North Dakota | Environmental Quality
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PUBLIC NOTICE STATEMENT

Public Notice Date: 07/26/2023 **Public Notice Number:** ND-2023-016

The North Dakota Department of Environmental Quality (NDDEQ) is requesting public comment on an *Escherichia coli (E. coli)* bacteria Total Maximum Daily Load (TMDL) report for the Wild Rice River and tributaries in Ransom and Sargent Counties, North Dakota.

Summary

A TMDL is the amount of a pollutant a water body can handle and still meet state water quality standards. Section 303(d) of the federal Clean Water Act and accompanying regulations (40 CFR 130.7) requires states develop TMDLs for water bodies not meeting water quality standards and designated beneficial uses, as shown on the state's Section 303(d) list. The Wild Rice River & Tributaries report develops TMDLs for water bodies not supporting recreation use due to high levels of *E. coli* bacteria and identifies sources and reductions needed.

Public Comments

Prior to proposing TMDLs for EPA (U.S. Environmental Protection Agency) approval, the NDDEQ is requesting public comment on the draft document. The document is available for review and download from the NDDEQ website http://deq.nd.gov/PublicNotice.aspx. Copies may be requested by calling 701.328.5210, or by mail or in person at the address below. Comments may also be sent via e-mail to ejoynt@nd.gov.

North Dakota Department of Environmental Quality
Division of Water Quality, Watershed Management Program
4201 Normandy St.
Bismarck, ND 58503

Persons wishing to comment on the draft document are invited to submit comments in writing to the address or e-mail above, postmarked or delivered no later than August 25, 2023. For further information on making public comments/public comment tips please visit: https://deq.nd.gov/PublicCommentTips.aspx. All comments received during the public notice period will be considered prior to proposing the TMDL for EPA approval.

The NDDEQ will consider every request for reasonable accommodation to provide an accessible meeting facility or other accommodation for people with disabilities, language interpretation for people with limited English proficiency (LEP), and translations of written material necessary to access programs and information. Language assistance services are available free of charge to you. To request accommodations, contact NDDEQ's Non-discrimination Coordinator at 701-328-5150 or deqEJ@nd.gov. TTY users may use Relay North Dakota at 711 or 1-800-366-6888.

PURPOSE

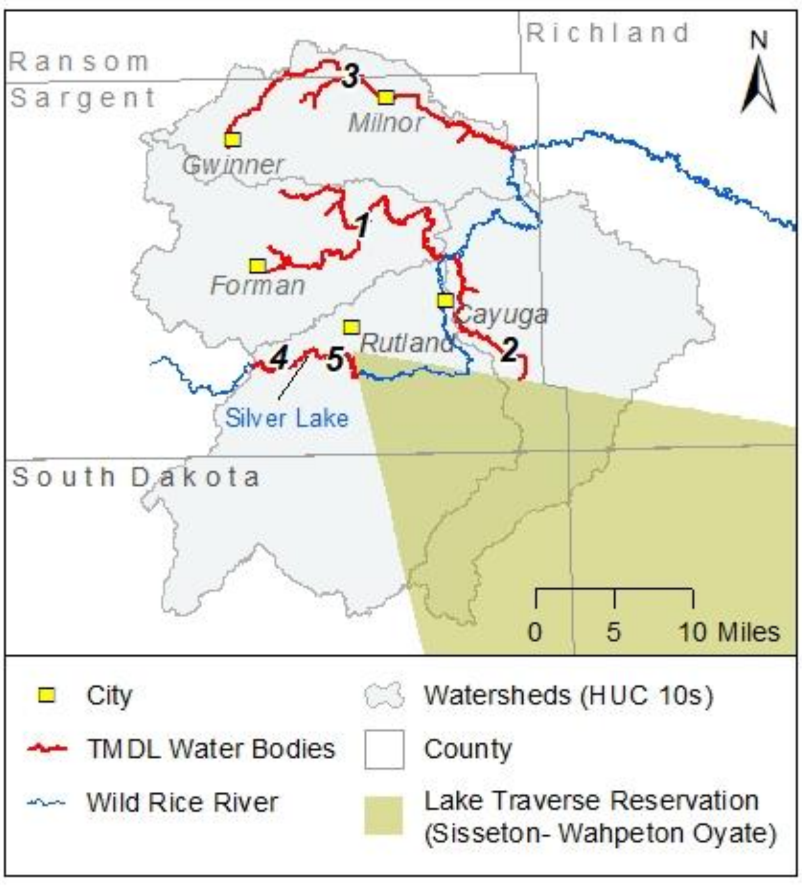
The federal Clean Water Act is a set of rules and programs helping states prevent and reduce water pollution. To support this goal, states must identify polluted waters and plan to restore their health. Part of this plan is developing a Total Maximum Daily Load (TMDL). A TMDL is the amount of a pollutant a water body can handle and still meet the state water quality standard.

Developing a TMDL is like writing a prescription for a water body - it determines how much of a pollutant is present, where it's coming from, and how it can be reduced to meet standards and restore water quality. Water quality standards protect the assigned uses of water bodies, such as drinking water or recreation. Water bodies not meeting water quality standards require a TMDL.

Wild Rice River and tributaries

This is a summary of the TMDL document for *Escherichia coli (E. coli)* bacteria in the Wild Rice River and tributaries in southeastern North Dakota. The document develops TMDLs for water bodies in Ransom and Sargent Counties that are not supporting recreation use due to high levels of *E. coli*. *E. coli* bacteria is common in human and animal digestive systems. As a result, *E. coli* in water suggests that sewage or animal waste is present. Water with high levels of *E. coli* can make people and animals sick and is unsafe to swim or recreate in.

The TMDL document is a tool to help restore the health of each water body and meet water quality standards. The five water bodies that TMDLs were developed for include:



1. *Crooked Creek watershed* to its confluence with the Wild Rice River (41 miles of stream).
2. *Shortfoot Creek* from its confluence with the Wild Rice River upstream to the reservation boundary, including all tributaries (18 miles of stream).
3. *Unnamed tributary to the Wild Rice River* located near Milnor in northeast Sargent County (39 miles of stream).
4. *Wild Rice River* from its confluence with Wild Rice Creek downstream to its confluence with Silver Lake (6 miles of stream).
5. *Wild Rice River* from its confluence with Silver Lake downstream to the reservation boundary (9 miles of stream).

HOW MUCH IS TOO MUCH?

North Dakota has water quality standards for *E. coli* that apply from May 1 to Sept. 30. All surface waters in the state are required to meet the *E. coli* standards so that the public can safely use waters for recreation. The standard has two conditions that BOTH apply to the amount of *E. coli* in surface water:

1. The monthly geometric mean of samples must be less than or equal to 126 CFU/100mL
2. No more than 10 percent of samples in a month can be greater than 409 CFU/100mL

E. coli bacteria is measured as colony forming units (CFU) in one-hundred milliliters (mL) of water. All five TMDL water bodies addressed in this document have *E. coli* levels higher than the standards. As a result, they are not meeting water quality standards and are not supporting recreation use.

WHERE IS IT COMING FROM?

High levels of *E. coli* bacteria are likely from more than one source, such as:

- Rain and snowmelt runoff from cropland and pasture
- Livestock in and near streams
- Leaking septic systems
- Wildlife
- Wastewater treatment facilities

Nearly half of the TMDL watershed area is used for crop production and another large part is open water and wetlands. In areas where manure is applied to cropland, *E. coli* can travel into streams, especially during rain events, snowmelt, and flooding. In addition, almost none of the area near water bodies is covered by trees or shrubs, which can buffer and help protect streams from *E. coli* in runoff.

Livestock grazing near water bodies in grasslands and pastures can add *E. coli* directly where livestock are in streams or through runoff.

Farms and isolated houses in the area likely use individual septic systems to treat household waste. If septic systems leak or fail, they can add *E. coli* to the watershed.

One water body, the Wild Rice River, flows through a national wildlife refuge. Each year, the hundreds of thousands of birds and other wildlife visiting the refuge and the surrounding area can add *E. coli* to the watershed.

Wastewater treatment facilities in the area are small lagoons permitted to discharge treated wastewater to surface water. Lagoons in this area rarely discharge (usually less than two times each year), but can also add *E. coli*.

E. coli in the Crooked Creek Watershed

Forman has a small lagoon system permitted to discharge treated wastewater to Crooked Creek. Forman rarely discharges, but could be adding *E. coli* to the watershed. High levels of *E. coli* are likely coming from runoff sources. More than half of the watershed area is cropland. Manure applied to cropland could add large amounts of *E. coli* carried into streams with rain and snowmelt. The amount of *E. coli* in the watershed needs to be reduced by up to 83% to meet water quality standards.

E. coli in Shortfoot Creek

Cayuga has a small lagoon system permitted to discharge treated wastewater to Shortfoot Creek. Cayuga has not discharged in over 30 years, so it is not adding *E. coli*. High levels of *E. coli* are likely coming from runoff sources. More than half of the watershed area is cropland. Manure applied to cropland could add large amounts of *E. coli* carried into streams with rain and snowmelt. The amount of *E. coli* in the water body needs to be reduced by up to 81% to meet water quality standards.

E. coli in the unnamed tributary to the Wild Rice River

Gwinner and Milnor have small lagoon systems permitted to discharge treated wastewater to the unnamed tributary to the Wild Rice River. The lagoons usually discharge once every spring (and again after the recreation season ends) and could add *E. coli* to the water body. High levels of *E. coli* are likely coming from runoff sources. More than half of the watershed area is cropland. Manure applied to cropland could add large amounts of *E. coli* carried into streams with rain and snowmelt. The amount of *E. coli* in the water body needs to be reduced by up to 74% to meet water quality standards.

E. coli in the Wild Rice River (two sections)

Rutland has a small lagoon system permitted to discharge treated wastewater to a drainage ditch that flows into the Wild Rice River. Rutland rarely discharges but could add *E. coli* to the water body. High levels of *E. coli* are likely coming from runoff sources. About one third of the watershed area is cropland, and one-quarter of the watershed is grassland and pasture. Manure applied to cropland and grazing in grasslands and pasture could add *E. coli* carried into streams with rain and snowmelt. A large amount of *E. coli* may be coming from the large number of birds that visit the nearby national wildlife refuge in the spring and fall. The amount of *E. coli* in the water bodies needs to be reduced by up to 79% to meet the target TMDL and support water quality standards.

WHAT CAN WE DO ABOUT IT?

Wastewater treatment facilities with potential to add *E. coli* will have *E. coli* limits added to their discharge permits (during the recreation season, May 1 to Sept. 30). Assigning a limit of 126 CFU/100mL will ensure facility discharges meet water quality standards.

Runoff sources that add *E. coli* do not have permits with water quality limits. Instead, reducing *E. coli* from rain or snowmelt runoff relies on voluntary actions of landowners and residents in the watershed. Landowners can do their part with Best Management Practices (BMPs). BMPs are tested, cost-effective methods that help control pollution and support water quality. Some of the BMPs that could help reduce the amount of *E. coli* reaching the water bodies include:

- Vegetation barriers/buffers
- Cover crops
- Nutrient management planning
- Drainage water management
- Livestock access control
- Waste storage facilities

Other actions that can help:

- An area-wide study of septic systems
- An *E. coli* source tracking study
- Local demos and workshops on watershed practices

MAKING IT HAPPEN

The TMDL document can be used to help direct efforts and actions to areas and sources that make the most impact to reduce *E. coli* in the water bodies. Restoring water quality in the Wild Rice River and tributaries depends almost entirely on local support. Progress has been made over many years and continues thanks to landowners, residents, and the Wild Rice Soil Conservation District.

Soil Conservation Districts coordinate community conservation efforts. Each districts operates under a locally elected board and works directly with landowners to tackle local resource concerns, such as water quality. In 2022 the Wild Rice Soil Conservation District started a new project expected to cover 10 years. Phase 1 of the project focuses on watershed areas with high levels of nutrients and sediments. Although phase 1 of the project does not specifically focus on *E. coli*, many Best Management Practices that reduce nutrients and sediments can also reduce *E. coli*. The TMDL document recommends continuing *E. coli* sampling on the five TMDL water bodies and expanding sampling in areas where more data is needed to understand sources. Additional sampling will measure progress and help adjust planning to meet water quality standards.

E. coli Bacteria TMDLs for the Wild Rice River and its Tributaries in Ransom and Sargent Counties, North Dakota

Wild Rice River (photo by Matt Olson)

Tributary to the Wild Rice River

Crooked Creek

Shortfoot Creek

Draft:
July 2023

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E. coli Bacteria TMDLs for the Wild Rice River and its Tributaries in Ransom and Sargent Counties, North Dakota

ND-09020105-014-S_00
ND-09020105-016-S_00
ND-09020105-017-S_00
ND-09020105-018-S_00
ND-09020105-022-S_00

Doug Burgum, Governor
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ABBREVIATIONS AND ACRONYMS

AFO	Animal Feeding Operation
AU	Assessment Unit
BMP	Best Management Practice
CAFO	Confined Animal Feeding Operation
cfs	Cubic feet per second
CFU	Colony Forming Unit
DAR	Drainage Area Ratio
DMR	Discharge Monitoring Report
DWR	(North Dakota) Department of Water Resources
ECHO	Enforcement and Compliance History Online
EPA	U.S. Environmental Protection Agency
E. coli	*Escherichia coli*
ft asl	Feet above sea level
FDC	Flow Duration Curve
HUC	Hydrologic Unit Code
LA	Load Allocation
LDC	Load Duration Curve
mL	Milliliter
MOS	Margin of Safety
MGD	Million Gallons per Day
NASSCDL	National Agricultural Statistical Survey Cropland Data Layer
NDAC	North Dakota Administrative Code
NDPHL	North Dakota Public Health Laboratory
NRCS	Natural Resource Conservation Service
NDDEQ	North Dakota Department of Environmental Quality
NDPDES	North Dakota Pollutant Discharge Elimination System
NDAWN	North Dakota Agriculture Weather Network
POTW	Publicly Owned Treatment Works
SCD	Soil Conservation District
TMDL	Total Maximum Daily Load
USFWS	U.S. Fish and Wildlife Service
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WLA	Wasteload Allocation
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION AND DESCRIPTION OF THE WATERSHED

The Wild Rice River and its tributaries define the Western Wild Rice subbasin, a 1,431,010-acre HUC 8 (8-digit hydrologic unit code) in southeastern North Dakota, northeastern South Dakota, and the northwestern Lake Traverse Reservation. The Western Wild Rice unit is part of the greater Red River basin. The Wild Rice River drains directly to the Red River of the North near the city of Fargo, North Dakota (Figure 1, Table 1).

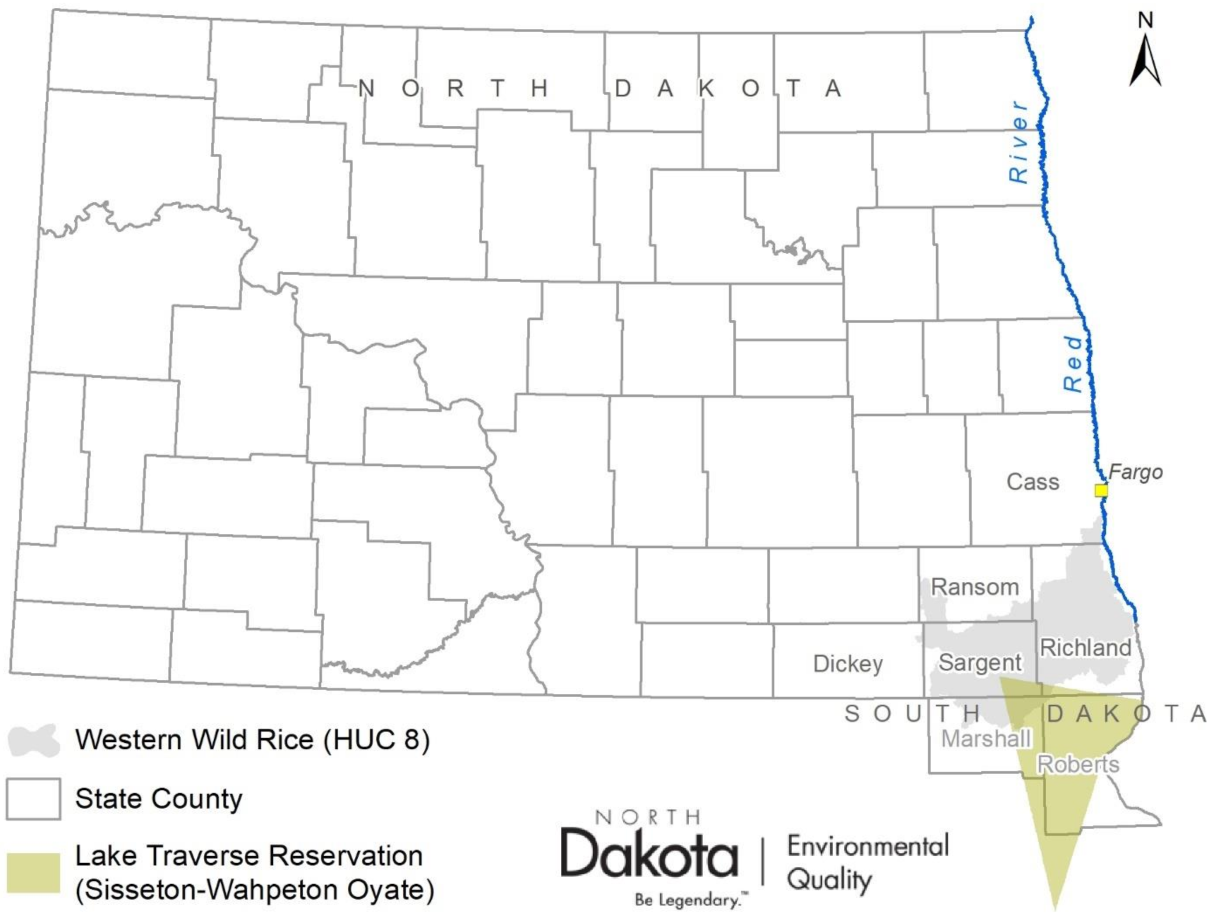

Figure 1. Location of Western Wild Rice subbasin (HUC 8) in North Dakota, South Dakota, and the Lake Traverse Reservation.

Table 1. General location and hydrologic characteristics of the Western Wild Rice subbasin.

Name	Western Wild Rice
Hydrologic Unit	09020105 (HUC 8)
Classification of Main Stream	Class II (Wild Rice River)
Area	1,431,010 acres
Counties and Tribal Land	North Dakota – Cass, Dickey, Ransom, Richland, Sargent South Dakota – Marshall, Roberts Tribal Land – Lake Traverse Reservation
Level III Ecoregions	Northern Glaciated Plains (46) Lake Agassiz Plain (48)
Major Drainage Basin	Red River

1.1 Clean Water Act Section 303(d) Listing Information

This report includes Total Maximum Daily Loads (TMDLs) for five assessment units (AUs) in the Western Wild Rice subbasin (HUC 8). The TMDLs for the five AUs are combined into one report based on their shared hydrologic characteristics (all AUs are within the same HUC 8) and their shared type of water quality impairment (*Escherichia coli* bacteria). The Western Wild Rice HUC 8 includes waters under other state (South Dakota) and federal (Lake Traverse Reservation via EPA) authority. However, the TMDLs developed in this report only address waters under the jurisdiction of the North Dakota Department of Environmental Quality (NDDEQ). Therefore, this report will describe the watershed as a whole, but will only develop TMDLs and allocations in the areas of the four watersheds that contain the five AUs as described in Table 2. The combined area of these watersheds is hereafter referred to as the Wild Rice Watersheds.

The North Dakota 2018 Section 303(d) List of Waters Needing Total Maximum Daily Loads is the most recently approved list of impaired waters and identifies 112.55 miles of stream segments in the Wild Rice Watersheds for TMDL development, representing the AUs. To clarify tribal boundaries, North Dakota has proposed new segment lengths and descriptions for two of the AUs (ND-09020105-016-S_00, ND-09020105-018-S_00). An additional AU (ND-09020105-017-S_00) was updated to correct a listing error where two tributaries for a separate watershed received an incorrect ID. The two small tributary segments to the Wild Rice River (previously assigned with ND-09020105-017-S_00) will be reassigned to ND-09020105-015-S_00 to reflect this correction. New segment lengths and descriptions will be submitted in the 2024 Integrated Report and are detailed in Table 2 and Figure 2.

Based on North Dakota Water Quality Standards and designated beneficial uses, the five AUs are considered not supporting for recreation due to *Escherichia coli (E. coli)* bacteria (NDDEQ, 2019). The North Dakota 2018 Section 303(d) List can be found in the 2018 Integrated Report on the North Dakota Department of Environmental Quality (NDDEQ) website (visit deq.nd.gov and enter “2018 Integrated Report” into Search box).

Table 2. Wild Rice Watersheds Section 303(d) listing information.

Assessment Unit ID	Size (miles)	Water Quality Stream Class	Description
ND-09020105-014-S_00	25.25	III	Unnamed tributary to the Wild Rice River (ND-09020105-012-S_00) located near Milnor, ND in NE Sargent County.
ND-09020105-016-S_00 *	18.07	III	Shortfoot Creek from its confluence with the Wild Rice River upstream to the reservation boundary, including all tributaries.
ND-09020105-017-S_00 *	40.70	III	Crooked Creek watershed to its confluence with Wild Rice River (ND-09020105-015-S_00).
ND-09020105-018-S_00 *	8.92	II	Wild Rice River from its confluence with the Silver Lake Diversion downstream to the reservation boundary.
ND-09020105-022-S_00	6.17	II	Wild Rice River from its confluence with Wild Rice Creek downstream to its confluence with the Silver Lake Diversion.
Designated Use	Recreation		
Use Support	Not Supporting		
Impairments	*E. coli*		
TMDL Priority Ranking	High		

*Updated AU sizes and descriptions will be recorded in the 2024 ND 303(d) list.

Section 303(d) segments ND-09020105-018-S_00 and ND-09020105-022-S_00 on the Wild Rice River are continuous in the Lake Tewaukon-Wild Rice River watershed and have been assigned separate unit IDs in North Dakota’s 2018 Integrated Report. Based on the availability of water quality data downstream of both segments, and their being continuous, the two IDs will be analyzed as one segment and will be represented by a single TMDL.

Additional segments of the Wild Rice River and tributaries have been listed on previous North Dakota Section 303(d) lists due to *E. coli* impairments for recreational use (Figure 2). Table 3 details *E. coli* TMDLs that have been approved by EPA for impaired segments directly upstream and downstream of the Wild Rice Watersheds. Assessment unit ND-09020105-016-S_00, addressed in this report, received an EPA approved TMDL in 2010 for recreational use impairment due to fecal coliform bacteria. North Dakota water quality standards have since been revised to use *E. coli* bacteria instead of fecal coliform for assessing recreational use. The *E. coli* TMDL developed in this report will therefore supersede the previous fecal coliform bacteria TMDL for ND-09020105-016-S_00.

Table 3. Approved *E. coli* TMDLs directly upstream and downstream of the Wild Rice Watersheds.

Assessment Unit ID	Size (miles)	Description	*E. coli* TMDL Approved by EPA
ND-09020105-012-S_00 *	45.68	Wild Rice River from its confluence with Shortfoot Creek downstream to its confluence with Elk Creek. Downstream of ND-09020105-016-S_00.	2018
ND-09020105-019-S_00	57.06	Wild Rice River upstream from its confluence with Wild Rice Creek, including all tributaries. Upstream of ND-09020105-022-S_00.	2011
ND-09020105-020-S_00	118.17	Wild Rice Creek from its confluence with the Wild Rice River upstream to the ND-SD border, including all tributaries. Upstream of ND-09020105-S_00.	2011

Notes:

To access TMDLs visit deq.nd.gov and enter “Completed TMDLs” into the Search box

* Assessment unit remains listed due to Sedimentation/Siltation and Combined Biota/Habitat Bioassessments impairments considered Not Supporting for Fish and Other Aquatic Biota

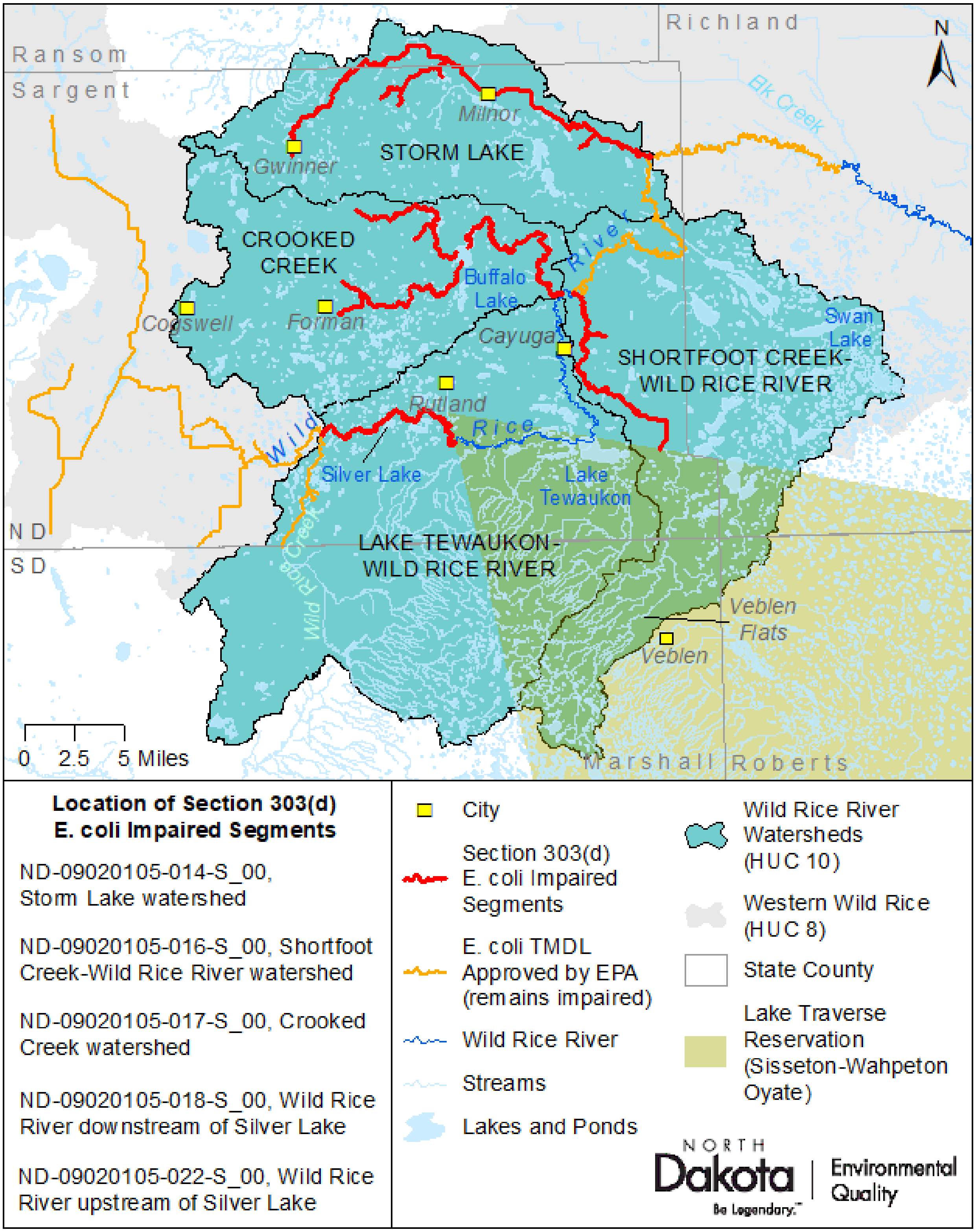

Figure 2. Location of *E. coli* TMDL segments in the Wild Rice Watersheds and adjacent sections with approved *E. coli* TMDLs.

