E. coli Bacteria TMDL for the Maple River in Cass, Barnes, Steele, Ransom, and Richland Counties, North Dakota

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1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

The Maple River watershed is a 1,009,909 acre watershed located in Cass, Barnes, Steele, Ransom and Richland Counties in southeastern North Dakota (Table 1 and Figure 1). For the purposes of this Total Maximum Daily Load (TMDL), the impaired segments are located in Steele, Ransom and Cass Counties. The Maple River impaired segments lie within the Level III Northern Glaciated Plains (46) and Lake Agassiz Plain (48) ecoregions.

Table 1. General Characteristics of the Maple River Watershed.

Legal Name	Maple River
Stream Classification	Class II
Major Drainage Basin	Red River
8-Digit Hydrologic Unit	09020205
Counties	Cass, Barnes, Steele, Ransom, Richland Counties
Level III Ecoregions	Northern Glaciated Plains (46) and Lake Agassiz Plain (48)
Watershed Area (acres)	1,009,909

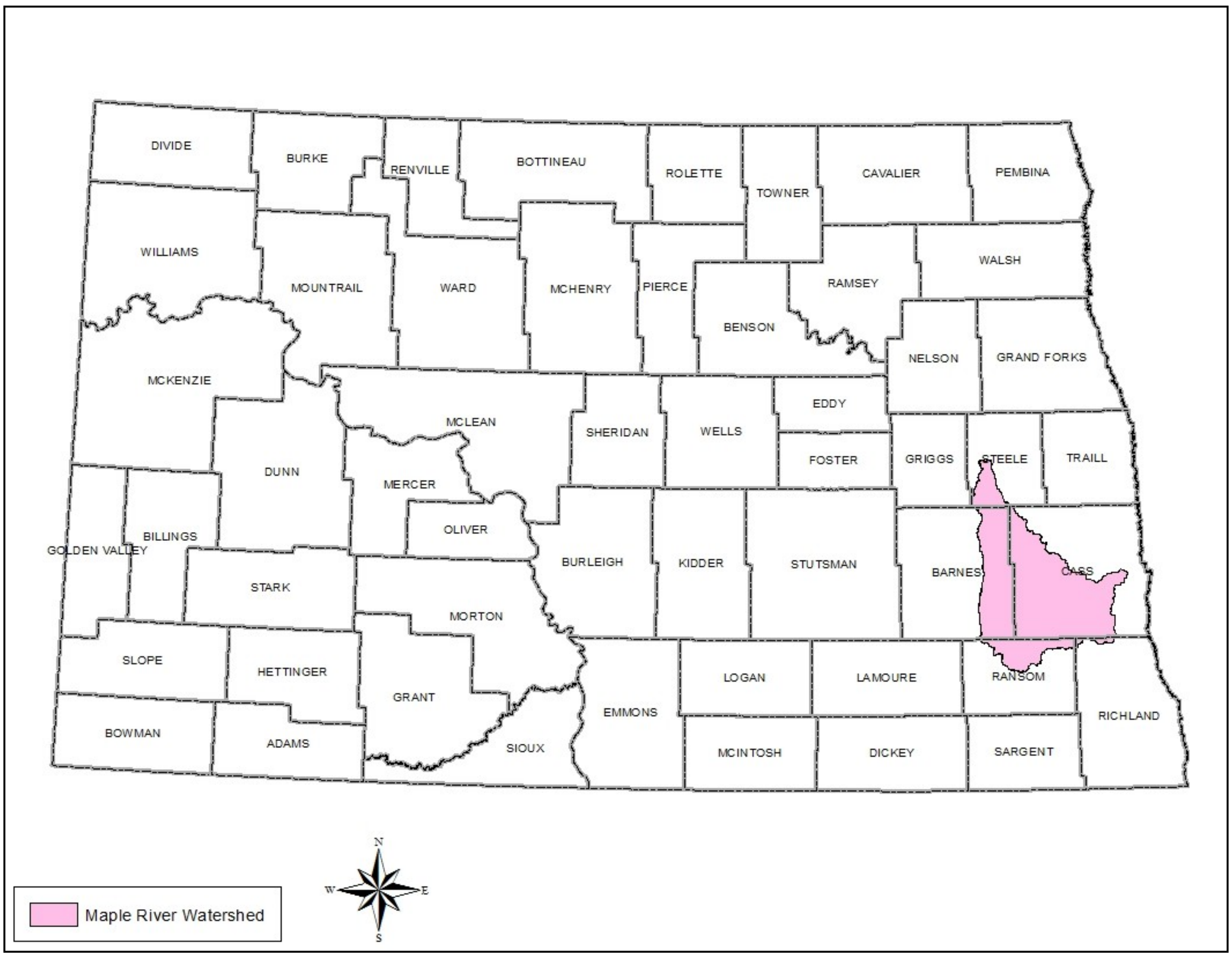

Figure 1. Maple River Watershed in North Dakota.

1.1 Clean Water Act Section 303(d) Listing Information

Based on the 2012 Section 303(d) List of Impaired Waters Needing TMDLs (NDDoH, 2012), the North Dakota Department of Health (NDDoH) has identified a 28.28 mile segment (ND-09020205-024-S_00) of the Maple River downstream to its confluence with a tributary near the Steele, Cass, and Barnes county line (ND-09020205-023-S_00) as not supporting for fish and other aquatic biota due to fishes bioassessments and dissolved oxygen and fully supporting, but threatened for recreation due to Escherichia coli (E. coli) bacteria.

A 40.06 mile segment (ND-09020205-015-S_00) of the Maple River from its confluence with a tributary watershed near Buffalo, ND (ND-09020205-019-S_00) downstream to its confluence with the South Branch Maple as fully supporting, but threatened for fish and other aquatic biota due to fishes bioassessment and fully supporting, but threatened for recreation due to E. coli bacteria.

A 26.15 mile segment (ND-09020205-012-S_00) of the Maple River from its confluence with the South Branch Maple River downstream to its confluence with a tributary near Leonard, ND as fully supporting, but threatened for fish and other aquatic biota due to dissolved oxygen and fishes bioassessments and not supporting recreation due to E. coli bacteria.

A 27.92 mile segment (ND-09020205-001-S_00) of the Maple River from its confluence with Buffalo Creek downstream to its confluence with the Sheyenne River as not supporting fish and other aquatic biota due to sedimentation/siltation, combination benthic/fishes bioassessments and fully supporting, but threatened recreation due to E. coli bacteria.

This TMDL report will only addresses the E. coli bacteria impairment for recreational use, for further information regarding the impaired segments of the Maple River please refer to Tables 2-5 and Figure 2. Currently, adequate information is not available to address the dissolved oxygen, sedimentation/siltation, and biological impairment TMDL listings. As additional information becomes available (e.g., through research), a TMDL or de-listing justification will be prepared to address these pollutants.

Table 2. Maple River Section 303(d) Listing Information for Assessment Unit ID ND-09020205-024-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020205-024-S_00
Waterbody Description	Maple River downstream to its confluence with a tributary near the Steele, Cass, and Barnes County line (ND-09020205-023-S_00).
Size	28.28 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Escherichia coli
TMDL Priority	High

Table 3. Maple River Section 303(d) Listing Information for Assessment Unit ID ND-09020205-015-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020205-015-S_00
Waterbody Description	Maple River from its confluence with a tributary watershed near Buffalo, ND (ND-09020205-019-S_00) downstream to its confluence with the South Branch Maple River.
Size	40.06 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Escherichia coli
TMDL Priority	High

Table 4. Maple River Section 303(d) Listing Information for Assessment Unit ID ND-09020205-012-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020205-012-S_00
Waterbody Description	Maple River from its confluence with the South Branch Maple River downstream to its confluence with a tributary near Leonard, ND.
Size	26.15 miles
Designated Use	Recreation
Use Support	Not Supporting
Impairment	Escherichia coli
TMDL Priority	High

Table 5. Maple River Section 303(d) Listing Information for Assessment Unit ID ND-09020205-001-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020205-001-S_00
Waterbody Description	Maple River from its confluence with Buffalo Creek downstream to its confluence with the Sheyenne River.
Size	27.92 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Escherichia coli
TMDL Priority	High

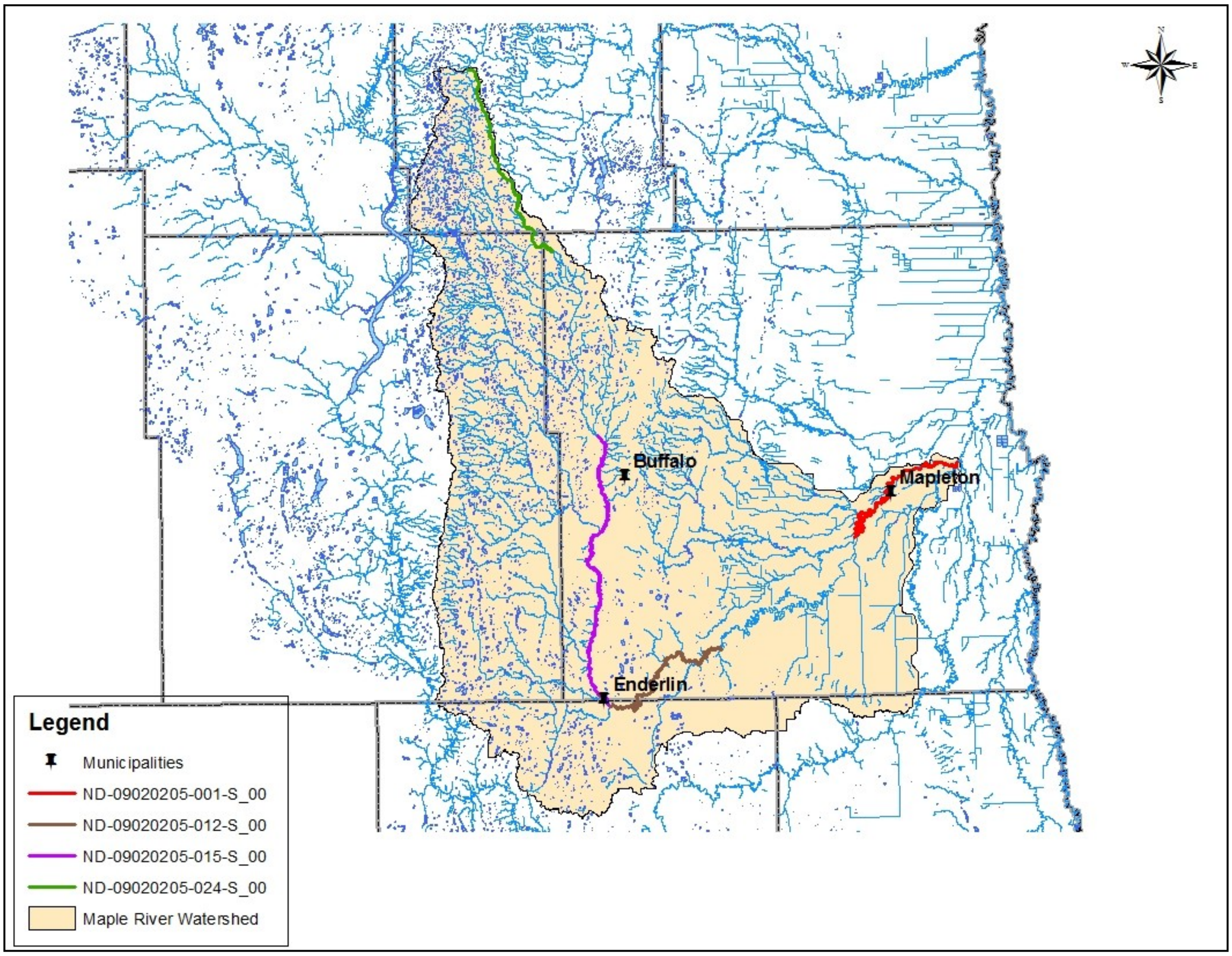

Figure 2. Maple River TMDL Listed Segments.

1.2 Ecoregions

The watersheds for the Section 303(d) listed segments highlighted in this TMDL lie within four Level IV ecoregions End Moraine Complex (46f), Drift Plains (46i), Glacial Lake Agassiz Basin (48a), and Sand Deltas and Beach Ridges (48b) Figure 3. The End Moraine Complex ecoregion (46f) is composed of blocks of material scraped off and thrust up by the continental glacier at the south end of the Devils Lake basin. The western part of the ecoregion exhibits similar stagnate moraines similar to the Missouri Coteau while the southern moraines contain slightly higher elevations resulting in wooded lake boundaries and morainal ridges. Land use within the End Moraine Complex ecoregion consists of mixed range and cropland depending on slope and presence of rocky soil.

The Drift Plains ecoregion (46i) was formed by the retreating Wisconsin glacier that left a thick mantle of glacial till. The landscape consists of temporary and seasonal wetlands. Due to the productive soil of this ecoregion almost all of the area is under cultivation. Glacial Lake Agassiz Basin ecoregion (48a) is comprised of thick beds of glacial drift overlain by silt and clay lacustrine deposits from glacial Lake Agassiz. The topography of this ecoregion is extremely flat, with sparse lakes and pothole wetlands. Tallgrass prairie was the dominant habitat prior to European settlement and has now been replaced with intensive agriculture. Agricultural production in the southern region consists of corn, soybeans, wheat, and sugar beets. The Sand Deltas and Beach Ridges ecoregion (48b) disrupts the flat topography of the Red River Valley. The beach ridges are parallel lines of sand and gravel that were formed by wave action of the contracting shoreline levels of Lake Agassiz. The deltas consist of lenses of fine to coarse sand and are blown into dunes (USGS, 2006).

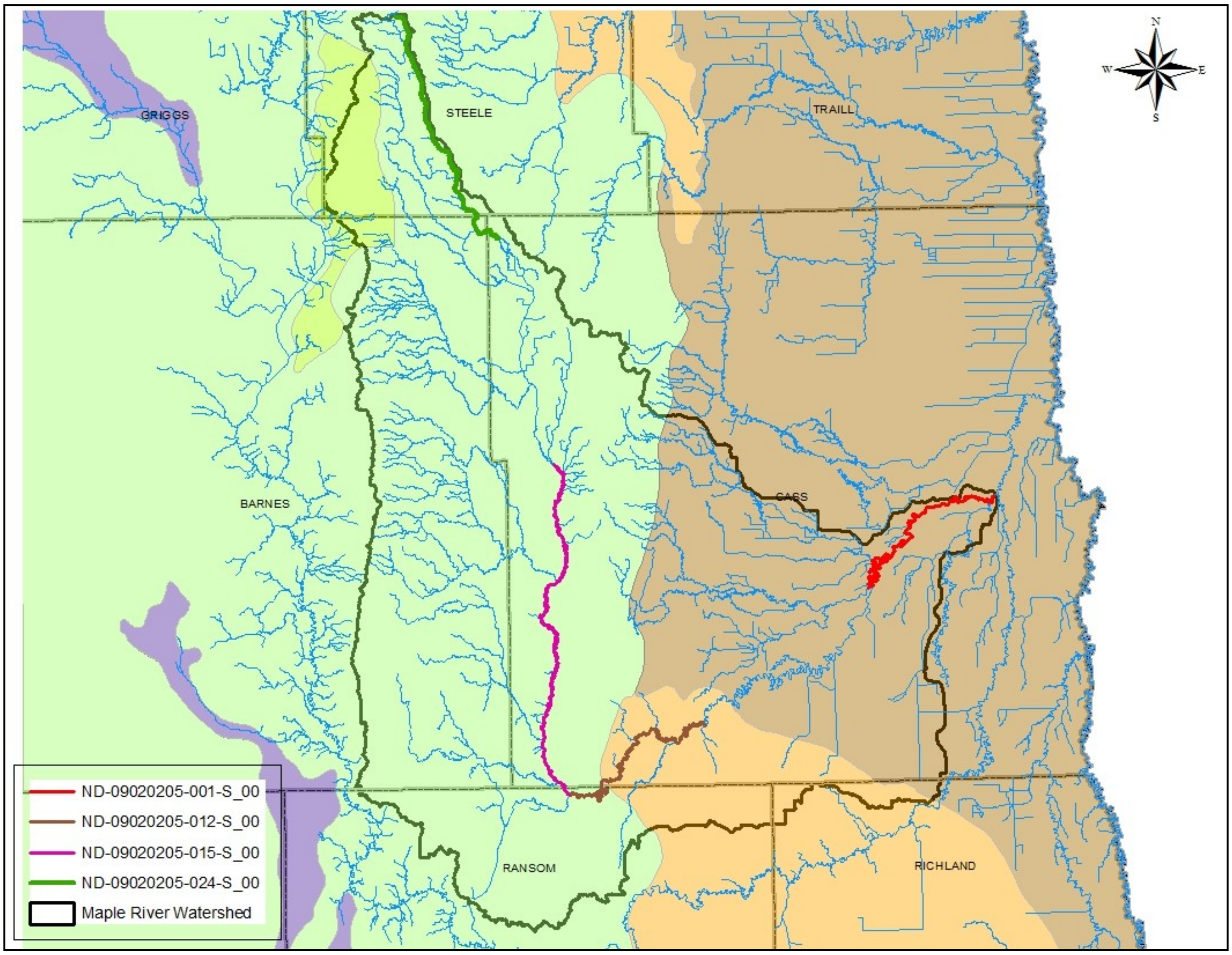

Figure 3. Level IV Ecoregions in the Maple River Watershed and TMDL Listed Segments.

1.3 Land Use

The dominant land use in the Maple River watershed is row crop agriculture. According to the 2010 National Agricultural Statistical Service (NASS, 2010) land survey data, approximately 70 percent of the land is cropland, 19 percent in pasture/rangeland/hay, and 11 percent is water/wetlands, developed space, woods, fallow/barren. The majority of the crops grown consist of soybeans, corn, spring wheat, sugar beets, sunflowers, barley and dry beans (Figure 4).

