Fecal Coliform Bacteria TMDL for Beaver Creek and Its Tributaries in Emmons, McIntosh and Logan Counties, North Dakota

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1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

Beaver Creek and the Beaver Creek watershed are located within the Missouri River basin. The watershed extends from near Fredonia in eastern Logan County to the Missouri River near Linton in western Emmons County, North Dakota. The watershed is approximately 2,681 square kilometers (km^2) or 662,392 acres in size. Table 1 summarizes the geographical, hydrological and physical characteristics, while Figure 1 shows the location of the Beaver Creek watershed.

Table 1. General Characteristics of Beaver Creek and the Beaver Creek Watershed.

Legal Name	Beaver Creek
Stream Classification	Class II
Major Drainage Basin	Missouri River
Assessment Unit ID	ND 10130104
Counties	Emmons, Logan and McIntosh counties
Eco-Region	Northwestern Glaciated Plains (42) and Northwestern Great Plains (43) level III ecoregions
Watershed Area	662,392 acres

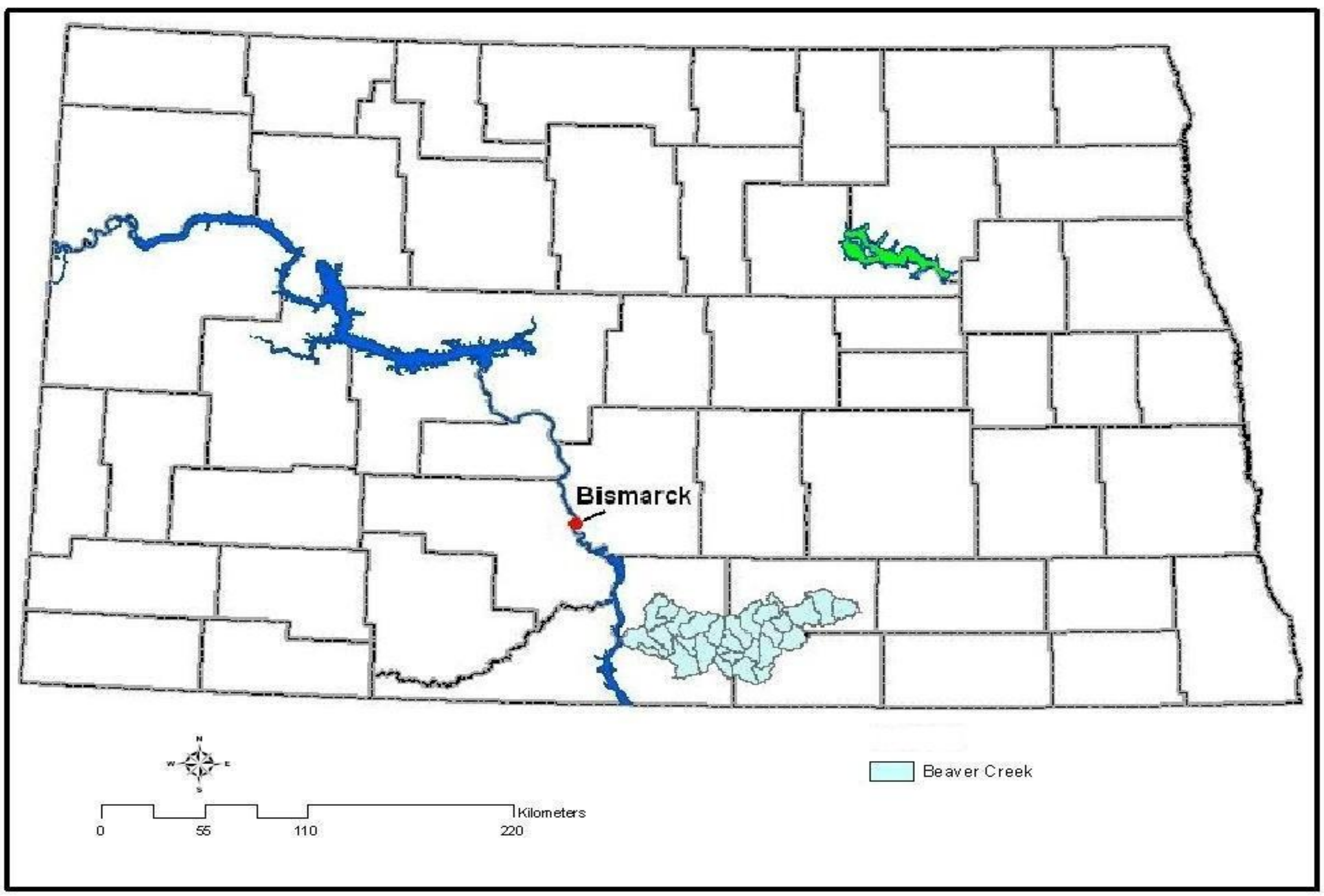

Figure 1. General Location of the Beaver Creek Watershed in North Dakota.

1.1 Clean Water Act Section 303(d) Listing Information

As part of the 2010 Clean Water Act Section 303(d) Total Maximum Daily Load (TMDL) listing process, the North Dakota Department of Health (NDDoH) has identified Beaver Creek and several of its tributaries as impaired (Figure 2, Tables 2-10). The NDDoH assessed these waterbodies as either fully supporting, but threatened or not supporting for the beneficial use of recreation. These assessments are based on fecal coliform bacteria data collected from 2005-2009.

Table 2. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-001-S_00 (NDDoH, 2010).

Assessment Unit ID	ND-10130104-001-S_00
Waterbody Description	Beaver Creek from its confluence with Sand Creek downstream to Lake Oahe.
Size	8.43 miles
Designated Uses Impaired	Recreation
Use Support	Fully supporting, but threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 3. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-003-S_00 (NDDoH, 2010).

Assessment Unit ID	ND 10130104-003-S_00
Waterbody Description	Beaver Creek from its confluence with Spring Creek downstream to its confluence with Sand Creek.
Size	14.9 miles
Designated Uses Impaired	Recreation
Use Support	Fully supporting, but threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 4. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-004-S_00 (NDDoH, 2010).

Assessment Unit ID	ND 10130104-004-S_00
Waterbody Description	Sand Creek and tributaries.
Size	108.56 miles
Designated Uses Impaired	Recreation
Use Support	Not supporting
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 5. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-005-S_00 (NDDoH, 2010).

Assessment Unit ID	ND 10130104-005-S_00
Waterbody Description	Spring Creek and tributaries.
Size	63.14 miles
Designated Uses Impaired	Recreation
Use Support	Not supporting
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 6. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-007-S_00 (NDDoH, 2010).

Assessment Unit ID	ND 10130104-007-S_00
Waterbody Description	Beaver Creek from its confluence with the South Branch Beaver Creek downstream to its confluence with Spring Creek.
Size	37.68 miles
Designated Uses Impaired	Recreation
Use Support	Fully supporting, but threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 7. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-008-S_00 (NDDoH, 2010).

Assessment Unit ID	ND 10130104-008-S_00
Waterbody Description	Clear Creek and tributaries.
Size	108.95 miles
Designated Uses Impaired	Recreation
Use Support	Fully supporting, but threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 8. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-010-S_00 (NDDoH, 2010).

Assessment Unit ID	ND 10130104-010-S_00
Waterbody Description	Beaver Creek from Beaver Lake downstream to its confluence with the South Branch Beaver Creek. Located in Emmons and McIntosh Counties
Size	38.92 miles
Designated Uses Impaired	Recreation
Use Support	Not supporting
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 9. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-012-S_00 (NDDoH, 2010).

Assessment Unit ID	ND 10130104-012-S_00
Waterbody Description	Unnamed tributary on the south side of Beaver Lake, Logan and McIntosh Counties.
Size	158.02 miles
Designated Uses Impaired	Recreation
Use Support	Fully supporting, but threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

Table 10. Section 303(d) TMDL Listing Information for Assessment Unit ND-10130104-014-S_00 (NDDoH, 2010).

Assessment Unit ID	ND 10130104-014-S_00
Waterbody Description	South Branch Beaver Creek from its confluence with the South Branch Beaver Creek Watershed (ND-10130104-015-S) downstream to its confluence with Beaver Creek. Located in McIntosh and Emmons Counties.
Size	43.45 miles
Designated Uses Impaired	Recreation
Use Support	Fully supporting, but threatened
Impairment	Fecal Coliform Bacteria
TMDL Priority	High

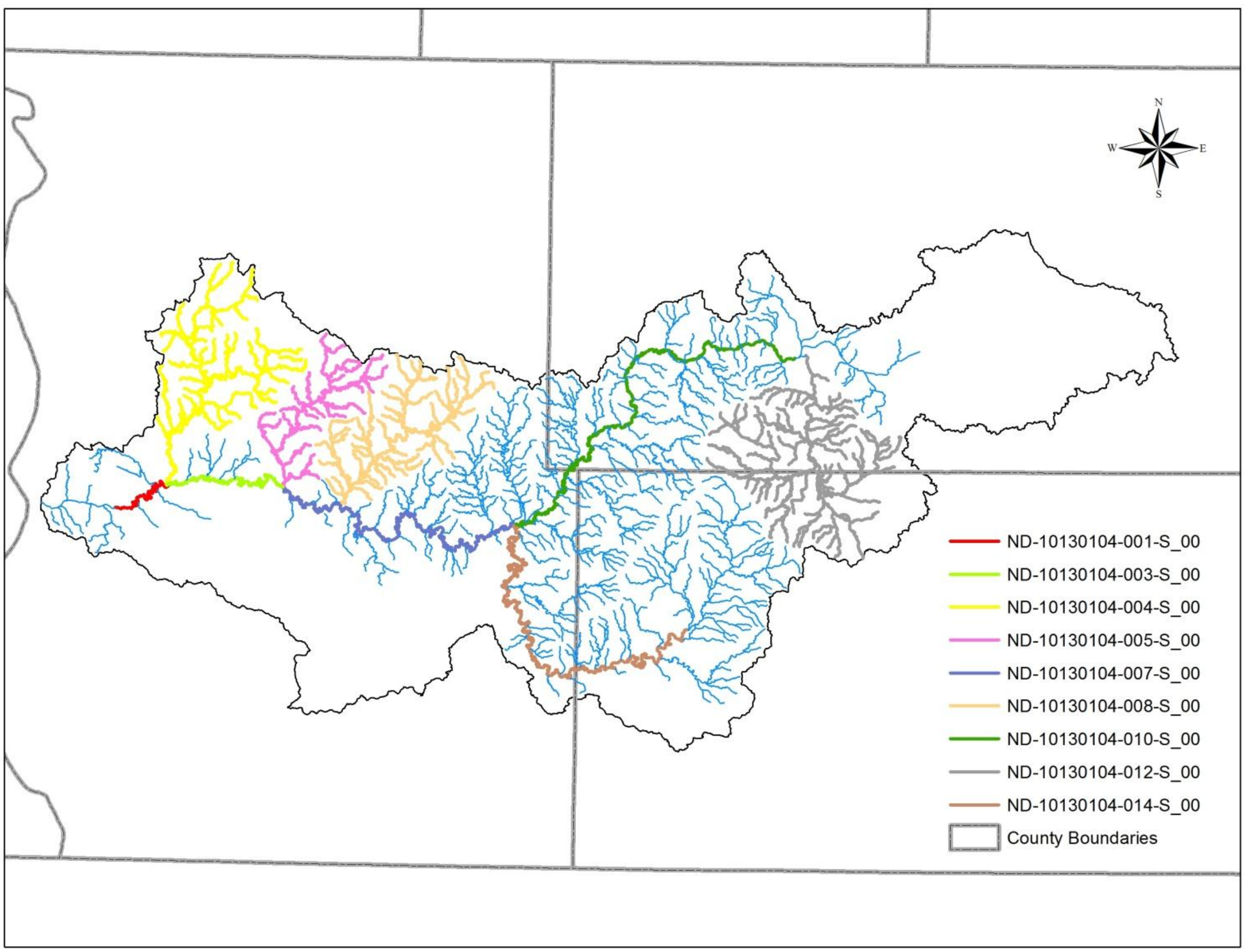

Figure 2. Beaver Creek Watershed Section 303(d) Listed Waterbodies.

1.2 Topography

1.2.1 Ecoregions

Approximately 86 percent of the watershed lies within the Northwestern Glaciated Plains (42) level III ecoregion, while 14 percent lies within the Northwestern Great Plains (43) level III ecoregion.

The headwaters of the watershed lies within two level IV ecoregions, the Missouri Coteau (42a) ecoregion and Collapsed Glacial Outwash (42b) ecoregion. Additionally, two level IV ecoregions comprise the main body of the watershed, the Missouri Coteau Slope (42c) ecoregion and River Breaks (43c) ecoregion.

The Northwestern Glaciated Plains (42) ecoregion marks the westernmost extent of continental glaciation. The morainal landscape has significant surface irregularity and high concentrations of wetlands. The rise in elevation along the eastern boundary defines the beginning of the Great Plains. Land use is transitional between the intensive dryland farming on the Drift Plains (46i) ecoregion to the east and the predominance of cattle ranching and farming to the west on the Northwestern Great Plains (43) ecoregion.

The Missouri Coteau Slope (42a) ecoregion declines in elevation from the Missouri Coteau to the Missouri River. Unlike the Missouri Coteau where there is a paucity of streams, the Missouri Coteau Slope ecoregion has a simple drainage pattern and fewer wetland depressions. Due to the level to gently rolling topography, there is more cropland than on the Missouri Coteau. Cattle graze on the steeper land that occurs along drainages.

Areas of Collapsed Glacial Outwash (42b) ecoregion formed from gravel and sand deposited by glacial meltwater and precipitation runoff over stagnant ice. Many large, shallow lakes are found in these areas; these lakes and wetlands tend to be slightly to very alkaline depending upon the flowpath of groundwater moving through the permeable outwash deposits. They attract birds preferring large areas of open water, such as white pelicans, black terns, and Forster's terns, as well as those living in brackish water, such as avocets and tundra swans.

The rolling hummocks of the Missouri Coteau (42c) ecoregion enclose countless wetland depressions or potholes. During its slow retreat, the Wisconsinan glacier stalled on the Missouri escarpment for thousands of years, melting slowly beneath a mantle of sediment to create the characteristic pothole topography of the Coteau. The wetlands of the Missouri Coteau and the neighboring prairie pothole regions are the major waterfowl production areas in North America. Land use on the coteau is a mixture of tilled agriculture in flatter areas and grazing land on steeper slopes.

The River Breaks (43c) ecoregion form broken terraces and uplands that descend to the Missouri River and its major tributaries. They have formed particularly in soft, easily erodible strata, such as Pierre shale. The dissected topography, wooded draws, and uncultivated areas provide a haven for wildlife. Riparian gallery forests of Beaver and green ash persist along major tributaries such as the Moreau and Cheyenne rivers, but they have largely been eliminated along the Missouri River by impoundments (USGS 2006).

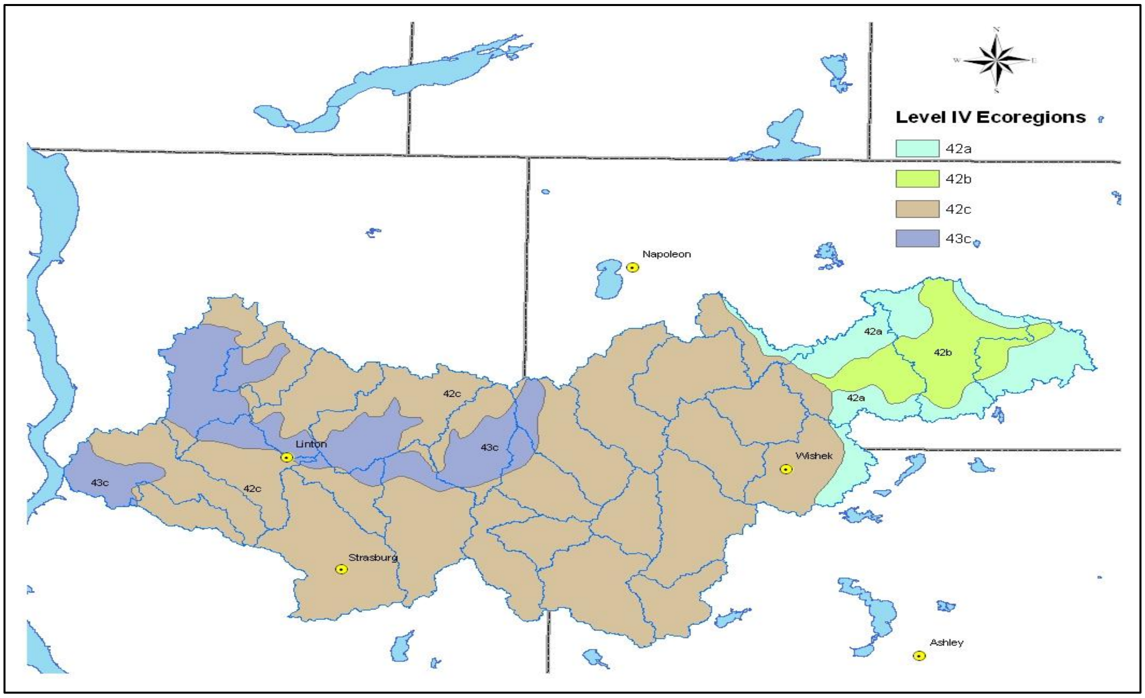

Figure 3. Level IV Ecoregions in the Beaver Creek Watershed

1.2.2 Soil Associations

The dominant soil mapunits within the Beaver Creek watershed are Bowdle-Lehr loams (24,854 acres = 4%), Zahl-Williams loams (24,372 acres = 3.9%), Zahl-Williams loams (24,016 acres = 3.8%), Wabek-Appam sandy loams (21,262 acres = 3.4%), and Williams-Bowbells loams (20,336 acres = 3.3%).

Williams series consist of very deep, well drained soils that formed in calcareous glacial till. These soils are on backslopes and summits on glacial till plains and moraines. Slopes range from 0 to 35%. Amor series consist of well drained soils that are moderately deep to soft sandstone bedrock. They formed in material weathered from stratified soft sandstone, siltstone and mudstone. These soils are on uplands and have slopes ranging from 0 to 25%. Zahl series consist of very deep, well drained soils that formed in calcareous glacial till. These soils are on shoulders on glacial till plains, moraines and valley side slopes. Slopes range from 1 to 60%. Wabek series consist of very deep, excessively drained soils that formed in sand and gravel glaciofluvial deposits. These soils are on outwash plains, beach ridges, terraces and terrace escarpments and have slopes ranging from 0 to 45%. Vebar series consist of well drained, moderately deep soils that formed in residuum weathered from soft calcareous sandstone. These soils are on uplands and have slopes ranging from 0 to 65% (NRCS 2009).

1.3 Land Use/Land Cover

The dominant land use in the Beaver Creek watershed is grassland/rangeland. According to the 2009 National Agricultural Statistical Service land survey data (NASS, 2009), approximately 54 percent of the land is grassland/rangeland, 29 percent is actively cultivated, nine percent is pastureland/hayland, and eight (8) percent is comprised of wetlands, water, woods, and urban development. The majority of the crops grown consist of spring wheat, sunflower, corn and soybeans (Figure 11).

Table 11. Land Use in the Beaver Creek Watershed in 2009 (NASS, 2009).

Land Use/Land Cover	Acres	Percent
Grassland	357,019	53.9
Cropland	194,139	29.3
Spring Wheat	83,113	12.6
Winter Wheat	12,931	2.0
Sunflower	41,857	6.3
Barley	26,762	0.6
Soybean	21,140	3.2
Corn	3,886	4.0
Other Crops	4,450	0.7
Pasture/Hay Land/Alfalfa	57,111	8.6
Water/Wetlands	22,909	3.5
Open Space/Developed	29,598	4.5
Shrubland/Forest	996	0.2
Barren/Fallow/Idle Cropland	620	<0.1
Total	662,392	100.0

1.4 Climate and Precipitation

The climate of the region varies significantly depending on the season. Average monthly precipitation data for the climate stations, within the watershed, near Linton, ND (325210) and Wishek, ND (329515) were obtained from the High Plains Regional Climate Center (HPRCC). Precipitation occurs mainly in the form of rainfall with the majority occurring during the months of April through October (Figures 4 and 5). Average annual precipitation is 16.37 inches at Linton and 17.85 inches at Wishek.

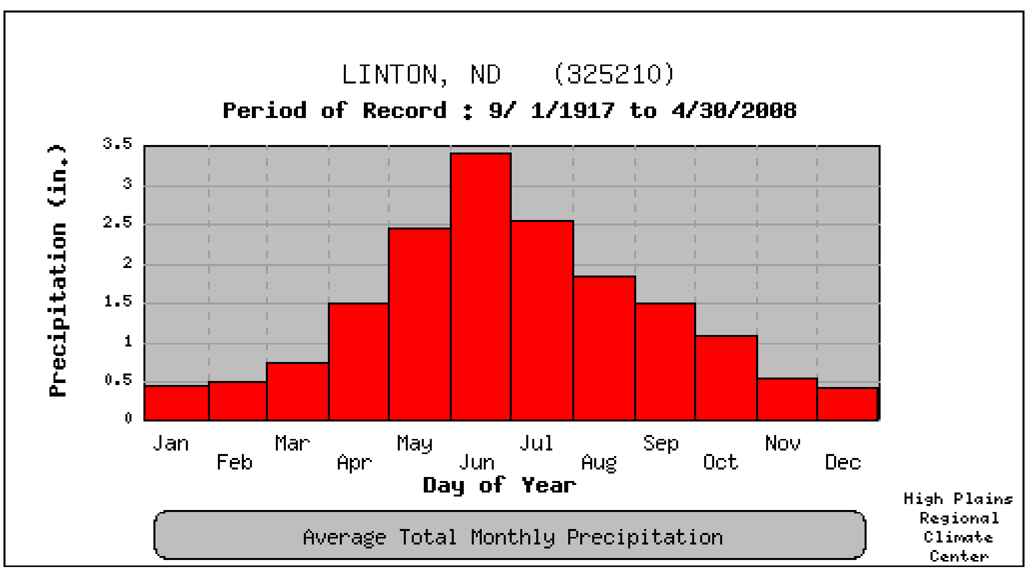

Figure 4. Average Monthly Precipitation at Linton, North Dakota.

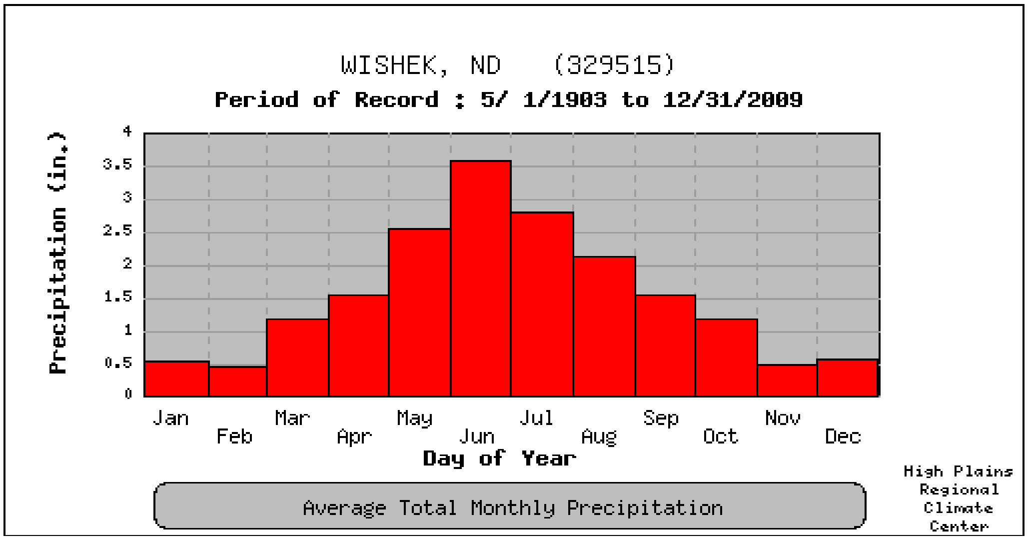

Figure 5. Average Monthly Precipitation at Wishek, North Dakota.

1.5 Available Data

Table 12 lists monitoring sites within the Beaver Creek Watershed, while Figure 6 shows their locations.

Table 12. Water Quality Monitoring Sites in the Beaver Creek Watershed.

Station ID	Description	Waterbody ID	Monitoring Period	Sample Number
384050	Tributary to Beaver Lake	ND-10130104-012-S_00	1996-2005	168
384051	Beaver Creek	ND-10130104-010-S_00	1996-2009	231
384053	South Branch Beaver Creek	ND-10130104-014-S_00	1996-2009	236
384054	Beaver Creek	ND-10130104-008-S_00	1996-2005	170
384055	Spring Creek	ND-10130104-005-S_00	1996-2005	184
384056	Beaver Creek	ND-10130104-007-S_00	1996-2009	251
384057	Sand Creek	ND-10130104-004-S_00	1996-2009	225
384058	Beaver Creek	ND-10130104-001-S_00	1996-2005	181

1.5.1 Fecal Coliform Bacteria Data

Water quality samples and discharge data used for this report were collected at eight locations as part of the pre-project assessment (1995-1996) and throughout the implementation of a Section 319 Nonpoint Source Pollution reduction project (1997-2009) (Figure 6). Fecal coliform data for each site are provided in Appendix A. While the state of North Dakota has an E. coli bacteria standard (see Section 2.0), no E. coli data are available for the TMDL reaches described in the report.