1.2 Ecoregions

Ecological regions are delineated at multiple levels (I – V), and are based on geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology (Omernik, 1987). Recognition of similarities within a region, and dissimilarities across regions, are critical for successful development and implementation of environmental monitoring and assessment practices. Level IV regions are sufficiently detailed for state-level applications and are used in TMDL development for the state of North Dakota.

The Wild Rice Watersheds extends across the Northern Glaciated Plains and Lake Agassiz Plain (Omernik level III) ecoregions. The Northern Glaciated Plains are characterized by flat to gently rolling landscape of glacial drift with high concentrations of temporary and seasonal wetlands. The Glacial Lake Agassiz Plain is characterized by extremely flat landscape, the result of thick lakebed sediments deposited on top of glacial till (Bryce et. al, 1996).

This region has been shaped by series of glaciations, where glacial ice – and the flowing and ponding water associated with the ice – produced a variety of landforms (Bluemle 1979). From the south the Prairie Coteau reaches into the Wild Rice Watersheds area as tightly undulating, hummocky landscape with no drainage pattern and closely spaced semipermanent and seasonal wetlands (Bryce et al. 1996). The Coteau is bound by the Prairie Coteau Escarpment, which marks a distinct elevation change, dropping from over 2,000 feet to less than 1,200 feet upon meeting the Minnesota River Prairie and smooth Glacial Lake Basins below. The majority of the Wild Rice Watersheds area consists of the Tewaukon/Big Stone Stagnation Moraine, a poorly drained landscape dense with semipermanent wetlands. From the Moraine the area transitions to Drift Plains with wetlands more commonly temporary or seasonal. The level Drift Plains give way to the highly erosive Sand Deltas and Beach Ridges that border the extremely level and flood-prone Glacial Lake Agassiz Basin. Less extensive sections of the Wild Rice Watersheds also include areas of highly permeable Glacial Outwash and highly erodible Glacial Lake Deltas (Figure 3).

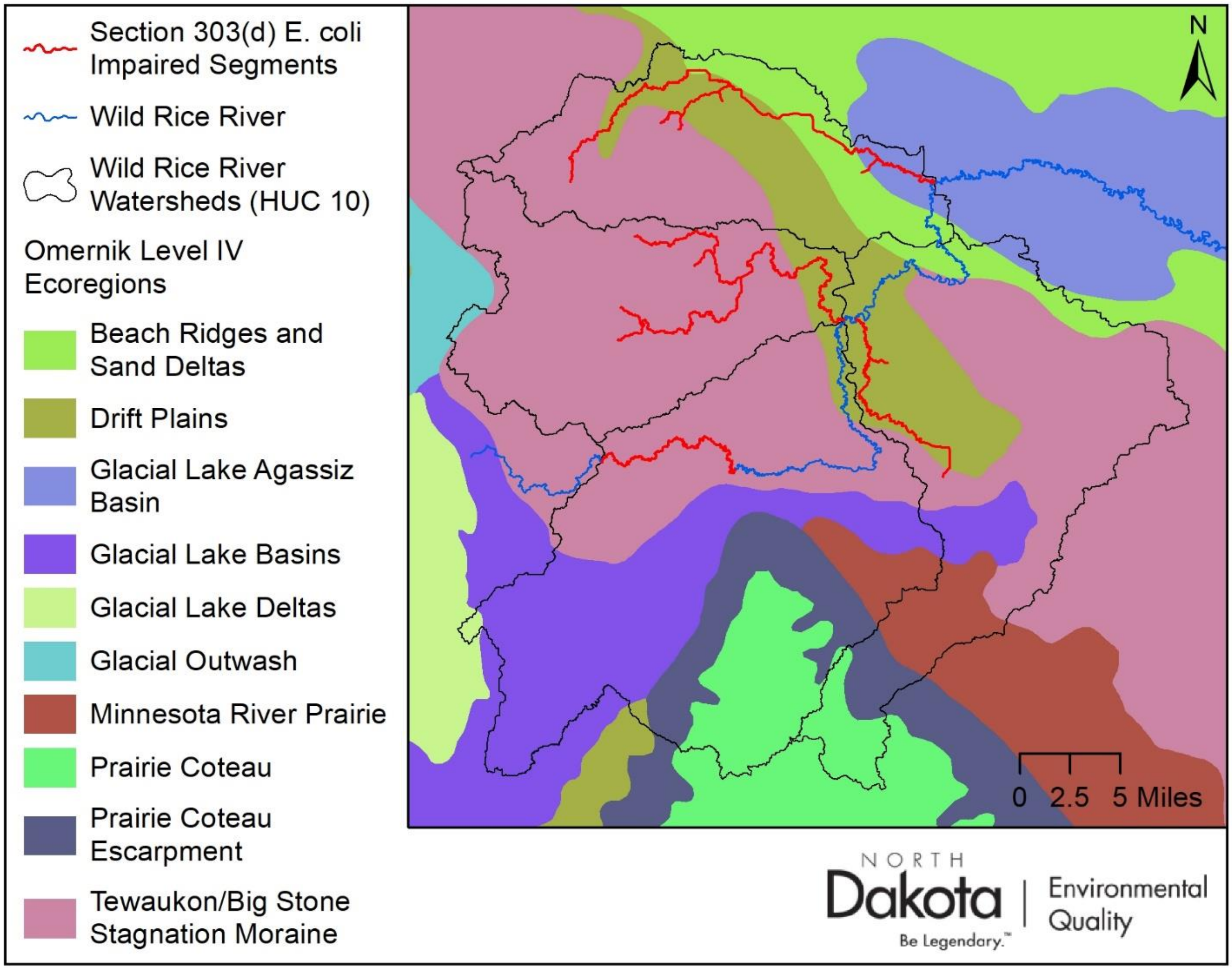

Figure 3. Level IV Ecoregions of the Wild Rice Watersheds.

The Wild Rice Watersheds spans an elevation range of 2,080 feet above sea level (ft asl) on the Prairie Coteau to 1,053 ft asl on the Beach Ridges and Sand Deltas of the Watersheds outlet. The Wild Rice River flows into the area at approximately 1,247 ft asl (Figure 4).

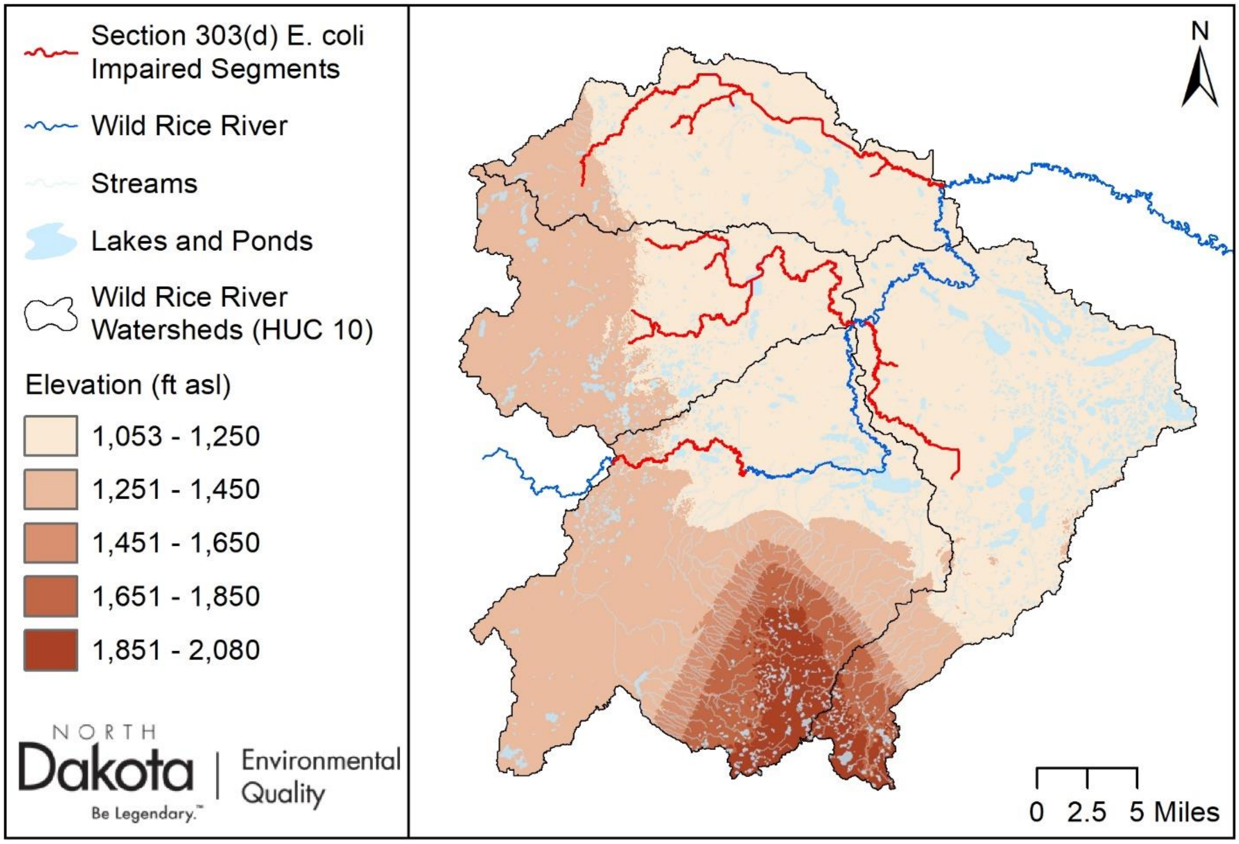

Figure 4. Topography of the Wild Rice Watersheds.

1.2.1 Land Use

The U.S. Department of Agriculture's (USDA) National Agricultural Statistical Survey (NASS) Cropland Data Layer (CDL) Program provides cropland acreage estimates based on satellite imagery and ground truth datasets. Annual imagery has a ground resolution of 30 or 56 meters, depending on location and year. NASSCDL 2020 data in the Wild Rice Watersheds has a resolution of 30 meters (USDA 2020).

Figure 5 shows land use in the Wild Rice Watersheds for the year 2020. Categories are listed in order of area, from largest (Soybeans) to smallest (Other Crops). Table 4 lists category details.

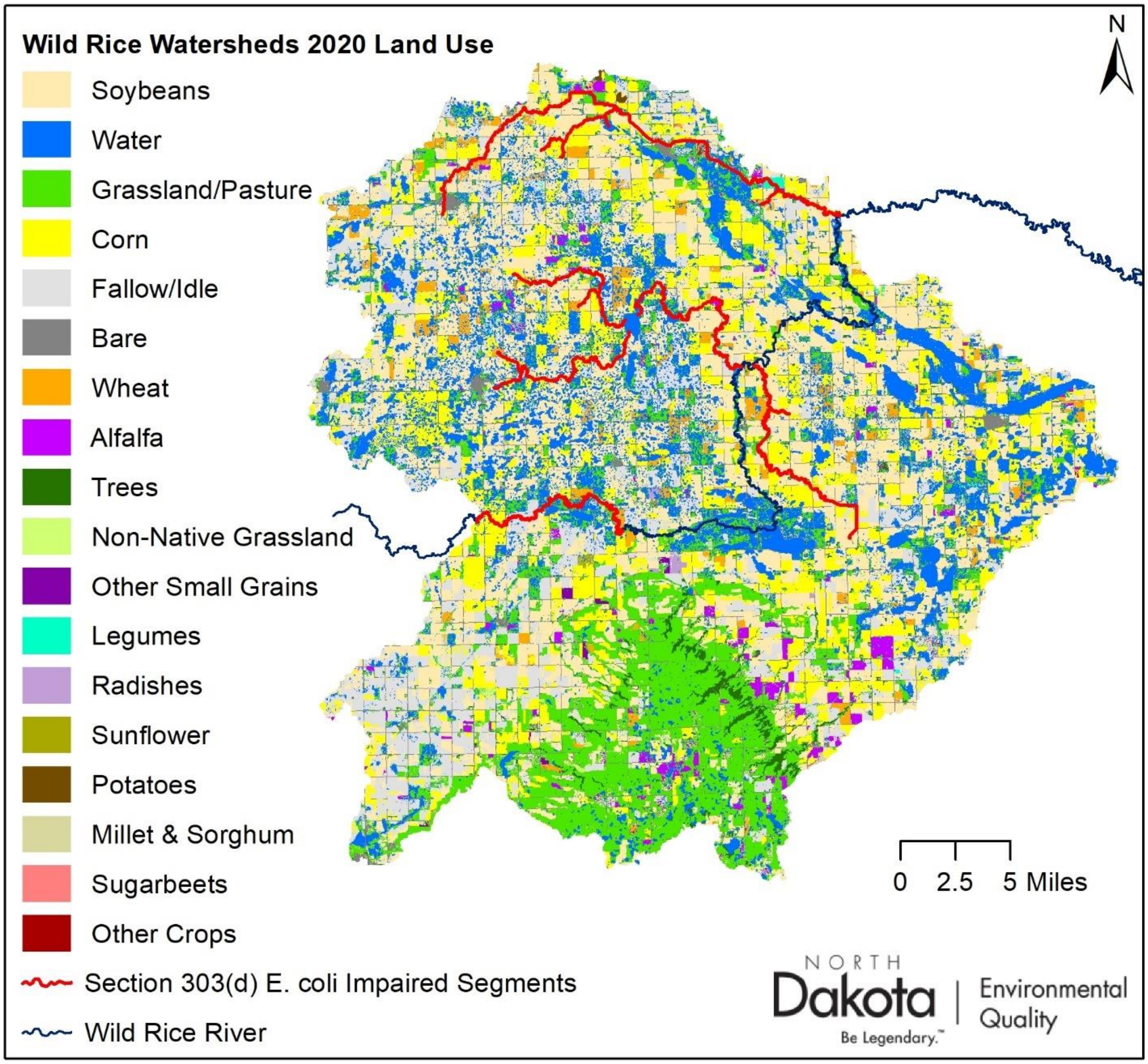

Figure 5. National Agricultural Statistical Survey Cropland Data Layer 2020 land use in the Wild Rice Watersheds.

Based on NASSCDL estimates the Wild Rice Watersheds land use in 2020 was majority agricultural. The entire Wild Rice Watersheds area consisted of 47% cropland and an additional 14% of fallow/idle cropland. Major cropland consisted of soybeans (27% of total area) and corn (15% of total area). Grassland/pasture reflected 15% and water, including open water and wetlands, covered 18% of the area (Figure 6). To identify potential land use impacts on water quality a ¼-mile buffer was applied to the riparian area of Section 303(d) *E. coli* impaired segments. Dominant land use categories within ¼-mile of 303(d) *E. coli* impaired segments were the same as dominant categories in overall watershed area, with different ratios. Within ¼-mile of Section 303(d) *E. coli* impaired segments 56% of land was in use as cropland and an additional 10% was fallow/idle. Major cropland categories within the ¼-mile riparian buffer consisted of soybeans (34%) and corn (16%). Water covered 20% of the area and grassland/pasture represented 9%. All additional individual land use categories, referred to in Figures 6-10 as “Other” consisted of less than five percent area each (e.g. other crops, bare, trees, etc.). Land use within ¼-mile of impaired segments was also majority soybeans, but a smaller percentage of grassland/pasture compared to land use in the overall watershed area. Table 4 details land use category acreage and percent of total area in the Wild Rice Watersheds.

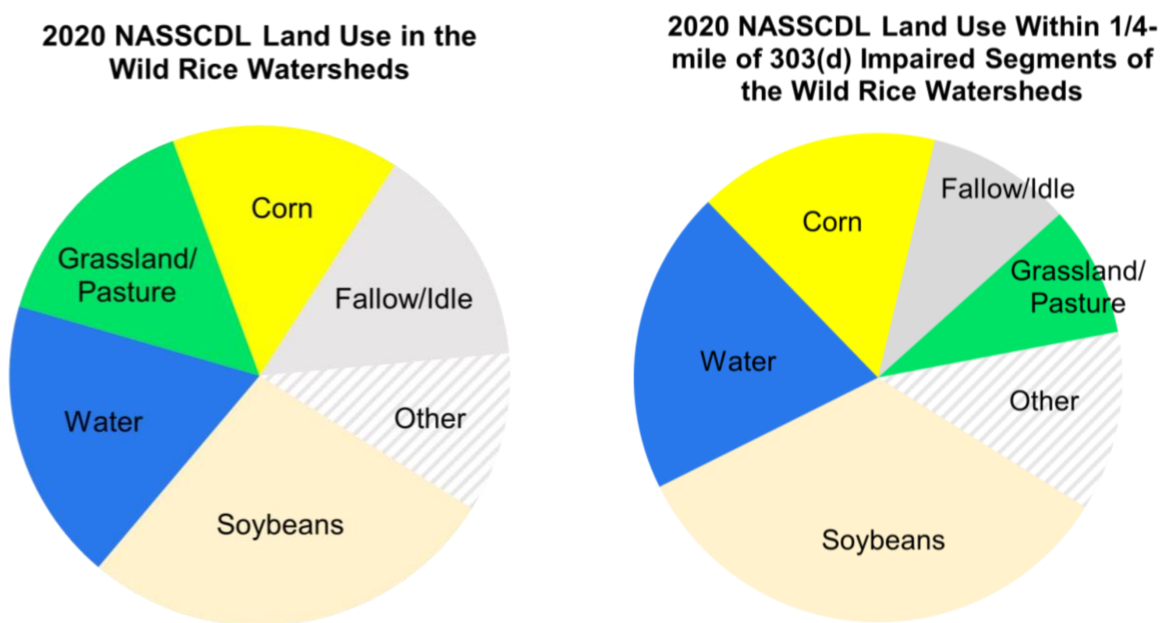

Figure 6. National Agricultural Statistical Survey Cropland Data Layer 2020 land use categories in the Wild Rice Watersheds. (left) Major land use categories throughout entire Wild Rice Watersheds area. (right) Major land use categories within ¼-mile of 303(d) *E. coli* impaired segments in the Wild Rice Watersheds.

Table 4. National Agricultural Statistical Survey Cropland Data Layer 2020 land use in the Wild Rice Watersheds.

Land Use Category	Acres	Percent (%) of Watershed Area
Soybeans	147,526	27
Water [1]	99,152	18
Grassland/Pasture	80,625	15
Corn	79,686	15
Fallow/Idle	78,336	14
Bare [2]	18,666	3
Wheat [3]	12,396	2
Alfalfa	9,248	2
Trees [4]	7,905	1
Non-Native Grassland [5]	4,733	1
Other Small Grains [6]	858	< 1
Legumes [7]	640	< 1
Radishes	459	< 1
Sunflower	384	< 1
Potatoes	283	< 1
Millet & Sorghum	171	< 1
Sugarbeets	137	< 1
Other Crops [8]	17	< 1
Total Area =	541,221*	

Notes

[1] Water includes open water and wetlands.

[2] Bare includes developed areas and barren.

[3] Wheat includes durum, spring, and winter wheat.

[4] Trees includes forest and shrubland.

[5] Non-Native Grassland includes other hay/non-alfalfa, sod/grass seed, and switchgrass.

[6] Other Small Grains includes barley, rye, and oats.

[7] Legumes includes dry beans and peas.

[8] Other Crops includes canola, flaxseed, buckwheat, onions, triticale, and other crops not differentiated.

* Not equal to watersheds area due to limits of NASSCDL raster pixel resolution.

Land use was assessed for individual watersheds to identify differences near each AU. Figures 7-10 and Tables 5-8 detail 2020 NASSCDL major land use categories and percent of total watershed and buffer areas for Section 303(d) *E. coli* impaired segments in the Wild Rice Watersheds.

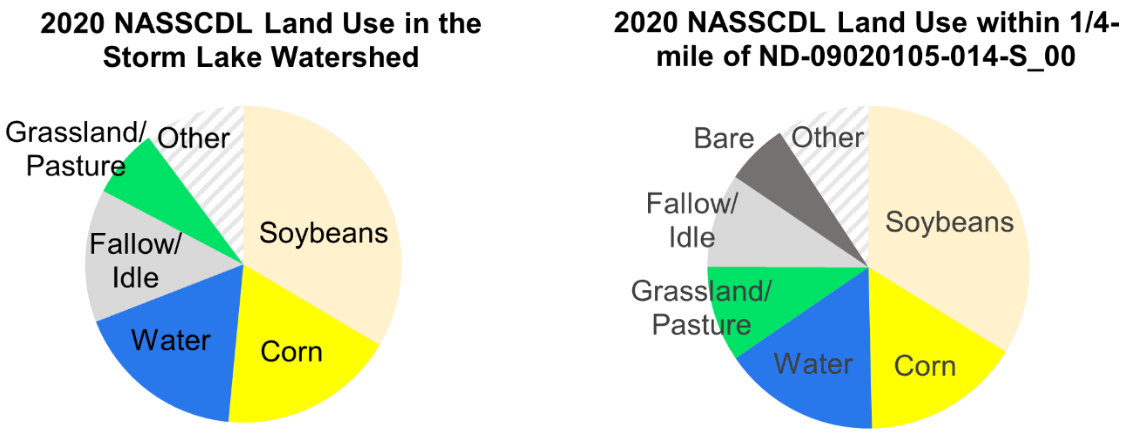

Figure 7. National Agricultural Statistical Survey Cropland Data Layer 2020 land use in the Storm Lake watershed (HUC 10 = 0902010506, AU = ND-09020105-014-S_00).

Table 5. National Agricultural Statistical Survey Cropland Data Layer 2020 land use percentages in the Storm Lake watershed.

Land Use	Percent (%) of Storm Lake Watershed Area	Percent (%) of Area within ¼-mile of ND-09020105-014-S_00
Crops (all)	56	58
Water	18	16
Fallow/Idle	14	9
Grassland/Pasture	7	10
Bare	4	6
Trees	1	1

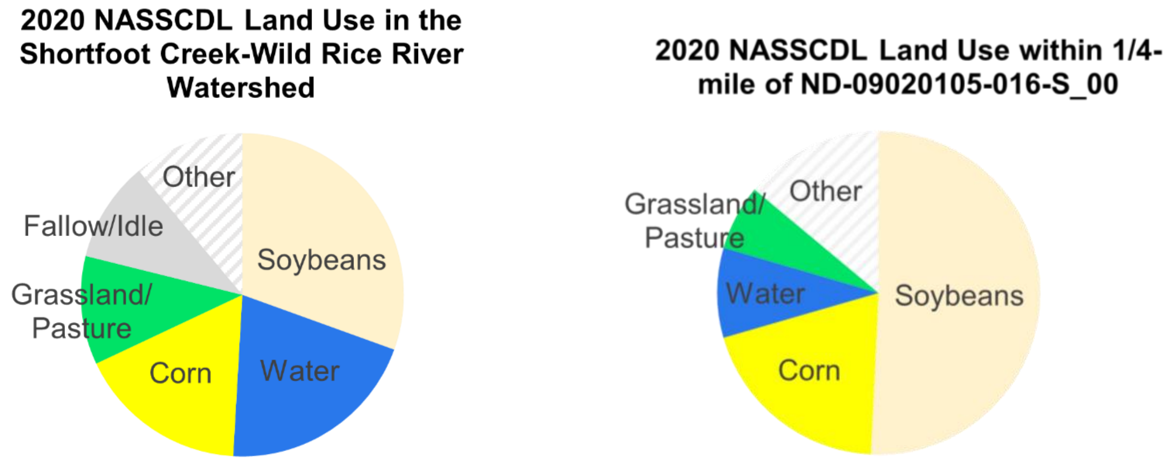

Figure 8. National Agricultural Statistical Survey Cropland Data Layer 2020 land use in the Shortfoot Creek-Wild Rice watershed (HUC 10 = 0902010505, AU = ND-09020105-016-S_00).

Table 6. National Agricultural Statistical Survey Cropland Data Layer 2020 land use percentages in the Shortfoot Creek-Wild Rice River watershed.

Land Use	Percent (%) of Shortfoot Creek-Wild Rice River Watershed Area	Percent (%) of Area within ¼-mile of ND-09020105-016-S_00
Crops (all)	53	75
Water	20	9
Grassland/Pasture	12	7
Fallow/Idle	10	5
Bare	3	3
Trees	2	1

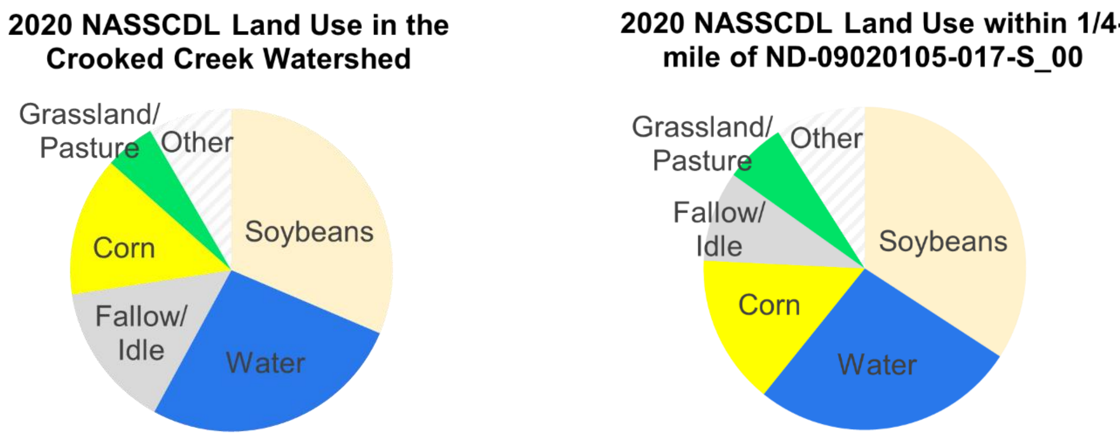

Figure 9. National Agricultural Statistical Survey Cropland Data Layer 2020 land use in the Crooked Creek watershed (HUC 10 = 0902010504, AU = ND-09020105-017-S_00).

Table 7. National Agricultural Statistical Survey Cropland Data Layer 2020 land use percentages in the Crooked Creek watershed.

