September 2022

Lower Rainy River Watershed

Lower Rainy River Watershed Total Maximum Daily Load

An *E. coli* TMDL for the Black River

MINNESOTA POLLUTION CONTROL AGENCY

CLEAN WATER LAND & LEGACY AMENDMENT

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Abbreviations

1W1P	One Watershed, One Plan
ac	acres
AUID	assessment unit identifier
BMP	best management practice
b org/day	billion organisms per day
BWSR	Board of Water and Soil Resources
cfs	cubic feet per second
CLMP	Citizen Lake Monitoring Program
CSMP	Citizen Stream Monitoring Program
DNR	Minnesota Department of Natural Resources
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information System
HSPF	Hydrologic Simulation Program–Fortran
HUC	hydrologic unit code
IBI	index of biotic integrity
ITPHS	imminent threat to public health and safety
IWM	intensive watershed monitoring
KSWCD	Koochiching Soil and Water Conservation District
LA	load allocation
MAWQCP	Minnesota Agricultural Water Quality Certification Program
mL	milliliter
MOS	margin of safety
MPCA	Minnesota Pollution Control Agency
MS4	municipal separate storm sewer system
NA	not applicable
NLCD	National Land Cover Database
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service

org	organisms
PWP	Permanent Wetland Preserve
RIM	Reinvest in Minnesota
SDS	state disposal system
SFIA	Sustainable Forest Incentive Act
SSTS	subsurface sewage treatment systems
SWCD	soil and water conservation district
TAS	Treatment as a State
TMDL	total maximum daily load
USGS	United States Geological Survey
WLA	wasteload allocation
WRAPS	Watershed Restoration and Protection Strategies
WRP	Wetland Reserve Program

Executive summary

Section 303(d) of the federal Clean Water Act requires that total maximum daily loads (TMDLs) be developed for waters that do not support their designated uses. A TMDL study determines what is needed to attain and maintain water quality standards in waters that are not currently meeting them. A TMDL study identifies pollutant sources as specifically as possible and allocates pollutant loads among those sources. This TMDL study addresses the Black River Subwatershed in the Lower Rainy River Watershed, located in Koochiching County, Minnesota. The cause of impairment is high levels of *Escherichia coli* (*E. coli*) bacteria, affecting aquatic recreation designated uses.

The Black River consists of two main branches, with the confluence of the branches located 100 to 150 meters from the main stem of the Rainy River. Land cover in the Black River Subwatershed is characterized by extensive wetlands located on the old Glacial Lake Agassiz lake bed. Development pressure is negligible, with occasional lands being parceled out for timber production or recreational homes. Several small farming operations are located on high ground near the stream corridor.

In 2017 and 2018, *E. coli* concentrations in the impaired reaches were highest under low flows, and slightly elevated concentrations were observed under high flows, indicating that the impairments are due to a mix of sources. Septic systems and direct fecal deposition from cattle access to streams, which are more prominent under low flows, along with pasture runoff, which occurs under high flows, are the primary sources of concern.

The pollutant loading capacities for the two impairments were determined through the use of load duration curves. These curves represent the allowable pollutant load at any given flow. Water quality data were compared to the standards to determine pollutant reduction needs. A 10% explicit margin of safety (MOS) accounts for uncertainty. To meet the standard, the *E. coli* concentrations in the West Fork Black River and Black River need to be reduced by approximately 23% to 27%.

Reasonable assurance that pollutant targets will be achieved is provided through nonpermitted source reduction programs, statewide initiatives, and local planning and implementation efforts. Implementation strategies recommended to address the high priority sources and to help achieve the Black River TMDLs include pasture and grazing management, septic system inventory and upgrades, and education and outreach. Implementation will focus on an adaptive management approach, with continued monitoring and adjustment of the implementation approach. Management activities will be changed or refined to efficiently meet the TMDL and lay the groundwork for de-listing the Black River impairments. Public participation included meetings with watershed stakeholders and regional water resource professionals.

This TMDL report is supported by previous work, including the *Lower Rainy River and Rapid River Watersheds Monitoring and Assessment Report* (MPCA 2020) and various watershed modeling memos (RESPEC 2015, 2016, 2021).

1. Project overview

1.1 Purpose

Section 303(d) of the federal Clean Water Act requires that TMDLs be developed for waters that do not support their designated uses. These waters are referred to as "impaired" and are included in Minnesota's list of impaired water bodies. The term "TMDL" refers to the maximum amount of a given pollutant a water body can receive on a daily basis and still achieve water quality standards. A TMDL study determines what is needed to attain and maintain water quality standards in waters that are not currently meeting them. A TMDL study identifies pollutant sources and allocates pollutant loads among those sources. The total of all allocations, including wasteload allocations (WLAs) for permitted sources, load allocations (LAs) for nonpermitted sources (including natural background), and the MOS, which is implicitly or explicitly defined, cannot exceed the maximum allowable pollutant load.

This TMDL report is a component of a larger effort led by the Minnesota Pollution Control Agency (MPCA) to develop watershed restoration and protection strategies (WRAPS) for the Lower Rainy River Watershed (United States Geological Survey [USGS] Hydrologic Unit Code [HUC] 8 09030008). The Lower Rainy River Watershed is composed of tributaries to the Rainy River that flow in a northerly direction, and the watershed stretches from the city of International Falls west to the Rainy River's outlet to the Lake of the Woods (Figure 1). The Lower Rainy Watershed is not a traditional watershed that encompasses the entire drainage area of a river, but rather is an administrative area with several small to medium sized streams. West of the Rapid River, this watershed's major waterways include Wabanica Creek, Winter Road River, Baudette River, Silver Creek, and Miller Creek. East of the Rapid River, the Black River and its tributaries make up the bulk of this watershed's drainage area.

Streams and rivers in the Lower Rainy Watershed largely drain wetland and peat bog terrain. While much of the watershed's natural streams remain unaltered, the Lower Rainy River Watershed's wetlands and peat bogs were extensively ditched at the turn of the 20th century in an attempt to drain land for agricultural development. A relatively small portion of these ditched systems has been restored to natural condition, and today 50% of the watershed's total stream length (including artificial created ditches) within the Lower Rainy River Watershed has been altered. The Black River Subwatershed and its southern tributaries, including the south fork of the Black River, have been particularly impacted by this ditching.

This TMDL study addresses the Black River Subwatershed in the Lower Rainy River Watershed (Figure 1), located in Koochiching County, Minnesota. Other components of this larger effort include the Lower Rainy River Monitoring and Assessment Report (MPCA 2020) and the Lower Rainy River Watershed WRAPS (MPCA 2022).

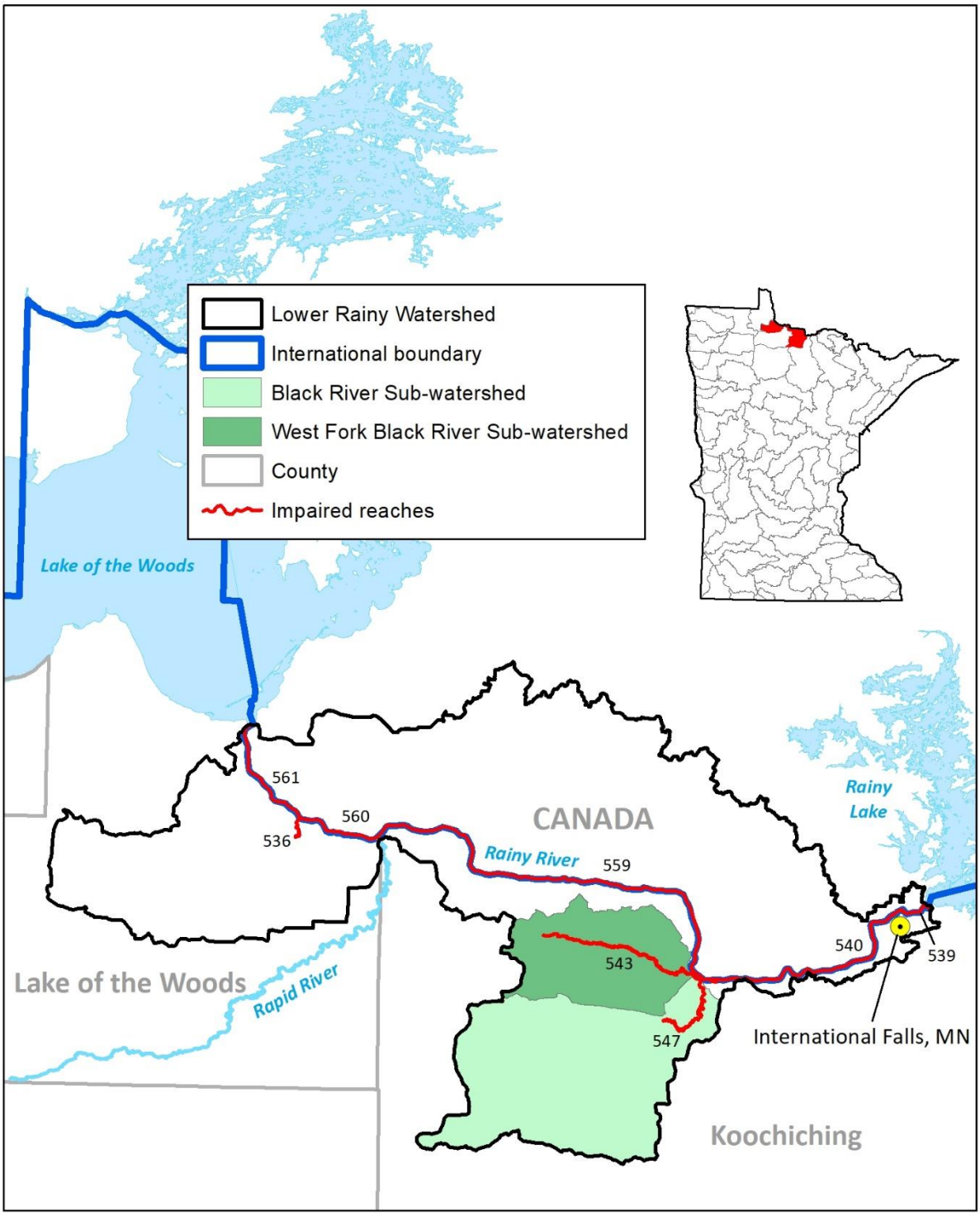

Figure 1. Lower Rainy River Watershed (09030008) and impaired water bodies

The 3-digit numbers in the map refer to the last 3 digits of the assessment unit identification (AUID). See Table 1 for information on the impaired reaches.

1.2 Identification of water bodies

Table 1 summarizes Lower Rainy River Watershed impairments and those addressed by TMDLs in this report. The impairments include streams not meeting their aquatic recreation use due to high *E. coli* concentrations, a stream not meeting its aquatic life use due to low dissolved oxygen, and water bodies not meeting the aquatic consumption use due to high concentrations of mercury in fish tissue or in the water column. For all but one of the mercury impairments, mercury TMDLs were approved as part of the Minnesota Statewide Mercury TMDL (MPCA 2007). Revisions to Appendix A of the Minnesota Statewide Mercury TMDL are submitted to the U.S. Environmental Protection Agency (EPA) every two years with the impaired waters list. Water resources with mercury concentrations greater than 0.572 mg/kg are not part of Appendix A, and a TMDL for the remaining mercury impairment in the Lower Rainy Watershed is expected to be completed by 2033.

The remainder of this TMDL report focuses on the *E. coli* impairments located on the West Fork Black River (09030008-543) and the Black River (09030008-547).