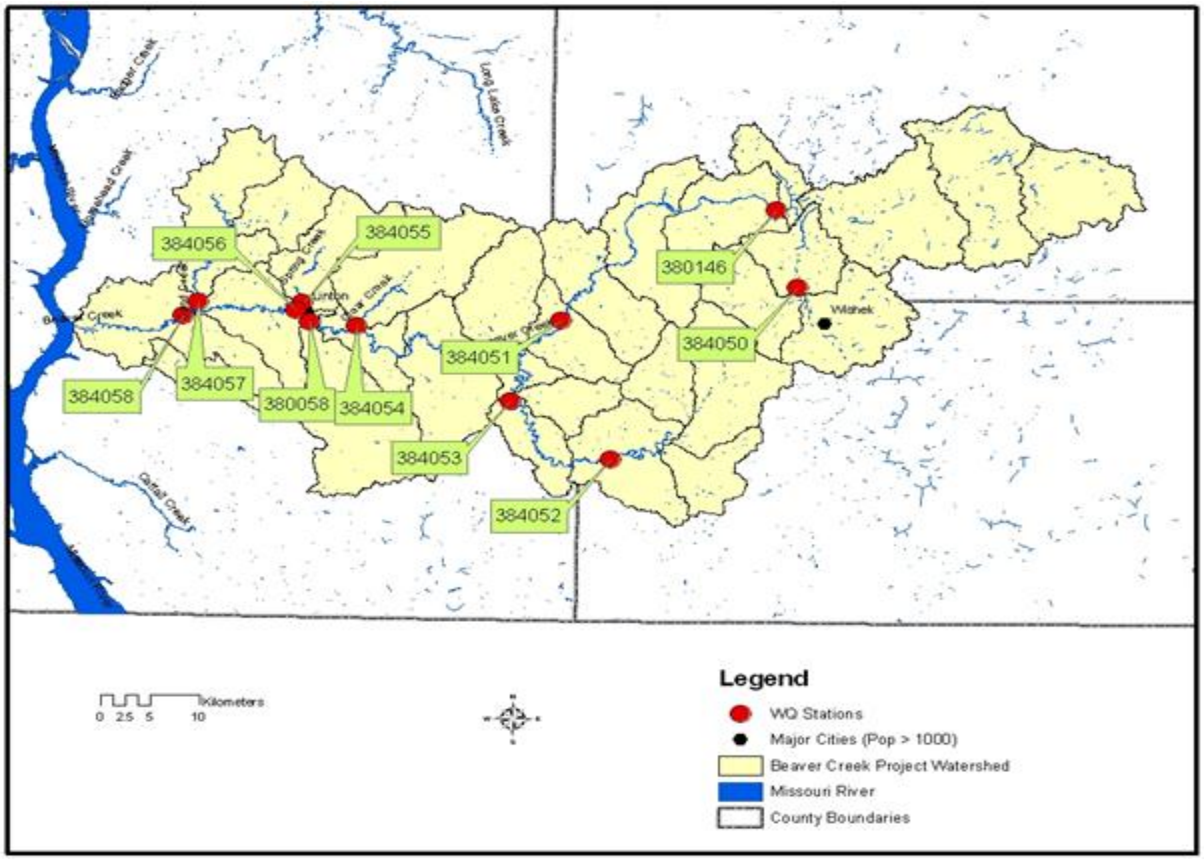

Figure 6. Water Quality Monitoring Locations in the Beaver Creek Watershed.

Table 13 provides an example of a summary of fecal coliform geometric mean concentrations, the percentage of samples exceeding 400 CFU/100 mL, and the recreational use assessment for assessment unit ND-10130104-007-S_00. This assessment is based on data collected at water quality site 384056. Summaries for all other TMDL listed segments are provided in Appendix A. The geometric mean concentration of fecal coliform bacteria and the percent of samples over 400 CFU/100 mL were calculated for each sampling location using those samples collected during the recreational period of May 1 through September 30. Months with less than five samples were listed as lacking data. Based on the data collected, classifications were assigned to each sampling location.

Table 13. Geometric Means, Percent Exceeding Standards and Beneficial Use Assessment for TMDL Listed Segment ND-10130104-007-S_00 (as represented by 384056).

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	52	72	13	Fully supporting, but Threatened
June	25	140	15	Fully supporting, but Threatened
July	7	187	43	Fully supporting, but Threatened
August	7	175	43	Fully supporting, but Threatened
September	5	109	0	Fully Supporting

1.5.2 Hydraulic Discharges

A discharge record was constructed for the TMDL listed segments based on stream flow and discharge measurements collected by the United States Geological Service (USGS) from 1996 - 2009 at site 06354580 which is collocated with STORET site 384056 located on Beaver Creek below Linton (Appendix B). Discharges for the other listed reaches were developed using the Drainage-Area Ratio Method described in Section 5.1.

2.0 WATER QUALITY STANDARDS

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

2.1 Narrative Water Quality Standards

The North Dakota Department of Health has set narrative water quality standards that apply to all surface waters in the State. The narrative general water quality standards are listed below (NDDoH, 2006).

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

- No discharge of pollutants, which alone or in combination with other substances, shall:
  1) Cause a public health hazard or injury to environmental resources;
  2) Impair existing or reasonable beneficial uses of the receiving waters; or
  3) Directly or indirectly cause concentrations of pollutants to exceed applicable standards of the receiving waters.

In addition to the narrative standards, the NDDoH has set a biological goal for all surface waters in the State. The goal states that "the biological condition of surface waters shall be similar to that of sites or waterbodies determined by the department to be regional reference sites" (NDDoH, 2006).

2.2 Numeric Water Quality Standards

Beaver Creek is a Class II stream (NDDoH, 2006) which carries the following definition:

Class II-The quality of the waters in this class shall be suitable for the propagation and/or protection of resident fish species and other aquatic biota and for swimming, boating, and other water recreation. The quality of the waters shall be for irrigation, stock watering, and wildlife without injurious effects. After treatment consisting of coagulation, settling, filtration, and chlorination, or equivalent treatment processes, the water quality shall meet the bacteriological, physical, and chemical requirements of the Department for municipal or domestic use. Additional treatment for municipal use 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 or limited value for beneficial uses such as municipal water, fish life, or irrigation.

The TMDL listed tributaries to Beaver Creek are Class III streams (NDDoH, 2006) which carries the following definition:

Class III- The quality of the waters in this class shall be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation and fish and aquatic biota. The quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses.

Numeric criteria have been developed for Class II and III streams for both fecal coliform bacteria and E. coli (Table 14). Both bacteria standards applies only during the recreation season of May 1 to September 30.

Table 14. North Dakota Fecal Coliform and E. coli Bacteria Standards for Class II and III Streams.

Parameter	Standard	
	Geometric Mean[1]	Maximum[2]
Fecal Coliform Bacteria	200 CFU/100 mL	400 CFU/100 mL
E. coli Bacteria	126 CFU/100 mL	409 CFU/100 mL

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

3.0 TMDL TARGET

A TMDL target is the value that is measured to judge the success of the TMDL effort. TMDL targets must be based on state water quality standards, but can also include site-specific values when no numeric criteria are specified in the standard. The following TMDL target for Beaver Creek and its tributaries are based on the North Dakota fecal coliform bacteria standard for Class II and III streams.

3.1 Beaver Creek and Its Tributaries Fecal Coliform Bacteria TMDL Targets

Beaver Creek and its tributaries are impaired because of fecal coliform bacteria. The listed segments in the Beaver Creek watershed are listed as not supporting or fully supporting, but threatened, for recreational beneficial uses because of fecal coliform bacteria counts exceeding the North Dakota water quality standard. The North Dakota water quality standard for fecal coliform bacteria is a geometric mean concentration of 200 CFU/100 mL during the recreation season from May 1 to September 30. Thus, the TMDL target for this report is 200 CFU/100 mL. In addition, no more than ten percent of samples collected for fecal coliform bacteria should exceed 400 CFU/100 mL.

While the standard is intended to be expressed as the 30-day geometric mean, the target is based on the 200 CFU/100 mL geometric mean standard. Expressing the target in this way will ensure the TMDL will result in both components of the standard being met and recreational uses are restored.

Currently, the state of North Dakota has both a fecal coliform bacteria standard and an E. coli bacteria standard. During the current triennial water quality standards review period, the Department will be eliminating the fecal coliform bacteria standard and will only have the E. coli standard for bacteria. This standards change is recommended by the US EPA as E. coli is believe to be a better indicator of recreational use risk (i.e., incidence of gastrointestinal disease). During this transition period to an E. coli only bacteria standard, the fecal coliform bacteria target for this TMDL and the resulting load allocation are believed to be protective of the E. coli standard as well. This conclusion is based on the assumption that the ratio of E. coli to fecal coliform in the environment is equal to or less that the ratio of the E. coli bacteria standard to the fecal coliform bacteria standard, which is 63% (126:200). If the ratio of E. coli to fecal coliform in the environment is greater than 63%, then it is unlikely that the current TMDL will result in attainment of the E. coli standard. The department will assess attainment of the E. coli standard through additional monitoring consistent with the state's water quality standards and beneficial use assessment methodology.

4.0 SIGNIFICANT SOURCES

4.1 Point Sources

Within the Beaver Creek watershed, there is a municipal point source located in Wishek, ND located on segment ND-10130104-012-S_00. This facility is permitted through the North Dakota Pollutant Discharge Elimination System (NDPDES) Program. The Wishek facility discharges intermittently for short periods of time (6-8 days) into an unnamed tributary that is part of TMDL listed segment ND-10130104-012-S_00 and enters Beaver Lake. From 1995-2009 the city of Wishek discharged 25 times averaging 6.64 days and 6.95 million gallons per discharge. Grab samples were taken once per discharge period as required by permit conditions. The concentration of fecal coliform bacteria reported in four of the six sampled events were 20 CFU/100 mL or less with two events reported as 950 CFU/100 mL or higher. While the majority of the samples were reported as 20 CFU/100 mL (equal to 79.2×10^7 CFU/day) or less, the water quality standard value of 200 CFUs/100 mL will be used in the waste load allocation (WLA) for the TMDL for segment ND-10130104-012-S_00.

There are 18 (fourteen medium and four large) permitted CAFOs/AFOs in the watershed. However, they are zero discharge facilities and are not deemed a significant point source of fecal coliform bacteria loadings to Beaver Creek or its impaired tributaries.

4.2 Nonpoint Sources

The data collected during the water quality assessment (NDDoH, 2010) and subsequent water quality improvement project indicate that the primary nonpoint sources for fecal coliform bacteria in the Beaver Creek watershed are as follows:

- Runoff of manure from cropland and pastureland;
- Runoff of manure from unpermitted animal feeding areas;
- Direct deposit of manure into Beaver Creek by grazing livestock; and
- Background levels associated with wildlife.

Animal feeding areas within the Beaver Creek watershed were identified as part of data collection effort for the assessment project (1995). The identified animal feeding areas contained almost exclusively beef or dairy cattle.

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

5.0 TECHNICAL ANALYSIS

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

The loading capacity or TMDL is the amount of pollutant (e.g. fecal coliform bacteria) a waterbody can receive and still meet and maintain water quality standards and beneficial uses. The following technical analysis addresses the fecal coliform load allocation and the load allocation reductions necessary to achieve the water quality standards target of 200 CFU/100 mL plus a margin of safety.

5.1 Mean Daily Stream Flows

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

Flows used in the load duration curve analysis for TMDL listed segment ND-10130104-007-S_00 were based on the mean daily flow record for United States Geological Survey (USGS) gaging station 06354580 located on Beaver Creek below Linton, ND from 1995-2009. Flows used in the load duration curves for the remaining ungauged TMDL listed segments were estimated using the Drainage-Area Ratio Method developed by the USGS (Ries et. al, 2000). The Drainage-Area Ratio Method assumes that the streamflow at an 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 are nested within the same 8-digit HUC as the gauged site. Drainage area and landuse for the ungauged sites and the index station (06354580) were determined through GIS using digital elevation models (DEMs) and the 2006 NASS landuse database. Streamflow data for the index station (06354580) was obtained from the USGS Water Science Center website. The index station (06354580) streamflow data were 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 to obtain estimated flow statistics for the ungauged sites.

5.2 Flow Duration Curve Analysis

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

A basic flow duration curve runs from high to low (0 to 100 percent) along the x-axis with the corresponding flow value on the y-axis (Figure 7). 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 7, a flow duration interval of forty-seven (47) percent, associated with a stream flow of 13 cfs, implies that 47 percent of all observed mean daily discharge values equal or exceed 13 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 (fecal coliform bacteria in this case) (USEPA, 2007). As depicted in Figure 7, the flow duration curve for USGS site 06354580,, collocated with water quality site 384056 and representing TMDL segment ND 10130104-007-S_00, was divided into four zones, one representing high flows exceeding 98 cfs (0-8 percent), moist condition flows between 13-98 cfs (8.01-47 percent), dry condition flows between 1.9-13cfs (47.01-90 percent), and for low flows between 0.2-1.9 cfs (90.01-99 percent). No flow occurred one percent of the time (99-100 percent). These flow intervals were defined by examining the range of flows for the site for the period of record and then by looking for natural breaks in the flow record based on the flow duration curve plot (Figure 7). A secondary factor in determining the flow intervals used in the analysis is the number of fecal coliform observations available for each flow interval.

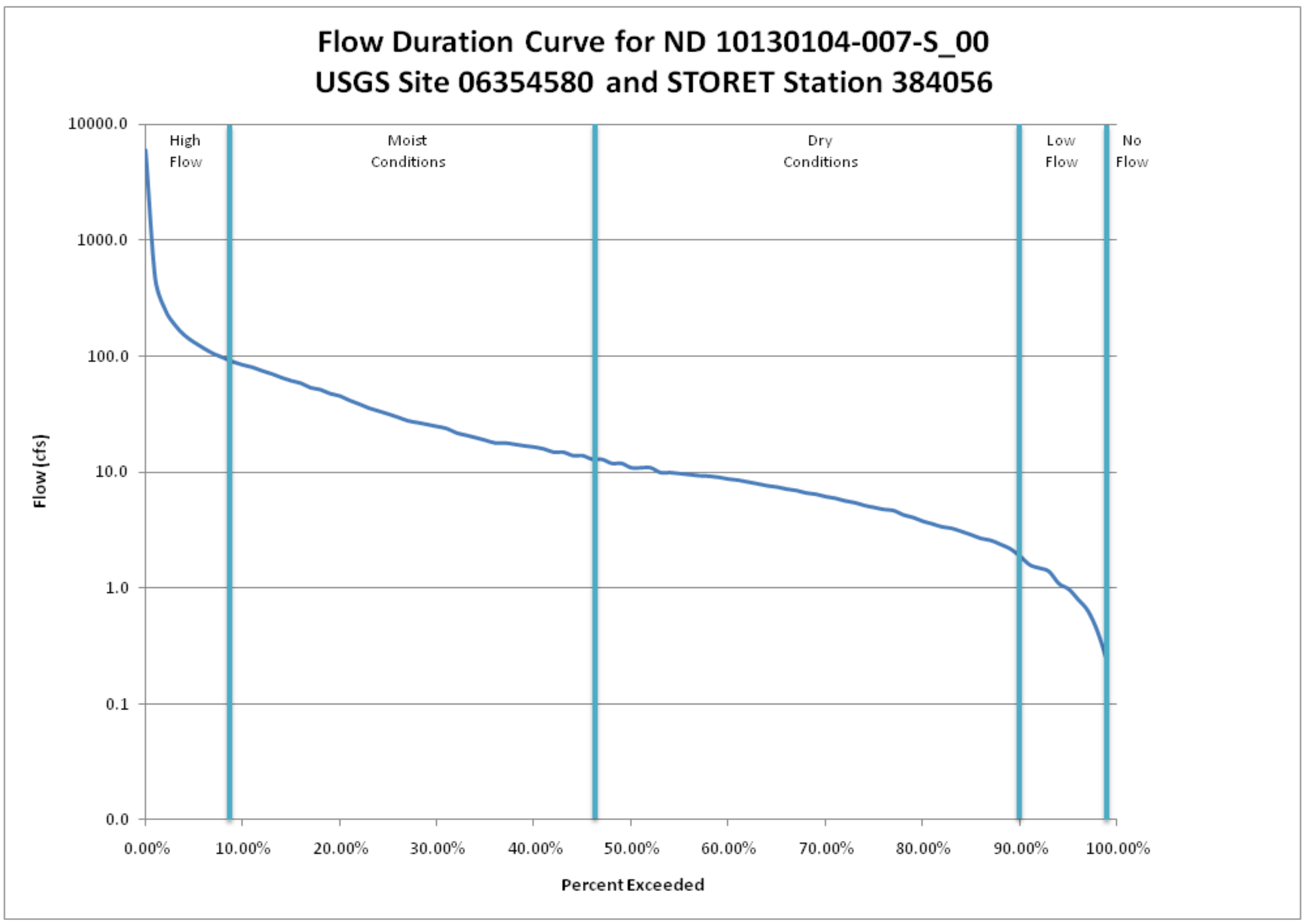

Figure 7. Flow Duration Curve for Beaver Creek Site 384056 (below Linton).

5.3 Load Duration Curve Analysis

An important factor in determining NPS pollution loads is variability in stream flows and loads associated with high and moderate to low flow. To better correlate the relationship between the pollutant of concern and hydrology of the 303(d) listed segments, load duration curves were developed for the listed segments in the Beaver Creek watershed (Appendix E). The load duration curves were derived using the 200 CFU/100 mL target (i.e. state water standard) and the flows generated as described in Section 5.1.

Observed in-stream fecal coliform bacteria concentrations from monitoring site 384056, representing TMDL segment ND 10130104-007-S_00, from 1995-2009 were converted to pollutant loads by multiplying total fecal coliform bacteria concentrations by the mean daily flow and a conversion factor. These loads are plotted against the percent exceeded of the flow on the day of sample collection (Figure 8). Points plotted above the 200 CFU/100 mL target curve exceed the TMDL target. Points plotted below the curve are meeting the target of 200 CFU/100 mL.

For each flow interval or zone (i.e., high, moist conditions, dry conditions, low), a regression relationship was developed between the samples which occur above the TMDL target (200 CFU/100 mL) curve and the corresponding percent exceeded flow. The load duration curve for site 384056, representing TMDL segment ND 10130104-007-S_00, depicting the regression relationship for each flow interval is provided in Figure 8 as an example. Load duration curves for all other TMDL listed segments are provided in Appendix E.

In the example below, the regression line for each flow interval was then used with the midpoint of the percent exceeded flow for that interval to calculate the existing total fecal coliform bacteria load for that flow interval. In the example provided in Figure 8, the regression relationship between observed fecal coliform bacteria loading and percent exceeded flow for the high flow interval (0-8 percent) is:

Fecal coliform 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 4.01 percent, the existing fecal coliform load is:

Fecal coliform load (10^7 CFUs/day) = antilog (6.36 + (-31.01*0.0401))
= 288,649 x 10^7 CFUs/day

The midpoint for the high flow interval is also used to estimate the TMDL target load. In the case of the previous example, the TMDL target load for the midpoint of the high flow regime, or 4.01 percent, exceeded the 200 CFU/100 mL TMDL target curve and is equal to 85,875 x 10^7 CFUs/day (Figure 7). TMDL target loads are similarly derived for each of the remaining flow regimes (i.e. moist, dry, and low).

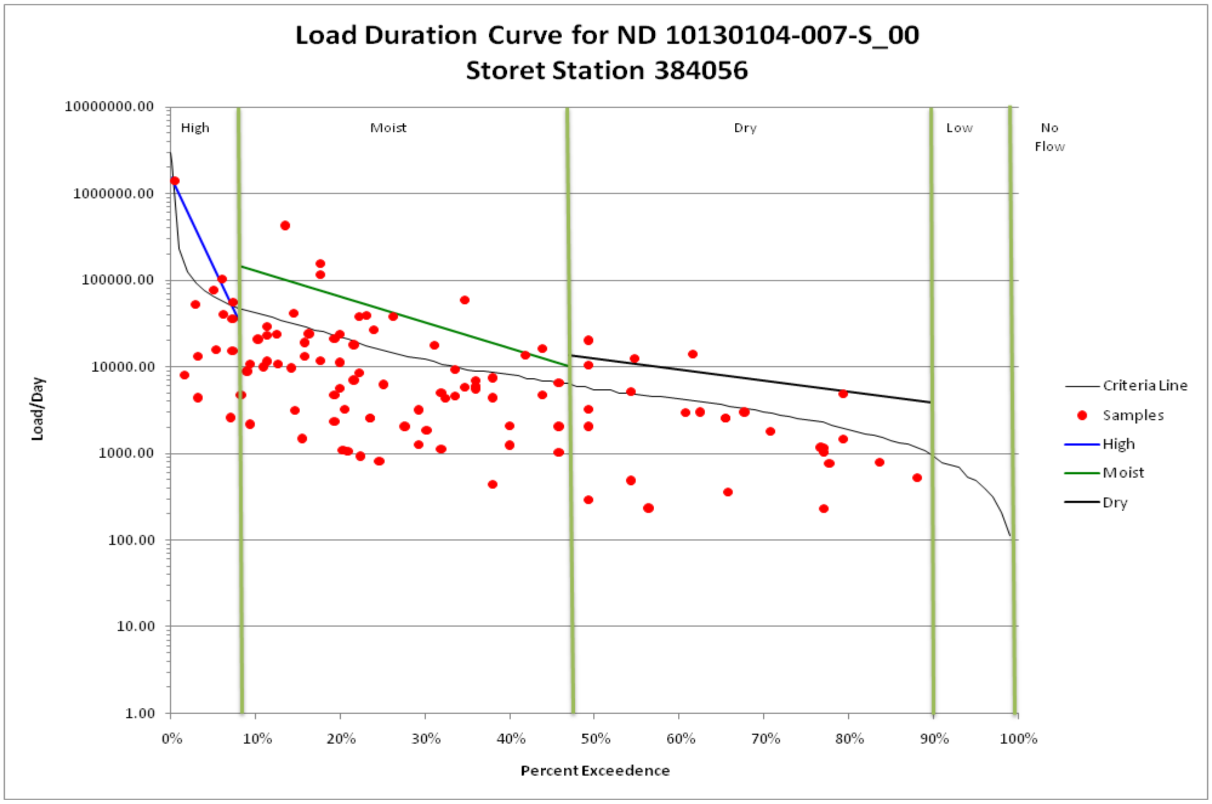

Figure 8. Load Duration Curve for Beaver Creek Site 384056 (below Linton).

5.4 Waste Load Allocation (WLA) Analysis

Based on the city of Wishek's discharge monitoring report (DMR) data for the period 1995-2009 (Appendix D), the city discharged 25 times. The average volume of wastewater discharged each time was 6.95 million gallons and the average discharge period was 6.64 days (range 5-8 days). As stated earlier, while the majority (4 of 6) of the reported fecal coliform concentrations reported in the DMRs were 20 CFU/100 mL or less, a fecal coliform concentration of 200 CFUs/100 mL will be used to estimate a WLA for the TMDL. Based on these assumptions a daily load of 792.4 x 10^7 CFUs/day is estimated for the WLA used for TMDL segment ND-10130104-012-S_00. The following is the formula used in calculated the WLA:

$$\text{WLA} = \frac{6.95 \text{ million gallons/discharge} \times 200 \text{ CFU/100 mL}}{6.64 \text{ days/discharge}}$$

$$= \frac{6.95 \text{ million gallons/discharge} \times 3.7854 \text{ liters/gallon} \times 1000 \text{ mL/1-Liter} \times 200 \text{ CFU/100 mL}}{6.64 \text{ days/discharge}}$$

$$= 792.4 \times 10^7 \text{ CFUS/day}$$

5.5 Loading Calculations for Waterbody ND-10130104-003-S_00

Developing the TMDL for Section 303(d) listed waterbody ND-10130104-003-S_00 was complicated by the lack of a monitoring site within the listed segment. Existing loads and TMDL loads for this waterbody for each flow regime were, therefore, estimated by averaging the estimated existing loads for each site immediately upstream (384051 and 384056) and downstream (384058). The TMDL target load for each flow regime was then calculated by the following equation and are provided in Table 15.

TMDL Load for ND-10130103-003-S_00 = Average Existing Load– (Average Existing Load * Average Percent Reduction)

Table 15. Existing and TMDL Target Load Calculations (10^7CFUs/day) for Waterbody ND-10130104-003-S_00.

Site	High Flow Regime	Percent Reduction Required to Meet TMDL Target for the High Flow Regime	Moist Condition Flow Regime	Percent Reduction Required to Meet TMDL Target for the Moist Condition Flow Regime	Dry Condition Flow Regime	Percent Reduction Required to Meet TMDL Target for the Dry Condition Flow Regime
384051	95,333	58.82 %	22,729	73.42 %	5,217	72.55%
384056	288,649	70.25 %	39,886	65.65 %	7,360	56.12%
384058	281,898	62.45 %	39,198	56.92 %	No TMDL Needed	
Calculated existing load for ND-10130104-003-S_00[1]	221,960[1]		33,937[1]		4,192[1]	
Calculated TMDL target load for ND-10130104-003-S_00[3]	80,261[4]	Average percent reduction[2] 63.84 %	11,766[4]	Average percent reduction[2] 65.33 %	1,469[4]	Average percent reduction[2] 64.97%

[1] Based on the average existing loads for sites 384051, 384056, and 384058.
[2] Based on the average percent reduction of sites 384051, 384056, and 384058.
[3] The average percent reductions shown are estimates based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reductions needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.
[4] Based on the calculated existing load for the flow regime and the average percent reduction needed.

5.6 Loading Sources

The majority of load reductions can generally be allotted to nonpoint sources, however to account for uncertainty due to periodic discharges from a permitted municipal facility (i.e. Wishek) a waste load allocation (WLA) for the impaired segment ND-10130104-012-S_00 is included in that TMDL.