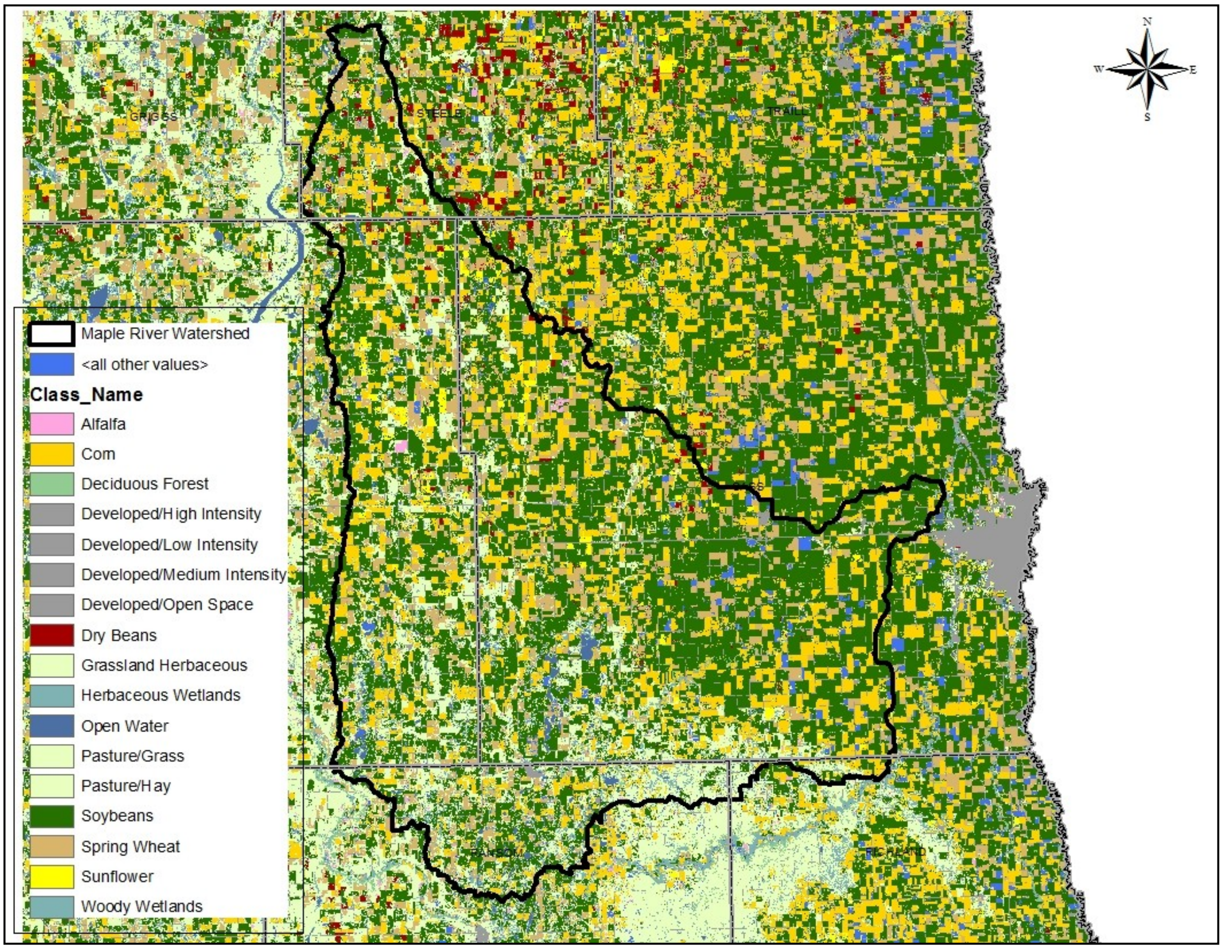

Figure 4. Land Use in the Maple River Watershed (NASS, 2010).

1.4 Climate and Precipitation

Figures 5 and 6 show the annual precipitation and monthly average temperature for the Fingal, ND (Barnes County) North Dakota Agriculture Weather Network (NDAWN) station from 2002-2012. Barnes County has a subhumid climate characterized by warm summers with frequent hot days and occasional cool days. Average temperatures range from 10 º F in winter to 70º F in summer. Precipitation occurs primarily during the warm period and is normally heavy in later spring and early summer. Total annual precipitation is about 19 inches.

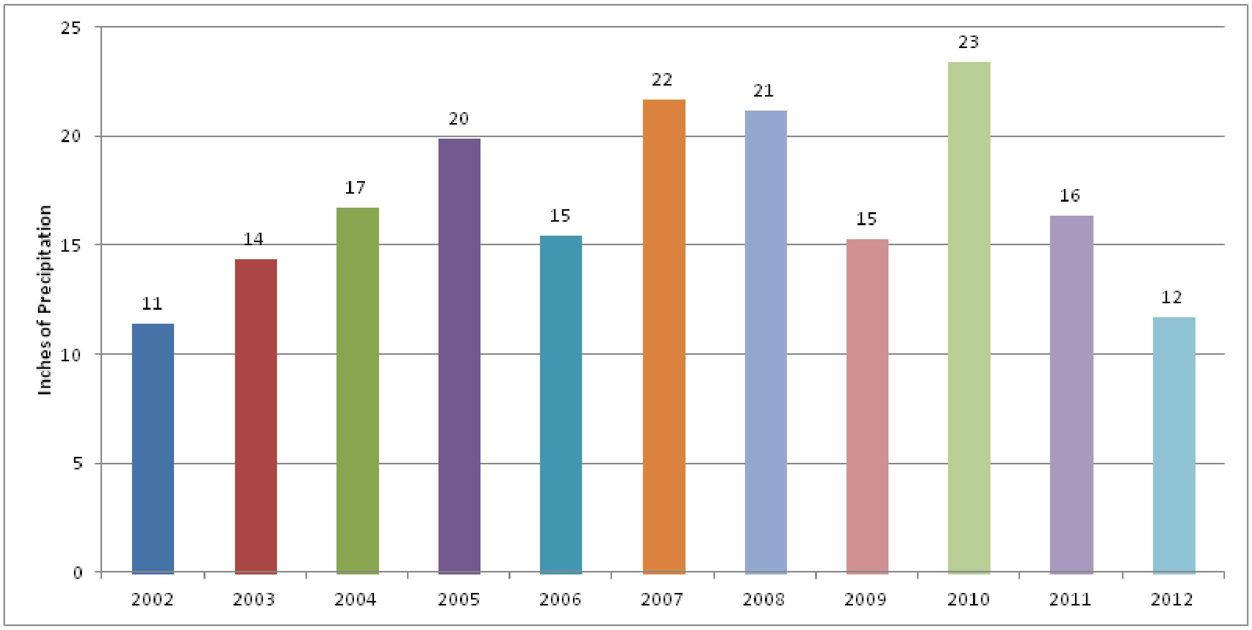

Figure 5. Annual Total Precipitation at Fingal, North Dakota from 2002-2012. North Dakota Agricultural Weather Network (NDAWN).

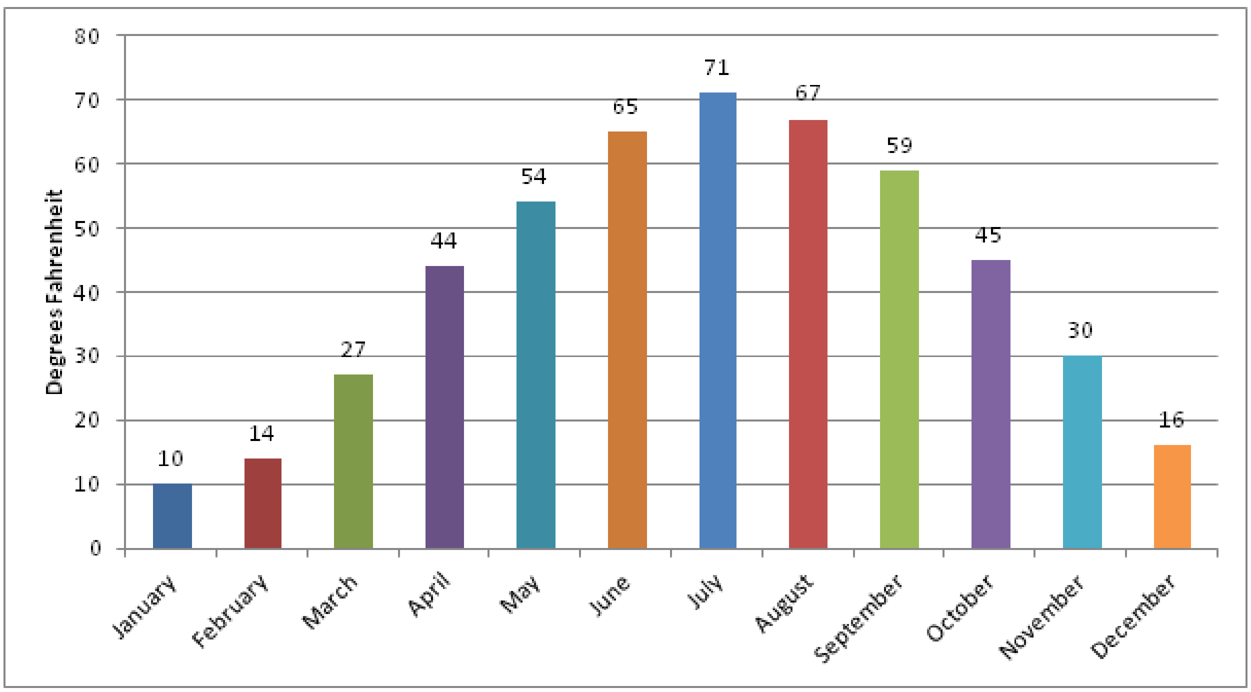

Figure 6. Monthly Average Air Temperature at Fingal, North Dakota from 2002-2012. North Dakota Agricultural Weather Network (NDAWN).

1.5 Available Data

1.5.1 E. coli Bacteria Data

Table 6. Summary of E. coli Bacteria Data for Site 385352 Collected in 2011, 2012, and 2013.

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 409 CFU/100mL	Recreational Use Assessment
May	11	62	0%	Fully Supporting
June	10	273	20%	Not Supporting
July	10	281	30%	Not Supporting
August	5	61	0%	Fully Supporting
September	4	47	0%	Fully Supporting

Table 7. Summary of E. coli Bacteria Data for Site 385360 Collected in 2011, 2012, and 2013.

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 409 CFU/100mL	Recreational Use Assessment
May	12	59	8%	Fully Supporting
June	9	145	22%	Not Supporting
July	11	106	9%	Fully Supporting
August	5	73	20%	Fully Supporting but Threatened
September	4	150	0%	Not Supporting

Table 8. Summary of E. coli Bacteria Data for Site 385351 Collected in 2011, 2012, and 2013.

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 409 CFU/100mL	Recreational Use Assessment
May	11	119	9%	Fully Supporting
June	10	264	20%	Not Supporting
July	13	169	8%	Not Supporting
August	12	160	25%	Not Supporting
September	11	82	9%	Fully Supporting

Table 9. Summary of E. coli Bacteria Data for Site 384155 Collected in 2011, 2012 and 2013.

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 409 CFU/100mL	Recreational Use Assessment
May	15	28	0%	Fully Supporting
June	12	84	17%	Full Supporting, but Threatened
July	17	45	6%	Fully Supporting
August	15	27	0%	Fully Supporting
September	12	36	8%	Fully Supporting

An analysis of the 2011, 2012 and 2013 E. coli bacteria data collected at site 385352, showed that for the months of May, August and September recreational use was fully supporting (Table 6). For the months of June and July, results for both the geometric mean concentration and the percentage of samples exceeding the E. coli bacteria water quality standard for recreational use was not supporting (Table 6).

Monthly results for site 385360 showed that during the months of June and September recreational use was not supporting, while May and July were assessed as fully supporting, and August was fully supporting, but threatened recreational beneficial uses (Table 7).

The recreation use assessment for site 385351 concluded that during the months of May and September recreation use was fully supporting, while June, July and August was assessed as not supporting (Table 8).

Site 384155 had a recreational use assessment that demonstrated a fully supporting recreational use for the months of May, July, August and September, while June had a fully supporting, but threatened recreational use support. It is also important to note that while the geometric means were relatively low, the percent exceeded results for July and September were approaching the maximum water quality standard value of ten percent (Table 9).

1.5.2 Hydraulic Discharge

The daily stream discharge record for water quality monitoring site 385351, corresponding to waterbody segment ND-09020205-012-S_00, was obtained from the United States Geological Survey (USGS) gauging station 05059700 located on Maple River near Enderlin, ND (Figure 7). USGS station 05059700 has operated continuously since 1956 and is collocated with the NDDoH monitoring location 385351.

A daily stream discharge record was also developed for water quality monitoring site 384155, corresponding to waterbody segment ND-09020205-001-S_00, and was also obtained from the USGS gauging station 05060100 located on the Maple River near Mapleton, ND (Figure 7). USGS station 05060100 has operated continuously since 1944 and is collocated with the NDDoH monitoring location 384155.

A discharge record was constructed for sites 385352 and 385360, corresponding to waterbody segments ND-09020205-024-S_00 and ND-09020205-015-S_00, using the Drainage Area Ratio Method (Ries et al., 2000 and Emerson et al., 2005) and the historical discharge measurements collected by the USGS at gauging station 05059700 from 1993-2013.

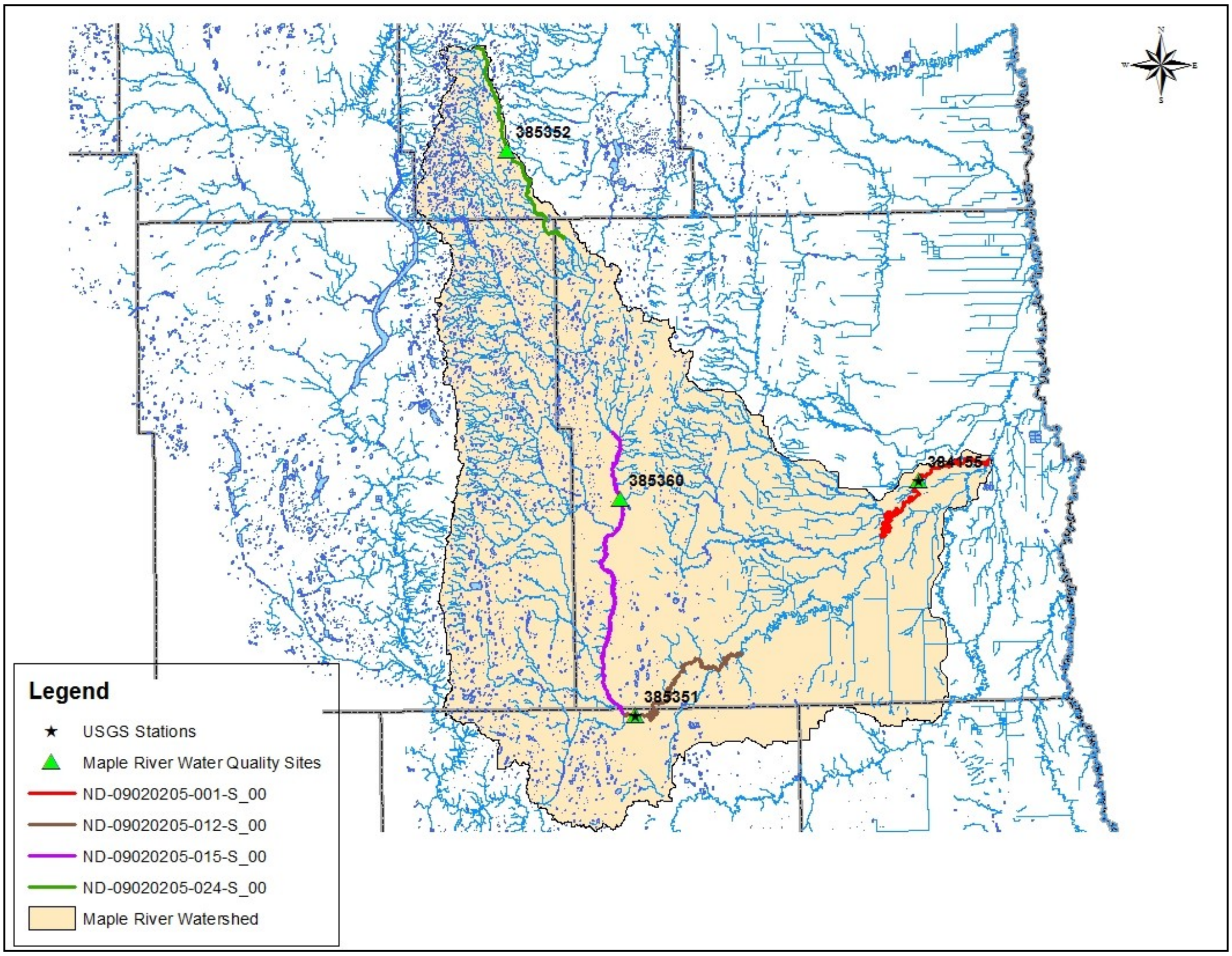

Figure 7. E. coli Bacteria Sample Sites and USGS Gauge Stations (05059700 and 05060100) on the Maple River.

2.0 WATER QUALITY STANDARDS

The Clean Water Act requires that 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, which in this case E. coli bacteria.

2.1 Narrative Water Quality Standards

The NDDoH 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:

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

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

2.2 Numeric Water Quality Standards

The impaired segments of the Maple River are all Class II streams. The NDDoH definition of a Class II stream is shown below (NDDoH, 2011).

Class II- The quality of the waters in this class shall be the same as the quality of class I streams, except that additional treatment may be required to meet the drinking water requirements of the department. Streams in this classification may be intermittent in nature which would make these waters of limited value for beneficial uses such as municipal water, fish life, irrigation, bathing, or swimming.

Table 10 provides a summary of the current numeric E. coli criteria which applies to Class II streams. The E. coli bacteria standard applies only during the recreation season from May 1 to September 30.

Table 10. North Dakota Bacteria Water Quality Standards for Class II Streams.

Parameter	Standard	
	Geometric Mean[1]	Maximum[2]
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 TARGETS

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

3.1 Maple River Target Reductions in E. coli Bacteria Concentrations

The four Maple River segments (ND-09020205-015-S_00, ND-09020205-012-S_00, ND-09020205-001-S_00, and ND-09020205-024-S_00) are impaired for recreation use due to E. coli bacteria concentrations exceeding the North Dakota water quality standard. The North Dakota water quality standard for E. coli bacteria is a geometric mean concentration of 126 CFU/100 mL during the recreation season from May 1 to September 30. 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, for purposes of these TMDLs, the target is based on an E. coli concentration of 126 CFU/100 mL expressed as a daily average based on individual grab samples. Expressing the target in this way will ensure the TMDL will result in both components of the standard being met and recreational uses are restored.