Table 1. Impaired water bodies in the Lower Rainy River Watershed (2020 impaired waters list)

Water body name	Water body description	AUID (09030008-###)	Year added to 303(d) list	TMDL target completion year	Use class	Affected designated use	Pollutant or stressor	EPA category upon TMDL report approval [a]	Planned recategorization	TMDL developed in this report
West Fork Black River	Headwaters to Black R	543	2020	2021	2Bg	Aquatic Recreation	*E. coli*	4A	–	Y
Black River	Unnamed cr to W Fk Black R	547	2020	2021	2Bg	Aquatic Recreation	*E. coli*	4A	–	Y
Baudette River	Unnamed cr to Rainy R	536	1994	2021	2Bg	Aquatic Life	Dissolved Oxygen	5	Y [b]	N
Black River	Unnamed cr to W Fk Black R	547	2006	2033	2Bg	Aquatic Consumption	Mercury in water column	5	–	N [c]
Rainy River	Rainy Lk to International Falls Dam	539	1998	NA	1B, 2Bdg	Aquatic Consumption	Mercury in fish tissue	4A	–	N [d]
Rainy River	International Falls Dam to Little Fork R	540	1998	NA	1C, 2Bdg	Aquatic Consumption	Mercury in fish tissue	4A	–	N [d]
Rainy River	Little Fork R to Rapid R	559	1998	NA	1C, 2Bdg	Aquatic Consumption	Mercury in fish tissue	4A	–	N [d]
Rainy River	Rapid R to RR bridge in Baudette	560	1998	NA	1C, 2Bdg	Aquatic Consumption	Mercury in fish tissue	4A	–	N [d]
Rainy River	RR bridge in Baudette to Lake of the Woods	561	1998	NA	2Bg	Aquatic Consumption	Mercury in fish tissue	4A	–	N [d]

a. 4A: Impaired and a TMDL study has been approved by USEPA; 5: Impaired and a TMDL study has not been approved by USEPA.
b. Listing correction under consideration to remove impairment from 303(d) list.
c. Mercury in water column impairments that do not have fish tissue impairments on the same reach are not part of the Minnesota Statewide Mercury TMDL (MPCA 2007). A TMDL for this water body is expected to be completed by 2033.
d. Approved TMDL in MPCA (2007)

1.3 Priority ranking

The MPCA's schedule for TMDL completions, as indicated on Minnesota's Section 303(d) impaired waters list, reflects Minnesota's priority ranking of this TMDL. The MPCA has aligned TMDL priorities with the watershed approach. The schedule for TMDL completion corresponds to the WRAPS report completion following the 2-year intensive watershed monitoring (IWM) cycle that occurs every 10 years. The MPCA developed a state plan, Minnesota's TMDL Priority Framework Report (MPCA 2022), to meet the needs of EPA's national measure (WQ-27) under *EPA's Long-Term Vision for Assessment, Restoration and Protection under the CWA Section 303(d) Program* (EPA 2013). As part of these efforts, the MPCA identified water quality impaired segments that will be addressed by TMDLs through watershed approach.

2. Applicable water quality standards and numeric water quality targets

The federal Clean Water Act requires states to designate beneficial uses for all waters and develop water quality standards to protect each use. Water quality standards consist of several parts:

- Beneficial uses—Identify how people, aquatic communities, and wildlife use our waters
- Numeric criteria—Amounts of specific pollutants allowed in a body of water that still protect it for the beneficial uses
- Narrative criteria—Statements of unacceptable conditions in and on the water
- Anti-degradation protections—Extra protection for high-quality or unique waters and existing uses

Together, the beneficial uses, numeric and narrative criteria, and anti-degradation protections provide the framework for achieving Clean Water Act goals. Minnesota's water quality standards are in Minn. R. chs. 7050 and 7052.

2.1 Beneficial uses

The beneficial uses for waters in Minnesota are grouped into one or more classes as defined in Minn. R. 7050.0140. The classes and associated beneficial uses are:

- Class 1 – domestic consumption
- Class 2 – aquatic life and recreation
- Class 3 – industrial consumption
- Class 4 – agriculture and wildlife
- Class 5 – aesthetic enjoyment and navigation
- Class 6 – other uses and protection of border waters
- Class 7 – limited resource value waters

The Class 2 aquatic life beneficial use includes a tiered aquatic life uses framework for rivers and streams. The framework contains three tiers—exceptional, general, and modified uses.

All surface waters are protected for multiple beneficial uses, and numeric and narrative water quality criteria are adopted into rule to protect each beneficial use. TMDLs are developed to protect the most sensitive use of a water body.

2.2 Narrative and numeric criteria and state standards

Narrative and numeric water quality criteria for all uses are listed for four common categories of surface waters in Minn. R. 7050.0220. The four categories are:

- Cold water aquatic life and habitat, also protected for drinking water: Classes 1B; 2A, 2Ae, or 2Ag; 3; 4A and 4B; and 5

- Cool and warm water aquatic life and habitat, also protected for drinking water: Classes 1B or 1C; 2Bd, 2Bde, 2Bdg, or 2Bdm; 3; 4A and 4B; and 5
- Cool and warm water aquatic life and habitat and wetlands: Classes 2B, 2Be, 2Bg, 2Bm, or 2D; 3; 4A and 4B; and 5
- Limited resource value waters: Classes 3; 4A and 4B; 5; and 7

The narrative and numeric water quality criteria for the individual use classes are listed in Minn. R. 7050.0221 through 7050.0227. The procedures for evaluating the narrative criteria are presented in Minn. R. 7050.0150.

The MPCA assesses individual water bodies for impairment for Class 2 uses—aquatic life and recreation. Class 2A waters are protected for the propagation and maintenance of a healthy community of cold water aquatic life and their habitats. Class 2B waters are protected for the propagation and maintenance of a healthy community of cool or warm water aquatic life and their habitats. Protection of aquatic life entails the maintenance of a healthy aquatic community as measured by fish and macroinvertebrate indices of biotic integrity (IBI). Fish and invertebrate IBI scores are evaluated against criteria established for individual monitoring sites by water body type and use subclass (exceptional, general, and modified).

Both Class 2A and 2B waters are also protected for aquatic recreation activities including bathing and swimming, and the consumption of fish and other aquatic organisms. In streams, aquatic recreation is assessed by measuring the concentration of *E. coli* in the water, which is used as an indicator species of potential waterborne pathogens. To determine if a lake supports aquatic recreational activities, its trophic status is evaluated using total phosphorus, Secchi depth, and chlorophyll-*a* as indicators. The ecoregion standards for aquatic recreation protect lake users from nuisance algal bloom conditions fueled by elevated phosphorus concentrations that degrade recreational use potential.

2.3 Anti-degradation policies and procedures

The purpose of the anti-degradation provisions in Minn. R. ch. 7050.0250 through 7050.0335 is to achieve and maintain the highest possible quality in surface waters of the state. To accomplish this purpose:

- Existing uses and the level of water quality necessary to protect existing uses are maintained and protected.
- Degradation of high water quality is minimized and allowed only to the extent necessary to accommodate important economic or social development.
- Water quality necessary to preserve the exceptional characteristics of outstanding resource value waters is maintained and protected.
- Proposed activities with the potential for water quality impairments associated with thermal discharges are consistent with Section 316 of the Clean Water Act, United States Code, title 33, Section 1326.

2.4 Black River Subwatershed water quality standards

The pollutant addressed in this TMDL is *E. coli*. In Minnesota, *E. coli* is used as an indicator species of potential water pathogens, and exceedances of the *E. coli* criteria indicate that a water body does not meet the aquatic recreation designated use. Water use classifications for the Black River are provided in *Beneficial Use Designations for Stream Reaches: Rainy River–Lower Watershed (09030008)* (MPCA n.d.), which is incorporated by reference in Minn. R. 7050.0470. This TMDL report addresses the Black River and the West Fork Black River, which have the designated uses 2Bg, 3C, 4A, 4B, 5, and 6. The impaired reaches do not meet the *E. coli* criteria for class 2 waters.

The *E. coli* standard for class 2 streams in Minnesota has two parts, a chronic standard and an acute standard (Table 2). Exceedances of either *E. coli* criterion in class 2 waters indicates that a water body does not meet the applicable designated use. The *E. coli* TMDLs in this report are based on the monthly geometric mean (chronic) criterion of 126 organisms (org)/100 mL. It is assumed that practices implemented to meet the geometric mean criterion will also address the individual sample (acute) criterion (1,260 org/100 mL), and that the individual sample criterion will also be met. Although the TMDLs are based on the monthly geometric mean criterion, both criteria apply.

Red Lake Nation is in the process of gaining Treatment as a State (TAS) approval, and their draft standards are under development. Their intention is to adopt the state's criteria for *E. coli*; there should be no conflicts for the *E. coli* TMDLs in this study. To learn more about Red Lake Nation tribal lands in this watershed, see Section 3.

Table 2. *E. coli* criteria for class 2B water bodies in Minnesota

***E. coli* water quality standard**	**Numeric criteria**
Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions within any calendar month, nor shall more than 10% of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31.	< 126 organisms / 100 mL water (monthly geometric mean) < 1,260 organisms / 100 mL water (individual sample)

3. Watershed and water body characterization

This TMDL study addresses the Black River *E. coli* impairments in the Lower Rainy River Watershed in Northern Minnesota. The Black River Subwatershed is approximately 400 square miles and drains portions of Koochiching County, Minnesota. The unincorporated community of Loman (population 163) is located near the Black River outlet, with scattered smaller rural communities such as Fairland. The majority of the communities within the subwatershed are small and feature fewer than 200 people.

The subwatershed is located in the Northern Minnesota Wetlands ecoregion. The project area was covered by glacial Lake Agassiz and contains lacustrine soil types, which are highly erodible and well documented in the Rainy River Basin region. The Black River system consists of a main stem and a west fork. The main stem flows 48 miles from its headwaters to its confluence with the Rainy River, with one major tributary, the South Fork Black River, which drains 45 square miles. Recreational uses of the Black River include canoe and kayak paddling, waterfowl hunting, and fishing.

Native American lands of the Red Lake Band of Chippewa Indians include 12,175 acres in the Black River Subwatershed (Figure 2). The majority of this area is in the watershed of the main stem of the Black River with 10,857 acres, with a smaller amount (1,318 acres) in the West Fork Black River Subwatershed. Although there are no Red Lake tribal lands adjacent to either impaired river segment, the MPCA is communicating with and working with the Red Lake Band in recognition of their traditional fishing, hunting, and gathering. It is understood that MPCA has no jurisdiction on tribal lands, and load reductions are not assigned to tribal lands in this TMDL (see Section 4.1.2). For more information about the Red Lake Department of Natural Resources' Red Lake Waters Program *"Ezhi-ganawenjigaadeg-Nibi,"* please see https://www.redlakenation.org/department-of-natural-resources/.

More information on the watersheds can be found in the Lower Rainy River and Rapid River Watersheds Monitoring and Assessment Report (MPCA 2020).