Major Land Use Category	Percent (%) of Crooked Creek Watershed Area	Percent (%) of Area within ¼-mile of ND-09020105-017-S_00
Crops (all)	50	54
Water	27	27
Fallow/Idle	15	9
Grassland/Pasture	5	6
Bare	3	3
Trees	< 1	< 1

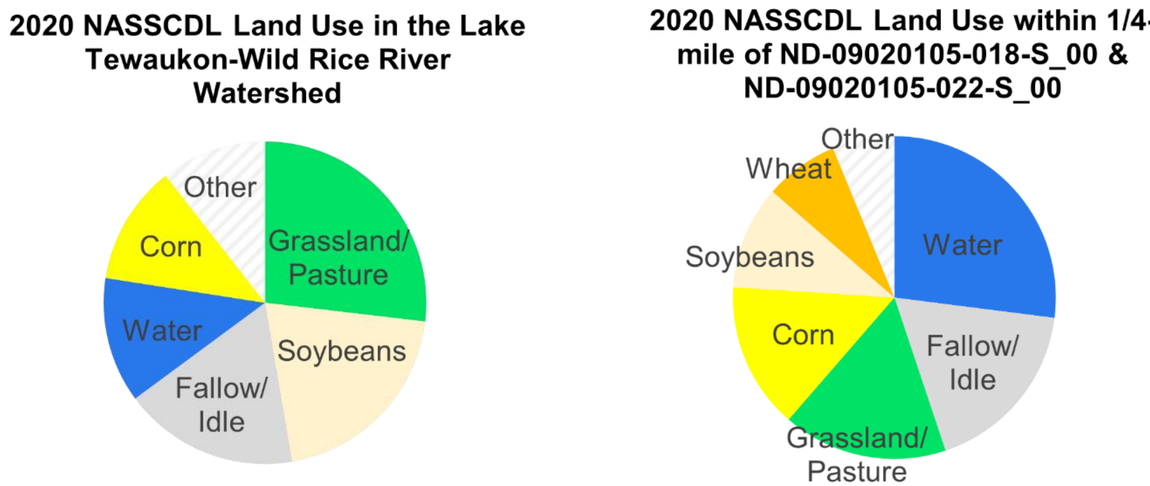

Figure 10. National Agricultural Statistical Survey Cropland Data Layer 2020 land use in the Lake Tewaukon-Wild Rice River watershed (HUC 10 = 0902010503, AUs = ND-09020105-018-S_00 and ND-09020105-022-S_00).

Table 8. National Agricultural Statistical Survey Cropland Data Layer 2020 land use percentages in the Lake Tewaukon-Wild Rice River watershed.

Land Use	Percent (%) of Lake Tewaukon-Wild Rice River Watershed Area	Percent (%) of Area within ¼-mile of ND-09020105-018-S_00 and ND-09020105-022-S_00
Crops (all)	37	33
Grassland/Pasture	27	18
Fallow/Idle	18	18
Water	13	27
Bare	3	3
Trees	2	< 1

1.2.2 Climate and Rainfall

Southeastern North Dakota has a continental climate with warm to cool summers and cold, severe winters. Weather data for the Wild Rice Watersheds was represented by the North Dakota Agricultural Weather Network (NDAWN). NDAWN collects weather data from across North Dakota and bordering regions. Stations are assumed to represent all weather conditions except rainfall, in a 20-mile radius. The station closest to the Wild Rice Watersheds with a period of record overlapping water quality data collection was in Mooreton, ND (approximately 27 miles east of Milnor, ND) and for the purposes of this report is considered the best representation of the Wild Rice Watersheds area.

From 1992-2021 Mooreton total annual rainfall ranged from 12.25 inches (2012) to 25.32 inches (2008). Figure 11 shows total and average monthly rainfall for 1992 - 2021, grouped by month. Years coinciding with water quality data collection in the Wild Rice Watersheds are highlighted. Based on the Mooreton, ND NDAWN station, total rainfall in the area typically increases from April to June, peaking in June. Average total rainfall decreases overall from June to October but with much more variation in summer and fall months compared to spring.

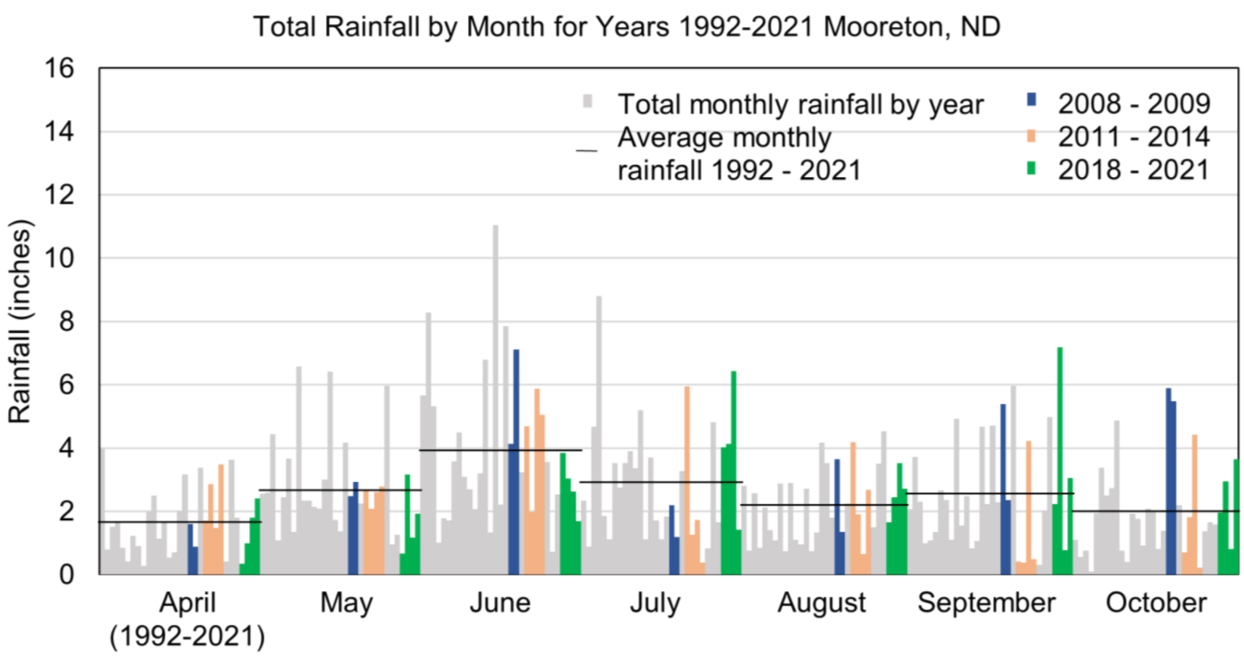

Figure 11. North Dakota Agricultural Weather Network Mooreton, ND station rainfall data for the months of April-October, 1992-2021.

Average annual air temperature at Mooreton from 1992 - 2021 ranged from 38.24 °F (1996) to 46.52 °F (2016). Figure 12 shows average monthly temperature for 1992 – 2021, grouped by month. Years coinciding with water quality data collection in the Wild Rice Watersheds are highlighted. Based on the Mooreton, ND NDAWN station, air temperature typically increases from April to July, peaking in July. Average monthly temperature was more variable in spring and fall months compared to summer.

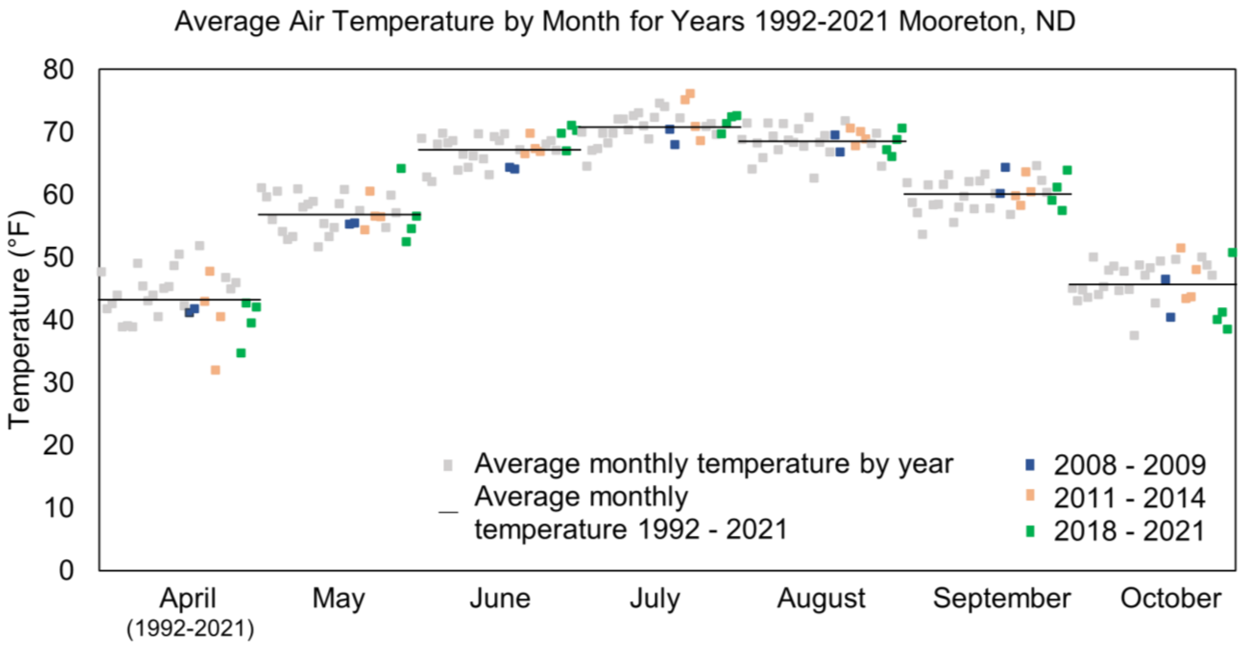

Figure 12. North Dakota Agricultural Weather Network Mooreton, ND station air temperature data for the months of April-October, 1992-2021.

1.3 Land Ownership

The Wild Rice River HUC 10 watersheds cross the state boundary between North Dakota and South Dakota, and state-tribal boundaries between the Dakota's and the Lake Traverse Reservation (Sisseton-Wahpeton Oyate). The watersheds area is majority privately owned, and includes areas managed by the Lake Traverse Reservation, the federal U.S. Fish and Wildlife Service (USFWS), the North Dakota Game and Fish Department, the North Dakota Land Department, and the state of South Dakota (Figure 13). The areas of analysis for TMDLs and allocations ('Wild Rice Watersheds', as described in Table 2) exclude areas of the state of South Dakota and the Lake Traverse Reservation. In the Wild Rice Watersheds, Section 303(d) *E. coli* impaired waters flow through the USFWS Tewaukon National Wildlife Refuge (ND-09020105-018-S_00) and through/along multiple USFWS Waterfowl Production Areas.

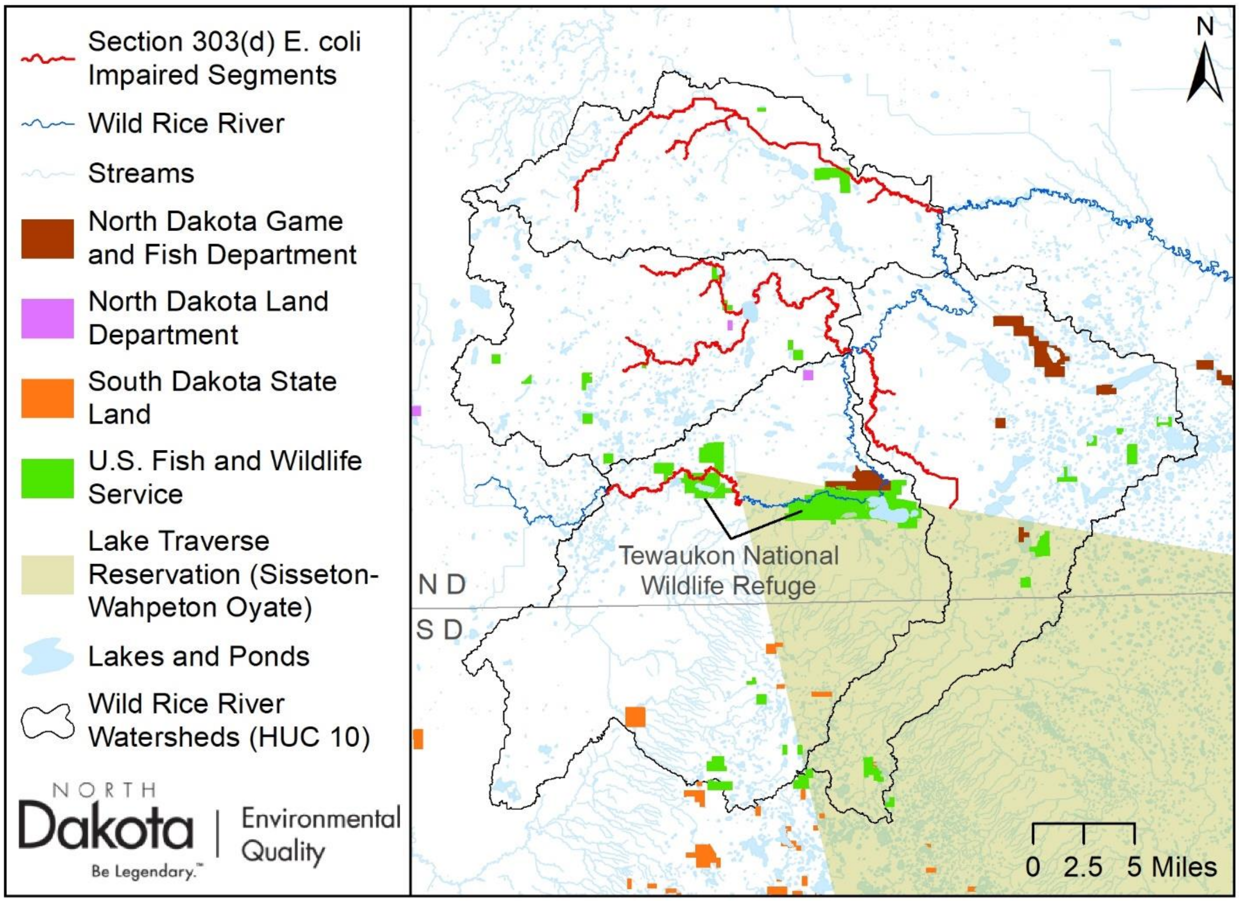

Figure 13. Land ownership in the Wild Rice River Watersheds.

1.4 Available Data

Water quality data were collected from monitoring sites over multiple years during the recreation season (May 1-September 30). Streamflow (discharge) data were available from a U.S. Geological Survey (USGS) gaging station or were estimated based on drainage area ratios. Figure 14 details station locations for water quality and streamflow data used in developing the Wild Rice Watersheds TMDLs. Drainage areas and contributing drainage areas were based on USGS StreamStats delineation tool (see Section 1.4.2).

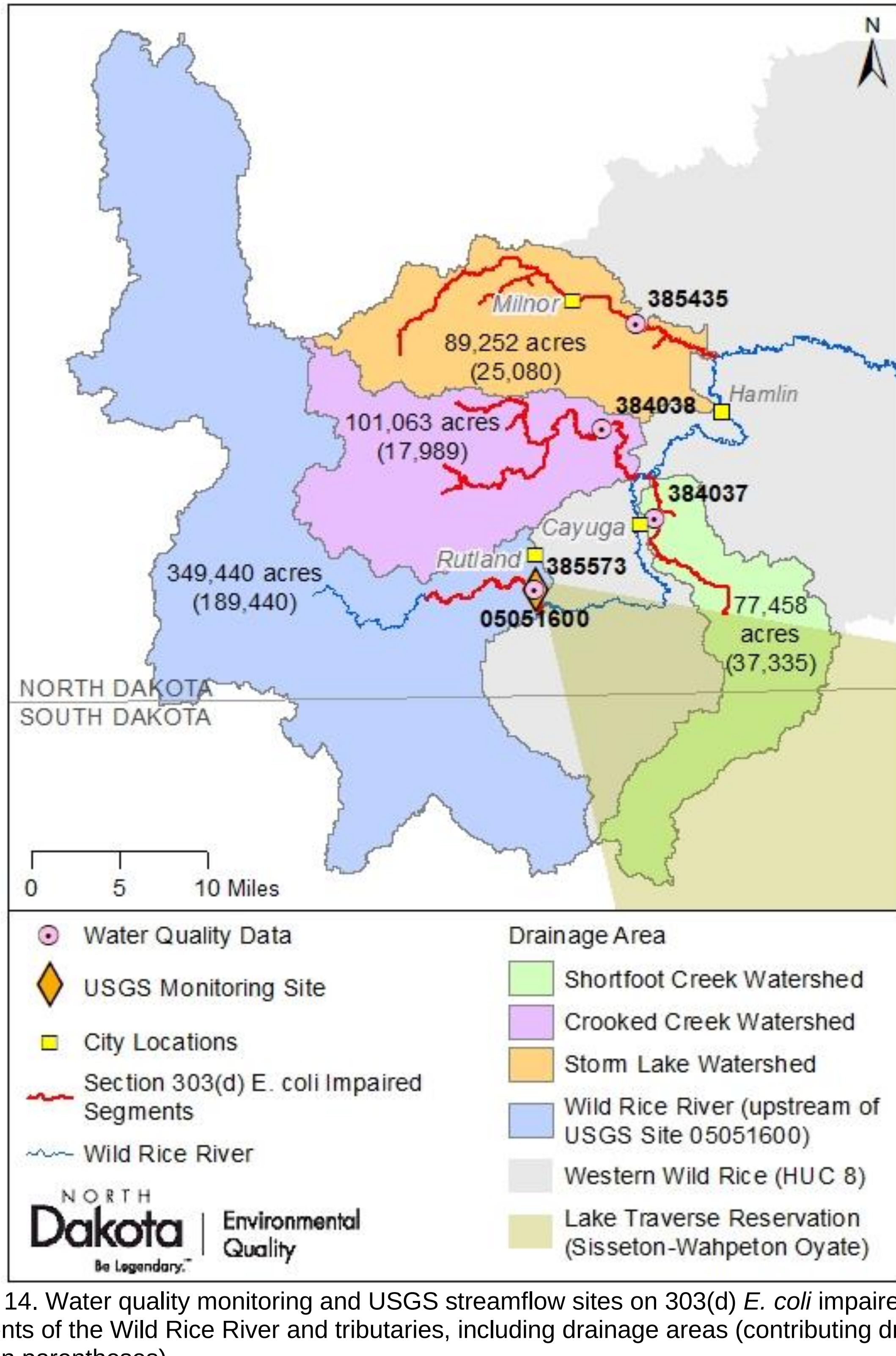

Figure 14. Water quality monitoring and USGS streamflow sites on 303(d) *E. coli* impaired segments of the Wild Rice River and tributaries, including drainage areas (contributing drainage areas in parentheses).

1.4.1 *E. coli* Bacteria Data

Water quality data from four NDDEQ monitoring sites (385435, 385573, 384037, 384038) were used to determine *E. coli* bacteria concentration trends in the Wild Rice Watersheds. Complete water quality data can be found in Appendix A and on the NDDEQ water quality data portal at https://deq.nd.gov. Where more than one site with water quality data was present on an impaired reach, the site furthest downstream and with more recent *E. coli* data was used.

Samples were analyzed by the North Dakota Public Health Laboratory (NDPHL) in Bismarck, ND. *E. coli* bacteria samples were measured as Colony Forming Units (CFU) per 100 mL of solution using methods of either membrane filtration and dilution or multi-well distribution. In 2018, the NDPHL changed *E. coli* testing methods from membrane filtration to multi-well distribution. The multi-well distribution method uses Quanti-tray and measures in Most Probable Number (MPN). MPN and CFU represent units specific to analytical techniques, but are considered equivalent measures of bacteria concentration (EPA, 2001). For NDDEQ monitoring sites with datasets reflecting both analytical methods (data collected before and following 2018) only Quanti-tray results were used in analysis. Use of Quanti-tray method results reflected the most recent water quality data (2018-2021) and provided a uniform measurement range for analysis.

Geometric mean *E. coli* bacteria concentrations, percentage of samples exceeding water quality standards, and resulting recreational use assessments were determined for each site, as detailed in sections 1.4.1.1-4. Water quality standards and metrics for assessing recreational use are defined in section 2.0 of this report.

1.4.1.1 Water Quality Monitoring Site 385435

The NDDEQ water quality monitoring site 385435 is three miles east and one mile south of Milnor, ND in the Storm Lake watershed (Figure 14). The site is located on an unnamed (known locally as Bulldog or Muskrat Creek) tributary to the Wild Rice River and represents AU ND-09020105-014-S_00. Water quality samples were collected by the Wild Rice Soil Conservation District (SCD) as part of the Wild Rice River Watershed Project, which monitored the effectiveness of nonpoint source controls in the watershed area. SCD staff collected samples weekly (when conditions allowed) during the recreation season (May 1-September 30) in 2008 and 2009.

Analysis of water quality data showed monthly *E. coli* bacteria concentrations not supporting recreational use for the months of June-September (Table 9). A recreational use assessment could not be completed for the month of May due to the number of samples collected (N < 5).

Table 9. *E. coli* water quality data for May-September 2008-2009 from water quality monitoring site 385435 on an unnamed tributary to the Wild Rice River.

Month	N (number of samples)	Geometric Mean Concentration (CFU/100mL)	Percent of Samples Exceeding 409 CFU/100mL)	Recreational Use Assessment
May	2	NA	NA	Insufficient Data
June	10	603	80	Not Supporting
July	8	238	12.5	Not Supporting
August	8	254	37.5	Not Supporting
September	8	262	25	Not Supporting
See Section 2.2.2 for discussion of North Dakota's recreational use *E. coli* assessment methodology and minimum sample size				

1.4.1.2 Water Quality Monitoring Site 385573

The NDDEQ water quality monitoring site 385573 is on the Wild Rice River two miles south of Rutland, ND in the Lake Tewaukon-Wild Rice River watershed. The water quality site is co-located with the USGS streamflow gaging station 05051600, upstream of Sisseton-Wahpeton-Oyate tribal land. Site 385573 represents AUs ND-09020105-018-S_00 and ND-09020105-022-S_00. Water quality samples were collected by the Wild Rice SCD as part of the Wild Rice River Watershed Project, which monitored the effectiveness of nonpoint source controls in the watershed area. SCD staff collected samples weekly (when conditions allowed) during the recreation season (May 1-September 30) in 2011-2014.

Analysis of water quality data showed monthly *E. coli* bacteria concentrations Not Supporting recreational use for the months of June-September (Table 10). Water quality data for the month of May showed *E. coli* bacteria concentrations fully supporting recreational use.

Table 10. *E. coli* water quality data for May-September 2011-2014 from water quality monitoring site 385573 on the Wild Rice River.

Month	N (number of samples)	Geometric Mean Concentration (CFU/100mL)	Percent of Samples Exceeding 409 CFU/100mL)	Recreational Use Assessment
May	27	50	7.4	Fully Supporting
June	33	369	39.4	Not Supporting
July	29	150	13.8	Not Supporting
August	27	134	14.8	Not Supporting
September	23	312	39.1	Not Supporting

1.4.1.3 Water Quality Monitoring Site 384037

The NDDEQ water quality monitoring site 384037 is on Shortfoot Creek one mile east of Cayuga, ND. The site is in the Shortfoot Creek-Wild Rice River watershed and represents AU ND-09020105-016-S_00. Water quality samples were collected by the Wild Rice SCD as part of the Wild Rice River Watershed Project, which monitored the effectiveness of nonpoint source controls in the watershed area. SCD staff collected samples weekly (when conditions allowed) during the recreation season (May 1-September 30).

Analysis of water quality data from 2018-2021 showed monthly *E. coli* bacteria concentrations Not Supporting recreational use for the months of June-September; water quality data for the month of May showed *E. coli* bacteria concentrations Fully Supporting recreational use (Table 11). Water quality data at site 384037 was collected in 2008-2009, and 2011-2021. Data from the period of 2018-2021 was used in analysis to reflect updated laboratory testing methods for *E. coli* beginning in 2018.

Table 11. *E. coli* water quality data for May-September 2018-2021 from water quality monitoring site 384037 on Shortfoot Creek.

Month	N (number of samples)	Geometric Mean Concentration (CFU/100mL)	Percent of Samples Exceeding 409 CFU/100mL)	Recreational Use Assessment
May	20	54	5.0	Fully Supporting
June	15	163	26.7	Not Supporting
July	15	286	33.3	Not Supporting
August	14	248	21.4	Not Supporting
September	12	468	50.0	Not Supporting

1.4.1.4 Water Quality Monitoring Site 384038

The NDDEQ water quality monitoring site 384038 is on Crooked Creek one mile south and 6.5 miles west of Hamlin, ND. The site is in the Crooked Creek watershed and represents AU ND-09020105-017-S_00. Water quality samples were collected by the Wild Rice SCD as part of the Wild Rice River Watershed Project, which monitored the effectiveness of nonpoint source controls in the watershed area. SCD staff collected samples weekly (when conditions allowed) during the recreation season (May 1-September 30).

Analysis of water quality data from 2018-2021 showed monthly *E. coli* bacteria concentrations Not Supporting recreational use for the months of July-September. Water quality data for the month of May showed *E. coli* bacteria concentrations Fully Supporting recreational use; water quality data for the month of June showed *E. coli* bacteria concentrations Fully Supporting, but Threatened (Table 12). Water quality data at site 384038 was collected in 2008-2009, and 2015-2021. Data from the period of 2018-2021 was used in analysis to reflect updated laboratory testing methods for *E. coli* beginning in 2018.

Table 12. *E. coli* water quality data for May-September 2018-2021 from water quality monitoring site 384038 on Crooked Creek.

Month	N (number of samples)	Geometric Mean Concentration (CFU/100mL)	Percent of Samples Exceeding 409 CFU/100mL)	Recreational Use Assessment
May	20	29	0	Fully Supporting
June	14	92	21	Fully Supporting, but Threatened
July	14	196	36	Not Supporting
August	13	320	46	Not Supporting
September	10	427	60	Not Supporting

1.4.2 Hydrologic Discharge

Streamflow data were collected from, or estimated based on, the USGS streamgaging network. Average daily discharge records were available from one USGS gaging station on an impaired reach in the Wild Rice Watersheds. USGS site 05051600 is located on the Wild Rice River two miles south of Rutland, ND (Figure 14). Site 05051600 has a drainage area of 546 square miles (sq mi), or 349,440 acres, and a contributing drainage area of 296 sq mi (189,440 acres). The larger drainage area of 546 sq mi represents the entire area of upstream drainages, including closed basins. The contributing drainage area represents the area where runoff flows downstream to the gaging station and does not include areas of closed basins.

USGS site 05051600 is co-located with water quality monitoring site 385573 and discharge data were available for the water quality monitoring period, 2011-2014 (May-Sept.). Streamflow was recorded for 612 days during this period. Average daily discharge was correlated with *E. coli* bacteria concentrations at site 385573 to determine *E. coli* loading in Wild Rice River AUs ND-09020105-018-S_00 and ND-09020105-022-S_00.

Measured streamflow data were not available for additional water quality monitoring sites or in respective watershed areas. To estimate average daily discharge at ungaged locations the Drainage Area Ratio (DAR) method (Ries et al., 2000) was applied. The DAR method estimates unknown discharge based on known discharge of a hydrologically similar watershed, and relative difference in watershed areas. Average daily discharge was estimated for the Storm Lake, Crooked Creek, and Shortfoot Creek watersheds using the DAR method based on streamflow data from USGS site 05051600. The drainage area of site 05051600 is in the same 8-digit HUC (Wild Rice) as the ungaged watershed areas and represents similar ecoregions. The drainage area of site 05051600 is therefore assumed to be hydrologically similar to each ungaged watershed for application of the DAR method.