4.0 SIGNIFICANT SOURCES

4.1 Point Source Pollution Sources

Within the watersheds of the TMDL listed reaches of the Maple River there are three wastewater treatment systems permitted through the North Dakota Pollutant Discharge Elimination System (NDPDES) Program. They are located in Buffalo, Enderlin, and Mapleton, North Dakota. Each system is allowed to discharge on an “as needed” basis (Appendix D). There is a limited amount of E. coli data available for these systems during their discharges. Therefore, wasteload allocations will be given to three facilities as described later in Section 5.5.

There is one permitted animal feeding operation (AFO) in the watersheds of the TMDL listed reaches of the Maple River. The NDDOH has permitted one small (0-300 AUs) AFO currently in the permitting process. The AFO is a zero discharge facility and is not deemed a significant source of E. coli bacteria loading to the Maple River.

4.2 Nonpoint Source Pollution Sources

The TMDL listed segments which are the focus of this report are experiencing E. coli bacteria, pollution from nonpoint sources in the watersheds. The southeast section of North Dakota typically experiences long duration and/or intense precipitation during the early summer months. These storms can cause overland flooding and rising river levels. Due to the close proximity of unpermitted AFOs and livestock grazing and watering to the river, it is likely that this contributes E. coli bacteria to the Maple River and its tributaries.

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

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 concentrating in a specific area, thus decreasing the probability of their contribution of fecal matter in significant quantities.

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

Stormwater runoff from the cities of Buffalo, Enderlin, and Mapleton will be treated as nonpoint sources because their populations do not fall under the criteria for a MS4 permit. The permit requirements call for a city to have a population of 10,000 or more, or be considered an urbanized area that can significantly contribute pollutants to a MS4 with a population of 10,000 people. These towns have total populations less than 10,000 and are not located within an urbanized area with an existing MS4 permit. The total populations are listed as follows, Buffalo, ND-188, Enderlin, ND-886 and Mapleton, ND-762. Therefore stormwater runoff from these towns will be included in the load allocation.

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 determine the cause and effect relationship between the water quality target and the identified source, the "load duration curve" methodology was used.

The loading capacity or TMDL is the amount of a pollutant (e.g., E. coli bacteria) a waterbody can receive and still meet and maintain water quality standards and beneficial uses.

5.1 Mean Daily Stream Flow

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

Flows for TMDL segments ND-09020205-024-S_00 and ND-09020205-015-S_00 were determined by utilizing the Drainage-Area Ratio Method developed by the USGS (Ries et. al, 2000 and Emerson, Vecchia, and Dahl, 2005). The Drainage-Area Ratio Method assumes that the streamflow at the ungauged site is hydrologically similar (same per unit area) to the stream gauging station used as an index. This assumption is justified since the ungauged sites (385352 and 385360) are nested on the same reach as the index station (05059700).

Streamflow data for the index station (05059700) was obtained from the USGS Water Science Center website. The index station (05059700) streamflow data was then divided by the drainage area to determine streamflows per unit area at the index station. Those values are then multiplied by the drainage area for the ungauged site and a seasonal regression equation (Emerson, Vecchia, and Dahl, 2005) to obtain estimated flow statistics for the ungauged site.

Winter: $Qy = 1.24(Ay/Ax)^{0.85}\,Qx$

Spring: $Qy = 1.02(Ay/Ax)^{0.91}\,Qx$

Summer: $Qy = 1.06(Ay/Ax)^{1.02}\,Qx$

Mean daily discharge for TMDL segments ND-09020205-001-S_00 and ND-09020205-012-S_00 were developed using stage and discharge data obtained from USGS gauge station sites 05059700 and 05060100 which were collocated with sites 385351 and 384155 for the years 1993-2013 and 1995-2013, respectively.

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 (EPA, 2007).

A basic flow duration curve runs from high to low (0 to 100 percent) along the x-axis with the corresponding flow value on the y-axis (Figure 8). Using this approach, flow duration intervals are expressed as a percentage, with zero corresponding to the highest flows in the record (i.e., flood conditions) and 100 to the lowest flows in the record (i.e., drought). Therefore, as depicted in Figure 8, a flow duration interval of twenty five (25) percent, associated with a stream flow of 8.8 cfs, implies that 25 percent of all observed mean daily discharge values equal or exceed 8.8 cfs.

Once the flow duration curve is developed for the stream site, flow duration intervals can be defined which can be used as a general indicator of hydrologic condition (i.e., wet vs dry conditions and to what degree). These intervals (or zones) provide additional insight about conditions and patterns associated with the impairment (E. coli bacteria in this case) (EPA, 2007).

As depicted in Figure 8, the flow duration curve for site 385352, representing TMDL segment ND-09020205-024-S_00, was divided into four zones, one representing high flows (0-8 percent), moist conditions (8-39 percent), dry conditions (39-84 percent) and one for low flows (84-97 percent). Based on the flow duration curve analysis, no flow occurred 3 percent of the time (97-100 percent).

Similarly, as depicted in Figure 9, the flow duration curve for water quality site 385360, representing TMDL segment ND-09020205-015-S_00, was also divided into four zones, one representing high flows (0-12 percent), one for moist conditions (12-43 percent), one for dry conditions (43-71 percent), and one for low flows (71-97 percent). Based on the flow duration curve analysis, no flow or zero flow occurred 3 percent of the time (97-100 percent).

In Figure 10, the flow duration curve for water quality site 385351, representing TMDL segment ND-09020205-012-S_00, had four flow zones with high flows between the 0-15 percent flow duration interval, moist conditions occurring between the 15- 43 percent flow duration interval, dry conditions between 43-71 percent, and low flows between the 71-99 percent flow duration interval. No flow or zero flow occurred 1 percent of the time (99-100 percent).

The flow duration curve for water quality site 384155, representing TMDL segment ND-090200205-001-S_00, describes four flow zones with high flows occurring between the 0-15 percent flow duration interval, moist conditions between the 15-45 percent flow duration interval, dry conditions between 45-90 percent, and low flows between the 90-97 percent flow duration interval. No flow or zero flow occurred 3 percent of the time (97-100 percent) (Figure 11).

These flows intervals were defined by examining the range of flows for the site for the period of record and then by looking for natural breaks in the flow record based on the flow duration curve plot (Figures 8-11). Where possible breaks were adjusted to try and include E. coli bacteria observations above the criterion in every flow regime. In no case were flow regime breaks adjusted by more than five percent.

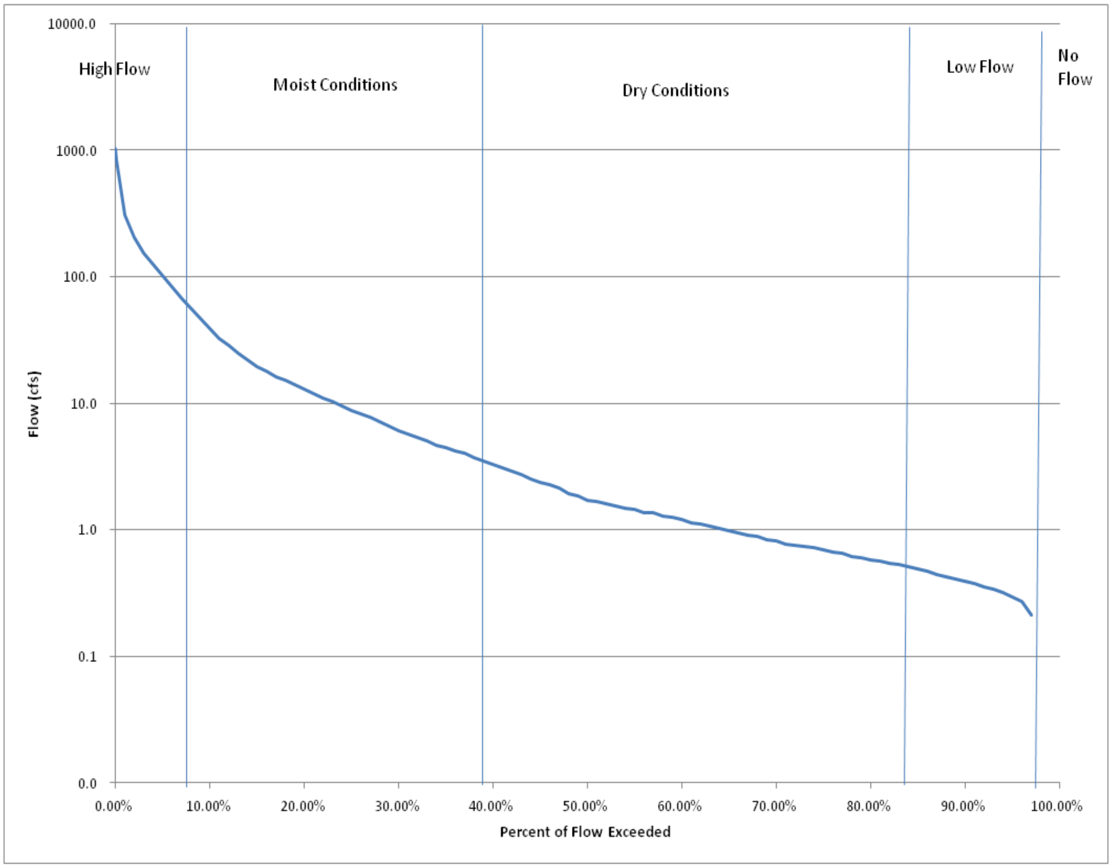

Figure 8. Flow Duration Curve for the Maple River Monitoring Station 385352; Located near Hope, North Dakota.

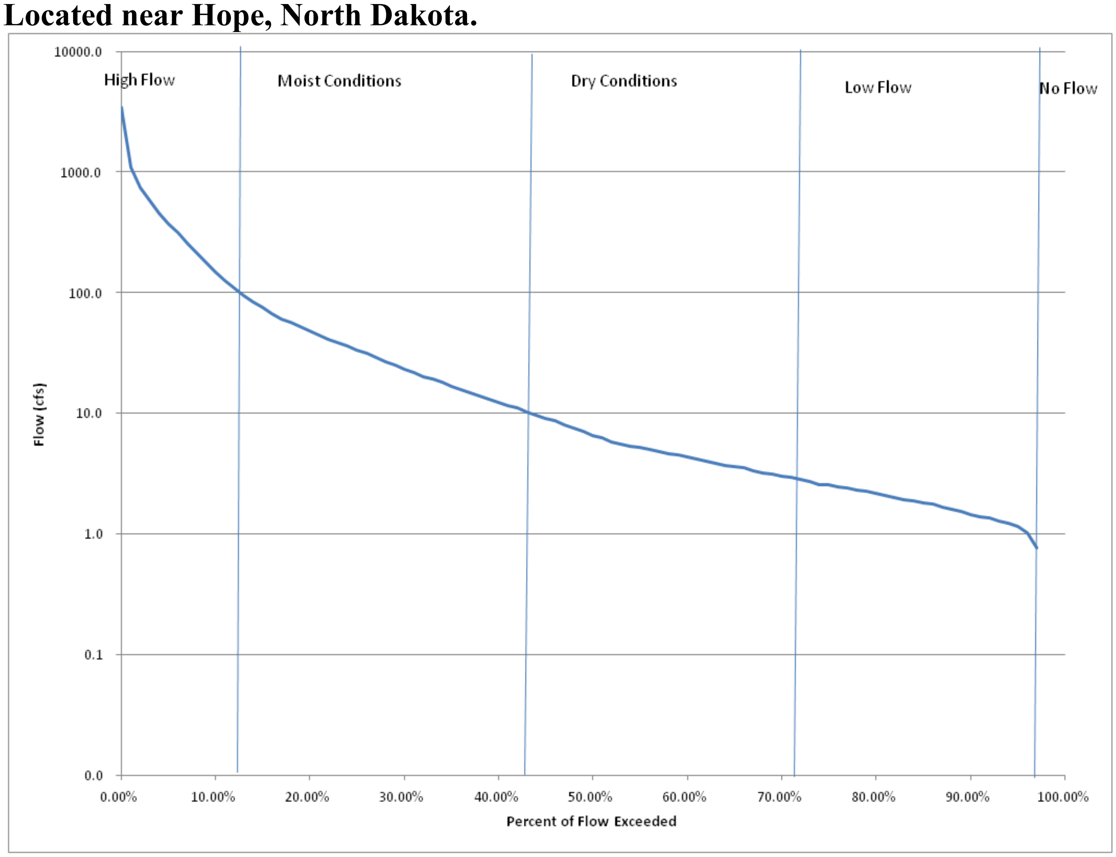

Figure 9. Flow Duration Curve for the Maple River Monitoring Station 385360; Located near Buffalo, North Dakota.

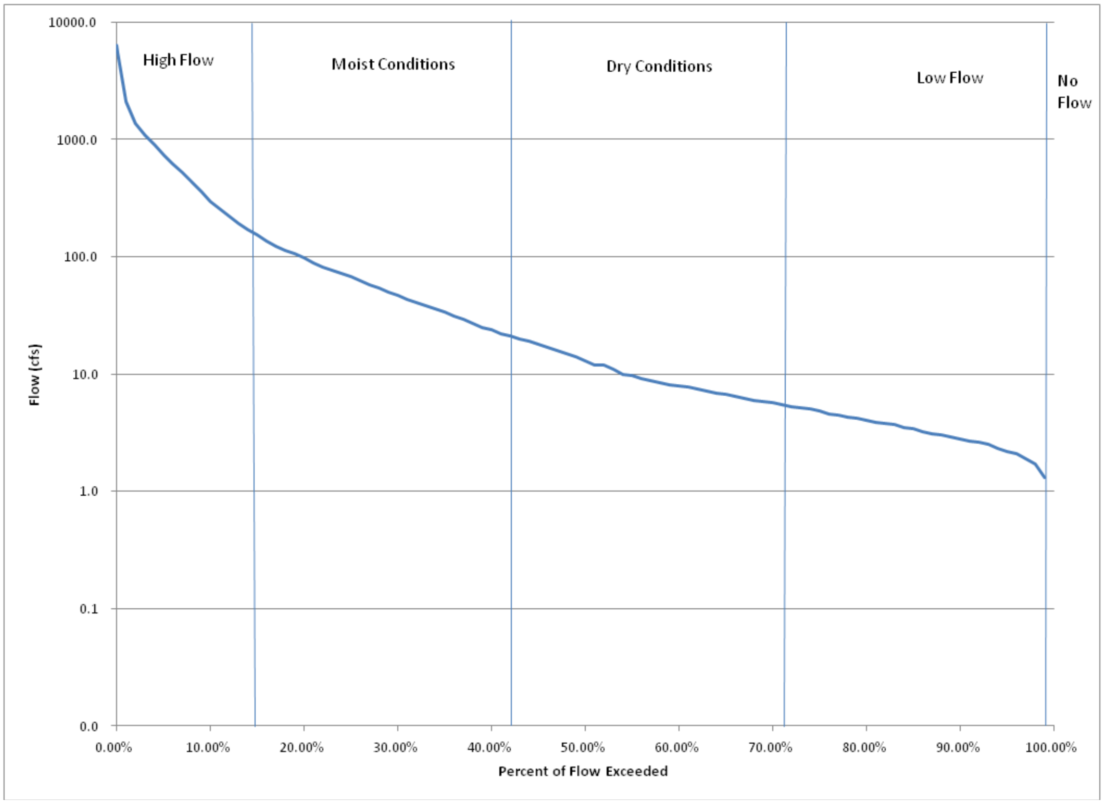

Figure 10. Flow Duration Curve for the Maple River Monitoring Station 385351; Located near Enderlin, North Dakota.

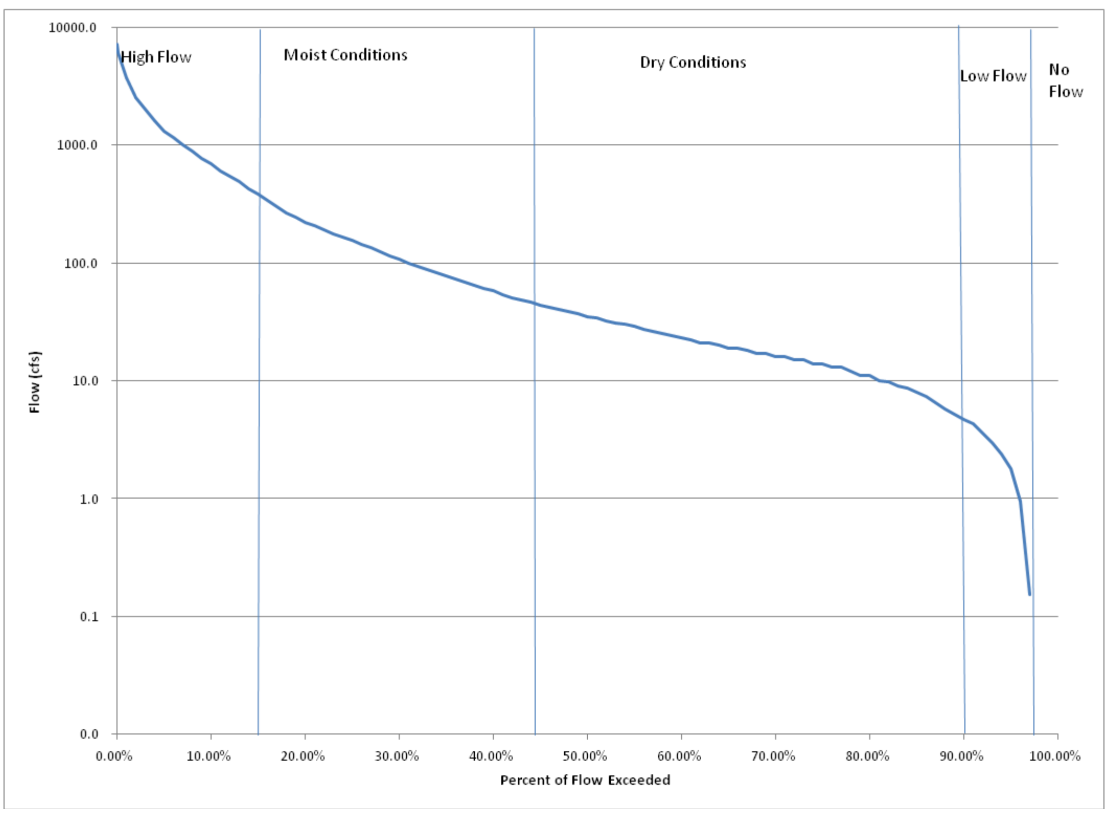

Figure 11. Flow Duration Curve for the Maple River Monitoring Station 384155; Located near Mapleton, North Dakota.