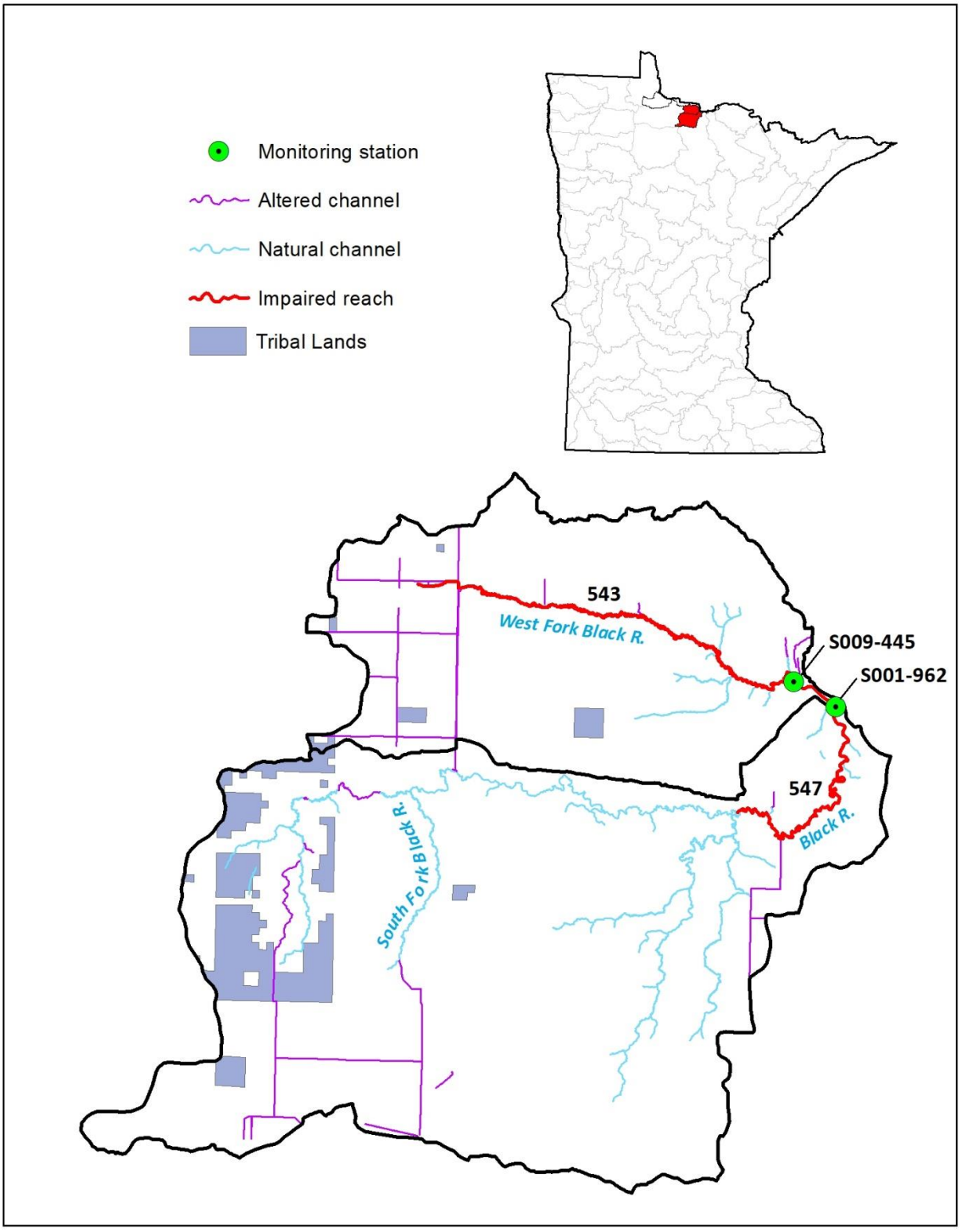

Figure 2. Black River Subwatershed and tribal lands

3.1 Stream subwatersheds

The watershed boundaries of the impaired stream segments of the Black River were defined using watershed delineations from the MPCA's Hydrologic Simulation Program–Fortran (HSPF) model application of the Lower Rainy River Watershed. The model watershed boundaries are based on Minnesota Department of Natural Resources (DNR) Level 7 watershed boundaries (Figure 2, Table 3).

Table 3. Watershed areas of impaired streams

Water body name	AUID	Watershed area (acres) [a]
West Fork Black River, Headwaters to Black R	543	81,620
Black River, Unnamed cr to W Fk Black R	547	173,635

3.2 Land cover

Land cover in the Black River Subwatershed is characterized by extensive wetlands located on the old Glacial Lake Agassiz lake bed. Development pressure is negligible, with occasional lands being parceled out for timber production or recreational homes. Small livestock and crop operations exist in the watershed; however, the majority of the landscape is woody and emergent wetlands (Table 4, Figure 3).

Table 4. Land cover summary (NLCD 2016), percent area

Land cover	West Fork Black River (543)	Black River (547)
Woody wetlands	78%	85%
Emergent herbaceous wetlands	18%	11%
Open water	< 1%	< 1%
Forest	1%	2%
Shrub and grassland	< 1%	< 1%
Agriculture	< 1%	< 1%
Developed	< 1%	< 1%
Total	100%	100%

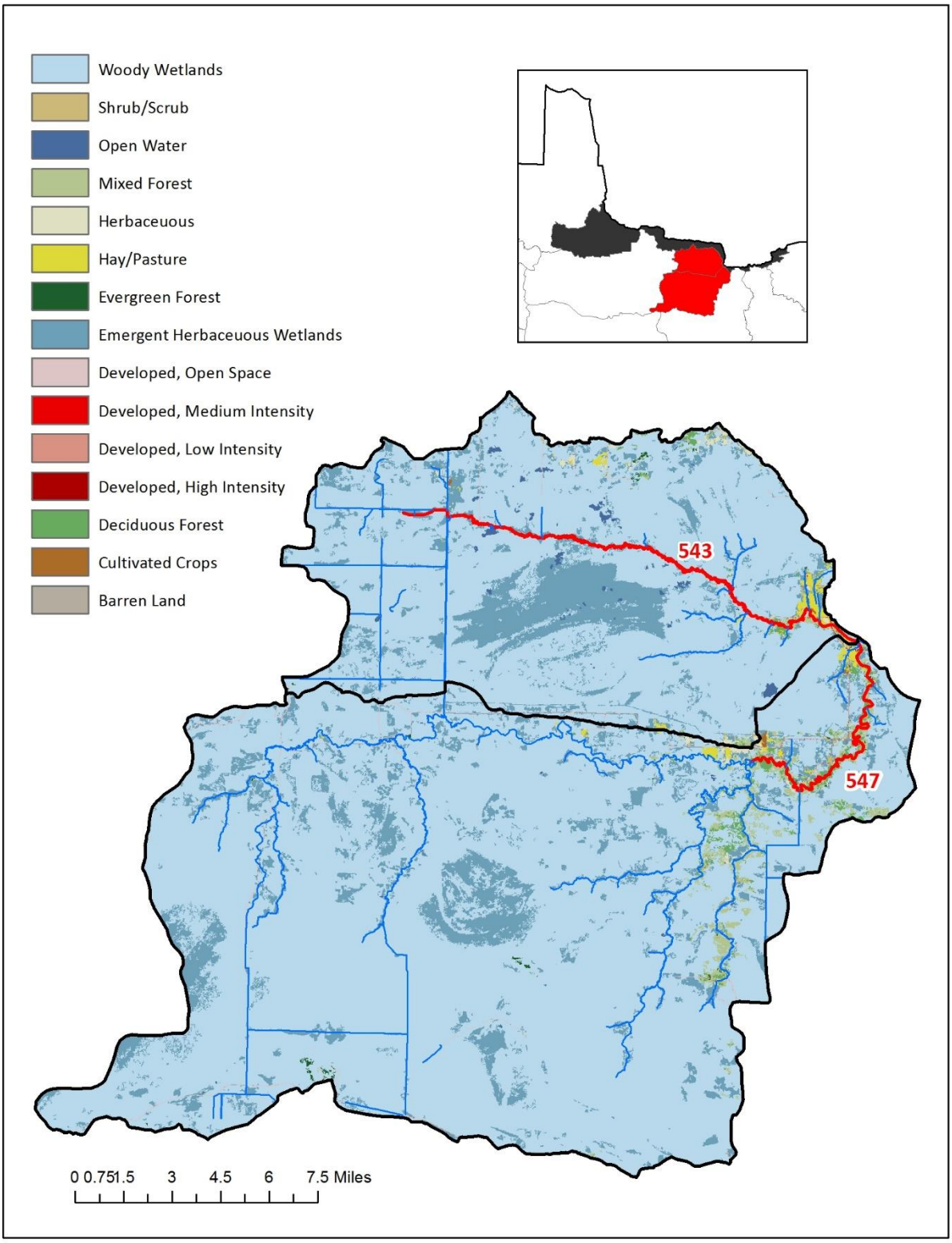

Figure 3. Black River Subwatershed land cover (NLCD 2016)

Pre-European settlement land cover in the Black River Watershed consisted predominantly of conifer bogs and swamps, with small areas of aspen trending to conifers (Figure 4). Much of the project area retains the pre-settlement forest and wetlands, however, the Black River Subwatershed stream network has been altered 29% through ditched networks.

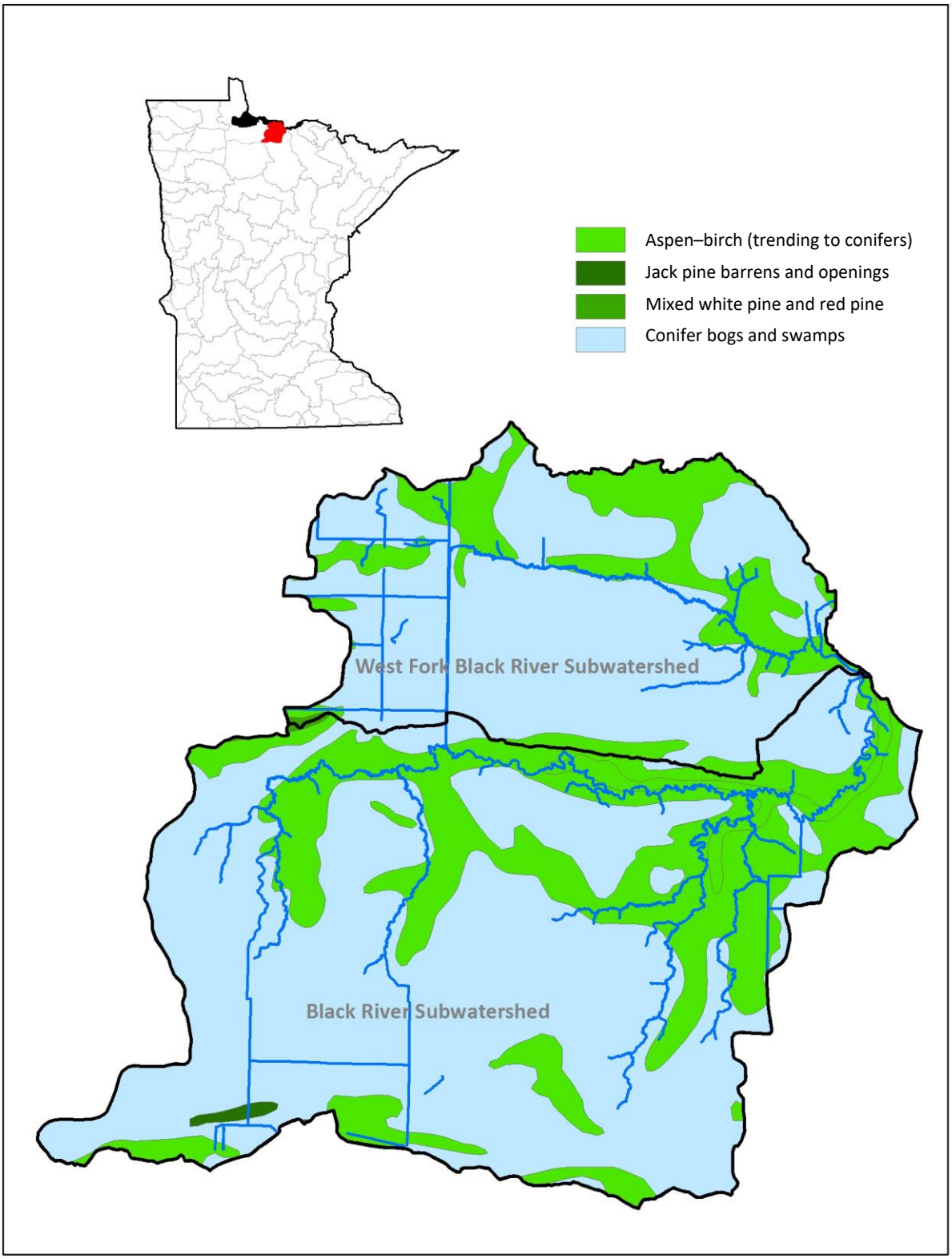

Figure 4. Black River Subwatershed pre-European settlement land cover (Marschner)

Land ownership in the Black River Subwatershed includes county, state, and federal public lands, with several small recreational cabins, hunting lands, and several small farms mainly along the high landscape features of the river corridor.

3.3 Water quality

E. coli concentration data were downloaded from the MPCA's Environmental Quality Information System (EQuIS)—data are available for the impaired reaches from 2017 and 2018. Results from multiple samples from the same day were averaged. Daily average flows along the impaired reaches were simulated with the MPCA's HSPF model application of the Lake of the Woods Watershed (run on 7/27/2021; model version "RainyR_WQ033Eb"). The simulated flows from the HSPF model integrate flow monitoring data and provide long-term, continuous flow estimates; these simulated flows were used in developing the stream TMDLs. For additional information regarding HSPF modeling, see modeling documentation (RESPEC 2016, RESPEC 2021; MPCA revised the hydrology calibration after the RESPEC 2021 model version).