The USGS StreamStats drainage area delineation tool was used to determine contributing drainage areas of each watershed. StreamStats uses digital elevation data from the USGS 3D Elevation Program (3DEP) to identify drainage boundaries and estimate basin characteristics. StreamStats drainage areas for each watershed are listed below in Table 13. Contributing drainage areas were used in DAR method calculations to represent typical conditions where smaller closed basins do not contribute to overall basin discharge. Estimated streamflow was correlated with *E. coli* bacteria concentrations from water quality monitoring sites to determine *E. coli* loading.

Table 13. Watershed drainage areas based on USGS StreamStats delineation tool.

Watershed	Drainage Area (acres)	Contributing Drainage Area (acres)*
Storm Lake	89,252	25,080
Crooked Creek	101,063	17,989
Shortfoot Creek	77,458	37,335
*Based on: Drainage Area – (Percent of total drainage area to isolated lakes * Drainage Area)		

Hydrologic discharge data can be found in the USGS National Water Dashboard at https://dashboard.waterdata.usgs.gov/.

1.4.2.1 Hydrologic Alteration

Water control efforts such as dams and drains have been constructed in the Wild Rice Watersheds to mitigate flooding and support land use such as agriculture, livestock, recreation, and fish and wildlife. Flow controls impact discharge conditions (e.g. reducing peak flows, changing magnitude and duration of flow) and add uncertainty to discharge estimates described in Section 1.4.2. The North Dakota Department of Water Resources (DWR) maintains water resource data, including known dam and drain locations, on their MapServices webpage (https://mapservice.dwr.nd.gov/). The DWR water resource data reflects structures the agency has recorded and verified, which may not be an exhaustive list; efforts are ongoing to field verify location and status of structures and update data displayed in MapServices.

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 water body 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 state water quality standards.

There are three parts of water quality standards: beneficial uses, water quality criteria (numeric and narrative), and antidegradation policies. The NDDEQ has set narrative and numeric water quality standards to protect designated beneficial uses of all surface waters in the State. Numeric water quality standards are measurable limits or ranges of chemical concentrations or physical conditions. Narrative water quality standards support numeric standards as descriptions of conditions and goals.

Water quality standards for the State of North Dakota can be found at https://www.ndlegis.gov/information/acdata/pdf/33.1-16-02.1.pdf (visit deq.nd.gov and enter search criteria "Water Quality Standards").

2.1 Stream Classifications and Beneficial Uses

Stream classification is the assignment (designation) of a single or group of uses (class) to a water body based on the potential of the water body to support those uses. Beneficial uses are simple narrative descriptions of water quality expectations or water quality goals.

Surface water classifications represent present and future most beneficial uses such as public water supply, aquatic life and wildlife, recreation, agriculture, and industry. The Wild Rice Watersheds includes one Class II stream (Wild Rice River) and multiple Class III streams. Class II and III streams are defined below, as found under NDAC 33.1-16-02.1-09(1).

Class II streams, including the Wild Rice River:

> The quality of the waters in this class shall be the same as the quality of class I streams […suitable for the propagation or protection, or both, of resident fish species and other aquatic biota and for swimming, boating, and other water recreation. The quality of waters shall be suitable for irrigation, stock watering, and wildlife without injurious effects. After treatment consisting of coagulation, settling, filtration, and chlorination, or equivalent treatment processes, the water quality shall meet the bacteriological, physical, and chemical requirements of the department for municipal or domestic use.], except that additional treatment may be required to meet the drinking water requirements of the department. Streams in this classification may be intermittent in nature which would make these waters of limited value for beneficial uses such as municipal water, fish life, irrigation, bathing, or swimming.

Class III streams, including all streams in the Wild Rice Watersheds with the exception of the Wild Rice River:

> 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 period 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.

2.2 Water Quality Criteria

2.2.1 North Dakota Narrative Water Quality Criteria

Conditions of narrative general water quality standards include:

- 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.

A complete list of narrative water quality standards can be found under North Dakota Administrative Code (NDAC) 33.1-16-02.1-08(1). General water quality standards include a narrative biological goal under which the biological conditions of surface waters shall be similar to that of sites or water bodies determined by the department to be regional reference sites (NDAC, 2019).

2.2.2 North Dakota Numeric Water Quality Criteria

Numeric water quality standards applied to surface waters are based on water body classification.

Table 14 provides a summary of the current numeric *E. coli* bacteria water quality standard that applies to all streams. The *E. coli* bacteria standard is only applicable during the recreation season of May 1 through September 30 (NDAC, 2019).

Table 14. The NDDEQ *E. coli* bacteria water quality standards for all streams.

Parameter	Standard	
	Geometric Mean	Maximum
E. coli bacteria	126 CFU*/100mL	409 CFU*/100mL

Notes:

[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 maximum standard.

* Colony Forming Units

The NDDEQ has established a recreational use assessment for *E. coli* bacteria, which can be determined by following the guidance under NDAC 33.1-16-02.1, *Standards of Quality for Waters of the State*, summarized as BOTH:

1. A 30-day geometric mean concentration of 126 CFU/100 mL or less, based on samples collected during the recreation season of May 1 through September 30.
2. No more than 10 percent of samples collected during any consecutive 30-day period being above 409 CFU/100 mL.

The Water Quality Assessment Methodology for North Dakota's Surface Waters lists a minimum *E. coli* sample size for recreation use. In the current 2018 methodology, recreation use assessment is based on a minimum of five monthly *E. coli* samples to calculate geometric mean, and a minimum of 10 monthly *E. coli* samples to calculate percent exceeding the maximum. However, in TMDL development, North Dakota has consistently applied a minimum of five monthly samples for both calculations of geometric mean and percent exceeding in all approved TMDLs. To maintain consistency, the Wild Rice Watersheds TMDLs are based on a minimum of five monthly *E. coli* samples for *both* geometric mean and percent exceeding. Using a minimum of five samples, rather than 10, is not expected to change the recreation use assessment of the TMDL water bodies, which are all considered Not Supporting for *E. coli*. The Water Quality Assessment Methodology for North Dakota's Surface Waters minimum sample size for recreational use assessment will be reviewed and clarified in the next (2024) Integrated Report.

For assessment purposes, the 30-day consecutive period shall follow the calendar month. If necessary, samples may be pooled by calendar month across years.

Recreational use support is determined by the following:

- Fully Supporting: Both criteria 1 and 2 are met.
- Fully Supporting, but Threatened: Criterion 1 is met, but 2 is not.
- Not Supporting: Criterion 1 is not met. Criterion 2 may or may not be met.

North Dakota water quality standards designate a recreation standard that applies to both primary recreation activities (e.g. bathing and swimming) and secondary recreation activities (e.g. boating, fishing, and wading). In the event water quality standards are updated, such as the addition of a separate limited/secondary contact recreation numeric standard, or a reclassification of assessment unit water bodies, the NDDEQ will reevaluate *E. coli* TMDL calculations in the Wild Rice Watersheds.

2.3 Antidegradation

North Dakota's antidegradation component of water quality standards (NDAC 33.1-16-02.1 App IV)) is designed to protect existing uses and maintain high-quality waters. The numeric water quality criteria denote where beneficial uses become impaired, whereas the antidegradation policy protects high-quality waters where the water quality is above or better than the criteria. Antidegradation rules apply to regulated point source activities that may have some effect on water quality. Nonpoint sources of pollution are not included. This TMDL supports the antidegradation component of the standards because it is written to meet numeric *E. coli* bacteria to support full attainment of recreational beneficial use.

2.4 Additional Water Quality Standards

As described in Section 1, water bodies in the Wild Rice Watersheds extend upstream into South Dakota and into the Lake Traverse Reservation (see Figures 1, 2). The TMDLs developed in this report address waters under the jurisdiction of the state of North Dakota, as described in Table 2. Water quality standards for additional authorities in the Wild Rice Watersheds are detailed below for comparison and consideration of mutual water quality goals.

2.4.1 Water Quality Standards for the State of South Dakota

The South Dakota Department of Agriculture and Natural Resources (SDDANR) has set water quality standards to protect designated beneficial uses of all surface waters in South Dakota. Waters designated for recreational beneficial use are assigned numeric *E. coli* water quality criteria for immersion recreation or limited contact recreation. No waters in the Wild Rice Watersheds were assigned specific recreational uses by the state of South Dakota and as such are not subject to numeric *E. coli* water quality criteria (visit sdlegislature.gov and search "Uses Assigned to Streams"). Narrative water quality standards applicable to South Dakota waters can be found in South Dakota Administrative Rules 74:51:01 Surface Water Quality Standards (visit sdlegislature.gov and search "Surface Water Quality Standards").

2.4.2 Water Quality Standards for the Lake Traverse Reservation

The Sisseton-Wahpeton Oyate of the Lake Traverse Reservation do not currently administer a water quality standards program as authorized by the U.S. Environmental Protection Agency (EPA). EPA is currently developing a proposed rule to establish tribal baseline water quality standards for all reservation waters.

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 water quality standards but can also include specific values when no numeric criteria are established. The impaired reaches in the Wild Rice Watersheds (Table 2) exceed the NDDEQ numeric criteria for *E. coli* and as such are listed as Not Supporting for recreational beneficial use. The target value used to develop the TMDLs for the Wild Rice Watersheds impaired reaches is 126 CFU/100 mL as the maximum monthly geometric mean. Applying the monthly geometric mean criterion as a daily target ensures both criteria (monthly geometric mean < 126 CFU/100 mL and < 10% monthly samples > 409 CFU/100 mL) are met.

4.0 SOURCES OF *E. COLI*

Pollutant sources are generally defined as two categories: point sources and nonpoint sources, and the allowable load of the TMDL divided among each. For point sources, the allocated loads are called "wasteload allocations" (WLAs). For nonpoint sources, the allocated loads are called "load allocations" (LAs).

4.1 Point Source Pollution

Point sources are discernible, confined and discrete conveyances, such as pipes, ditches, wells, containers, or concentrated animal feeding operations, from which pollutants are being, or may be, discharged.

Point source dischargers in the Wild Rice Watersheds are permitted by state (ND, SD) and federal (EPA) agencies. Permits for point source discharge identify pollutants of concern for the type of activity and receiving water body. Discharge conditions are also based on federal, state, and local standards. Permitted wastewater systems (lagoons) are required to sample treated effluent and obtain water quality results prior to discharging. Information on active discharge permits can be found on EPAs Enforcement and Compliance History Online (ECHO) website https://echo.epa.gov/. Permittees in the Wild Rice Watersheds were identified using ECHO and the North Dakota Pollutant Discharge Elimination System (NDPDES) permits program database. ECHO Discharge Monitoring Report (DMR) records for the period of 2007 – 2021 were available for review.

Smaller wastewater lagoon facilities have the potential to discharge *E. coli* bacteria, but do not frequently discharge due to the small volume of influent received from local populations. Most permitted facilities in the Wild Rice Watersheds are in small cities that are not anticipated to experience a significant increase in population. Under current NDPDES permits, wastewater lagoon facilities in the Wild Rice Watersheds are required to collect a water quality grab sample prior to discharge, and once weekly (minimum) during discharge events. However, current monitoring requirements for the facilities do not include *E. coli* bacteria and as such no *E. coli* bacteria discharge data are available.

Concentrated Animal Feeding Operations/Animal Feeding Operations (CAFO/AFO) in North Dakota are permitted by the NDDEQ. Facilities are defined or designated as a small, medium, or large CAFO or AFO based on the type and number of animals and site conditions. Under NDAC 33.1-16-03.1-12 permitted CAFO/AFO facilities are prohibited from discharging manure or process wastewater. Facilities are also required to maintain Nutrient Management Plans to ensure manure handling does not impact waters of the state. Nine CAFO/AFOs were permitted by the NDDEQ in the Wild Rice Watersheds, including one large, four medium, and four small facilities.

Permitted facilities in the Wild Rice Watersheds are listed in Appendix B.

4.1.1 Permittees in the Storm Lake Watershed (ND-09020105-014-S_00)

The North Dakota Pollutant Discharge Elimination System (NDPDES) program permits two Publicly Owned Treatment Works (POTWs) in the Storm Lake watershed (Figure 15).

The Gwinner POTW is a four-cell wastewater lagoon system in north-central Sargent County for the city of Gwinner, ND with one permitted discharge point on the upstream section of AU ND-09020105-014-S_00. The POTW serves residents and receives industrial wastewater from the local Bobcat facility. Discharge Monitoring Report (DMR) data for Gwinner showed the facility is a non-continuous discharger. The POTW discharges semiannually, once in the beginning of the recreation season and again following the recreation season. For the period of 2007 – 2021, discharge typically occurred over a one to two-week period and averaged five million gallons per day. The current permit for the city of Gwinner POTW is set to expire on September 30, 2024.

The Milnor POTW is a three-cell wastewater lagoon system in northeast Sargent County for the city of Milnor, ND with one permitted discharge point on AU ND-09020105-014-S_00. DMR data for Milnor showed the facility is a non-continuous discharger. The POTW typically discharges one to two times per year, often in the beginning of the recreation season and again following the recreation season. For the period of 2007 – 2021, discharge typically occurred over a one-week period and averaged one million gallons per day. The current permit for the city of Milnor POTW is set to expire on September 30, 2024.

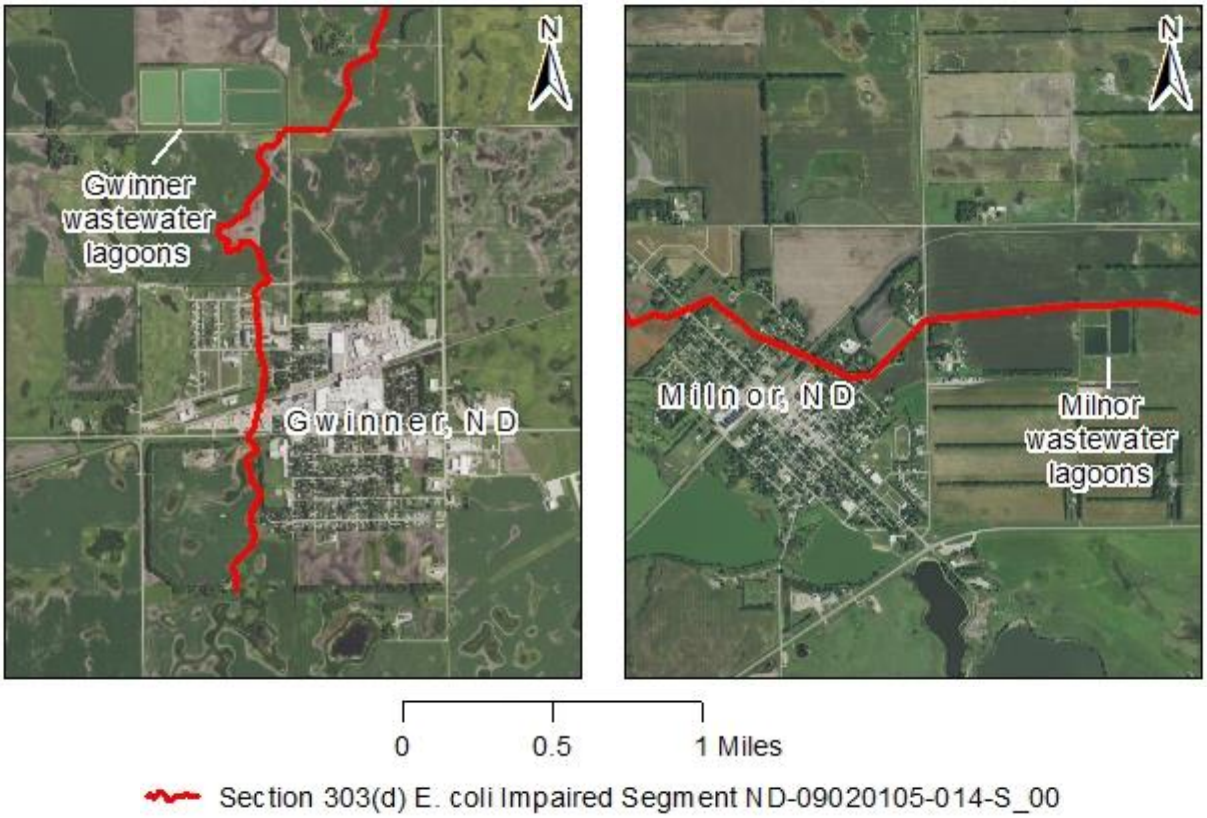

Figure 15. 2020 aerial imagery in the Storm Lake watershed of wastewater lagoons in the cities of Gwinner (left) and Milnor (right), North Dakota.

4.1.2 Permittees in the Crooked Creek Watershed (ND-09020105-017-S_00)

The NDPDES program permits two POTWs in the Crooked Creek watershed.

The Cogswell POTW is a three-cell wastewater lagoon system in west-central Sargent County for the city of Cogswell, ND. The facility has one permitted discharge point in the Crooked Creek watershed. The POTW is permitted to discharge to an unnamed slough that is not directly connected to other surface waters (see Figure 2 showing location of Cogswell, ND). ECHO records show that no discharge has been reported.

The Forman POTW is a three-cell wastewater lagoon system in central Sargent County for the city of Forman, ND. The facility has one permitted discharge point on the upstream section of AU ND-09020105-017-S_00 (Figure 16). DMR data for Forman showed the facility is a non-continuous discharger. The POTW typically discharges one to two times per year, often in the beginning of the recreation season and again following the recreation season. For the period of 2007 – 2021, discharge typically occurred over a one-week period and averaged one million gallons per day. The current permit for the city of Forman POTW is set to expire on September 30, 2024.

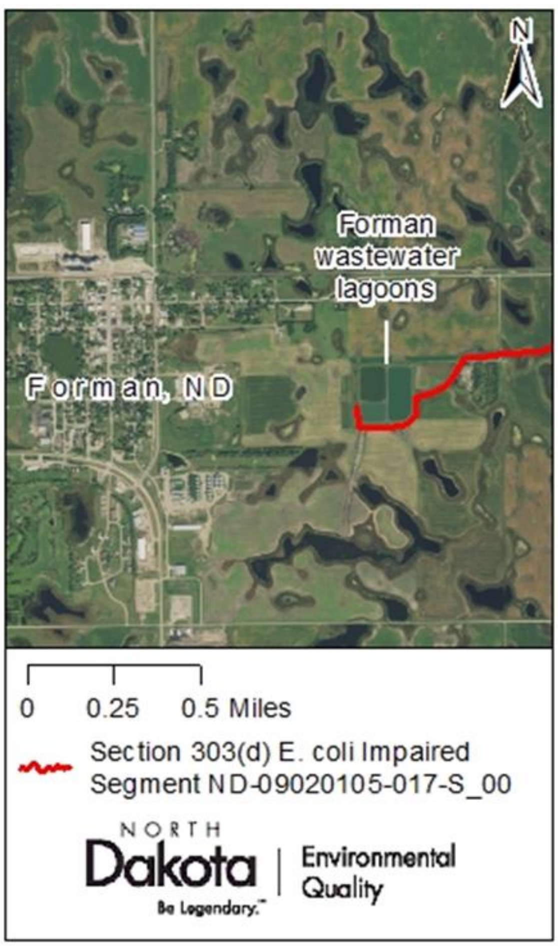

Figure 16. 2020 aerial imagery in the Crooked Creek watershed for the city of Forman, North Dakota.

4.1.3 Permittees in the Shortfoot Creek-Wild Rice River Watershed (ND-09020105-016-S_00)

The Shortfoot Creek-Wild Rice River watershed has two POTWs permitted by the NDPDES program and one POTW permitted by the EPA (within Lake Traverse Reservation).

The Lidgerwood POTW is a three-cell wastewater lagoon system in southwestern Richland County for the city of Lidgerwood, ND permitted by NDPDES. The facility has one permitted discharge point in the Shortfoot Creek-Wild Rice River watershed. The POTW is permitted to discharge to a branch of Swan Lake, which is within a subwatershed that does not contribute to the impaired segments of Shortfoot Creek.

The Cayuga POTW is a three-cell wastewater lagoon system in east-central Sargent County for the city of Cayuga, ND permitted by NDPDES. The facility has one permitted discharge point on Shortfoot Creek (AU ND-09020105-016-S_00) (Figure 17). ECHO records show that no discharge has been reported.

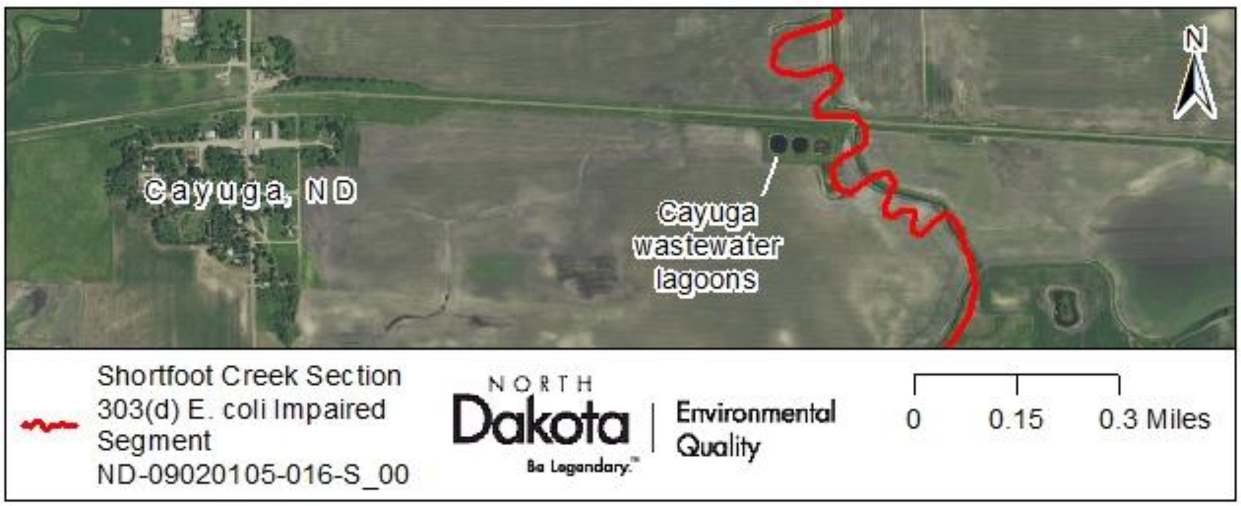

Figure 17. 2020 aerial imagery in the Shortfoot Creek-Wild Rice River watershed for the city of Cayuga, North Dakota.

The Veblen Flats Housing Wastewater Treatment Plant (WWTP) is a two-cell wastewater lagoon system in northeast Marshall County for the Veblen Flats Housing Community on the Lake Traverse Reservation (Sisseton-Wahpeton Oyate). The POTW is permitted by EPA as a “no-discharge” facility located in the Shortfoot Creek watershed, upstream of North Dakota’s designated assessment unit ND-09020105-016-S_00. ECHO records show that no discharge has been reported under this permit. The nearby city of Veblen, SD does not discharge to the Wild Rice Watersheds.

4.1.4 Permittees in the Lake Tewaukon-Wild Rice River Watershed (ND-09020105-018-S_00 & ND-09020105-022-S_00)

The NDPDES program permits one POTW in the Lake Tewaukon-Wild Rice River watershed (Figure 18).

The Rutland POTW is a three-cell wastewater lagoon system in southeastern Sargent County for the city of Rutland, ND. The facility is permitted to discharge to a drainage ditch to the Wild Rice River, approximately two miles north of the downstream end of ND-09020105-018-S_00 where water quality monitoring site 385573 and USGS streamgaging station 05051600 are located. DMR data for Rutland showed the facility is a non-continuous discharger. The POTW typically discharges one to two times per year, but has not discharged every year. For the period of 2007 – 2021 discharge typically occurred for less than one week and averaged 0.23 million gallons per day. The current permit for the city of Rutland is set to expire September 30, 2024.

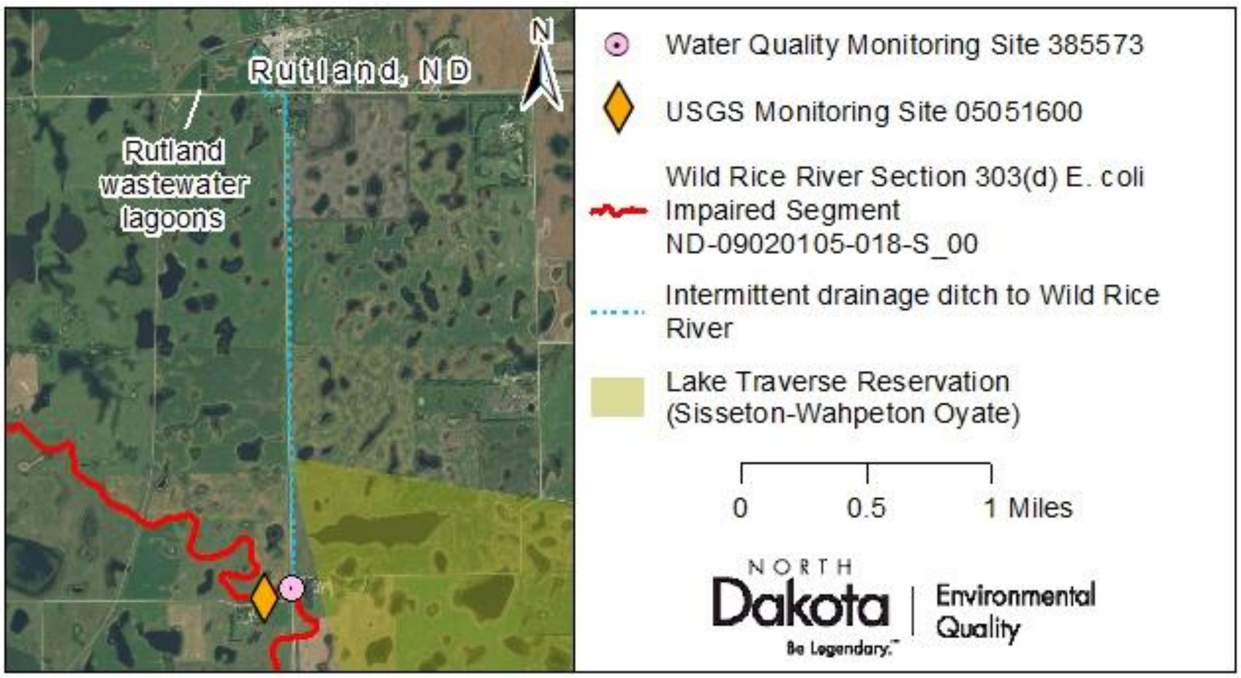

Figure 18. 2020 aerial imagery in the Lake Tewaukon-Wild Rice River watershed for the city of Rutland, North Dakota.

4.2 Nonpoint Source Pollution

Nonpoint sources are diffuse and are typically associated with runoff, streambank erosion, most agricultural activities, atmospheric deposition, and groundwater seepage. Potential nonpoint sources of *E. coli* bacteria pollution in the Wild Rice Watersheds include runoff from cropland and pasture (including application of manure), livestock in riparian areas, leaking septic systems, and wildlife.

4.2.1 Cropland and Pasture

The 2020 land use assessment (see Section 1.2.1) showed dominant land uses in the Wild Rice Watersheds were cropland (soybeans and corn) and grassland/pasture. Application of manure to cropland, and manure from livestock grazing in grassland/pasture can transport *E. coli* bacteria to stream segments through runoff. Water was shown to cover 20% of the area within ¼-mile of Section 303(d) *E. coli* impaired segments. While some areas of the Wild Rice Watersheds are closed basins, the high density of wetlands in this area provides additional opportunities for pollutant transport where temporary or seasonal wetlands connect during periods of flooding. Additionally, only 1% of the riparian area (area within ¼-mile of Section 303(d) segments) was determined to be trees/shrubland. Without vegetative buffers *E. coli* bacteria can be more readily transported from fields to water bodies in the Wild Rice Watersheds. Grazing in riparian areas can also contribute *E. coli* bacteria, where livestock directly deposit fecal matter into, and adjacent to, water bodies.