The most significant sources of fecal coliform bacteria loading remain nonpoint source pollution originating from livestock. Based on the data available, the general focus of BMPs and load reductions for the listed segments should be on unpermitted animal feeding areas and critical pasture areas described in the assessment report. Higher priority should be given to the unpermitted animal feeding areas located in close proximity to Beaver Creek.

One of the more important concerns regarding nonpoint sources is variability in stream flows. Variable stream flows often cause different source areas and loading mechanisms to dominate (Cleland, 2003). As previously described, four flow regimes ((i.e., high flow, moist conditions, dry conditions, and low flow) were selected to represent the hydrology of the listed segments when applicable.

By relating runoff characteristics to each flow regime one can infer which sources are most likely to contribute to fecal coliform bacteria loading. Animals grazing in the riparian area contribute fecal coliform bacteria by depositing manure where it has an immediate impact on water quality. Due to the close proximity of manure to the stream or by direct deposition in the stream, riparian grazing impacts water quality at high, medium and low flows (Table 16). In contrast, intensive grazing of livestock in the upland and not in the riparian area has a high potential to impact water quality at high flows and medium impact at moderate flows (Table 16). 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 fecal coliform bacteria contamination.

Table 16. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

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

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

6.0 MARGIN OF SAFETY AND SEASONALITY

6.1 Margin of Safety

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

To account for the uncertainty associated with known sources and the load reductions necessary to reach the TMDL target of 200 CFU/100 mL, a ten percent explicit margin of safety was used for this TMDL. The MOS was calculated as ten percent of the TMDL. In other words ten percent of the

TMDL is set aside from the load allocation as a MOS. The ten percent MOS was derived by taking the difference between the points on the load duration curve using the 200 CFU/100 mL standard and the curve using the 180 CFU/100 mL.

In addition, the waste load allocation (WLA) of 20 CFU/100 mL (79.2 x 10^7 CFU/day) which is included for segment ND-10130104-012-S_00 is also an implicit MOS. While this WLA applies to all four flow regimes and for every day, in fact the city of Wishek only discharges periodically and less than 10 days per year. For the remainder of the year, this WLA is available as a MOS.

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 Beaver Creek TMDLs address seasonality because the flow duration curve was developed using fourteen (14) years of flow data encompassing twelve 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 coliform loads during the seasons covered by the standard.

7.0 TMDLs

Table 17 provides an outline of the critical elements for the fecal coliform bacteria TMDL for Beaver Creek and its tributaries. The TMDLs for Beaver Creek and its tributaries are presented in Tables 18-26. Load duration curves on which these TMDLs are based can be found in Appendix E. The TMDL summary provides an estimate of the existing daily load, an estimate of the average daily loads necessary to meet water quality target (i.e. TMDL load). This TMDL load includes a load allocation from known nonpoint sources and in one listed segement a point source and a ten percent margin of safety. It should be noted that the TMDL loads, load allocations, and the MOS are estimated based on available data and reasonable assumptions and are to be used as a guide for implementation. The actual reduction needed to meet the applicable water quality standards may be higher or lower depending on the results of future monitoring.

While there were no exceedences of the 200 CFU/100 mL fecal coliform standard for many of the segment and flow regimes, a TMDL load has been provided for each of these segments and flow regimes as a guide to future watershed management. Based on available data, it can be assumed that these segments and flow regimes are currently meeting the water quality standards.

The TMDL can be described by the following equation**:** TMDL = LC = WLA + LA + MOS where:

LC	=	loading capacity, or the greatest loading a waterbody can receive without violating water quality standards;
WLA	=	wasteload allocation, or the portion of the TMDL allocated to existing or future point sources;
LA	=	load allocation, or the portion of the TMDL allocated to existing or future nonpoint sources;
MOS	=	margin of safety, or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality. The margin of safety can be provided implicitly through analytical assumptions or explicitly by reserving a portion of loading capacity.

Table 17. TMDL Summary for Beaver Creek.

Category	Description	Explanation
Beneficial Use Impaired	Recreation	Contact Recreation (i.e. swimming, fishing)
Pollutant	Fecal Coliform Bacteria	See Section 2.1
TMDL Target	200 CFU/100 mL	Based on North Dakota water quality standards
WLA	Point Source Contributions	There is one contributing point source in the watershed (ND-10130104-012).
LA	Nonpoint Source Contributions	Loads are a result of nonpoint sources (i.e., rangeland, pasture land, etc.)
Margin of Safety (MOS)	Explicit	10 percent

Table 18. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-001-S_00 as represented by Site 384058.

	Flow Regime			
	High Flow	**Moist Conditions**	**Dry Conditions**	**Low Flow**
Existing Load	281,898	39,198		
TMDL	105,840	16,889	3981[1]	603[1]
WLA	0	0	No load reduction necessary	No load reduction necessary
LA	95,256	15,200		
MOS	10,584	1,689		

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

Table 19. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-003-S_00, Averaged from Nearby Sites 384051, 384056, and 384058.

	Flow Regime			
	High Flow	**Moist Conditions**	**Dry Conditions**	**Low Flow**
Existing Load	221,960	33,937	5,217	No load reduction necessary
TMDL	80,261	11,766	1,469	
WLA	0	0	0	
LA	72,235	10,589	1,323	
MOS	8,026	1,177	146	

Table 20. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-004-S_00 as represented by Site 384057.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	23,921	4,422	1,356	
TMDL	9,008	1,437	344	62[1]
WLA	0	0	0	No load reduction necessary
LA	8,107	1,293	310	
MOS	901	144	34	

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

Table 21. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-005-S_00 as represented by Site 384055.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	18,489	1,420	431	
TMDL	4,431	707	182	43[1]
WLA	0	0	0	No load reduction necessary
LA	3,988	636	164	
MOS	443	71	18	

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

Table 22. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-007-S_00 as represented by Site 384056.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	288,649	39,886	7,360	
TMDL	85,875	13,703	3,230	587[1]
WLA	0	0	0	No load reduction necessary
LA	77,287	12,333	2,907	
MOS	8,588	1,370	323	

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

Table 23. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-008-S_00 as represented by Site 384054.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	18,987	2,439		
TMDL	5,972	1,054	254[1]	43[1]
WLA	0	0	No load reduction necessary	No load reduction necessary
LA	5,375	949		
MOS	597	105		

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

Table 24. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-010-S_00 as represented by Site 384051.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	95,333	22,729	5,217	
TMDL	39,262	6,041	1,432	268[1]
WLA	0	0	0	No load reduction necessary
LA	35,336	5,437	1,289	
MOS	3,926	604	143	

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

Table 25. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-012-S_00 as represented by Site 384050.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	16,637	7,124		
TMDL	12,065	1,856	440[1]	83[1]
WLA	792	792	No load reduction necessary	No load reduction necessary
LA	10,066	878		
MOS	1,207	186		

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

Table 26. Fecal Coliform Bacteria TMDL (10^7 CFU/day) for the Beaver Creek Waterbody ND-10130104-014-S_00 as represented by Site 384053.

	Flow Regime			
	High Flow	Moist Conditions	Dry Conditions	Low Flow
Existing Load	101,025	11,957	9,949	
TMDL	25,046	3,632	827	603[1]
WLA	0	0	0	No load reduction necessary
LA	22,541	3,269	744	
MOS	2,505	363	83	

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

8.0 ALLOCATION

There is a permitted municipal facility in Wishek, ND which discharges to segment ND-0130104-00-012-S_00, therefore a portion, 79.2 x 10^7 CFU/day of the total fecal coliform bacteria load for this TMDL has been allocated to this point source. The remaining load has been allocated to nonpoint sources in the watershed. The entire nonpoint source load is allocated as a single load because there is not enough detailed source data to allocate the load to individual uses (e.g., animal feeding, septic systems, riparian grazing, upland grazing). To achieve the TMDL targets identified in the report will require the wide spread support and voluntary participation of landowners and residents in the watershed. The TMDL described in this report is a plan to improve water quality by implementing best management practices through non-regulatory approaches. “Best management practices” (BMPs) are methods, measures, or practices that are determined to be a reasonable and cost effective means for a land owner to meet nonpoint source pollution control needs,” (USEPA, 2001). This TMDL plan should be considered an adaptive management plan and is put forth as a recommendation for what needs to be accomplished for Beaver Creek, its tributaries and associated watershed to restore and maintain its recreational uses. Water quality monitoring should continue to assess the effects of the recommendations made in this TMDL. Monitoring may indicate that BMP implementation and/or the loading capacity recommendations should be adjusted.

Nonpoint source pollution is the largest contributor to elevated total fecal coliform bacteria levels in the Beaver Creek watershed. The fecal coliform samples and load duration curve analysis of the impaired reaches identified all high flow and moist conditions, and dry conditions for ND10130104-004, ND10130104-005, ND10130104-007, and ND10130104-010 as the time of fecal coliform bacteria exceedences of the 200 CFU/100 mL target (Table 27). To reduce NPS pollution for these flow regimes, specific BMPs are described in Section 8.1 that will mitigate the effects of total fecal coliform bacteria loading to the impaired reach.

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

Table 27. Management Practices and Flow Regimes Affected by the 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 and erosion from poorly managed grazing land and riparian areas can be a significant source of loading to surface water. Precipitation, plant cover, number of animals, and soils are factors that affect the amount of bacteria delivered to a waterbody as a result of livestock. These specific BMPs are known to reduce NPS pollution from livestock.

<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 an alternative water source and 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 environment.

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

In a study by Tiedemann et al. (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 show that when livestock are managed at a stocking rate of 19 acres per animal unit month with water developments and fencing, bacteria levels were reduced significantly.

Table 28. Bacterial Water Quality Response to Four Grazing Strategies (Tiedemann et al., 1988).

Grazing Strategy		Geometric Mean Fecal Coliform 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 the loading originating from confined animal feeding areas. A waste management system is made up of various components designed to control NPS pollution from concentrated animal feeding operations (CAFOs) and animal feeding operations (AFOs). Diverting clean water around the feeding area and detaining dirty water from the feeding area in a pond are typical practices of a waste management system. Manure handling and application procedures are also integral to the waste management system. The application of manure is designed to be adaptive to environmental, soil, and plant conditions to minimize the probability of contamination of surface water.

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 29), suggest that vegetative filter strips are capable of removing up to 55 percent of fecal coliform loading to rivers and streams (Table 29). 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).

Table 29. 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

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

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

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

Septic system failure 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 (USEPA, 2002).

9.0 PUBLIC PARTICIPATION

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

- Emmons County Soil Conservation District;
- Logan County Soil Conservation District;
- McIntosh County Soil Conservation District;
- Emmons County Water Resource Board;
- Logan County Water Resource Board;
- McIntosh County Water Resource Board;
- US EPA - Region VIII; and
- USDA-NRCS (State Office).

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

- Emmons County Record;
- Napoleon Homestead; and
- Ashley Tribune.

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

10.0 MONITORING STRATEGY

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 insure that the best management practices (BMPs) and technical assistance that were implemented as part of the Section 319 Beaver Creek Watershed Restoration Project are successful in reducing both fecal coliform and E. coli bacteria loadings to levels prescribed in this TMDL, water quality monitoring is being conducted in accordance with an approved Quality Assurance Project Plan (QAPP 2003).

In regards to the point source discharge for the city of Wishek, discharge monitoring will continue to be implemented to ensure both the permit limit and their discharge volumes are consistent with their wasteload allocations and therefore, water quality standards.

11.0 RESTORATION STRATEGY

In response to the Beaver Creek Watershed Assessment, local sponsors successfully applied for and received Section 319 funding for the Beaver Creek Watershed Restoration Project. Beginning in 1996, local sponsors provided technical assistance and implemented BMPs designed to reduce fecal coliform bacteria loadings and to help restore the beneficial uses of the Beaver Creek (i.e., recreation). A QAPP (NDDoH, 2003) was developed as part of this watershed restoration project that detailed the how, when and where monitoring would be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s). As the data were gathered and analyzed, watershed restoration tasks were adapted, if necessary, to place BMPs where they would have the greatest benefit to water quality and in meeting the TMDL goal(s).

Also, as part of the implementation plan for this TMDL, it was recommended that the permitted point sources (i.e., 10 AFO/CAFOs) in the watershed be inspected to ensure that they are being operated in compliance with their permit conditions, and to verify that they aren't significant fecal coliform sources. Currently, all permitted CAFOs (greater than or equal to 1000 animal units) are inspected annually by the NDDoH. Permitted AFOs (<1000 animal units) in the Beaver Creek watershed are inspected on an as needed basis.

12.0 REFERENCES

Cleland. 2003. *TMDL development from the "Bottom Up" - Part III: Duration Curves and Wet-Weather Assessments.* America's Clean Water Foundation, Washington, DC.

HPRCC, 2009. Linton and Wishek, *North Dakota Weather Station.* High Plains Regional Climate Center. Available at http://www.hprcc.unl.edu/wrcc/states/nd.htmL

NDASS. 2009. *North Dakota Agricultural Statistics Service*. Available at **http://www.nass.usda.gov/Statistics_by_State/North_Dakota/index.asp.**

NDDoH. 2005. *Quality Assurance Project Plan for the Beaver Creek Watershed Implementation Project (revised 2007)*. North Dakota Department of Health, Division of Water Quality, Bismarck, North Dakota.

NDDoH. 2006. *Standards of Water Quality for the State of North Dakota.* Chapter 33-16-02 of the North Dakota Century Code. North Dakota Department of Health, Division of Water Quality, Bismarck, North Dakota.

NDDoH. 2010. *Beaver Creek Watershed Assessment Report.* North Dakota Department of Health, Division of Water Quality, Bismarck, North Dakota.
NDDoH. 2010. *North Dakota 2010 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads.* North Dakota Department of Health, Division of Water Quality. Bismarck, North Dakota.

NRCS. 1998. *Natural Resource Conservation Service Practice Specification 528.* USDA - Natural Resources Conservation Service, North Dakota. Available at http://efotg.nrcs.usda.gov

NRCS. 1999. *Natural Resource Conservation Service.* USDA – *Web Soil Survey*. Available at http://websoilsurvey.nrcs.usda.gov

Pennsylvania State University. 1992. Non point Source Database. Pennsylvania State University, Department of Agricultural and Biological Engineering, University Park, PA.

Ries, K.G., III, and P.J. Friesz. 2000. *Methods for estimating low-flow statistics for Massachusetts streams.* U.S. Geological Survey Water Resources Investigations Report 00-4135. U.S. Geological Survey, Reston, VA. <http://pubs.usgs.gov/wri/wri004135/ >.

Tiedemann, A.R., D.A. Higgins, T.M. Quigley, H.R. Sanderson, and C.C. Bohn. 1998. *Bacterial Water Quality Responses to Four Grazing Strategies - Comparison with Oregon Standards*.

USEPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.* EPA 840-B-92-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 2001. *Protocol for Developing Pathogen TMDLs.* EPA 841-R-00-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 2002. Onsite Wastewater Treatment Systems Manual. EPA/625/R-00/008. U. S. Environmental Protection Agency. Office of Water, Office of Research and Development.

USEPA. 2007. An Approach for Using Load Duration Curves in the Developmentof TMDLs. EPA-841-B-07-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. Available at http://www.epa.gov/owow/tmdl/techsupp.html

USGS. 2006. *Ecoregions of North Dakota and South Dakota*. United States Geological Survey. Available at http://www.npwrc.usgs.gov/resource/habitat/ndsdeco/nodak.htm.

Appendix A
Fecal Coliform Bacteria Data and Geometric Means for Data Collected in the Beaver Creek Watershed

384056	
Date	C
5/1/1996	20
5/8/1996	100
5/15/1996	50
5/21/1996	240
5/23/1996	220
5/29/1996	60
6/5/1996	260
6/12/1996	1200
6/17/1996	480
7/18/1996	400
8/14/1996	440
5/7/1997	10
5/14/1997	50
5/22/1997	10
5/29/1997	130
6/11/1997	30
6/26/1997	120
7/22/1997	90
9/15/1997	20
5/12/1998	10
5/20/1998	90
5/27/1998	120
6/3/1998	130
7/8/1998	520
8/12/1998	140
9/16/1998	360
5/20/1999	30
5/25/1999	140
6/2/1999	150
8/4/1999	80
5/4/2000	10
5/8/2000	210
5/15/2000	90
6/1/2000	320
5/10/2001	50
5/22/2001	100
5/31/2001	30
6/21/2001	360
5/2/2002	10
5/7/2002	40
5/15/2002	10
5/22/2002	20
5/29/2002	10
6/5/2002	210
6/11/2002	140
6/26/2002	90
5/15/2003	60
5/22/2003	60
5/29/2003	70
6/24/2003	890
5/6/2004	10
6/2/2004	90
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5/2/2005	50
5/5/2005	30
5/11/2005	10
5/16/2005	30
5/26/2005	180
6/2/2005	170
6/8/2005	10
5/3/2006	50
5/11/2006	100
5/18/2006	690
5/25/2006	510
6/1/2006	150
6/15/2006	100
6/22/2006	70
6/29/2006	90
5/1/2007	80
5/3/2007	20
5/7/2007	30
5/10/2007	90
5/14/2007	130
5/17/2007	350
5/21/2007	190
5/24/2007	440
5/29/2007	1200
5/31/2007	2500
6/6/2007	110
6/14/2007	140
6/20/2007	60
6/27/2007	50
7/5/2007	120
7/18/2007	110
7/24/2007	20
8/1/2007	20
8/7/2007	500
8/15/2007	150
8/28/2007	680
9/5/2007	100
9/11/2007	180
9/25/2007	120
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5/21/2008	30
5/27/2008	70
6/3/2008	140
6/10/2008	60
6/18/2008	170
7/30/2008	100
8/6/2008	150
5/18/2009	10
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5/27/2009	20
6/2/2009	130
6/23/2009	180
6/29/2009	180

384050	
Date	C
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7/18/1996	620
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5/7/1997	50
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6/11/1997	130
6/26/1997	670
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9/15/1997	70
5/6/1998	170
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9/16/1998	160

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5/2/2002	30
5/7/2002	130
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6/11/2002	180
6/26/2002	1140
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5/22/2003	150
5/29/2003	370
6/24/2003	680
5/6/2004	70
6/2/2004	440
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5/2/2005	20
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5/11/2005	20
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6/2/2005	130
7/28/2005	250
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5/21/2007	340
5/24/2007	530
5/29/2007	2300
5/31/2007	10000
6/6/2007	380
6/14/2007	650
6/20/2007	840
6/27/2007	1100
7/5/2007	1400
7/18/2007	720
7/24/2007	240
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5/21/2008	40
5/27/2008	90
6/3/2008	580
6/10/2008	130
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5/27/2009	20
6/2/2009	70
6/29/2009	120

84051

Date	C
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6/17/1996	350
7/2/1996	1500
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5/7/1997	50
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5/29/1997	40
6/11/1997	130
6/26/1997	670
7/22/1997	50
9/15/1997	70
5/6/1998	170
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6/3/1998	300
7/8/1998	1000
9/16/1998	160
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5/25/1999	240
6/2/1999	550
7/14/1999	1300
5/4/2000	100
5/8/2000	950
5/15/2000	250
6/1/2000	10
5/10/2001	100
5/31/2001	20
7/16/2001	100
5/2/2002	30
5/7/2002	130
5/15/2002	20
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5/29/2002	20
6/5/2002	500
6/11/2002	180
6/26/2002	1140
5/15/2003	120
5/22/2003	150
5/29/2003	370
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5/6/2004	70
6/2/2004	440
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5/2/2005	20
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5/11/2005	20
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6/2/2005	130
7/28/2005	250
5/3/2006	100
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5/18/2006	10
5/25/2006	150
6/1/2006	80
6/15/2006	1000
6/22/2006	1600

6/29/2006	1400
5/1/2007	150
5/3/2007	100
5/7/2007	130
5/10/2007	150
5/14/2007	620
5/17/2007	300
5/21/2007	340
5/24/2007	530
5/29/2007	2300
5/31/2007	10000
6/6/2007	380
6/14/2007	650
6/20/2007	840
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7/5/2007	1400
7/18/2007	720
7/24/2007	240
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6/3/2008	580
6/10/2008	130
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5/18/2009	30
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5/27/2009	20
6/2/2009	70
6/29/2009	120

84053

Date	C
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5/29/1997	10
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6/26/1997	160
7/22/1997	50
5/6/1998	50
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5/27/1998	90
6/3/1998	40
7/8/1998	60
9/16/1998	10
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5/25/1999	100
6/2/1999	160
6/22/1999	570
7/14/1999	270
8/4/1999	10
5/4/2000	90
5/8/2000	70
5/15/2000	250
6/1/2000	350
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7/16/2001	100
5/2/2002	10
5/7/2002	10
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5/29/2003	150
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5/11/2005	70
5/16/2005	10
5/26/2005	400
7/28/2005	270
5/3/2006	10
5/11/2006	110
5/18/2006	48000
5/25/2006	7200
6/1/2006	90000
5/1/2007	130
5/3/2007	70
5/7/2007	50
5/10/2007	100
5/14/2007	170
5/17/2007	1000
5/21/2007	780
5/24/2007	450
5/29/2007	640
5/31/2007	3000
6/6/2007	310
6/14/2007	1600
6/20/2007	660
6/27/2007	560
7/5/2007	380
7/10/2007	420
7/24/2007	800
8/7/2007	1400
8/28/2007	350
9/5/2007	2000
9/25/2007	1100
5/13/2008	120
6/3/2008	3700
6/10/2008	900
7/30/2008	520
5/18/2009	10
5/20/2009	20
5/26/2009	110
5/27/2009	30
6/2/2009	110
6/23/2009	110
6/29/2009	360

384054

Date	C
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5/23/1996	120
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6/12/1996	1100
6/17/1996	170
7/18/1996	330
8/14/1996	10
5/7/1997	10
5/14/1997	30
5/22/1997	100
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6/11/1997	100
6/26/1997	170
7/22/1997	30
9/15/1997	910
5/6/1998	40
5/6/1998	70
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6/3/1998	160
9/16/1998	100
5/5/1999	1100
5/20/1999	40
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6/2/1999	70
6/22/1999	360
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5/7/2002	250
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5/22/2003	50
5/29/2003	120
6/24/2003	710
6/2/2004	50
6/14/2004	180
5/2/2005	10
5/5/2005	10
5/11/2005	10
5/16/2005	10
5/26/2005	140
6/2/2005	10
7/28/2005	180

384055

Date	C
05/01/96	10
05/08/96	90
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05/21/96	220
05/23/96	250
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06/05/96	180
06/12/96	450
06/17/96	650
07/02/96	240
07/18/96	150
08/14/96	70
05/07/97	120
05/14/97	40
05/22/97	210
05/29/97	250
06/11/97	140
06/26/97	100
09/15/97	230
05/06/98	380
05/12/98	400
05/20/98	120
05/27/98	130
06/03/98	70
07/08/98	210
08/12/98	50
09/16/98	370
05/20/99	190
05/25/99	190
06/02/99	390
06/22/99	700
07/14/99	1000
08/04/99	80
05/04/00	160
05/08/00	800
05/15/00	30
06/01/00	360
05/10/01	80
05/22/01	130
05/31/01	70
06/21/01	820
05/02/02	10
05/07/02	360
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05/29/02	80
06/05/02	730
06/11/02	170
06/26/02	110
05/15/03	30
05/22/03	60
05/29/03	120
05/06/04	60
06/02/04	140
06/14/04	480
05/02/05	30
05/05/05	10
05/11/05	190
05/16/05	80
05/26/05	140
06/02/05	290

384057

Date	C
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5/23/1996	90
5/29/1996	30
6/5/1996	140
6/12/1996	480
6/17/1996	300
7/2/1996	310
7/18/1996	130
8/14/1996	260
5/14/1997	40
5/22/1997	110
5/29/1997	180
6/11/1997	80
6/26/1997	410
7/22/1997	80
9/15/1997	100
5/6/1998	150
5/12/1998	360

5/20/1998	250
5/27/1998	310
6/3/1998	60
7/8/1998	310
9/16/1998	180
5/5/1999	550
5/25/1999	420
6/2/1999	450
7/14/1999	1300
8/4/1999	20
5/4/2000	370
5/15/2000	630
6/1/2000	620
5/10/2001	10
5/22/2001	620
5/31/2001	370
5/2/2002	10
5/7/2002	20
5/15/2002	250
5/22/2002	660
5/29/2002	450
6/5/2002	530
5/15/2003	660
5/22/2003	130
5/29/2003	970
6/24/2003	580
6/14/2004	50
5/2/2005	20
5/5/2005	10
5/11/2005	10
6/2/2005	510
6/8/2005	200
7/28/2005	210
5/3/2006	120
5/11/2006	200
5/18/2006	500
5/25/2006	420
6/1/2006	510
6/15/2006	800
5/1/2007	470
5/3/2007	290
5/7/2007	280
5/10/2007	210
5/14/2007	1000

5/17/2007	900
5/21/2007	650
5/24/2007	990
5/29/2007	400
5/31/2007	5900
6/6/2007	320
6/14/2007	2400
6/20/2007	10000
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5/13/2008	350
5/27/2008	320
6/3/2008	1400
6/10/2008	970
6/18/2008	280
7/8/2008	950
5/18/2009	10
5/20/2009	60
5/26/2009	280
5/27/2009	80
6/2/2009	250

384058

Date	C
5/1/1996	20
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5/15/1996	10
5/21/1996	250
5/23/1996	170
5/29/1996	70
6/5/1996	220
6/12/1996	1500
6/17/1996	450
7/2/1996	210
7/18/1996	140
8/14/1996	440
5/7/1997	10
5/14/1997	30
5/22/1997	20
5/29/1997	20
6/11/1997	150
6/26/1997	50
7/22/1997	10
9/15/1997	50
5/6/1998	40