5.3 Load Duration Analysis

An important factor in determining nonpoint source pollution (NPS) 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 the hydrology of the Section 303(d) TMDL listed segments, a load duration curve was developed for each of the Maple River TMDL listed segments. The load duration curves for the four TMDL listed reaches were derived using the E. coli bacteria TMDL target of 126 CFU/100 mL and the flows generated as described in Sections 5.1 and 5.2.

Observed in-stream E. coli bacteria data obtained from monitoring sites 385352, 385360, 385351, and 384155 in 2010 and 2013 (Appendix A) were converted to a pollutant load by multiplying E. coli bacteria concentrations by the mean daily flow on the date of collection and a conversion factor. These loads are plotted against the percent exceeded of the flow on the day of sample collection (Figures 12, 13, 14 and 15). Points plotted above the 126 CFU/100 mL target curve exceed the State water quality target. Points plotted below the curve are meeting the State water quality target of 126 CFU/100 mL.

For each flow interval or zone, 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 385352, 385360, 385351, and 384155 depicting the regression relationship for each flow interval are provided in Figures 12, 13, 14, and 15. As there were no E. coli bacteria concentrations above the TMDL target in the high and low flow regimes for site 385360, the low flow regime for site 385352, and the low flow regime for site 384155, a regression relationship and existing load could not be calculated for these flow regimes.

The regression lines for the high, moist and dry condition flows for site 385352 were then used with the midpoint of the percent exceeded flow for that interval to calculate the existing E. coli bacteria load for that flow interval. In the example provided in Figure 12, the regression relationship between observed E. coli bacteria loading and percent exceeded flow for the moist condition, dry condition, and low flow interval are:

E. coli bacteria load (expressed as 10^7 CFUs/day) = antilog (Intercept + (Slope*Percent Exceeded Flow))

Where the midpoint of the high flow interval from 0 to 8 percent is 4 percent, the existing E. coli bacteria load is

E. coli bacteria load (10^7 CFUs/day) = antilog (5.41+ (-11.61*0.04))
= 87,524 x 10^7 CFUs/day

Where the midpoint of the moist condition interval from 8 to 39 percent is 23.5 percent, the existing E. coli bacteria load is

E. coli bacteria load (10^7 CFUs/day) = antilog (4.54+ (-2.83*0.235))
= 7,461 x 10^7 CFUs/day

Where the midpoint of the dry condition interval from 39 to 84 percent is 61.5 percent, the existing E. coli bacteria load is

E. coli bacteria load (10^7 CFUs/day) = antilog (4.45+ (-1.70*0.615))
= 2,496 x 10^7 CFUs/day

The midpoint for the flow intervals is also used to estimate the TMDL target load. In the case of the previous examples, the TMDL target load for the midpoints or 4, 23.5, and 61.5 percent exceeded flow derived from the 126 CFU/100 mL TMDL target curves are 38,591 x 10^7 CFUs/day, 3,057 x 10^7 CFUs/day, and 346 x 10^7 CFUs/day, respectively.

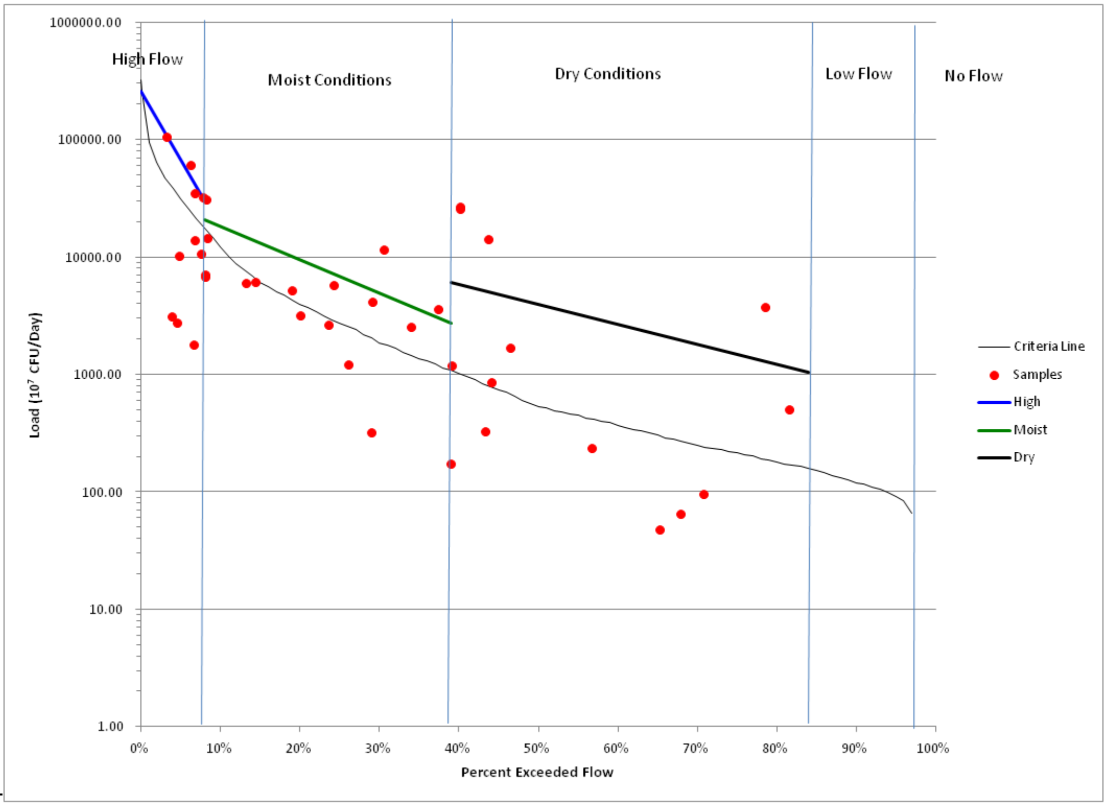

Figure 12. E. coli Bacteria Load Duration Curve for the Maple River Monitoring Station 385352. The curve reflects flows collected from 1993-2013.

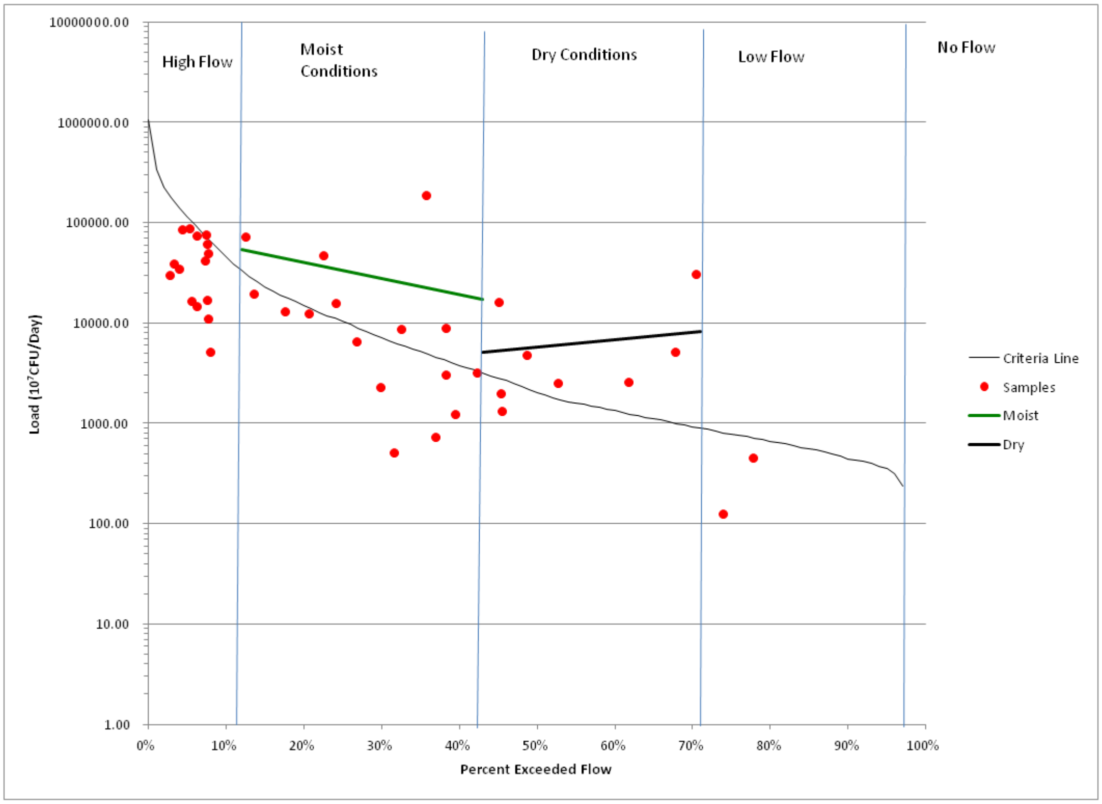

Figure 13. E. coli Bacteria Load Duration Curve for the Maple River Monitoring Station 385360. The curve reflects flows collected from 1993-2013.

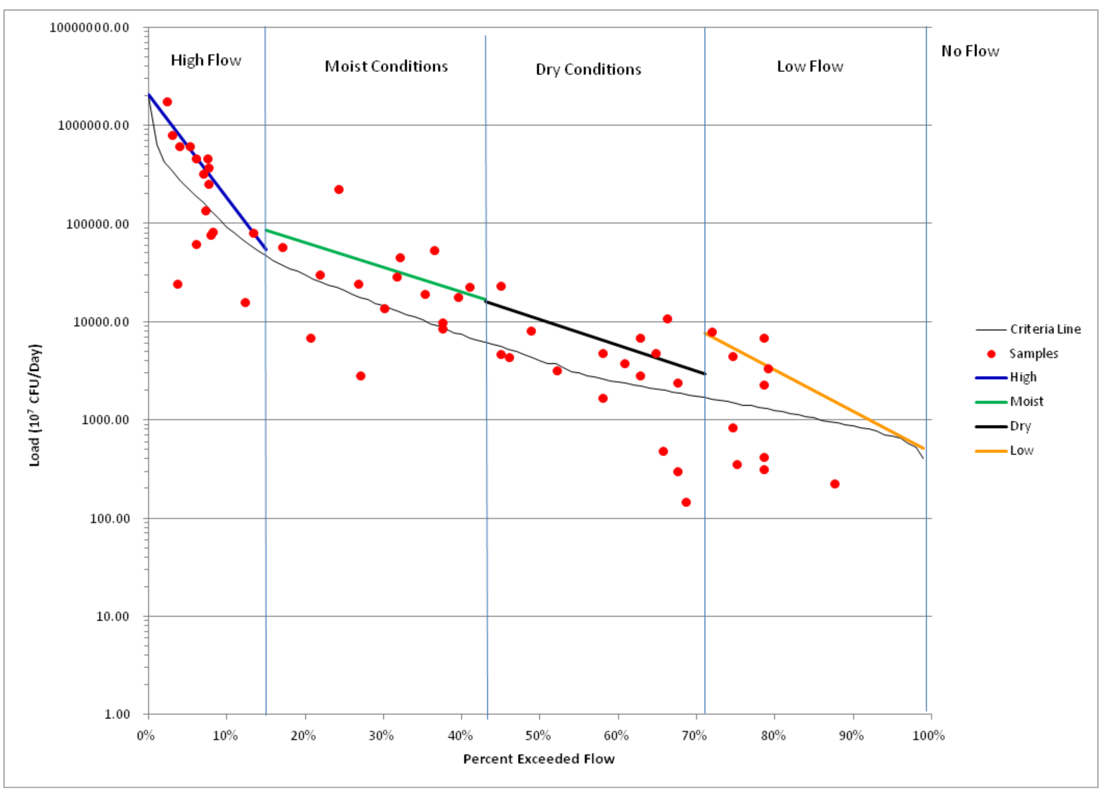

Figure 14. E. coli Bacteria Load Duration Curve for the Maple River Monitoring Station 385351. The curve reflects flows collected from 1993-2013.

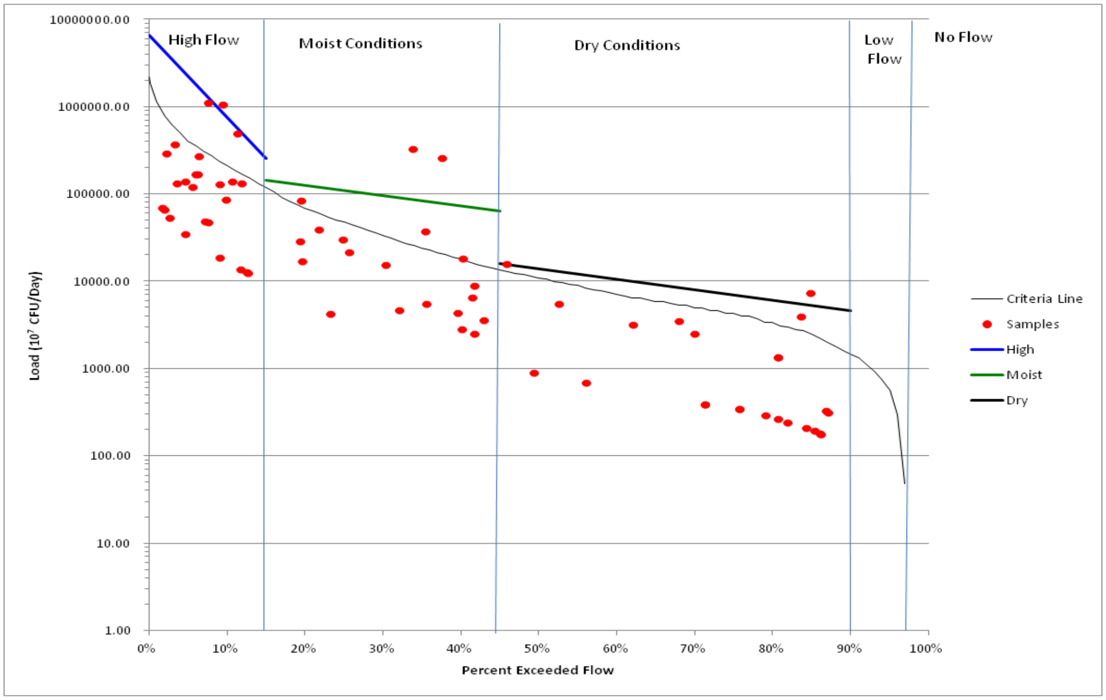

Figure 15. E. coli Bacteria Load Duration Curve for the Maple River Monitoring Station 384155. The curve reflects flows collected from 1995-2013.

5.4 Wasteload Allocation Analysis

Waste load allocation calculations for the cities of Buffalo, Enderlin and Mapleton, ND will be calculated based on the following criteria:

1) The maximum daily discharge will be used in wasteload allocation calculations. This value was chosen because it represents the highest discharge volume on record that the facility has produced and will allow for flexibility in bacterial loading, due to the variability of the facilities discharge volumes and durations.

2) Since very little E. coli bacteria data has been collected, the systems are assigned the water quality standards value of 126 CFU/100mL for this TMDL. This value was chosen both because it is the North Dakota water quality standard, and because those dischargers throughout the state that are required to sample for bacteria are assigned this same value in their permit.

It should also be noted that all of these facilities are allowed under their NDPDES permit to discharge on an "as needed" basis.

5.4.1 Buffalo, ND Wastewater Treatment System

The city of Buffalo, ND has one permitted wastewater treatment system (Figure 2). Discharge monitoring reports (DMRs) indicate this wastewater treatment system discharged once in 2011. The discharge occurred on May 3-6, 2011, the total discharge volume was 2.29 million gallons for the duration of 4 days (Appendix D). This calculates to a maximum daily discharge of 0.57 million gallons per day (MGD) (Appendix D).

Since no E. coli bacteria data are collected as a permit requirement, an E. coli bacteria concentration of 126 CFUs/100 mL is assumed for the wasteload allocation calculation. The wasteload allocation for Buffalo, ND was determined by taking the maximum daily discharge volume of 0.57 MGD multiplied by an E. coli bacteria concentration of 126 CFUs/100 mL, times appropriate conversion factors.

WLA = 0.57 million gallons/ day * 126 CFUs/100mL

= 0.57 million gallons/day * 3.7854 L/gal*1000mL/L* 126 CFU/100mL

= 271.8 x 10^7 CFUs/day

5.4.2 Enderlin, ND Wastewater Treatment Systems

According to the NDPEDS permit the city of Enderlin, ND, has two wastewater discharge points (Figure 2). These discharge points were identified in the DMR report as Outfall 001 and Outfall 003 (Appendix D). Outfall 001 had discharges during the recreation season (May 1-September 30) in September 27-30, 2010; September 7-12, 2011 and August 1-9, 2012 (Appendix D). Outfall 003 also had discharges during the recreation season, May 17-30, June 28-30 and July 1-4 in 2013 and May 12-19 and June 12-25 of 2014 (Appendix D). For the city of Enderlin, ND will be given a maximum daily discharge value for each outfall (001 and 003) of 1.23 and 1.70 MGD.

The wasteload allocation for Outfall 001 was determined by average daily discharge volume of 1.23 MGD multiplied by an E. coli bacteria concentration of 126 CFUs/100 mL, times appropriate conversion factors.

WLA-Outfall 001 = 1.23 million gallons/ day * 126 CFUs/100mL

= 1.23million gallons/day * 3.7854 L/gal*1000mL/L* 126 CFU/100mL

= 586.6 x 10^7 CFUs/day

The wasteload allocation for Outfall 003 was determined by taking the average daily discharge volume of 1.70 MGD multiplied by an E. coli bacteria concentration of 126 CFUs/100 mL, times appropriate conversion factors.

