Grant

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Blackduck River Watershed NKE Plan

This nine key element (NKE) plan addresses the water quality concerns in the Blackduck River Watershed. If implemented as written, this NKE plan will achieve the estimated reductions to achieve water quality standards and goals in 10 years.

MINNESOTA POLLUTION CONTROL AGENCY

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Contents

List of figures

List of tables

Executive summary

This NKE plan was developed to fulfill the requirements set forth by the U.S. Environmental Protection Agency (EPA) for recipients of grants appropriated by Congress under Section 319 of the Clean Water Act (EPA 2013). The requirements emphasize the use of watershed-based NKE plans that contain the nine minimum elements documented in the guidelines and EPA's Handbook for Developing Watershed NKE plans to Restore and Protect our Waters (EPA 2008).

This NKE plan builds on the foundation of many levels of NKE planning efforts, water quality conditions, implementation goals and activities and an evaluation approach for the watershed. With the EPA approval of the NKE plan, the NKE plan will set the stage to further the previous and current restoration activities and continue efforts to achieve the water quality goals in the watershed.

Through the efforts of the partners several NKE plans and reports such as Total Maximum Daily Load (TMDL), Upper/Lower Red Lake Watershed Restoration and Protection Strategies (WRAPS), and the Upper/Lower Red Lake One Watershed One NKE plan (1W1P), leading to a wealth of watershed information. The Upper/Lower Red Lake partners including, Red Lake DNR, Beltrami SWCD/County, and the Minnesota Pollution Control Agency have developed this NKE plan for the Blackduck River Watershed. The partners prioritized areas during this process and continue a strong working relationship.

The Blackduck River originates from Blackduck Lake and flows northwest for over 33 miles and outlets into Lower Red Lake within the Red Lake Diminished Reservation, for a total watershed area of 204,089 acres. The preliminary work, completed during the various NKE planning processes, identified NKE plans and projects to address impaired waters for aquatic recreation and life designated uses.

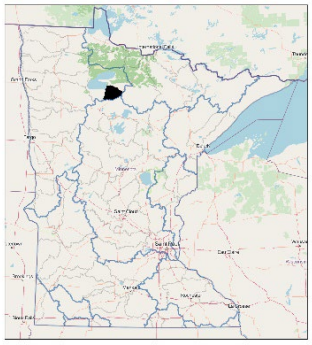
The implementation activities as described will exceed the E. Coli load reduction needed to achieve the E. Coli TMDLs. The primary reductions will be achieved through the implementation of pasture management and the replacement/upgrades of failing SSTS. Additional implementation activities will provide 87% of the TP load reductions needed to reach the TMDL goal. The loads and reductions were calculated using the EPA's PLET model. Critical areas for each pollutant source were identified by Red Lake DNR and Beltrami SWCD in a targeted implementation assessment for the Watershed. Critical areas associated with channel alteration and streambed and bank erosion were identified using multiple rapid geospatial assessments, in addition to known resource issues.

Introduction

The federal Clean Water Act Section 319 (Section 319) grant program provides funding to states to address nonpoint source (NPS) water pollution in watersheds. The Minnesota Pollution Control Agency (MPCA) passes through funding in Section 319 grants to local governments and organizations to implement best management practices (BMPs) and adopt strategies to mitigate NPS. The Small Watersheds Program will provide sustainable, longer-term funding to a select number of Focus Watersheds, which will develop detailed Nine Key Element (NKE) plans following the EPA guidance and using existing local water plans and state reports. They will then be eligible to receive Section 319 grant funds to implement the NKE plan over the course of multiple grant cycles, for up to approximately 16 years. The NKE plans are expected to be iterative. As new information and data become available, the watershed partners are expected to employ adaptive management to stay on track. A key goal for the NKE plans is to support the development and enhancement of partnerships among landowners and other citizens, local governmental units (LGUs), organizations, businesses, and state and federal agencies.

The Blackduck River and its tributaries have been identified as priority resources through multiple collaborative efforts by local, tribal, and state agencies. The Blackduck River Watershed (Watershed) is located within the Red Lake Nation, Beltrami County, Red Lake Watershed District, and to a lesser extent Koochiching and Itasca Counties. The Watershed is a hydrological unit code (HUC) 10 (0902030206) broken into 10 HUC 12 (subwatershed) as shown by Figure 1, within the southern region of the Upper/Lower Red Lake Watershed HUC 8 (09020302).

Figure 1. Watershed Map of the Blackduck River and its tributaries.



HUC 12	Watershed Name
090203020601	Blackduck Lake
090203020602	Darrigans Creek
090203020603	O'Brien Creek
090203020604	Upper Blackduck River
090203002605	Spring Creek
090203020606	Perry Creek
090203020607	South Cormorant River
090203020608	Upper North Cormorant River
090203020609	Lower North Cormorant River
090203020610	Lower Blackduck River

The Red Lake Department of Natural Resources (Red Lake DNR) and the Beltrami Soil and Water Conservation District (SWCD) are actively working together to address resource management needs and opportunities through resource NKE planning and working jointly on the pursuit of and implementation of various grants. The Blackduck River Watershed NKE plan is an extension of this partnership with the MPCA and builds upon existing planning, reports, and implementation frameworks.

The shared goal of this NKE plan is to make measurable progress for the targeted waterbodies, ultimately restoring impaired waters and preventing degradation of unimpaired waters by addressing the sources of the excess *Escherichia coli* (*E. coli*) and phosphorus along with poor habitat conditions and related biological stressors affecting the fish and macroinvertebrate communities.

It is understood that the State of Minnesota does not have jurisdiction over tribal lands (includes reservation and tribal trust lands). However, this NKE plan effort has been a cooperative effort between the MPCA and Red Lake DNR Water Program to study and assess this watershed. Joint decisions and recommendations have been made by both entities.

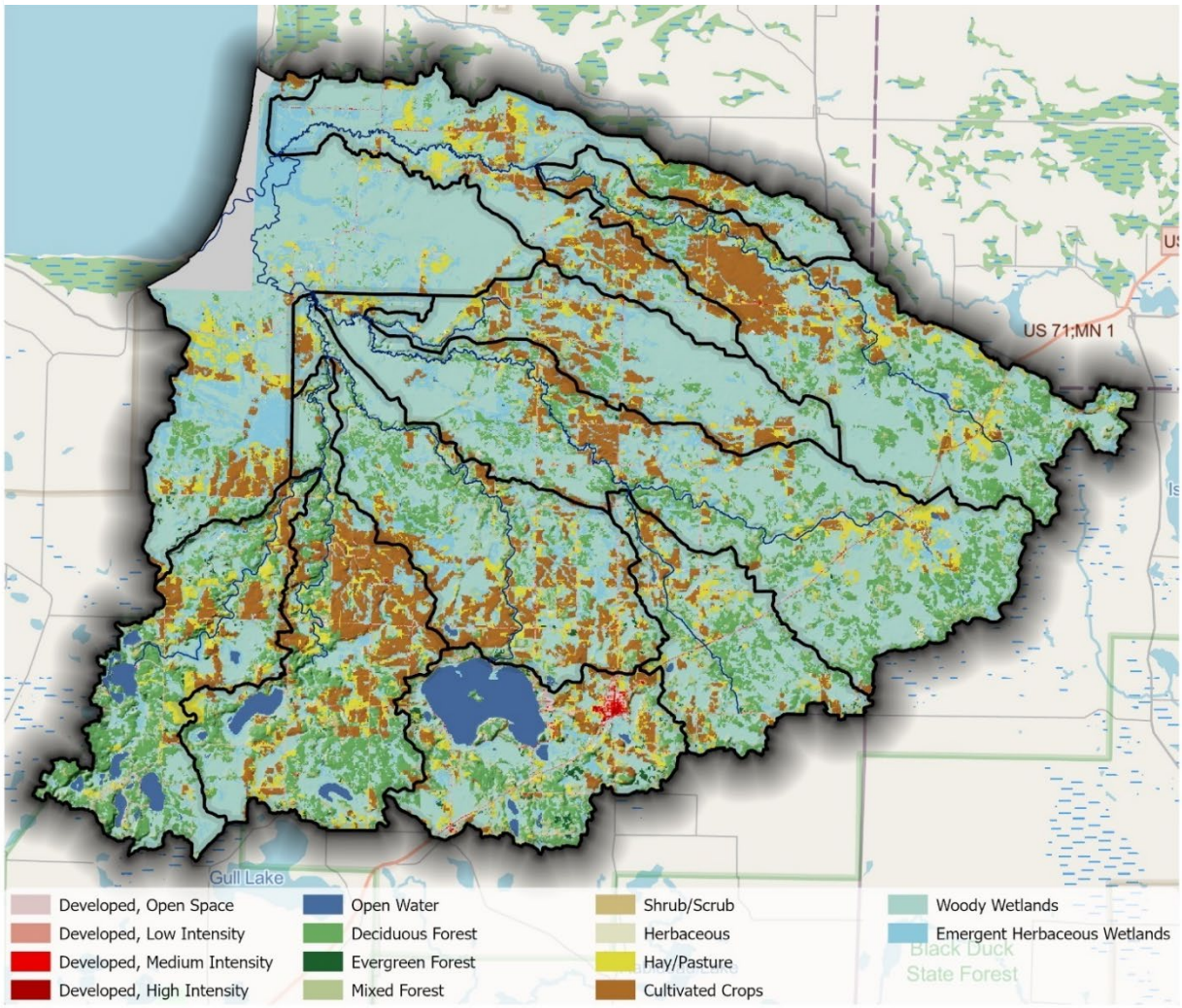
Watershed characterization

The Blackduck River originates from Blackduck Lake and flows north for approximately six miles before turning toward the northwest. The Blackduck River continues winding toward the northwest for 11 miles before being joined by a larger tributary called O'Brien Creek. O'Brien Creek originates near Medicine Lake in the south-central region of the subwatershed and flows toward the north. Darrigans Creek, a tributary of O'Brien Creek, flows northwest out of Whitefish Lake. Almost all the land that Darrigans Creek passes through is pasture. After the confluence of O'Brien Creek, the Blackduck River continues toward the northwest for three miles and is joined by a major tributary called the South Cormorant River. The South Cormorant River drains a 90 square mile subwatershed located in the central portion of the Watershed. After the confluence of the South Cormorant River, the Blackduck River continues flowing northwest for three miles before turning toward the north. The Blackduck River flows north for two miles and enters a large wetland area along the southeast corner of Lower Red Lake. At this location, the Blackduck River has an extensive wetland riparian zone and has low gradient. Another major tributary called the North Cormorant River joins the Blackduck River within this wetland area. The North Cormorant River flows from east to west for 39 miles and drains a 69 square mile subwatershed. After joining with the North Cormorant River, the Blackduck River flows southwest for four miles, passing through the Red Lake Nation Diminished Reservation before entering Lower Red Lake.

In 2018, the Minnesota Department of Natural Resources (DNR) assessed a majority of the channels in the Watershed. The 2018 Upper/Lower Red Lake Watershed Fluvial Geomorphology Report characterized these channels as narrow and deep (stream type E) with gravel or sand substrates (DNR 2018). These stream types are very sensitive to disturbance such as changes to the sediment or water supply. Protection and reestablishment of riparian vegetation is extremely important for stream type E to maintain their pattern and profile. Additionally, vegetation cover is crucial for some channels where the adjacent floodplain consists of highly-erodible soils (such as Perry Creek, Darrigans Creek, and South Cormorant River). Most channels assessed were categorized as stream type E. Further, several streams did not have access to floodplain at bankfull elevation and encounter stress to banks and bed during minor flooding events such as the South Cormorant River. Though none were considered severely incised, steps could be taken to reconnect channels to the floodplain.

