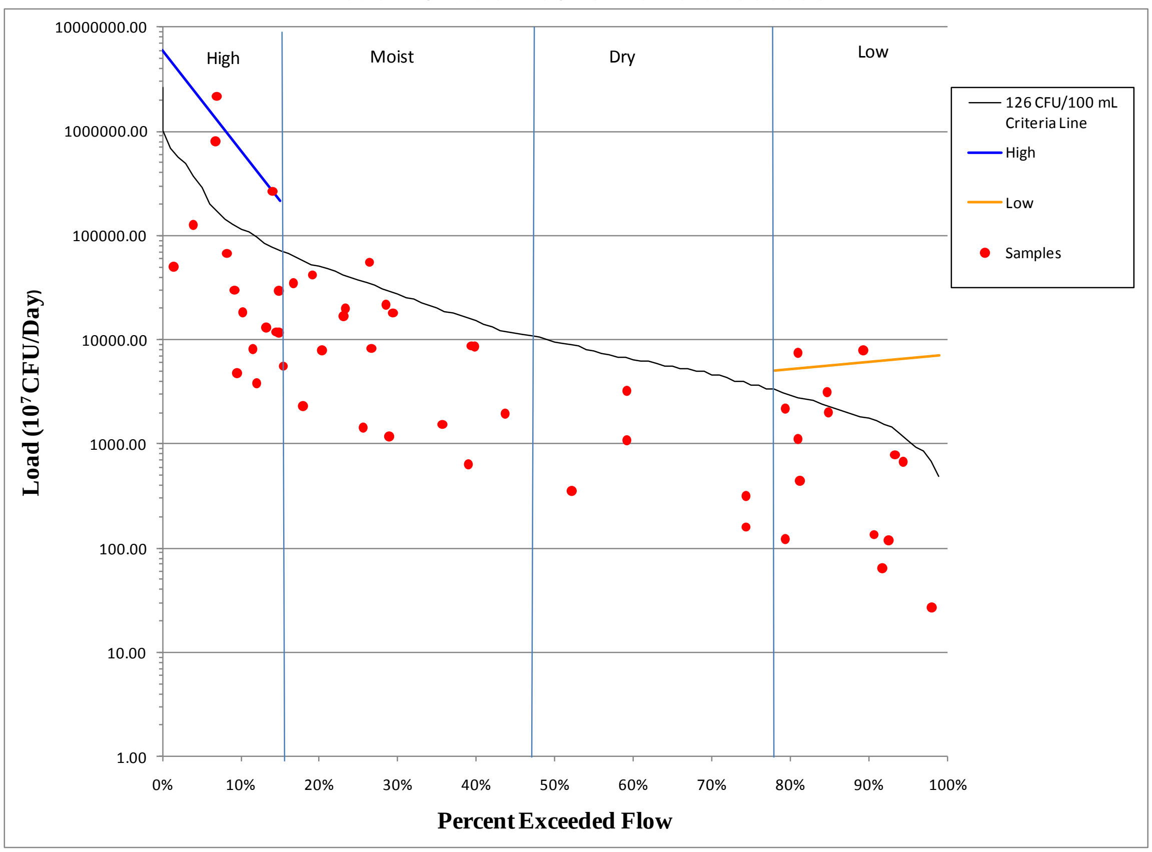
EI Name	Trt Name	Dschg Loc	Parameter	Start	End	Days	PAvg	Conc Units
Velva City Of	Cell 2	Effluent	Fecal	1998-2-1 12:00 AM	1998-7-31 12:00 AM	7	200	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1998-8-6 12:00 AM	1998-8-13 12:00 AM	8	40	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1999-4-27 12:00 AM	1999-5-4 12:00 AM	8	200	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1999-6-16 12:00 AM	1999-6-23 12:00 AM	8	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	1999-9-1 12:00 AM	1999-9-8 12:00 AM	7		#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2000-5-23 12:00 AM	2000-5-30 12:00 AM	8	30	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2001-5-12 12:00 AM	2001-5-20 12:00 AM	9	30	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2001-10-12 12:00 AM	2001-10-19 12:00 AM	8		#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2002-10-8 12:00 AM	2002-10-14 12:00 AM	7	105	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2003-5-16 12:00 AM	2003-5-23 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2003-9-25 12:00 AM	2003-10-1 12:00 AM	6	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2004-5-18 12:00 AM	2004-5-24 12:00 AM	6	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2004-12-2 12:00 AM	2004-12-8 12:00 AM	7	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2005-5-13 12:00 AM	2005-5-20 12:00 AM	8	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2005-9-16 12:00 AM	2005-9-23 12:00 AM	8	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2006-4-27 12:00 AM	2006-5-4 12:00 AM	8	90	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2006-7-21 12:00 AM	2006-7-31 12:00 AM	11	10	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2007-6-23 12:00 AM	2007-6-29 12:00 AM	7	250	#/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2007-6-23 12:00 AM	2007-6-30 12:00 AM	8	250	Num/100 ml
Velva City Of	Cell 2	Effluent	Fecal	2008-7-9 12:00 AM	2008-7-16 12:00 AM	8	10	Num/100 mL
Velva City Of	Cell 2	Effluent	Fecal Geo Mean	2009-4-22 12:00 AM	2009-4-29 12:00 AM	8	7700	Num/100 ml
Velva City Of	Cell 2	Effluent	Fecal Geo Mean	2009-11-6 12:00 AM	2009-11-13 12:00 AM	8	10	Num/100 ml
Velva City Of	Cell 2	Effluent	Fecal Geo Mean	2010-6-24 12:00 AM	2010-6-30 12:00 AM	7	150	Num/100 ml