E. coli data were summarized by year to evaluate annual trends in water quality (Table 5) and by month to evaluate seasonal variation (Table 6). The frequency of exceedances represents the percentage of samples that exceed the water quality standard. High *E. coli* concentrations in August are the cause of impairment in both reaches (Table 6). *E. coli* concentrations vary over time in the impaired reaches, with high concentrations often occurring on the same day in both reaches (Figure 5).

Table 5. Annual summary of *E. coli* data for impaired reaches

Reach (AUID)	Station	Year	Sample count	Geometric mean (org / 100mL)	Minimum (org / 100mL)	Maximum (org / 100mL)	Number of individual standard exceedances	Frequency of individual standard exceedances
Black River (543)	S009-445	2017	9	55	4.1	816	0	0
		2018	6	75	19.5	1,120	0	0
West Fork Black River (547)	S001-962	2017	9	56	11	2,420 [a]	1	11%
		2018	6	42	9.7	1,414	1	17%

a. 2,420 org/100mL is the method's maximum recordable value.

Table 6. Monthly summary of *E. coli* data for impaired reaches, 2017–2018

Values in red indicate months in which the monthly geometric mean standard of 126 org/100 mL was exceeded or the individual sample standard of 1,260 org/100 mL was exceeded in greater than 10% of the samples.

Reach (AUID)	Station	Month	Sample count	Geometric mean (org / 100mL)	Minimum (org / 100mL)	Maximum (org / 100mL)	Number of individual standard exceedances	Frequency of individual standard exceedances
Black River (543)	S009-445	June	5	56	23	222	0	0
		July	5	25	4	116	0	0
		August	5	173	15	1,120	0	0
West Fork	S001-962	June	5	31	10	291	0	0
		July	5	25	11	179	0	0

Reach (AUID)	Station	Month	Sample count	Geometric mean (org / 100mL)	Minimum (org / 100mL)	Maximum (org / 100mL)	Number of individual standard exceedances	Frequency of individual standard exceedances
Black River (547)		August	5	163	13	2,420 [a]	2	40%

a. 2,420 org/100mL is the method's maximum recordable value.

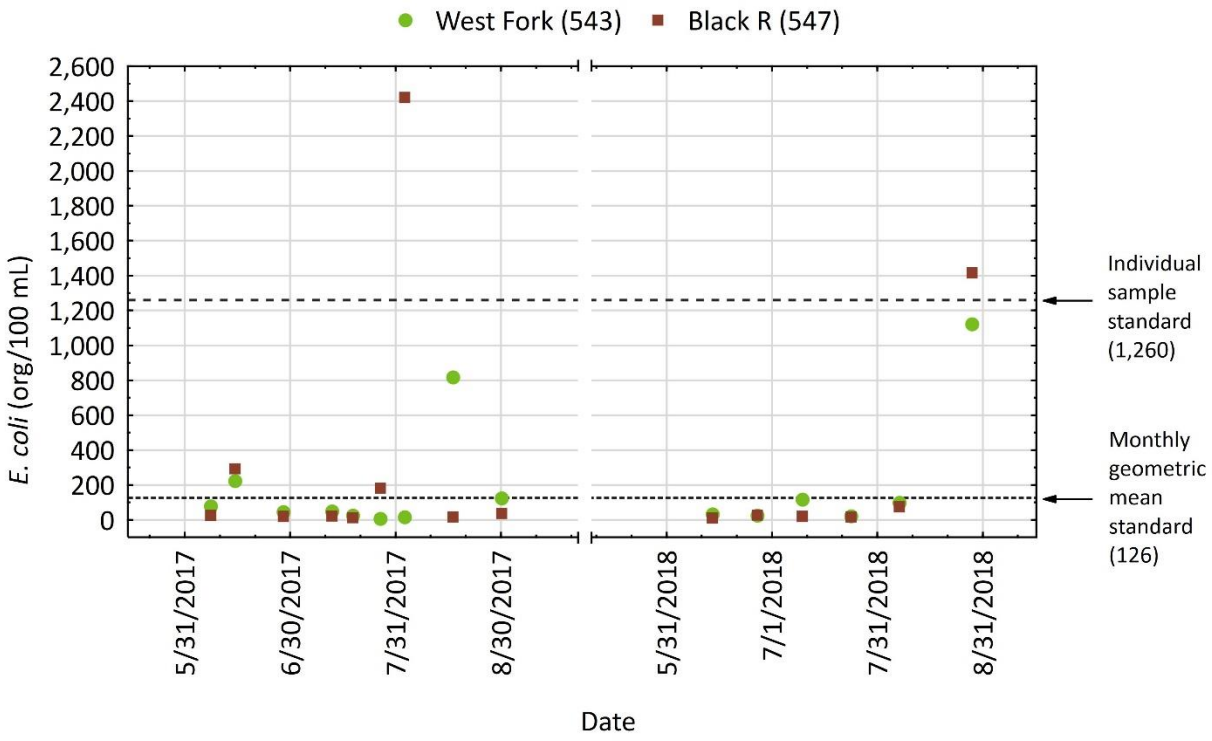

Figure 5. Scatterplot of *E. coli* data versus time

Data are the same as those summarized in Table 6. West Fork (543) data are from site S009-445; Black River (547) data are from site S001-962.

Water quality is often a function of stream flow, and water quality duration curves are used to evaluate the relationships between hydrology and water quality. For example, *E. coli* concentrations can increase with rising flows if watershed runoff from a feedlot is a substantial source. Other parameters may be more concentrated at low flows and diluted by increased water volumes at higher flows. Water quality duration curves include load duration curves and concentration duration curves, and they provide a visual display of the relationship between stream flow and water quality. Water quality duration curves were developed as follows.

Develop flow duration curves: Flow duration curves relate mean daily flow to the percent of time those values have been met or exceeded. For example, an average daily flow at the 50% exceedance value is the midpoint or median flow value; average daily flow in the reach equals or exceeds this value 50% of the time. The curve is divided into flow zones, including very high flows (0% to 10%), high flows (10% to 40%), mid flows (40% to 60%), low flows (60% to 90%), and very low flows (90% to 100%).

Flow duration curves were developed using average daily flow (1996 through 2018) from HSPF modeling. Simulated flows from all months (even those outside of the time period that the standard is in effect) were used to develop the flow duration curves.

Develop load and concentration duration curves: To develop load duration curves, all average daily flows were multiplied by the water quality standard (i.e., 126 org/100 mL *E. coli*) and converted to a daily load to create curves that represent the load in the stream when the stream meets its water quality standard under all flow conditions. Loads calculated from water quality monitoring data are also plotted on the load duration curve. Loads are based on the concentration of the sample multiplied by the simulated daily average flow on the day that the sample was taken. Each calculated load that plots above the load duration curve represents an exceedance of the water quality standard whereas loads that plot below the load duration curve are less than the water quality standard. Load duration curves are provided in the TMDL summary (Figure 7 and Figure 8 in Section 4.1.9).

Concentration duration graphs are similar to load duration curves, but instead plot concentration on the y-axis instead of load. The *E. coli* concentration duration graph for the impaired reaches indicates that in 2017 and 2018 *E. coli* concentrations were highest under low flows in both reaches, and slightly elevated concentrations were observed under high flows (Figure 6).

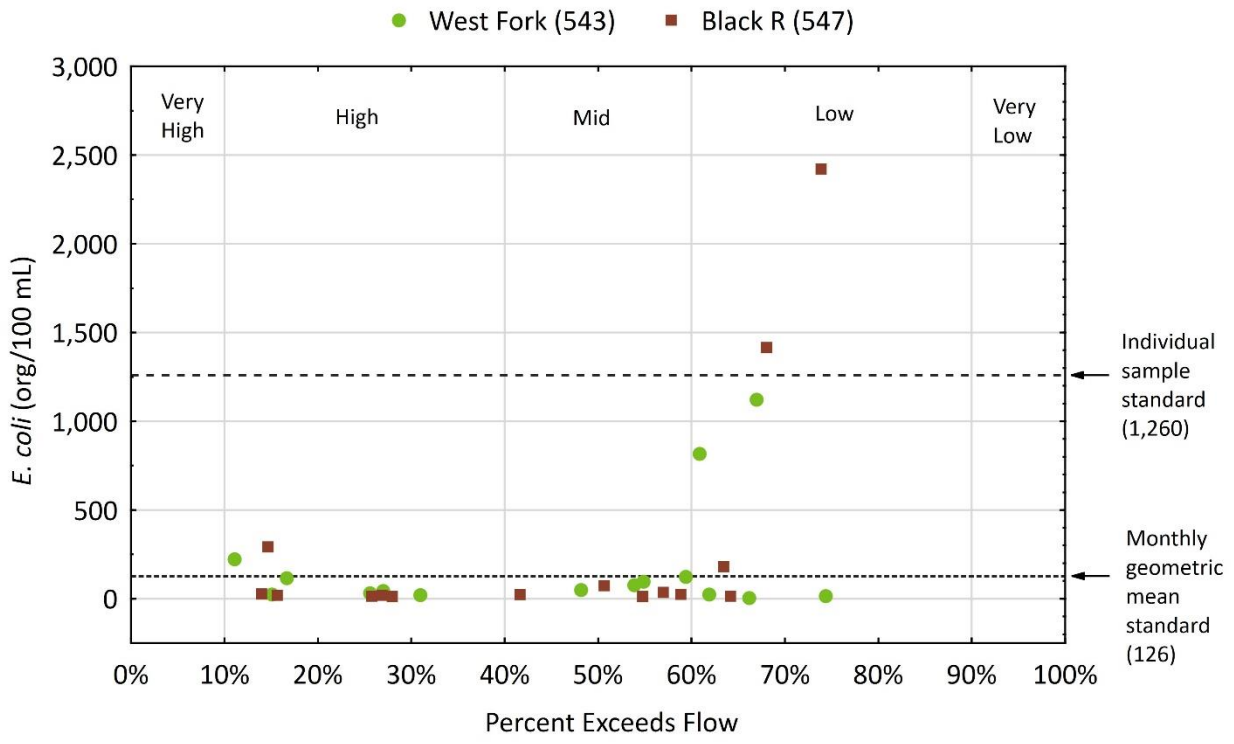

Figure 6. *E. coli* concentration duration graph

Data are the same as those summarized in Table 6. West Fork (543) data are from site S009-445; Black River (547) data are from site S001-962.

3.4 *E. coli* source summary

The relationship between *E. coli* sources and *E. coli* concentrations found in streams is complex, involving precipitation and flow, temperature, sunlight and shading, livestock management practices,

wildlife contributions, *E. coli* survival rates, land use practices, and other environmental factors. Source assessments evaluate the magnitude, timing, and location of pollutant loading to a water body. The purpose of this source assessment is to identify possible sources of *E. coli* in the Black River Subwatershed.

The *E. coli* sources in the Black River Watershed are all nonpermitted sources. Nonpermitted sources are pollutant sources that do not require a National Pollutant Discharge Elimination System (NPDES) permit. All Minnesota NPDES permits are also State Disposal System (SDS) permits, but some pollutant sources require SDS permit coverage alone without NPDES permit coverage (e.g., spray irrigation, large septic systems, land application of bio-solids, and small feedlots). The phrase "nonpermitted" does not indicate that the pollutants are illegal, but rather that they do not require an NPDES permit. Some nonpermitted sources are unregulated, and some nonpermitted sources are regulated through non-NPDES programs and permits such as state and local regulations.

The pollutant sources include pasture runoff and cattle access to streams, wildlife, and septic systems. Some pollutant loading is from natural background, which means that the source occurs outside of human influence. There are no permitted feedlots, wastewater treatment facilities, or municipal separate storm sewer systems (MS4s) in the watershed.

3.4.1 Pasture runoff and cattle access to streams

Pastures are grazed areas where the concentration of animals allows a vegetative cover to be maintained during the growing season. Pastures are a common type of livestock operation in northern Minnesota and have less of an environmental impact than open feedlots when managed well. Pastures are neither permitted nor registered with the state or county, and livestock on pastures are not restricted from accessing lakes, rivers, or other waters. However, perennial vegetative buffers of up to 50 feet along lakes, rivers, and streams are required by Minnesota's buffer law (see Section 6.1.3), and this applies to waters within pastures. On a voluntary basis, pasture owners can implement best management practices (BMPs) to reduce erosion and runoff.