4.2.2 Septic Systems

Failing septic systems or direct discharge sewage systems contributing *E. coli* bacteria may also be occurring in the Wild Rice Watersheds. Though specific location and loading potential are unknown, septic systems with isolated single-family dwellings and farmsteads are located throughout the Wild Rice Watersheds.

4.2.3 Wildlife

The Wild Rice Watersheds area is dense with temporary and seasonal wetlands that support wildlife, most notably migrating bird populations. The Tewaukon National Wildlife Refuge on the Wild Rice River (see Section 1.3, Figure 13) attracts hundreds of thousands of migratory waterfowl, shorebirds, and wading birds during spring and fall migrations. Wildlife can contribute *E. coli* bacteria through direct deposit of waste in water bodies and riparian areas and through runoff. Extent of *E. coli* bacteria loading in the Wild Rice Watersheds due to wildlife is undetermined without conducting bacteria source tracking analysis.

5.0 TECHNICAL ANALYSIS

The loading capacity, or Total Maximum Daily Load (TMDL), is the amount of a pollutant (e.g. *E. coli* bacteria) a water body can receive and still meet and maintain water quality standards and beneficial uses. The goal of TMDL development is to define the link between the water quality target and the identified source or sources of the pollutant, and to determine the load reduction needed to meet the TMDL target.

To determine the cause-and-effect relationship between the water quality target and identified source(s), the Load Duration Curve (LDC) methodology was applied. Critical conditions were considered by evaluating exceedances in each flow interval and assigning associated reductions. The following technical analysis addresses the reductions necessary to achieve the TMDL target for *E. coli* bacteria of 126 CFU/100 mL with a margin of safety.

5.1 Mean Daily Streamflow

In southeastern North Dakota rain events are variable. Rain events can be sporadic and heavy, or light occurring over a short duration. Precipitation events of large magnitude, occurring at a faster rate than absorption, contribute to high runoff events. These events are represented by runoff in the high flow regime (Figure 19). The moist and dry 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. Mean daily discharge for each TMDL segment in the Wild Rice Watersheds were based on data collected from USGS streamgaging station 05051600 (see section 1.6.2).

5.2 Flow Duration Curve Analysis

The Flow Duration Curve (FDC) serves as the foundation for the Load Duration Curve (LDC). FDC analysis considers the cumulative frequency of historic flow data over a specified time period. An FDC 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*" (e.g. duration) provides a uniform scale ranging from 0 to 100 percent, accounting for the full range of stream flows for the period of record. Low flows are exceeded most of the time, while flood flows are exceeded infrequently (EPA, 2007).

On a graph, the FDC runs from high to low (0 to 100 percent) along the x-axis and corresponding flow values on the y-axis (Figure 19). Using this approach, flow duration intervals (or zones) are expressed as a percentage, with zero corresponding to the highest flows in the record (e.g. flood conditions) and one hundred (100) to the lowest flows in the record (e.g. drought). Flow duration intervals are a general indicator of hydrologic condition (e.g. wet vs dry and to what degree). Intervals provide additional insight about conditions and patterns associated with the impairment (EPA, 2007).

FDCs were developed for the Wild Rice Watersheds using streamflow data from USGS streamgaging station 05051600 on the Wild Rice River (Figure 14). Station 05051600 collects mean daily discharge data from March-September each year. Although North Dakota Water Quality Standards for *E. coli* apply from May-September; March and April flow data were included to better represent potential variability in spring flow conditions. FDCs for the Wild Rice Watersheds were developed using data from (March-September) 2008-2021.

FDCs for ungaged sites were developed using streamflow estimates based on drainage area ratios (Section 1.6.2). As a result, FDCs show the same trends and were assigned similar flow duration intervals. Flow intervals were defined by examining the range of flows for the period of record and identifying natural breaks in the flow record. For the period of record, High Flow occurred up to 8% of the time (0-8%), Moist conditions 22% of the time (8-30%), Dry conditions 43% of the time (30-73%), and Low Flow 15% of the time (73-88%). No flow occurred 12% of the time (88-100%).

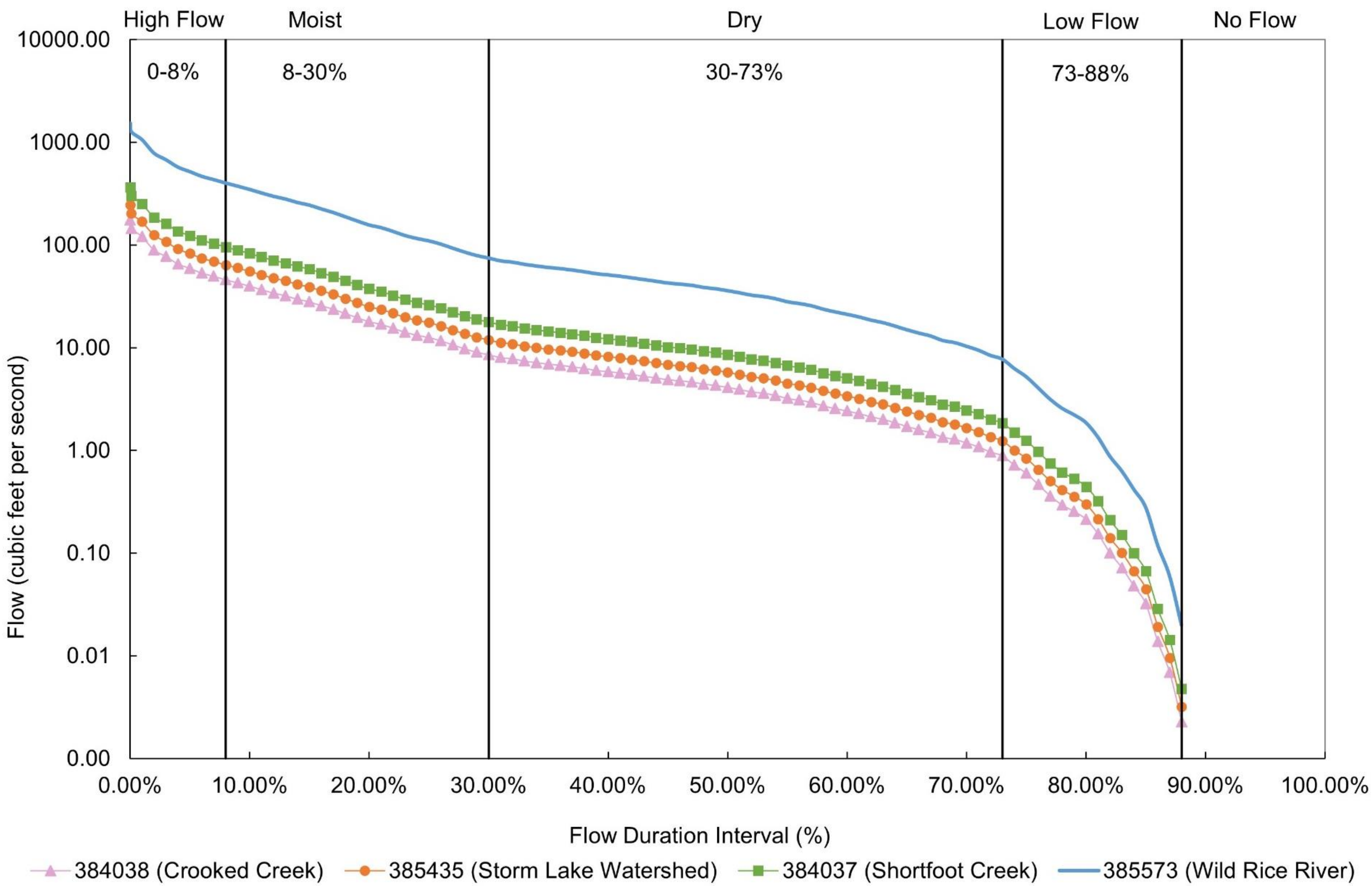

Figure 19. Flow Duration Curves for water quality monitoring stations in the Wild Rice Watersheds. Flow data collected from USGS streamgaging station 05051600 March-September 2008-2021.

5.3 Load Duration Curve Analysis

An important factor in determining pollution source is the variability in stream flows and associated loads. A Load Duration Curve (LDC) correlates pollutant concentration and flow to help determine pollutant loading. LDCs for AUs in the Wild Rice Watersheds were developed using the *E. coli* bacteria target of 126 CFU/100 mL and flow data as described in Section 5.2.

E. coli bacteria data collected from each monitoring site were converted into pollutant loads by multiplying concentration and mean daily flow and applying unit conversions. Loads were plotted against flow percentiles, where the percent represented the fraction of flows that met or exceeded the flow measured (or estimated) on the day an *E. coli* bacteria sample was collected. A target water quality standard line was included to represent the TMDL target (flow at which *E. coli* bacteria concentration = 126 CFU/mL). Points plotted below the line were meeting State water quality standards, and points plotted above the line exceeded standards.

For each flow duration interval, or zone, a regression relationship was developed for the samples that plotted above the TMDL target line. Regression equations were used to determine existing *E. coli* bacteria loading using the midpoint of each flow duration interval.

Regression equation (where *load* is measured in 10^7 CFU/day):

*E. coli bacteria load = antilog (intercept + (slope * midpoint percent of flow duration interval))*

The LDC for site 385573 represents AUs ND-09020105-018-S_00 and ND-09020105-022-S_00 on the Wild Rice River and is based on co-located USGS streamgaging station 05051600 mean daily discharge data (Figure 20).

The LDC for site 384037 represents AU ND-09020105-016-S_00 on Shortfoot Creek and is based on Drainage Area Ratio method estimates of streamflow from USGS streamgaging station 05051600 (Figure 21).

The LDC for site 385435 represents AU ND-09020105-014-S_00 on an unnamed tributary to the Wild Rice River, in the Storm Lake watershed, and is based on Drainage Area Ratio method estimates of streamflow from USGS streamgaging station 05051600 (Figure 22). As detailed in Table 9, site 385435 had only two *E. coli* samples collected in May. As a result, water quality samples in High Flow (spring runoff) conditions were not represented by the LDC and flow intervals were adjusted to reflect sampling conditions, combining High and Moist Flow intervals.

The LDC for site 384038 represents AU ND-09020105-017-S_00 on Crooked Creek and is based on Drainage Area Ratio method estimates of streamflow from USGS streamgaging station 05051600 (Figure 23). Flow intervals for the LDC were adjusted, combining Dry and Low Flow intervals, due to no samples being collected in estimated Low Flow conditions.

LDCs and flow interval regression components for each water quality monitoring site are detailed in Appendices C-F.

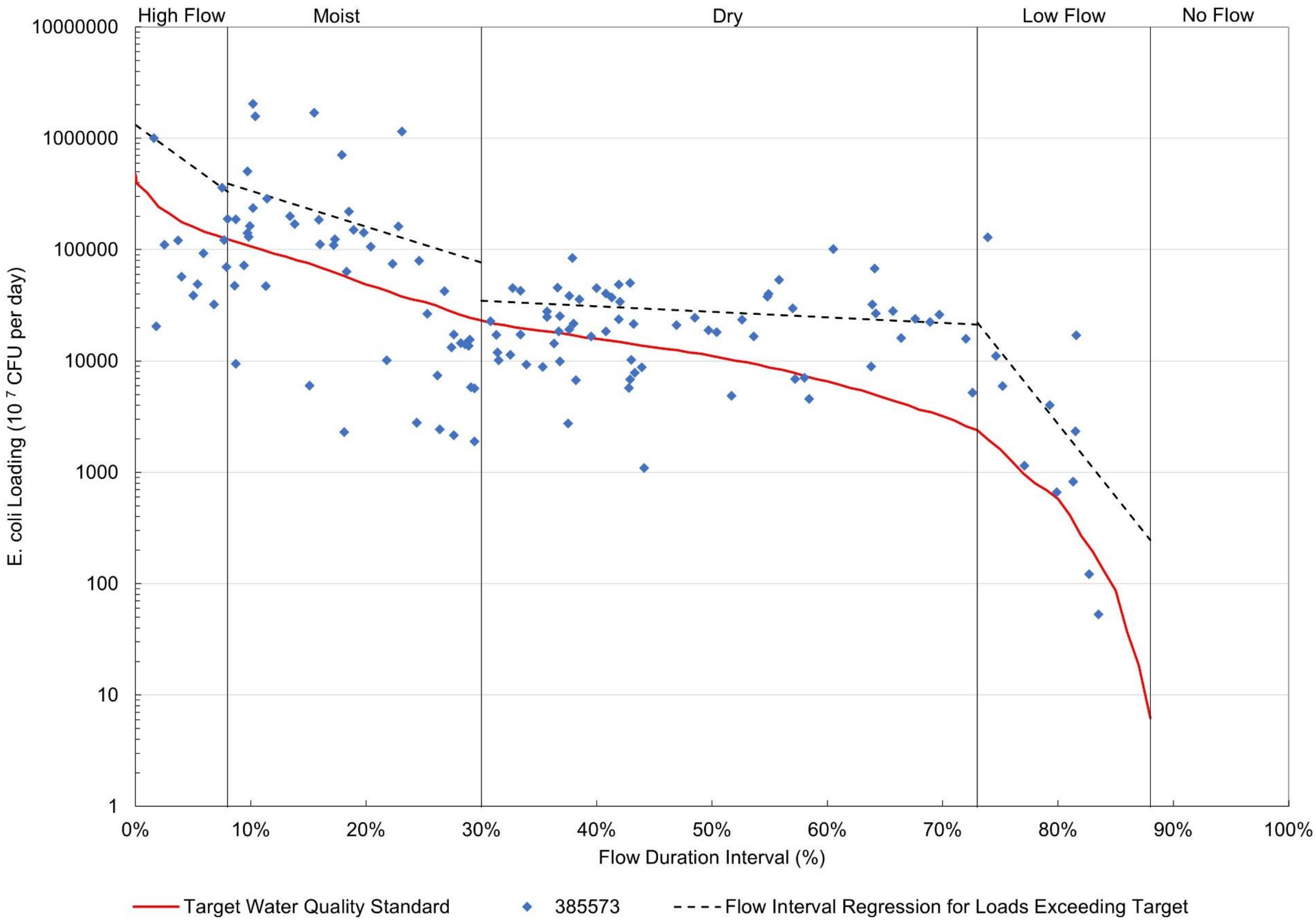

Figure 20. Load Duration Curve and flow interval exceedance regressions for site 385573 on the Wild Rice River (ND-09020105-018-S_00 and ND-09020105-022-S_00).

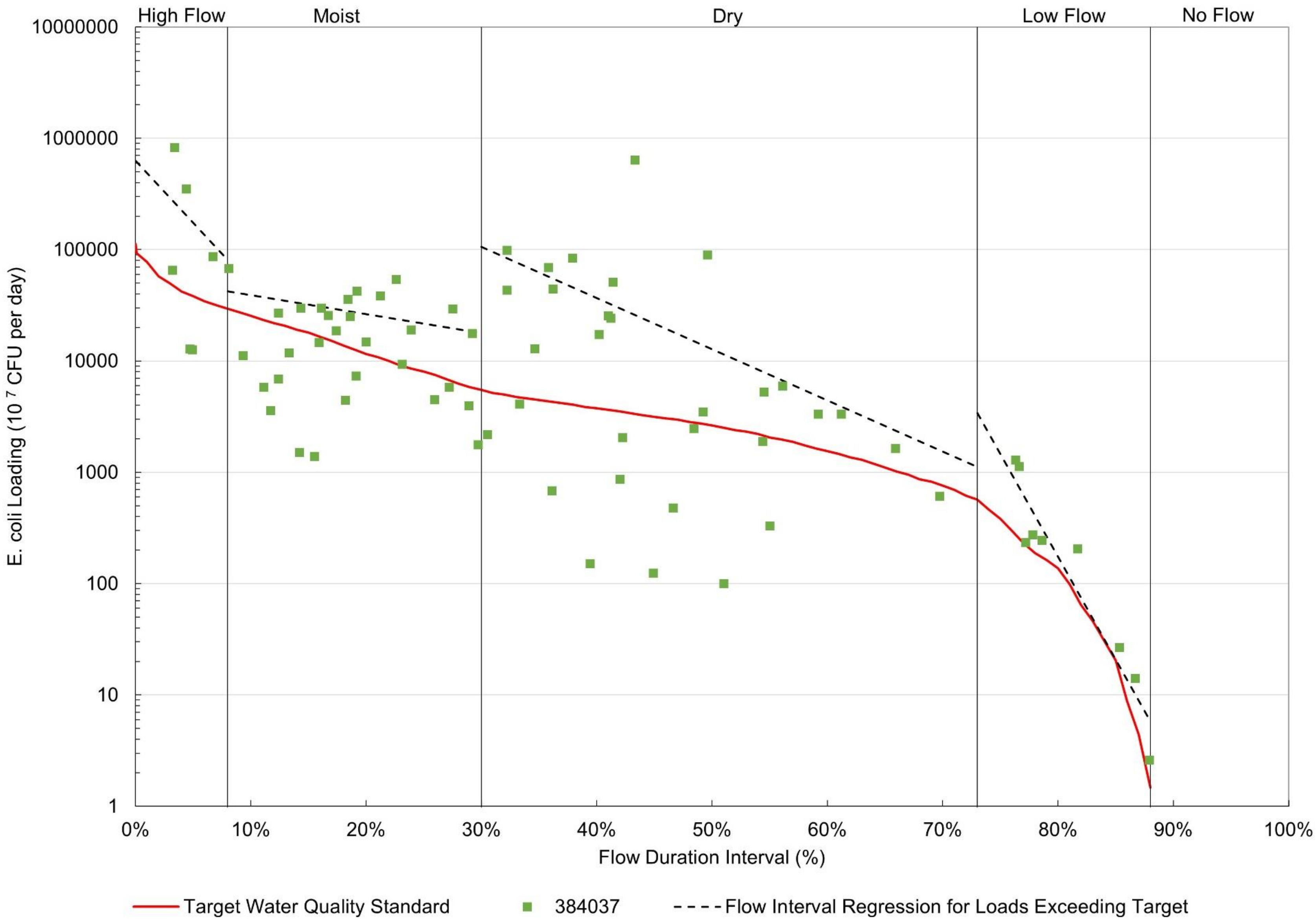

Figure 21. Load Duration Curve and flow interval exceedance regressions for site 384037 on Shortfoot Creek (ND-09020105-016-S_00).

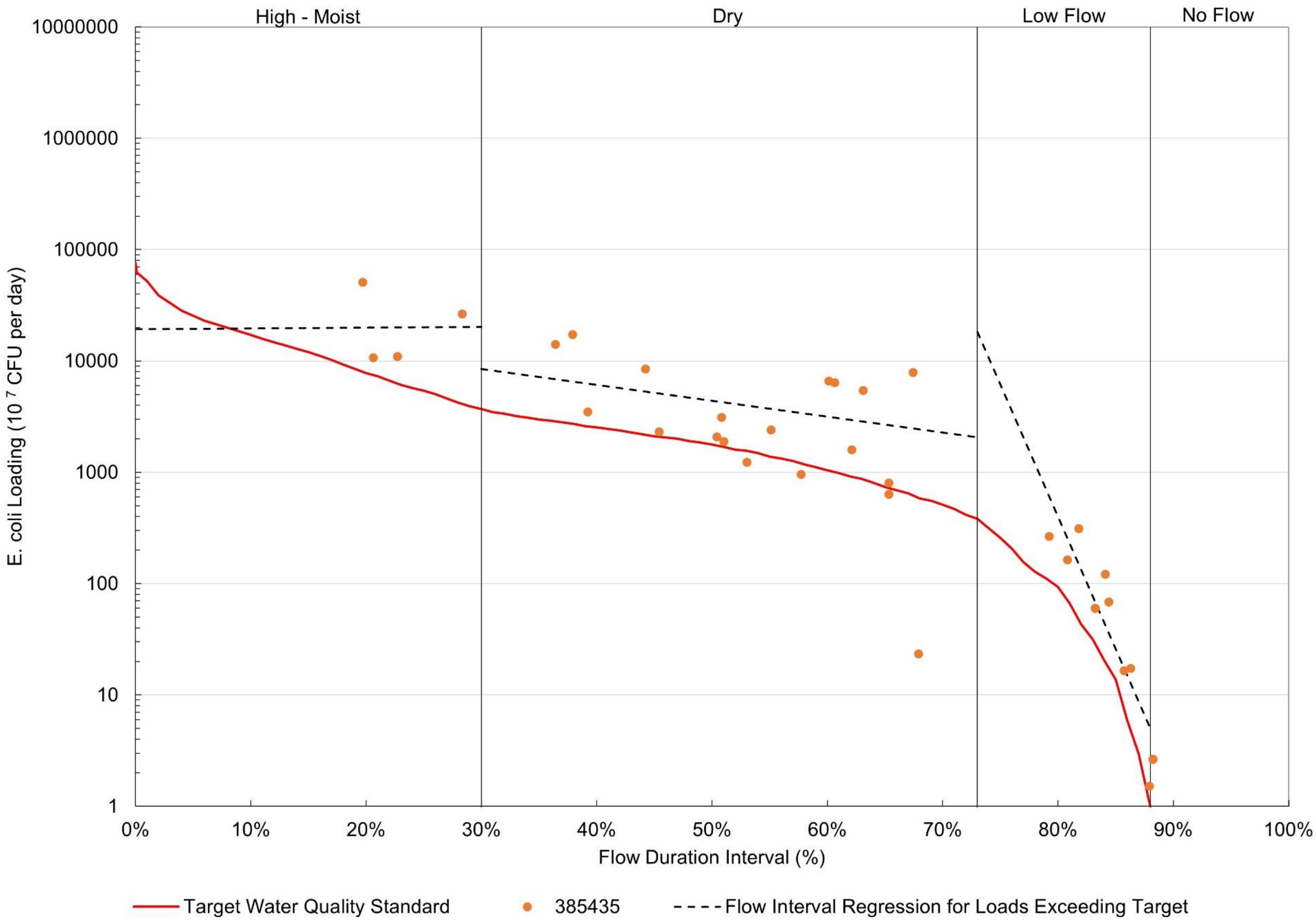

Figure 22. Load Duration Curve and flow interval exceedance regressions for site 385435 on an unnamed tributary to the Wild Rice River in the Storm Lake watershed (ND-09020105-014-S_00).

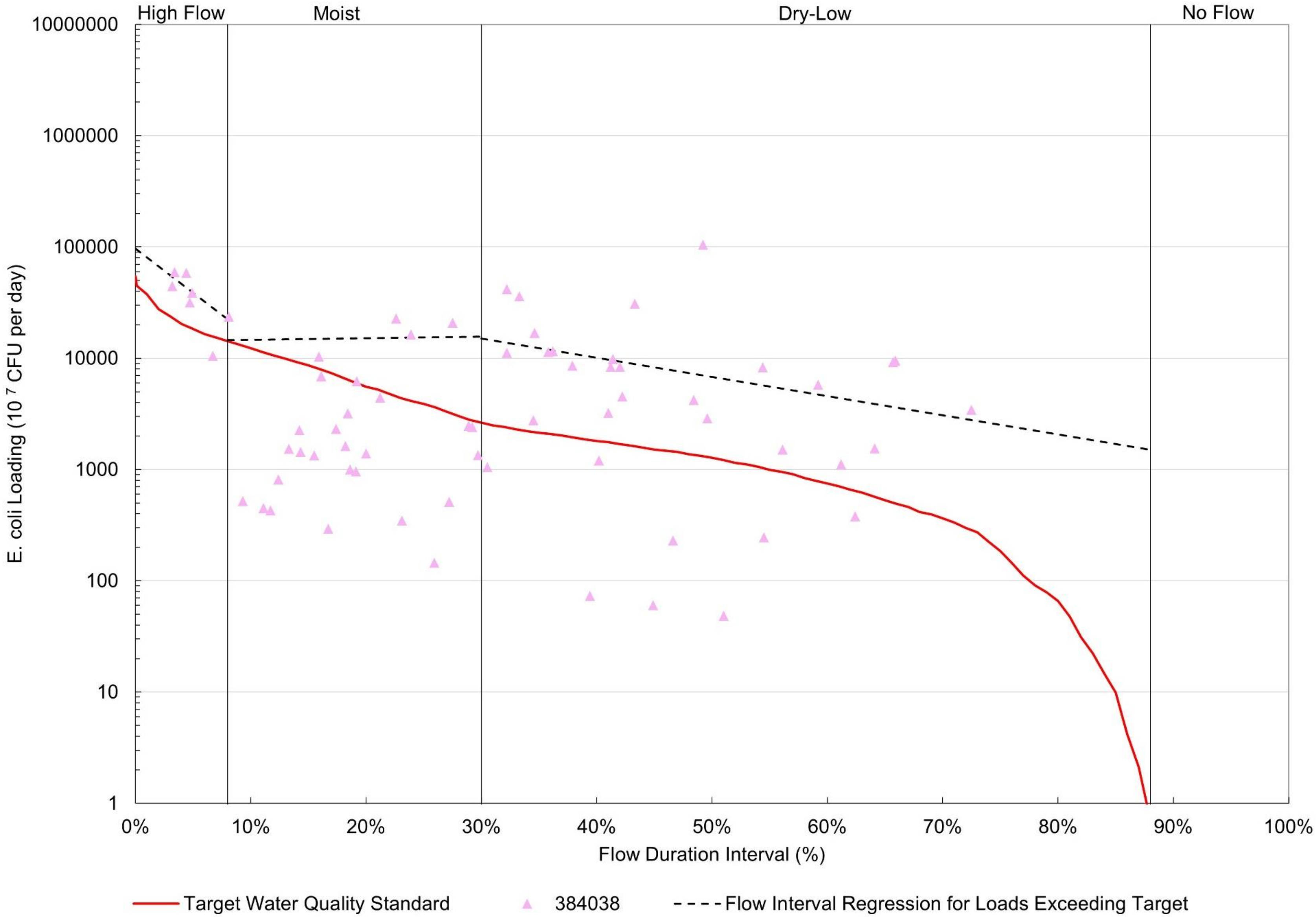

Figure 23. Load Duration Curve and flow interval exceedance regressions for site 384038 on Crooked Creek (ND-09020105-017-S_00).

The midpoint of each flow interval regression (points plotting above Target Water Quality Standard) was used to represent existing *E. coli* bacteria loading at each site. Table 15 details existing loads and corresponding water quality standards (TMDL). TMDLs were represented by the Target Water Quality Standard at flow regression midpoints. LDC analyses indicated exceedance of State Water Quality Standards in each flow interval, for all assessment units in the Wild Rice Watersheds.

Table 15. Estimated *E. coli* bacteria loading at water quality monitoring sites in the Wild Rice Watersheds based on LDC and regressions above water quality target curve.