5/12/1998	40
5/20/1998	50
5/27/1998	20
6/3/1998	200
7/8/1998	410
8/12/1998	140
9/16/1998	940
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5/25/1999	150
6/2/1999	320
6/22/1999	740
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6/5/2002	10
6/11/2002	60
6/26/2002	160
5/15/2003	190
5/22/2003	50
5/29/2003	110
5/6/2004	30
6/2/2004	70
6/14/2004	130
5/2/2005	30
5/5/2005	10
5/11/2005	50
5/16/2005	10
5/26/2005	70
6/2/2005	140
6/8/2005	250
7/28/2005	10

Assessment Unit ID ND-10130104-012-S_00 as represented by Site 384050

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	37	80	16	Fully supporting, but Threatened
June	13	158	31	Fully supporting, but Threatened
July	7	664	71	Not Supporting
August	3	Lacking data	Lacking data	
September	0	Lacking data	Lacking data	

Assessment Unit ID ND-10130104-014-S_00 as represented by Site 384053

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	50	98	10	Fully supporting, but Threatened
June	24	319	54	Not Supporting
July	11	320	55	Not Supporting
August	2	Lacking data	Lacking data	
September	2	Lacking data	Lacking data	

Assessment Unit ID ND-10130104-014-S_00 as represented by Site 384053

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	50	69	16	Fully supporting, but Threatened
June	21	148	29	Fully supporting, but Threatened
July	10	246	40	Not Supporting
August	4	Lacking data	Lacking data	
September	3	Lacking data	Lacking data	

Assessment Unit ID ND-10130104-008-S_00 as represented by Site 384054

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	36	59	6	Fully Supporting
June	14	152	14	Fully supporting, but Threatened
July	4	Lacking data	Lacking data	
August	1	Lacking data	Lacking data	
September	2	Lacking data	Lacking data	

Assessment Unit ID ND-10130104-005-S_00 as represented by Site 384055

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	38	110	11	Fully supporting, but Threatened
June	16	276	38	Not Supporting
July	5	414	40	Not Supporting
August	3	Lacking data	Lacking data	
September	2	Lacking data	Lacking data	

Assessment Unit ID ND-10130104-004-S_00 as represented by Site 384057

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	48	177	40	Fully supporting, but Threatened
June	17	319	59	Not Supporting
July	5	291	0	Fully supporting, but Threatened
August	2	Lacking data	Lacking data	
September	2	Lacking data	Lacking data	

Assessment Unit ID ND-10130104-001-S_00 as represented by Site 384058

Month	N	Geometric Mean Concentration (CFU/100mL)	Percentage of Samples Exceeding 400 CFU/100mL	Recreational Use Assessment
May	38	56	5	Fully Supporting
June	16	175	25	Fully supporting, but Threatened
July	6	105	33	Fully supporting, but Threatened
August	3	Lacking data	Lacking data	
September	2	Lacking data	Lacking data	

Appendix B
Stream Discharge Measurements for Site 384056

Discharge Q

Date	Q
5/1/96	96.0
5/2/96	95.0
5/3/96	93.0
5/4/96	90.0
5/5/96	87.0
5/6/96	87.0
5/7/96	85.0
5/8/96	85.0
5/9/96	85.0
5/10/96	85.0
5/11/96	85.0
5/12/96	85.0
5/13/96	85.0
5/14/96	84.0
5/15/96	82.0
5/16/96	81.0
5/17/96	157.0
5/18/96	172.0
5/19/96	180.0
5/20/96	143.0
5/21/96	132.0
5/22/96	126.0
5/23/96	103.0
5/24/96	94.0
5/25/96	84.0
5/26/96	79.0
5/27/96	74.0
5/28/96	70.0
5/29/96	66.0
5/30/96	59.0
5/31/96	55.0
6/1/96	57.0
6/2/96	60.0
6/3/96	62.0
6/4/96	65.0
6/5/96	65.0
6/6/96	62.0
6/7/96	61.0
6/8/96	58.0
6/9/96	56.0
6/10/96	58.0
6/11/96	55.0
6/12/96	53.0
6/13/96	54.0
6/14/96	55.0
6/15/96	238.0
6/16/96	1000.0
6/17/96	1200.0
6/18/96	900.0
6/19/96	400.0
6/20/96	200.0
6/21/96	134.0
6/22/96	107.0
6/23/96	108.0
6/24/96	107.0
6/25/96	95.0
6/26/96	93.0
6/27/96	100.0
6/28/96	101.0
6/29/96	109.0
6/30/96	102.0
7/1/96	98.0
7/2/96	95.0
7/3/96	90.0
7/4/96	91.0
7/5/96	94.0
7/6/96	87.0
7/7/96	88.0
7/8/96	89.0
7/9/96	75.0
7/10/96	81.0
7/11/96	75.0
7/12/96	84.0
7/13/96	124.0
7/14/96	95.0
7/15/96	77.0
7/16/96	52.0
7/17/96	42.0
7/18/96	39.0
7/19/96	28.0
7/20/96	24.0
7/21/96	25.0
7/22/96	26.0
7/23/96	27.0
7/24/96	27.0
7/25/96	26.0
7/26/96	25.0
7/27/96	24.0
7/28/96	29.0
7/29/96	37.0
7/30/96	36.0
7/31/96	34.0
8/1/96	65.0
8/2/96	111.0
8/3/96	550.0
8/4/96	231.0
8/5/96	135.0
8/6/96	100.0
8/7/96	70.0
8/8/96	58.0
8/9/96	50.0
8/10/96	47.0
8/11/96	42.0
8/12/96	39.0
8/13/96	40.0
8/14/96	36.0
8/15/96	31.0
8/16/96	28.0
8/17/96	25.0
8/18/96	30.0
8/19/96	34.0
8/20/96	26.0
8/21/96	22.0
8/22/96	23.0
8/23/96	21.0
8/24/96	20.0
8/25/96	20.0
8/26/96	19.0
8/27/96	18.0
8/28/96	18.0
8/29/96	18.0
8/30/96	18.0
8/31/96	18.0
9/1/96	17.0
9/2/96	16.0
9/3/96	15.0
9/4/96	14.0
9/5/96	13.0
9/6/96	12.0
9/7/96	12.0
9/8/96	11.0
9/9/96	10.0

9/10/96	9.6
9/11/96	9.2
9/12/96	8.8
9/13/96	8.4
9/14/96	8.0
9/15/96	7.5
9/16/96	7.1
9/17/96	7.6
9/18/96	8.2
9/19/96	9.6
9/20/96	17.0
9/21/96	20.0
9/22/96	19.0
9/23/96	20.0
9/24/96	33.0
9/25/96	35.0
9/26/96	28.0
9/27/96	26.0
9/28/96	24.0
9/29/96	22.0
9/30/96	21.0
10/1/96	24.0
10/2/96	24.0
10/3/96	21.0
10/4/96	20.0
10/5/96	19.0
10/6/96	18.0
10/7/96	17.0
10/8/96	16.0
10/9/96	15.0
10/10/96	14.0
10/11/96	14.0
10/12/96	13.0
10/13/96	13.0
10/14/96	13.0
10/15/96	13.0
10/16/96	13.0
10/17/96	13.0
10/18/96	13.0
10/19/96	13.0
10/20/96	13.0
10/21/96	15.0
10/22/96	15.0
10/23/96	15.0
10/24/96	14.0
10/25/96	14.0
10/26/96	18.0
10/27/96	33.0
10/28/96	30.0
10/29/96	33.0
10/30/96	45.0
10/31/96	26.0
11/1/96	36.0

11/2/96	41.0
11/3/96	31.0
11/4/96	24.0
11/5/96	22.0
11/6/96	24.0
11/7/96	24.0
11/8/96	26.0
11/9/96	30.0
11/10/96	22.0
11/11/96	24.0
11/12/96	23.0
11/13/96	25.0
11/14/96	22.0
11/15/96	21.0
11/16/96	20.0
11/17/96	17.0
11/18/96	16.0
11/19/96	16.0
11/20/96	16.0
11/21/96	16.0
11/22/96	15.0
11/23/96	15.0
11/24/96	15.0
11/25/96	14.0
11/26/96	15.0
11/27/96	16.0
11/28/96	16.0
11/29/96	16.0
11/30/96	17.0
12/1/96	17.0
12/2/96	17.0
12/3/96	18.0
12/4/96	18.0
12/5/96	18.0
12/6/96	18.0
12/7/96	17.0
12/8/96	17.0
12/9/96	17.0
12/10/96	18.0
12/11/96	18.0
12/12/96	18.0
12/13/96	17.0
12/14/96	18.0
12/15/96	16.0
12/16/96	16.0
12/17/96	13.0
12/18/96	11.0
12/19/96	11.0
12/20/96	10.0
12/21/96	10.0
12/22/96	11.0
12/23/96	11.0
12/24/96	11.0

12/25/96	10.0
12/26/96	10.0
12/27/96	10.0
12/28/96	10.0
12/29/96	9.9
12/30/96	10.0
12/31/96	10.0
1/1/97	10.0
1/2/97	11.0
1/3/97	11.0
1/4/97	11.0
1/5/97	11.0
1/6/97	11.0
1/7/97	11.0
1/8/97	11.0
1/9/97	11.0
1/10/97	11.0
1/11/97	11.0
1/12/97	11.0
1/13/97	11.0
1/14/97	11.0
1/15/97	11.0
1/16/97	11.0
1/17/97	10.0
1/18/97	9.9
1/19/97	9.9
1/20/97	9.8
1/21/97	9.9
1/22/97	9.9
1/23/97	9.8
1/24/97	9.7
1/25/97	9.6
1/26/97	9.5
1/27/97	9.4
1/28/97	9.4
1/29/97	9.4
1/30/97	9.4
1/31/97	9.5
2/1/97	9.6
2/2/97	9.5
2/3/97	9.6
2/4/97	9.7
2/5/97	9.8
2/6/97	9.8
2/7/97	9.8
2/8/97	9.9
2/9/97	10.0
2/10/97	10.0
2/11/97	10.0
2/12/97	10.0
2/13/97	10.0
2/14/97	10.0
2/15/97	10.0

2/16/97	10.0
2/17/97	10.0
2/18/97	10.0
2/19/97	10.0
2/20/97	10.0
2/21/97	10.0
2/22/97	10.0
2/23/97	10.0
2/24/97	10.0
2/25/97	10.0
2/26/97	10.0
2/27/97	10.0
2/28/97	10.0
3/1/97	10.0
3/2/97	10.0
3/3/97	10.0
3/4/97	11.0
3/5/97	11.0
3/6/97	11.0
3/7/97	11.0
3/8/97	11.0
3/9/97	11.0
3/10/97	11.0
3/11/97	11.0
3/12/97	11.0
3/13/97	11.0
3/14/97	11.0
3/15/97	11.0
3/16/97	11.0
3/17/97	11.0
3/18/97	11.0
3/19/97	11.0
3/20/97	12.0
3/21/97	14.0
3/22/97	18.0
3/23/97	49.0
3/24/97	63.0
3/25/97	100.0
3/26/97	300.0
3/27/97	1500.0
3/28/97	2800.0
3/29/97	5400.0
3/30/97	5000.0
3/31/97	6030.0
4/1/97	6040.0
4/2/97	6080.0
4/3/97	4770.0
4/4/97	3180.0
4/5/97	2680.0
4/6/97	2090.0
4/7/97	594.0
4/8/97	290.0
4/9/97	212.0

4/10/97	210.0
4/11/97	207.0
4/12/97	306.0
4/13/97	395.0
4/14/97	444.0
4/15/97	709.0
4/16/97	1510.0
4/17/97	2760.0
4/18/97	4400.0
4/19/97	4700.0
4/20/97	3800.0
4/21/97	2800.0
4/22/97	1880.0
4/23/97	1360.0
4/24/97	984.0
4/25/97	694.0
4/26/97	539.0
4/27/97	454.0
4/28/97	399.0
4/29/97	367.0
4/30/97	337.0
5/1/97	293.0
5/2/97	260.0
5/3/97	234.0
5/4/97	213.0
5/5/97	205.0
5/6/97	193.0
5/7/97	180.0
5/8/97	171.0
5/9/97	167.0
5/10/97	160.0
5/11/97	152.0
5/12/97	147.0
5/13/97	137.0
5/14/97	129.0
5/15/97	126.0
5/16/97	120.0
5/17/97	112.0
5/18/97	108.0
5/19/97	101.0
5/20/97	96.0
5/21/97	91.0
5/22/97	89.0
5/23/97	89.0
5/24/97	86.0
5/25/97	83.0
5/26/97	80.0
5/27/97	77.0
5/28/97	75.0
5/29/97	74.0
5/30/97	72.0
5/31/97	70.0
6/1/97	68.0

6/2/97	66.0
6/3/97	64.0
6/4/97	62.0
6/5/97	60.0
6/6/97	59.0
6/7/97	57.0
6/8/97	54.0
6/9/97	50.0
6/10/97	47.0
6/11/97	44.0
6/12/97	42.0
6/13/97	41.0
6/14/97	39.0
6/15/97	36.0
6/16/97	33.0
6/17/97	30.0
6/18/97	28.0
6/19/97	28.0
6/20/97	29.0
6/21/97	28.0
6/22/97	28.0
6/23/97	27.0
6/24/97	52.0
6/25/97	74.0
6/26/97	79.0
6/27/97	75.0
6/28/97	74.0
6/29/97	61.0
6/30/97	54.0
7/1/97	51.0
7/2/97	46.0
7/3/97	42.0
7/4/97	37.0
7/5/97	35.0
7/6/97	34.0
7/7/97	37.0
7/8/97	39.0
7/9/97	37.0
7/10/97	35.0
7/11/97	32.0
7/12/97	30.0
7/13/97	29.0
7/14/97	26.0
7/15/97	24.0
7/16/97	22.0
7/17/97	21.0
7/18/97	29.0
7/19/97	30.0
7/20/97	24.0
7/21/97	34.0
7/22/97	53.0
7/23/97	43.0
7/24/97	32.0

7/25/97	31.0
7/26/97	38.0
7/27/97	35.0
7/28/97	31.0
7/29/97	30.0
7/30/97	32.0
7/31/97	47.0
8/1/97	41.0
8/2/97	36.0
8/3/97	30.0
8/4/97	22.0
8/5/97	20.0
8/6/97	18.0
8/7/97	17.0
8/8/97	16.0
8/9/97	16.0
8/10/97	15.0
8/11/97	14.0
8/12/97	13.0
8/13/97	13.0
8/14/97	13.0
8/15/97	13.0
8/16/97	13.0
8/17/97	13.0
8/18/97	13.0
8/19/97	12.0
8/20/97	12.0
8/21/97	12.0
8/22/97	11.0
8/23/97	11.0
8/24/97	11.0
8/25/97	10.0
8/26/97	9.9
8/27/97	9.8
8/28/97	9.5
8/29/97	9.4
8/30/97	9.5
8/31/97	9.3
9/1/97	10.0
9/2/97	10.0
9/3/97	9.5
9/4/97	9.1
9/5/97	9.1
9/6/97	9.2
9/7/97	9.6
9/8/97	9.7
9/9/97	9.7
9/10/97	9.7
9/11/97	10.0
9/12/97	11.0
9/13/97	10.0
9/14/97	10.0
9/15/97	10.0

9/16/97	10.0
9/17/97	9.9
9/18/97	9.5
9/19/97	9.4
9/20/97	9.3
9/21/97	9.5
9/22/97	9.8
9/23/97	10.0
9/24/97	10.0
9/25/97	10.0
9/26/97	10.0
9/27/97	11.0
9/28/97	11.0
9/29/97	11.0
9/30/97	11.0
10/1/97	14.0
10/2/97	14.0
10/3/97	12.0
10/4/97	12.0
10/5/97	12.0
10/6/97	12.0
10/7/97	12.0
10/8/97	13.0
10/9/97	12.0
10/10/97	12.0
10/11/97	13.0
10/12/97	15.0
10/13/97	17.0
10/14/97	16.0
10/15/97	16.0
10/16/97	16.0
10/17/97	15.0
10/18/97	16.0
10/19/97	16.0
10/20/97	16.0
10/21/97	16.0
10/22/97	15.0
10/23/97	15.0
10/24/97	14.0
10/25/97	14.0
10/26/97	12.0
10/27/97	14.0
10/28/97	14.0
10/29/97	14.0
10/30/97	15.0
10/31/97	15.0
11/1/97	15.0
11/2/97	15.0
11/3/97	14.0
11/4/97	15.0
11/5/97	15.0
11/6/97	16.0
11/7/97	17.0

11/8/97	17.0
11/9/97	17.0
11/10/97	15.0
11/11/97	14.0
11/12/97	14.0
11/13/97	14.0
11/14/97	14.0
11/15/97	12.0
11/16/97	12.0
11/17/97	12.0
11/18/97	12.0
11/19/97	13.0
11/20/97	12.0
11/21/97	12.0
11/22/97	12.0
11/23/97	12.0
11/24/97	13.0
11/25/97	14.0
11/26/97	15.0
11/27/97	16.0
11/28/97	17.0
11/29/97	18.0
11/30/97	16.0
12/1/97	16.0
12/2/97	16.0
12/3/97	17.0
12/4/97	15.0
12/5/97	14.0
12/6/97	14.0
12/7/97	14.0
12/8/97	14.0
12/9/97	14.0
12/10/97	14.0
12/11/97	14.0
12/12/97	15.0
12/13/97	15.0
12/14/97	17.0
12/15/97	16.0
12/16/97	16.0
12/17/97	17.0
12/18/97	16.0
12/19/97	17.0
12/20/97	16.0
12/21/97	16.0
12/22/97	16.0
12/23/97	16.0
12/24/97	15.0
12/25/97	15.0
12/26/97	15.0
12/27/97	15.0
12/28/97	15.0
12/29/97	15.0
12/30/97	15.0

12/31/97	15.0
1/1/98	15.0
1/2/98	15.0
1/3/98	15.0
1/4/98	13.0
1/5/98	13.0
1/6/98	12.0
1/7/98	12.0
1/8/98	12.0
1/9/98	9.4
1/10/98	9.4
1/11/98	9.4
1/12/98	9.0
1/13/98	8.6
1/14/98	9.2
1/15/98	9.4
1/16/98	9.5
1/17/98	9.7
1/18/98	9.7
1/19/98	9.7
1/20/98	9.7
1/21/98	9.7
1/22/98	9.8
1/23/98	9.8
1/24/98	9.8
1/25/98	9.9
1/26/98	11.0
1/27/98	13.0
1/28/98	14.0
1/29/98	14.0
1/30/98	13.0
1/31/98	12.0
2/1/98	11.0
2/2/98	10.0
2/3/98	10.0
2/4/98	13.0
2/5/98	13.0
2/6/98	13.0
2/7/98	14.0
2/8/98	14.0
2/9/98	15.0
2/10/98	16.0
2/11/98	17.0
2/12/98	17.0
2/13/98	17.0
2/14/98	17.0
2/15/98	16.0
2/16/98	20.0
2/17/98	30.0
2/18/98	40.0
2/19/98	50.0
2/20/98	60.0
2/21/98	70.0

2/22/98	87.0
2/23/98	106.0
2/24/98	115.0
2/25/98	142.0
2/26/98	162.0
2/27/98	146.0
2/28/98	130.0
3/1/98	120.0
3/2/98	110.0
3/3/98	100.0
3/4/98	95.0
3/5/98	90.0
3/6/98	87.0
3/7/98	85.0
3/8/98	82.0
3/9/98	78.0
3/10/98	75.0
3/11/98	72.0
3/12/98	70.0
3/13/98	68.0
3/14/98	66.0
3/15/98	64.0
3/16/98	62.0
3/17/98	61.0
3/18/98	60.0
3/19/98	60.0
3/20/98	64.0
3/21/98	75.0
3/22/98	90.0
3/23/98	130.0
3/24/98	170.0
3/25/98	200.0
3/26/98	350.0
3/27/98	476.0
3/28/98	609.0
3/29/98	477.0
3/30/98	317.0
3/31/98	263.0
4/1/98	225.0
4/2/98	217.0
4/3/98	197.0
4/4/98	180.0
4/5/98	169.0
4/6/98	158.0
4/7/98	149.0
4/8/98	141.0
4/9/98	135.0
4/10/98	129.0
4/11/98	121.0
4/12/98	116.0
4/13/98	107.0
4/14/98	101.0
4/15/98	94.0

4/16/98	88.0
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4/18/98	80.0
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6/6/98	14.0
6/7/98	14.0

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8/10/98	7.8
8/11/98	7.6
8/12/98	7.4
8/13/98	7.2
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3/23/99	131.0
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4/20/99	82.0
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4/29/99	70.0
4/30/99	72.0
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5/2/99	82.0
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5/23/99	133.0
5/24/99	124.0
5/25/99	117.0
5/26/99	111.0
5/27/99	105.0
5/28/99	100.0
5/29/99	94.0
5/30/99	90.0
5/31/99	86.0
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6/2/99	79.0
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6/29/99	86.0
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4/28/00	52.0
4/29/00	54.0
4/30/00	56.0
5/1/00	54.0
5/2/00	52.0
5/3/00	48.0
5/4/00	45.0
5/5/00	43.0
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5/10/00	47.0
5/11/00	50.0
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5/13/00	52.0
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5/18/00	51.0
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5/22/00	44.0
5/23/00	42.0
5/24/00	38.0
5/25/00	32.0
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5/28/00	33.0
5/29/00	30.0
5/30/00	30.0
5/31/00	30.0
6/1/00	34.0
6/2/00	33.0
6/3/00	32.0
6/4/00	32.0
6/5/00	32.0
6/6/00	30.0
6/7/00	26.0
6/8/00	23.0
6/9/00	20.0
6/10/00	18.0
6/11/00	17.0
6/12/00	16.0
6/13/00	18.0
6/14/00	18.0
6/15/00	17.0
6/16/00	18.0
6/17/00	17.0
6/18/00	17.0
6/19/00	17.0
6/20/00	17.0
6/21/00	20.0
6/22/00	20.0
6/23/00	18.0
6/24/00	17.0
6/25/00	15.0
6/26/00	14.0
6/27/00	12.0
6/28/00	11.0
6/29/00	10.0
6/30/00	9.2
7/1/00	9.2
7/2/00	9.2
7/3/00	8.8
7/4/00	8.4
7/5/00	8.8
7/6/00	8.4
7/7/00	8.0
7/8/00	7.6
7/9/00	7.2
7/10/00	8.6
7/11/00	8.4
7/12/00	8.0
7/13/00	7.6
7/14/00	7.2
7/15/00	6.8
7/16/00	7.0
7/17/00	7.2
7/18/00	7.4
7/19/00	7.0
7/20/00	8.6
7/21/00	8.2
7/22/00	7.8
7/23/00	7.4
7/24/00	7.0
7/25/00	6.6
7/26/00	6.2
7/27/00	5.4
7/28/00	5.0
7/29/00	4.2
7/30/00	4.2
7/31/00	4.4
8/1/00	4.2
8/2/00	3.4
8/3/00	3.9
8/4/00	2.7
8/5/00	5.0
8/6/00	5.4
8/7/00	3.8
8/8/00	3.6
8/9/00	3.3
8/10/00	2.4

8/11/00	2.0
8/12/00	1.6
8/13/00	2.0
8/14/00	4.7
8/15/00	6.8
8/16/00	5.8
8/17/00	4.7
8/18/00	7.1
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8/21/00	4.5
8/22/00	4.8
8/23/00	4.2
8/24/00	6.3
8/25/00	5.5
8/26/00	3.9
8/27/00	2.7
8/28/00	3.4
8/29/00	7.2
8/30/00	6.8
8/31/00	5.3
9/1/00	3.3
9/2/00	5.4
9/3/00	7.2
9/4/00	6.9
9/5/00	6.9
9/6/00	6.9
9/7/00	6.1
9/8/00	5.8
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9/17/00	2.6
9/18/00	1.7
9/19/00	1.9
9/20/00	2.7
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9/24/00	3.8
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9/27/00	3.4
9/28/00	3.5
9/29/00	3.8
9/30/00	3.8
10/1/00	3.5
10/2/00	3.3

10/3/00	2.4
10/4/00	3.1
10/5/00	3.1
10/6/00	3.0
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10/10/00	3.7
10/11/00	3.4
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10/18/00	6.0
10/19/00	5.3
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10/24/00	6.2
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10/26/00	7.9
10/27/00	12.0
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10/31/00	8.8
11/1/00	8.7
11/2/00	8.7
11/3/00	8.9
11/4/00	8.7
11/5/00	8.4
11/6/00	8.6
11/7/00	9.4
11/8/00	9.3
11/9/00	9.5
11/10/00	9.7
11/11/00	9.7
11/12/00	9.8
11/13/00	9.5
11/14/00	9.4
11/15/00	9.2
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11/18/00	9.4
11/19/00	9.3
11/20/00	9.2
11/21/00	9.1
11/22/00	9.0
11/23/00	9.3
11/24/00	9.5

11/25/00	9.3
11/26/00	9.1
11/27/00	8.8
11/28/00	8.8
11/29/00	8.9
11/30/00	9.0
12/1/00	9.3
12/2/00	9.2
12/3/00	9.0
12/4/00	8.9
12/5/00	8.7
12/6/00	8.8
12/7/00	9.1
12/8/00	9.4
12/9/00	9.7
12/10/00	9.9
12/11/00	9.6
12/12/00	9.2
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12/14/00	8.3
12/15/00	8.5
12/16/00	8.7
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12/20/00	8.0
12/21/00	7.6
12/22/00	7.2
12/23/00	6.9
12/24/00	6.4
12/25/00	6.0
12/26/00	5.6
12/27/00	5.4
12/28/00	5.6
12/29/00	5.9
12/30/00	6.3
12/31/00	6.9
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1/13/01	6.5
1/14/01	6.4
1/15/01	6.2
1/16/01	6.0