Appendix D
Flow and Load Duration Curves, Estimated Loads, and TMDL Targets from Load Duration Curve Spreadsheet

Flow Duration Curve for Site 380095



Load Duration Curve for Site 380095



Exisiting and TMDL Load Results for High and Low Flow Regimes

	Load (Million CFU/Day)			
	Median Percentile	**Existing**	**TMDL**	**Days**
High	7.50%	1132662.01	154154.62	54.75
Low	88.50%	6035.67	1849.86	76.65
			Total	131

Exisitng Loads for Moist Condition based on Single Sample

Date	C	Q	PercentRank	Load(CFUx10^7/Day)
9/12/2001	200	113	26.4%	55300

Load Duration Curve Results

Percent Exceeded	Q	Load(CFUx10^7/Day)
0.01%	8549.5	2635896
0.10%	3341.2	1030117
1.00%	2200.0	678280
2.00%	1827.6	563466
3.00%	1571.4	484477
4.00%	1200.0	369971
5.00%	938.0	289194
6.00%	658.3	202966
7.00%	547.0	168639
8.00%	462.0	142451
9.00%	420.4	129619
10.00%	372.0	114691
11.00%	349.0	107600
12.00%	311.0	95884
13.00%	271.9	83842
14.00%	251.0	77386
15.00%	232.0	71528
16.00%	218.0	67211
17.00%	200.0	61662
18.00%	185.0	57037
19.00%	171.2	52789
20.00%	163.0	50254
21.00%	156.0	48090
22.00%	147.0	45321
23.00%	137.0	42238
24.00%	127.0	39155
25.00%	120.0	36997
26.00%	115.0	35456
27.00%	109.0	33606
28.00%	101.0	31139
29.00%	94.0	28981
30.00%	89.0	27440
31.00%	83.0	25590
32.00%	79.0	24356
33.00%	74.0	22815
34.00%	69.0	21273
35.00%	65.0	20040
36.00%	61.0	18807
37.00%	58.0	17882
38.00%	55.0	16957
39.00%	51.8	15977
40.00%	49.0	15107
41.00%	45.0	13874