Grazing impacts to water quality include pasture runoff and near-channel disturbance, which can be intensified if livestock have access to the stream. The MPCA staff observed several areas of poor manure management in pastured areas in a 2018 windshield survey of the Black River Subwatershed; these areas also lacked vegetation. The windshield survey also indicated a high degree of vegetated and or forested slopes along the streams in the Black River Watershed; however, several areas of degraded streambank were observed.

Buffer strips are in good condition in much of the riparian areas of the West Fork of the Black River and Black River corridor, meeting the requirements of Minnesota's buffer law (Minn. Stat. § 103F.48). There are 20 to 30 farms in this watershed and they are compliant with the state buffer laws (J. Aasen, personal communication 1/13/21).

3.4.2 Wildlife and beaver dams

E. coli can enter surface water from wildlife (e.g., ducks, geese, swans, and beaver) dwelling and congregating in wetlands, streams, and lakes. Fecal bacteria fate and transport mechanisms differ between wildlife that live in surface water such as waterfowl and semi-aquatic mammals (e.g., beaver),

where there is a daily source of fecal input directly to waters, and wildlife that dwell in upland areas such as deer, where input of fecal bacteria to water bodies is primarily precipitation-driven.

Beaver dams are present in the watershed, and wetlands, forests, and in-stream wildlife such as beavers are potential sources of wildlife-driven *E. coli* to the impaired reaches. Beavers share stream and riparian habitat with an abundance of other wildlife, as the streams and wetlands are closely connected in the Black River Watershed.

3.4.3 Septic systems

Subsurface sewage treatment systems (SSTS) that are an imminent threat to public health and safety (ITPHS) can contribute *E. coli* to nearby surface waters. These types of septic systems have either a sewage discharge to surface water, a sewage discharge to the ground surface, a sewage backup, or any other situation with the potential to immediately and adversely affect or threaten public health or safety (e.g., unsafe tank lids or electrical hazards). Therefore, not all of the ITPHS septic systems discharge *E. coli* directly to surface waters. The current estimate in Koochiching County is 1,200 to 2,220 systems with 40% failing to protect groundwater and 10% an ITPHS. There are approximately 20 to 30 SSTS in the Black River Subwatershed, the majority of which are seasonal. There have been a low number of instances of SSTS discharging at the surface reported in the watershed. The exact extent of septic systems that are an ITPHS currently is unknown; however, an estimate of 10% was determined to be appropriate for this watershed, based on communication with the county.

3.4.4 Natural background

"Natural background" is defined in both Minnesota statute and rule. The Clean Water Legacy Act (Minn. Stat. § 114D.15, subd. 10) defines natural background as "characteristics of the water body resulting from the multiplicity of factors in nature, including climate and ecosystem dynamics, that affect the physical, chemical, or biological conditions in a water body, but does not include measurable and distinguishable pollution that is attributable to human activity or influence." Minn. R. 7050.0150, subp. 4 states, "'Natural causes' means the multiplicity of factors that determine the physical, chemical, or biological conditions that would exist in a water body in the absence of measurable impacts from human activity or influence."

Natural background sources are inputs that would be expected under natural, undisturbed conditions. Natural background sources of *E. coli* can include inputs from forested land, wetlands, and wildlife. However, for the West Fork of the Black River and Black River impairments, natural background levels are implicitly incorporated in the water quality standards used by the MPCA to determine/assess impairment, and therefore natural background is accounted for and addressed through the MPCA's water body assessment process. Natural background conditions were evaluated within the source assessment portion of this study. These source assessment exercises indicate that natural background inputs are generally low compared to inputs from livestock on pasture, cattle access to surface waters, and septic systems.

3.4.5 Naturalized *E. coli*

Research in the last 15 years has found the persistence of *E. coli* in soil, beach sand, and sediments throughout the year in the north central United States without the continuous presence of sewage or

mammalian sources. This *E. coli* that persists in the environment outside of a warm-blooded host is referred to as naturalized *E. coli* (Jang et al. 2017). Naturalized *E. coli* can originate from different types of *E. coli* sources, including natural background sources such as wildlife and human-attributed sources such as pets, livestock, and human wastewater. Therefore, whereas naturalized *E. coli* can be related to natural background sources, naturalized *E. coli* is not always from a natural background source.

An Alaskan study (Adhikari et al. 2007) found that total coliform bacteria in soil were able to survive for six months in subfreezing conditions. Two studies near Duluth, Minnesota found that *E. coli* were able to grow in agricultural field soil (Ishii et al. 2010) and temperate soils (Ishii et al. 2006). A study by Chandrasekaran et al. (2015) of ditch sediment in the Seven Mile Creek Watershed in southern Minnesota found that strains of *E. coli* had become naturalized to the water−sediment ecosystem. Survival and growth of fecal coliform has been documented in storm sewer sediment in Michigan (Marino and Gannon 1991), and *E. coli* regrowth was documented on concrete and stone habitat within an urban Minnesota watershed (Burns & McDonnell Engineering Company, Inc. 2017). This ability of *E. coli* to survive and persist naturally in watercourse sediment can increase *E. coli* counts in the water column, especially after resuspension of sediment (e.g., Jamieson et al. 2005).

The MPCA does not currently use methods as standard practice to estimate (using an equation or model) or measure (using a laboratory analysis) what proportion of *E. coli* is naturalized. While a measurement would be preferable over an estimate, it is also more expensive, because it involves a laboratory component. The adaptation and evolution of naturalized *E. coli* that allows it to survive and reproduce in the environment makes it physically and genetically distinct from *E. coli* that cannot survive outside of a warm-blooded host. Laboratory methods target those physical and genetic differences and quantify their presence to provide a measurement. The MPCA is developing a protocol for the use of laboratory analyses to track *E. coli* to their source(s) (i.e., microbial source tracking); these approaches may shed light on naturalized *E. coli*.

3.4.6 Summary of *E. coli* sources

The monitoring data and source assessment suggest that the *E. coli* stream impairments are due to a mix of sources that occur primarily under low flows, but are also observed under high flows (Figure 6). Septic systems and direct fecal deposition from cattle access to streams which are more prominent under low flows, along with pasture runoff which occurs under high flows, are the primary sources of concern. Other sources include wildlife and natural background.

4. TMDL development

A water body's TMDL represents the loading capacity, or the amount of pollutant that a water body can assimilate while still meeting water quality standards. The loading capacity is allocated to the water body's pollutant sources. The allocations include WLAs for NPDES-permitted sources, LAs for nonpermitted sources (including natural background), and an MOS, which is implicitly or explicitly defined. The sum of the allocations and MOS cannot exceed the loading capacity, or TMDL. This section describes the general approach used to derive the TMDLs and allocations and includes the *E. coli* TMDL tables.

4.1 TMDL development approach

Details on the approaches used to develop the TMDL components are provided in the following sections.

4.1.1 Loading capacity methodology

The *E. coli* loading capacities were developed using load duration curves for the two impairments. See Section 3.3 for a description of load duration curve development. The load duration curves provide loading capacities along all flows observed in the stream, along with observed loads calculated from monitoring data and simulated flow. For any given flow in the load duration curve, the loading capacity is determined by selecting the point on the load duration curve that corresponds to the flow exceedance (along the x-axis).

The load duration curve method is based on an analysis that encompasses the cumulative frequency of historic flow data over a specified period. Because this method uses a long-term record of daily flow volumes, virtually the full spectrum of allowable loading capacities is represented by the resulting curve. In the TMDL equation tables in this report, only five points on the entire load duration curve are depicted (the midpoints of the designated flow zones). However, the entire curve represents the TMDL and is what the EPA ultimately approves.

4.1.2 Boundary condition for tribal lands

E. coli loads from tribal lands are included as boundary conditions for the two TMDLs, and *E. coli* load reductions are not assigned to the tribal land runoff. The boundary condition load for tribal runoff is based on the percent of tribal government land in the watershed of each impaired stream (Table 7, Figure 2) and is for tribal guidance only for managing their water resources. The boundary condition load was calculated as:

percent of the tribal government lands X (loading capacity – MOS)

It is understood that MPCA has no jurisdiction on tribal lands and that EPA does not approve the part of a TMDL that is located within the boundaries of tribal lands. This approach was developed in cooperation with the Red Lake Department of Natural Resources staff.

Table 7. Tribal land area in impairment watersheds

Impaired reach (AUID)	Area of tribal land (ac)	Total watershed area (ac)	Percent tribal land (%)
West Fork Black River (543)	1,318	81,620	1.6
Black River (547)	10,857	173,635	6.3

4.1.3 Load allocation methodology

The LA is allocated to existing or future nonpermitted pollutant sources. The LA was calculated as the TMDL minus the MOS minus the boundary condition for tribal lands.

Natural background conditions were also evaluated, where possible, within the modeling and source assessment portion of this study (Section 3.4.4). Natural background sources are implicitly included in the LA portion of the TMDL tables, and reductions should focus on the major human attributed sources identified in the source assessment.

4.1.4 Wasteload allocation methodology

The WLA is allocated to existing or future NPDES-permitted pollutant sources. Because there are no NPDES-permitted sources of *E. coli* in the Black River Subwatershed, WLAs are not assigned in these TMDLs.

WLAs for regulated construction stormwater (MNR100001) are not developed in Minnesota because *E. coli* is not a typical pollutant from construction sites. Industrial stormwater receives a WLA only if the pollutant is part of benchmark monitoring for an industrial site in the watershed of an impaired water body. There are no fecal bacteria or *E. coli* benchmarks associated with the industrial stormwater general permit (MNR050000), and therefore industrial stormwater *E. coli* WLAs were not assigned.

4.1.5 Margin of safety

The MOS accounts for uncertainty concerning the relationship between LAs and WLAs and water quality. The MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as a load set aside). An explicit MOS of 10% was included in the TMDLs to account for these uncertainties. The use of an explicit MOS accounts for uncertainty in water quality monitoring, calibration and validation of the HSPF watershed model, and environmental variability in flow. This MOS is considered to be sufficient given the robust dataset and the calibration results of the HSPF model. The Lake of the Woods Watershed model was calibrated and validated using 32 stream flow gaging stations (RESPEC 2015).

Calibration results indicate that the HSPF model is a valid representation of hydrology in the watershed. Simulated flows from the model were used to develop the load duration curves for the impairments.

4.1.6 Seasonal variation and critical conditions

The application of load duration curves in the *E. coli* TMDLs addresses seasonal variation and critical conditions. Load duration curves evaluate pollutant loading across all flow regimes including high flow, which is when pollutant loading from watershed runoff is typically the greatest, and low flow, which is when loading from direct sources to the stream typically have the most impact. Because flow varies

seasonally, load duration curves address seasonality through their application across all flow conditions in the impaired water body.

Seasonal variation and critical conditions are addressed by the water quality standards. The *E. coli* standard for aquatic recreation applies from April through October, which is when aquatic recreation is more likely to occur in Minnesota waters and when high *E. coli* concentrations generally occur.

4.1.7 Baseline year

The monitoring data used to calculate the percent reductions are from 2017 through 2018. The baseline year for implementation is 2017, the midpoint of the time period. BMPs present on the landscape during the model simulation time period are implicitly accounted for in the model.

4.1.8 Percent reduction

The estimated percent reduction provides a rough approximation of the overall reduction needed for the water body to meet the water quality standard. The percent reduction is a means to capture the level of effort needed to reduce *E. coli* concentrations in the watershed. The percent reduction should not be construed to mean that each of the separate sources listed in the TMDL table needs to be reduced by that amount.

The existing concentration was calculated as the maximum monthly observed geometric mean *E. coli* concentration. The percent reduction needed to meet the standard was calculated as the maximum monthly observed geometric mean concentration minus the geometric mean standard (126 org/100 mL), divided by the maximum monthly observed geometric mean concentration. By using the highest observed monthly geometric mean, the percent reduction calculation approximates the reduction in *concentration* (as opposed to load) needed to meet the monthly geometric mean standard overall, aggregated across all flow conditions and sources.