WLA-Outfall 003 = 1.70 million gallons/ day * 126 CFUs/100mL

= 1.70 million gallons/day * 3.7854 L/gal*1000mL/L* 126 CFU/100mL

= 810.8 x 10^7 CFUs/day

5.4.3 Mapleton, ND Wastewater Treatment System

The city of Mapelton, ND, has one permitted wastewater treatment facility (Figure, 2). Discharge monitoring reports indicate this wastewater treatment system discharged in 2010 and 2011. Based on the DMR data, the discharges occurred on May 19-26, 2010 and May 23-29, 2011. When a discharge occurs it is from two cells (3 and 4) simultaneously from one pipe. (Appendix D).

The wasteload allocation for Mapleton, ND was determined by taking the maximum daily discharge volume of 1.53 MGD multiplied by an E. coli bacteria concentration of 126 CFUs/100 mL, times appropriate conversion factors.

WLA = 1.53 million gallons/ day * 126 CFUs/100mL

= 1.53 million gallons/day * 3.7854 L/gal*1000 mL/L*126 CFU/100mL

= 729.7 x 10^7 CFUs/day

5.5 Loading Sources

The majority of load reductions can generally be allotted to nonpoint sources. However, to account for uncertainty due to periodic discharges from permitted municipal facilities (e.g., Buffalo, Enderlin and Mapleton, ND), WLAs are included for the impaired segments ND-09020205-015-S_00, ND-09020205-012-S_00 and ND-09020205-001-S_00, respectively. Due to the close proximity of the city of Enderlin and the impaired segments ND-09020205-015-S_00 and ND-09020205-012-S_00, further investigation was needed to determine the location of the outfalls. It was determined that the city of Enderlin's outfalls discharged to the impaired segment ND-09020205-012-S_00 and will be given the appropriate wasteload allocations in the TMDL.

Based on best professional judgment, the general focus of Best Management Practices (BMPs) and load reductions for the listed waterbody should be on unpermitted animal feeding operations, and riparian grazing adjacent to or in close proximity to the Maple River.

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, exceedences of the E. coli bacteria standard was observed in three flow regimes (i.e., High, Moist and Dry Conditions) at site 385352, representing assessment unit ND-09020205-024-S_00 (Figure 13), in two flow regimes (i.e., Moist and Dry Conditions) at site 385360, representing assessment unit ND-09020205-015-S_00 (Figure 14), in four flow regimes (i.e., High, Moist and Dry Conditions and Low Flow) at site 385351, representing assessment unit ND-09020205-012-S_00 (Figure 15), and in three flow regimes (i.e., High, Moist and Dry Conditions), at site 384155, representing assessment unit ND-09020205-001-S_00 (Figure 16).

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to E. coli bacteria loading. Animals grazing in the riparian area contribute E. coli 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 flow and under moist and dry conditions (Table 11). In contrast, intensive grazing of livestock in the upland and not in the riparian area has a greater potential to impact water quality during high flows and under moist conditions (i.e., moderate flows) (Table 11). 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 E. coli bacteria contamination.

Table 11. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

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

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

6.0 MARGIN OF SAFETY AND SEASONALITY

6.1 Margin of Safety

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

To account for the uncertainty associated with known sources and the load reductions necessary to reach the TMDL target of 126 CFU/100 mL, a ten percent explicit margin of safety was used for these TMDLs. The MOS was calculated as ten percent of the TMDL.

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 TMDLs which are included in this report address seasonality because the flow duration curve for Maple River segments (ND-090200205-015-S_00, ND-09020205-024-S_00 and ND-09020205-012-S_00) were developed using 1993 to 2013 flow data (21 years), and the Maple River segment ND-09020205-001-S_00) was developed using 18 years of USGS gauge data encompassing all 12 months of the year. Additionally, the water quality standard is seasonally based on the recreation season from May 1 to September 30 and controls will be designed to reduce E.coli bacteria loads during the seasons covered by the standard.

7.0 TMDL

Table 12 provides an outline of the critical elements of the bacteria TMDL for the four TMDL listed segments. TMDLs for the Maple River (ND-09020205-024-S_00, ND-09020205-015-S_00, ND-09020205-012-S_00 and ND-09020205-001-S_00) are summarized in Tables 13 through 16, respectively. The TMDLs provide a summary of average daily loads by flow regime necessary to meet the water quality target (i.e., TMDL). The TMDL load includes a load allocation from known nonpoint sources and a 10 percent margin of safety. It should be noted that the TMDL loads, load allocations, and the MOS are estimated based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reduction needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.

Table 12. TMDL Summary for the Maple River.

Category	Description	Explanation
Beneficial Use Impaired	Recreation	Contact Recreation (i.e., swimming, fishing)
Pollutants	E. coli Bacteria	See Section 2.1
E. coli Bacteria TMDL Target	126 CFU/100 mL	Based on the current state water quality standard for E. coli bacteria. Monitoring will be conducted to determine compliance with the current water quality standard of 126 CFU/100 mL.
Significant Sources	Nonpoint and Point Sources	Includes nonpoint sources to all segments, including. unpermitted AFOs, riparian grazing, failing septic systems located near the river, and stormwater runoff from the cities of Buffalo, Enderlin, and Mapleton for segments ND-09020205-015-S_00, ND-09020205-012-S_00, and ND-09020205-001-S_00, respectively.
Margin of Safety (MOS)	Explicit	10 percent

TMDL = LC = WLA + LA + MOS

where

LC = loading capacity, or the greatest loading a waterbody can receive without violating water quality standards;
WLA = wasteload allocation, or the portion of the TMDL allocated to existing or future point sources;
LA = load allocation, or the portion of the TMDL allocated to existing or future non-point sources;

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

Table 13. E. coli Bacteria TMDL (10^7 CFU/day) for the Maple River Waterbody ND-09020205-024-S_00.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	87,524	7,460	2,496	
TMDL	38,591	3,057	346	116[1]
WLA	0	0	0	No Reduction Necessary
LA	34,732	2,751.3	311.4	
MOS	3,859.1	305.7	34.6	

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

Table 14. E. coli Bacteria TMDL (10^7 CFU/day) for the Maple River Waterbody ND-09020205-015-S_00.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load		30,411	6,493	
TMDL	96,486[1]	8,502	1,480	578[1]
WLA-Buffalo	No Reduction Necessary	271.8	271.8	No Reduction Necessary
LA		7,651.8	1,332	
MOS		850.2	148.0	

[1]TMDL load is provided as a guideline for watershed management and BMP implementation.

Table 15. E. coli Bacteria TMDL (10^7 CFU/day) for the Maple River Waterbody ND-09020205-012-S_00.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	333,959	37,567	6,891	1,997
TMDL	147,757	15,415	2,713	1,048
WLA-Outfall 001	586.6	586.6	586.6	586.6
WLA-Outfall 003	810.8	810.8	810.8	810.8
LA	131,583	12,476.1	1,044.3	-454.2
MOS	14,775.7	1,541.5	271.3	104.8

Table 16. E. coli Bacteria TMDL (10^7 CFU/day) for the Maple River Waterbody ND-09020205-001-S_00.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	1,287,662.65	95,80.64	8,581.08	
TMDL	295,653.15	32,989.09	5,549.57	555[1]
WLA-Mapleton	729.7	729.7	729.7	No Reduction Necessary
LA	265,358.2	28,960.5	4,265	
MOS	29,565.3	3,298.9	554.9	

[1]**TMDL load is provided as a guideline for watershed management and BMP implementation.**

8.0 ALLOCATION

The permitted municipal facilities in Buffalo, ND which discharges to segment ND-09020205-015-S_00, Enderlin, ND which has two discharges to segment ND-09020205-012-S_00 and Mapelton, ND which discharges to segment ND-09020205-001-S_00, will have a portion of the TMDL, 271.8 x 10^7 CFUs/day, 586.6 x 10^7 CFUs/day and 810.8 x 10^7 and 729.7 x 10^7 CFUs/day, respectively have been allocated to these point sources. The remaining load has been allocated to nonpoint sources in the watersheds.

To achieve the TMDL targets identified in the report, it will require the wide spread support and voluntary participation of landowners and residents in the watershed. The TMDLs described in this report are a plan to improve water quality by implementing BMPs through non-regulatory approaches. 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, (EPA, 2001). This TMDL plan is put forth as a recommendation for what needs to be accomplished for the Maple River and associated watersheds to restore and maintain its recreational uses. Water quality monitoring should continue in order to measure BMP effectiveness and determine through adaptive management if loading allocation recommendations need to be adjusted.

Nonpoint source pollution is the sole contributor to elevated E. coli bacteria levels in the Maple River watersheds. The E. coli bacteria samples and load duration curve analysis of the impaired reaches identified the high, moist and dry condition flow regimes for TMDL segment ND-09020205-024-S_00; moist and dry conditions for ND-09020205-015-S_00; high, moist, dry and low flow conditions for ND-090200205-012-S_00; and high, moist and dry condition flows for ND-09020205-001-S_00 as the time of E. coli bacteria exceedences for the 126 CU/100 mL target. To reduce NPS pollution for the high, moderate, and low flow regimes, specific BMPs are described in Sections 8.1, 8.2 and 8.3 and Tables 17-19 that will mitigate the effects of E. coli bacteria loading to the impaired reaches.

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

Table 17. Management Practices and Flow Regimes Affected by Implementation of BMPs.

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

8.1 Livestock Management Recommendations

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

<u>Livestock exclusion from riparian areas</u>- 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.

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

<u>Prescribed grazing</u>- This practice is used to increase ground cover and ground stability by rotating livestock throughout multiple fields. Grazing with a specified rotation minimizes overgrazing and resulting erosion. The Natural Resource Conservation Service (NRCS) recommends grazing systems to improve and maintain water quality and quantity. Duration, intensity, frequency, and season of grazing can be managed to enhance vegetation cover and litter, resulting in reduced runoff, improved infiltration, increased quantity of soil water for plant growth, and better manure distribution and increased rate of decomposition, (NRCS, 1998). In a study by Tiedemann et al. (1998), as presented by USEPA (1993), the effects of four grazing strategies on bacteria levels in thirteen watersheds in Oregon were studied during the summer of 1984. Results of the study (Table 18) showed that when livestock are managed at a stocking rate of 19 acres per animal unit month, with water developments and fencing, bacteria levels were reduced significantly.

Table 18. Bacterial Water Quality Response to Four Grazing Strategies (Tiedemann et al., 1988).

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

Waste management system- Waste management systems can be effective in controlling up to 90 percent of fecal coliform bacteria loading originating from confined animal feeding areas (Table 19). A waste management system is made up of various components designed to control nonpoint source pollution from concentrated animal feeding operations (CAFOs) and animal feeding operations (AFOs). Diverting clean water from the feeding area and containing dirty water from the feeding area in a pond are typical practices of a waste management system. Manure handling and application of manure is designed to be adaptive to environmental, soil, and plant conditions to minimize the probability of contamination of surface water.

Table 19. Relative Gross Effectiveness[a] of Confined Livestock Control Measures (Pennsylvania State University, 1992a).

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

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

8.2 Other Recommendations

Vegetative filter strip- Vegetated filter strips are used to reduce the amount of sediment, particulate organics, dissolved contaminants, nutrients, and in the case of this TMDL, fecal coliform bacteria to streams. The effectiveness of filter strips and other BMPs in removing fecal coliform bacteria is quite successful. Results from a study by Pennsylvania State University (1992a) as presented by USEPA (1993) (Table 19), suggest that vegetative filter strips are capable of removing up to 55 percent of fecal coliform bacteria loading to rivers and streams (Table 19). 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).

9.0 PUBLIC PARTICIPATION

To satisfy the public participation requirement of this TMDL, a hard copy of the TMDLs for the Maple River and a request for comment were mailed to participating agencies, partners, and to those who request a copy.

Those included in the mailing of a hard copy are as follows:

- Cass County Soil Conservation District;
- Maple River Water Resource District;
- Natural Resource Conservation Service (State Office); and
- U.S. Environmental Protection Agency, Region VIII

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

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 and technical assistance that are implemented as part of the Section 319 Maple River watershed project 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).

In regards to the four point sources, as NDPDES permits are renewed, E. coli bacteria limits will be established in their permits and discharge monitoring will be implemented to ensure both the permit limits and their discharge volumes are consistent with their wasteload allocations and therefore, water quality standards.

11.0 TMDL IMPLEMENTATION STRATEGY

In response to the Maple River Watershed Assessment and in anticipation of this completed TMDL, local sponsors successfully applied for and received Section 319 funding for the Maple River watershed project. Beginning in May 2010, local sponsors have been providing technical assistance and implementing BMPs designed to reduce E. coli bacteria loadings and to help restore the beneficial uses of Maple River (i.e., recreation). As the watershed restoration project progresses, water quality data are collected to monitor and track the effects of BMP implementation as well as to judge overall success of the project in reducing E. coli bacteria loadings. A QAPP has been developed as part of this watershed restoration project that details the how, when and where monitoring will be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s). As the data are gathered and analyzed, watershed restoration tasks will be adapted, if necessary, to place BMPs where they will have the greatest benefit to water quality and in meeting the TMDL goal(s).

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Appendix A
E. coli Bacteria Data Collected for Sites 385352, 385360, 385352, and 384155 in 2011, 2012 and 2013

Site 385352 Maple River near Hope, ND

	385352									
	May		June		July		August		September	
	18-May-11	70	01-Jun-11	50	05-Jul-11	800	02-Aug-11	30	06-Sep-11	100
	25-May-11	10	06-Jun-11	40	13-Jul-11	140	09-Aug-11	20	13-Sep-11	20
	01-May-12	10	13-Jun-11	310	20-Jul-11	140	17-Aug-11	220	19-Sep-11	120
	08-May-12	200	20-Jun-11	110	26-Jul-11	50	23-Aug-11	60	27-Sep-11	20
	14-May-12	150	27-Jun-11	250	09-Jul-12	3200	30-Aug-11	110		
	22-May-12	230	05-Jun-12	220	18-Jul-12	380				
	29-May-12	290	12-Jun-12	3300	24-Jul-12	70				
	07-May-13	10	20-Jun-12	2200	31-Jul-12	50				
	14-May-13	100	26-Jun-12	320	01-Jul-13	370				
	22-May-13	80	04-Jun-13	260	10-Jul-13	2500				
	29-May-13	50								
Geomean		62		273		281		61		47
% Exceeded 409 CFU/100 mL		0%		20%		30%		0%		0%
Recreational Use Support	FS		NS		NS		FS		FS	

Site 385360 Maple River near Buffalo, ND

	385360									
	May		June		July		August		September	
	18-May-11	20	01-Jun-11	30	05-Jul-11	30	02-Aug-11	30	06-Sep-11	180
	24-May-11	70	06-Jun-11	100	13-Jul-11	290	09-Aug-11	80	13-Sep-11	260
	01-May-12	40	13-Jun-11	90	20-Jul-11	20	17-Aug-11	20	19-Sep-11	120
	08-May-12	10	20-Jun-11	110	26-Jul-11	130	23-Aug-11	90	27-Sep-11	90
	14-May-12	40	28-Jun-11	20	09-Jul-12	80	30-Aug-11	480		
	22-May-12	60	05-Jun-12	90	18-Jul-12	20				
	29-May-12	700	12-Jun-12	4700	01-Jul-13	90				
	04-May-13	100	20-Jun-12	180	10-Jul-13	20				
	07-May-13	10	26-Jun-12	640	16-Jul-13	270				
	14-May-13	90			23-Jul-13	260				
	22-May-13	180			30-Jul-13	4200				
	29-May-13	110								
Geomean		59		145		106		73		150
% Exceeded 409 CFU/100 mL		8%		22%		9%		20%		0%
Recreational Use Support	FS		NS		FS		FSbT		NS	

Site 385351 Maple River near Enderlin, ND

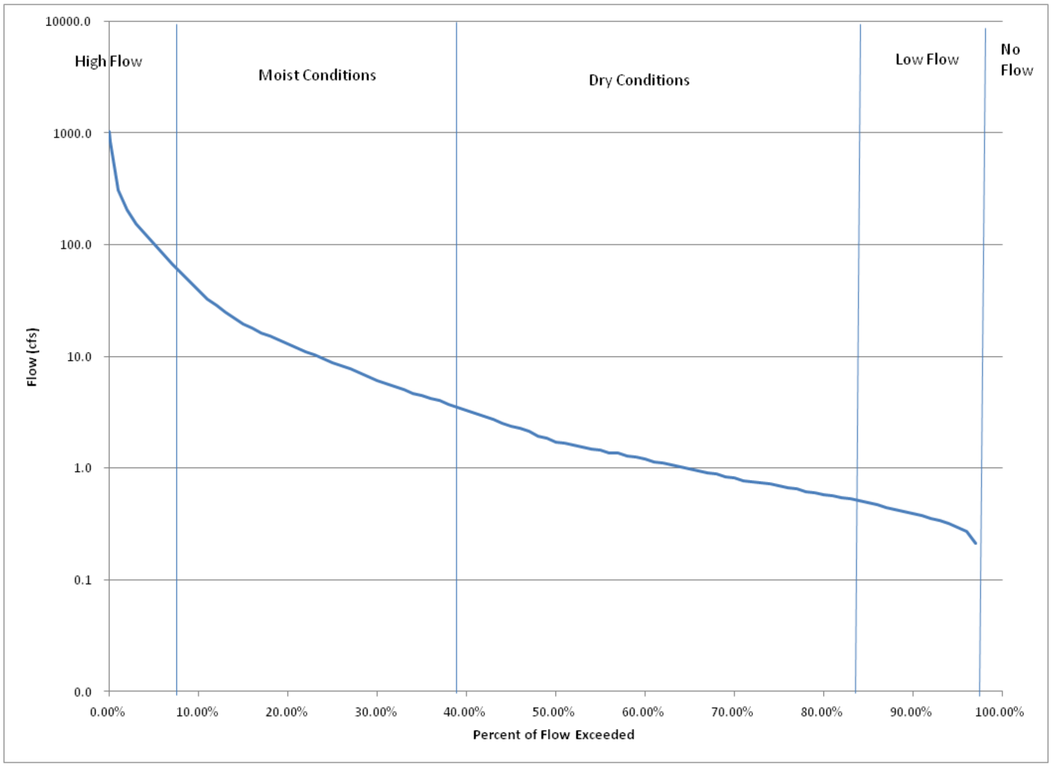
	385351									
	May		June		July		August		September	
	18-May-11	70	01-Jun-11	390	05-Jul-11	280	02-Aug-11	380	06-Sep-11	180
	25-May-11	250	06-Jun-11	270	13-Jul-11	290	09-Aug-11	680	13-Sep-11	700
	01-May-12	290	13-Jun-11	360	20-Jul-11	100	17-Aug-11	30	19-Sep-11	220
	08-May-12	40	20-Jun-11	220	26-Jul-11	100	23-Aug-11	220	27-Sep-11	230
	14-May-12	190	28-Jun-11	150	09-Jul-12	140	30-Aug-11	650	04-Sep-12	160
	22-May-12	320	05-Jun-12	450	18-Jul-12	230	07-Aug-12	70	12-Sep-12	10
	29-May-12	560	12-Jun-12	120	24-Jul-12	110	14-Aug-12	330	17-Sep-12	40
	07-May-13	10	20-Jun-12	400	31-Jul-12	290	20-Aug-12	80	24-Sep-12	30
	14-May-13	30	26-Jun-12	500	01-Jul-13	370	28-Aug-12	170	9/4/2013	30
	22-May-13	300	04-Jun-13	120	10-Jul-13	600	07-Aug-13	1300	17-Sep-13	160
	29-May-13	110			16-Jul-13	200	13-Aug-13	30	24-Sep-13	20
					23-Jul-13	80	19-Aug-13	20		
					30-Jul-13	30				
Geomean		119		264		169		160		82
% Exceeded 409 CFU/100 mL		9%		20%		8%		25%		9%
Recreational Use Support	FS		NS		NS		NS		FS	