E. coli (10^7 *CFU/day*)		High Flow	Moist	Dry	Low Flow
Wild Rice River (ND-09020105-018-S_00 & ND-09020105-022-S_00)					
385573	Existing Load	658,962	172,941	27,129	2,334
	TMDL	176,985	53,014	10,328	487
Shortfoot Creek (ND-09020105-016-S_00)					
384037	Existing Load	224,415	27,422	10,861	141
	TMDL	42,019	12,586	2,452	116
Unnamed tributary to Wild Rice River (Storm Lake watershed) (ND-09020105-014-S_00)					
385435	Existing Load	19,733		4,169	302
	TMDL	12,047		1,647	78
Crooked Creek (ND-09020105-017-S_00)					
384038	Existing Load	46,205	15,055	4,756	
	TMDL	20,246	6,065	790	

5.4 Wasteload Allocation (WLA) Analysis

Wasteload allocations for permitted POTWs were calculated based on:

1) The computed average daily discharge during the recreation period (May – September) from 2007 to 2021. Calculating WLAs based on average daily discharge during the recreation period accounts for variability in volume and duration of facility discharges. Average daily discharge was calculated by dividing the total volume discharged by the number of days discharging as reported on facility Discharge Monitoring Reports (DMRs).

2) The North Dakota Water Quality Standard for *E. coli* bacteria, 126 CFU/100 mL. Calculating WLAs based on state water quality standards ensures permitted dischargers are meeting state water quality standards.

The above criteria are represented by the following equation:

WLA = POTW Average Daily Discharge x 126 CFU / 100 mL x Unit Conversion

Discharge Monitoring Report (DMR) data used in wasteload allocation calculations is detailed in Appendix G.

5.4.1 Storm Lake Watershed Wasteload Allocations (ND-09020105-014-S_00)

Wasteload allocations were determined for two NDPDES permitted dischargers for ND-09020105-014-S_00 in the Storm Lake watershed including the City of Gwinner, ND POTW and the City of Milnor, ND POTW.

5.4.1.1 City of Gwinner, ND Publicly Owned Treatment Works Wasteload Allocation

Average discharge from the City of Gwinner POTW during the five-month recreation season was 5.2 million gallons per day (MGD) over 13 days.

Gwinner POTW WLA =

$$5.2 \text{ MGD} * 126 \text{ CFU} / 100 \text{ mL} * 378{,}541 \times 10^4 \text{ mL/MG}$$

$$= 2{,}500 \times 10^7 \text{ CFU per day}$$

The current City of Gwinner NDPDES permit does not include *E. coli* bacteria limits. Upon permit reissuance (October 1, 2024) the POTW permit should include *E. coli* bacteria limits based on North Dakota Water Quality Standards. The WLA for the City of Gwinner is not intended to add load limits to the NDPDES permit. The updated permit is deemed consistent with the assumptions of the WLA, as required under 40 CFR 122.44(d)(1)(vii)(B), by adhering to permit requirements, primarily by meeting end-of-pipe *E. coli* concentrations consistent with the applicable water quality criteria and concentration-based TMDL target.

The WLA above represents discharge that is non-continuous and occurs during periods when increased streamflow typically occurs (May, June, July). As such, the WLA represents estimated loading contribution during the High-Moist Flow Interval only (Table 19). WLAs equal to zero representing Dry and Low Flow Intervals are not intended to restrict discharge under the updated NDPDES permit during Dry and/or Low Flow conditions. As long as wastewater discharges from the City of Gwinner POTW do not exceed future *E. coli* effluent concentration limits, variable flow rates from this facility are not expected to impact the TMDL. The TMDL allocations (i.e., WLAs) would need to be adjusted in the future if facility capacity increases or a new wasteload is added to the stream segment.

5.4.1.2 City of Milnor, ND Publicly Owned Treatment Works Wasteload Allocation

Average discharge from the City of Milnor POTW during the five-month recreation season was 1.060 million gallons per day (MGD) over seven days.

Milnor POTW WLA =

1.060 MGD * 126 CFU / 100 mL * 378,541 x 10^4 mL/MG

= 505.6 x 10^7 CFU per day

The current City of Milnor NDPDES permit does not include *E. coli* bacteria limits. Upon permit reissuance (October 1, 2024) the POTW permit should include *E. coli* bacteria limits based on North Dakota Water Quality Standards. The WLA for the City of Milnor is not intended to add load limits to the NDPDES permit. The updated permit is deemed consistent with the assumptions of the WLA, as required under 40 CFR 122.44(d)(1)(vii)(B), by adhering to permit requirements, primarily by meeting end-of-pipe *E. coli* concentrations consistent with the applicable water quality criteria and concentration-based TMDL target.

The WLA above represents discharge that is non-continuous and occurs during periods when increased streamflow typically occurs (May, June, July). As such, the WLA represents estimated loading contribution during the High-Moist Flow Interval only (Table 19). WLAs equal to zero representing Dry and Low Flow Intervals are not intended to restrict discharge under the updated NDPDES permit during Dry and/or Low Flow conditions. As long as wastewater discharges from the City of Milnor POTW do not exceed future *E. coli* effluent concentration limits, variable flow rates from this facility are not expected to impact the TMDL. The TMDL allocations (i.e., WLAs) would need to be adjusted in the future if facility capacity increases or a new wasteload is added to the stream segment.

In 2018 an *E. coli* TMDL was approved for a segment of the Wild Rice River (ND-09020105-012-S_00), including a WLA for the city of Milnor POTW. The 2018 WLA was developed to represent indirect point source contribution to the Wild Rice River from the tributary to the Wild Rice River that the POTW discharged to (ND-09020105-014-S_00, addressed in this report). Further, the 2018 WLA was determined based on POTW discharge data from 2011-2014, which estimated POTW loading to be 925.3 x 10^7 CFU/day. The current TMDL represents a WLA for the tributary to the Wild Rice River that the POTW discharges directly to (ND-09020105-014-S_00) and was determined using POTW discharge data from 2007-2021. Therefore, the current TMDL WLA and permit criteria detailed in Section 5.4.1.2 will supersede the 2018 WLA. In compliance with the updated WLA and permit criteria, the city of Milnor POTW is not expected to impact the TMDL previously developed for ND-09020105-012-S_00 on the Wild Rice River.

5.4.2 Shortfoot Creek Wasteload Allocations (ND-09020105-016-S_00)

A wasteload allocation was considered for one NDPDES permitted discharger for ND-09020105-016-S_00 on Shortfoot Creek, the City of Cayuga POTW. Additional permittees in the Shortfoot Creek-Wild Rice River watershed included the City of Lidgerwood, ND POTW and the Veblen Flats Housing Wastewater Treatment Plant on the Lake Traverse Reservation.

The Lidgerwood POTW is permitted to discharge to a water body in the subwatershed that does not contribute to the impaired segments of Shortfoot Creek and as such does not require a WLA for this TMDL.

The Veblen Flats Housing WWTP, located in the Shortfoot Creek Watershed upstream of North Dakota's designated assessment unit, is permitted under EPA's General Permit for Wastewater Lagoon Systems in Indian County. This segment of Shortfoot Creek is not under jurisdiction of North Dakota's state water quality standards and as such no WLA was developed. Further, as described in Section 4.1.3, the WWTP has not reported any discharge. It should be noted that the current Veblen Flats Housing WWTP permit does not include *E. coli* bacteria limits because the facility is considered a "no-discharge" lagoon and is therefore not permitted to discharge to Shortfoot Creek. If a discharge did occur in the future, monitoring would be required, and the permittee would be required to notify EPA and the Tribe as a condition of the permit.

5.4.2.1 City of Cayuga, ND Publicly Owned Treatment Works Wasteload Allocation

As detailed in Section 4.1.1, ECHO records show that no discharge has been reported for the City of Cayuga POTW. As such, a WLA equal to zero was used to represent estimated loading contribution. The current NDPDES permit does not include *E. coli* bacteria limits. Upon permit reissuance (October 1, 2024) the POTW permit should include *E. coli* bacteria limits based on North Dakota Water Quality Standards.

WLAs equal to zero are not intended to restrict discharge under the updated NDPDES permit. As long as wastewater discharge from the City of Cayuga POTW does not exceed future *E. coli* effluent concentration limits, variable flow rates from this facility are not expected to impact the TMDL. The TMDL allocations (i.e., WLAs) would need to be adjusted in the future if the facility capacity increases or a new wasteload is added to the stream segment.

5.4.3 Crooked Creek Wasteload Allocations (ND-09020105-017-S_00)

A wasteload allocation was determined for one NDPDES permitted discharger for ND-09020105-017-S_00 on Crooked Creek, the City of Forman, ND POTW. One additional facility, the City of Cogswell, ND POTW, is permitted to discharge in the Crooked Creek watershed. The Cogswell POTW is permitted to discharge to a water body that does not contribute to the impaired segments of Crooked Creek and as such does not require a WLA for this TMDL.

5.4.3.1 City of Forman, ND Publicly Owned Treatment Works Wasteload Allocation

Average discharge from the City of Forman POTW during the five-month recreation season was 1.48 million gallons per day (MGD) over seven days.

$$\text{Forman POTW WLA} =$$

$$1.48 \text{ MGD} * 126 \text{ CFU} / 100 \text{ mL} * 378{,}541 \times 10^{4} \text{ mL/MG}$$

$$= 706 \times 10^{7} \text{ CFU per day}$$

The current City of Forman NDPDES permit does not include *E. coli* bacteria limits. Upon permit reissuance (October 1, 2024) the POTW permit should include *E. coli* bacteria limits based on North Dakota Water Quality Standards. The WLA for the City of Forman is not intended to add load limits to the NDPDES permit. The updated permit is deemed consistent with the assumptions of the WLA, as required under 40 CFR 122.44(d)(1)(vii)(B), by adhering to permit requirements, primarily by meeting end-of-pipe *E. coli* concentrations consistent with the applicable water quality criteria and concentration-based TMDL target.

The WLA above represents discharge that is non-continuous and occurs during periods when increased streamflow typically occurs (May, June, July). As such, the WLA represents estimated loading contribution during the High and Moist Flow Intervals only (Table 20). A WLA equal to zero representing the Dry-Low Flow Interval is not intended to restrict discharge under the updated NDPDES permit during Dry-Low Flow conditions. As long as wastewater discharges from the City of Forman POTW do not exceed future *E. coli* effluent concentration limits, variable flow rates from this facility are not expected to impact the TMDL. The TMDL allocations (i.e., WLAs) would need to be adjusted in the future if facility capacity increases or a new wasteload is added to the stream segment.

5.4.4 Wild Rice River Wasteload Allocations (ND-09020105-018-S_00 & ND-09020105-022-S_00)

There were no permitted facilities directly discharging to segments ND-09020105-018-S_00 or ND-09020105-022 on the Wild Rice River. One facility, the City of Rutland, ND POTW, is permitted to discharge to a drainage ditch to the Wild Rice River that meets the downstream end of segment ND-09020105-018-S_00.

5.4.4.1 City of Rutland, ND Publicly Owned Treatment Works Wasteload Allocation

Average discharge from the City of Rutland POTW during the five-month recreation season was 0.23 million gallons per day (MGD) over seven days.

$$\text{Rutland POTW WLA} =$$

$$0.23 \text{ MGD} * 126 \text{ CFU} / 100 \text{ mL} * 378{,}541 \times 10^4 \text{ mL/MG}$$

$$= 110 \times 10^7 \text{ CFU per day}$$

The current city of Rutland NDPDES permit does not include *E. coli* bacteria limits. Upon permit reissuance (October 1, 2024) the POTW permit should include *E. coli* bacteria limits based on North Dakota Water Quality Standards. The WLA for the City of Rutland is not intended to add load limits to the NDPDES permit. The updated permit is deemed consistent with the assumptions of the WLA, as required under 40 CFR 122.44(d)(1)(vii)(B), by adhering to permit requirements, primarily by meeting end-of-pipe *E. coli* concentrations consistent with the applicable water quality criteria and concentration-based TMDL target. As long as wastewater discharges from the City of Rutland do not exceed future *E. coli* effluent concentration limits, variable flow rates from this facility are not expected to impact the TMDL. The TMDL allocations (i.e., WLA) would need to be adjusted in the future if facility capacity increases or a new wasteload is added to the stream segment.

6.0 MARGIN OF SAFETY AND SEASONALITY

Section 303(d) of the Clean Water Act and EPA regulations require “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 that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." (40 CFR Part 130.7(b)(5))

6.1 Margin of Safety

A Margin of Safety (MOS) acknowledges the uncertainty in pollutant loading analysis and can be incorporated into a TMDL as conservative assumptions during development (implicit) or as a separate component (explicit). Analyses in Wild Rice Watersheds produce uncertainty in knowing *E. coli* sources, using the Drainage-Area Ratio method to estimate flow, and as a result uncertainty in the load reductions determined to achieve TMDL targets. To account for these uncertainties TMDLs were calculated using an explicit 10% MOS; where 10% of each TMDL (as calculated from LDCs) was added.

6.2 Seasonality

The summer season is considered the critical period when recreation is most likely to occur. As a result, North Dakota Water Quality Standards for *E. coli* bacteria concentration apply during the recreation season, May 1-September 30. To account for seasonal variability, all available flow data for the period of 2008-2021 (March-September) was used in developing LDCs. Further, reductions were assigned based on flow intervals which typically correlate with seasonality (e.g. higher flows in the spring and lower flows in the fall).

7.0 TOTAL MAXIMUM DAILY LOAD

Total Maximum Daily Loads for impaired segments in the Wild Rice Watersheds were calculated based on the sum of respective load allocations, wasteload allocations and Margins of Safety, as represented by the following equation:

$$\textbf{TMDL} = \textbf{LC} = \textbf{WLA} + \textbf{LA} + \textbf{MOS}$$

where,

LC = Loading Capacity, the greatest loading a water body can receive without violating water quality standards.

WLA = Wasteload Allocation, the portion of the TMDL allocated to existing or future point sources.

LA = Load Allocation, the portion of the TMDL allocated to existing or future non-point sources.

MOS = Margin of Safety, the portion of the TMDL accounting for uncertainty in the relationship between pollutant loads and receiving water quality.

Each TMDL was developed in consideration of critical elements such as beneficial use impairment, state water quality standards, pollutant sources, and margins of safety (Table 16).

Table 16. Critical elements for the Wild Rice Watersheds Section 303(d) listed segments.

Category	Description	Explanation
Beneficial Use Impairment	Recreation	Contact recreation (i.e. fishing, swimming)
Pollutant	*E. coli* bacteria	See Section 2.0
Existing Load	See Table 15	See Section 5.3
TMDL Target	126 CFU/100 mL	See Section 2.1.2
Pollutant Sources	Nonpoint and Point Sources	See Section 4.0
Margin of Safety	Explicit	10%

The five *E. coli* impaired segments of the Wild Rice Watersheds were assigned four TMDLs to support state water quality standards and beneficial uses (Tables 17-20). Each provides an estimate of the existing daily load and the target average daily load, differentiated by flow regime. Loads, load allocations, and MOS were estimated based on available data and reasonable assumptions and are intended to be a guide for implementation. Actual reductions needed to meet applicable state water quality standards may be higher or lower depending on future monitoring results.

Table 17. *E. coli* bacteria TMDL (CFU x 10^7 / day) for the Wild Rice River (ND-09020105-018-S_00 & ND-09020105-022-S_00) based on monitoring site 385573.

Unit: CFU x 10^7/day	Flow Interval			
	High	Moist	Dry	Low
Existing Load	658,962	172,941	27,129	2,334
TMDL	176,985	53,014	10,328	487
WLA – Rutland POTW	110 (<1% of TMDL)	110 (<1% of TMDL)	110 (1% of TMDL)	110 (23% of TMDL)
LA	159,176.5 (89% of TMDL)	47,602.6 (89% of TMDL)	9,185.2 (89% of TMDL)	328.3 (67% of TMDL)
MOS	17,698.5 (10% of TMDL)	5,301.4 (10% of TMDL)	1,032.8 (10% of TMDL)	48.7 (10% of TMDL)
Reduction Needed	*73%*	*69%*	*62%*	*79%*

Table 18. *E. coli* bacteria TMDL (CFU x 10^7 / day) for Shortfoot Creek (ND-09020105-016-S_00) based on monitoring site 384037.

Unit: CFU x 10^7/day	Flow Interval			
	High	Moist	Dry	Low
Existing Load	224,415	27,422	10,861	141
TMDL	42,019	12,586	2,452	116
WLA	0	0	0	0
LA	37,817.1 (90% of TMDL)	11,327.4 (90% of TMDL)	2,206.8 (90% of TMDL)	104.4 (90% of TMDL)
MOS	4,201.9 (10% of TMDL)	1,258.6 (10% of TMDL)	245.2 (10% of TMDL)	11.6 (10% of TMDL)
Reduction Needed	*81%*	*54%*	*77%*	*18%*

Table 19. *E. coli* bacteria TMDL (CFU x 10^7 / day) for an unnamed tributary to the Wild Rice River (ND-09020105-014-S_00) based on monitoring site 385435.

Unit: CFU x 10^7/day	Flow Interval		
	High - Moist	Dry	Low
Existing Load	19,733	4,169	302
TMDL	12,047	1,647	78
WLA – Gwinner POTW	2,500 (21% of TMDL)	0	0
WLA – Milnor POTW	505.6 (4% of TMDL)	0	0
LA	7,837.7 (65% of TMDL)	1,482.3 (90% of TMDL)	70.2 (90% of TMDL)
MOS	1,204.7 (10% of TMDL)	164.7 (10% of TMDL)	7.8 (10% of TMDL)
Reduction Needed	*39 %*	*60 %*	*74 %*

Table 20. *E. coli* bacteria TMDL (CFU x 10^7 / day) for Crooked Creek (ND-09020105-017-S_00) based on monitoring site 384038.

Measurement unit: CFU x 10^7 / day	Flow Interval		
	High	Moist	Dry - Low
Existing Load	46,205	15,055	4,756
TMDL	20,246	6,065	790
WLA – Forman POTW	706 (3% of TMDL)	706 (12% of TMDL)	0
LA	17,515.4 (87% of TMDL)	4,752.5 (78% of TMDL)	711 (90% of TMDL)
MOS	2,024.6 (10% of TMDL)	606.5 (10% of TMDL)	79 (10% of TMDL)
Reduction Needed	*56%*	*60%*	*83%*

7.1 Allocations

There are multiple permitted point source dischargers actively and routinely discharging to two Section 303(d) *E. coli* impaired segments in the Wild Rice Watersheds. As discussed in Section 4.0, permitted facilities discharging are small wastewater lagoon systems servicing residential areas not anticipated to experience significant increase in population. The majority of *E. coli* bacteria loading in the Wild Rice Watersheds is due to nonpoint sources. Where no point source discharge is permitted or contributing, loading was entirely allocated to nonpoint sources (less a margin of safety). Nonpoint source loads are allocated as single loads for each TMDL due to limited data on individual source contribution (e.g. septic systems, agricultural runoff, wildlife, etc.).

7.1.1 Allocations to ND-09020105-014-S_00 in the Storm Lake Watershed

The cities of Gwinner and Milnor POTWs are non-continuous dischargers to an unnamed tributary to the Wild Rice River in the Storm Lake watershed (ND-09020105-014-S_00). The POTWs were designated WLAs of 2,500 x 10^7 CFU/day and 505.6 x 10^7 CFU/day respectively. As detailed in Section 5.4.1 the WLAs represent estimated loading during high-moist flow conditions and do not restrict POTW discharge compliant with state water quality *E. coli* concentration standards. The remaining load was allocated to nonpoint sources, less a margin of safety.

7.1.2 Allocations to ND-09020105-016-S_00 in the Shortfoot Creek-Wild Rice River Watershed

There were no known point source dischargers contributing to AU ND-09020105-016-S_00 in the Shortfoot Creek-Wild Rice watershed. The entire load for all flow intervals was allocated to nonpoint sources, less a margin of safety.

7.1.3 Allocations to ND-09020105-017-S_00 in the Crooked Creek Watershed

The city of Forman POTW is a non-continuous discharger to an unnamed tributary to Crooked Creek in the Crooked Creek watershed (ND-09020105-017-S_00). The POTW was designated a WLA of 706 x 10^7 CFU/day. As detailed in Section 5.4.1 the WLA represents estimated loading during high and moist flow conditions and does not restrict POTW discharge compliant with state water quality *E. coli* concentration standards. The remaining load was allocated to nonpoint sources, less a margin of safety.

7.1.4 Allocations to ND-09020105-018-S_00 and ND-09020105-022-S_00 in the Lake Tewaukon-Wild Rice River watershed

The city of Rutland is a non-continuous discharger indirectly contributing to AU ND-09020105-022-S_00. The POTW was designated a WLA of 110 x 10^7 CFU/day. As detailed in Section 5.4.4 the WLA represents estimated loading and does not restrict POTW discharge as long as it complies with state water quality *E. coli* concentration standards. The remaining load allocation was allocated to nonpoint sources, less a margin of safety.

8.0 POLLUTION REDUCTION RECOMMENDATIONS

As discussed in Section 5.4, publicly owned treatment works discharging to Section 303(d) *E. coli* impaired segments of the Wild Rice Watersheds should include state water quality standards for *E. coli* bacteria (126 CFU/100 mL) upon permit reissuance. The intermittent dischargers typically contribute a small percentage of the estimated existing daily load of *E. coli.* However, dischargers meeting the state water quality standard can still contribute larger percentages of the allowable TMDL (see Tables 17, 19, 20). Including *E. coli* bacteria limits based on state water quality standards in reissued POTW permits will identify actual contributions and inform further action, if needed.

Nonpoint source pollution is estimated to be the largest contributor to elevated *E. coli* bacteria levels in the Wild Rice Watersheds. Achieving TMDL targets requires widespread support and voluntary participation of landowners and residents in the Watersheds. The TMDLs described in this report are a plan to improve water quality by implementing best management practices (BMPs) through non-regulatory approaches. BMPs are methods, measures, or practices that are determined to be a reasonable and cost-effective means for a landowner to meet nonpoint source pollution control needs (EPA, 2001).

The Natural Resource Conservation Service (NRCS) is a leading agency in the development and implementation of BMPs. The agency has cataloged and described in detail over 100 BMPs to protect water quality. NRCS BMPs are recommended for mitigation based on their credibility and thorough designs. These recommendations do not exclude use of other BMPs as means for mitigation.

Specific BMPs recommended to support reduction of *E. coli* bacteria nonpoint source pollution in the Wild Rice Watersheds are described below. Water quality monitoring should be conducted, or continue where already taking place, in order to determine BMP effectiveness and identify needs for loading allocation adjustments.

8.1 Cropland Management Recommendations

8.1.1 Vegetative Barrier (NRCS Practice Standard 601)

Vegetative barriers are permanent strips of stiff, dense vegetation established along the general contour of slopes or across concentrated flow areas. Vegetation is used to reduce erosion, manage water flow, stabilize slopes, and trap sediment. Reducing erosion helps reduce movement and rate of movement of sediment (and bacteria) into an adjacent water body. This practice applies to all areas where erosion and sediment (and bacteria) transport are concerns.

8.1.2 Cover Crop (NRCS Practice Standard 340)

Cover crops are grasses, legumes, and forbs planted for seasonal vegetative cover. Cover crops reduce erosion, maintain soil health, and use excess nutrients. This practice applies to all areas where vegetation can protect or improve natural resources (for example, surface water quality). Similar to vegetative barriers, cover crops help manage water flow and reduce movement and rate of movement of sediment (and bacteria) from runoff. Selection of species and timeline of cover crops is based on the desired outcome, such as reducing water quality degradation by utilizing excessive soil nutrients.

8.1.3 Nutrient Management (NRCS Practice 590)

Nutrient management addresses the rate, source, placement, and timing of plant nutrients and soil amendments while reducing environmental impacts. This practice applies to all fields where plant nutrients and soil amendments are applied. Successful management is based on the four R's of nutrient stewardship – apply the *right nutrient source* at the *right rate* at the *right time* in the *right place* – to improve nutrient use efficiency by the crop and to reduce nutrient losses (to surface water). Nutrient management planning improves plant health and productivity while reducing the risk of pathogen (*E. coli*) transport to surface water.

8.1.4 Drainage Water Management (NRCS Practice 554)

Drainage water management addresses drainage volume and water table elevation by regulating flow from a surface or subsurface agricultural system. Managing drainage water reduces nutrient, pathogen, and pesticide loading from drainage systems into downstream receiving waters and improves plant health and productivity. This practice applies to agricultural land with surface or subsurface drainage systems that can be adapted, or are partially adapted, to allow management of drainage volume and water table by changing the elevation of water level at the outlets. Water control structures for outlets set just below the root zone of actively growing crops prior to and during liquid manure applications help prevent direct leakage of manure into drain pipes through soil macro pores (cracks, wormholes, root channels).

8.2 Livestock Management Recommendations

8.2.1 Access Control, Fencing, Water Well & Tank Development (NRCS Practice 472, 382, 642)

Access control is the temporary or permanent exclusion of animals, people, vehicles, and equipment from an area, such as livestock exclusion from riparian areas. Fencing installation limits access to surface water, reducing erosion and reducing bacteria deposition of fecal matter from livestock wading in streams. Where the quality and quantity of water is appropriate for livestock use, a water well and tank provide an alternative water source.

8.2.2 Waste Storage Facility (NRCS Practice 313)

Waste storage facilities are agricultural waste containments used to store manure, agricultural by-products, wastewater, and contaminated runoff. This practice applies where regular storage is needed, and soils, geology, and topography are suitable for construction. Impoundments such as pits or dugouts are designed and constructed to store manure and prevent waste from reaching surface waters.

8.3 Septic System Analysis Recommendation

Septic systems fail when one or more components do not work properly, and untreated waste leaves the system. Untreated septic system waste is a potential source of *E. coli*. Wastes may pond in the leach field and ultimately run off directly into nearby streams. System failure is often the result of improper maintenance (age, inadequate pumping, use of harmful household chemicals), improper installation, or location. In the absence of an existing data, an area-wide septic system analysis is recommended to identify possible *E. coli* bacteria discharges from failing or improperly functioning septic systems.

8.4 *E. coli* Bacteria Source Tracking Analysis Recommendation

Source tracking analysis provides insight to sources (for example, wildlife, livestock, human) and points of entry into a watershed. The Wild Rice Watersheds area contains many temporary and seasonal wetlands that support wildlife. In particular, Section 303(d) *E. coli* impaired segment ND-09020105-018-S_00 flows through a national wildlife refuge (Lake Tewaukon) known to attract hundreds of thousands of birds during migration. Advances in technology and widespread use have decreased the cost of source tracking; local watershed agency partners are recommended to use source tracking in their water quality monitoring programs to help identify *E. coli* sources and support management planning.

8.5 Other Recommendations

Promotion of informational and educational opportunities on watershed practices and water quality encourages land owners and watershed users to network and share ideas that work best in their community. Multiple agencies and organizations host similar venues throughout North Dakota, such as:

a) State funded Water Education Foundation Water Tours. Tours connect participants with projects and plans in North Dakota that address water use, water quality, and sustainability. To learn more visit https://ndwater.org/nd-water-education-foundation/.
b) Soil Conservation District sponsored multi-day workshops/summits. SCDs bring speakers to present on a wide range of topics and involve participants in learning activities.
c) Soil Conservation District sponsored field day demonstrations.
d) North Dakota State University and NDDEQ sponsored "Leadership Academy" focused on watershed restoration and resource conservation activities.
e) NDDEQ annually sponsored "Water Quality Certification" workshop. Participants use a hands-on approach to better understand water quality sampling procedures and techniques.
f) River Keepers annually sponsored river events. Activities include canoeing, excursions, and fishing presented under the theme of environmental education. To learn more visit https://www.riverkeepers.org/.