4.1.9 TMDL summary

E. coli concentrations were highest under low flows in both reaches, and slightly elevated concentrations were observed under high flows (Figure 7, Figure 8). To meet the standard, the *E. coli* concentrations in the West Fork Black River and Black River need to be reduced by approximately 23% to 27% (Table 8, Table 9). All reductions need to be made by nonpermitted sources as there are no known permitted sources of *E. coli* in the watershed.

Figure 7. *E. coli* load duration curve, West Fork Black River (09030008-543)

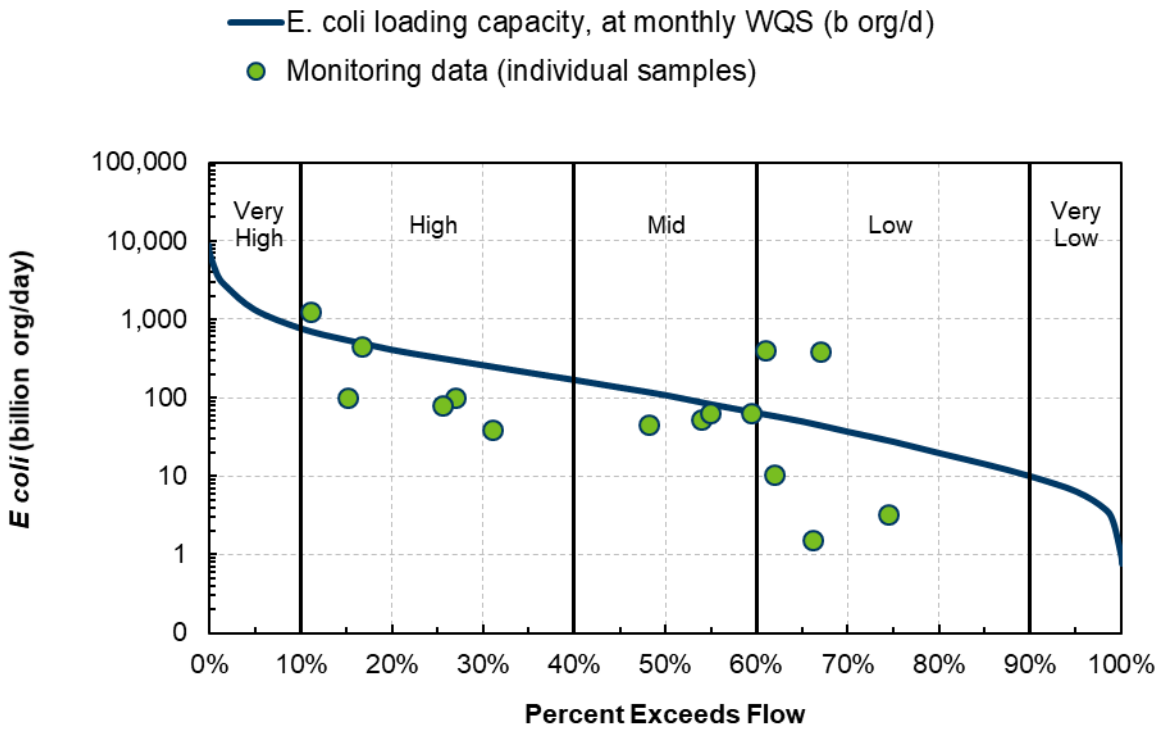

Table 8. West Fork Black River (09030008-543) *E. coli* TMDL summary

- Listing year: 2020
- Baseline year(s): 2017
- Numeric standard used to calculate TMDL: 126 org/100 mL *E. coli*
- TMDL and allocations apply Apr–Oct

	***E. coli* load (B org/day [a]) by flow zone**				
TMDL parameter	**Very High (249–2,877 cfs)**	**High (55–249 cfs)**	**Mid (21–55 cfs)**	**Low (3–21 cfs)**	**Very Low (0.2–3 cfs)**
Boundary condition: Red Lake Band of Chippewa Indians	19	4.7	1.6	0.41	0.093
Load allocation	1,168	287	95	25	5.7
Margin of safety	132	32	11	2.8	0.64
TMDL	1,319	324	108	28	6.4
Total MN load [b]	1,300	319	106	28	6.3
Maximum observed monthly geometric mean (org / 100 mL)	173				
Overall estimated percent reduction	27%				

a. b org/day = billion organisms per day

b. Total MN load = TMDL minus boundary condition for Red Lake Band of Chippewa Indians.

Loads are rounded to two significant digits, except in the case of values greater than 100, which are rounded to the nearest whole number.

Figure 8. *E. coli* load duration curve, Black River (09030008-547)

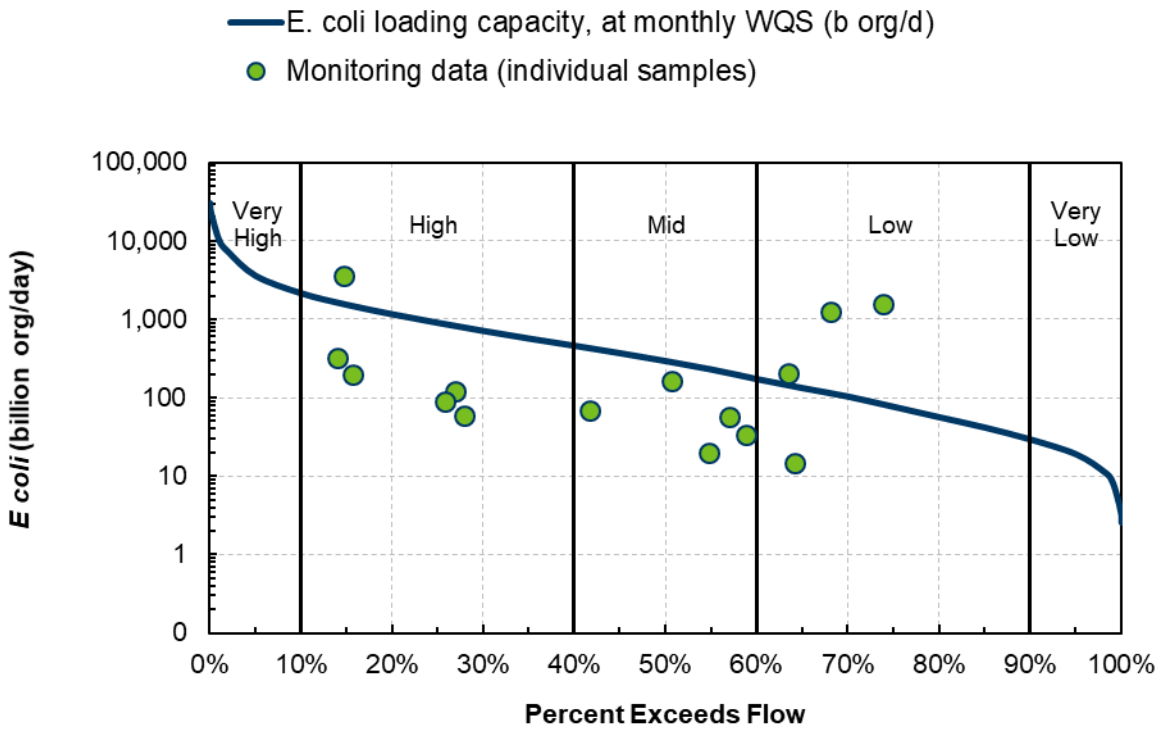

Table 9. Black River (09030008-547) *E. coli* TMDL summary

- Listing year: 2020
- Baseline year(s): 2017
- Numeric standard used to calculate TMDL: 126 org/100 mL *E. coli*
- TMDL and allocations apply Apr–Oct

	***E. coli* load (B org/day [a]) by flow zone**				
TMDL parameter	**Very High (691–9805 cfs)**	**High (149–691 cfs)**	**Mid (56–149 cfs)**	**Low (10–56 cfs)**	**Very Low (0.7–10 cfs)**
Boundary condition: Red Lake Band of Chippewa Indians	200	50	17	4.3	1.1
Load allocation	2,994	757	247	65	16
Margin of safety	355	90	29	7.7	1.9
TMDL	3,549	897	293	77	19
Total MN load [b]	3,349	847	276	73	18
Maximum observed monthly geometric mean (org / 100 mL)	163				
Overall estimated percent reduction	23%				

a. b org/day = billion organisms per day

b. Total MN load = TMDL minus boundary condition for Red Lake Band of Chippewa Indians.

Loads are rounded to two significant digits, except in the case of values greater than 100, which are rounded to the nearest whole number.

5. Future growth considerations

Land use in the watershed is predominantly forested, with private residences and small to medium farms dispersed throughout. Koochiching County is projected to decrease in population by 36% by the year 2050, relative to 2020 (Minnesota State Demographic Center projections data, downloaded January 19, 2021), and a substantial increase in population in the Black River Subwatershed is not expected. Koochiching County is a popular recreation area in northern Minnesota; as such a small amount of growth could occur along the Black River system.

5.1 New or expanding permitted MS4 WLA transfer process

Future transfer of watershed runoff loads in this TMDL may be necessary if any of the following unlikely scenarios occur within the project watershed boundaries.

1. One or more nonregulated MS4s become regulated. If this has not been accounted for in the WLA, then a transfer must occur from the LA.
2. A new MS4 or other stormwater-related point source is identified and is covered under an NPDES permit. In this situation, a transfer must occur from the LA.

Load transfers will be based on methods consistent with those used in setting the allocations in this TMDL. Loads will be transferred on a simple land area basis. In cases where WLA is transferred to a regulated MS4, the permittees will be notified of the transfer and have an opportunity to comment.

5.2 New or expanding wastewater

Since there are no WLA in this TMDL, this section is not applicable to this report.

6. Reasonable assurance

A TMDL requires reasonable assurance that pollutant reduction targets will be achieved. Pollutant reduction needs in the Black River Subwatershed are from nonpermitted sources. There is "reasonable assurance" that elements are in place that are making (or will make) progress toward needed pollutant reductions. Restoration of the Black River and West Fork of the Black River will occur as part of local, regional, state, and federal efforts and will be led as appropriate by Koochiching County, Koochiching County Soil and Water Conservation District (SWCD), state and federal agencies, nonprofit organizations, and residents.

6.1 Reduction of nonpermitted sources

Several nonpermitted reduction programs exist to support implementation of nonpoint source reduction BMPs in the Black River Subwatershed. These programs identify BMPs, provide means of focusing BMPs, and support their implementation via state initiatives, ordinances, and/or dedicated funding. The following examples describe large-scale programs that have proven to be effective and/or will reduce pollutant loads going forward.

6.1.1 SSTS regulation

SSTSs are regulated through Minn. Stat. §§ 115.55 and 115.56. SSTS specific rule requirements can be found in Minn. R. 7080 through 7083. Regulations include the following:

- Minimum technical standards for design and installation of individual and mid-size SSTS
- A framework for local units of government to administer SSTS programs
- Statewide licensing and certification of SSTS professionals, SSTS product review and registration, and establishment of the SSTS Advisory Committee
- Various ordinances for SSTS installation, maintenance, and inspection

Each county maintains an SSTS ordinance, in accordance with Minn. Stat. and Minn. R., establishing minimum requirements for regulation of SSTS, for the treatment and dispersal of sewage within the applicable jurisdiction of the county, to protect public health and safety, to protect groundwater quality, and to prevent or eliminate the development of public nuisances. Ordinances serve the best interests of the county's citizens by protecting health, safety, general welfare, and natural resources. In addition, each county zoning ordinance prescribes the technical standards that on-site septic systems are required to meet for compliance and outlines the requirements for the upgrade of systems found not to be in compliance. This includes systems subject to inspection at transfer of property, upon the addition of living space that includes a bedroom and/or a bathroom, and at discovery of the failure of an existing system. From 2002-2016, Koochiching County replaced a total of over 400 systems (Figure 9).