The Watershed land area encompasses approximately 204,089 acres (319 square miles) and is located primarily in Beltrami County with small portions in Koochiching, Clearwater, and Itasca Counties. The Watershed outlets to Lower Red Lake within the Red Lake Diminished Reservation. Most of the watershed is in the Northern Minnesota Wetlands Ecoregion with small portions in the North Central Hardwood Forests and the Northern Lakes and Forests Ecoregions. Land cover was established by the 2019 National Land Cover dataset shown in Figure 2, for use in the EPA's Pollutant Load Estimate Tool (PLET) condensed into five categories: Urban, Cropland, Pastureland, Forest, and Wetland. The summarized categories total acres are shown in Table 1 and can be summarized as: 54% of the Watershed is Wetlands, 20% is Forest, 13% is Cropland, Pastureland is approximately 8%, and 2% of the watershed is considered developed. The main crops grown are small grains, soybeans, and forage crops. The pastureland is used primarily for beef and dairy, which account for over 65% of the total agricultural animals.

Figure 2. Blackduck River Watershed land cover (NLCD, 2019).



Subwatershed Characterization

Blackduck Lake

The Blackduck Lake Subwatershed (090203020601) drains 24.3 square miles of land within the southern region of the Watershed. The headwaters of the watershed originates from a wetland area adjacent to the east side of the City of Blackduck, on the far eastern edge of the subwatershed. The land within the subwatershed is primarily wetland (30.4 %) closely followed by forest (27.6 %), Open water (18.5 %), cropland (8.3 %), pasture land (7.8 %), and urban (7.3 %). The only community within the subwatershed is the City of Blackduck and is the largest city within the Watershed.

Blackduck River

The Blackduck River Subwatersheds (090203020604 and 090203020610) drains 75.3 square miles of land within the central region of the Watershed. The headwaters of the watershed originates from Blackduck Lake, on the Southern edge of the Watershed. The land within the subwatershed is primarily wetland (67.7 %) followed by forest (11.9 %), cropland (11.4 %), pastureland (7.1 %), urban (1.9 %), and open water (0.2 %).

Darrigans Creek

The Darrigans Creek Subwatershed (090203020602) drains 25.7 square miles of land within the Western region of the Watershed. The headwaters of the watershed originates from Whitefish Lake. The land within the subwatershed is primarily forested (36.8 %) closely followed by forest (34.9 %), cropland (10.7 %), pastureland (9.1 %), open water (6.3 %), and urban (2.2 %).

North Cormorant River

The North Cormorant River Subwatersheds (090203020608 and 090203020608) drains 69.2 square miles of land within the Northern region of the Watershed. The North Cormorant River originates from a wetland area located approximately 5 miles southwest of Northome. The land within the subwatershed is primarily wetlands (57.3 %) followed by forest (16.4 %), cropland (16.0 %), pastureland (8.1 %), urban (1.9 %), and open water (0.2 %). The only community within the subwatershed is the City of Northome in the Eastern part or the subwatershed.

O'Brian Creek

The O'Brian Creek Subwatershed (090203020603) drains 69.2 square miles of land within the South Western region of the Watershed. O'Brian Creek originates from Medicine Lake. The land within the subwatershed is primarily wetlands (33.8 %) followed by forest (28.0 %), cropland (23.4 %), pastureland (9.7 %), open water (2.7 %), and urban (2.3 %).

Perry Creek

The Perry Creek Subwatershed (090203020606) drains 20 square miles of land within the southeast region of the Upper/Lower Red Lake Watershed. Perry Creek is in the central part of the Watershed with an outlet into the South Cormorant River. The land within the subwatershed is primarily wetland (66.5 %) followed by cropland (15.2 %), forest (9.2 %), pastureland (7.0 %), urban (2.0 %), and no open water.

South Cormorant River

The South Cormorant River Subwatershed (090203020607) drains 90 square miles of land within the southeast region of the Upper/Lower Red Lake Watershed. The South Cormorant River originates from a wetland area northwest of Funkley, on the far eastern edge of the subwatershed. The land within the subwatershed is primarily wetland (60.6 %) followed by forested (24.1 %), cropland (8 %), pastureland (5.7 %), urban (1.4 %), and open water (0.2 %). The community of Funkley is within the subwatershed.

Spring Creek

The Spring Creek Subwatershed (090203020605) drains 17.8 square miles of land within the southeast region of the Upper/Lower Red Lake Watershed. Spring Creek originates from a wetland area north of Blackduck, on the far eastern edge of the subwatershed. The land within the subwatershed is primarily wetland (52.2 %) followed by forested (27.0 %), cropland (10.6 %), pastureland (7.2 %), urban (2.6 %), and open water (0.4 %).

Table 1. Land use in the Blackduck River Watershed in acres used in PLET based on the National Land Cover Data set (NLCD).

PELT Land use Categories	Urban	Cropland	Pastureland	Forest	Wetlands
NLCD (2019) Land use Categories	Developed, High Intensity Developed, Low Intensity Developed, Medium Intensity Developed, Open Space	Cultivated Crops	Hay/Pasture Herbaceous	Deciduous Forest Evergreen Forest Mixed Forest Shrub/Scrub	Herbaceous Wetlands Woody Wetlands
HUC 12 Watersheds					
	Acres	Acres	Acres	Acres	Acres
090203020601 - Blackduck Lake	1,128	1,293	1,219	4,294	4,717
090203020602 - Darrigans Creek	365	1,757	1,492	6,053	5,735
090203020603 - O'Brien Creek	497	5,060	2,102	6,057	7,314
090203020604 - Upper Blackduck River	447	3,875	1,643	4,178	10,542
090203020605 - Spring Creek	301	1,201	819	3,146	5,866
090203020606 - Perry Creek	259	1,952	901	1,214	8,473
090203020607 - South Cormorant River	469	2,675	1,919	8,079	20,353
090203020608 - Upper North Cormorant River	424	4,263	1,821	6,068	12,681

090203020609 - Lower North Cormorant River	432	2,829	1,785	1,213	12,721
090203020610 - Lower Blackduck River	455	1,605	1,773	1,536	22,067
Totals	**4,778**	**26,511**	**15,475**	**41,837**	**110,468**

Water quality conditions and categorization

Beginning in 2014, the MPCA initiated an intensive watershed monitoring (IWM) effort of rivers, streams and lakes within the Upper/Lower Red Lake Watershed. In total, 37 stream sites (35 newly established) were monitored for biology, 96 lakes for eutrophication indicators, and 11 lakes for fish community health. Four of these lakes were monitored as part of the Citizen Lake Monitoring Program. The Red Lake DNR sampled 16 stream sites for water chemistry as part of a Surface Water Assessment Grant and also monitored numerous lakes throughout the watershed and provided these data to the MPCA for assessment. The Red Lake Watershed District also sampled six stream sites and two lakes regularly and provided data to the MPCA for assessment. In general, most of the impaired streams occurred within the Blackduck River Watershed as well as an impairment to Blackduck Lake, one of the larger locally significant lakes in the Upper/Lower Red Lake Watershed.

The results of the monitoring and assessment are summarized for Total Maximum Daily Load (TMDL) in subsequent sections. Please refer to the Upper/Lower Red Lake Watershed Monitoring and Assessment Report (MPCA 2017) for full monitoring and assessment details. The MPCA has also developed a Stressor Identification (SID) Report (MPCA 2018) for the Upper/Lower Red Lake Watershed. Results from the SID report was incorporated into this NKE plan in an effort to fully capture the existing condition of the Watershed as well as the primary stressors to Watershed resources. However, assessment statistics (exceedance rate, for example) for TSS, *E. coli* bacteria, dissolved oxygen (DO), total phosphorus (TP), fish index of biological integrity (FIBI), macroinvertebrate index of biological integrity (MIBI), and Lake Eutrophication were compared to impairment thresholds and other statistical benchmarks for categorization (Table 2).

1. Protection – lakes and streams that meet water quality standards by a relatively wide margin. There is no immediate concern that these highest quality lakes and streams may become impaired, but protection is still recommended to prevent degradation of water quality.
2. Nearly impaired – lakes and streams that meet water quality standards by a relatively narrow margin and are not on the 303(d) list of impaired waters. Degradation of water quality in these lakes and streams could result in future impairments.
3. Nearly restored – lakes and streams that did not meet water quality standards by a relatively narrow margin and are on the 303(d) list of impaired waters. These lakes and streams are assumed to require the least amount of effort for restoration and short-term goals could potentially result in restoration of good water quality and/or habitat.
4. Restoration – lakes and streams that failed to meet water quality standards by a relatively wide margin and are on the 303(d) list of impaired waters. These lakes and streams presumably require more effort to restore and will require more short and long-term goals to restore water quality and/or habitat.

5. Potential impairment – lakes and streams that did not meet water quality standards or thresholds and are not on the 303(d) list of impaired waters.

Waterbodies were categorized into five restoration and protection categories according to the proximity of their current condition to the water quality standards:

Some lakes and streams did not have sufficient water quality data available to determine an appropriate restoration and protection category and were categorized as having ‘Insufficient data’. Future monitoring should be considered for these lakes and streams.

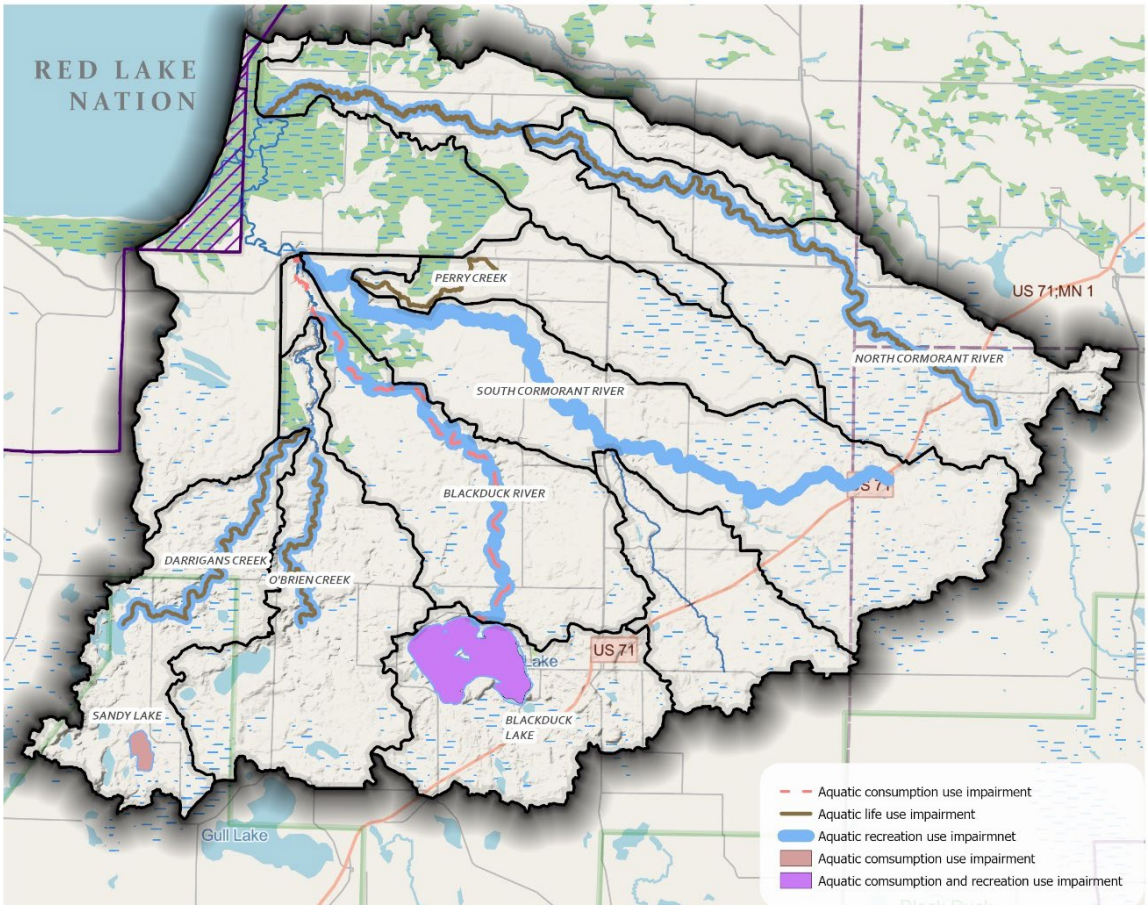
Table 2. Protection and restoration categories for streams and rivers in the Blackduck River Watershed.