9.0 PUBLIC PARTICIPATION

Outreach with the Sisseton-Wahpeton Oyate of the Lake Traverse Reservation was conducted prior to a public comment period. A draft of this report (and summary) were shared with the tribe in February 2023 with an invitation to collaborate and discuss any questions or concerns regarding the TMDLs, as well as notice of the upcoming public comment period.

This report was available to the public and open to comment during a 30-day period, July 26-August 25, 2023. During the public comment period the report was posted on the department webpage at https://deq.nd.gov/PublicNotice.aspx. Copies of the report were available to anyone who submitted a request and were emailed or mailed to participating agencies and partners, including:

- Sisseton-Wahpeton Oyate of the Lake Traverse Reservation
- Wild Rice Soil Conservation District
- Sargent County Water Resource District
- Natural Resource Conservation Service (State Office)
- South Dakota Department of Agriculture and Natural Resources
- U.S. Environmental Protection Agency, Region 8
- Tewaukon National Wildlife Refuge

The report was also shared with the following NDPDES permitted facilities:

- City of Cayuga, ND
- City of Forman, ND
- City of Gwinner, ND
- City of Milnor, ND
- City of Rutland, ND

The 30-day public notice soliciting comment and participation was published in the Sargent County Teller, the Daily News (Wahpeton), and the Fargo Forum.

10.0 FUTURE MONITORING

As described in Section 7, TMDLs were estimated based on available data and reasonable assumptions and are intended to guide implementation. Actual reductions needed to meet water quality standards may be higher or lower depending on future monitoring. Monitoring in the Wild Rice Watersheds has been conducted by the Wild Rice Soil Conservation District (SCD) through Section 319 Nonpoint Source project funding (https://www.wildricescd.com/).

In 2022 the Wild Rice SCD began a new project, the Wild Rice River PTMApp Prioritization and Implementation Project, using the Prioritize, Target and Measure Application (PTMApp) mapping system to prioritize areas for watershed planning (visit deq.nd.gov and enter search criteria “NPS Task Force Members Binder Past Projects”). The project prioritizes 12-digit HUCs (subwatersheds) that PTMApp identifies as the highest sources of nutrients and sediments. Although prioritization focuses on nutrients and sediments, water quality monitoring continues to include *E. coli* bacteria sampling. The entire project, expected to span roughly 10 years, will focus on the top five to seven subwatersheds in the Western Wild Rice HUC 8 in Sargent County.

Phase I of the PTMApp project focused on three 12-digit HUCs. Two of the priority HUCs coincide with impaired segments and water quality monitoring stations addressed in this TMDL: water quality monitoring site 384037 on Shortfoot Creek (ND-09020105-016-S_00) and 384038 on Crooked Creek (ND-09020105-017-S_00). Site 385234 on the Wild Rice River (directly downstream of the confluence of the Storm Lake watershed and the Wild Rice River) was also prioritized in Phase I (ND-09020105-012-S_00, *E. coli* TMDL approved by EPA in 2018). Water quality data collected under the Wild Rice PTMApp project will be compared to TMDLs to determine *E. coli* bacteria reduction progress.

At this time there are no active monitoring projects on the three additional impaired segments addressed in this report (ND-09020105-014-S_00, ND-09020105-018-S_00, ND-09020105-022-S_00). However, additional subwatersheds prioritized under future phases of the Wild Rice River PTMApp Project should continue collecting *E. coli* data to determine reduction progress. Further, where no projects are planned future monitoring should be conducted following implementation of BMPs in order to compare conditions to TMDLs and determine *E. coli* bacteria reduction progress. The NDDEQ will continue assisting the Wild Rice SCD with sampling location prioritization, with consideration of reaches where little or no data is available (or where more recent data is needed).

11.0 TMDL IMPLEMENTATION STRATEGY

Allocations for TMDLs in the Wild Rice Watersheds were developed to comply with North Dakota water quality standards. Successful implementation of TMDLs requires collaboration among landowners, agencies, and other parties and individuals. Point source pollution will be addressed and managed through state and federal permits using the established wasteload allocations. Permit criteria that support the success of the Wild Rice Watersheds TMDLs are detailed in Section 5.4.

Nonpoint source pollution management relies on voluntary programs. Voluntary programs depend on availability of Section 319 funds or other watershed restoration programs (e.g. NRCS Environmental Quality Incentives Program), matching funds, and local sponsorship. With these requirements in place a Project Implementation Plan (PIP) can be developed (in accordance with the TMDL) and submitted to the North Dakota Nonpoint Source Pollution Task Force for review. Under the PIP and supporting Quality Assurance Project Plans (QAPPs) project participants collect and monitor data tracking BMP implementation and effectiveness. Recommended BMPs supporting TMDL load allocations for nonpoint sources are detailed in Section 8. As data are gathered and analyzed, watershed restoration activities are adapted to place BMPs where they provide the greatest benefit to water quality.

Ultimately, the success of the TMDLs depends on local engagement and voluntary implementation of BMPs. Such efforts are ongoing through projects managed by the Wild Rice SCD. This report is intended to guide current and future projects in order to restore and maintain surface water quality in the Wild Rice Watersheds.

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Appendix A – Water Quality Monitoring Data for NDDEQ Sites 385435, 385573, 384037, and 384037

Tables A1 – A4 detail water quality data for NDDEQ monitoring sites used to develop TMDLs for the Wild Rice Watersheds. Footnotes for each are combined and listed following Table A4.

Table A1. *E. coli* bacteria water quality data for site 385435 in the Storm Lake watershed (ND-09020105-014-S_00) May-September 2008-2009*.

Date	Time	Result (CFU/100mL)
5/12/2008	10:14	150
5/27/2008	19:55	5 [a/]
6/3/2008	10:24	2100 [b/]
6/10/2008	09:12	490
6/18/2008	09:34	620
6/24/2008	09:44	800 [c/]
6/30/2008	10:01	1600 [d/]
7/7/2008	09:44	310
7/15/2008	09:28	740
7/21/2008	09:33	250
7/27/2008	09:17	340
8/6/2008	10:15	120
8/11/2008	10:40	410
8/18/2008	09:58	290
8/25/2008	09:22	500
9/2/2008	09:58	1200 [b/]
9/8/2008	11:19	130
9/15/2008	09:47	250
9/22/2008	10:25	650
9/29/2008	09:56	370
6/1/2009	10:42	220
6/9/2009	10:35	800 [c/]
6/15/2009	10:44	800 [c/]
6/23/2009	11:17	800 [c/]
6/30/2009	10:21	180

7/6/2009	10:27	140
7/13/2009	10:11	220
7/21/2009	10:10	170
7/27/2009	10:10	100
8/3/2009	10:30	140
8/10/2009	10:26	100
8/17/2009	10:06	220
8/24/2009	09:34	800 [c/]
9/1/2009	12:24	110
9/14/2009	10:35	140
9/28/2009	09:27	230

Table A2. *E. coli* bacteria water quality data for site 385573 on the Wild Rice River (ND-09020105-018_00) May-September 2011-2014*.

Date	Time	Result (CFU/100mL)
5/18/2011	09:37	30
5/23/2011	11:53	50
5/25/2011	10:30	10
5/31/2011	10:41	190
6/1/2011	10:08	120
6/6/2011	11:17	200
6/7/2011	09:23	80
6/13/2011	10:32	60
6/14/2011	09:54	370
6/20/2011	10:07	150
6/21/2011	10:28	190
6/27/2011	10:21	350
6/28/2011	09:36	70
7/5/2011	15:00	570
7/6/2011	09:12	80

7/11/2011	09:35	40
7/12/2011	08:51	60
7/18/2011	09:50	80
7/19/2011	09:00	30
7/25/2011	09:35	160
8/1/2011	08:58	460
8/2/2011	09:28	10
8/8/2011	09:35	40
8/9/2011	09:00	30
8/15/2011	09:00	280
8/16/2011	09:54	1900 [d/]
8/22/2011	10:41	300
8/23/2011	07:42	260
8/29/2011	11:48	330
8/30/2011	09:58	200
9/6/2011	09:14	220
9/7/2011	06:58	250
9/12/2011	09:45	500
9/13/2011	14:38	350
9/19/2011	10:11	360
9/20/2011	09:00	280
9/26/2011	09:45	230
9/27/2011	09:43	520
4/30/2012	11:40	10
5/7/2012	09:00	80
5/9/2012	09:33	70
5/14/2012	10:20	70
5/16/2012	09:26	150
5/21/2012	15:13	60

5/23/2012	07:30	800 [c/]
5/30/2012	09:51	110
6/4/2012	11:01	680
6/6/2012	10:50	800 [c/]
6/11/2012	11:32	800 [c/]
6/13/2012	10:35	8000 [d/]
6/18/2012	10:48	760
6/20/2012	10:34	2000 [d/]
6/25/2012	11:31	260
6/27/2012	10:49	490
7/9/2012	15:04	800 [c/]
7/11/2012	10:34	6300 [d/]
7/23/2012	10:46	800 [c/]
7/24/2012	09:48	270
7/30/2012	10:28	150
7/31/2012	10:31	140
8/6/2012	10:20	70
8/7/2012	10:48	40
5/7/2013	11:30	10
5/6/2013	14:45	5 [a/]
5/13/2013	13:00	10
5/14/2013	11:00	10
5/21/2013	09:00	100
5/22/2013	11:00	3800 [d/]
5/28/2013	11:15	60
5/29/2013	11:00	60
6/5/2013	10:45	410
6/4/2013	14:00	90
6/11/2013	15:00	210

6/12/2013	09:13	220
6/18/2013	17:30	800 [c/]
6/19/2013	10:30	1000 [d/]
6/24/2013	15:00	2900 [d/]
6/26/2013	11:00	1500 [d/]
7/1/2013	10:30	270
7/8/2013	14:00	290
7/10/2013	10:00	310
7/15/2013	10:15	130
7/17/2013	09:45	330
7/22/2013	15:00	130
7/30/2013	11:00	110
7/31/2013	10:30	270
8/5/2013	14:30	100
8/7/2013	10:30	130
8/13/2013	10:00	70
8/14/2013	09:45	70
8/19/2013	15:00	60
8/21/2013	10:15	100
8/26/2013	10:30	620
8/28/2013	11:15	160
9/3/2013	11:30	70
9/4/2013	10:30	80
9/9/2013	14:30	360
9/11/2013	10:30	210
9/16/2013	12:10	570
9/18/2013	11:45	470
9/24/2013	10:30	80
9/25/2013	11:00	120

5/5/2014	11:00	10
5/7/2014	10:45	30
5/12/2014	08:45	30
5/14/2014	10:00	140
5/19/2014	09:00	10
5/21/2014	09:45	70
5/27/2014	10:00	30
5/28/2014	11:00	30
6/2/2014	09:30	280
6/4/2014	09:00	170
6/9/2014	09:30	280
6/10/2014	10:30	320
6/16/2014	09:45	290
6/24/2014	08:30	180
6/25/2014	09:00	80
6/30/2014	09:00	2400 [d/]
7/8/2014	17:15	60
7/9/2014	10:15	70
7/14/2014	09:30	20
7/15/2014	10:30	50
7/22/2014	09:45	50
7/23/2014	10:30	60
7/28/2014	10:00	140
7/30/2014	09:45	200
8/4/2014	12:00	190
8/5/2014	10:30	180
8/13/2014 **	08:00	440
8/18/2014	15:00	210
8/19/2014	18:00	260

8/25/2014	16:15	190
8/26/2014	09:15	10
9/2/2014	11:30	300
9/3/2014	10:30	540
9/8/2014	11:00	800 [c/]
9/10/2014	11:15	800 [c/]
9/15/2014	15:15	220
9/16/2014	10:45	1700 [d/]
9/22/2014	11:30	480

Table A3. *E. coli* bacteria water quality data for site 384037 on Shortfoot Creek (ND-09020105-016-S_00), May-September 2018-2021**.

Date	Time	Result (CFU/100mL)
5/2/2018	10:05	5 [a/]
5/7/2018	10:41	5 [a/]
5/9/2018	09:02	20
5/14/2018	10:40	5 [a/]
5/16/2018	10:00	310
5/23/2018	09:55	20
5/30/2018	09:51	98
6/4/2018	09:40	130
6/6/2018	09:11	560
6/11/2018	08:25	530
6/13/2018	09:07	180
6/18/2018	09:50	200
7/9/2018	07:42	160
7/11/2018	08:25	20
7/16/2018	09:14	110
7/18/2018	09:23	110
7/23/2018	09:20	31

8/1/2018	09:24	74
8/6/2018	09:09	260
8/13/2018	09:25	170
8/20/2018	09:28	350
8/27/2018	09:33	200
9/4/2018	09:25	150
9/24/2018	09:02	270
5/6/2019	08:55	20
5/13/2019	08:53	10
5/20/2019	08:51	1100
5/22/2019	09:03	41
5/29/2019	08:59	31
6/3/2019	09:10	10
6/10/2019	08:43	240
6/12/2019	09:12	74
6/17/2019	08:44	160
6/24/2019	08:55	200
7/1/2019	08:47	130
7/8/2019	08:38	210
7/9/2019	09:05	340
7/16/2019	08:53	74
7/22/2019	08:51	52
8/5/2019	09:05	85
8/6/2019	08:35	40
8/14/2019	08:56	390
8/19/2019	09:00	230
8/20/2019	08:48	110
9/3/2019	09:24	720
9/9/2019	08:52	430

9/11/2019	08:52	290
9/16/2019	08:57	170
9/18/2019	09:06	41
5/4/2020	09:15	160
5/6/2020	09:05	340
5/11/2020	09:11	52
5/18/2020	09:09	41
5/20/2020	09:19	74
6/1/2020	09:13	160
6/3/2020	09:26	41
6/8/2020	09:31	460
6/15/2020	08:07	110
6/22/2020	09:10	580
7/6/2020	09:12	24000
7/15/2020	09:13	4200
7/20/2020	09:05	840
7/22/2020	07:10	880
7/27/2020	09:11	2200
8/3/2020	09:11	280
8/5/2020	09:09	570
8/10/2020	09:35	1100
8/12/2020	09:25	2500
9/2/2020	09:04	360
9/9/2020	09:37	2000
9/14/2020	09:36	1300
9/16/2020	09:23	2600
9/21/2020	09:02	1800
5/3/2021	09:25	110
5/5/2021	09:18	380

5/10/2021	09:14	290

Table A4. *E. coli* bacteria water quality data for site 384038 on Crooked Creek (ND-09020105-017-S_00), May-September 2018-2021**.

Date	Time	Result (CFU/100mL)
5/2/2018	09:40	5 [a/]
5/7/2018	10:20	5 [a/]
5/9/2018	08:42	20
5/14/2018	10:20	10
5/16/2018	09:38	30
6/18/2018	09:30	2400
6/20/2018	09:45	1500
6/25/2018	09:00	2300
6/27/2018	09:30	340
7/9/2018	07:21	10000
7/16/2018	09:34	2000
7/18/2018	09:42	390
7/23/2018	08:59	620
8/1/2018	09:00	340
8/6/2018	09:30	930
5/6/2019	09:15	5 [a/]
5/13/2019	08:25	31
5/20/2019	09:10	380
5/22/2019	09:25	210
5/29/2019	09:20	5 [a/]
6/3/2019	08:48	20
6/10/2019	09:13	20
6/12/2019	09:33	20
6/17/2019	08:20	31
6/24/2019	08:30	20

7/1/2019	09:06	10
7/8/2019	08:10	5 [a/]
7/9/2019	08:39	63
7/16/2019	09:17	5 [a/]
7/22/2019	08:29	52
8/5/2019	08:42	110
8/6/2019	09:13	63
8/14/2019	09:14	110
8/19/2019	08:32	110
8/20/2019	08:26	160
9/3/2019	09:00	630
9/9/2019	09:15	130
9/11/2019	08:26	210
9/16/2019	09:19	240
9/18/2019	08:37	260
5/4/2020	08:59	10
5/6/2020	08:45	85
5/11/2020	09:37	5 [a/]
5/18/2020	08:43	10
5/20/2020	08:50	20
6/1/2020	09:33	41
6/3/2020	08:58	31
6/8/2020	09:07	110
6/15/2020	09:25	20
6/22/2020	09:36	84
7/6/2020	08:46	2400
7/15/2020	09:28	280
7/20/2020	08:44	600
7/22/2020	08:48	230

7/27/2020	09:27	330
8/3/2020	08:50	500
8/5/2020	08:46	840
8/10/2020	09:52	590
8/12/2020	09:02	2200
8/17/2020	09:17	160
8/17/2020	09:36	980
9/2/2020	09:20	680
9/9/2020	09:11	700
9/14/2020	09:09	550
9/16/2020	09:41	720
9/21/2020	09:21	1000
5/3/2021	09:08	200
5/5/2021	08:35	200
5/5/2021	08:52	74
5/10/2021	08:54	74
5/12/2021	08:47	150

Tables A1-A4 Footnotes:

* Sample analysis conducted using membrane filtration methods.
** Sample analysis conducted using multi-well distribution (Quanti-Tray) methods.
[a/] Non-detect, assigned lower detection limit
[b/] Result > 800 CFU/100mL 1st dilution
[c/] Too numerous to count, assigned upper detection limit
[d/] 2nd dilution
[e/] Two samples collected. Higher value (listed) was used in calculations and for daily load estimates in Load Duration Curve.

Appendix B – Permitted Facilities in the Wild Rice Watersheds

Table B1. National Pollutant Discharge Elimination System permitted facilities in the Storm Lake watershed (0902010506) based on ECHO 06/13/2022.

Permit Number	Description	# of Permits	Wasteload Allocation Rationale
ND0020010	Gwinner, ND POTW Permit	1	WLA applies. Discharges treated wastewater to impaired segment
NDG320338	Milnor, ND POTW Permit	1	WLA applies. Discharges treated wastewater to impaired segment
NDP######	Individual Pretreatment Permits	1	WLA does not apply. Facilities discharge to POTWs
NDR05####	Industrial Stormwater General Permit	4	WLA does not apply. Facilities do not discharge *E. coli*
NDR32####	Mining, Excavation, and Paving Materials Stormwater General Permit	2	WLA does not apply. Facilities do not discharge *E. coli*

Table B2. National Pollutant Discharge Elimination System permitted facilities in the Crooked Creek watershed (0902010504) based on ECHO 06/13/2022.

Permit Number	Description	# of Permits	Wasteload Allocation Rationale
NDG320009	Cogswell, ND POTW Permit	1	WLA does not apply. Discharges to closed basin not contributing to impaired segment
NDG321369	Forman, ND POTW Permit	1	WLA applies. Discharges treated wastewater to impaired segment

Table B3. North Dakota Pollutant Discharge Elimination System permitted facilities in the Lake Tewaukon-Wild Rice River watershed (0902010503) based on ECHO 06/13/2022.

Permit Number	Description	# of Permits	Wasteload Allocation Rationale
NDG321300	Rutland, ND POTW Permit	1	WLA applies. Potential for treated wastewater discharge to contribute to impaired segment
SDP######	Individual Pretreatment Permits	1	WLA does not apply. Facilities discharge to POTWs and are permitted by SD
SDR10####	Construction Stormwater General Permit	1	WLA does not apply. Facilities do not discharge *E. coli* and are permitted by SD

Table B4. North Dakota Pollutant Discharge Elimination System permitted facilities in the Shortfoot Creek-Wild Rice River watershed (0902010505) based on ECHO 06/13/2022.

Permit Number	Description	# of Permits	Wasteload Allocation Rationale
NDG321598	Cayuga, ND POTW Permit	1	WLA does not apply. No discharge reported
NDG321539	Lidgerwood, ND POTW Permit	1	WLA does not apply. Discharges to surface waters not contributing to impaired segment
SDG589805	Veblen Flats Housing WWTP	1	WLA does not apply. Zero discharge facility permitted by EPA
SDR10####	Construction Stormwater General Permit	1	WLA does not apply. Facilities do not discharge *E. coli* and are permitted by SD

Table B5. Permitted Concentrated Animal Feeding Operations/Animal Feeding Operations in the Wild Rice Watersheds.

Facility Size	# of Permits	Wasteload Allocation Rationale
Large	1	WLAs do not apply. Zero discharge facilities. Under NDAC 33.1-16-03.1-12 permitted CAFO/AFO facilities are prohibited from discharging manure or process wastewater
Medium	4	
Small	4	

Appendix C – Load Duration Curve and Flow Interval Regression Data for ND-09020105-018-S_00 and ND-09020105-022-S_00

Table C1. Summary of load duration curve results for the Wild Rice River (ND-09020105-018-S_00 and ND-09020105-022-S_00) based on NDDEQ monitoring site 385573.

	Load (10^7 CFU / day)				Load (10^7 CFU / period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Reduction
High	4.01%	658,962	176,985	29	19,217,626	5,161,502	73.14%
Moist	19%	172,941	53,014	80	13,887,195	4,257,006	69.35%
Dry	51.5%	27,129	10,328	157	4,257,832	1,621,036	61.93%
Low	80.5%	2,334	487	55	127,765	26,679	79.12%
			Total	321	37,490,419	11,066,223	70.48%

Table C2. Load duration curve results for **all flow intervals** (0.01%-88%) for the Wild Rice River (ND-09020105-018-S_00 and ND-09020105-022-S_00) based on NDDEQ monitoring site 385573 (*E. coli* samples > 126 CFU/100 mL).

	Percent Ranking		Percent Ranking	
High	>0.0001		<0.08	
Moist	>0.08		<0.3	
Dry	>0.3		<0.73	
Low	>0.73		<0.88	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
5/31/2011	190	404.0	8.0%	187824
6/6/2011	200	383.0	8.7%	187432
6/14/2011	370	316.0	11.4%	286091
6/20/2011	150	354.0	9.8%	129930
6/21/2011	190	352.0	9.9%	163649
6/27/2011	350	420.0	7.5%	359694
7/5/2011	570	362.0	9.7%	504893
7/25/2011	160	361.0	9.7%	141333
8/1/2011	460	888.0	1.6%	999509
8/15/2011	280	345.0	10.2%	236370
8/16/2011	1900	340.0	10.4%	1580697

8/22/2011	300	271.0	13.4%	198933
8/23/2011	260	266.0	13.8%	169228
8/29/2011	330	229.0	15.9%	184912
8/30/2011	200	227.0	16.0%	111089
9/6/2011	220	204.0	17.2%	109817
9/7/2011	250	202.0	17.3%	123568
9/12/2011	500	180.0	18.5%	220221
9/13/2011	350	175.0	18.9%	149873
9/19/2011	360	161.0	19.8%	141822
9/20/2011	280	155.0	20.4%	106195
9/26/2011	230	132.0	22.3%	74288
9/27/2011	520	127.0	22.8%	161593
5/16/2012	150	50.1	40.8%	18388
5/23/2012	800	27.3	55.8%	53440
6/4/2012	680	16.1	64.2%	26789
6/6/2012	800	11.4	68.9%	22316
6/11/2012	800	5.7	74.6%	11119
6/13/2012	8000	6.6	73.9%	128805
6/18/2012	760	8.5	72.0%	15751
6/20/2012	2000	20.7	60.5%	101302
6/25/2012	260	8.1	72.6%	5179
6/27/2012	490	5.0	75.2%	5959
7/9/2012	800	2.1	79.3%	4013
7/11/2012	6300	1.1	81.6%	16957
7/23/2012	800	1.2	81.5%	2329
7/24/2012	270	1.3	81.3%	826
7/30/2012	150	3.1	77.1%	1145
7/31/2012	140	1.9	79.9%	665
5/22/2013	3800	124.0	23.1%	1152979

6/5/2013	410	48.3	41.9%	48456
6/11/2013	210	36.7	49.7%	18858
6/12/2013	220	30.8	53.6%	16580
6/18/2013	800	12.2	67.6%	23882
6/19/2013	1000	10.7	69.7%	26182
6/24/2013	2900	239.0	15.5%	1695946
6/26/2013	1500	193.0	17.9%	708377
7/1/2013	270	54.1	38.5%	35742
7/8/2013	290	48.1	42.0%	34132
7/10/2013	310	49.0	41.3%	37168
7/15/2013	130	52.0	39.5%	16541
7/17/2013	330	50.1	40.8%	40455
7/22/2013	130	57.8	36.7%	18386
7/31/2013	270	64.4	33.4%	42547
8/7/2013	130	71.2	30.8%	22648
8/26/2013	620	55.4	37.9%	84046
8/28/2013	160	55.2	38.0%	21611
9/9/2013	360	51.3	40.0%	45189
9/11/2013	210	35.4	50.4%	18190
9/16/2013	570	28.6	54.9%	39889
9/18/2013	470	25.8	57.0%	29671
5/14/2014	140	185.0	18.3%	63375
6/2/2014	280	66.0	32.7%	45219
6/4/2014	170	59.6	35.7%	24792
6/9/2014	280	56.0	37.6%	38367
6/10/2014	320	58.0	36.6%	45414
6/16/2014	290	112.0	24.6%	79475
6/24/2014	180	96.4	26.8%	42459
6/30/2014	2400	346.0	10.2%	2031905

7/28/2014	140	55.8	37.6%	19115
7/30/2014	200	48.4	41.9%	23686
8/4/2014	190	59.7	35.7%	27755
8/5/2014	180	57.4	36.8%	25281
8/13/2014	440	46.6	42.9%	50171
8/18/2014	210	40.8	46.9%	20965
8/19/2014	260	38.4	48.5%	24430
8/25/2014	190	46.2	43.2%	21479
9/2/2014	300	32	52.6%	23490
9/3/2014	540	28.7	54.8%	37922
9/8/2014	800	16.4	63.9%	32103
9/10/2014	800	14.3	65.7%	27993
9/15/2014	220	16.5	63.8%	8882
9/16/2014	1700	16.3	64.1%	67804
9/22/2014	480	13.7	66.4%	16091

Table C3. Load duration curve results for **high flow interval** (0.01%-8%) for the Wild Rice River (ND-09020105-018-S_00 and ND-09020105-022-S_00) based on NDDEQ monitoring site 385573 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-7.52	6.12	0.01%	1316441	
		8.00%	329852	
Median	Existing Load/day	TMDL Load/day	Days	
4.01%	658962	176985	29	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
6/27/2011	350	420.0	7.5%	359694
8/1/2011	460	888.0	1.6%	999509

Table C4. Load duration curve results for **moist flow interval** (8%-30%) for the Wild Rice River (ND-09020105-018-S_00 and ND-09020105-022-S_00) based on NDDEQ monitoring site 385573 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-3.21	5.85	8.00%	390335	
		30.00%	76623	
Median	Existing Load/day	TMDL Load/day	Days	
19.00%	172941	53014	80	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
6/6/2011	200	383.0	8.7%	187432
6/14/2011	370	316.0	11.4%	286091
6/20/2011	150	354.0	9.8%	129930
6/21/2011	190	352.0	9.9%	163649
7/5/2011	570	362.0	9.7%	504893
7/25/2011	160	361.0	9.7%	141333
8/15/2011	280	345.0	10.2%	236370
8/16/2011	1900	340.0	10.4%	1580697
8/22/2011	300	271.0	13.4%	198933
8/23/2011	260	266.0	13.8%	169228
8/29/2011	330	229.0	15.9%	184912
8/30/2011	200	227.0	16.0%	111089
9/6/2011	220	204.0	17.2%	109817
9/7/2011	250	202.0	17.3%	123568
9/12/2011	500	180.0	18.5%	220221
9/13/2011	350	175.0	18.9%	149873
9/19/2011	360	161.0	19.8%	141822
9/20/2011	280	155.0	20.4%	106195
9/26/2011	230	132.0	22.3%	74288