1/17/01	6.0
1/18/01	5.9
1/19/01	5.9
1/20/01	6.0
1/21/01	6.0
1/22/01	6.2
1/23/01	6.5
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1/27/01	6.2
1/28/01	6.2
1/29/01	6.3
1/30/01	6.4
1/31/01	6.0
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2/2/01	6.3
2/3/01	5.9
2/4/01	5.5
2/5/01	5.1
2/6/01	5.0
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2/10/01	4.9
2/11/01	4.8
2/12/01	4.8
2/13/01	4.8
2/14/01	4.9
2/15/01	5.0
2/16/01	5.2
2/17/01	5.3
2/18/01	5.3
2/19/01	5.3
2/20/01	5.2
2/21/01	5.2
2/22/01	5.1
2/23/01	5.1
2/24/01	5.0
2/25/01	4.9
2/26/01	4.9
2/27/01	5.2
2/28/01	5.4
3/1/01	5.6
3/2/01	5.7
3/3/01	5.7
3/4/01	5.7
3/5/01	5.6
3/6/01	5.5
3/7/01	5.2
3/8/01	5.2
3/9/01	5.1
3/10/01	5.1

3/11/01	5.2
3/12/01	5.3
3/13/01	5.4
3/14/01	5.4
3/15/01	5.6
3/16/01	5.7
3/17/01	10.0
3/18/01	18.0
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3/29/01	133.0
3/30/01	199.0
3/31/01	224.0
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4/2/01	318.0
4/3/01	523.0
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4/5/01	366.0
4/6/01	379.0
4/7/01	541.0
4/8/01	686.0
4/9/01	757.0
4/10/01	731.0
4/11/01	417.0
4/12/01	351.0
4/13/01	315.0
4/14/01	279.0
4/15/01	249.0
4/16/01	223.0
4/17/01	204.0
4/18/01	185.0
4/19/01	171.0
4/20/01	165.0
4/21/01	157.0
4/22/01	150.0
4/23/01	145.0
4/24/01	142.0
4/25/01	135.0
4/26/01	126.0
4/27/01	118.0
4/28/01	110.0
4/29/01	102.0
4/30/01	96.0
5/1/01	92.0
5/2/01	88.0

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5/4/01	80.0
5/5/01	80.0
5/6/01	89.0
5/7/01	88.0
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5/11/01	82.0
5/12/01	75.0
5/13/01	70.0
5/14/01	65.0
5/15/01	62.0
5/16/01	60.0
5/17/01	58.0
5/18/01	54.0
5/19/01	52.0
5/20/01	48.0
5/21/01	48.0
5/22/01	46.0
5/23/01	47.0
5/24/01	46.0
5/25/01	45.0
5/26/01	43.0
5/27/01	42.0
5/28/01	39.0
5/29/01	36.0
5/30/01	36.0
5/31/01	35.0
6/1/01	33.0
6/2/01	31.0
6/3/01	29.0
6/4/01	28.0
6/5/01	27.0
6/6/01	29.0
6/7/01	30.0
6/8/01	31.0
6/9/01	33.0
6/10/01	35.0
6/11/01	36.0
6/12/01	42.0
6/13/01	59.0
6/14/01	48.0
6/15/01	51.0
6/16/01	52.0
6/17/01	58.0
6/18/01	101.0
6/19/01	146.0
6/20/01	130.0
6/21/01	118.0
6/22/01	106.0
6/23/01	97.0
6/24/01	89.0

6/25/01	84.0
6/26/01	81.0
6/27/01	76.0
6/28/01	72.0
6/29/01	67.0
6/30/01	64.0
7/1/01	60.0
7/2/01	56.0
7/3/01	52.0
7/4/01	48.0
7/5/01	41.0
7/6/01	37.0
7/7/01	39.0
7/8/01	34.0
7/9/01	32.0
7/10/01	36.0
7/11/01	34.0
7/12/01	33.0
7/13/01	32.0
7/14/01	35.0
7/15/01	40.0
7/16/01	60.0
7/17/01	51.0
7/18/01	43.0
7/19/01	46.0
7/20/01	51.0
7/21/01	49.0
7/22/01	50.0
7/23/01	44.0
7/24/01	41.0
7/25/01	43.0
7/26/01	45.0
7/27/01	124.0
7/28/01	98.0
7/29/01	102.0
7/30/01	127.0
7/31/01	115.0
8/1/01	137.0
8/2/01	116.0
8/3/01	99.0
8/4/01	86.0
8/5/01	76.0
8/6/01	67.0
8/7/01	61.0
8/8/01	56.0
8/9/01	53.0
8/10/01	49.0
8/11/01	47.0
8/12/01	46.0
8/13/01	44.0
8/14/01	43.0
8/15/01	41.0
8/16/01	40.0

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8/18/01	38.0
8/19/01	37.0
8/20/01	36.0
8/21/01	35.0
8/22/01	33.0
8/23/01	32.0
8/24/01	31.0
8/25/01	30.0
8/26/01	29.0
8/27/01	28.0
8/28/01	27.0
8/29/01	27.0
8/30/01	26.0
8/31/01	25.0
9/1/01	25.0
9/2/01	23.0
9/3/01	21.0
9/4/01	20.0
9/5/01	18.0
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9/7/01	19.0
9/8/01	19.0
9/9/01	19.0
9/10/01	17.0
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9/12/01	16.0
9/13/01	15.0
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9/16/01	19.0
9/17/01	18.0
9/18/01	18.0
9/19/01	18.0
9/20/01	17.0
9/21/01	16.0
9/22/01	16.0
9/23/01	15.0
9/24/01	14.0
9/25/01	14.0
9/26/01	13.0
9/27/01	13.0
9/28/01	12.0
9/29/01	12.0
9/30/01	12.0
10/1/01	11.0
10/2/01	12.0
10/3/01	11.0
10/4/01	11.0
10/5/01	10.0
10/6/01	11.0
10/7/01	11.0
10/8/01	11.0

10/9/01	11.0
10/10/01	10.0
10/11/01	9.9
10/12/01	9.4
10/13/01	9.1
10/14/01	9.2
10/15/01	8.3
10/16/01	12.0
10/17/01	12.0
10/18/01	11.0
10/19/01	10.0
10/20/01	9.6
10/21/01	9.5
10/22/01	9.3
10/23/01	9.3
10/24/01	9.6
10/25/01	9.9
10/26/01	9.7
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10/29/01	12.0
10/30/01	11.0
10/31/01	11.0
11/1/01	11.0
11/2/01	11.0
11/3/01	10.0
11/4/01	11.0
11/5/01	11.0
11/6/01	11.0
11/7/01	11.0
11/8/01	10.0
11/9/01	11.0
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11/20/01	11.0
11/21/01	12.0
11/22/01	12.0
11/23/01	11.0
11/24/01	11.0
11/25/01	10.0
11/26/01	9.6
11/27/01	9.2
11/28/01	8.8
11/29/01	8.8
11/30/01	8.8

12/1/01	8.8	1/23/02	7.3	3/17/02	22.0
12/2/01	8.6	1/24/02	7.6	3/18/02	21.0
12/3/01	8.2	1/25/02	7.8	3/19/02	20.0
12/4/01	8.1	1/26/02	7.8	3/20/02	18.0
12/5/01	8.2	1/27/02	7.6	3/21/02	17.0
12/6/01	8.1	1/28/02	7.5	3/22/02	17.0
12/7/01	8.0	1/29/02	7.2	3/23/02	16.0
12/8/01	7.8	1/30/02	7.1	3/24/02	16.0
12/9/01	7.7	1/31/02	7.0	3/25/02	15.0
12/10/01	7.8	2/1/02	7.1	3/26/02	15.0
12/11/01	7.3	2/2/02	7.2	3/27/02	25.0
12/12/01	7.3	2/3/02	7.3	3/28/02	42.0
12/13/01	7.2	2/4/02	7.2	3/29/02	70.0
12/14/01	7.3	2/5/02	7.4	3/30/02	107.0
12/15/01	7.2	2/6/02	7.8	3/31/02	140.0
12/16/01	7.4	2/7/02	8.2	4/1/02	144.0
12/17/01	7.3	2/8/02	8.8	4/2/02	146.0
12/18/01	7.4	2/9/02	9.2	4/3/02	131.0
12/19/01	7.0	2/10/02	9.0	4/4/02	116.0
12/20/01	6.6	2/11/02	9.5	4/5/02	105.0
12/21/01	6.4	2/12/02	10.0	4/6/02	99.0
12/22/01	6.5	2/13/02	11.0	4/7/02	103.0
12/23/01	6.6	2/14/02	11.0	4/8/02	100.0
12/24/01	6.3	2/15/02	12.0	4/9/02	97.0
12/25/01	6.3	2/16/02	13.0	4/10/02	109.0
12/26/01	6.2	2/17/02	13.0	4/11/02	101.0
12/27/01	6.1	2/18/02	14.0	4/12/02	91.0
12/28/01	6.3	2/19/02	14.0	4/13/02	92.0
12/29/01	6.3	2/20/02	14.0	4/14/02	92.0
12/30/01	6.4	2/21/02	15.0	4/15/02	88.0
12/31/01	6.1	2/22/02	15.0	4/16/02	83.0
1/1/02	5.9	2/23/02	16.0	4/17/02	81.0
1/2/02	5.9	2/24/02	15.0	4/18/02	80.0
1/3/02	5.8	2/25/02	14.0	4/19/02	79.0
1/4/02	5.6	2/26/02	13.0	4/20/02	77.0
1/5/02	5.7	2/27/02	12.0	4/21/02	80.0
1/6/02	5.9	2/28/02	11.0	4/22/02	82.0
1/7/02	6.0	3/1/02	10.0	4/23/02	81.0
1/8/02	6.1	3/2/02	10.0	4/24/02	77.0
1/9/02	6.4	3/3/02	10.0	4/25/02	72.0
1/10/02	6.8	3/4/02	9.8	4/26/02	69.0
1/11/02	7.1	3/5/02	9.8	4/27/02	68.0
1/12/02	7.2	3/6/02	9.8	4/28/02	65.0
1/13/02	7.1	3/7/02	9.7	4/29/02	67.0
1/14/02	7.1	3/8/02	9.6	4/30/02	65.0
1/15/02	7.5	3/9/02	9.5	5/1/02	63.0
1/16/02	7.3	3/10/02	9.5	5/2/02	61.0
1/17/02	7.0	3/11/02	9.8	5/3/02	59.0
1/18/02	7.0	3/12/02	11.0	5/4/02	56.0
1/19/02	7.5	3/13/02	13.0	5/5/02	52.0
1/20/02	7.3	3/14/02	15.0	5/6/02	51.0
1/21/02	7.5	3/15/02	19.0	5/7/02	48.0
1/22/02	7.3	3/16/02	21.0	5/8/02	48.0

5/9/02	46.0
5/10/02	44.0
5/11/02	46.0
5/12/02	49.0
5/13/02	47.0
5/14/02	46.0
5/15/02	43.0
5/16/02	38.0
5/17/02	35.0
5/18/02	33.0
5/19/02	31.0
5/20/02	28.0
5/21/02	25.0
5/22/02	23.0
5/23/02	21.0
5/24/02	17.0
5/25/02	13.0
5/26/02	12.0
5/27/02	12.0
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5/31/02	10.0
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6/3/02	11.0
6/4/02	10.0
6/5/02	10.0
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6/7/02	9.3
6/8/02	9.3
6/9/02	8.9
6/10/02	8.1
6/11/02	7.4
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6/13/02	5.1
6/14/02	4.1
6/15/02	5.1
6/16/02	4.9
6/17/02	4.0
6/18/02	3.5
6/19/02	5.4
6/20/02	10.0
6/21/02	4.8
6/22/02	2.2
6/23/02	2.2
6/24/02	2.2
6/25/02	2.3
6/26/02	2.4
6/27/02	2.4
6/28/02	2.3
6/29/02	2.0
6/30/02	2.0

7/1/02	2.1
7/2/02	1.7
7/3/02	1.6
7/4/02	1.6
7/5/02	1.5
7/6/02	1.4
7/7/02	1.3
7/8/02	1.3
7/9/02	1.4
7/10/02	1.6
7/11/02	2.1
7/12/02	2.4
7/13/02	2.4
7/14/02	2.3
7/15/02	2.2
7/16/02	2.1
7/17/02	2.0
7/18/02	1.9
7/19/02	1.9
7/20/02	1.8
7/21/02	1.8
7/22/02	1.8
7/23/02	2.0
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7/26/02	2.8
7/27/02	2.6
7/28/02	2.8
7/29/02	2.6
7/30/02	2.6
7/31/02	2.5
8/1/02	2.5
8/2/02	2.4
8/3/02	2.1
8/4/02	1.8
8/5/02	5.6
8/6/02	7.6
8/7/02	6.5
8/8/02	2.1
8/9/02	1.1
8/10/02	0.7
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8/12/02	0.4
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8/14/02	0.6
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8/16/02	0.4
8/17/02	0.4
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8/22/02	0.3

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8/26/02	0.5
8/27/02	0.5
8/28/02	0.4
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9/2/02	0.8
9/3/02	0.4
9/4/02	0.3
9/5/02	0.3
9/6/02	0.3
9/7/02	0.4
9/8/02	0.5
9/9/02	0.6
9/10/02	0.7
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10/10/02	1.0
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10/14/02	1.5

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3/25/03	102.0
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5/13/03	80.0
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5/17/03	72.0
5/18/03	72.0
5/19/03	71.0
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5/22/03	73.0
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5/26/03	54.0
5/27/03	50.0
5/28/03	45.0
5/29/03	41.0
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6/12/03	72.0
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6/14/03	61.0
6/15/03	80.0
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6/17/03	57.0
6/18/03	53.0
6/19/03	45.0
6/20/03	34.0
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6/25/03	51.0
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6/28/03	52.0
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6/30/03	51.0
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7/5/03	23.0
7/6/03	20.0

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7/8/03	24.0
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7/10/03	20.0
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7/18/03	12.0
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7/26/03	6.0
7/27/03	5.4
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8/6/03	1.8
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9/20/03	1.7
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10/17/03	8.7
10/18/03	8.6
10/19/03	9.4
10/20/03	8.7

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12/7/03	4.7
12/8/03	4.6
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12/10/03	4.4
12/11/03	4.3
12/12/03	4.2

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12/14/03	4.0
12/15/03	3.8
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12/18/03	3.8
12/19/03	3.8
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2/3/04	3.1

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3/2/04	4.8
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3/19/04	90.0
3/20/04	92.0
3/21/04	77.0
3/22/04	84.0
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3/24/04	81.0
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3/27/04	65.0

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4/15/04	17.0
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5/6/04	9.6
5/7/04	9.0
5/8/04	8.8
5/9/04	8.6
5/10/04	8.2
5/11/04	8.1
5/12/04	8.3
5/13/04	8.6
5/14/04	9.4
5/15/04	11.0
5/16/04	10.0
5/17/04	11.0
5/18/04	11.0
5/19/04	12.0

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5/21/04	11.0
5/22/04	16.0
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5/25/04	13.0
5/26/04	13.0
5/27/04	12.0
5/28/04	13.0
5/29/04	13.0
5/30/04	15.0
5/31/04	18.0
6/1/04	19.0
6/2/04	21.0
6/3/04	24.0
6/4/04	27.0
6/5/04	26.0
6/6/04	26.0
6/7/04	21.0
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6/17/04	39.0
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6/20/04	17.0
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7/3/04	8.0
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7/17/04	5.3
7/18/04	5.1
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7/29/04	4.6
7/30/04	4.4
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3/18/05	7.5
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3/20/05	8.5
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3/22/05	8.9
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3/24/05	9.3
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3/29/05	33.0
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4/2/05	45.0
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5/10/05	18.0
5/11/05	18.0
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5/17/05	35.0
5/18/05	34.0
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6/3/05	18.0
6/4/05	18.0
6/5/05	17.0
6/6/05	17.0
6/7/05	18.0
6/8/05	33.0
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6/10/05	565.0
6/11/05	307.0
6/12/05	245.0
6/13/05	177.0
6/14/05	140.0
6/15/05	112.0
6/16/05	98.0
6/17/05	88.0
6/18/05	78.0
6/19/05	68.0
6/20/05	69.0
6/21/05	62.0
6/22/05	61.0
6/23/05	53.0
6/24/05	51.0
6/25/05	49.0
6/26/05	44.0
6/27/05	41.0
6/28/05	36.0
6/29/05	37.0
6/30/05	37.0
7/1/05	34.0
7/2/05	31.0
7/3/05	32.0
7/4/05	31.0
7/5/05	29.0
7/6/05	28.0
7/7/05	26.0
7/8/05	23.0
7/9/05	22.0
7/10/05	20.0
7/11/05	19.0
7/12/05	18.0
7/13/05	18.0
7/14/05	17.0
7/15/05	17.0
7/16/05	17.0
7/17/05	16.0

7/18/05	16.0
7/19/05	16.0
7/20/05	16.0
7/21/05	15.0
7/22/05	15.0
7/23/05	65.0
7/24/05	63.0
7/25/05	50.0
7/26/05	86.0
7/27/05	128.0
7/28/05	135.0
7/29/05	159.0
7/30/05	142.0
7/31/05	102.0
8/1/05	78.0
8/2/05	61.0
8/3/05	49.0
8/4/05	40.0
8/5/05	33.0
8/6/05	32.0
8/7/05	33.0
8/8/05	31.0
8/9/05	29.0
8/10/05	27.0
8/11/05	29.0
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8/16/05	41.0
8/17/05	37.0
8/18/05	31.0
8/19/05	26.0
8/20/05	23.0
8/21/05	20.0
8/22/05	20.0
8/23/05	24.0
8/24/05	24.0
8/25/05	21.0
8/26/05	19.0
8/27/05	17.0
8/28/05	16.0
8/29/05	15.0
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8/31/05	13.0
9/1/05	12.0
9/2/05	11.0
9/3/05	11.0
9/4/05	10.0
9/5/05	10.0
9/6/05	9.1
9/7/05	7.3
9/8/05	6.2

9/9/05	7.6
9/10/05	9.4
9/11/05	9.5
9/12/05	8.8
9/13/05	9.0
9/14/05	8.7
9/15/05	8.5
9/16/05	8.0
9/17/05	9.2
9/18/05	9.5
9/19/05	9.4
9/20/05	8.6
9/21/05	8.1
9/22/05	8.1
9/23/05	7.0
9/24/05	6.6
9/25/05	6.6
9/26/05	6.3
9/27/05	6.1
9/28/05	5.6
9/29/05	4.6
9/30/05	4.7
10/1/05	4.4
10/2/05	4.8
10/3/05	4.1
10/4/05	4.4
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10/6/05	4.2
10/7/05	4.4
10/8/05	4.2
10/9/05	4.8
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10/11/05	4.6
10/12/05	4.1
10/13/05	4.4
10/14/05	4.4
10/15/05	3.1
10/16/05	3.4
10/17/05	7.5
10/18/05	5.1
10/19/05	3.5
10/20/05	5.6
10/21/05	5.9
10/22/05	6.3
10/23/05	5.5
10/24/05	6.0
10/25/05	5.8
10/26/05	6.5
10/27/05	5.7
10/28/05	6.4
10/29/05	6.5
10/30/05	7.9
10/31/05	9.6

11/1/05	8.6	12/24/05	4.2	2/15/06	7.0
11/2/05	8.1	12/25/05	5.3	2/16/06	6.0
11/3/05	7.5	12/26/05	6.1	2/17/06	5.0
11/4/05	9.4	12/27/05	6.6	2/18/06	5.0
11/5/05	8.1	12/28/05	7.3	2/19/06	5.2
11/6/05	7.7	12/29/05	7.8	2/20/06	5.5
11/7/05	9.7	12/30/05	8.1	2/21/06	5.7
11/8/05	9.1	12/31/05	8.3	2/22/06	6.1
11/9/05	7.6	1/1/06	8.3	2/23/06	6.5
11/10/05	7.7	1/2/06	8.4	2/24/06	6.6
11/11/05	8.8	1/3/06	8.6	2/25/06	6.9
11/12/05	9.0	1/4/06	8.9	2/26/06	7.0
11/13/05	15.0	1/5/06	9.1	2/27/06	7.2
11/14/05	7.5	1/6/06	9.2	2/28/06	7.3
11/15/05	4.5	1/7/06	9.2	3/1/06	7.5
11/16/05	3.0	1/8/06	9.3	3/2/06	8.0
11/17/05	2.9	1/9/06	9.3	3/3/06	9.1
11/18/05	4.9	1/10/06	9.4	3/4/06	11.0
11/19/05	7.2	1/11/06	9.5	3/5/06	20.0
11/20/05	8.2	1/12/06	9.6	3/6/06	36.0
11/21/05	8.2	1/13/06	9.6	3/7/06	42.0
11/22/05	7.9	1/14/06	9.6	3/8/06	90.0
11/23/05	8.4	1/15/06	9.5	3/9/06	110.0
11/24/05	8.4	1/16/06	9.6	3/10/06	160.0
11/25/05	8.0	1/17/06	9.5	3/11/06	190.0
11/26/05	7.8	1/18/06	9.4	3/12/06	168.0
11/27/05	7.7	1/19/06	9.4	3/13/06	129.0
11/28/05	7.7	1/20/06	9.3	3/14/06	131.0
11/29/05	7.4	1/21/06	9.4	3/15/06	116.0
11/30/05	7.0	1/22/06	9.3	3/16/06	97.0
12/1/05	6.2	1/23/06	9.2	3/17/06	86.0
12/2/05	5.7	1/24/06	9.0	3/18/06	87.0
12/3/05	5.4	1/25/06	8.9	3/19/06	72.0
12/4/05	5.0	1/26/06	9.0	3/20/06	61.0
12/5/05	4.5	1/27/06	9.2	3/21/06	60.0
12/6/05	4.0	1/28/06	9.4	3/22/06	56.0
12/7/05	3.6	1/29/06	9.6	3/23/06	54.0
12/8/05	3.4	1/30/06	9.6	3/24/06	50.0
12/9/05	3.5	1/31/06	9.6	3/25/06	52.0
12/10/05	4.1	2/1/06	9.6	3/26/06	48.0
12/11/05	5.8	2/2/06	9.6	3/27/06	61.0
12/12/05	7.8	2/3/06	9.5	3/28/06	52.0
12/13/05	8.4	2/4/06	9.5	3/29/06	61.0
12/14/05	8.4	2/5/06	9.3	3/30/06	67.0
12/15/05	8.2	2/6/06	9.2	3/31/06	66.0
12/16/05	7.8	2/7/06	9.0	4/1/06	75.0
12/17/05	6.7	2/8/06	8.9	4/2/06	72.0
12/18/05	5.7	2/9/06	8.9	4/3/06	63.0
12/19/05	4.4	2/10/06	8.6	4/4/06	53.0
12/20/05	3.2	2/11/06	8.4	4/5/06	45.0
12/21/05	2.9	2/12/06	8.2	4/6/06	42.0
12/22/05	2.9	2/13/06	7.7	4/7/06	39.0
12/23/05	3.3	2/14/06	7.3	4/8/06	36.0

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4/10/06	33.0
4/11/06	31.0
4/12/06	31.0
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4/14/06	31.0
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4/22/06	28.0
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5/6/06	28.0
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5/10/06	19.0
5/11/06	18.0
5/12/06	17.0
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5/16/06	13.0
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5/26/06	9.8
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5/30/06	8.0
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6/2/06	8.0
6/3/06	7.8
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6/15/06	4.7
6/16/06	4.6
6/17/06	4.8
6/18/06	5.1
6/19/06	4.9
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7/1/08	13.0
7/2/08	11.0
7/3/08	10.0
7/4/08	9.4
7/5/08	9.2
7/6/08	8.6
7/7/08	9.9
7/8/08	9.3
7/9/08	8.6
7/10/08	8.2
7/11/08	7.6
7/12/08	6.7
7/13/08	6.0
7/14/08	5.5
7/15/08	5.3
7/16/08	4.8
7/17/08	4.3
7/18/08	4.2
7/19/08	4.3
7/20/08	5.3
7/21/08	5.1
7/22/08	4.3
7/23/08	4.2
7/24/08	3.7
7/25/08	3.2
7/26/08	2.7
7/27/08	6.1
7/28/08	5.9
7/29/08	5.2
7/30/08	3.2
7/31/08	4.2
8/1/08	3.2
8/2/08	3.4
8/3/08	5.0

8/4/08	27.0
8/5/08	27.0
8/6/08	19.0
8/7/08	12.0
8/8/08	9.5
8/9/08	8.6
8/10/08	9.4
8/11/08	8.3
8/12/08	7.5
8/13/08	6.6
8/14/08	5.8
8/15/08	5.8
8/16/08	4.9
8/17/08	4.0
8/18/08	3.1
8/19/08	2.4
8/20/08	1.7
8/21/08	1.7
8/22/08	0.7
8/23/08	1.1
8/24/08	0.6
8/25/08	0.4
8/26/08	0.5
8/27/08	1.5
8/28/08	0.8
8/29/08	0.5
8/30/08	0.4
8/31/08	0.4
9/1/08	0.5
9/2/08	0.7
9/3/08	0.7
9/4/08	0.7
9/5/08	0.8
9/6/08	0.8
9/7/08	0.7
9/8/08	0.7
9/9/08	0.7
9/10/08	0.4
9/11/08	0.7
9/12/08	0.6
9/13/08	1.4
9/14/08	1.3
9/15/08	1.1
9/16/08	0.8
9/17/08	0.7
9/18/08	0.5
9/19/08	0.6
9/20/08	0.6
9/21/08	0.4
9/22/08	0.8
9/23/08	3.1
9/24/08	2.0
9/25/08	1.2