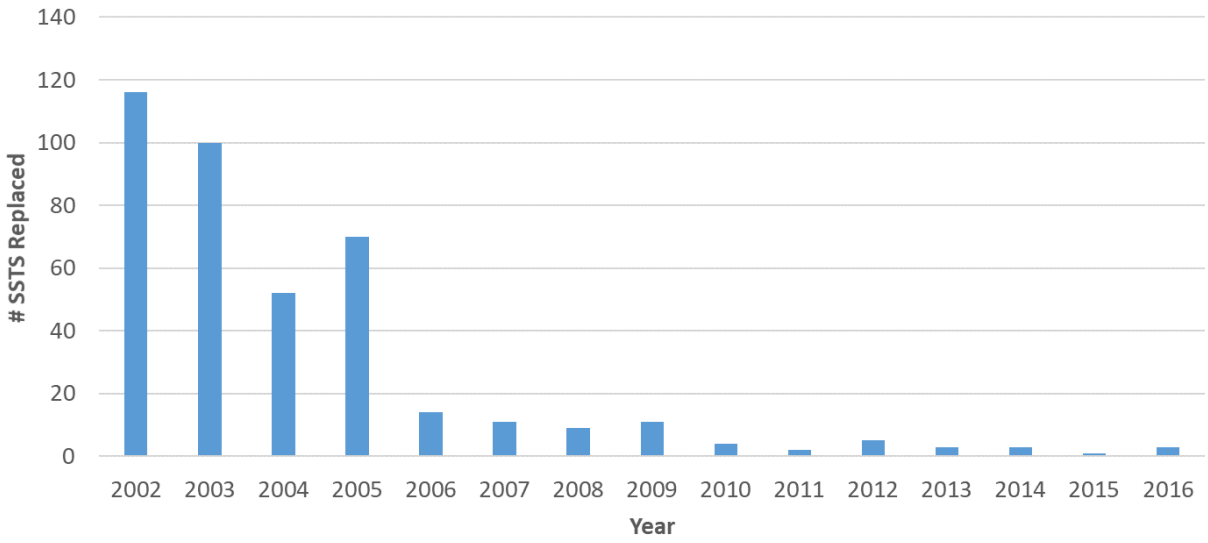

Figure 9. SSTS replacements by year in Koochiching County

All known ITPHS are recorded in a statewide database by the MPCA. From 2006 to 2019, 797 alleged straight pipes were tracked by the MPCA statewide, 765 of which were abandoned, fixed, or were found not to be a straight pipe system. The remaining known, unfixed, straight pipe systems have received a notice of noncompliance and are currently within the 10-month deadline to be fixed, have been issued Administrative Penalty Orders, or are docketed in court. Koochiching County Environmental Services Department works to understand and inventory the SSTS issues within the county. More information on SSTS financial assistance at the MPCA, can be found at the following address: https://www.pca.state.mn.us/water/ssts-financial-assistance.

6.1.2 Feedlot Program

The MPCA's Feedlot Program addresses both permitted and nonpermitted feedlots. While farms and livestock exist in the Black River Subwatershed, they do not have enough livestock to require registration through the state or county. The following information on the Feedlot Program is provided to demonstrate that measures would be in place to implement feedlot rules if needed in the future.

The Feedlot Program implements rules governing the collection, transportation, storage, processing, and disposal of animal manure and other livestock operation wastes. Minn. R. ch. 7020 regulates feedlots in the state of Minnesota. All feedlots capable of holding 50 or more animal units, or 10 in shoreland areas, are subject to this rule. The focus of the rule is on animal feedlots and manure storage areas that have the greatest potential for environmental impact. A feedlot holding 1,000 or more animal units is permitted in Minnesota.

The Feedlot Program is implemented through cooperation between MPCA and delegated county governments in 50 counties in the state. The MPCA works with county representatives to provide training, program oversight, policy and technical support, and formal enforcement support when needed. A county participating in the program has been delegated authority by the MPCA to administer the Feedlot Program. These delegated counties receive state grants to help fund their feedlot programs based on the number of feedlots in the county and the level of inspections they complete. In recent

years, annual grants given to these counties statewide totaled about two million dollars (MPCA 2017). Koochiching County is not a participant in the delegated authority arrangement offered by MPCA; therefore, the MPCA is tasked with running the Feedlot Program in that county.

6.1.3 Minnesota buffer law

Minnesota's buffer law (Minn. Stat. § 103F.48) requires perennial vegetative buffers of up to 50 feet along lakes, rivers, and streams and buffers of 16.5 feet along public ditches. These buffers help filter out phosphorus, nitrogen, and sediment. Alternative practices are allowed in place of a perennial buffer in some cases. Amendments enacted in 2017 clarify the application of the buffer requirement to public waters, provide additional statutory authority for alternative practices, address concerns over the potential spread of invasive species through buffer establishment, establish a riparian protection aid program to fund local government buffer law enforcement and implementation, and allowed landowners to be granted a compliance waiver until July 1, 2018, when they filed a compliance plan with the appropriate SWCD.

The Board of Water and Soil Resources (BWSR) provides oversight of the buffer program, which is primarily administered at the local level. Compliance with the buffer law ranges from 94% to 100% in Koochiching County as of March 2021 (data available on BWSR website under Buffer Program Update). The Black River Watershed has approximately 20 to 30 farms located in the watershed and is 100% compliant with the Minnesota buffer law (J. Aasen, Personal communication 1/13/21).

6.1.4 Minnesota Agricultural Water Quality Certification Program

The Minnesota Agricultural Water Quality Certification Program (MAWQCP) is a voluntary opportunity for farmers and agricultural landowners to take the lead in implementing conservation practices that protect our water. Those who implement and maintain approved farm management practices will be certified and, in turn, obtain regulatory certainty for a period of 10 years.

Through this program, certified producers receive:

- Regulatory certainty: certified producers are deemed to be in compliance with any new water quality rules or laws during the period of certification
- Recognition: certified producers may use their status to promote their business as protective of water quality
- Priority for technical assistance: producers seeking certification can obtain specially designated technical and financial assistance to implement practices that promote water quality

Through this program, the public receives assurance that certified producers are using conservation practices to protect Minnesota's lakes, rivers, and streams.

6.1.5 Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a voluntary federal conservation program that provides financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, increased soil health and reduced soil erosion and sedimentation, improved or

created wildlife habitat, and mitigation against increasing weather volatility. Through EQIP, the NRCS provides agricultural producers with financial resources and one-on-one help to plan and implement conservation practices.

6.1.6 Sustainable Forest Incentive Act

The Sustainable Forest Incentive Act (SFIA) is a voluntary program that provides incentive payments to encourage sustainable use of forest lands to property owners with qualifying lands. Property owners can receive a payment for each acre of qualifying forest land they enroll. In return, the land cannot be developed and must have a forest management plan. All enrolled land must remain in SFIA for at least 8, 20, or 50 years depending on the agreement. Descriptions of qualifying properties can be found at the following address: https://www.revenue.state.mn.us/sustainable-forest-incentive-act.

6.1.7 Conservation easements

Conservation easements are a critical component of the state's efforts to improve water quality by reducing soil erosion, reducing phosphorus and nitrogen loading, and improving wildlife habitat and flood attenuation on private lands. Easements protect the state's water and soil resources by permanently restoring wetlands, adjacent native grassland wildlife habitat complexes, and permanent riparian buffers. In cooperation with county SWCDs, BWSR's programs compensate landowners for granting conservation easements and establishing native vegetation habitat on economically marginal, flood prone, environmentally sensitive, or highly erodible lands. These easements vary in length of time from 10 years to permanent/perpetual easements. Types of conservation easements in Minnesota include Reinvest in Minnesota (RIM), and the Wetland Reserve Program (WRP) or Permanent Wetland Preserve (PWP).

6.2 Summary of local plans

Minnesota has a long history of water management by local government, which included developing water management plans along county boundaries since the 1980s. The BWSR-led One Watershed, One Plan (1W1P) program is rooted in work initiated by the Local Government Water Roundtable (Association of Minnesota Counties, Minnesota Association of Watershed Districts, and Minnesota Association of SWCDs). The Roundtable recommended that local governments organize to develop focused implementation plans based on watershed boundaries. That recommendation was followed by the legislation (Minn. Stat. § 103B.801) that would establish the 1W1P program, which provides policy, guidance, and support for developing comprehensive watershed management plans:

- Align local water planning purposes and procedures on watershed boundaries to create a systematic, watershed-wide, science-based approach to watershed management.
- Acknowledge and build off existing local government structure, water plan services, and local capacity.
- Incorporate and make use of data and information, including WRAPS.
- Solicit input and engage experts from agencies, citizens, and stakeholder groups; focus on implementation of prioritized and targeted actions capable of achieving measurable progress.

- Serve as a substitute for a comprehensive plan, local water management plan, or watershed management plan developed or amended, approved, and adopted.

Koochiching County has indicated that it intends to participate in the 1W1P process and intends to begin planning within the next several years. The Black River Subwatershed will be incorporated into the 1W1P for the combined Rapid River and Lower Rainy River HUC-8 watersheds. The 1W1P planning boundaries are found at the following link: https://bwsr.state.mn.us/one-watershed-one-plan-participating-watersheds.

Until the completion of a comprehensive watershed management plan that incorporates the Black River Subwatershed, the Koochiching County Comprehensive Local Water Management Plan (2018 through 2028) remains in effect per the Comprehensive Local Water Management Act (Minn. Stat. § 103B.301). The plan expiration date may be extended pending future participation in the 1W1P program. Restoring impaired waters in the county is a priority concern addressed in the current water plan. Action items to address impaired waters include developing protection strategies and implementing projects and actions directed at reducing sources of nonpoint source pollution.

6.3 Examples of pollution reduction efforts

The Koochiching Soil and Water Conservation District (KSWCD) has been an active partner in Minnesota water quality work. KSWCD staff dedicate time to water quality projects in the county's seven major watersheds. The KSWCD spearheaded a major sediment reduction project on the Rat Root River on the east side of the county. Over 20 miles of river corridor were cleared of wood log jams that had blocked flows and fish passage and had degraded important walleye spawning areas. In addition, the KSWCD developed a habitat project in the Rat Root River, creating several stream spawning riffles. They have also been actively involved in several sediment source assessments, lake shoreline stabilizations, stream chemical monitoring, and flow measurements.

6.4 Funding

Funding sources to implement TMDLs can come from local, state, federal, and/or private sources. Examples include BWSR's Watershed-based Implementation Funding, Clean Water Fund Competitive Grants (e.g., Projects and Practices), and conservation funds from Natural Resources Conservation Service (NRCS) (e.g., Environmental Quality Incentives Program and Conservation Stewardship Program).

Watershed-based implementation funding is a noncompetitive process to fund water quality improvement and protection projects for lakes, rivers/streams, and groundwater. This funding allows collaborating local governments to pursue timely solutions based on a watershed's highest priority needs. The approach depends on the completion of a comprehensive watershed management plan developed under the 1W1P program to provide assurance that actions are prioritized, targeted, and measurable. This watershed has not applied for 1W1P funding, but would need to in the future to be able to secure watershed-based implementation funding.

BWSR has begun the transition of moving more funding toward watershed-based implementation funding to accelerate water management outcomes, enhance accountability, and improve consistency and efficiency across the state. This approach allows more clean water projects to be implemented and helps local governments spend limited resources where they are most needed.

Watershed-based implementation funding assurance measures are based on fiscal integrity and accountability for achieving measurable progress towards water quality elements of comprehensive watershed management plans. Assurance measures will be used as a means to help grantees meaningfully assess, track, and describe use of these grant funds to achieve clean water goals through prioritized, targeted, and measurable implementation. The following assurance measures are supplemental to existing reporting and on-going grant monitoring efforts:

- Understand contributions of prioritized, targeted, and measurable work in achieving clean water goals.
- Review progress of programs, projects, and practices implemented in identified priority areas.
- Complete Clean Water Fund grant work on schedule and on budget.
- Leverage funds beyond the state grant.

Over $500,000 has been spent on watershed implementation projects in the Lower Rainy Watershed within Koochiching County since 2004 (Figure 10).