9/27/2011	520	127.0	22.8%	161593
5/22/2013	3800	124.0	23.1%	1152979
6/24/2013	2900	239.0	15.5%	1695946
6/26/2013	1500	193.0	17.9%	708377
5/14/2014	140	185.0	18.3%	63375
6/16/2014	290	112.0	24.6%	79475
6/24/2014	180	96.4	26.8%	42459
6/30/2014	2400	346.0	10.2%	2031905

Table C5. Load duration curve results for **dry flow interval** (30%-73%) for the Wild Rice River (ND-09020105-018-S_00 and ND-09020105-022-S_00) based on NDDEQ monitoring site 385573 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-0.50	4.69	30.00%	34786	
		73.00%	21157	
Median	Existing Load/day	TMDL Load/day	Days	
51.50%	27129	10328	157	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
5/16/2012	150	50.1	40.8%	18388
5/23/2012	800	27.3	55.8%	53440
6/4/2012	680	16.1	64.2%	26789
6/6/2012	800	11.4	68.9%	22316
6/18/2012	760	8.5	72.0%	15751
6/20/2012	2000	20.7	60.5%	101302
6/25/2012	260	8.1	72.6%	5179
6/5/2013	410	48.3	41.9%	48456
6/11/2013	210	36.7	49.7%	18858
6/12/2013	220	30.8	53.6%	16580
6/18/2013	800	12.2	67.6%	23882

6/19/2013	1000	10.7	69.7%	26182
7/1/2013	270	54.1	38.5%	35742
7/8/2013	290	48.1	42.0%	34132
7/10/2013	310	49.0	41.3%	37168
7/15/2013	130	52.0	39.5%	16541
7/17/2013	330	50.1	40.8%	40455
7/22/2013	130	57.8	36.7%	18386
7/31/2013	270	64.4	33.4%	42547
8/7/2013	130	71.2	30.8%	22648
8/26/2013	620	55.4	37.9%	84046
8/28/2013	160	55.2	38.0%	21611
9/9/2013	360	51.3	40.0%	45189
9/11/2013	210	35.4	50.4%	18190
9/16/2013	570	28.6	54.9%	39889
9/18/2013	470	25.8	57.0%	29671
6/2/2014	280	66.0	32.7%	45219
6/4/2014	170	59.6	35.7%	24792
6/9/2014	280	56.0	37.6%	38367
6/10/2014	320	58.0	36.6%	45414
7/28/2014	140	55.8	37.6%	19115
7/30/2014	200	48.4	41.9%	23686
8/4/2014	190	59.7	35.7%	27755
8/5/2014	180	57.4	36.8%	25281
8/13/2014	440	46.6	42.9%	50171
8/18/2014	210	40.8	46.9%	20965
8/19/2014	260	38.4	48.5%	24430
8/25/2014	190	46.2	43.2%	21479
9/2/2014	300	32	52.6%	23490
9/3/2014	540	28.7	54.8%	37922

9/8/2014	800	16.4	63.9%	32103
9/10/2014	800	14.3	65.7%	27993
9/15/2014	220	16.5	63.8%	8882
9/16/2014	1700	16.3	64.1%	67804
9/22/2014	480	13.7	66.4%	16091

Table C6. Load duration curve results for **low flow interval** (73%-88%) for the Wild Rice River (ND-09020105-018-S_00 and ND-09020105-022-S_00) based on NDDEQ monitoring site 385573 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-13.02	13.85	73.00%	22111	
		88.00%	246	
Median	Existing Load/day	TMDL Load/day	Days	
80.50%	2334	487	55	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
6/11/2012	800	5.7	74.6%	11119
6/13/2012	8000	6.6	73.9%	128805
6/27/2012	490	5.0	75.2%	5959
7/9/2012	800	2.1	79.3%	4013
7/11/2012	6300	1.1	81.6%	16957
7/23/2012	800	1.2	81.5%	2329
7/24/2012	270	1.3	81.3%	826
7/30/2012	150	3.1	77.1%	1145
7/31/2012	140	1.9	79.9%	665

Appendix D – Load Duration Curve and Flow Interval Regression Data for ND-09020105-016-S_00

Table D1. Summary of load duration curve results for Shortfoot Creek (ND-09020105-016-S_00) based on NDDEQ monitoring site 384037.

Load (10^7 CFU / day)					Load (10^7 CFU / period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Reduction
High	4.01%	224,415	42,019	29	6,544,728	1,225,417	81.28%
Moist	19%	27,422	12,586	80	2,201,973	1,010,676	54.10%
Dry	51.5%	10,861	2,452	157	1,704,567	384,858	77.42%
Low	80.5%	141	116	55	7,701	6,334	17.75%
			Total	321	10,458,969	2,627,284	74.88%

Table D2. Load duration curve results for **all flow intervals** (0.01%-88%) for Shortfoot Creek (ND-09020105-016-S_00) based on NDDEQ monitoring site 384037 (*E. coli* samples > 126 CFU/100 mL).

	Percent Ranking		Percent Ranking	
High	>0.0001		<0.08	
Moist	>0.08		<0.3	
Dry	>0.3		<0.73	
Low	>0.73		<0.88	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
5/16/2018	310	6.932510217	54.5%	5259
6/4/2018	130	0.733611526	77.2%	233
6/6/2018	560	0.947284787	76.3%	1298
6/11/2018	530	0.868937924	76.6%	1127
6/13/2018	180	0.557924624	78.6%	246
6/18/2018	200	3.347547742	65.9%	1638
7/9/2018	160	8.903052505	49.2%	3486
8/6/2018	260	5.24686561	59.2%	3338
8/13/2018	170	0.660012959	77.8%	275
8/20/2018	350	0.239788881	81.7%	205
8/27/2018	200	0.054605389	85.3%	27

9/4/2018	150	0.007122442	87.9%	3
9/24/2018	270	0.021367326	86.7%	14
5/20/2019	1100	130.8155181	4.4%	352102
6/10/2019	240	42.49723729	18.6%	24957
6/17/2019	160	37.98635736	20.0%	14872
6/24/2019	200	61.0155865	14.3%	29860
7/1/2019	130	29.43942695	23.1%	9365
7/8/2019	210	49.85709403	16.7%	25619
7/9/2019	340	42.97206676	18.4%	35750
8/14/2019	390	18.6133151	29.2%	17763
8/19/2019	230	53.1809003	16.1%	29930
9/3/2019	720	30.62650062	22.6%	53957
9/9/2019	430	40.36050469	19.2%	42466
9/11/2019	290	95.44072285	8.1%	67725
9/16/2019	170	156.9311388	3.2%	65279
5/4/2020	160	68.85027271	12.4%	26955
5/6/2020	340	104.6998975	6.7%	87105
6/1/2020	160	47.72036143	17.4%	18683
6/8/2020	460	34.18772162	21.2%	38481
6/22/2020	580	12.15563435	40.2%	17251
7/6/2020	24000	10.89733627	43.3%	639952
7/15/2020	4200	8.736862192	49.6%	89789
7/20/2020	840	11.77577078	41.2%	24204
7/22/2020	880	11.8469952	41.0%	25510
7/27/2020	2200	152.8950884	3.4%	823061
8/3/2020	280	27.77752382	23.9%	19031
8/5/2020	570	21.08242833	27.5%	29404
8/10/2020	1100	16.1204604	32.2%	43390
8/12/2020	2500	16.09671893	32.2%	98468

9/2/2020	360	14.62474758	34.6%	12883
9/9/2020	2000	14.12617664	35.8%	69131
9/14/2020	1300	13.9837278	36.2%	44482
9/16/2020	2600	13.17651771	37.9%	83828
9/21/2020	1800	11.58583899	41.4%	51029
5/5/2021	380	6.410197804	56.1%	5960
5/10/2021	290	4.700811723	61.2%	3336

Table D3. Load duration curve results for **high flow interval** (0.01%-8%) for Shortfoot Creek (ND-09020105-016-S_00) based on NDDEQ monitoring site 384037 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-11.15	5.80	0.01%	625790	
		8.00%	80478	
Median	Existing Load/day	TMDL Load/day	Days	
4.01%	224415	42019	29	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
5/20/2019	1100	130.8155181	4.4%	352102
9/16/2019	170	156.9311388	3.2%	65279
5/6/2020	340	104.6998975	6.7%	87105
7/27/2020	2200	152.8950884	3.4%	823061

Table D4. Load duration curve results for **moist flow interval** (8%-30%) for Shortfoot Creek (ND-09020105-016-S_00) based on NDDEQ monitoring site 384037 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-1.70	4.76	8.00%	42186	
		30.00%	17825	
Median	Existing Load/day	TMDL Load/day	Days	
19.00%	27422	12586	80	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
6/10/2019	240	42.49723729	18.6%	24957
6/17/2019	160	37.98635736	20.0%	14872
6/24/2019	200	61.0155865	14.3%	29860
7/1/2019	130	29.43942695	23.1%	9365
7/8/2019	210	49.85709403	16.7%	25619
7/9/2019	340	42.97206676	18.4%	35750
8/14/2019	390	18.6133151	29.2%	17763
8/19/2019	230	53.1809003	16.1%	29930
9/3/2019	720	30.62650062	22.6%	53957
9/9/2019	430	40.36050469	19.2%	42466
9/11/2019	290	95.44072285	8.1%	67725
5/4/2020	160	68.85027271	12.4%	26955
6/1/2020	160	47.72036143	17.4%	18683
6/8/2020	460	34.18772162	21.2%	38481
8/3/2020	280	27.77752382	23.9%	19031
8/5/2020	570	21.08242833	27.5%	29404

Table D5. Load duration curve results for **dry flow interval** (30%-73%) for Shortfoot Creek (ND-09020105-016-S_00) based on NDDEQ monitoring site 384037 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-4.60	6.40	30.00%	105746	
		73.00%	1115	
Median	Existing Load/day	TMDL Load/day	Days	
51.50%	10861	2452	157	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
5/16/2018	310	6.932510217	54.5%	5259
6/18/2018	200	3.347547742	65.9%	1638
7/9/2018	160	8.903052505	49.2%	3486
8/6/2018	260	5.24686561	59.2%	3338
6/22/2020	580	12.15563435	40.2%	17251
7/6/2020	24000	10.89733627	43.3%	639952
7/15/2020	4200	8.736862192	49.6%	89789
7/20/2020	840	11.77577078	41.2%	24204
7/22/2020	880	11.8469952	41.0%	25510
8/10/2020	1100	16.1204604	32.2%	43390
8/12/2020	2500	16.09671893	32.2%	98468
9/2/2020	360	14.62474758	34.6%	12883
9/9/2020	2000	14.12617664	35.8%	69131
9/14/2020	1300	13.9837278	36.2%	44482
9/16/2020	2600	13.17651771	37.9%	83828
9/21/2020	1800	11.58583899	41.4%	51029
5/5/2021	380	6.410197804	56.1%	5960
5/10/2021	290	4.700811723	61.2%	3336

Table D6. Load duration curve results for **low flow interval** (73%-88%) for Shortfoot Creek (ND-09020105-016-S_00) based on NDDEQ monitoring site 384037 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-18.46	17.01	73.00%	3410	
		88.00%	6	
Median	Existing Load/day	TMDL Load/day	Days	
80.50%	141	116	55	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
6/4/2018	130	0.733611526	77.2%	233
6/6/2018	560	0.947284787	76.3%	1298
6/11/2018	530	0.868937924	76.6%	1127
6/13/2018	180	0.557924624	78.6%	246
8/13/2018	170	0.660012959	77.8%	275
8/20/2018	350	0.239788881	81.7%	205
8/27/2018	200	0.054605389	85.3%	27
9/4/2018	150	0.007122442	87.9%	3
9/24/2018	270	0.021367326	86.7%	14

Appendix E – Load Duration Curve and Flow Interval Regression Data for ND-09020105-014-S_00

Table E1. Summary of load duration curve results for an unnamed tributary to the Wild Rice River in the Storm Lake Watershed (ND-09020105-014-S_00) based on NDDEQ monitoring site 385435.

	Load (10^7 CFU / day)			Load (10^7 CFU / period)			
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Reduction
High - Moist	15.01%	19,733	12,047	109	2,160,012	1,318,684	38.95%
Dry	51.50%	4,169	1,647	157	654,328	258,530	60.49%
Low	80.50%	302	78	55	16,561	4,255	74.31%
			Total	321	2,830,900	1,581,469	44.14%

Table E2. Load duration curve results for **all flow intervals** (0.01%-88%) for an unnamed tributary to the Wild Rice River in the Storm Lake watershed (ND-09020105-014-S_00) based on NDDEQ monitoring site 385435 (*E. coli* samples > 126 CFU/100 mL).

	Percent Ranking	Percent Ranking
High - Moist	>0.0001	<0.3
Dry	>0.3	<0.73
Low	>0.73	<0.88

Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
5/12/2008	150	5.7	50.4%	2084
6/3/2008	800	3.4	60.1%	6619
6/10/2008	490	7.1	44.2%	8471
6/18/2008	620	9.3	36.4%	14130
6/24/2008	800	2.8	63.1%	5463
6/30/2008	1600	2.0	67.4%	7867
7/7/2008	310	0.4	79.2%	266
7/15/2008	740	0.1	84.1%	121
7/21/2008	250	0.0	85.7%	17
7/27/2008	340	0.0	88.2%	3
8/11/2008	410	0.0	100.0%	0

8/18/2008	290	0.2	80.8%	164
8/25/2008	500	0.1	84.4%	68
9/2/2008	800	0.2	81.8%	312
9/8/2008	130	0.0	87.9%	2
9/15/2008	250	0.1	83.2%	60
9/22/2008	650	0.0	100.0%	0
9/29/2008	370	0.0	86.3%	17
6/1/2009	220	20.4	22.7%	10989
6/9/2009	800	13.5	28.3%	26443
6/15/2009	800	8.9	37.9%	17327
6/23/2009	800	26.0	19.7%	50888
6/30/2009	180	24.4	20.6%	10747
7/6/2009	140	6.8	45.4%	2316
7/13/2009	220	4.5	55.1%	2412
7/21/2009	170	8.4	39.2%	3496
8/3/2009	140	2.3	65.3%	803
8/17/2009	220	3.0	62.1%	1597
8/24/2009	800	3.3	60.6%	6400
9/14/2009	140	5.5	51.0%	1890
9/28/2009	230	5.6	50.8%	3124

Table E3. Load duration curve results for **high-moist flow interval** (0.01%-30%) for an unnamed tributary to the Wild Rice River in the Storm Lake watershed (ND-09020105-014-S_00) based on NDDEQ monitoring site 385435 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y
0.07	4.29	0.01%	19293
		30.00%	20183
Median	Existing Load/day	TMDL Load/day	Days
15.01%	19733	12047	109

Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
6/1/2009	220	20.4	22.7%	10989
6/9/2009	800	13.5	28.3%	26443
6/23/2009	800	26.0	19.7%	50888
6/30/2009	180	24.4	20.6%	10747

Table E4. Load duration curve results for **dry flow interval** (30%-73%) for an unnamed tributary to the Wild Rice River in the Storm Lake watershed (ND-09020105-014-S_00) based on NDDEQ monitoring site 385435 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-1.42	4.35	30.00%	8426	
		73.00%	2063	
Median	Existing Load/day	TMDL Load/day	Days	
51.50%	4169	1647	157	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
5/12/2008	150	5.7	50.4%	2084
6/3/2008	800	3.4	60.1%	6619
6/10/2008	490	7.1	44.2%	8471
6/18/2008	620	9.3	36.4%	14130
6/24/2008	800	2.8	63.1%	5463
6/30/2008	1600	2.0	67.4%	7867
6/15/2009	800	8.9	37.9%	17327
7/6/2009	140	6.8	45.4%	2316
7/13/2009	220	4.5	55.1%	2412
7/21/2009	170	8.4	39.2%	3496
8/3/2009	140	2.3	65.3%	803
8/17/2009	220	3.0	62.1%	1597
8/24/2009	800	3.3	60.6%	6400

9/14/2009	140	5.5	51.0%	1890
9/28/2009	230	5.6	50.8%	3124

Table E5. Load duration curve results for **low flow interval** (73%-88%) for an unnamed tributary to the Wild Rice River in the Storm Lake watershed (ND-09020105-014-S_00) based on NDDEQ monitoring site 385435 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-23.71	21.56	73.00%	18139	
		88.00%	5	
Median	Existing Load/day	TMDL Load/day	Days	
80.50%	302	78	55	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
7/7/2008	310	0.4	79.2%	266
7/15/2008	740	0.1	84.1%	121
7/21/2008	250	0.0	85.7%	17
8/18/2008	290	0.2	80.8%	164
8/25/2008	500	0.1	84.4%	68
9/2/2008	800	0.2	81.8%	312
9/8/2008	130	0.0	87.9%	2
9/15/2008	250	0.1	83.2%	60
9/29/2008	370	0.0	86.3%	17

Appendix F – Load Duration Curve and Flow Interval Regression Data for ND-09020105-017-S_00

Table F1. Summary of load duration curve results for Crooked Creek (ND-09020105-017-S_00) based on NDDEQ monitoring site 384038.

Load (10^7 CFU / day)					Load (10^7 CFU / period)		
	Median Percentile	Existing	TMDL	Days	Existing	TMDL	Reduction
High	4.01%	46,205	20,247	29	1,347,493	590,449	56.18%
Moist	19.00%	15,055	6,065	80	1,208,926	486,980	59.72%
Dry-Low	59.00%	4,756	790	212	1,006,788	167,174	83.40%
			Total	321	3,563,206	1,244,603	65.07%

Table F2. Load duration curve results for **all flow intervals** (0.01%-88%) for Crooked Creek (ND-09020105-017-S_00) based on NDDEQ monitoring site 384038 (*E. coli* samples > 126 CFU/100 mL).

	Percent Ranking		Percent Ranking	
High	>0.0001		<0.08	
Moist	>0.08		<0.3	
Dry-Low	>0.3		<0.88	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
6/18/2018	2400	1.612967625	65.9%	9472
6/20/2018	1500	0.936893961	72.5%	3439
6/25/2018	2300	1.635846598	65.7%	9206
6/27/2018	340	1.864636332	64.1%	1551
7/9/2018	10000	4.289807513	49.2%	104967
7/16/2018	2000	7.378468922	33.3%	36109
7/18/2018	390	4.40420238	48.4%	4203
7/23/2018	620	5.502393103	42.0%	8348
8/1/2018	340	5.456635156	42.2%	4540
8/6/2018	930	2.528126561	59.2%	5753
5/20/2019	380	63.03157172	4.4%	58608
5/22/2019	210	61.65883331	4.7%	31683

8/20/2019	160	26.42521428	15.9%	10346
9/3/2019	630	14.75693784	22.6%	22749
9/9/2019	130	19.44712739	19.2%	6186
9/11/2019	210	45.98673653	8.1%	23630
9/16/2019	240	75.61500709	3.2%	44405
9/18/2019	260	60.74367438	4.9%	38645
7/6/2020	2400	5.250724395	43.3%	30835
7/15/2020	280	4.209731106	49.6%	2884
7/20/2020	600	5.673985403	41.2%	8330
7/22/2020	230	5.708303863	41.0%	3213
7/27/2020	330	73.67029435	3.4%	59487
8/3/2020	500	13.38419944	23.9%	16375
8/5/2020	840	10.15826419	27.5%	20879
8/10/2020	590	7.767411469	32.2%	11214
8/12/2020	2200	7.755971983	32.2%	41752
8/17/2020	160	7.058163294	34.5%	2763
8/17/2020	980	7.046723807	34.6%	16898
9/2/2020	680	6.806494587	35.8%	11325
9/9/2020	700	6.737857666	36.2%	11541
9/14/2020	550	6.348915119	37.9%	8544
9/16/2020	720	5.58246951	41.4%	9835
9/21/2020	1000	3.386088063	54.4%	8285
5/3/2021	200	3.088661409	56.1%	1512
5/5/2021	200	2.265018367	61.2%	1108

Table F3. Load duration curve results for **high flow interval** (0.01%-8%) for Crooked Creek (ND-09020105-017-S_00) based on NDDEQ monitoring site 384038 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y
-7.95	4.98	0.01%	95981
		8.00%	22243

Median	Existing Load/day	TMDL Load/day	Days	
4.01%	46205	20246	29	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^{7} CFU / day)
5/20/2019	380	63.03157172	4.4%	58608
5/22/2019	210	61.65883331	4.7%	31683
9/16/2019	240	75.61500709	3.2%	44405
9/18/2019	260	60.74367438	4.9%	38645
7/27/2020	330	73.67029435	3.4%	59487

Table F4. Load duration curve results for **moist flow interval** (8%-30%) for Crooked Creek (ND-09020105-017-S_00) based on NDDEQ monitoring site 384038 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
0.14	4.15	8.00%	14542	
		30.00%	15586	
Median	Existing Load/day	TMDL Load/day	Days	
19.00%	15055	6065	80	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^{7} CFU / day)
8/20/2019	160	26.42521428	15.9%	10346
9/3/2019	630	14.75693784	22.6%	22749
9/9/2019	130	19.44712739	19.2%	6186
9/11/2019	210	45.98673653	8.1%	23630
8/3/2020	500	13.38419944	23.9%	16375
8/5/2020	840	10.15826419	27.5%	20879

Table F5. Load duration curve results for **dry-low flow interval** (30%-88%) for Crooked Creek (ND-09020105-017-S_00) based on NDDEQ monitoring site 384038 (*E. coli* samples > 126 CFU/100 mL).

Slope	Intercept	X	Y	
-1.72	4.69	30.00%	15004	
		88.00%	1507	
Median	Existing Load/day	TMDL Load/day	Days	
59.00%	4756	790	212	
Date	Concentration (CFU / 100 mL)	Q (Flow, CFS)	Percent Ranking	Load (10^7 CFU / day)
6/18/2018	2400	1.612967625	65.9%	9472
6/20/2018	1500	0.936893961	72.5%	3439
6/25/2018	2300	1.635846598	65.7%	9206
6/27/2018	340	1.864636332	64.1%	1551
7/9/2018	10000	4.289807513	49.2%	104967
7/16/2018	2000	7.378468922	33.3%	36109
7/18/2018	390	4.40420238	48.4%	4203
7/23/2018	620	5.502393103	42.0%	8348
8/1/2018	340	5.456635156	42.2%	4540
8/6/2018	930	2.528126561	59.2%	5753
7/6/2020	2400	5.250724395	43.3%	30835
7/15/2020	280	4.209731106	49.6%	2884
7/20/2020	600	5.673985403	41.2%	8330
7/22/2020	230	5.708303863	41.0%	3213
8/10/2020	590	7.767411469	32.2%	11214
8/12/2020	2200	7.755971983	32.2%	41752
8/17/2020	160	7.058163294	34.5%	2763
8/17/2020	980	7.046723807	34.6%	16898
9/2/2020	680	6.806494587	35.8%	11325

9/9/2020	700	6.737857666	36.2%	11541
9/14/2020	550	6.348915119	37.9%	8544
9/16/2020	720	5.58246951	41.4%	9835
9/21/2020	1000	3.386088063	54.4%	8285
5/3/2021	200	3.088661409	56.1%	1512
5/5/2021	200	2.265018367	61.2%	1108

Appendix G – Discharge Monitoring Report Data for Wasteload Allocations in the Wild Rice Watersheds

Table G1. City of Gwinner (NDPDES permit ND0020010) DMR data during the recreation season 2007-2021 used to develop WLA for ND-09020105-014-S_00 (unnamed tributary to the Wild Rice River in the Storm Lake watershed).

Discharge Start	Number of Days Discharging	Discharge Volume (Millions of gallons)	Estimated Discharge Flow (Millions of gallons per day)
05/21/21	7	38	5.4
05/17/20	14	40	2.9
06/04/19	14	75	5.4
05/17/18	7	46	6.6
05/09/17	7	90	13
05/06/16	7	47	6.7
06/22/15	14	47	3.4
06/11/14	14	47	3.4
06/24/13	13	47	3.6
05/30/12	6	31	5.2
05/06/11	32	57	1.8
04/30/10	13	33	2.5
06/04/09	13	34	2.6
06/11/08	7	34	4.9
05/30/07	27	66	2.4

Table G2. City of Milnor (NDPDES permit NDG320388) DMR data during the recreation season 2007-2021 used to develop WLA for ND-09020105-014-S_00 (unnamed tributary to the Wild Rice River in the Storm Lake watershed).

Discharge Start	Number of Days Discharging	Discharge Volume (Millions of gallons)	Estimated Discharge Flow (Millions of gallons per day)
05/07/07	8	1.029	0.129
07/08/08	8	1.029	0.129
05/05/09	8	12.349	1.544
05/06/10	8	1.234	0.154
05/04/11	8	14.407	1.801
09/27/11	4	6.174	1.544
07/26/13	9	17.49	1.943

06/23/14	8	8.23284	1.029
05/16/16	6	6.174	1.029
06/15/17	7	6.174	0.882
06/11/18	4	6.174	1.544
05/09/19	7	7.203	1.029
04/27/20	7	7.203	1.029

Table G3. City of Forman (NDPDES permit NDG321369) DMR data during the recreation season 2007-2021 used to develop WLA for ND-09020105-017-S_00 (Crooked Creek).

Discharge Start	Number of Days Discharging	Discharge Volume (Millions of gallons)	Estimated Discharge Flow (Millions of gallons per day)
05/01/07	6	8.76	1.46
07/03/07	7	13.13	1.88
07/01/08	7	10.57	1.51
04/29/09	4	7.66	1.92
07/28/09	6	10.77	1.80
06/10/10	8	10.9	1.36
05/23/11	8	11.6	1.45
07/09/12	8	10.77	1.35
07/02/13	7	11.3	1.61
06/10/14	7	10.2	1.46
06/17/15	6	8.4	1.40
07/06/16	8	8.011	1.00
05/31/17	7	8.011	1.14
06/06/18	6	9.302	1.55
07/09/19	7	12.038	1.72
05/20/20	7	7.289	1.04
05/11/21	6	9.477	1.58

Table G4. City of Rutland (NDPDES permit NDG321300) DMR data during the recreation season 2007-2021 used to develop WLA for ND-09020105-018-S_00 & ND-09020105-022-S_00 (Wild Rice River).

Discharge Start	Number of Days Discharging	Discharge Volume (Millions of gallons)	Estimated Discharge Flow (Millions of gallons per day)
08/29/19	5	1.306	0.2612
07/30/16	7	1.306	0.1866
06/06/12	8	1.5	0.1875
07/28/11	6	1.47	0.245
05/03/11	7	1.633	0.2333
09/25/10	6	1.47	0.245
04/29/10	7	1.633	0.2333
09/23/09	8	1.63	0.2038
06/26/08	5	1.47	0.294