Stream Name	Reach Description	Impairment	AUID	TSS	DO	Bacteria (*E. coli*)	FIBI	MIBI	Habitat Minimum MSHA
Blackduck River	South Cormorant R to North Cormorant R	*E. coli*	09020302-512	Potential impairment	Protection	Restoration	------	------	------
	North Cormorant R to Lower Red Lk		09020302-513	Insufficient data	Potential impairment	Protection	Insufficient data	------	Fair score (45<MSHA<66)
	Blackduck Lk to O'Brien Cr	*E. coli*	09020302-510	Nearly impaired	Insufficient data	Restoration	Protection	Potential impairment	Good score (>66)
Coburn Creek	Headwaters to Blackduck Lk		09020302-515	------	------	------	------	------	------
Darrigans Creek	Headwaters (Whitefish Lk 04-0137- 00) to O'Brien Cr	*E. coli*, M-IBI	09020302-508	Protection	Insufficient data	Restoration	Protection	Restoration	Fair score (45<MSHA<66)
Meadow Creek	T151 R31W S3, east line to North Cormorant R		09020302-543	Insufficient data	Insufficient data	Insufficient data	------	------	------
North Cormorant River	Headwaters to Blackduck R	*E. coli,* DO, TSS	09020302-506	Restoration	Restoration	Restoration	Protection	Nearly impaired	Fair score (45<MSHA<66)
O'Brien Creek	T149 R32W S2, south line to T150 R32W S23, north line	*E. coli*, DO	09020302-544	Protection	Restoration	Restoration	------	------	------
	Darrigans Creek to Blackduck River		09020302-514	Insufficient data	Insufficient data	Insufficient data	Protection	Protection	
South Cormorant River	Headwaters to Blackduck R	*E. coli*	09020302-507	Protection	Insufficient data	Restoration	Protection	Nearly impaired	Fair score (45<MSHA<66)
Spring Creek	T149 R30W S10, south line to T149 R30W S5, north line		09020302-546	Insufficient data	Insufficient data	Insufficient data	------	------	------

Impairments

The Red Lake Nation Diminished Reservation, a federally recognized reservation, is located in the western portion of the watershed, purple boundary line (Figure 3). Six impaired stream reaches flow from within the State of Minnesota to the federally recognized Indian reservation. These stream reaches do not serve as a border between the State of Minnesota and the Red Lake Nation (for example, as the Red River of the North serves as the border between the states of Minnesota and North Dakota).

Figure 3. Designated use impairments with in the Blackduck River Watershed.



The state and the Red Lake DNR have worked cooperatively on water quality assessments and the development of the TMDLs for these waters. The Red Lake DNR manages tribal lands and resources for the benefit of tribal members. While the MPCA does not have jurisdiction on the Red Lake Nation lands, the Red Lake Nation and the MPCA cooperated on this Watershed effort due to the benefits that would be realized by both the tribe and the State of Minnesota as a result of implementing this NKE plan. The Red Lake Diminished Reservation is a closed reservation and permission is needed by nontribal members to enter tribal lands. The Red Lake DNR accompanied the MPCA staff during biological sampling in tribal waters, assisted with water quality sampling, participated in assessment activities, conducted public participation events within the Reservation and in other areas of the watershed outside their jurisdiction, provided a wealth of local knowledge of the watershed, and wrote significant sections of the TMDL study. For the purposes of the 303(d) list, the assessment of the portion of any water body within the Reservation is advisory to EPA only, because EPA has stated that it does not approve the state's impaired waters listings or TMDLs for waters within the boundaries of an Indian reservation.

Note that the MPCA includes parcels held in trust (tribal trust lands) in the definition of Indian reservation. The Watershed has a handful of resources identified as impaired based on mercury levels. This NKE plan does not cover toxic pollutants. For more information on mercury impairments, see the statewide mercury TMDL on the MPCA website at MPCA Statewide Mercury TMDL. The impairments in the Watershed are summarized in Table 3.

Table 3. Impairments listed on the 2024 303(d) list in the Blackduck/Cormorant River Watershed.

Water body name	Year added to List	AUID	Use Class	Affected designated use	Pollutant or stressor
Blackduck Lake	1998 2010	04-0069-00	2B	Aquatic Consumption Aquatic Recreation	Mercury in fish tissue Nutrients
Blackduck River	2016 2018	09020302-510	2Bg	Aquatic Consumption Aquatic Recreation	Mercury in fish tissue *Escherichia* coli (*E*. coli)
Blackduck River	2016	09020302-511	2Bg	Aquatic Consumption	Mercury in fish tissue
Blackduck River[1] Blackduck River[1]	2016 2018	09020302-512	2Bg	Aquatic Consumption Aquatic Recreation	Mercury in fish tissue *Escherichia* coli (*E*. coli)
Blackduck River[1]	2016	09020302-513	2Bg	Aquatic Consumption	Mercury in fish tissue
Darrigans Creek	2018	09020302-508	2Bg	Aquatic Life Aquatic Recreation	Benthic macroinvertebrates bioassessments *Escherichia* coli (*E*. coli)
North Cormorant River	2018	09020302-506	2Bg	Aquatic Life Aquatic Life Aquatic Recreation	Dissolved oxygen Total suspended solids (TSS)[2] *Escherichia* coli (*E*. coli)
O'Brien Creek	2018	09020302-544	1B, 2Ag	Aquatic Life Aquatic Recreation	Dissolved oxygen *Escherichia* coli (*E*. coli)
Perry Creek	2018	09020302-605	2Bg	Aquatic Life	Fish bioassessments
Sandy Lake	2006	04-0124-00	2B	Aquatic Consumption	Mercury in fish tissue
South Cormorant River	2018	09020302-507	2Bg	Aquatic Recreation	*Escherichia* coli (*E*. coli)

[1] *Partial tribal designation with Red Lake Nation*

TMDL Summary

A TMDL is a calculation of how much pollutant a lake or stream can receive before it does not support recreational uses or aquatic life. The TMDL studies are required under the Clean Water Act for all

impaired lakes and streams. The following subsections summarize each of the resource impairments for use in setting reduction goals for this NKE plan, as established in MPCA 2021a.

Escherichia coli

The stream bacteria impairments were characterized by high *E. coli* concentrations during June through September. Minnesota *E. coli* water quality standards were developed to directly protect for primary (swimming and other recreation where immersion and inadvertently ingesting water is likely) and secondary (boating and wading where the likelihood of ingesting water is much less) body contact during the warm season months, as there is very little swimming in Minnesota during the cold season months. The TMDL study developed *E. coli* load duration curves and TMDLs for the *E. coli*-related recreational use impairments that were linked to anthropogenic sources (human or ruminant) identified through microbial source tracking.

The loading capacities for *E. coli*-related recreational use impaired stream reaches receiving a TMDL, were determined using load duration curves. Flow and load duration curves are used to determine the flow conditions (flow regimes) under which exceedances occur. The water quality analysis conducted on these data evaluated variability in flow by five flow regimes: from high flows, such as flood events, to low flows, such as base flow. Flows for each stream were modeled using a HSPF model for the period 2007 through 2014. The loading capacities were determined by applying the *E. coli* water quality standard (126 org/100 mL) to the flow duration curve to produce a bacteria standard curve. Targeted loading reduction presented in Table 4 represents the median *E. coli* load (in billion org/day) along the bacteria standard curve within each flow regime.

Table 4. Estimated E. coli-related recreational use impaired stream reductions per flow regime.

Stream AUID	Flow Regime				
	Very High	High	Mid	Low	Very Low
	E. Coli (billion organisms per day)				
North Cormorant River 09020302-506	*NA*	8% *(4.1/50.3)*	*NA*	*NA*	91% *(32.6/36.0)*
South Cormorant River 09020302-507	*NA*	20% (35.7/175.5)	*NA*	6% (2.1/34.3)	*NA*
Darrigans Creek 09020302-508	3% *(2.9/92.0)*	67% *(68.7/102.0)*	86% *(89.3/103.8)*	92% *(89.7/97.1)*	87% *(18.4/21.2)*
Blackduck River 09020302-510	*NA*	25% *(14.3/57.5)*	*NA*	*NA*	*NA*
O'Brien Creek 09020302-544	*NA*	70% *(91.2/131.0)*	3% *(0.6/18.5)*	*NA*	*NA*

The load duration curve method is based on an analysis that encompasses the cumulative frequency of historical flow data. 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. The values in Table 4, only depicts five points along the entire load capacity curve (the midpoints of the designated flow regimes). However, it should be understood that the entire curve represents the TMDL and is what is ultimately approved by EPA. For the purposes of this NKE plan, the annual load reduction needed to

achieve the *E. coli* standard is assumed to be the greatest load from any flow regime of the estimated annual load as shown in Table 5.

Table 5. E. coli reductions needed to meet goal load reductions.

Stream name Identification	Estimated Existing Load (Billion organisms per day)	Load Reduction (Billion organisms per day)	% reduction
North Cormorant River 09020302-506	36	32.6	91%
South Cormorant River 09020302-507	175.5	35.7	20%
Darrigans Creek 09020302-508	97.1	89.7	92%
Blackduck River 09020302-510	57.5	14.3	25%
O'Brien Creek 09020302-544	131	91.2	70%

Nutrients

The lake eutrophication-related recreational use impairment was characterized by phosphorus and Chl-a concentrations, and Secchi transparency depths that failed to meet the state water quality standards. Excessive nutrient loads, in particular TP, lead to an increase in algal blooms and reduced transparency – both of which may significantly impair or prohibit the use of lakes for aquatic recreation. The TMDL study developed phosphorus lake response models and calculated phosphorus TMDL for Blackduck Lake.

The load allocation includes all sources of phosphorus that do not require National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) permit coverage: watershed runoff, internal loading, atmospheric deposition, and any other identified loads described in the TMDL. The remainder of the load capacity (TMDL), after subtraction of the Margin of Safety (MOS) and calculation of the wasteload allocation, was used to determine the load allocation for Blackduck lake, Table 6. Note that the MOS was distributed proportionately among internal loading and watershed runoff based on the proportion of existing loads relative to the load capacity. The MOS cannot be accounted for in the atmospheric deposition and upstream impaired lake allocations as no further reductions can be achieved from these sources beyond what is needed to achieve the load capacity (i.e., atmospheric loads cannot be reduced and upstream impaired lakes are not required to improve in-lake water quality beyond the state eutrophication standards).

Table 6. Blackduck Lake wasteload and load allocations reduction goals.