Percent Exceeded	Q	Load(CFUx10^7/Day)
42.00%	43.0	13257
43.00%	40.0	12332
44.00%	39.0	12024
45.00%	37.0	11407
46.00%	36.0	11099
47.00%	35.0	10791
48.00%	34.0	10483
49.00%	32.6	10057
50.00%	31.0	9558
51.00%	30.0	9249
52.00%	29.0	8941
53.00%	28.0	8633
54.00%	26.0	8016
55.00%	25.0	7708
56.00%	24.0	7399
57.00%	23.0	7091
58.00%	22.0	6783
59.00%	22.0	6783
60.00%	21.0	6474
61.00%	20.0	6166
62.00%	20.0	6166
63.00%	19.0	5858
64.00%	18.0	5550
65.00%	18.0	5550
66.00%	17.0	5241
67.00%	17.0	5241
68.00%	16.0	4933
69.00%	16.0	4933
70.00%	15.0	4625
71.00%	15.0	4625
72.00%	14.0	4316
73.00%	13.0	4008
74.00%	13.0	4008
75.00%	12.0	3700
76.00%	12.0	3700
77.00%	11.0	3391
78.00%	11.0	3391
79.00%	10.0	3083
80.00%	9.5	2941
81.00%	9.1	2806
82.00%	8.8	2713
83.00%	8.4	2590
84.00%	7.9	2436
85.00%	7.3	2251

Percent Exceeded	Q	Load(CFUx10^7/Day)
86.00%	6.9	2127
87.00%	6.6	2035
88.00%	6.2	1912
89.00%	5.9	1819
90.00%	5.7	1757
91.00%	5.4	1665
92.00%	5.0	1542
93.00%	4.7	1449
94.00%	4.1	1264
95.00%	3.5	1079
96.00%	3.0	925
97.00%	2.8	863
98.00%	2.2	678
99.00%	1.6	493

Appendix E
US EPA Region 8 Public Notice Review and Comments

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**E. coli Bacteria TMDL for the Souris River in McHenry County, North Dakota**
Submitted by:	**Mike Ell, North Dakota Department of Health**
Date Received:	**September 16, 2011**
Review Date:	**September 16, 2011**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Public Notice**
Notes:	

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

☐ Approve
☐ Partial Approval
☐ Disapprove
☐ Insufficient Information

Approval Notes to Administrator:

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

1. Problem Description
   - 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 draft Souris River, Segment 1 (McHenry County, ND), E. coli TMDL was submitted to EPA for review via an email from Mike Ell, NDDoH on September 16, 2011. The email included the draft TMDL document and a request to review and comment on the TMDL document.

COMMENTS: None.

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The Souris River watershed is a 139,709 acre watershed located in McHenry County, in north central North Dakota. The listed segment of the Souris River is from the confluence with Oak Creek downstream to the confluence with the Wintering River in McHenry County, ND (51 miles; ND-09010003-001-S_00). It is part of the larger Souris River basin in the Lower Souris sub-basin (HUC 09010003). This segment is listed as impaired for sediment/siltation and E. coli. The TMDL document included in this review only addresses the E. coli impairment. The sediment impairment will be addressed in a separate document.

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

COMMENTS: None.

1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

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

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

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

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

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

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

SUMMARY: The Souris River, Segment 1, in McHenry County as addressed by this TMDL document is impaired based on E. coli concentrations impacting the recreational uses. The Souris River is Class IA stream that shall be suitable for the propagation and/or protection of resident fish species and other aquatic biota and for swimming, boating, and other water recreation. Class IA streams shall also be suitable for irrigation, stock watering and wildlife without injurious effects. Numeric criteria for E. coli in Class IA streams have been established and are presented in the excerpted Table 8 shown below. Discussion of additional applicable water quality standards for Souris River can be found on pages 12 and 13 of the TMDL.

Table 8. North Dakota E. coli Bacteria Standard for Class IA Streams.

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

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

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

COMMENTS: None.