Site 384155 Maple River near Mapleton, ND

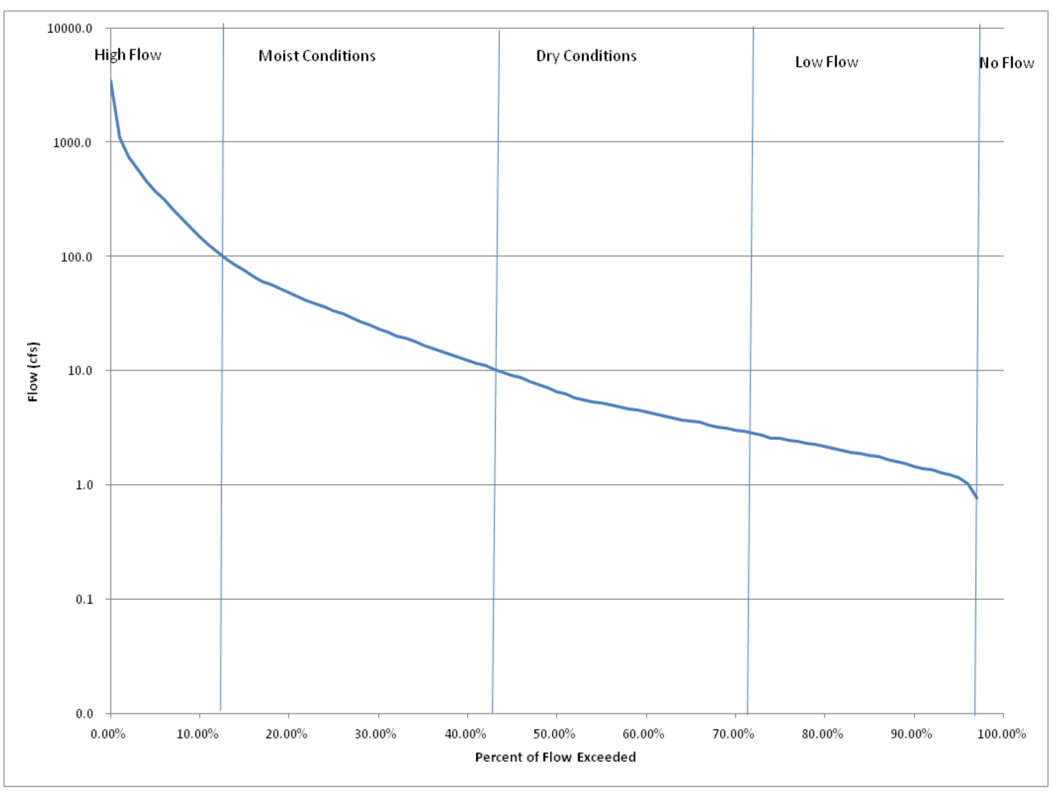
	384155									
	May		June		July		August		September	
	03-May-11	10	14-Jun-10	50	27-Jul-10	1600	31-Aug-10	180	06-Sep-11	60
	18-May-11	50	01-Jun-11	480	05-Jul-11	200	02-Aug-11	10	13-Sep-11	50
	25-May-11	60	06-Jun-11	40	13-Jul-11	20	09-Aug-11	10	19-Sep-11	70
	01-May-12	10	07-Jun-11	70	19-Jul-11	10	17-Aug-11	10	27-Sep-11	60
	08-May-12	10	14-Jun-11	10	20-Jul-11	150	23-Aug-11	20	04-Sep-12	10
	14-May-12	40	22-Jun-11	600	26-Jul-11	20	29-Aug-11	20	12-Sep-12	10
	22-May-12	80	28-Jun-11	90	09-Jul-12	20	30-Aug-11	50	17-Sep-12	10
	29-May-12	60	05-Jun-12	350	17-Jul-12	10	07-Aug-12	100	24-Sep-12	10
	29-May-12	100	20-Jun-12	80	18-Jul-12	10	14-Aug-12	10	25-Sep-12	1600
	07-May-13	20	26-Jun-12	30	24-Jul-12	50	20-Aug-12	10	9/4/2013	10
	13-May-13	10	04-Jun-13	130	31-Jul-12	50	21-Aug-12	30	17-Sep-13	20
	14-May-13	10	17-Jun-13	30	01-Jul-13	360	28-Aug-12	150	24-Sep-13	110
	22-May-13	60			10-Jul-13	70	07-Aug-13	80		
	28-May-13	20			16-Jul-13	80	13-Aug-13	30		
	29-May-13	30			16-Jul-13	60	19-Aug-13	10		
					23-Jul-13	10				
					30-Jul-13	10				
Geomean		28		84		45		27		36
% Exceeded 409 CFU/100 mL		0%		17%		6%		0%		8%
Recreational Use Support	FS		FSbT		FS		FS		FS	

Appendix B
Flow Duration Curves for Sites 385352, 385360, 385351 and 384155

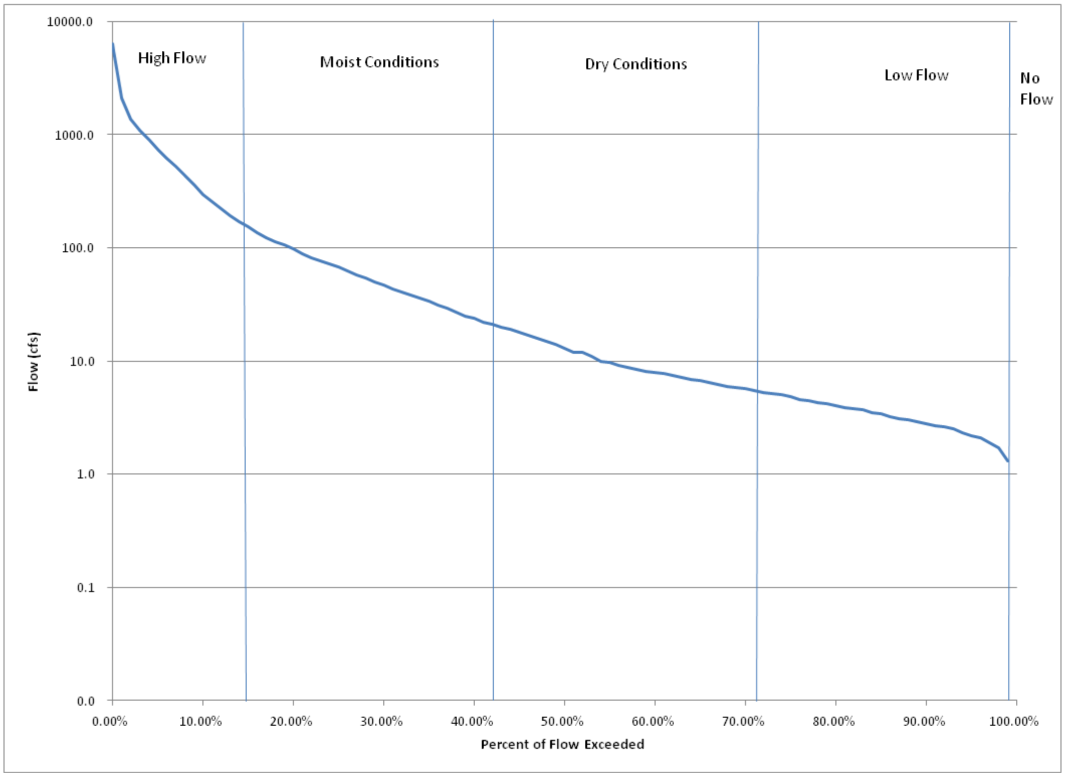
Site 385352 Maple River located near Hope, ND



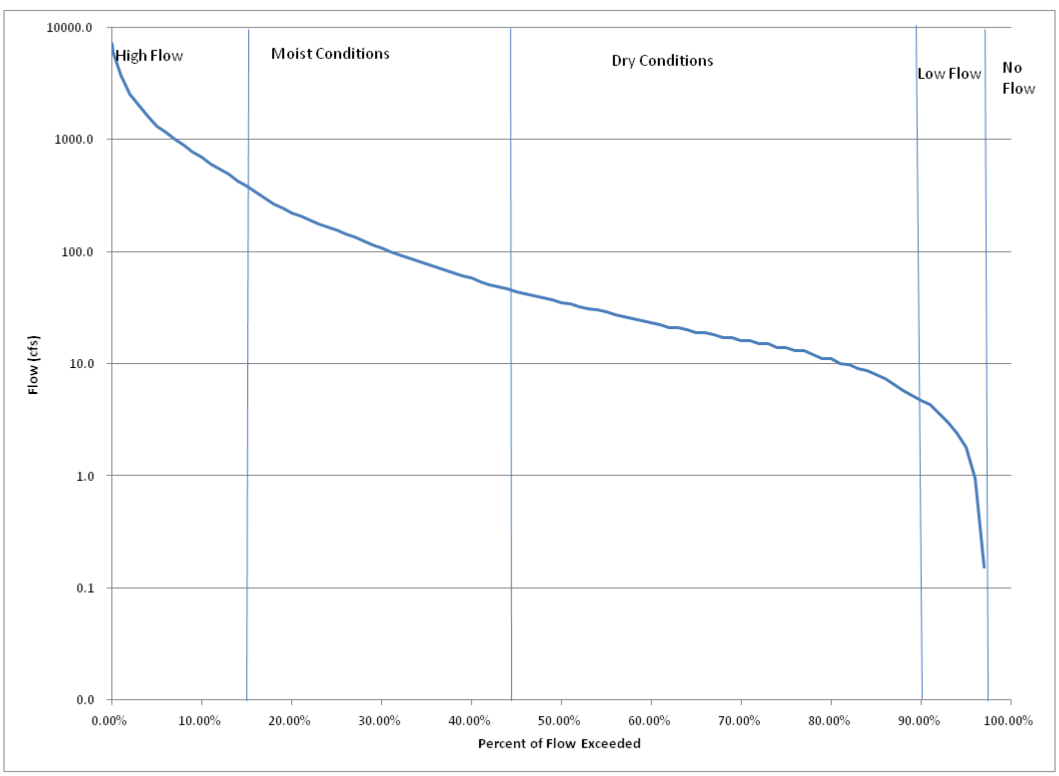
Site 385360 Maple River near Buffalo, ND



Site 385351 Maple River near Enderlin, ND



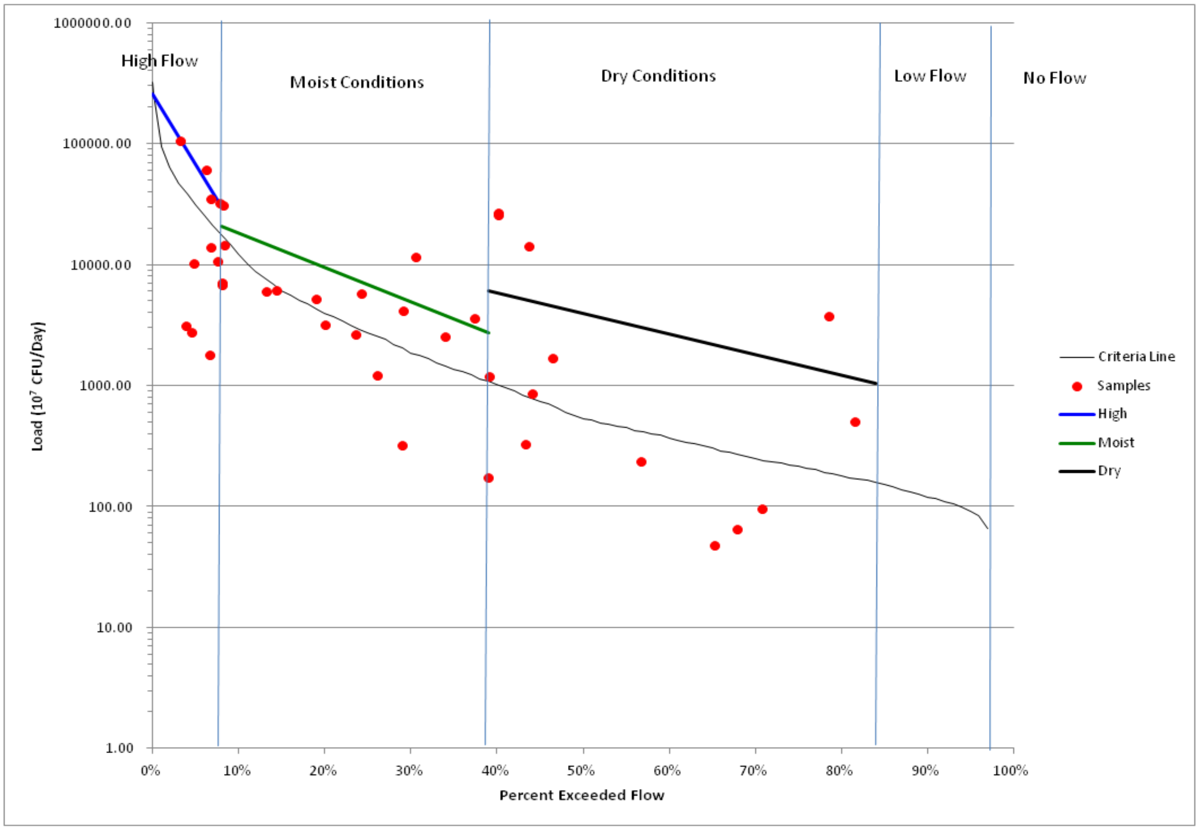
Site 384155 Maple River near Mapleton, ND



Appendix C
Load Duration Curve, Estimated Loads, TMDL Targets, and Percentage of Reduction Required for Sites 385352, 385360, 385351, and 384155

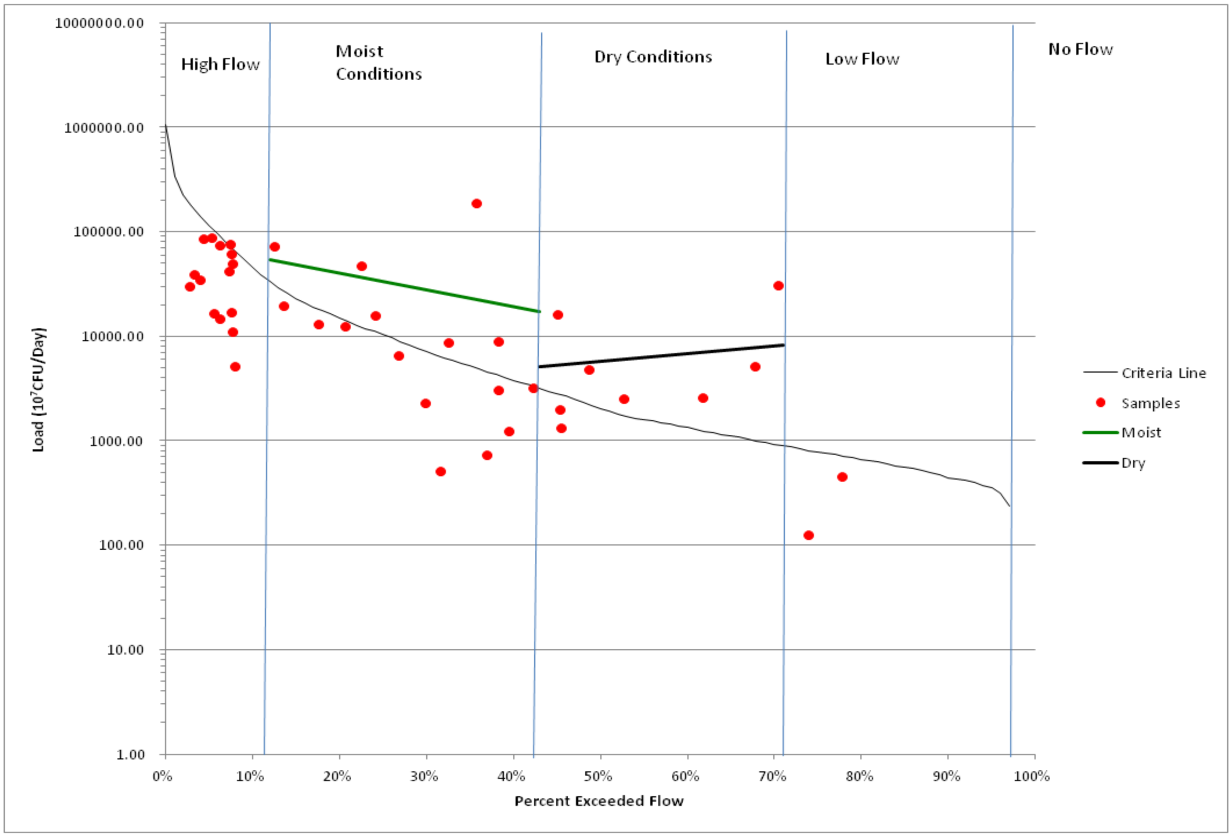
Site 385352 Maple River near Hope, ND

	Load (10^7 CFUs/Day)				Load (10^7 CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.00%	87523.66	38591.10	29.20	2555690.77	1126860.09	55.91%
Moist	23.50%	7460.55	3056.63	113.15	844161.41	345857.78	59.03%
Dry	61.50%	2495.78	346.08	164.25	409931.80	56843.44	86.13%
			Total	307	3809784	1529561	59.85%