Blackduck Lake Load Component		Existing	TMDL		Reduction	
		(lb/yr)	(lb/yr)	(lb/day)	(lb/yr)	(%)
Wasteload Allocations	Construction/Industrial Stormwater (MNR100001/MNR500000)	0.058	0.058	0.000166	0	0%
	Total WLA	0.058	0.058	0.000166	0	
Load Allocations	Watershed runoff	713.6	640.8	1.755	72.8	10%
	Failing septic systems	24.2	0.0	0.000	24.2	100%
	Internal/Unknown load	1,785.1	1,079.1	2.954	706.0	40%
	Total Watershed/In-lake	2522.9	1,719.9	4.709	803.0	32%
	Atmospheric	625.3	625.3	1.713	0.0	0%
Total LA		3,148.2	2,345.2	6.422	803.0	26%
MOS			260.6	0.714		
TOTAL		3,148.3	2,605.9	7.136		

*Load allocation components are broken down for guidance in implementation NKE planning; loading goals for these components may change through the adaptive implementation process, but the total load allocation for the lake will not be modified from the total listed in the table above.

Macroinvertebrate Bioassessments

The only macroinvertebrate bioassessment-related aquatic life impairments in the Watershed is in Darrigans Creek as characterized by low Index of Biological Integrity (IBI) scores. The presence of a diverse and reproducing aquatic community is a good indication that the stream is supporting its aquatic life beneficial use. The aquatic community integrates the cumulative impacts of pollutants, habitat alteration, and hydrologic modification on a waterbody over time. Characterization of an aquatic community is accomplished using IBI, which incorporates multiple attributes of the aquatic community, called “metrics”, to evaluate complex biological systems. In 2018, the MPCA completed a SID study to determine the cause of low FIBI and MIBI scores. While sediment/TSS was identified as a stressor for aquatic life impairments, the root cause of the sediment stressor was altered hydrology or channel alterations. Because the linkage between the impairments and sediment/TSS was weak, TSS TMDLs were not developed for the macroinvertebrate bioassessment-related aquatic life impairments.

Implementation strategies

The implementation strategies, schedule, milestones, assessments, costs, and the estimated pollutant reductions by practice are described in Table 7. The NKE plan is estimated to yield the reductions needed to reach water quality standards for *E. coli* and Nutrients within ten years. Estimated pollutant reductions by practice were calculated using the EPA's PLET for decision-making purposes. Reductions for this NKE plan were calculated using the PLET combined efficiencies; therefore, the summation of individual practice estimates may not equal the reductions estimated for the entire NKE plan.

Eligibility for funding refers to current practice eligibility in 2024, as described in the EPA's 2014 Guidance and Minnesota's 2021 NSPMP. Practices are subject to a final verification at time of any financial award and must meet all current and necessary rules and guidelines for eligibility. Any stormwater activities that take place in a municipal separate storm sewer system (MS4) permitted conveyance system are not eligible for Section 319 grant funding, nor can they be used for match funding. Monitoring to determine the effectiveness of this NKE plan and the BMPs implemented is eligible for Section 319 funding. General diagnostic and exploratory monitoring activities are not eligible for funding or match purposes.

Table 7. Implementation types, eligibility, activities, schedule, milestones, assessment criteria, costs, and estimated per practice pollutant reductions (PLET, 2024).

Treatment Groups	Amount	BMP or activity	Milestones					Assessment	Cost		Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)		Material	Staff	TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
Cropland	2 systems	Cultivated wild rice paddy nutrient reduction BMP's		1	1			# of BMPs	$150,000	$45,000	296.01	275.08	
	325 acres	Cover Crops	65	65	65	65	65	# of acres	$60,000	$18,000	32.5	22.75	65
	440 acres	Tillage Management	88	88	88	88	88	# of acres	$16,000	$4,800	338.8	302.28	110
	240 acres	Crop Rotation	48	48	48	48	48	# of acres	$40,000	$12,000		180	141.6
	29 acres	Filter strips	5	5	5	5	7	# of acres	$100,000	$30,000	15.46	12.62	9.8
	34 crossings	Increase stream connectivity by replacing culverts and removing stream barriers	2	2	2	2	4	# of culverts	$2,720,000	$816,000	6.8	5.24	4.30
Pasture	20 bmps	Interior fencing for livestock to assist with prescribed grazing	1	4	5	5	5	# of BMPs	$300,000	$16,000	4	2.6	3.6
	20 bmps	Livestock watering systems	1	4	5	5	5	# of BMPs	$860,000	$258,000	4	2.6	3.6
	4 systems	Manure storage facilities		1	1	1	1	# of BMPs	$200,000	$60,000	1.6	1.6	1.4
	10 crossings	Livestock stream crossings	1	2	2	2	3	# of crossings	$600,000	$50,000	51	0.8	4.3
	2000 linear feet	Stream access control	100	400	500	500	500	linear feet of stream	$158,400	$47,520	1.88	1.88	1.88
	1500 acres	Revitalize established pasture via no-till practices	300	300	300	300	300	# of acres	$60,000	$18,000		225	270
	2300 acres	Provide prescribed grazing plans to livestock producers	160	160	160	160	160	# of acres		$700,000		598	989
	5 plans	Nutrient management plans	1	1	1	1	1	# of plans	$40,000	$12,000			
	20 acres	Establishing trees on converted fields or field edges.					20	# of acres	$2,500	$750	10.2	1.6	8.6
	20 BMPs	Heavy-use protection area	1	4	5	5	5	# of BMP's	$60,000	$10,000	0.83	0.48	0.45

Treatment Groups	Amount	BMP or activity	Milestones					Assessment	Cost		Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)		Material	Staff	TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
	2.5 acres	Critical Area plantings	0.25	0.5	0.5	0.5	0.75	# of acres	$5,000	$1,000	1.05	0.5	0.45
Urban	3000 lf	Buffer at golf course			1000	1000	1000	# of riparian feet	$4,000	$1,200	13	12.2	10.6
	1000 feet	Plant lake shoreline buffers	200	200	200	200	200	# linear feet	$250,000	$75,000	3	1.5	1.5
	2 BMPs	Stormwater BMP		1	1			# of BMP's	$150,000	$45,000	2.25	1.95	1.8
Streambank	2500 lf	Improve bank and bed stability along streams		600	600	600	700	# linear feet of stream	$1,250,000	$250,000	58.5	30.36	79.56
	3 BMP's	Improve eroding boat and canoe access points	1	1	1			# of BMP's	$100,000	$15,000	12.15	6.36	16.52
Septic System	*15 systems (match eligible)	Address failing SSTS	3	3	3	3	3	# of BMP's	$200,000	$5,000	2,959	133	383
Habitat	*4 BMP’s	Develop sturgeon habitat structures		1	1	1	1	# of habitat structures	$100,000	$30,000			
	*50 acres	Work to control and minimize the populations of terrestrial invasive species affecting forest and pasture health.	5	5	5	5	5	# of acres protected	$15,000	$4,500			
Drinking Water	*20 wells	Work to seal unused wells	4	4	4	4	4	# of wells	$40,000	$3,000			
Protection Protection	3000 acres	Forest stewardship plans	300	600	600	600	900	# of acres protected	$30,400	$9,120	3.99	4.92	12.77
	1500 acres	Implementation of BMPs in forest stewardship plans	150	300	300	300	450	# of acres protected	$375,000	$56,250			
	40 acres	DWSMA Protection BMP for City of Blackduck					40	# of acres protected	$100,000	$2,000			
Monitoring	Reference element i.	Monitoring effectiveness of stream BMP practices						Reference the monitoring section	$30,000	$60,000			
Technical Assessment	1 report	Stormwater retrofit analysis for Blackduck	1					# of reports	$75,000	$5,000			
	*1 assessment	Sturgeon habitat feasibility on the Blackduck and Cormorant Rivers			1			# of assessments	$80,000	$24,000			

Treatment Groups	Amount	BMP or activity	Milestones					Assessment	Cost		Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)		Material	Staff	TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
Project Development	1 report	Stream protection model development	1					report development	$30,000	$9,000			
	1 report	City of Blackduck Stormwater Analysis	1					# of reports	$40,000	$12,000			
	.1 FTE	Local and tribal staff will help support the development of a geological atlas by the Minnesota Geological Survey and Minnesota Department of Natural Resources (MNDNR).	.1 FTE					# of FTEs		$10,000			
	staff time/FTE	Complete culvert inventory (local and tribal staff building of the work of the MN DNR)	Complete database					Database development		$40,000			
	1 report	LiDAR stream change detection analysis	1 report					# of reports	$60,000	$2,000			
Education/Outreach	5 workshops	Provide one chloride reduction/application training workshop for public works	1	1	1	1	1	# trainings held # attendees # of people using tools/assessments	$20,000	$6,000			
Education/Outreach	5 workshops	Provide/coordinate training for gravel road maintenance and application of summer chloride/dust suppressants.	1	1	1	1	1	# trainings held # attendees # of people using tools/assessments	$20,000	$6,000			
Education/Outreach	1-5 educational/outreach materials	Develop and distribute education and outreach resources to landowners about arsenic in drinking water. Outreach will be targeted using information gathered from the MDH Well Testing Grant	develop resource materials	distribute resource materials & available on websites	distribute resource materials & available on websites	distribute resource materials & available on websites	distribute resource materials & available on websites	# of mailers sent out, #number of qr codes activated	$10,000	$3,000			

Treatment Groups	Amount	BMP or activity	Milestones					Assessment	Cost		Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)		Material	Staff	TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
Education/Outreach	1-5 educational/outreach materials	Increase landowner knowledge on septic system maintenance and failing system impacts through targeted outreach where known issues are occurring. Outreach will be targeted using information gathered from County SSTS database	develop resource materials	distribute resource materials & available on websites	distribute resource materials & available on websites	distribute resource materials & available on websites	d distribute resource materials & available on websites	# of mailers sent out, #number of qr codes activated	$10,000	$3,000			
Education/Outreach	10 workshops	Maintain annual cattle workshop in partnership with the Blackduck Coop	2	2	2	2	2	# of attendees	$10,000	$3,000			
Education/Outreach	8 workshops	Increase landowner knowledge on forest management and land management resources through annual education and outreach. (newsletters, workshop)		2	2	2	2	# of attendees	$10,000	$3,000			
Education/Outreach	180 producers (This is based on FSA data, may not be specific watershed)	Create and print educational material for agricultural beef producers regarding pasture practices and soil health. This might include an annual mailer, information channeled through the Blackduck Co-op, social posts, etc. (Implementation of the aforementioned outreach plan)	develop resource materials and distribute to producers	re-evaluate resource materials as necessary, and distribute	re-evaluate resource materials as necessary, and distribute	re-evaluate resource materials as necessary, and distribute	re-evaluate resource materials as necessary, and distribute	# of mailers sent out, #number of qr codes activated	$10,000	$3,000			
Education/Outreach	3 plans	Create a general outreach plan to educate beef producers, forest landowners, row crop farmers, etc (Tele) about soil health practices.	Develop plan	Continue plan	Continue plan	Continue plan	Continue plan	# of plans	$60,000	$10,000			
Education/Outreach	5 tours	Annual field tour of grazing and soil health practices	1	1	1	1	1	# of attendees	$30,000	$9,000			