9/26/08	1.3
9/27/08	0.7
9/28/08	0.6
9/29/08	0.6
9/30/08	0.7
10/1/08	0.7
10/2/08	0.8
10/3/08	1.1
10/4/08	0.8
10/5/08	1.1
10/6/08	2.8
10/7/08	2.7
10/8/08	1.8
10/9/08	1.2
10/10/08	1.2
10/11/08	2.4
10/12/08	5.9
10/13/08	9.3
10/14/08	11.0
10/15/08	10.0
10/16/08	12.0
10/17/08	23.0
10/18/08	25.0
10/19/08	18.0
10/20/08	14.0
10/21/08	13.0
10/22/08	12.0
10/23/08	11.0
10/24/08	8.8
10/25/08	8.3
10/26/08	8.0
10/27/08	7.7
10/28/08	7.6
10/29/08	7.4
10/30/08	7.0
10/31/08	5.7
11/1/08	5.5
11/2/08	5.8
11/3/08	6.2
11/4/08	6.4
11/5/08	7.0
11/6/08	7.6
11/7/08	5.7
11/8/08	5.7
11/9/08	6.1
11/10/08	6.8
11/11/08	7.7
11/12/08	8.4
11/13/08	11.0
11/14/08	11.0
11/15/08	11.0
11/16/08	10.0
11/17/08	11.0

11/18/08	12.0		1/10/09			3/4/09		
11/19/08	18.0		1/11/09			3/5/09		
11/20/08	16.0		1/12/09			3/6/09		
11/21/08	14.0		1/13/09			3/7/09		
11/22/08	14.0		1/14/09			3/8/09		
11/23/08	19.0		1/15/09			3/9/09		
11/24/08	17.0		1/16/09			3/10/09		
11/25/08	15.0		1/17/09			3/11/09		
11/26/08	13.0		1/18/09			3/12/09		
11/27/08	13.0		1/19/09			3/13/09		
11/28/08	11.0		1/20/09			3/14/09		
11/29/08	11.0		1/21/09			3/15/09		
11/30/08	11.0		1/22/09			3/16/09		
12/1/08			1/23/09			3/17/09		
12/2/08			1/24/09			3/18/09		
12/3/08			1/25/09			3/19/09		
12/4/08			1/26/09			3/20/09		
12/5/08			1/27/09			3/21/09		
12/6/08			1/28/09			3/22/09		
12/7/08			1/29/09			3/23/09		
12/8/08			1/30/09			3/24/09		
12/9/08			1/31/09			3/25/09	7350.0	
12/10/08			2/1/09			3/26/09	5520.0	
12/11/08			2/2/09			3/27/09	4340.0	
12/12/08			2/3/09			3/28/09	3730.0	
12/13/08			2/4/09			3/29/09	3200.0	
12/14/08			2/5/09			3/30/09	2600.0	
12/15/08			2/6/09			3/31/09	1400.0	
12/16/08			2/7/09			4/1/09	777.0	
12/17/08			2/8/09			4/2/09	589.0	
12/18/08			2/9/09			4/3/09	886.0	
12/19/08			2/10/09			4/4/09	1040.0	
12/20/08			2/11/09			4/5/09	834.0	
12/21/08			2/12/09			4/6/09	659.0	
12/22/08			2/13/09			4/7/09	563.0	
12/23/08			2/14/09			4/8/09	526.0	
12/24/08			2/15/09			4/9/09	921.0	
12/25/08			2/16/09			4/10/09	1730.0	
12/26/08			2/17/09			4/11/09	2770.0	
12/27/08			2/18/09			4/12/09	5120.0	
12/28/08			2/19/09			4/13/09	5690.0	
12/29/08			2/20/09			4/14/09	4770.0	
12/30/08			2/21/09			4/15/09	3950.0	
12/31/08			2/22/09			4/16/09	3180.0	
1/1/09			2/23/09			4/17/09	2370.0	
1/2/09			2/24/09			4/18/09	1600.0	
1/3/09			2/25/09			4/19/09	1030.0	
1/4/09			2/26/09			4/20/09	737.0	
1/5/09			2/27/09			4/21/09	576.0	
1/6/09			2/28/09			4/22/09	487.0	
1/7/09			3/1/09			4/23/09	425.0	
1/8/09			3/2/09			4/24/09	380.0	
1/9/09			3/3/09			4/25/09	351.0	

4/26/09	332.0
4/27/09	326.0
4/28/09	321.0
4/29/09	328.0
4/30/09	312.0
5/1/09	283.0
5/2/09	255.0
5/3/09	237.0
5/4/09	227.0
5/5/09	217.0
5/6/09	202.0
5/7/09	190.0
5/8/09	175.0
5/9/09	160.0
5/10/09	150.0
5/11/09	147.0
5/12/09	146.0
5/13/09	144.0
5/14/09	132.0
5/15/09	124.0
5/16/09	118.0
5/17/09	112.0
5/18/09	106.0
5/19/09	98.0
5/20/09	91.0
5/21/09	83.0
5/22/09	78.0
5/23/09	73.0
5/24/09	68.0
5/25/09	66.0
5/26/09	64.0
5/27/09	60.0
5/28/09	54.0
5/29/09	50.0
5/30/09	47.0
5/31/09	46.0
6/1/09	43.0
6/2/09	41.0
6/3/09	39.0
6/4/09	38.0
6/5/09	38.0
6/6/09	40.0
6/7/09	41.0
6/8/09	41.0
6/9/09	39.0
6/10/09	35.0
6/11/09	34.0
6/12/09	31.0
6/13/09	31.0
6/14/09	30.0
6/15/09	30.0
6/16/09	30.0
6/17/09	30.0

6/18/09	38.0
6/19/09	60.0
6/20/09	61.0
6/21/09	98.0
6/22/09	62.0
6/23/09	48.0
6/24/09	43.0
6/25/09	43.0
6/26/09	37.0
6/27/09	30.0
6/28/09	25.0
6/29/09	24.0
6/30/09	25.0
7/1/09	22.0
7/2/09	21.0
7/3/09	22.0
7/4/09	20.0
7/5/09	23.0
7/6/09	23.0
7/7/09	23.0
7/8/09	22.0
7/9/09	18.0
7/10/09	19.0
7/11/09	19.0
7/12/09	25.0
7/13/09	36.0
7/14/09	41.0
7/15/09	38.0
7/16/09	33.0
7/17/09	29.0
7/18/09	29.0
7/19/09	28.0
7/20/09	27.0
7/21/09	22.0
7/22/09	21.0
7/23/09	17.0
7/24/09	16.0
7/25/09	16.0
7/26/09	16.0
7/27/09	13.0
7/28/09	11.0
7/29/09	12.0
7/30/09	12.0
7/31/09	11.0
8/1/09	11.0
8/2/09	9.6
8/3/09	9.2
8/4/09	9.9
8/5/09	10.0
8/6/09	11.0
8/7/09	15.0
8/8/09	25.0
8/9/09	23.0

8/10/09	16.0
8/11/09	13.0
8/12/09	12.0
8/13/09	10.0
8/14/09	8.7
8/15/09	8.7
8/16/09	9.7
8/17/09	9.5
8/18/09	8.1
8/19/09	8.0
8/20/09	8.0
8/21/09	7.9
8/22/09	7.7
8/23/09	7.5
8/24/09	7.3
8/25/09	7.0
8/26/09	6.7
8/27/09	6.5
8/28/09	6.3
8/29/09	6.1
8/30/09	6.0
8/31/09	5.8
9/1/09	5.6
9/2/09	5.4
9/3/09	5.2
9/4/09	5.0
9/5/09	4.9
9/6/09	4.7
9/7/09	4.6
9/8/09	4.5
9/9/09	4.4
9/10/09	4.3
9/11/09	4.5
9/12/09	4.8
9/13/09	4.6
9/14/09	4.4
9/15/09	4.2
9/16/09	4.0
9/17/09	3.9
9/18/09	3.8
9/19/09	3.7
9/20/09	3.6
9/21/09	3.6
9/22/09	3.5
9/23/09	3.4
9/24/09	3.3
9/25/09	3.3
9/26/09	3.2
9/27/09	3.2
9/28/09	3.2
9/29/09	3.2
9/30/09	3.2
10/1/09	3.1

10/2/09	3.1
10/3/09	4.5
10/4/09	8.0
10/5/09	11.0
10/6/09	11.0
10/7/09	10.0
10/8/09	8.3
10/9/09	6.3
10/10/09	6.4
10/11/09	7.6
10/12/09	7.9
10/13/09	10.0
10/14/09	11.0
10/15/09	13.0
10/16/09	12.0
10/17/09	12.0
10/18/09	11.0
10/19/09	12.0
10/20/09	16.0
10/21/09	18.0
10/22/09	19.0
10/23/09	17.0
10/24/09	19.0
10/25/09	21.0
10/26/09	21.0
10/27/09	20.0
10/28/09	13.0
10/29/09	19.0
10/30/09	25.0
10/31/09	25.0
11/1/09	23.0

11/2/09	25.0
11/3/09	33.0
11/4/09	31.0
11/5/09	29.0
11/6/09	26.0
11/7/09	22.0
11/8/09	20.0
11/9/09	18.0
11/10/09	18.0
11/11/09	18.0
11/12/09	17.0
11/13/09	16.0
11/14/09	15.0
11/15/09	14.0
11/16/09	13.0
11/17/09	12.0
11/18/09	13.0
11/19/09	
11/20/09	
11/21/09	
11/22/09	15.0
11/23/09	17.0
11/24/09	14.0
11/25/09	
11/26/09	
11/27/09	
11/28/09	
11/29/09	
11/30/09	
12/1/09	
12/2/09	

12/3/09	
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12/11/09	
12/12/09	
12/13/09	
12/14/09	
12/15/09	
12/16/09	
12/17/09	
12/18/09	
12/19/09	
12/20/09	
12/21/09	
12/22/09	
12/23/09	
12/24/09	
12/25/09	
12/26/09	
12/27/09	
12/28/09	
12/29/09	
12/30/09	
12/31/09	

Appendix C
Wastewater Discharge Information for the City of Wishek

Discharges for the City of Wishek

Cell	Start	End	Days	Amount	Unit
Cell 3	2009-7-1 12:00 AM	2009-7-8 12:00 AM	8	6.534	MGAL
Cell 2	2009-4-21 12:00 AM	2009-4-24 12:00 AM	4	3.789	MGAL
Cell 3	2008-5-30 12:00 AM	2008-6-6 12:00 AM	8	6.534	MGAL
Cell 2	2007-5-10 12:00 AM	2007-5-17 12:00 AM	8	7.579	MGAL
Cell 2 &3	2006-3-31 12:00 AM	2006-4-6 12:00 AM	7	14.113	MGAL
Cell 2	2003-6-17 12:00 AM	2003-6-24 12:00 AM	7	7.579	MGAL
Cell 2	2002-6-12 12:00 AM	2002-6-19 12:00 AM	8	7.579	MGAL
Cell 3	2001-10-15 12:00 AM	2001-10-17 12:00 AM	3	6.534	MGAL
Cell 3	2001-6-29 12:00 AM	2001-7-4 12:00 AM	6	6.534	MGAL
Cell 2	2001-4-18 12:00 AM	2001-4-23 12:00 AM	6	7.579	MGAL
Cell 3	2000-11-2 12:00 AM	2000-11-8 12:00 AM	7	6.534	MGAL
Cell 2 & 3	2000-4-6 12:00 AM	2000-4-13 12:00 AM	8	10.323	MGAL
Cell 3	1999-11-12 12:00 AM	1999-11-19 12:00 AM	8	6.534	MGAL
Cell 3	1999-6-8 12:00 AM	1999-6-14 12:00 AM	7	6.53	MGAL
Cell 3	1999-4-19 12:00 AM	1999-4-26 12:00 AM	8	6.53	MGAL
Cell 3	1998-7-1 12:00 AM	1998-12-31 12:00 AM	5	6.53	MGAL
Cell 2	1998-1-1 12:00 AM	1998-6-30 12:00 AM	8	7.58	MGAL
Cell 2	1997-7-1 12:00 AM	1997-12-31 12:00 AM	7	7.58	MGAL
Cell 2	1997-3-31 12:00 AM	1997-4-7 12:00 AM	8	7.58	MGAL
Cell 2	1996-10-3 12:00 AM	1996-10-9 12:00 AM	7	7.58	MGAL
Cell 2	1996-8-5 12:00 AM	1996-8-6 12:00 AM	2	1.52	MGAL
Cell 2	1996-6-18 12:00 AM	1996-6-21 12:00 AM	4	5.68	MGAL
Cell 2	1996-4-18 12:00 AM	1996-4-24 12:00 AM	7	5.68	MGAL
Cell 2	1995-5-26 12:00 AM	1995-6-1 12:00 AM	7	7.58	MGAL
Cell 2	1995-4-17 12:00 AM	1995-4-24 12:00 AM	8	5.68	MGAL
		Average	6.64	6.9518	

Fecal Coliform Samples for Associated Discharges

	Start	End	Result	Unit	
	2009-7-1 12:00 AM	2009-7-8 12:00 AM	10	#/100mL	
	2009-4-21 12:00 AM	2009-4-24 12:00 AM	20	#/100mL	
	2008-5-30 12:00 AM	2008-6-6 12:00 AM	10	#/100mL	
	2007-5-10 12:00 AM	2007-5-17 12:00 AM	3800	#/100mL	
	2003-6-17 12:00 AM	2003-6-24 12:00 AM	10	#/100mL	
	2002-6-12 12:00 AM	2002-6-19 12:00 AM	950	#/100mL	

Appendix D
Watershed Size Percentages, Flow Regimes Per Listed Segment and Example Flow Duration Curve for Site 384056

Watershed Size and Flow Adjustment Percentages based on USGS Site 06354580			
Contributing Acres Above USGS Site	446,400.45		
ND 10130104-012-S_00			
Unnamed Tributary to Beaver Lake	62,722.34		14.05%
ND 10130104-010-S_00			
Beaver - Beaver Lake to South Branch	94,694.94		
	35,415.10	Doyles Lake	
	62,722.34	Unnamed Tributary	
	11,258.77	Beaver Lake	
	204,091.14		45.72%
ND 10130104-014-S_00			
South Branch Beaver Creek	114,212.44		25.59%
ND 10130104-007-S_00			
Beaver - South Branch to Spring Creek	69,435.64		
	114,212.44	South Branch Beaver Creek	
	35,415.10	Doyles Lake	
	62,722.34	Unnamed Tributary	
	94,694.94	Beaver Lake to South Branch	
	11,258.77	Beaver Lake	
	35,638.29	Clear Creek	
	23,022.95	Spring Creek	
	446,400.45		100.00%
ND 10130104-008-S_00			
Clear Creek	35,638.29		7.98%
ND 10130104-005-S_00			
Spring Creek	23,022.95		5.16%
ND 10130104-012-S_00			
Beaver - Spring to Sand	22,217.51		
	69,435.64	Beaver - South Branch to Spring Creek	
	35,415.10	Doyles Lake	
	62,722.34	Unnamed Tributary	
	94,694.94	Beaver Lake to South Branch	
	11,258.77	Beaver Lake	
	114,212.44	South Branch - Beaver Creek	
	35,638.29	Clear Creek	
	23,022.95	Spring Creek	
	31,224.17	Sand Creek	
	499,842.14		111.97%
ND 10130104-004-S_00			
Sand Creek	46,828.15		10.49%
ND 10130104-001-S_00			
Sand to Oahe	34,734.39		
	69,435.64	Beaver - South Branch to Spring Creek	
	35,415.10	Doyles Lake - Unlisted	
	62,722.34	Unnamed Tributary	
	94,694.94	Beaver Lake to South Branch	
	11,258.77	Beaver Lake- Unlisted	
	114,212.44	South Branch - Beaver Creek	
	35,638.29	Clear Creek	
	23,022.95	Spring Creek	
	22,217.51	Beaver - Spring to Sand	
	46,828.15	Sand Creek	
	550,180.49		123.25%

Flow Regimes Selected for Each STORET Site

384050

Flow Regimes		
Name	**Start**	**End**
High	0.01%	8.00%
Moist	8.00%	50.00%
Dry	50.00%	91.00%
Low	91.00%	98.00%

384054

Flow Regimes		
Name	**Start**	**End**
High	0.01%	8.00%
Moist	8.00%	48.00%
Dry	48.00%	90.00%
Low	90.00%	97.00%

384051

Flow Regimes		
Name	**Start**	**End**
High	0.01%	8.00%
Moist	8.00%	50.00%
Dry	50.00%	90.00%
Low	90.00%	99.00%

384055

Flow Regimes		
Name	**Start**	**End**
High	0.01%	8.00%
Moist	8.00%	48.00%
Dry	48.00%	86.00%
Low	86.00%	96.00%

384053

Flow Regimes		
Name	**Start**	**End**
High	0.01%	7.00%
Moist	7.00%	48.00%
Dry	48.00%	90.00%
Low	90.00%	99.00%

384056

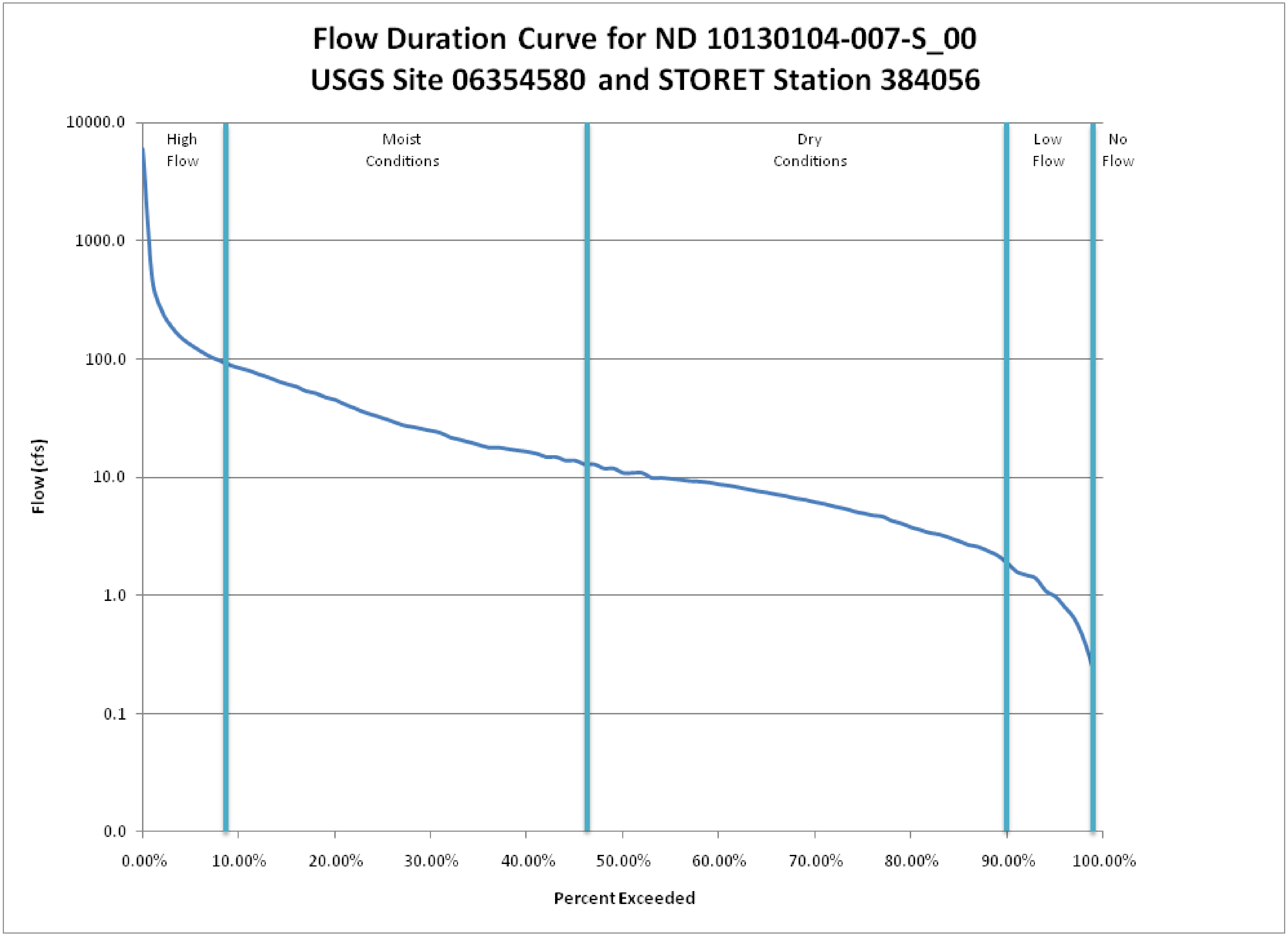
Flow Regimes		
Name	**Start**	**End**
High	0.01%	8.00%
Moist	8.00%	48.00%
Dry	48.00%	90.00%
Low	90.00%	99.00%

384057

Flow Regimes		
Name	**Start**	**End**
High	0.01%	8.00%
Moist	8.00%	48.00%
Dry	48.00%	89.00%
Low	89.00%	99.00%

384058

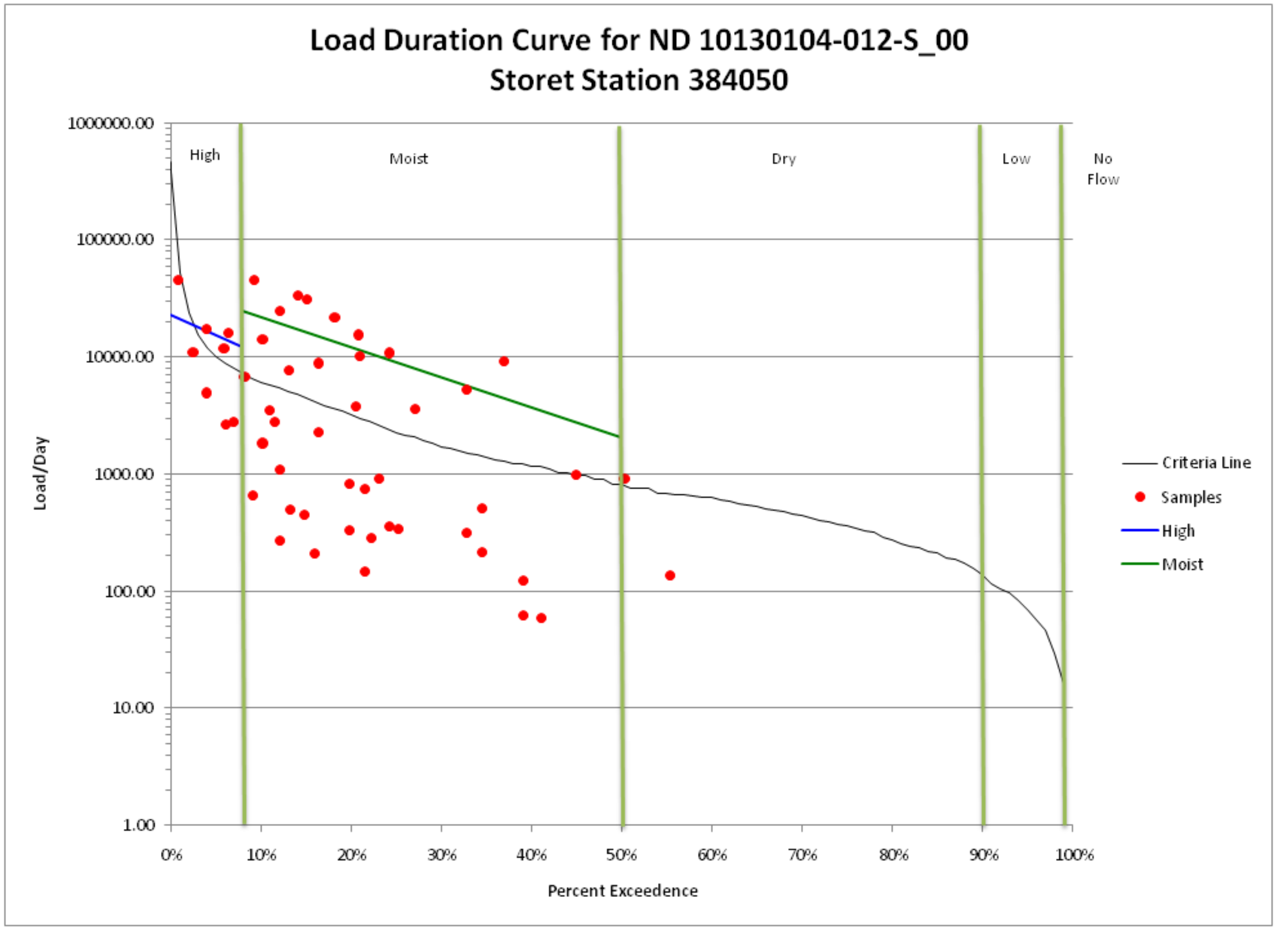
Flow Regimes		
Name	**Start**	**End**
High	0.01%	8.00%
Moist	8.00%	48.00%
Dry	48.00%	91.00%
Low	91.00%	99.00%


Flow Duration Curve for ND 10130104-007-S_00
USGS Site 06354580 and STORET Station 384056
High Flow
Moist Conditions
Dry Conditions
Low Flow
No Flow
10000.0
1000.0
100.0
10.0
1.0
0.1
0.0
Flow (cfs)
0.00%
10.00%
20.00%
30.00%
40.00%
50.00%
60.00%
70.00%
80.00%
90.00%
100.00%
Percent Exceeded

Appendix E
Estimated Loads, TMDL Target, Percentage of Reduction Required and Load Duration Curves for Listed Segments in the Beaver Creek Watershed