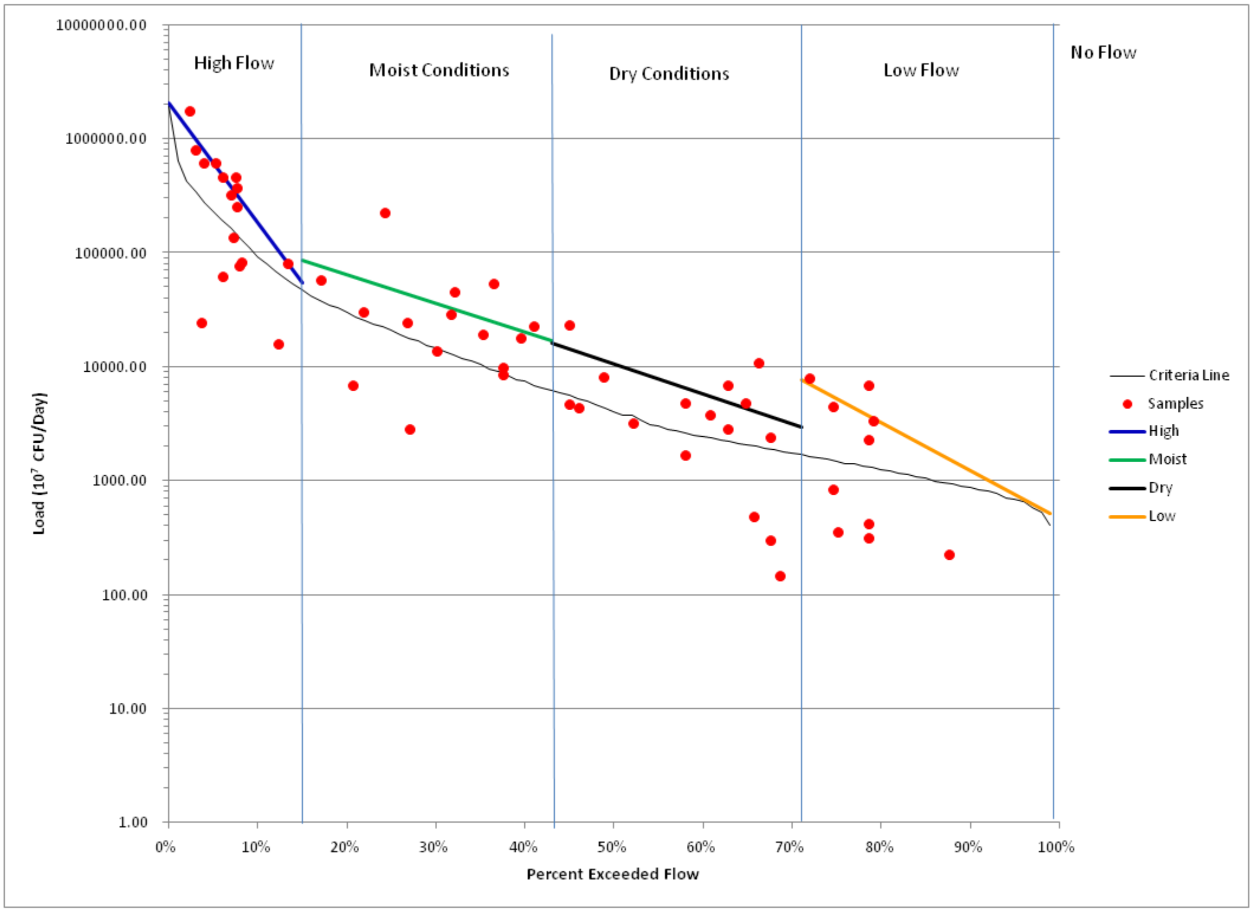
Site 385360 Maple River near Buffalo, ND

	Load (10^7 CFUs/Day)				Load (10^7 CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
Moist	27.50%	30411.89	8502.84	113.15	3441105.18	962096.57	72.04%
Dry	57.00%	6493.85	1480.98	102.20	663671.39	151356.53	77.19%
			Total	215	4104777	1113453	72.87%



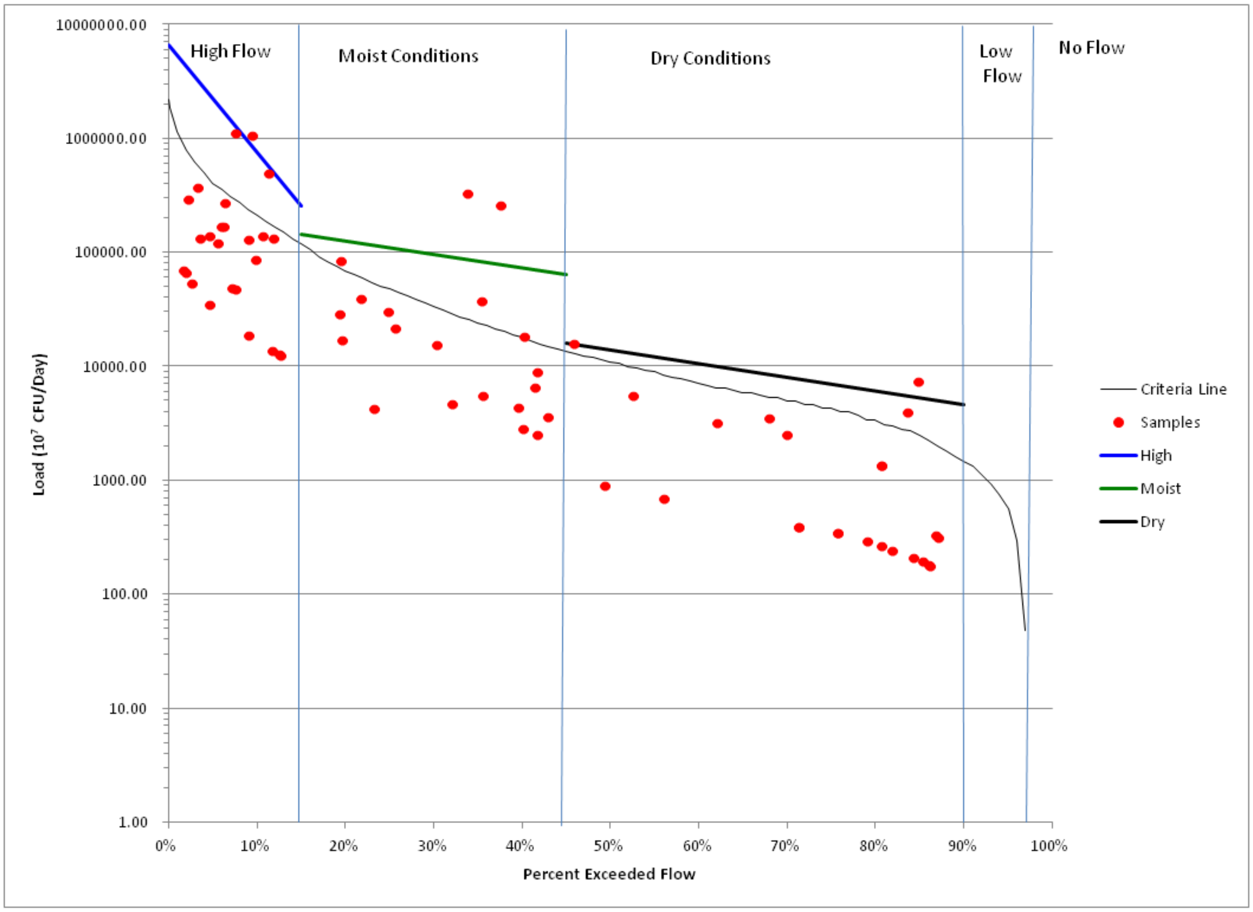
Site 385351 Maple River near Enderlin, ND

	Load (10^7 CFUs/Day)				Load (10^7CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	7.50%	333959.07	147757.21	54.75	18284259.24	8089707.11	55.76%
Moist	29.00%	37567.28	15415.46	102.20	3839375.81	1575460.26	58.97%
Dry	57.00%	6891.79	2713.12	102.20	704341.22	277281.01	60.63%
Low	85.00%	1997.99	1048.25	102.20	204194.42	107131.30	47.53%
			Total	361	23032171	10049580	56.37%



Site 384155 Maple River near Mapleton, ND

	Load (10^7 CFUs/Day)				Load (10^7 CFUs/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	7.50%	1287662.65	295653.15	54.75	70499530.02	16187010.19	77.04%
Moist	30.00%	95280.64	32989.09	109.50	10433230.05	3612305.31	65.38%
Dry	67.50%	8581.08	5549.57	164.25	1409441.64	911516.29	35.33%
			Total	329	82342202	20710832	74.85%



Appendix D
North Dakota Department of Health Water Quality
NDPDES DMR Data for Buffalo, Enderlin, and Mapleton

Permit #	Facility Name	Trt Name	Start	End	Days	Total Discharged	Units	Discharge/ Day	Units
NDG321946	City of Buffalo	Cell 3	5/3/2011	5/6/2011	4	2.29	MGAL	0.57	MGAL/Day

Outfall 001								
Permit #	Facility Name	Start	End	Days	Total Discharged	Units	Discharge/ Day	Units
ND0022462	City of Enderlin	9/27/2010	9/30/2010	4	4.9	MGAL	1.23	MGAL/Day
ND0022462	City of Enderlin	9/7/2011	9/12/2011	6	6.86	MGAL	1.14	MGAL/Day
ND0022462	City of Enderlin	8/1/2012	8/9/2012	9	6.75	MGAL	0.75	MGAL/Day
Total Average Discharge							1.04	MGAL/Day

Outfall 003								
Permit #	Facility Name	Start	End	Days	Total Discharged	Units	Discharge/ Day	Units
ND0022462	City of Enderlin	5/17/2013	5/30/2013	14	20.4	MGAL	1.46	MGAL/Day
ND0022462	City of Enderlin	6/28/2013	6/30/2013	3	3.78	MGAL	1.26	MGAL/Day
ND0022462	City of Enderlin	7/1/2013	7/4/2013	4	6.8	MGAL	1.7	MGAL/Day
ND0022462	City of Enderlin	5/12/2014	5/19/2014	8	10.9	MGAL	1.36	MGAL/Day
ND0022462	City of Enderlin	6/12/2014	6/25/2014	14	13.5	MGAL	0.96	MGAL/Day
Total Average Dishcarge							1.35	MGAL/Day

Permit #	Facility Name	Trt Name	Start	End	Days	Total Discharged	Units	Discharge/ Day	Units
May 19-26, 2010									
NDG220494	City of Mapleton	Cell 3	5/19/2010	5/26/2010	8	4.89	MGAL	0.61	MGAL/Day
NDG220494	City of Mapleton	Cell 4	5/19/2010	5/26/2010	8	5.31	MGAL	0.66	MGAL/Day
Subtotal					8	10.2	MGAL	1.27	MGAL/Day
May 23-29, 2011									
NDG220494	City of Mapleton	Cell 3	5/23/2011	5/29/2011	7	5.13	MGAL	0.73	MGAL/Day
NDG220494	City of Mapleton	Cell 4	5/23/2011	5/29/2011	7	5.57	MGAL	0.79	MGAL/Day
Subtotal					7	10.7	MGAL	1.53	MGAL/Day

Appendix E
US EPA Region 8 TMDL Review Form and Decision Document

EPA REGION 8 TMDL REVIEW FORM AND DECISION DOCUMENT

TMDL Document Info:

Document Name:	**E. coli Bacteria TMDL for the Maple River in Cass, Barnes, Steele, Ransom, and Richland Counties, North Dakota**
Submitted by:	**North Dakota Department of Health, Division of Water Quality**
Date Received:	**September 5, 2014**
Review Date:	**February 2015**
Reviewer:	**Julie Kinsey/Brent Truskowski**
Rough Draft / Public Notice / Final Draft?	**Public Notice Draft**
Notes:	

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

☐ Approve
☐ Partial Approval
☐ Disapprove
☐ Insufficient Information

Approval Notes to the 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 TMDL review elements identified in the following 8 sections:

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

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

Each of the following eight sections describes the factors that EPA Region 8 staff considers when reviewing TMDL documents. Also included in each section is a list of EPA's review elements 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 this review form 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 form 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

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

Review Elements:

☒ Each TMDL document submitted to EPA should include a notification of the document status (e.g., pre-public notice, public notice, final), and a request for EPA review.

☐ 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 ☐ N/A

Summary: *EPA was sent a submittal letter and copy of the public notice draft document for review on September 5, 2014 via email from the North Dakota Department of Health (NDDoH).*

Comments: *No comment*

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.

Review Elements:

☒ 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:

Physical Setting/Location: *The four Maple River segments of concern are located in the Maple River Watershed, a 1,009,909 acre watershed in Cass, Barnes, Steele, Ransom and Richland counties in the southeastern portion of the State of North Dakota. The impaired segments are located in Steele, Ransom and Cass Counties and, for purposes of this TMDL, comprise the entire watershed. The Maple River impaired segments lie within the Level III Northern Glaciated Plains (46) and Lake Agassiz Plain (48) Ecoregions.*
NDDoH provided the Waterbody IDs (WBIDs), as well as several maps to delineate the physical boundaries of the segments and identify the land uses of the watershed.

Listing History/Impairment Status: *The Maple River segments of concern have been listed on the State's 303(d) list since 2012 as impaired or threatened due to violations of the recreation use E. coli standards. They include segments: ND-09020205-024-S_00, ND-09020205-015-S_00, ND-09020205-012-S_00, and ND-09020205-001-S_00.*

NDDoH provided the following four tables in the TMDL document to show the designated uses, impairment status, and priority rating of the segments of concern (Tables 2-5 of the TMDL Document).

Table 2. Maple River Section 303(d) Listing Information for Assessment Unit ID ND-09020205-024-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020205-024-S_00
Waterbody Description	Maple River downstream to its confluence with a tributary near the Steele, Cass, and Barnes County line (ND-09020205-023-S_00).
Size	28.28 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Escherichia coli
TMDL Priority	High

Table 3. Maple River Section 303(d) Listing Information for Assessment Unit ID ND-09020205-0215-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020205-015-S_00
Waterbody Description	Maple River from its confluence with a tributary watershed near Buffalo, ND (ND-09020205-019-S_00) downstream to its confluence with the South Branch Maple River.
Size	40.06 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Escherichia coli
TMDL Priority	High

Table 4. Maple River Section 303(d) Listing Information for Assessment Unit ID ND-09020205-012-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020205-012-S_00
Waterbody Description	Maple River from its confluence with the South Branch Maple River downstream to its confluence with a tributary near Leonard, ND.
Size	26.15 miles
Designated Use	Recreation
Use Support	Not Supporting
Impairment	Escherichia coli
TMDL Priority	High

Table 5. Maple River Section 303(d) Listing Information for Assessment Unit ID ND-09020205-001-S_00 (NDDoH, 2012).

Assessment Unit ID	ND-09020205-001-S_00
Waterbody Description	Maple River from its confluence with Buffalo Creek downstream to its confluence with the Sheyenne River.
Size	27.92 miles
Designated Use	Recreation
Use Support	Fully Supporting, but Threatened
Impairment	Escherichia coli
TMDL Priority	High

Comments: *Please clarify this sentence from Section 1.0 of the document: "For the purposes of this Total Maximum Daily Load (TMDL), the impaired segments are located in Steele, Ransom and Cass Counties and comprise the entire watershed." What does "comprise the entire watershed" mean? That these TMDLs are written to consider E. coli loads from the entire watershed? Does NDDoH have data to show that all of the other segments in the watershed are NOT impaired? The 2012 list includes 2 other segments in the watershed as impaired for E. coli: ND-09020205-017-S_00 & ND-09020205-018-S_00 – both are tributaries to Maple River segment ND-09020205-015-S_00. Why aren't they being addressed by this TMDL document?*

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).

Review Elements:

☒ 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 identified sources. Therefore, <u>all TMDL documents must be written to meet the existing water quality standards</u> for that waterbody (CWA §303(d)(1)(C)). *Note: In some circumstances, the load reductions determined to be necessary by the TMDL analysis may prove to be infeasible and may possibly indicate that the existing water quality standards and/or assessment methodologies may be erroneous. However, the TMDL must still be determined based on existing water quality standards. Adjustments to water quality standards and/or assessment methodologies may be evaluated separately, from the TMDL.*

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

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

Recommendation:

☒ Approve ☐ Partial Approval ☐ Disapprove ☐ Insufficient Information

Summary: *The four Maple River segments included in this TMDL document are impaired based on E. coli bacteria concentrations impacting the recreational uses. NDDoH defined the impaired segments of the Maple River as Class II streams. Numeric criteria for E. coli have been established for North Dakota Class II streams and are presented Table 10 shown below, excerpted from the TMDL document. The E. coli bacteria standard applies only during the recreation season from May 1 to September 30. Discussion of additional applicable water quality standards for these stream segments can be found in Section 2.0 of the TMDL document.*

Table 10. North Dakota Bacteria Water Quality Standards for Class II Streams.

Parameter	Standard	
	Geometric Mean[1]	Maximum[2]
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: *No comment*

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, embeddedness, stream morphology, up-slope conditions and a measure of biota).