Treatment Groups	Amount	BMP or activity	Milestones					Assessment	Cost		Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)		Material	Staff	TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
Education/Outreach	1-5 educational/outreach materials	Provide resource material to help landowners control and minimize the populations of terrestrial invasive species affecting forest and pasture health.	develop resource materials	distribute resource materials & available on websites	distribute resource materials & available on websites	distribute resource materials & available on websites	d distribute resource materials & available on websites	# of mailers sent, # of qr codes activated	$10,000	$3,000			
Education/Outreach	10 workshops	Woodland management establishing weather-resilient trees and vegetation	2	2	2	2	2	# of attendees	$10,000	$20,000			
Education/Outreach	1.25 FTE	Assist producers in implementing their Grazing Management planning (local and tribal staff)	0.25	0.25	0.25	0.25	0.25	# of FTEs		$120,000			
Education/Outreach	1.25 FTE	Assist producers in implementing their soil health planning (local and tribal staff)	0.25	0.25	0.25	0.25	0.25	# of FTEs		$120,000			
Education/Outreach	1.25 FTE	Assist woodland owners in implementing their forest stewardship plan (local and tribal staff)	0.25	0.25	0.25	0.25	0.25	# of FTEs		$120,000			
Education/Outreach	provide 1-5 education/outreach materials	Provide education BMPs to reduce flows and load from surface and subsurface water from current and legacy sand and gravel mining	develop resource materials	distribute resource materials	distribute resource materials	distribute resource materials	distribute resource materials	# of mailers sent out, #number contacts made	$10,000	$2,000			
Education/Outreach	1-2 sites	Provide education about private and public lands that have been illegally used as dump sites		1		1		# of sites worked with	$5,000	$5,000			
Education/Outreach	1.25 FTE	Provide forester for landowner contacts and technical assistance (local and tribal staff)	0.25	0.25	0.25	0.25	0.25	# of FTEs		$120,000			

Treatment Groups	Amount	BMP or activity	Milestones					Assessment	Cost		Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)		Material	Staff	TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
Education/Outreach	4.25 FTE	Provide Grazing Land Specialist for landowner contracts and technical assistance (local and tribal staff)	0.75	0.75	0.75	0.75	0.75	# of FTEs		$700,000			
Totals									**$8,516,300**	**$4,013,140**	**3,757.52**	**1,823.32**	**2,119.73**

*Ineligible for 319 funds

Element a. Sources Identified

> An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based NKE plan (and to achieve any other watershed goals identified in the watershed-based NKE plan), as discussed in item (b) immediately below. Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed (e.g., X numbers of dairy cattle feedlots needing upgrading, including a rough estimate of the number of cattle per facility; Y acres of row crops needing improved nutrient management or sediment control; or Z linear miles of eroded streambank needing remediation).
>
> EPA Handbook for Restoring and Protecting Our Waters

The following pollutant sources were evaluated within the Watershed as appropriate: nonpoint source pollution including watershed runoff, loading from upstream waterbodies, land use, other sources such as point sources included feedlots and septic systems. The main intent is to address resource needs for impaired water resources by addressing the identified sources, to meet water quality standards. However, the magnitude of the pollutant sources affecting water quality are limited but continued watershed implementation to maintain and protect existing uses is necessary for the preservation of water quality. Efforts to protect and preserve high-quality habitats and ecological function are equally as important as restoration goals in this watershed.

The focal pollutants are TSS, E. coli, and nutrients sources which are primarily nonpoint sources. Point sources are generally very small contributors of the pollutants. Human-influenced sources of phosphorus to the lakes and streams are primarily stormwater runoff from developed land, failing septic systems, culverts, livestock stream access, and pastureland. Other human potential sources include cropland, aggregate mining operations, and timber harvests without best management practices. The runoff sources are particularly critical along the riparian areas of the streams. Sediment inputs to the streams are associated with erosion from poorly vegetated areas, whether in developed areas, along roads, in open areas, or along streambanks. Pollutant loading for the entire Watershed is summarized in Table 8 by subwatershed.

Table 8. Pollutant loading by subwatershed in the Blackduck Watershed (PLET).

Subwatershed	N Load (lbs/year)	% N Load	P Load (lbs/year)	% P Load	Sediment Load (tons/year)	% Sediment Load
090203020601 - Blackduck Lake	9117	**9%**	1659	**10%**	156	**7%**
090203020602 - Darrigans Creek	6911	**7%**	1114	**7%**	140	**6%**
090203020606 - Perry Creek	5632	**6%**	911	**5%**	151	**7%**
090203020607 - South Cormorant River	9302	**9%**	1503	**9%**	193	**8%**
090203020608 - Upper North Cormorant River	18521	**19%**	3837	**22%**	293	**13%**
090203020609 - Lower North Cormorant River	9123	**9%**	1382	**8%**	203	**9%**
090203020610 - Lower Blackduck River	7297	**7%**	1032	**6%**	119	**5%**
090203020604 - Upper Blackduck River	15758	**16%**	2704	**16%**	585	**26%**
090203020603 - O'Brien Creek	13505	**14%**	2235	**13%**	339	**15%**
090203020605 - Spring Creek	4482	**4%**	738	**4%**	104	**5%**
TOTAL	99649	**100%**	17114	**100%**	2282	**100%**

Nonpoint source pollution

Nonpoint source (NPS) pollution sources are not permitted and come from diffuse origins that can be difficult to pinpoint. The NPS is carried from rain and snowmelt traveling overland and deposited in the lakes and streams. Changing the land cover and drainage for agriculture and development can decrease the ability of the land to absorb the water (MPCA, 2021b).

Escherichia coli

Humans, pets, livestock, and wildlife all contribute bacteria to the environment. These bacteria, after appearing in animal waste, are dispersed throughout the environment by an array of natural and man-made mechanisms. Bacteria fate and transport is affected by disposal and treatment mechanisms, methods of manure reuse, imperviousness of land surfaces, and natural decay and die-off due to environmental factors such as ultraviolet (UV) exposure and detention time in the landscape.

"Failing" subsurface sewage treatment systems (SSTS) are specifically defined as systems that are failing to protect groundwater from contamination. Failing SSTS were not considered a source of fecal pollution to surface water. However, systems which discharge partially treated sewage to the ground surface, road ditches, tile lines, and directly into streams, rivers and lakes are considered an imminent public health threat (IPHT). It is estimated that there are approximately 15 SSTS that need to be upgraded or replaced. The estimated pollutant loads from the PLET model for SSTS are shown in Table 9.

Table 9. Septic system nutrient load per subwatershed based on PLET.

Subwatershed	Septic Loading	
	N (lbs/yr)	P (lbs/yr)
090203020601 - Blackduck Lake	NA	24.2
090203020602 - Darrigans Creek	16.46	6.45
090203020606 - Perry Creek	21.26	8.33
090203020607 - South Cormorant River	31.54	12.35
090203020608 - Upper North Cormorant River	24.69	9.67
090203020609 - Lower North Cormorant River	29.14	11.41
090203020610 - Lower Blackduck River	18.86	7.39
090203020604 - Upper Blackduck River	25.03	9.8
090203020603 - O'Brien Creek	30.86	12.09
090203020605 - Spring Creek	20.91	8.19

Livestock have the potential to contribute bacteria to surface water through grazing activities or if their manure is not properly managed or stored. With the exception of pasture situations, livestock manure is typically collected and applied to nearby fields through injection, which significantly reduces the transport of bacteria contained in manure to surface waters. Pastures are not regulated in Minnesota, and therefore, pastured livestock in riparian areas can be a significant source of bacteria in streams and lakes.

Desktop data and microbial source tracking (MST) evidence for sources of bacteria to the impaired streams are summarized in Table 10. One of the impaired streams had low concentrations of a human biomarker, but no desktop data evidence for an IPHT in the impaired stream subwatershed. A septic survey should be considered in this subwatershed or additional MST data collection to verify the low biomarker detection from this TMDL study. Four impaired streams had low to high concentrations of the livestock biomarker and evidence for cattle in the drainage area. The livestock facilities and associated pastures and livestock access to water should be reviewed for proper manure management to address the bacteria impairments in these streams. Four of the impaired streams had low concentrations of one or both of the beaver and bird biomarkers, suggesting a watershed-wide low level of natural background source of bacteria to streams.

Table 10. Microbial source tracking within impaired stream reaches.

Impaired Stream Reach	Humans		Livestock		Beaver	Birds
	Estimated Number of IPHT	MST Biomarker	Active Registered Feedlots (Animal Units, AU)	MST Biomarker	MST Biomarker	MST Biomarker
North Cormorant River (-503)	1 or 2		14 (1,577 AUs)	Moderate	Low	
South Cormorant River (-057)	0 or 1		6 (417 AUs)		Low	
Darrigans Creek (-508)*	0	Low	6 (1,108 AUs)	High		
Blackduck River (-510)	0		5 (501 AUs)	Low		
Blackduck River (-512)*	0 or 1		0		Low	
O'Brien Creek (-544)	0		4 (220 AUs)	Low	Low	Low

Nutrients

Excess nutrients and riparian lakeshore development have been identified as likely stressors to aquatic life use in Blackduck Lake (DOW# 04-0069-00). Blackduck Lake is 2,686 acres in size and has a maximum depth of 28 feet. The littoral zone of Blackduck Lake covers approximately 50% of the lake area. The contributing watershed of Blackduck Lake is 15,548 acres. The ratio of lake size (2,686 acres) to contributing watershed size is roughly 1:6. There are several wetland complexes within the contributing watershed ranging in size from 44 – 429 acres plus many smaller wetlands and those associated with flowing waters.

There is development along the shoreline of Blackduck Lake. Currently, there are 184 land parcels adjacent to Blackduck Lake that are not a part of the regional park or other public land. These lots do not have equal shares of shoreline, and some of the longer stretches of undeveloped shoreline are single larger parcels. There are about 97 docks along the shoreline of Blackduck Lake or approximately 5 per km of shoreline (counted from aerial imagery in Google Earth Pro version 7.1.5.1557). The publicly owned parcels contain approximately 4.8 km of the entire shoreline, or about 24%.

Coburn Creek, a major inlet, flows through the city of Blackduck, through pasturelands, and a golf course near the outlet to the lake. From 2018 through 2024, 21 TP samples were collected from Coburn Creek. This TP dataset from Coburn Creek indicates that the average TP value was 0.16 milligrams per liter (mg/L) with values ranging from 0.04 mg/L to 0.43 mg/L. Coburn Creek is within the River Eutrophication North Region for Total Phosphorus with a standard value of 0.0500 mg/L. The TP dataset indicates that out of 21 total samples, 20 samples exceed the standard and 1 sample met the standard for a 95.2% exceedance rate. Coburn Creek also was the conduit for the wastewater treatment facility effluent from 1913 until the current wastewater treatment facility was constructed in 1989. For 76 years, Blackduck Lake was the "final disposal" site after treatment. The legacy effects of this long-term use of Blackduck Lake as the final disposal site for sewage are difficult to quantify. The city of Blackduck was contributing an estimated 42% of the TP load to Blackduck Lake in 1972 (EPA, 1974). Blackduck Lake, an

intermittently stratified lake, has periods of thermal stratification throughout the summer resulting in anoxic hypolimnion conditions.

The nutrient load estimated from Construction/Industrial stormwater, total water/In-lake, and atmospheric is shown in Table 6. The majority of the load reduction is unknown/internal load which is likely coming from the near shore area and in-lake sediment phosphorus release. Focus on preventing more nutrients from entering Blackduck Lake should be concentrated on Coburn Creek and improving current shoreland use. Management strategies such as stormwater management, shoreline restoration and protection projects, septic system improvements, and agricultural BMPs can help improve the water quality.

Habitat

Table 11. Number of stream miles with livestock access per subwatershed.