2. Water Quality Targets

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The water quality target for this TMDL is based on the numeric water quality standards for E. coli bacteria established to protect the recreational beneficial uses for the Souris River segment. The TMDL target for the impaired stream segment is: 126 cfu/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the target will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standard.

Effective January 2011, the Department revised the state water quality standards. In these latest revisions the Department eliminated the fecal coliform bacteria standard, retaining only the E. coli bacteria standard for the protection of recreational uses. This standards change was recommended by the US EPA as E. coli is believe to be a better indicator of recreational use risk.

COMMENTS: None.

3. Pollutant Source Analysis

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

Minimum Submission Requirements:

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

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

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

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

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

SUMMARY: The TMDL document includes the landuse breakdown for the watershed based on the 2010 National Agricultural Statistics Service data. In 2010, approximately 48 percent of the landuse in the watershed was cropland under active cultivation, 37 percent was pasture/range/haylands, and the remaining 15 percent was idle/fallow, water, woods or roads.

Within the watershed of the TMDL listed reach of the Souris River, there is one wastewater treatment system permitted through the North Dakota Pollution Elimination System Program. It is for the community of Velva, North Dakota (population 1,084 in 2010). This system is allowed to discharge on an “as needed” basis, usually two to four times a year. Bacteria monitoring was switched in 2011 from fecal coliform to E. coli bacteria, so no E. coli data is currently available for the point source discharge. However, the bacteria concentration entering this portion of the Souris River from the lagoon discharge is low, and not the primary cause of coliform bacteria impairment.

There is one permitted medium (301–999 animal units) animal feeding operation (AFO) in the watershed, however, they are zero discharge facility and are not deemed a significant source for this report.

The E. coli bacteria pollution to this segment is primarily originating from nonpoint sources in the watershed. Unpermitted animal feeding operations (AFOs) and livestock grazing and watering in proximity to the Souris River are common along the TMDL listed reach.

This area of North Dakota typically experiences short duration but intense precipitation during the spring and early summer months. These storms can cause overland flooding and rising river levels. Due to the close proximity of livestock grazing and watering to the river, it is likely that they contribute to the E. coli bacteria pollution in this listed segment of the Souris River. These assessments are supported by the load duration curve analysis which shows exceedences of the E. coli bacteria standard occurring during high, moist, and dry conditions.

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

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

COMMENTS: None.

4. TMDL Technical Analysis

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

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

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

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

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

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

Minimum Submission Requirements:

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

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

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

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

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

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

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

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

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

SUMMARY: The technical analysis should describe the cause and effect relationship between the identified pollutant sources, the numeric targets, and achievement of water quality standards. It should also include a description of the analytical processes used, results from water quality modeling, assumptions and other pertinent information. The technical analysis for the Segment 1 of the Souris River in McHenry County describes how the E. coli loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segment.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. To better correlate the relationship between the pollutant of concern and the hydrology of the Section 303(d) listed waterbody, a LDC was developed for monitoring site 380095. The LDC was derived using the 126 cfu/100 mL TMDL target (i.e., state water quality standard), the daily flow record recorded nearby, and the observed E. coli data collected from the site (see Figure 11 of the TMDL document) from 2001-2011.

Mean daily flows from 1991 through 2010 were used in the development of the flow duration curve and load duration curve for site 380095. Flows were obtained from the discharge record at the United States Geological Survey (USGS) gauge station (05120000) which is located on the Souris River near Verendrye, ND.

The flow duration curve was divided into four flow regimes, one representing high flows (0-15 percent), one for moist conditions (15-47 percent), one for dry conditions (47-78 percent), and one for low flows (78-99 percent). No flow occurred only one percent of the time. These flow intervals were defined by examining the range of flows for the site for the period of record and then by looking for natural breaks in the flow record based on the flow duration curve plot. The load duration curve plots the allowable E. coli load (using the 126 cfu/100 mL standard) across the four flow regimes. Single grab sample E. coli concentrations were converted to loads by multiplying by flow and a conversion factor to produce cfu/day values. Each value was plotted individually on the load duration curve. Values falling above the curve indicate exceedance of the TMDL at that flow value while values falling below the curve indicate attainment of the TMDL at that flow.