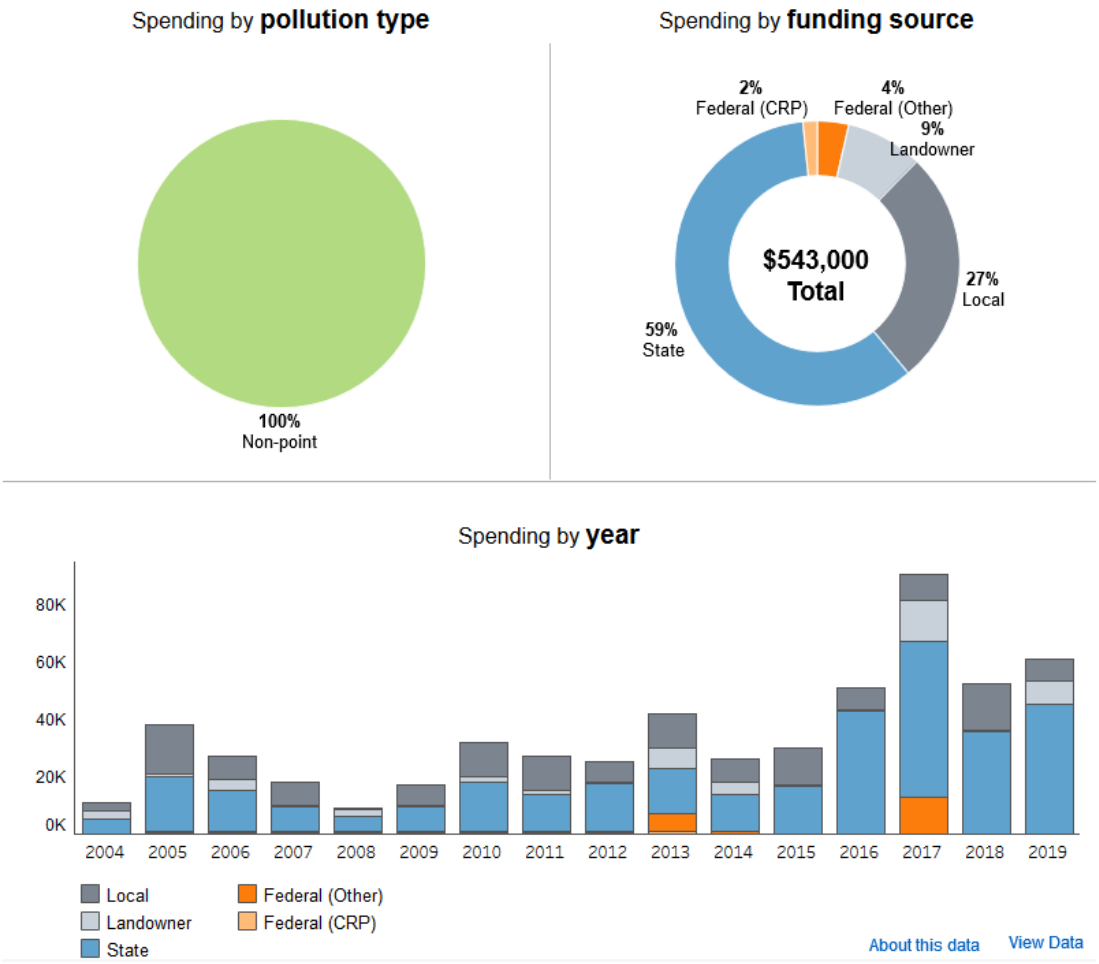

Figure 10. Spending for watershed implementation projects in the Lower Rainy River Watershed within Koochiching County; data from the MPCA's Healthier Watersheds website

7. Monitoring

Monitoring in the Lower Rainy River Watershed is expected to occur through the following programs:

- **Monitoring approach**: IWM at the HUC-8 watershed scale is part of the MPCA's watershed approach to restoring and protecting water quality. Monitoring occurs in each HUC-8 watershed approximately every 10 years and consists of a 2-year intensive monitoring program of lakes and streams in which the MPCA determines their overall health and identifies impaired waters. The next round of IWM in the Lower Rainy River Watershed is expected to begin in approximately 2028.
- **Citizen water monitoring**: The MPCA coordinates two programs aimed at encouraging long term citizen surface water monitoring: the Citizen Lake Monitoring Program (CLMP) and the Citizen Stream Monitoring Program (CSMP). CSMP has identified a site on the Black River as a high priority site in need of monitoring, though bacteria monitoring is not a part of this program. Having volunteers monitor a given lake or stream station monthly and from year to year can provide long-term data needed to help evaluate current status and trends. Volunteer monitoring is especially effective at helping to track water quality changes that occur in the years between intensive monitoring years. If interested in becoming a water monitoring volunteer, please visit Citizen water monitoring | Minnesota Pollution Control Agency (state.mn.us)
- **Other monitoring**: Other monitoring is important to determine the effectiveness of implementation activities and to delist waters that are no longer impaired in the Lower Rainy River Watershed. Continued monitoring is also important to determine when a change in management is needed. If BMPs are failing to make improvements in *E. coli* loading, additional monitoring of sources (e.g., naturalized *E. coli* sourcing) that are not currently well understood may be needed. This additional monitoring is not mandatory and will be dependent on availability of resources and local monitoring priorities.

8. Implementation strategy summary

This section summarizes implementation strategies for nonpermitted sources that could be used to help achieve the TMDLs in this report.

8.1 Implementation strategies

WRAPS for the Black River Subwatershed were developed as part of the MPCA's watershed approach to restoring and protecting water quality (MPCA 2022). A core team of regional resource professionals guided the selection of appropriate strategies that will steer future implementation planning to protect high quality waters and restore impaired waters. Nonpermitted sources of *E. coli* in the Black River Watershed are identified in the source assessment (Section 3.4) of this report.

The following activities are recommended to address nonpoint *E. coli* sources in the watershed:

- **Source assessment**

  Develop and execute a plan to assess where *E. coli* loads enter the Black River stream system. Investigate channelized stream segments and ditches. Evaluate farming practices in the watershed—as they relate to herd management, manure management, feeding locations, cattle access to streams, land applications of manure, and other practices—to ensure that the practices minimize or reduce *E. coli* loading to surface waters as much as possible.

- **Pasture and grazing management guidance and assistance**

  Work with the landowners of the Black River farming community to promote and develop a pasture and grazing management plan that benefits the pasture environment and stream ecosystem and reduces pollutant sources to the Black River and its tributaries. Encourage the use of barriers that limit or exclude animals from entering surface water bodies. Connect the landowners in the area with NRCS programs such as EQIP to provide funding for BMP implementation. Coordinate with other state and local experts such as the Sustainable Farming Association of Minnesota to maximize environmental and landowner benefits.

- **Septic system inventory and upgrades**

  Work with Koochiching County Environmental Services Department to conduct an inventory of SSTS in the Black River Subwatershed for systems with unknown status, identifying total number of systems and compliance status. Prioritize SSTS according to compliance status; identify all ITPHS systems as high priority for maintenance and replacement. Work with private landowners to achieve compliance.

- **Education and outreach**

  Provide education and outreach for pollutant-reduction activities. Assist private landowners in pasture management, grazing planning, and SSTS maintenance. Provide information or hands-on workshops to landowners on pasture management activities, as well as stream crossing, road, ditch, beaver dam, and stream habitat management.

8.2 Cost

TMDLs are required to include an overall approximation of implementation costs (Minn. Stat. 114D.25). The costs to implement the activities outlined in the strategy are approximately $97,700 to $3,810,000 over the next 10 years and address nonpermitted sources. The cost estimate is based on historical project costs and best professional judgement. The cost estimate includes pasture and livestock management BMPs, fencing, rotational grazing, and increasing local capacity with 0.25 FTE to oversee implementation in the watershed and the voluntary actions needed to achieve necessary TMDL reductions.

Replacement of ITPHS systems and SSTS maintenance were not considered in the overall cost calculation because their costs are already accounted for in existing programs. These systems vary widely across Minnesota, from $10,000 to upwards of $50,000 depending on the local soil conditions, presence of bedrock and other environmental factors.

Parcel sizes were figured on a 40-acre minimum to 200-acre maximum, based on area averages of the County Parcel maps. The amount of lands in the Black River Subwatershed that are eligible to enroll in forest stewardship programs and the level of landowner interest in enrollment are currently unknown.

8.3 Adaptive management

This list of implementation elements and the more detailed WRAPS report (MPCA 2022) uses an adaptive management approach. Continued monitoring and "course corrections" responding to monitoring results are the most appropriate strategy for attaining the water quality goals established in this TMDL. Management activities will be changed or refined to efficiently meet the TMDL and lay the groundwork for de-listing the Black River impairments.

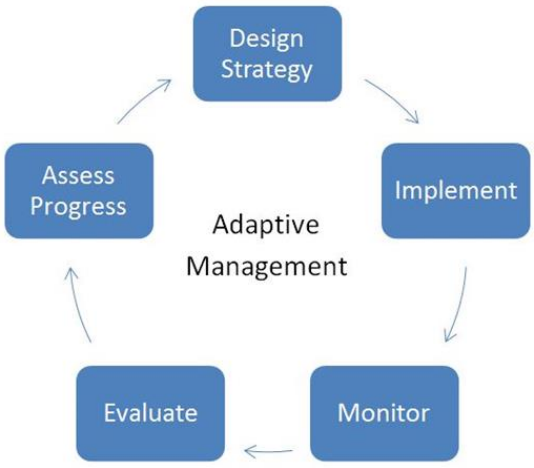

Figure 11. Adaptive management

9. Public participation

Public stakeholder meetings were held in combination with nearby watersheds—Rainy River-Headwaters and Rapid River. Many of the same natural resource professionals in state, tribal, county, and the SWCD are simultaneously working in these three watersheds. In an effort to save money and resources, a combined approach was agreed upon and undertaken. The Lower Rainy River Watershed was featured in all of the meetings and, as the meetings were spread out across Koochiching and Lake of the Woods counties, all three watersheds were discussed. The WRAPS process, TMDL process, monitoring and assessment results, and citizen perspectives on issues in the watersheds were all discussed.

The meetings were offered in several locations in the work area of these three watersheds. In early 2020, meetings and stakeholder engagement were moved online due to COVID-19 concerns. As much as possible, the MPCA prefers to have meetings in the communities that are affected by impaired waters. However, at the completion of the draft TMDL report, an online meeting will be conducted focusing specifically on the Black River impairments. The meeting will be recorded and available on the SWCD's website.

Meetings were held on the following dates:

- **5/18/17:** Baudette, MN public kick-off monitoring and assessment meeting for Lower Rainy River, Rainy River-Headwaters, and Rapid River watersheds
- **5/22/17:** Ranier, MN public kick-off monitoring and assessment meeting for Lower Rainy River, Rainy River–Headwaters, and Rapid River watersheds
- **10/23/17:** Ranier, MN public meeting for Lower Rainy River, Rainy River–Headwaters, and Rapid River watersheds
- **10/24/17:** Birchdale, MN public meeting for Lower Rainy River, Rainy River–Headwaters, and Rapid River watersheds
- **4/25/19:** Baudette, MN (10am) and Ranier, MN (3pm) Professional Judgement Group meeting for Lower Rainy River, Rainy River–Headwaters, and Rapid River watersheds
- **10/20/20:** Online meeting: public meeting update for Lower Rainy River, Rainy River–Headwaters, and Rapid River watersheds
- **10/27/20:** Online Zoom meeting: public meeting update for Lower Rainy River, Rainy River – Headwaters, and Rapid River watersheds

A core team of regional resource professionals met several times to provide their professional judgement on water quality issues within the watershed and provide guidance to WRAPS and TMDL development. This core team included representatives from various entities:

- Koochiching County SWCD
- Lake of the Woods County SWCD
- Koochiching County Environmental Services Department

- Minnesota DNR
- 1854 Treaty Authority
- MPCA
- Minnesota BWSR
- Minnesota Department of Health
- Minnesota Department of Agriculture
- United States Forest Service
- National Park Service
- Ontario Ministry of Natural Resources
- Red Lake Band of Chippewa (Miskwaagamiiwi-zaaga'igan)
- Rainy River First Nations (Emo, Ontario)

To learn more about Tribal and First Nations water quality programs please contact:

- Rainy River First Nations, Kiley Shebagegit, Lands and Natural Resources Coordinator, (807) 482-2479 ex.#237, k.shebagegit@bellnet.ca
- Red Lake Band of Chippewa, Red Lake DNR, 218-679-3959, or rldnr@redlakenation.org

An opportunity for public comment on the draft TMDL report was provided via a public notice in the State Register from April 4, 2022 to May 4, 2022. One comment letter was received and responded to because of the public comment period.

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