Subwatershed	Streams with livestock access (miles)	Total stream length (miles)
090203020601 - Blackduck Lake	0	13
090203020602 - Darrigans Creek	5	32
090203020603 - O'Brien Creek	20	48
090203020604 - Upper Blackduck River	12	58
090203020605 - Spring Creek	2	25
090203020606 - Perry Creek	1	33
090203020607 - South Cormorant River	4	74
090203020608 - Upper North Cormorant River	3	38
090203020609 - Lower North Cormorant River	10	61
090203020610 - Lower Blackduck River	0	48

The macroinvertebrate impairment in Darrigans Creek is caused by excess fine particulate sediment. The primary source of this sediment is bank erosion caused by cattle trampling of the stream banks. A long distance along the stream is currently, or has a history of being pasture, with cattle having continuous access to the creek. A review of public domain aerial photography revealed that many areas of bank erosion are evident along the creek. Continual grazing of cattle in riparian areas of streams (as opposed to flash grazing) nearly always results in degraded and eroding banks, as well as a widening and shallowing of the stream channel. Excluding cattle from the riparian corridor is the best solution to the bank instability occurring on Darrigans Creek. The creek appears to have strong potential to have a very good macroinvertebrate community. There are larger hard substrates present (cobble and gravel), that were they clean of fine sediment, would provide stellar habitat. Very clear stream flow was observed by the author at CSAH 32 (Nebish Road). The channel was also narrow and deep at that location, with healthy amounts of macrophyte growth, and the general reach has gradient that produces flow velocities that would provide for varying microhabitats, all of which are positive habitat features. Table 11 indicates the percentage of identified stream length livestock have continuous access to that stream reach.

Streambank

Stable watercourses are an important component of a healthy watershed. Four sites were assessed within the Blackduck River subwatershed. Pfankuch stability assessments were completed on the Blackduck River, Perry Creek, Darrigans Creek, and South Cormorant River. While none of the sites were considered entrenched (no access to a floodplain at two times the maximum depth at the measured riffle), some sites did not have access to a floodplain at the bankfull elevation. At these sites water would be confined to the channel during minor flooding events that occur every 1.5-5 years and place unnecessary stress on the banks and bed. Steps can be taken to either bring the channel form back up to before channel succession began or guide it more quickly to the next stable form within succession.

Another recommendation would be an assessment of the 34 private road crossings throughout the Watershed, or at least where streams are unstable or are not meeting biological standards, as improperly designed and installed crossing can have a significant impact on stream stability and fish passage. A majority of the channels assessed were narrow and deep (stream type E) with gravel or sand substrates. These stream types are very sensitive to disturbances, such as changes to the sediment or water supply. They require (and can handle) a moderate level of sediment inputs and the potential for streambank erosion is high. The presence of robust riparian vegetation is extremely important for E stream type to maintain their pattern and profile.

Point sources

Point sources are defined as facilities that discharge stormwater or wastewater to a lake or stream and have a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Permit. There is one municipal wastewater facility (Blackduck Waste Water Treatment Plant[WWTP]) and one industrial facility (Stoney Creek Sand & Gravel) that require NPDES or SDS permitting within the Watershed. The Blackduck WWTP contains a stabilization pond system within the Blackduck Lake (04-0069) Subwatershed; however, at this facility, treated wastewater is land applied using a spray irrigation system. No surface discharge is included in the permit for this facility.

Of the 30 animal feeding operations in the Watershed, there are zero concentrated animal feeding operations (CAFOs). A CAFOs is defined by the EPA based on the number and type of animals. The MPCA currently uses the federal definition of a CAFO in its permit requirements of animal feedlots along with

the definition of an animal unit (AU). In Minnesota, the following types of livestock facilities are required to operate under an NPDES permit or a state issued SDS permit: a) all federally defined CAFOs that have had a discharge, some of which are under 1,000 AUs in size; and b) all CAFOs and non-CAFOs that have 1,000 or more AUs. Animal feeding operations under 1,000 AUs and those that are not federally defined as CAFOs are not required to operate under NPDES or SDS permits. In Minnesota, feedlots with greater than 50 AUs, or greater than 10 AUs in shoreland areas, are required to register with the state. Facilities with AUs below these thresholds are not required to register with the state.

Rice paddy management

For subwatersheds with cultivated wild rice farms, wild rice growers should be encouraged and provided financial support to continue to improve the quality of water discharged from rice paddies. Research from wild rice farms in Clearwater County found that installation of main line tile systems provides numerous benefits for water quality and farmers (Hanson 2009). When main line tile drainage is used in wild rice paddies without internal surface drainage, it has all the same benefits as conventional tile drainage (low phosphorus and sediment) while also having low nitrate levels compared to high levels found in conventional agriculture tile drainage. Main line tile drainage also has many benefits to the wild rice farmer such as more evenness of rice quality and maturity, less ditch maintenance, fewer ruts during harvest, more control over drainage, no topsoil loss, and reduced plugging of tile outlets. Within the Watershed there are 299 acres of cultivated Wild Rice.

Forestland stewardship

Table 12. Acres of forest vulnerability per subwatershed.

Subwatershed	Forest Vulnerability (acres)
090203020601 - Blackduck Lake	23
090203020602 - Darrigans Creek	558
090203020603 - O'Brien Creek	569
090203020604 - Upper Blackduck River	582
090203020605 - Spring Creek	381
090203020606 - Perry Creek	483
090203020607 - South Cormorant River	768
090203020608 - Upper North Cormorant River	240
090203020609 - Lower North Cormorant River	805
090203020610 - Lower Blackduck River	249

Forests are key to the Watershed and its ability to maintain high water quality, even while other land conversion pressures exist. Although this Watershed is largely forested and has high quality resources, growing changes to the landscape are presenting challenges to ensuring long-term ecosystem health. In general, forests that are under county, state, tribal, or federal ownership have a low disturbance risk, as opposed to private forests. Our common understanding is that as natural lands within the watershed decrease, there is an increase of phosphorus loading to our water resources.

Forest stewardship is intended to protect local private forests using a water resource-based habitat framework. To ensure reasonable protection for the stream resources within this Watershed we prioritized the private forest landcover buffering streams that also have a vulnerability for conversion based on soils and adjacency to disturbed land classes, which totals 4,568 acres unevenly distributed across all sub-watersheds in Table 12.

Element b. Estimated reductions

> *An estimate of the load reductions expected for the management measures described under paragraph (c) below (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time). Estimates should be provided at the same level as in item (a) above (e.g., the total load reduction expected for dairy cattle feedlots; row crops; or eroded stream banks).*
>
> EPA Handbook for Restoring and Protecting Our Waters

The implementation activities described in Table 7 will exceed the *E. Coli* load reduction needed to achieve the *E. Coli* TMDLs with the Blackduck River Watershed. The primary reductions will be achieved through the implementation of pasture management and the replacement/upgrades of failing SSTS. It is expected that the *E. coli* water quality standard will be met when this NKE plan is fully implemented.

The activities will provide 100% of the TP load reductions needed to reach the TMDL goal, through shoreline restorations, urban BMP practices, pasture and cropland BMPs, and septic system upgrades. The loads and reductions were calculated using the EPA's PLET model and the University of Minnesota septic system improvement estimator. Table 13 lists the subwatershed's total and percentage pollutant reduction from the total subwatershed load, once fully implemented. The reductions in this section are calculated using the combined efficiencies calculator to calculate the impact of this NKE plan as a system.

Table 13. Load reduction targets and percentage of total subwatershed load reductions for implementation activities (PLET, 2024).

Subwatershed	N Reduction (lbs/year)	% N Reduction	P Reduction (lbs/year)	% P Reduction	Sediment Reduction (tons/year)	% Sediment Reduction
090203020601 - Blackduck Lake	336.46	3.7%	57.11	3.4%	3.42	2.2%
090203020602 - Darrigans Creek	268.59	3.9%	21.21	1.9%	1.71	1.2%
090203020606 - Perry Creek	157.06	2.8%	15.19	1.7%	1.86	1.2%
090203020607 - South Cormorant River	406.72	4.4%	91.6	6.1%	33.32	17.3%
090203020608 - Upper North Cormorant River	484.61	2.6%	132.41	3.5%	27.45	9.4%
090203020609 - Lower North Cormorant River	288.85	3.2%	24.68	1.8%	2.41	1.2%
090203020610 - Lower Blackduck River	269.05	3.7%	18.97	1.8%	1.23	1.0%
090203020604 - Upper Blackduck River	579.39	3.7%	66.13	2.4%	30.93	5.3%
090203020603 - O'Brien Creek	397.82	2.9%	39.44	1.8%	4.29	1.3%
090203020605 - Spring Creek	131.13	2.9%	10.96	1.5%	1.14	1.1%
TOTAL	3319.68	3.3%	477.69	2.8%	107.78	4.7%

Element c. Best management practices

> *A description of the BMPs (NPS management measures) that are expected to be implemented to achieve the load reductions estimated under paragraph (b) above (as well as to achieve other watershed goals identified in this watershed-based NKE plan), and an identification (using a map or a description) of the critical areas (by pollutant or sector) in which those measures will be needed to implement this NKE plan.*
>
> EPA Handbook for Restoring and Protecting Our Waters

The BMPs and associated implementation activities are described in Table 7. Core activities will include stream channel restoration, streambank stabilization, upland activities to reduce runoff, pasture management near waterways, access control, and SSTS improvements.

Critical areas for each pollutant source were identified by Red Lake DNR and Beltrami SWCD in a targeted implementation assessment for the Watershed. Critical areas associated with channel alteration and streambed and bank erosion were identified using multiple rapid geospatial assessments, in addition to known resource issues. The following describes how critical areas were identified:

- Watershed agricultural areas were identified by evaluating the land with the greatest potential for sediment and nutrient reductions to stream resources (S-score) based on soil texture, slope, and stream proximity, as shown in Figure 4.
- Stream reaches with elevated risk of *E. coli*, riparian area erosion, and stream incision as recognized by local knowledge and/or identified in existing state NKE plans and studies for this Watershed and are summarized in Figure 5.
- Critical areas for management activities for the lakes include the relatively small footprint of lakeshore development where septic systems need upgrades and shoreline areas are eroding or are mowed to the water's edge. An assessment completed by the Minnesota Department of Natural Resources has completed a scoring process for Blackduck Lake shoreline for implementation targeting, as shown in Figure 6.
- Forest stewardship and other water resource protection activities focus on acres that have the highest risk of conversion and impact if converted. The conversion of Blackduck River Watershed forests is most likely to occur due to agricultural pressures. The local partners identified priority areas as shown by Figure 7. The priority areas indicate, private forests throughout the Watershed that are adjacent to streams, the ability of the underlying soils to support agriculture (Soil Survey Geographic Database [SSURGO]), as well as if that forest is currently adjacent areas already converted to agriculture. All targeted areas have at least 20 acres of forest based on NACD (2019), so that local protection programs can be applied.

Figure 4. Prioritized agricultural areas within the Blackduck River Watershed.