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

The LDC represents flow-variable TMDL targets across the flow regimes shown in the TMDL document. For the Souris River segment covered by the TMDL document, the LDC is a dynamic expression of the allowable load for any given daily flow. Loading capacities were derived from this approach for the entire listed segment at each flow regime. Table 12 shows the loading capacity load (i.e., TMDL load) for the listed segment of the Souris River.

COMMENTS: We realize that a regression line cannot be drawn for the moist flow regime with only one data point above the curve. However, in the absence of additional data points above the curve, the single data point should be used to derive the existing load for the zone. That would enable the “Existing Load” to be derived for the moist flow in Table 12. [Note: the text on page 17 above the LDC says that regression lines could not be developed for zones without E. coli concentrations above the target – this wording should be revised to say that regression lines cannot be derived if there are 1 or less data points above the curve].

Table 12 should include the calculated WLA for the moist and dry flow zones unless the permit for Velva will not allow discharges to occur during the moist and dry flow regimes.

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 Souris River TMDL data description and summary are included tables throughout the document and in the data tables in Appendix B. Recent water quality monitoring was conducted over the period from 2001-2011 and included 54 E. coli samples collected at station 380095. The data set also includes approximately 20 years of flow record on Souris River from the USGS gauging site (05120000). The flow data, the water quality data, and the TMDL target, were used to develop the E. coli load duration curve for the Souris River.

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 wastewater treatment facility for Velva, ND, is the only point source located within the watershed of this impaired reach of the Souris River. According to the permit, the Velva facility is allowed to discharge on an "as needed basis". The Discharge Monitoring Report (DMR) indicates this system discharges between two and four times a year. Based on the DMR data this system discharges 6.57 million gallons of treated wastewater over an average of eight days each time there is a discharge. This is equal to 821,000 gallons per day. Since no E. coli data are available from the discharge, the TMDL document assumes that the discharge would meet the assigned the water quality standards value of 126 cfu/100 mL.

The wasteload allocation for Velva's discharge was determined by taking the average daily discharge and multiplying it by the assumed E. coli bacteria maximum concentration of 126 cfu/100 mL, times appropriate conversion factors. The resulting WLA is 3.92E+09 cfu/day.

There is one permitted medium (301–999 animal units) animal feeding operation (AFO) in the watershed, however, they are zero discharge facility and are not deemed a significant source for this report. Therefore, the E. coli WLA for this AFO is zero.

COMMENTS: None.

4.3 Load Allocations (LA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The TMDL document includes the landuse breakdown for the watershed based on the 2010 National Agricultural Statistics Service data. In 2010, approximately 48 percent of the landuse in the watershed was cropland under active cultivation, 37 percent was pasture/range/haylands, and the remaining 15 percent was idle/fallow, water, woods or roads. The single point source located in the impaired segment is not a significant source of E. coli loading. The most significant sources of E. coli bacteria loading were defined as nonpoint source pollution originating from livestock. Therefore, the majority of the TMDL has been allocated to nonpoint sources as a load allocation (LA). Source specific data are limited so an aggregate LA is assigned to nonpoint sources with a ranking of important contributors under various flow regimes provided as seen in the following excerpted table.

Table 10. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

Nonpoint Sources	Flows		
	High Flow	Medium Flow	Low Flow
Riparian Area Grazing (Livestock)	H	H	H
Animal Feeding Operations	H	M	L
Manure Application to Crop and Range Land	H	M	L
Intensive Upland Grazing (Livestock)	H	M	L
Note: Potential importance of nonpoint source area to contribute fecal coliform bacteria loads under a given flow regime. (H: High; M: Medium; L: Low)			

COMMENTS: None.