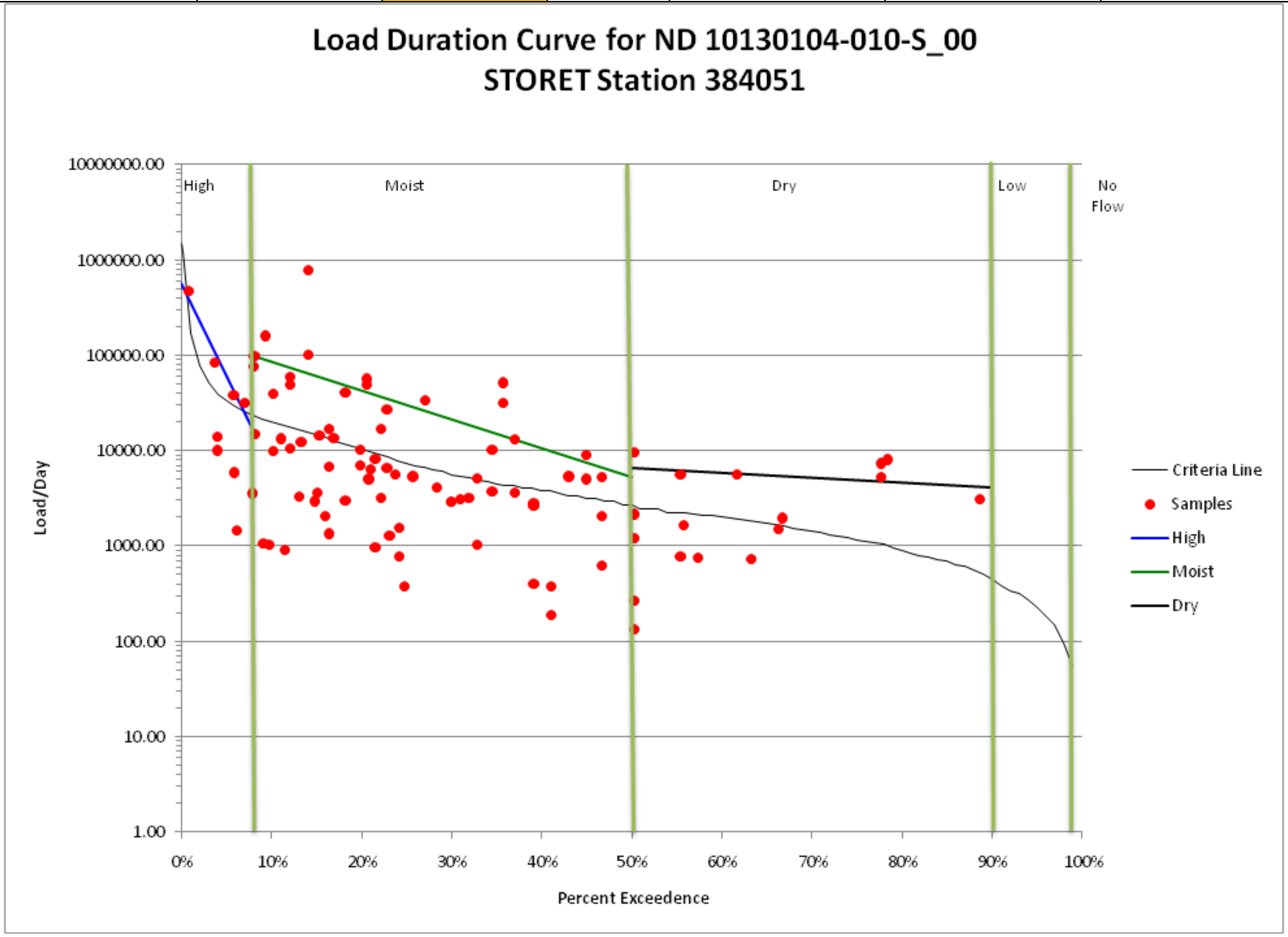
Assessment Unit ID ND-10130104-012-S_00 as represented by Site 384050

	Load (Million CFU/Day)				Load (Million CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.01%	16637.07	12065.37	29.16	485195.32	351868.34	27.48%
Moist	29.00%	7124.13	1856.46	153.30	1092129.11	284595.64	73.94%
			Total	182	1577324	636464	59.65%



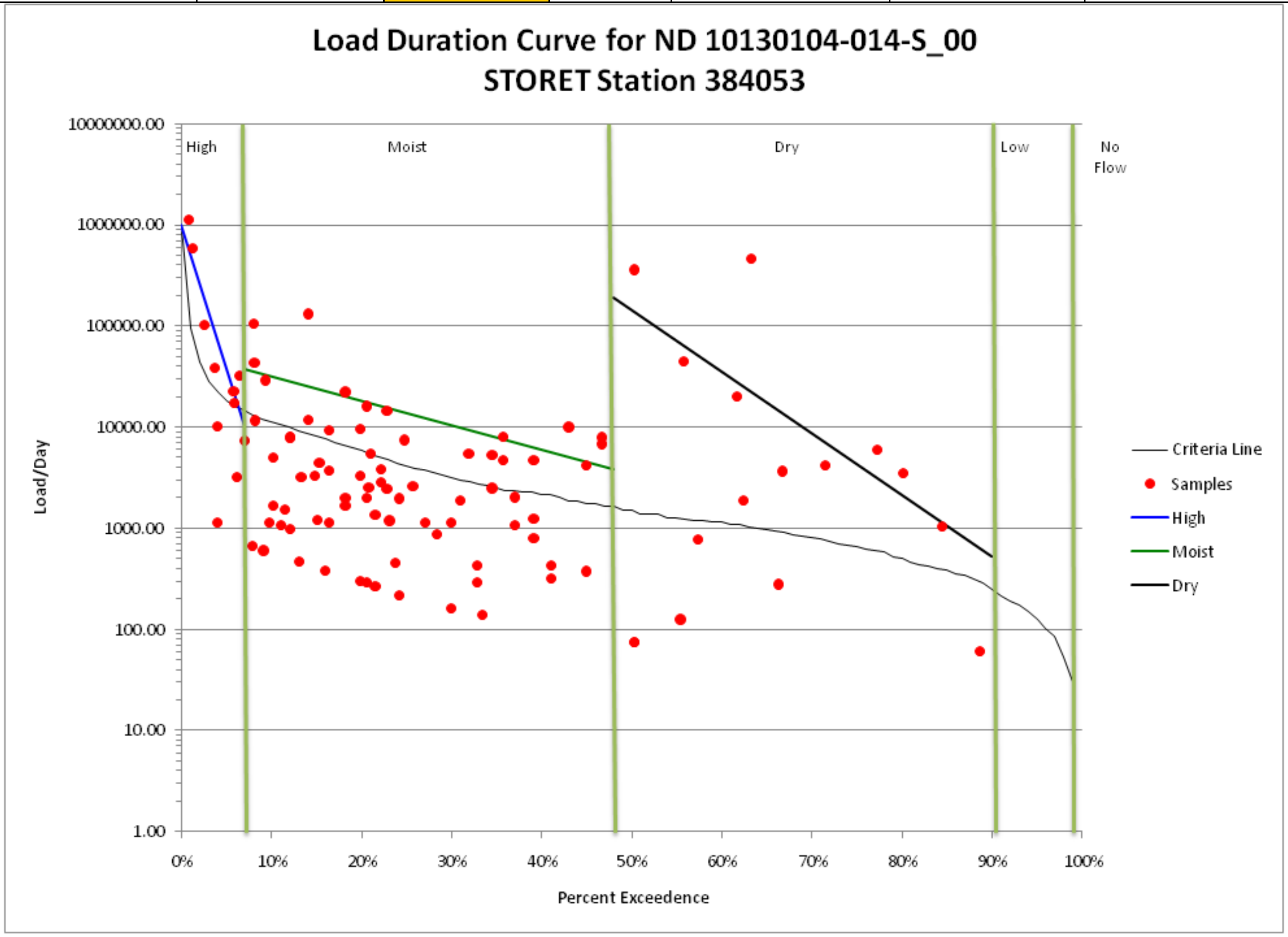
Assessment Unit ID ND-10130104-010-S_00 as represented by Site 384051

	Load (Million CFU/Day)				Load (Million CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.01%	95333.32	39261.82	29.16	2780253.34	1145012.14	58.82%
Moist	29.00%	22729.38	6041.10	153.30	3484413.56	926100.55	73.42%
Dry	70.00%	5216.94	1431.96	146.00	761672.78	209066.79	72.55%
			Total	328	7026340	2280179	67.55%



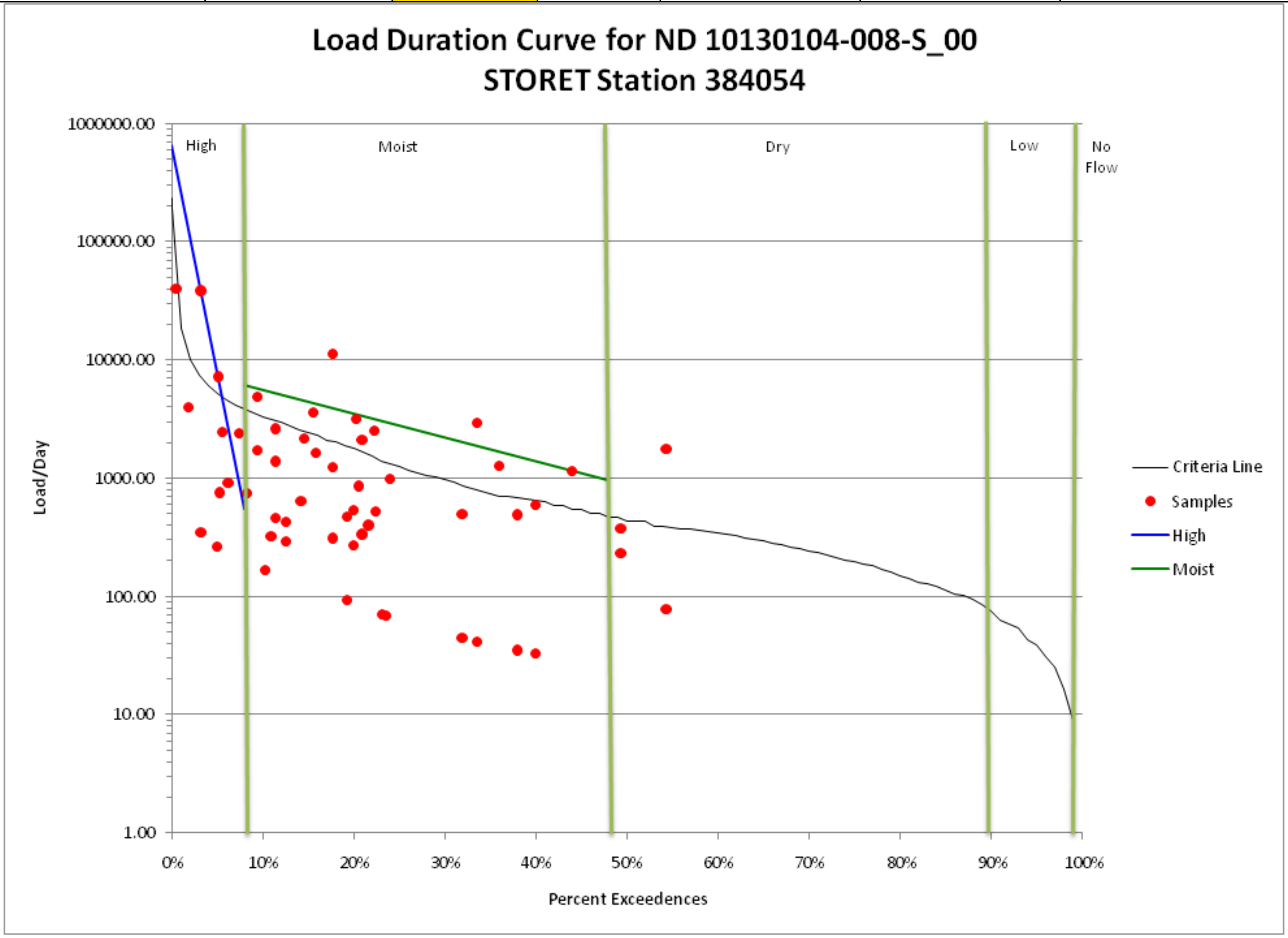
Assessment Unit ID ND-10130104-014-S_00 as represented by Site 384053

	Load (Million CFU/Day)				Load (Million CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	3.51%	101025.19	25046.46	25.51	2577506.14	639022.76	75.21%
Moist	27.50%	11957.08	3631.74	149.65	1789377.71	543489.31	69.63%
Dry	69.00%	9948.76	826.53	153.30	1525144.79	126707.52	91.69%
			Total	328	5892029	1309220	77.78%



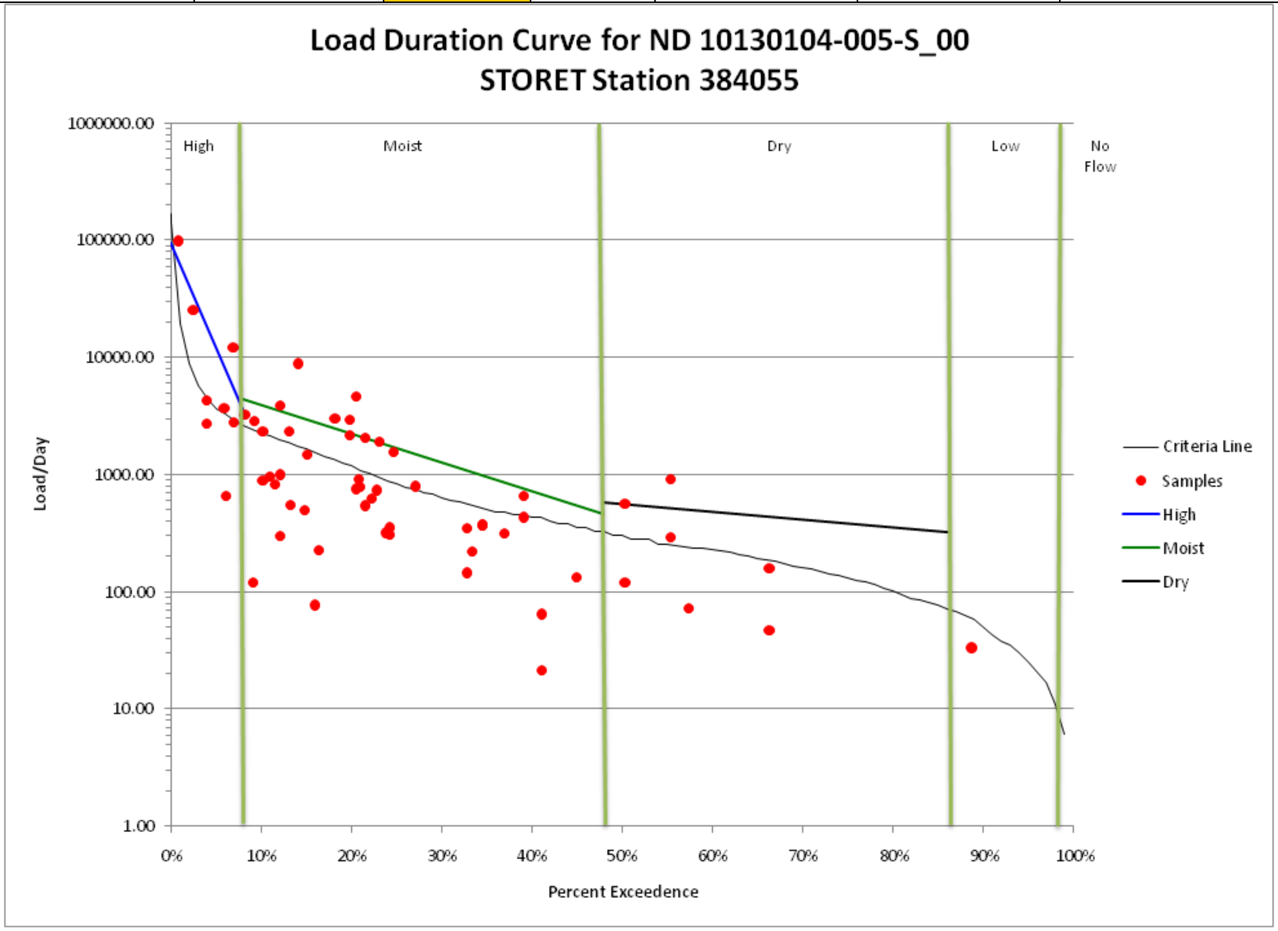
Assessment Unit ID ND-10130104-008-S_00 as represented by Site 384054

	Load (Million CFU/Day)				Load (Million CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.01%	18986.57	5972.31	29.16	553714.93	174173.39	68.54%
Moist	28.00%	2439.01	1054.42	146.00	356095.34	153944.97	56.77%
			Total	175	909810	328118	63.94%



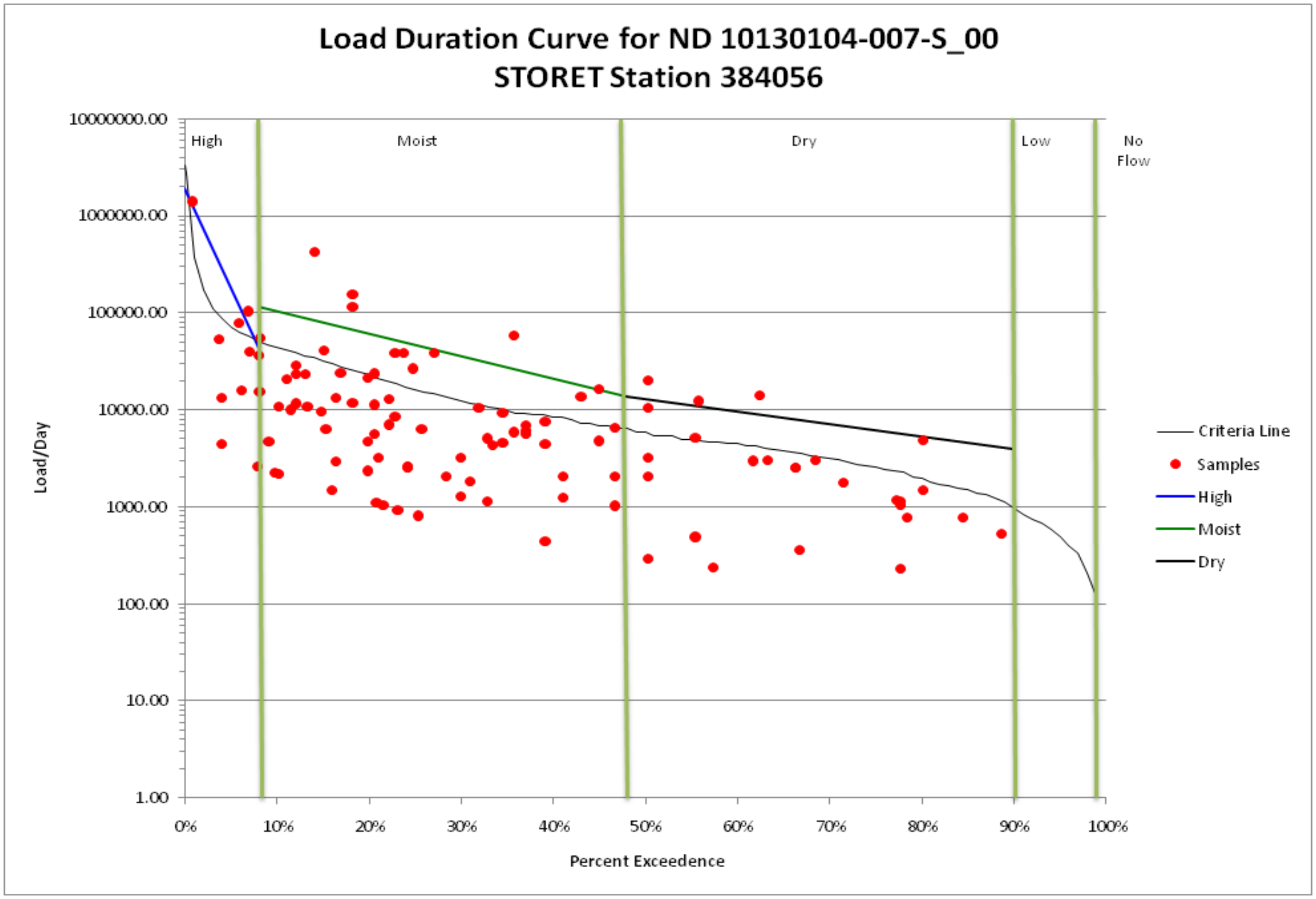
Assessment Unit ID ND-10130104-005-S_00 as represented by Site 384055

	Load (Million CFU/Day)				Load (Million CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.01%	18489.38	4431.12	29.16	539214.95	129227.09	76.03%
Moist	28.00%	1420.31	707.06	146.00	207365.73	103230.16	50.22%
Dry	67.00%	431.03	181.81	138.70	59783.80	25217.65	57.82%
			Total	314	806364	257675	68.04%



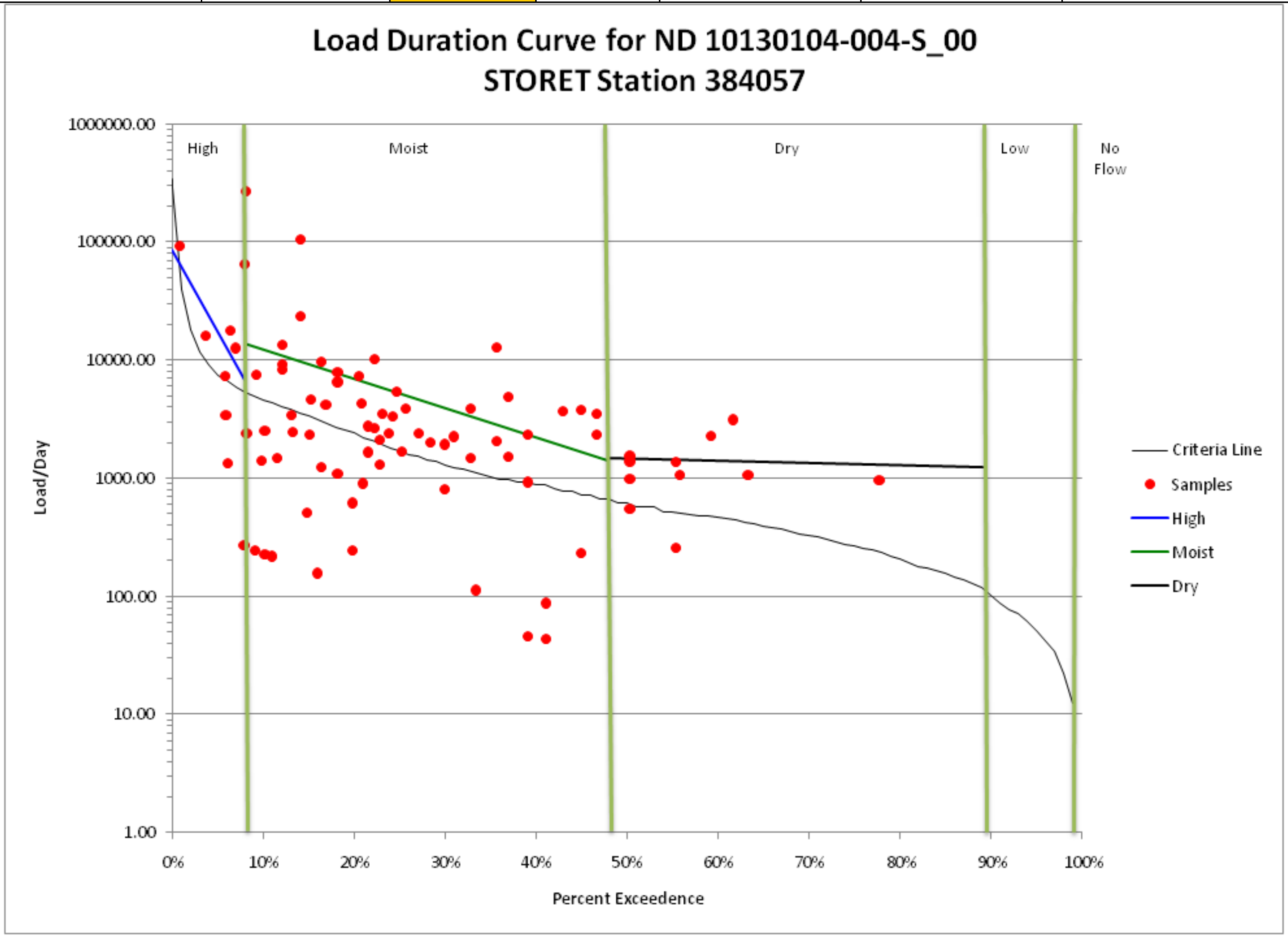
Assessment Unit ID ND-10130104-007-S_00 as represented by Site 384056

	Load (Million CFU/Day)				Load (Million CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.01%	288649.08	85874.50	29.16	8418017.40	2504401.00	70.25%
Moist	28.00%	39886.32	13702.63	146.00	5823402.84	2000584.46	65.65%
Dry	69.00%	7360.48	3229.91	153.30	1128362.33	495144.65	56.12%
			Total	328	15369783	5000130	67.47%