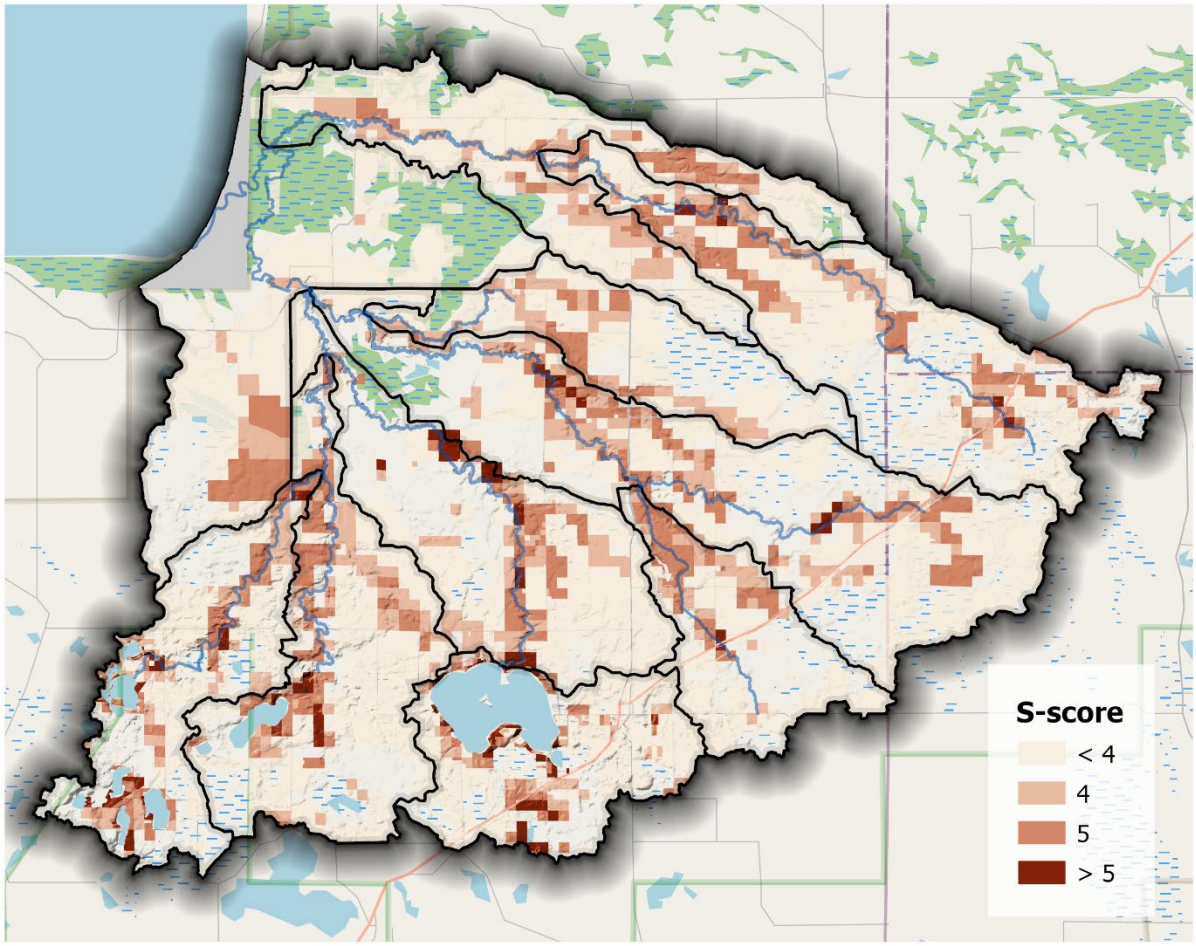


Figure 5. Blackduck River Watershed prioritized stream reaches and potential project locations.

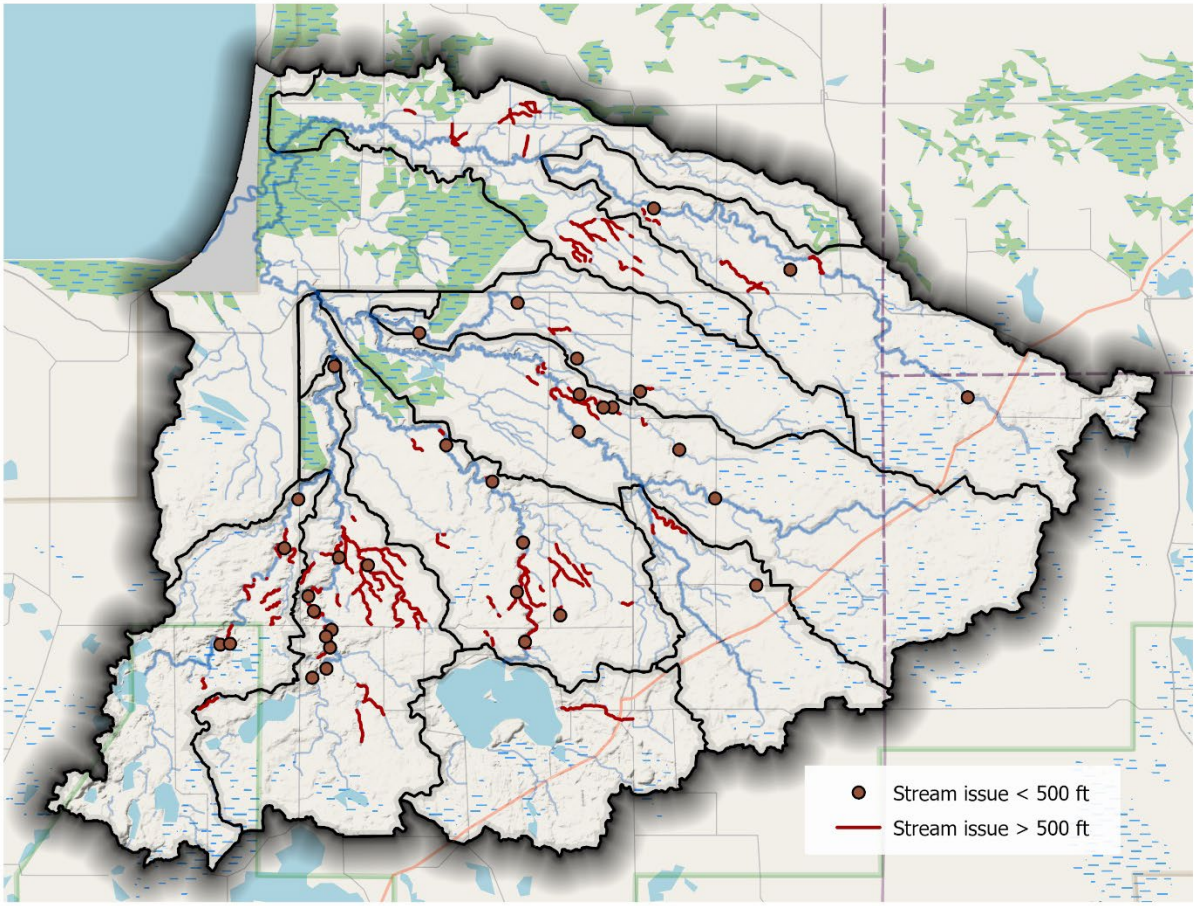
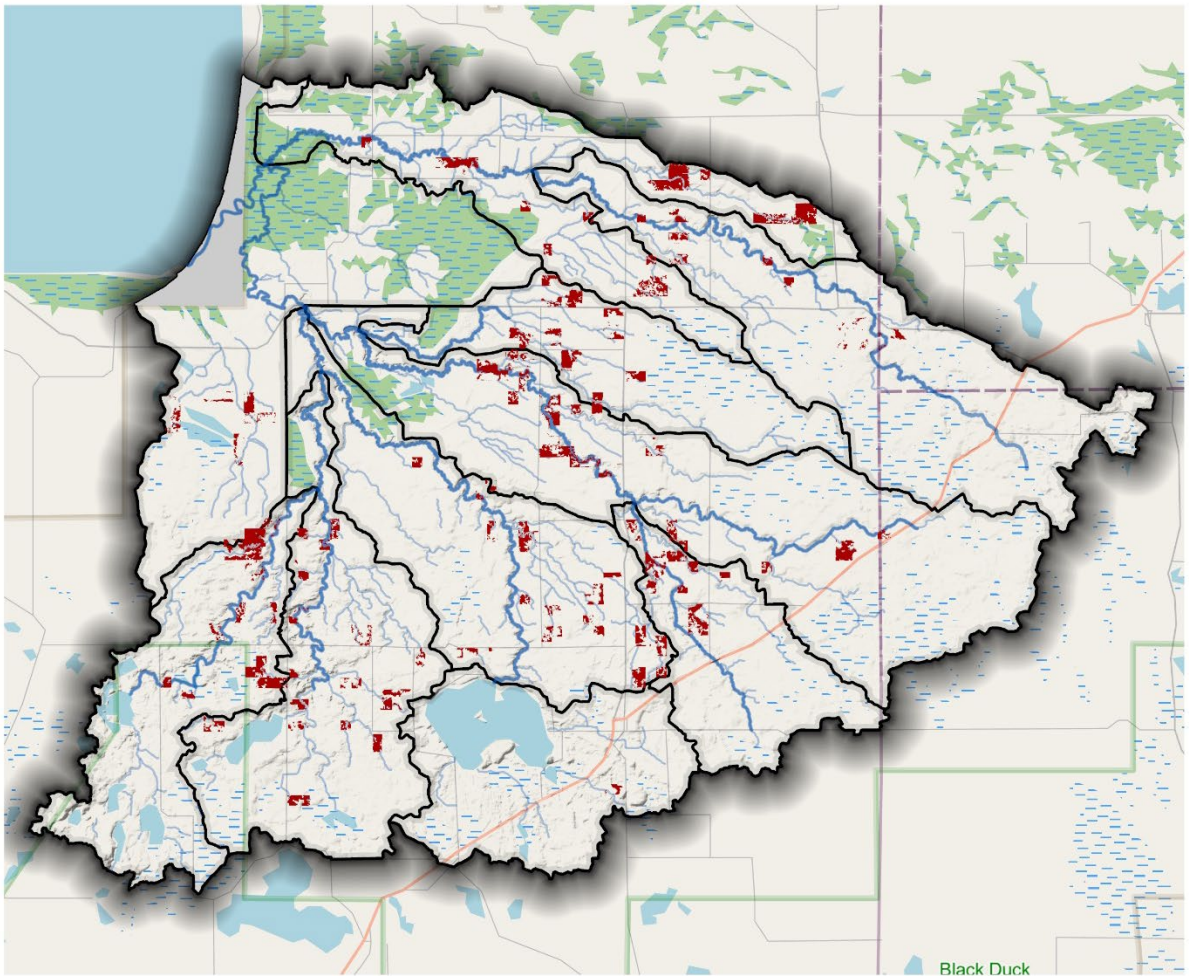


Figure 6. Critical shoreline areas around Blackduck Lake.



Element d. Expected costs and technical assistance

An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement the entire NKE plan (include administrative, Information and Education, and monitoring costs). Expected sources of funding, States to be used Section 319, State Revolving Funds, USDA's Environmental Quality Incentives Program and Conservation Reserve Program, and other relevant Federal, State, local and private funds to assist in implementing this NKE plan.

The estimated costs of the activities in this NKE plan are shown in Table 7. The costs to implement this NKE plan are estimated at $12,529,440.00 when fully implemented.

Funding for this NKE plan will be through Section 319 funding, Board of Water and Soil Resources One Watershed One Plan funding, implementation grants, Natural Resources Conservation Services – Environmental Quality Incentives Program (NRCS/EQIP) funding, Conservation Stewardship Program, and other opportunities.

Implementation of the activities in this NKE plan will occur with a wide range of people and organizations beginning with watershed landowners and residents and extending through local government units, state agencies, and federal agencies (Table 14). The Technical Assistance and project development activities allows the partnership to assist landowners by performing site visits to address pasture issues, erosion control issues, vegetation management and other conservation concerns.

Table 14. Partners' potential roles and responsibilities.