4.4 Margin of Safety (MOS):

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

Minimum Submission Requirements:

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

- ☐ <u>If the MOS is implicit</u>, 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.
- ☒ <u>If the MOS is explicit</u>, 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.
- ☐ <u>If</u>, rather than an explicit or implicit MOS, the <u>TMDL relies upon a phased approach</u> 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 Souris River TMDL includes an explicit MOS for the listed segment derived by calculating 10 percent of the loading capacity. The explicit MOS for the Souris River segment is included in Table 12.

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 TMDL is seasonal since the E. coli criteria are in effect from May 1 to September 30, therefore the TMDL is only applicable during that period.

COMMENTS: None.

5. Public Participation

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

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

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

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

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

COMMENTS: None.

6. Monitoring Strategy

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The Souris River segments will be monitored according to an approved quality assurance project plan. Once a watershed restoration plan is developed and implemented (e.g., a Section 319 Project Implementation Plan), monitoring will be conducted on Souris River according to a future Quality Assurance Project Plan.

COMMENTS: None.

7. Restoration Strategy

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

Minimum Submission Requirements:

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

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

SUMMARY: The Allocation section (Section 8.0) of the TMDL document includes a list of BMPs that are recommended to meet the TMDL loads. NDDoH typically works with local conservation districts or other cooperators to develop and implement Watershed Restoration Projects after the TMDL has been developed and approved. Detailed project implementation plans are developed as part of this process if Section 319 money is used.

There is only one permitted point source in the watershed from the small town of Velva's wastewater treatment facility. This source is not a significant source of E. coli loading to the impaired segment of the Souris River so it's not necessary to fully document reasonable assurance demonstrating that the nonpoint source loading reductions are practicable. The Velva wastewater treatment facility permit will be amended to include testing for E. coli bacteria in the discharged wastewater when the permit comes up for renewal.

COMMENTS: Implementation of the WLA is a necessary action once the TMDL is approved. When the Velva permit is up for renewal, the permit should be revised to include an E. coli limit in addition to a monitoring requirement.

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 Souris River E. coli TMDL document includes daily loads expressed as colonies per day for the listed segment of the river. The daily TMDL loads are included in TMDL section (Section 7.0) of the document.

COMMENTS: None.

Appendix F
NDDoH's Response to Comments Received from US EPA Region 8

US EPA Comment: We realize that a regression line cannot be drawn for the moist flow regime with only one data point above the curve. However, in the absence of additional data points above the curve, the single data point should be used to derive the existing load for the zone. That would enable the "Existing Load" to be derived for the moist flow in Table 12. [Note: the text on page 17 above the LDC says that regression lines could not be developed for zones without E. coli concentrations above the target – this wording should be revised to say that regression lines cannot be derived if there are 1 or less data points above the curve].

Table 12 should include the calculated WLA for the moist and dry flow zones unless the permit for Velva will not allow discharges to occur during the moist and dry flow regimes.

NDDoH Response: Section 5.3, E. coli Bacteria Load Duration Curve Analysis, was revised to include wording describing the calculation of an existing load for the moist condition flow regime using the single data point, and the use of the regression relationship for flow regimes with more than one data point above the load duration curve. Table 12 was also modified to include the existing load calculation for the moist condition flow regime as well as load allocations, waste load allocations, and a margin of safety for the moist and dry flow regimes. In addition, the last paragraph in Section 7.0, TMDL, was reworded to describe the inclusion of a load allocation, waste load allocation and margin of safety in the moist and dry flow regimes.

US EPA Comment: Implementation of the WLA is a necessary action once the TMDL is approved. When the Velva permit is up for renewal, the permit should be revised to include an E. coli limit in addition to a monitoring requirement.

NDDoH Response: As mention in the above response to comments, a WLA was provided for all four flow regimes for the TMDL segment. In addition, effluent limits and monitoring requirements based on this WLA will be added to the NDPDES permit for Velva, ND when their permit is re-issued in September 2013. Addition language was added to Section 11, Implementation Strategy, describing this requirement.