Review Elements:

☒ 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 TMDL target for the segments of concern is concentration-based, set at the water quality standard of 126 CFU/100 mL. While the standard is intended to be expressed as the 30-day geometric mean (with no more than ten percent of samples collected for E. coli bacteria to exceed 409 CFU/100 mL), for purposes of these TMDLs, the target is based on an E. coli concentration of 126 CFU/100 mL expressed as a daily average based on individual grab samples. Expressing the target in this way will ensure the TMDL will result in both components of the standard being met and that recreational uses are restored.*

Comments: *No comment*

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 identified source (or source category) when the relative load contribution from each source has been estimated. Therefore, the pollutant load from each identified source (or source category) should be specified and quantified. 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.

Review Elements:

☒ The TMDL should include an identification of the 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 the anthropogenic sources of the pollutant of concern have been identified, characterized, and 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 primary land use in the watershed is row crop agriculture – 70% of the land is cropland, 18% is pasture/rangeland/hay, and the remaining 11% is a combination of water/wetlands, developed space, woods, and fallow/barren.*

Point sources were identified in the TMDL document, including three permitted lagoon-type wastewater treatment systems and one permitted animal feeding operation (AFO. Because there is a limited amount of E. coli data available for wastewater systems during their discharges (none of the systems are required to collected E. coli data, and all are allowed to discharge on an "as needed" basis), the facilities were given wasteload allocations. The AFO is a zero discharge facility and was not deemed a significant source of E. coli bacteria loading to the Maple River – therefore, it was not given a wasteload allocation. Nonpoint sources of pollution are thought to be the major sources of E. coli pollution in the watershed, including contributions from failing septic systems, wildlife, and livestock (unpermitted AFOs and watering in the river).

Point sources were identified in Section 4.0 of the TMDL document, including three permitted lagoon-type wastewater treatment systems and one permitted animal feeding operation (AFO). Because there is a limited amount of E. coli data available for wastewater systems during their discharges (none of the systems are required to collected E. coli data, and all are allowed to discharge on an "as needed" basis), the facilities were given calculated wasteload allocations. The AFO is a zero discharge facility and was not deemed a significant source of E. coli bacteria loading to the Maple River – therefore, it was not given a wasteload allocation.

Nonpoint sources of pollution are thought to be the major sources of E. coli pollution in the watershed, including contributions from failing septic systems, wildlife, and livestock (unpermitted AFOs and watering in the river).

Comments: *Was stormwater from any of the municipalities considered as a source? Also, inferring sources based on flow regime (as stated was done in the TMDL document) needs to be "ground truthed" with data, as a variety of sources can be associated with a specific or multiple flow regimes. This TMDL document did not present much data, other than land uses, that one could draw (source) conclusions about based on the exceedances observed in various flow regimes. In particular, one cannot determine the relative source contributions from each source (assuming there are multiple sources in a watershed, which there usually are).*

4. TMDL Technical Analysis

TMDL determinations should be supported by an analysis of the available data, discussion of the known deficiencies and/or gaps in the 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:

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

Where:

TMDL	=	Total Maximum Daily Load (also called the Loading Capacity)
LAs	=	Load Allocations
WLAs	=	Wasteload Allocations
MOS	=	Margin Of Safety

Review Elements:

☒ 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:

- the spatial extent of the watershed in which the impaired waterbody is located and the spatial extent of the TMDL technical analysis;
- the distribution of land use in the watershed (e.g., urban, forested, agriculture);
- 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…;
- 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);
- 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 TMDL analysis was performed using load duration curves, which characterize water quality concentrations at different flow "intervals" or "zones" (in the case of these TMDLs: high flow, moist conditions, dry conditions, low flow and no flow). The method provides a visual display of the relationship between stream flow and loading capacity, the frequency and magnitude of water quality standard exceedances, allowable loadings, and the size of load reductions.*

The loading capacity was determined by taking the product of the water quality standard of 126 CFU/100 ml, daily average stream flow, and a conversion factor. For each flow interval, a regression relationship was developed between the samples which occur above the TMDL target

(126CFU/100 mL) curve and the corresponding flow rate. The regression lines for the flow intervals were then used with the midpoint of the percent exceeded flow for that interval to calculate the existing E. coli bacteria load.

Section 5.3 of the TMDL document explains and demonstrates the LDC analysis, and includes sample calculations of existing load in each flow regime, and the LDC graphs.

Section 5.1 of the TMDL document describes how the flow regimes for the TMDL were calculated or obtained. Flows for TMDL segments ND-09020205-024-S_00 and ND-09020205-015-S_00 were determined by utilizing the Drainage-Area Ratio Method developed by the USGS. The Drainage-Area Ratio Method assumes that the streamflow at the ungauged site is hydrologically similar (same per unit area) to the stream gauging station used as an index.

Streamflow data for the index station (05059700) was obtained from the USGS North Dakota Water Science Center website. The index station (05059700) streamflow data was then divided by the drainage area to determine streamflows per unit area at the index station. Those values are then multiplied by the drainage area for each ungauged site and a seasonal regression equation found in Section 5.1to obtain estimated daily flow statistics for the ungauged sites.

Comments: *In Section 5.1 please use consistent terminology in the discussion to those used in the flow/load duration curves i.e. high flow, moist conditions, dry conditions, low flow and no flow.*

Please provide a discussion of how the secondary factor of the number of E. coli bacteria observations available for each flow intervals were used to determine the flow record breaks.

In section 5.3 it is stated that "As there were no E. coli bacteria concentrations above the TMDL target in the high and low flow regimes for site 38360, the high flow regime for site 385352 and the low flow regime for site 384155 a regression relationship and existing load could not be calculated for these flow regimes". This statement should be modified to reflect better what is shown on the Load Duration Curves. On Figure 13 (Site 385360) there was one datum above the Criteria Line, however there was no regression line drawn, please explain this further. On Figure 12 (Site 38532) there are no data plotted at all in the high flow regime, please state this clearly. On Figure 15 (Site 384155) there were no data plotted in the low flow regime, please state this clearly.

In the second paragraph of Section 5.5, it is stated that "the general focus of Best Management practices (BMPs) and load reductions for the listed waterbody should be on household septic systems". Please explain how this conclusion was arrived at given the lack of data on septic systems. Please include Septic Systems in Table 11.

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…).

Review Elements:

☒ 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 E. coli concentration data used in the TMDL analysis is included in Section 1.5 and Appendix A of the TMDL document. Section 1.5 also provides a description of available flow data, and how flow data was calculated where gauge data were not available.*

Comments: *No comment*

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.

Review Elements:

☒ EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and 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: *Three permitted facilities, wastewater treatment facilities for the City of Buffalo, the City of Mapleton, and the City of Enderlin exist in the watershed, including. The WLAs were calculated by using the water quality standard of 126 CFU/100 ml multiplied by the maximum daily discharge of the treatment plants (and a conversion factor to net a daily load). The only exception was for the calculation of the City of Enderlin, which has two permitted wastewater systems - an average daily discharge was used to perform those calculations.*

WLAs for each permitted facility are found in Section 5.4 of the document. The NPDES permit numbers and discharge data for each facility are provided in Appendix D of the TMDL document.

The WLAs were calculated by using the water quality standard of 126 CFU/100 ml multiplied by the maximum daily discharge of the treatment plants (and a conversion factor to net a daily load). This max value was chosen because it represents the highest discharge volume on record that a facility has produced and will allow for flexibility in bacterial loading, due to the variability of the facilities discharge volumes and durations. The only exception to the criteria was for the calculation of the City of Enderlin which has two permitted wastewater systems - an average daily discharge was used to perform those calculations.

Comments: *NDDoH may want to reconsider assigning a wasteload allocation to the AFO, as it would be in violation of its permit if it ever was found to be contributing "any" E. coli to an impaired segment. A small WLA would allow the facility to be in compliance (unless, of course, the permit already does not allow for any E. coli release/contribution whatsoever… in that case, a lack of a WLA – which is essentially a WLA of 0 - is appropriate). Restated, by not giving the facility an assigned WLA, it is de facto assigning them a WLA of zero, thus any discharge would constitute a violation of their permit.*

Table 12 states there are no contributing point sources in the subwatershed, however Tables 14-16 each show a WLA for the segments due to the WWTPs located in the watersheds, please change the text in Table 12 to reflect there are point sources of E. coli in the segments.

In Section 5.4, paragraph 2, please explain the reasoning which led to the conclusion that "While these facilities have a permit limit of 126 CFU/100 ml for this TMDL, their discharge is typically much less." In the absence of data, this statement is hard to support. Please provide consistent terminology regarding what is being sampled for. It is confusing since the TMDL is for E. coli, and then average fecal value is discussed. It is hard to tell what contaminant is being discussed. These values probably aren't interchangeable, and if they are being used as proxies for each other, then a regression should be calculated to describe the relationship between the two contaminants.

It is unclear why the average discharge values were used to calculate the WLA for the City of Enderlin's facility. It is understood that they have two outfalls, yet it is still unclear why this warrants using the average flow vs. their maximum flow as done with the other WWTPs. Please provide a little more information regarding the reasoning/assumptions of why the average value was used vs. the maximum.

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.

Review Elements:

☒ 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 the 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**: Load Allocations (LA) are provided for each impaired segment in the watershed, accounting for both nonpoint and natural background sources. The LA was calculated by subtracting the 10% MOS and the WLAs from the TMDL (i.e., the Loading Capacity (LC)). Section 7 of the TMDL document contains tables which provide the loading allocations for the various segments. Table 12 provides an outline of the critical elements of the bacteria TMDL for the four TMDL listed segments. TMDLs for the Maple River (ND-09020205-024-S_00, ND-09020205-015-S_00, ND-09020205-012-S_00 and ND-09020205-001-S_00) are summarized in Tables 13 through 16, respectively. The TMDLs provide a summary of average daily loads by flow regime necessary to meet the water quality target (i.e., TMDL). The TMDL load includes a load allocation from known nonpoint sources and a 10 percent margin of safety.*

The Load Allocation (LA), which accounts for natural background and nonpoint sources, was calculated by subtracting the 10% MOS and the WLAs from the LC.

***Comments**: No comment*

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).

Review Elements:

☒ 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

<u>Summary:</u> *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. The MOS was calculated as ten percent of the TMDL (i.e., the Loading Capacity (LC)).*

<u>Comments</u>*: No comment*

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.

Review Elements:

☒ 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: *Section 6.2 of the TMDL document addresses seasonality by incorporating several years' data to develop the flow duration curve for each of the segments. Maple River segments (ND-090200205-015-S_00, ND-09020205-024-S_00 and ND-09020205-012-S_00) used 1993 to 2013 flow data (21 years), and the Maple River segment ND-09020205-001-S_00) was developed using 18 years of USGS gauge data encompassing all 12 months of the year. Additionally, the water quality standard is seasonally based on the recreation season from May 1 to September 30.*

Comments: *No comment*

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.

Review Elements:

☒ 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 draft of the submittal was public noticed in September of 2014. A description of the public participation process is included Section 9 of the TMDL document.*

Comments: *No comment*

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.

Review Elements:

☒ 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: *A monitoring plan is not required for TMDL approval. However, NDDoH states that there is a Section 319 Maple River Watershed Project, and to ensure that the BMPs and technical assistance that are implemented as part of the project 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).*

Comments: *The Monitoring section of the submittal states that there are six point sources in the watershed. EPA's understanding, from the point source descriptions in portions of the TMDL document, is that there are four point sources (i.e., permitted facilities), three permitted wastewater treatment facilities and one permitted AFO. Is this statement about six point sources referring to the number of outfalls? Please clarify.*

What parameters are being monitored as part of the 319 watershed project? Please provide more discussion on how monitoring will be done to show progress toward the TMDL and the identification of the sources of contamination.

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.

Review Elements:

☐ 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: *A formal restoration strategy is not required for TMDL approval. However, a Section 319 Maple River Watershed Project is currently in place. The TMDL document states that since May 2010, local sponsors have been providing technical assistance and implementing BMPs designed to reduce E. coli bacteria loadings and to help restore the beneficial uses of Maple River. As the watershed restoration project progresses, water quality data are collected to monitor and track the effects of BMP implementation as well as to judge overall success of the project in reducing E. coli bacteria loadings. A QAPP has been developed as part of this watershed restoration project that details the how, when and where monitoring will be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s). As the data are gathered and analyzed, watershed restoration tasks will be adapted, if necessary, to place BMPs where they will have the greatest benefit to water quality and in meeting the TMDL goal(s).*

Comments: *Since the implementation of BMPs started in 2010, are there preliminary results which show progress toward reduced E. coli levels?*

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.

Review Elements:

☒ 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: *Tables 13-16 of the TMDL document includes E. coli loads for each impaired segment of the Maple River expressed in units of CFU/day. The submittal includes daily load expressions for the TMDL targets.*

Comments: *No comment*

Appendix F
NDDoH Response to Comments

US EPA Region 8 Comment*:* Please clarify this sentence from Section 1.0 of the document: "For the purposes of this Total Maximum Daily Load (TMDL), the impaired segments are located in Steele, Ransom and Cass Counties and comprise the entire watershed." What does "comprise the entire watershed" mean? That these TMDLs are written to consider E. coli loads from the entire watershed? Does NDDoH have data to show that all of the other segments in the watershed are NOT impaired? The 2012 list includes 2 other segments in the watershed as impaired for E. coli: ND-09020205-017-S_00 & ND-09020205-018-S_00 – both are tributaries to Maple River segment ND-09020205-015-S_00. Why aren't they being addressed by this TMDL document?

NDDoH Response: Section 1.0 the phrase "comprise the entire watershed" was removed.

US EPA Region 8 Comment: Was stormwater from any of the municipalities considered as a source? Also, inferring sources based on flow regime (as stated was done in the TMDL document) needs to be "ground truthed" with data, as a variety of sources can be associated with a specific or multiple flow regimes. This TMDL document did not present much data, other than land uses, that one could draw (source) conclusions about based on the exceedances observed in various flow regimes. In particular, one cannot determine the relative source contributions from each source (assuming there are multiple sources in a watershed, which there usually are).

NDDoH Response: Section 4.2 a paragraph was added concerning stormwater runoff permit requirements for the cities of Buffalo, Enderlin, and Mapelton and the inferred sources were changed to better reflect the sources based on the flow regime.

US EPA Region 8 Comment: In Section 5.1 please use consistent terminology in the discussion to those used in the flow/load duration curves i.e. high flow, moist conditions, dry conditions, low flow and no flow.

Please provide a discussion of how the secondary factor of the number of E. coli bacteria observations available for each flow intervals were used to determine the flow record breaks.

In section 5.3 it is stated that "As there were no E. coli bacteria concentrations above the TMDL target in the high and low flow regimes for site 38360, the high flow regime for site 385352 and the low flow regime for site 384155 a regression relationship and existing load could not be calculated for these flow regimes". This statement should be modified to reflect better what is shown on the Load Duration Curves. On Figure 13 (Site 385360) there was one datum above the Criteria Line, however there was no regression line drawn, please explain this further. On Figure 12 (Site 385352) there are no data plotted at all in the high flow regime, please state this clearly. On Figure 15 (Site 384155) there were no data plotted in the low flow regime, please state this clearly.

In the second paragraph of Section 5.5, it is stated that "the general focus of Best Management practices (BMPs) and load reductions for the listed waterbody should be on household septic systems". Please explain how this conclusion was arrived at given the lack of data on septic systems. Please include Septic Systems in Table 11.

NDDoH Response: Section 5.1 was changed to have consistent terminology. A sentence was added discussing the secondary factor concerning E. coli bacteria observation and flow intervals. In Section 5.3, the language was modified to reflect EPA Region 8 comments and Load Duration Curves were revised as per EPA Region 8 comments. In Section 5.5, the discussion of Best Management Practices was changed to reflect the Load Duration Curve and land use in the watershed.

US EPA Region 8 Comment: NDDoH may want to reconsider assigning a wasteload allocation to the AFO, as it would be in violation of its permit if it ever was found to be contributing "any" E. coli to an impaired segment. A small WLA would allow the facility to be in compliance (unless, of course, the permit already does not allow for any E. coli release/contribution whatsoever… in that case, a lack of a WLA – which is essentially a WLA of 0 - is appropriate). Restated, by not giving the facility an assigned WLA, it is de facto assigning them a WLA of zero, thus any discharge would constitute a violation of their permit.

Table 12 states there are no contributing point sources in the subwatershed, however Tables 14-16 each show a WLA for the segments due to the WWTPs located in the watersheds, please change the text in Table 12 to reflect there are point sources of E. coli in the segments.

In Section 5.4, paragraph 2, please explain the reasoning which led to the conclusion that "While these facilities have a permit limit of 126 CFU/100 ml for this TMDL, their discharge is typically much less." In the absence of data, this statement is hard to support. Please provide consistent terminology regarding what is being sampled for. It is confusing since the TMDL is for E. coli, and then average fecal value is discussed. It is hard to tell what contaminant is being discussed. These values probably aren't interchangeable, and if they are being used as proxies for each other, then a regression should be calculated to describe the relationship between the two contaminants.

It is unclear why the average discharge values were used to calculate the WLA for the City of Enderlin's facility. It is understood that they have two outfalls, yet it is still unclear why this warrants using the average flow vs. their maximum flow as done with the other WWTPs. Please provide a little more information regarding the reasoning/assumptions of why the average value was used vs. the maximum.

NDDoH Response: The AFO was not assigned a WLA since it is deemed "a zero discharge facility". Table 12 was revised to reflect point sources in the segments. Section 5.4, paragraph 2 was revised to reflect EPA Region 8 comments. The maximum flow value was used to calculate for the city of Enderlin's facility.

US EPA Region 8 Comment: The Monitoring section of the submittal states that there are six point sources in the watershed. EPA's understanding, from the point source descriptions in portions of the TMDL document, is that there are four point sources (i.e., permitted facilities), three permitted wastewater treatment facilities and one permitted AFO. Is this statement about six point sources referring to the number of outfalls? Please clarify.

What parameters are being monitored as part of the 319 watershed project? Please provide more discussion on how monitoring will be done to show progress toward the TMDL and the identification of the sources of contamination.

NDDoH Response: Section 10 was revised to reflect the correct number of point source facilities in the TMDL. The 319 Implementation Project is focused on Buffalo Creek a tributary of the Maple River and not covered in this TMDL.

US EPA Region 8 Comment: Since the implementation of BMPs started in 2010, are there preliminary results which show progress toward reduced E. coli levels?

NDDoH Response: No preliminary results at this time.