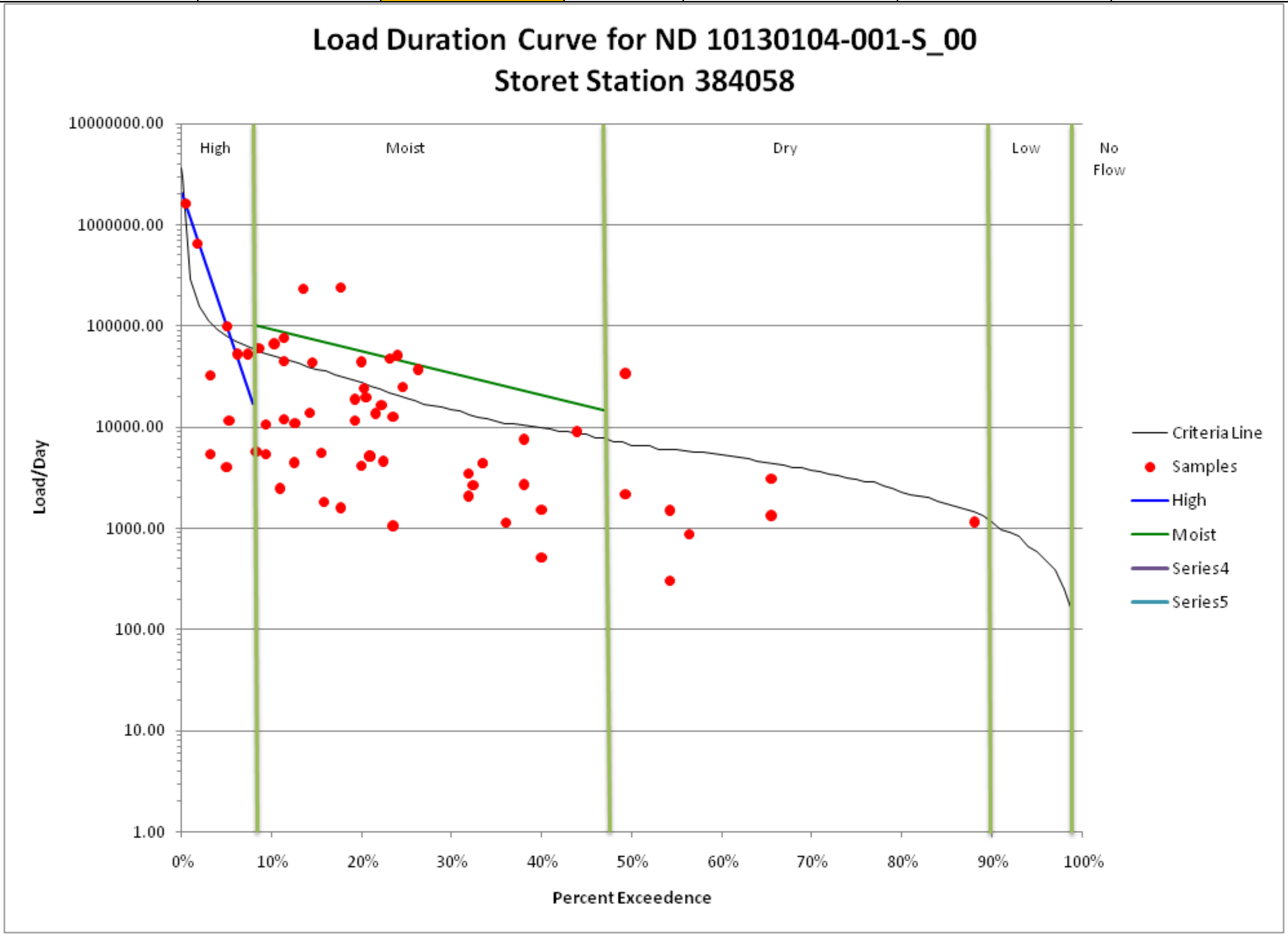
Assessment Unit ID ND-10130104-004-S_00 as represented by Site 384057

	Load (Million CFU/Day)				Load (Million CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.01%	23920.52	9008.24	29.16	697606.06	262711.66	62.34%
Moist	28.00%	4422.88	1437.41	146.00	645740.72	209861.31	67.50%
Dry	68.50%	1355.88	343.95	149.65	202906.78	51472.23	74.63%
			Total	325	1546254	524045	66.11%



Assessment Unit ID ND-10130104-001-S_00 as represented by Site 384058

	Load (Million CFU/Day)				Load (Million CFU/Period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Percent Reduction
High	4.01%	281897.86	105840.32	29.16	8221128.09	3086674.23	62.45%
Moist	28.00%	39198.41	16888.50	146.00	5722967.99	2465720.35	56.92%
			Total	175	13944096	5552395	60.18%



Appendix F
US EPA Region VII Public Notice Review

EPA REGION VIII TMDL REVIEW

TMDL Document Info:

Document Name:	**Fecal Coliform Bacteria TMDLs for Beaver Creek and its Tributaries in Emmons, McIntosh and Logan Counties, North Dakota**
Submitted by:	**Mike Ell, North Dakota Department of Health**
Date Received:	**August 26, 2010**
Review Date:	**September 7, 2010**
Reviewer:	**Vern Berry, EPA**
Rough Draft / Public Notice / Final?	**Public Notice**
Notes:	

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

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

Approval Notes to Administrator:

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

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

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

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

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

1. Problem Description

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

1.1 TMDL Document Submittal Letter

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

Minimum Submission Requirements.

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

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

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

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

SUMMARY: The public notice draft Beaver Creek fecal coliform TMDLs were submitted to EPA for review via an email from Mike Ell, NDDoH on August 26, 2010. The email included the draft TMDL document and a request to review and comment on the TMDL document.

COMMENTS: None.

1.2 Identification of the Waterbody, Impairments, and Study Boundaries

The TMDL document should provide an unambiguous description of the waterbody to which the TMDL is intended to apply and the impairments the TMDL is intended to address. The document should also clearly delineate the physical boundaries of the waterbody and the geographical extent of the watershed area studied.

Any additional information needed to tie the TMDL document back to a current 303(d) listing should also be included.

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The Beaver Creek watershed is a 662,392 acre watershed located in Emmons, Logan and McIntosh Counties, in south central North Dakota. The listed segments are: 1) Beaver Creek from its confluence with Sand Creek downstream to Lake Oahe (8.43 miles; ND-10130104-001-S_00); 2) Beaver Creek from its confluence with Spring Creek downstream to its confluence with Sand Creek (14.9 miles; ND-10130104-003-S_00); 3) Sand Creek and tributaries (108.56 miles; ND-10130104-004-S_00); 4) Spring Creek and tributaries (63.14 miles; ND 10130104-005-S_00); 5) Beaver Creek from its confluence with the South Branch Beaver Creek downstream to its confluence with Spring Creek (37.68 miles; ND-10130104-007-S_00); 6) Clear Creek and tributaries (108.95 miles; ND-10130104-008-S_00); 7) Beaver Lake downstream to its confluence with the South Branch Beaver Creek (38.92 miles; ND-10130104-010-S_00); 8) Unnamed tributary on the south side of Beaver Lake (158.02 miles; ND-10130104-012-S_00); and 9) South Branch Beaver Creek from its confluence with the South Branch Beaver Creek Watershed (ND-10130104-015-S) downstream to its confluence with Beaver Creek (43.45 miles; ND-10130104-014-S_00). The Beaver Creek watershed is part of the larger Missouri River basin in the Beaver sub-basin (HUC 10130104). These segments are listed as impaired for fecal coliform bacteria and are a high priority for TMDL development.

The designated uses for Beaver Creek are based on the Class II stream classification, and uses for the listed tributaries to Beaver Creek are based on the Class III stream classification as defined in the ND water quality standards (NDCC 33-15-02.1-09).

COMMENTS: It would be helpful to include a map that showed each one of the listed segments, along with labels identifying each segment and its corresponding monitoring location. From the map in Figure 5 it is impossible to tell where the listed segments are (e.g., 001 or 007), or one from another.

1.3 Water Quality Standards

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

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

Minimum Submission Requirements:

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

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

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

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

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

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

SUMMARY: The Beaver Creek segments addressed by the TMDL document are impaired based on fecal coliform concentrations impacting the recreational uses. Beaver Creek is a Class II stream and its tributaries are Class III streams. The quality of the waters in Class II streams shall be suitable for the propagation and/or protection of resident fish species and other aquatic biota and for swimming, boating, and other water recreation. The quality of the waters shall be for irrigation, stock watering, and wildlife without injurious effects. The quality of the waters in Class III streams shall be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation and fish and aquatic biota. Also, the quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses. Numeric criteria for fecal coliforms and E. coli in North Dakota, Class II and III streams have been established and are presented in the excerpted Table 14 shown below. Discussion of additional applicable water quality standards for Beaver Creek can be found on pages 10 – 11 of the TMDL.

Table 14. North Dakota Fecal Coliform and E. coli Bacteria Standards for Class II and III Streams.

Parameter	Standard	
	Geometric Mean[1]	Maximum[2]
Fecal Coliform Bacteria	200 CFU/100 mL	400 CFU/100 mL
E. coli Bacteria	126 CFU/100 mL	409 CFU/100 mL

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

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

COMMENTS: None.

2. Water Quality Targets

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

Minimum Submission Requirements:

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

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

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

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

SUMMARY: The water quality targets for these TMDLs are based on the numeric water quality standards for fecal coliform bacteria based on the recreational beneficial uses for Beaver Creek and its tributaries. The targets for the Beaver Creek segments are the fecal coliform standard expressed as the 30-day geometric mean of 200 CFU/100 mL during the recreation season from May 1 to September 30. While the standard is intended to be expressed as the 30-day geometric mean, the target was used to compare to values from single grab samples. This ensures that the reductions necessary to achieve the targets will be protective of both the acute (single sample value) and chronic (geometric mean of 5 samples) standard.

North Dakota currently has both a fecal coliform bacteria standard and an E. coli bacteria standard. During the next triennial water quality standards review period, the Department will be eliminating the fecal coliform bacteria standard and will only have the E. coli standard for bacteria. During this transition period to an E. coli only bacteria standard, the fecal coliform bacteria target for these TMDLs and the resulting load allocations are believed to be protective of the E. coli standard as well. The department will assess attainment of the E. coli standard through additional monitoring consistent with the state's water quality standards and beneficial use assessment methodology.

COMMENTS: None.

3. Pollutant Source Analysis

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

Minimum Submission Requirements:

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

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

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

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

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

SUMMARY: The TMDL document includes the cropland landuse breakdown for the watershed based on the 2009 National Agricultural Statistics Service data. Other landuses are not provided.

Within the Beaver Creek watershed, there is a municipal point source located in Wishek, ND located on segment ND-10130104-012-S_00. The Wishek facility discharges intermittently for short periods of time (6-8 days) into an unnamed tributary of segment ND-10130104-012-S_00 and enters Beaver Lake. A waste load allocation was calculated for the discharge from Wishek and is included in the TMDL for segment ND-10130104-012-S_00.

There are 18 (fourteen medium and four large) permitted CAFOs/AFOs in the watershed. They are zero discharge facilities and are not deemed a significant point source of fecal coliform bacteria loadings to Beaver Creek or its impaired tributaries.

The data collected during the water quality assessment and subsequent water quality improvement project indicate that the primary nonpoint sources for fecal coliform bacteria in the Beaver Creek watershed are as follows:

- Runoff of manure from cropland and pastureland;
- Runoff of manure from unpermitted animal feeding areas;

- Direct deposit of manure into Beaver Creek by grazing livestock; and
- Background levels associated with wildlife.

Animal feeding areas within the Beaver Creek watershed were identified as part of data collection effort for the assessment project. The identified animal feeding areas contained almost exclusively beef or dairy cattle.

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

COMMENTS: The landuse information in Section 1.3 includes a comparison of dominant crop types in 1997 and 2009. However, there is no information provided on the other landuses in the watershed. Typically, the most recent NASS data is used to describe the current landuse for all categories in the watershed. The comparison between 1997 and 2009 is interesting, but the most recent landuse is the most relevant. We recommend deleting the comparison and including the full landuse breakdown for 2009. It is helpful to know all of the landuses in the watershed in order to better understand the possible sources of fecal coliform to Beaver Creek and its tributaries.

4. TMDL Technical Analysis

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

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

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

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

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

Where:

TMDL = Total Pollutant Loading Capacity of the waterbody

LAs = Pollutant Load Allocations

WLAs = Pollutant Wasteload Allocations

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

Minimum Submission Requirements:

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

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

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

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

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

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

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

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

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

SUMMARY: The technical analysis should describe the cause and effect relationship between the identified pollutant sources, the numeric targets, and achievement of water quality standards. It should also include a description of the analytical processes used, results from water quality modeling, assumptions and other pertinent information. The technical analysis for the Beaver Creek watershed TMDLs describe how the fecal coliform loads were derived in order to meet the applicable water quality standards for the 303(d) impaired stream segments.

The TMDL loads and loading capacities were derived using the load duration curve (LDC) approach. To better correlate the relationship between the pollutant of concern and the hydrology of the Section 303(d) listed waterbodies, LDCs were developed for monitoring sites 384050, 384051 and 384053 - 384058. The LDCs were derived using the 200 CFU/100 mL TMDL target (i.e., state water quality standard), the daily flow records, and the observed fecal coliform data collected from each site (see Figure 7 of the TMDL document). Monitoring sites were sampled during the assessment period 1995-1996 and 1997-2009.

Flows used in the load duration curve analysis for TMDL listed segment ND-10130104-007-S_00 were based on the mean daily flow record for United States Geological Survey (USGS) gauging station 06354580 located on Beaver Creek below Linton, ND from 1995-2009. Flows used in the load duration curves for the remaining ungauged TMDL listed segments were estimated using the Drainage-Area Ratio Method developed by the USGS. The Drainage-Area Ratio Method assumes that the streamflow at an ungauged site is hydrologically similar to the stream gauging station used as an index. This assumption is justified since the ungauged sites are nested within the same 8-digit HUC as the gauged site. Drainage area and landuse for the ungauged sites and the index station (06354580) were determined through GIS using digital elevation models (DEMs) and the 2006 NASS landuse database. The index station (06354580) streamflow data were 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 to obtain estimated flow statistics for the ungauged sites.

The load duration curves plot the allowable fecal coliform load (using the 200 CFU/100 mL standard) across the four flow regimes. Single grab sample fecal coliform concentrations were converted to loads by multiplying by flow and a conversion factor to produce CFU/day values. Each value was plotted individually on the load duration curves. Values falling above the curves indicate exceedances of the TMDL at that flow value while values falling below the curves indicate attainment of the TMDLs at that flow.

Four flow regimes (i.e., High Flow, Moist Condition, Dry Condition, and Low Flow) were selected to represent the hydrology of the listed segments when applicable. The load duration curve for site 384056, representing TMDL segment ND 10130104-007-S_00, depicting the regression relationship for each flow interval is provided in Figure 7 of the TMDL as an example. Load duration curves for all other TMDL listed segments are provided in Appendix E of the TMDL document.

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

The LDCs represent flow-variable TMDL targets across the flow regimes shown in the TMDL document. For the Beaver Creek segments covered by the TMDL document, the LDCs are dynamic expressions of the allowable load for any given daily flow. Loading capacities were derived from this approach for the both listed segments at each flow regime. Tables 18 - 26 show the loading capacity load (i.e., TMDL load) for the listed segments of the Beaver Creek.

Developing the TMDL for Section 303(d) listed waterbody ND-10130104-003-S_00 was complicated by the lack of a monitoring site within the listed segment. Existing loads and TMDL loads for this waterbody for each flow regime were, therefore, estimated by averaging the estimated existing loads for each site immediately upstream (384051 and 384056) and downstream (384058). The TMDL target loads for each flow regime are provided in Table 15 of the TMDL document.

COMMENTS: None.

4.1 Data Set Description

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

Minimum Submission Requirements:

- ☒ TMDL documents should include a thorough description and summary of all available water quality data that are relevant to the water quality assessment and TMDL analysis such that the water quality impairments are clearly defined and linked to the impaired beneficial uses and appropriate water quality criteria.
- ☒ The TMDL document submitted should be accompanied by the data set utilized during the TMDL analysis. If possible, it is preferred that the data set be provided in an electronic format and referenced in the document. If electronic submission of the data is not possible, the data set may be included as an appendix to the document.

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

SUMMARY: The Beaver Creek TMDL data description and summary are included in the Available Data section, in tables throughout the document and in the data tables in Appendix A. Recent water quality monitoring was conducted from 1996-2009 (see Table 12 excerpted from the TMDL document below). The data set also includes approximately 15 years of flow records from USGS gauging site 06354580. This gauging site is co-located with the water quality monitoring station 384056. The flow data, along with the TMDL targets and water quality data were used to develop the fecal coliform load duration curves for the impaired segments of the Beaver Creek.

Table 12. Water Quality Monitoring Sites in the Beaver Creek Watershed.

Station ID	Description	Waterbody ID	Monitoring Period	Sample Number
384050	Tributary to Beaver Lake	ND-10130104-012-S_00	1996-2005	168
384051	Beaver Creek	ND-10130104-010-S_00	1996-2009	231
384053	South Branch Beaver Creek	ND-10130104-014-S_00	1996-2009	236
384054	Beaver Creek	ND-10130104-008-S_00	1996-2005	170
384055	Spring Creek	ND-10130104-005-S_00	1996-2005	184
384056	Beaver Creek	ND-10130104-007-S_00	1996-2009	251
384057	Sand Creek	ND-10130104-004-S_00	1996-2009	225
384058	Beaver Creek	ND-10130104-001-S_00	1996-2005	181

COMMENTS: None.

4.2 Waste Load Allocations (WLA):

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

Minimum Submission Requirements:

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

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

SUMMARY: Within the Beaver Creek watershed, there is one municipal point source located in Wishek, ND located on segment ND-10130104-012-S_00. This facility is permitted through the North Dakota Pollutant Discharge Elimination System (NDPDES) Program. The Wishek facility discharges intermittently for short periods of time (6-8 days) into an unnamed tributary that is part of TMDL listed segment ND-10130104-012-S_00 and enters Beaver Lake. From 1995-2009 the city of Wishek discharged 25 times averaging 6.64 days and 6.95 million gallons per discharge. Grab samples were taken once per discharge period as required by permit conditions. The concentration of fecal coliform bacteria reported in four of the six sampled events were 20 CFU/100 mL or less with two events reported as 950 CFU/100 mL or higher. As the majority of the samples were reported as 20 CFU/100 mL (equal to 79.2 x 107 CFU/day) or less, this value was used in the waste load allocation (WLA) for the TMDL for segment ND-10130104-012-S_00. Based on the city of Wishek's discharge monitoring report (DMR) data for the period 1995-2009, the city discharged 25 times. The average volume of wastewater discharged each time was 6.95 million gallons and the average discharge period was 6.64 days (range 5-8 days). Based on these assumptions a daily load of 79.2 x 107 CFUs/day is estimated for the WLA used for TMDL segment ND-10130104-012-S_00.

There are 18 (fourteen medium and four large) permitted CAFOs/AFOs in the watershed. However, they are zero discharge facilities and are not deemed a significant point source of fecal coliform bacteria loadings to Beaver Creek or its impaired tributaries.

COMMENTS: Using 20 cfu/100mL as the default concentration for the discharge from Wishek's wastewater facility is not a conservative assumption given that 1/3 of the samples were above 950 cfu/100mL. Calculating an average of the six samples, results in a concentration of 330 cfu/100mL or higher. If the City's permit contains a limit of 200 cfu/100 mL, then that value should be used to calculate the WLA allocation for Wishek's discharge.

4.3 Load Allocations (LA):

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The TMDL document includes the cropland landuse breakdown for the watershed based on the 2009 National Agricultural Statistics Service data. Other landuses are not provided. The majority of the crops grown consist of spring wheat, sunflowers, corn, soybeans, and barley. Unpermitted animal feeding operations are also present in the Beaver Creek watershed, but their number and location are unknown.

The load reductions needed for the Beaver Creek fecal coliform bacteria TMDL can be generally allotted to nonpoint sources. The most significant sources of total fecal coliform bacteria loading remain nonpoint source pollution originating from livestock. Based on the data available, the general focus of BMPs and load reductions for the listed segments should be on unpermitted animal feeding areas and critical pasture areas described in the assessment report. Higher priority should be given to the unpermitted animal feeding areas located in close proximity to Beaver Creek.

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

Source specific data are limited so an aggregate LA is assigned to nonpoint sources with a ranking of important contributors under various flow regimes provided as seen in the following excerpted table.

Table 16. Nonpoint Sources of Pollution and Their Potential to Pollute at a Given Flow Regime.

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

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

COMMENTS: None.

4.4 Margin of Safety (MOS):

Natural systems are inherently complex. Any mathematical relationship used to quantify the stressor → response relationship between pollutant loading rates and the resultant water quality impacts, no matter how rigorous, will include some level of uncertainty and error. To compensate for this uncertainty and ensure water quality standards will be attained, a margin of safety is required as a component of each TMDL. The MOS may take the form of a explicit load allocation (e.g., 10 lbs/day), or may be implicitly built into the TMDL analysis through the use of conservative assumptions and values for the various factors that determine the TMDL pollutant load → water quality effect relationship. Whether explicit or implicit, the MOS should be supported by an appropriate level of discussion that addresses the level of uncertainty in the various components of the TMDL technical analysis, the assumptions used in that analysis, and the relative effect of those assumptions on the final TMDL.

The discussion should demonstrate that the MOS used is sufficient to ensure that the water quality standards would be attained if the TMDL pollutant loading rates are met. In cases where there is substantial uncertainty regarding the linkage between the proposed allocations and achievement of water quality standards, it may be necessary to employ a phased or adaptive management approach (e.g., establish a monitoring plan to determine if the proposed allocations are, in fact, leading to the desired water quality improvements).

Minimum Submission Requirements:

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

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

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

SUMMARY: The Beaver Creek TMDLs include explicit MOSs for the listed segments derived by calculating 10 percent of the loading capacity. The explicit MOSs for the Beaver Creek segments are included in Tables 18 - 26 of the TMDL document.

COMMENTS: None.

4.5 Seasonality and variations in assimilative capacity:

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

Minimum Submission Requirements:

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

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

SUMMARY: By using the load duration curve approach to develop the TMDL allocations, seasonal variability in fecal coliform loads are taken into account. Highest steam flows typically occur during late spring, and the lowest stream flows occur during the winter months. Also, the TMDLs are seasonal since the fecal coliform criteria are in effect from May 1 to September 30, therefore the TMDLs are only applicable during that period.

COMMENTS: None.

5. Public Participation

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

Minimum Submission Requirements:

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

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

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

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

COMMENTS: None.

6. Monitoring Strategy

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

Minimum Submission Requirements:

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

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

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

SUMMARY: The 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 insure that the best management practices (BMPs) and technical assistance that were implemented as part of the Section 319 Beaver Creek Watershed Restoration Project are successful in reducing both fecal coliform and E. coli bacteria loadings to levels prescribed in this TMDL, water quality monitoring is being conducted in accordance with an approved Quality Assurance Project Plan.

COMMENTS: None.

7. Restoration Strategy

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

Minimum Submission Requirements:

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

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

SUMMARY: The Allocation section (Section 8.0) of the TMDL document includes a list of BMPs that are recommended to meet the TMDL loads. Local sponsors successfully applied for and received Section 319 funding for the Beaver Creek Watershed Restoration Project. Beginning in 1996, local sponsors provided technical assistance and implemented BMPs designed to reduce fecal coliform bacteria loadings and to help restore the beneficial uses of the Beaver Creek. In 2003 a Quality Assurance Project Plan was developed as part of this watershed restoration project that detailed the how, when and where monitoring would be conducted to gather the data needed to document success in meeting the TMDL implementation goal(s). As the data were gathered and analyzed, watershed restoration tasks were adapted, if necessary, to place BMPs where they would have the greatest benefit to water quality and in meeting the TMDL goal(s).

Also, as part of the implementation plan for this TMDL, it was recommended that the permitted point sources in the watershed be inspected to ensure that they are being operated in compliance with their permit conditions, and to verify that they aren't significant fecal coliform sources. Currently, all permitted CAFOs (greater than or equal to 1000 animal units) are inspected annually by the NDDoH. Permitted AFOs (<1000 animal units) in the Beaver Creek watershed are inspected on an as needed basis.

There are no significant permitted point sources in the watershed contributing to the bacteria load, so it's not necessary to fully document reasonable assurance demonstrating that the nonpoint source loadings are practicable.

COMMENTS: None.

8. Daily Loading Expression

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

Minimum Submission Requirements:

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

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

SUMMARY: The Beaver Creek fecal coliform TMDL document includes daily loads expressed as colonies per day for the listed segments of the river. The daily TMDL loads are included in TMDL section (Section 7.0) of the document.

COMMENTS: None.

Appendix G
North Dakota Department of Health Response to US EPA Region VIII Comments

US EPA Region VIII Comment: It would be helpful to include a map that showed each one of the listed segments, along with labels identifying each segment and its corresponding monitoring location. From the map in Figure 5 it is impossible to tell where the listed segments are (e.g., 001 or 007), or one from another.

NDDoH Response to Comment: Figure 2 has been added which shows each of the Section 303(d) listed segments.

US EPA Region VIII Comment: The landuse information in Section 1.3 includes a comparison of dominant crop types in 1997 and 2009. However, there is no information provided on the other landuses in the watershed. Typically, the most recent NASS data is used to describe the current landuse for all categories in the watershed. The comparison between 1997 and 2009 is interesting, but the most recent landuse is the most relevant. We recommend deleting the comparison and including the full landuse breakdown for 2009. It is helpful to know all of the landuses in the watershed in order to better understand the possible sources of fecal coliform to Beaver Creek and its tributaries

NDDoH Response to Comment: Section 1.3 and its accompanying Table 11 has been rewritten to describe all landuse types in the Beaver Creek watershed based on the 2009 NASS data.

US EPA Region VIII Comment: Using 20 cfu/100mL as the default concentration for the discharge from Wishek's wastewater facility is not a conservative assumption given that 1/3 of the samples were above 950 cfu/100mL. Calculating an average of the six samples, results in a concentration of 330 cfu/100mL or higher. If the City's permit contains a limit of 200 cfu/100 mL, then that value should be used to calculate the WLA allocation for Wishek's discharge

NDDoH Response to Comment: The Waste Load Allocation for the city of Wishek has been recalculated based on a 200 CFU/100 mL fecal coliform permit limit instead of assuming 20 CFU/100 mL.