Partner		General Roles	Potential Responsibilities
Local Groups	Landowners, Residents, and City of Blackduck	Provide input, information & feedback Share information Provide leadership Collaborate on projects development	Provide local perspectives Share information Monitor or allow monitoring of projects Implement resource improvement projects
Private Business	Blackduck Co-op	Provide local leadership	Continue to work with SWCD in promoting conservation through outreach and education and farm programs.
Implementation Partnership	Red Lake DNR, Beltrami County Soil & Water Conservation District, and Beltrami County	Serve on many state and local conservation-based committees Design and implement technical conservation projects, forest management NKE plans, invasive species control, shoreline stabilization, tree NKE planting, water sampling, soil sampling, etc. Provide grant administration management Pursue and develop funding proposals Conduct landowner outreach and community engagement Initiate and maintain landowner contacts and relationships Serve on the 1W1P Policy and Steering Committees Enforce NKE planning & zoning Enforce wetland rules, construction setbacks and lot width, and SSTS.	Maintain list of potential and finished projects Provide technical assistance to landowners/projects Develop work plans, perform financial transactions, provide for accountability of funds. Write funding requests Contractor facilitation and project management Conservation project development Keep partners aware of opportunities Provide project management
Regional Government	Red Lake Watershed District	Serve on the 1W1P Steering Committee Provide water quality monitoring Provide opportunity for local funds	Provide technical assistance and review
State Government	Minnesota Board of Water and Soil Resources	Serve on the 1W1P Advisory Committee Administer MN Clean Water Fund Projects Provide technical assistance Lead HUC-8 based Landscape Stewardship NKE planning efforts Tribal relations	Keep partners aware of opportunities Provide project management
	Minnesota Department of Natural Resources (Divisions of Fisheries, Forestry, Wildlife, and Ecological and Water Resources)	Serve on the 1W1P Advisory Committee Administer DNR programs, issue Public Waters Permits, conduct wetland rule enforcement Provide technical assistance for hydrology, fisheries, geomorphology, and forestry	Review/approve projects under Minnesota DNR programs Provide cost-share assistance for conservation projects Provide technical comments on project design
	Minnesota Pollution Control Agency	Serve on the 1W1P Advisory Committee Administer MPCA and Section 319 funding programs	Oversee implementation NKE plan Keep partners aware of opportunities

		Provide technical assistance for hydrology, geomorphology and water quality Assist in development and evaluation of project proposals	Provide data administration
	Environmental Protection Agency (Region 5)	Provide Section 319 grants and guidance	
Federal Government	Natural Resource Conservation Service	Administer U.S. Department of Agriculture (USDA) funding programs	Provide cost-share assistance for conservation projects
		Provide technical assistances	Assist landowners with design and implementation of conservation projects

Element e. Education and outreach

> An information/education component that will be implemented to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, implementing and maintaining the NPS management measures that will be implemented.

The Education and Outreach Implementation programs and actions are focused on increasing engagement and understanding to make progress toward NKE plan goals. The program is operated through sharing of services. Expectations are that a common set of template education and outreach materials will be developed for use across the watersheds but delivered by the staff within the NKE planning region. Engaging landowners is critical for understanding issues impacting residents and solutions that are viable. Actions may include development of educational materials, newsletters, coordination of volunteer activities, and public meetings to raise awareness and gain a better understanding of the consequences of individual decisions on water management.

Education and outreach have been initiated with landowners by postcard mailers, meetings, tours, as well as general outreach through County Fairs, social media, and radio public service announcements. Education and outreach activities will encourage community members to participate in conservation projects by attending public meetings and events, coordinating community activities around conservation projects including water quality, farm management, by establishing community leadership roles and communication tools to allow both agencies and citizens to participate in watershed conservation issues.

A unique relationship has been established in the Watershed between the Beltrami SWCD and the Blackduck Co-op, where shared use of equipment, newsletters, and general promotion of conservation practices has fostered a sense of trust in the farming community that would otherwise not be there. The full list of Outreach and education activities are in Table 7.

Element f. Reasonably expeditious schedule

A schedule for implementing the activities and NPS management measures identified in this NKE plan that is reasonably expeditious.

Timelines for the proposed implementation are shown in Table 7. This schedule will be updated using adaptive management as funding, partnerships, effectiveness of implementation, and new information becomes available.

Element g. Milestones

A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.

The milestones column in Table 15 provide interim, measurable milestones for determining successful implementation of practices in Table 7. The milestones in this plan serve the purpose of measuring continuous progress toward the restoration of the Blackduck River Watershed.

Table 15. Milestone table Blackduck River Watershed (PLET, 2024).

		Milestones			
Blackduck River Watershed	Indicator	Short Term (Yrs 0-4)	Mid Term (Yrs 4-8)	Long Term (Yrs 8-10)	Total
	Nitrogen (lbs/yr)	828	853	438	2120
	Phosphorus (lbs/yr)	746	762	316	1823
	Total Suspended Solids (t/yr)	1532	1560	724	3816

Element h. Assessment criteria

A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.

The milestones columns in Table 7 provide interim, measurable milestones for determining successful implementation of practices and progress toward executing this NKE plan. The assessment criteria focuses on measuring the forward progress of the implementation of practices and BMPs.

It is difficult to anticipate the response of the stream to BMPs within a 10-year period. While water chemistry and other water quality monitoring is considered the gold standard, to encourage the continued adoption and support of these efforts, alternative and additional measures must be employed. The connection of BMPs on the landscape to the response in chemistry changes can be difficult to communicate to the public. The milestones described in Table 7 offer alternative means of measuring, and importantly, communicating the successes to support the forward momentum of implementation adoption. There are estimated reductions associated with these practices which will allow watershed professionals to have an approximate idea of the loading changes to be expected. These milestones are to ensure that the expected reductions are taking place. Traditional water quality monitoring (chemical, sediment, and biological) and the visual inspections of the Watershed will demonstrate success. Visual inventories of streambank erosion, gullies, and field runoff can be the leading indicator of the success of implementation.

Element i. Monitoring

The monitoring & evaluation component to track progress and evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.

As part of the MPCA intensive water monitoring strategy, 37 stream sites were monitored for biology and 16 sites for water chemistry in 2014-2015. Additional sites will be sampled in the next 10-year cycle. Details about the MPCA IWM strategy can be found in the ULRLW Monitoring and Assessment Report.

The RLWD has been collecting water quality samples in the Watershed for its long-term monitoring program since 2008. They monitor six stream sites four times each year for stage, DO, temperature, specific conductivity, pH, turbidity, TP, orthophosphate, TSS, total Kjeldahl nitrogen, ammonia-nitrogen, *E. coli*, nitrite-nitrate, and biological oxygen demand at some sites. In addition, Red Lake Watershed District coordinates monthly monitoring May through September of Long Lake near Pinewood (04-0295-00) and Bartlett Lake for TP, chlorophyll-a, and Secchi depth.

The Red Lake DNR has been monitoring sites in the Watershed since the early 1990s. Sites are monitored for nutrients (TP, ammonia-nitrogen, total Kjeldahl nitrogen, nitrite-nitrate, and TSS) four times per year including a storm event. Stream physical parameters are measured twice per month from snowmelt to freeze up and include stage (tape-down or gage readings), DO, temperature, pH, specific conductivity, and turbidity, current Watershed sites are listed in Table 16. As implementation activities are conducted in the Watershed, an evaluation of the before and after conditions can be useful to aid in future project NKE planning.

Table 17 targets sites throughout the Watershed that could be used to evaluate the effectiveness of the implementation efforts provided enough funds and staff time. In addition to flow and water quality monitoring, a broader assessment of ecological function and restoration could be used to assess various components of the stream system and overall effectiveness of the implementation activity.

Table 16. Current monitoring sites within the Blackduck River Watershed.

Watershed Name	HUC12	Stream AUID	S-Code	Information
Lower Blackduck River	090203020610	09020302-512	To be established	Long-term monitoring location.
Lower Blackduck River	090203020610	09020302-512	To be established	Long-term monitoring location; good site to assess any project changes (more likely for the downstream sampling in the Upper Blackduck River Watershed).
Darrigans Creek	090203020602	09020302-508	S004-832	RLWD Long-term monitoring location; good site to assess pre- and post-project improvements
O'Brien Creek	090203020603	09020302-544	S004-833	RLWD Long-term monitoring location; good site to assess pre- and post-project improvements
Upper Blackduck River	090203020610	09020302-510	S004-831	RLWD Long-term monitoring location; good site to assess pre- and post-project improvements
Upper Blackduck River	090203020610	09020302-511	To be established	Long-term monitoring location; good site to assess any project changes
South Cormorant River	090203020610	09020302-507	S004-834	RLWD Long-term monitoring location; good site to assess pre- and post-project improvements from upstream (both South Cormorant and Fish Creek)
Lower North Cormorant River	09020302609	09020302-506	S004-931	Long-term monitoring location (both RLDNR/RLWD); good site to assess any project changes
Upper North Cormorant River	09020302609	09020302-506	To be established	RLWD Long-term monitoring location; good site to assess pre- and post-project improvements

Table 17. Monitoring site within the Blackduck River Watershed for determining potential effectiveness of implementation efforts.

Watershed Name	HUC12	Stream AUID	S-Code	Information
Lower Blackduck River	090203020610	09020302-512	To be established	Sampled for a 2-year project. This site would be better overall site for measuring the Watershed and should be added as a long-term site. Could also be utilized for pre- and post-monitoring in this watershed.
Darrigans Creek	090203020602	09020302-508	To be established	Only sampled 2x in 2016 for TP, 1x TSS. Would be a great site to monitor pre- and post-project improvements on this stream reach.
O'Brien Creek	090203020603	09020302-544	To be established	New site could help show improvements to the downstream and upstream portions following project implementation
O'Brien Creek	090203020603	09020302-544	To be established	New site could help show improvements to the downstream portion following project implementation (Current 319 targeting map has O'Brien Creek mapped incorrectly to Loon Lake rather than Medicine Lake)
South Cormorant River	090203020610	09020302-507	To be established	Sampled for a 2-year project. Could be utilized for pre- and post-monitoring in this watershed but wild rice operation is the only major issue in this stream reach.
South Cormorant River	090203020610	09020302-507	To be established	New site could help show improvements to the downstream portion following project implementation
Perry Creek	0900302607	09020302-605	To be established	Sampled for a 2-year project. Could be utilized for pre- and post-monitoring in this watershed (downstream sampling location)
Perry Creek	0900302607	09020302-605	To be established	New site could help show improvements to the downstream and upstream portions following project implementation
Perry Creek	0900302607	09020302-605	To be established	New site could help show improvements to the downstream and upstream portions following project implementation
Upper North Cormorant River	09020302609	09020302-506	To be established	New site could help show improvements to the downstream and upstream portions following project implementation
South Cormorant River	090203020610	09020302-616	To be established	Sampled for a 2-year project. Could be utilized for pre- and post-monitoring in this watershed (upstream sampling location).
Lower North Cormorant River	09020302609	09020302-506	To be established	Sampled for a 2-year project. Could be utilized for pre- and post-monitoring in this watershed (upstream sampling location)
Upper North Cormorant River	09020302609	09020302-506	To be established	Sampled for a 2-year project. Could be utilized for pre- and post-monitoring in this watershed (upstream sampling location)
Upper North Cormorant River	09020302609	09020302-542	To be established	Sampled for a 2-year project. Could be utilized for pre- and post-monitoring in this watershed (downstream sampling location)
Upper North Cormorant River	09020302609	09020302-542	To be established	Alternate new site for downstream sampling that could be utilized for pre- and post-monitoring in this watershed.
Upper North Cormorant River	09020302609	09020302-542	To be established	New site could help show improvements to the downstream portion following project implementation
Lower Blackduck River	090203020610	09020302-512	To be established	Former long-term site. Site removed due to bridge being removed.

In addition to the 10-year monitoring NKE plan proposed above, the second cycle of intensive watershed monitoring under Minnesota's HUC-8 Watershed Approach is scheduled to begin in 2025. Under this effort, the MPCA conducts 2 years of intensive watershed monitoring in all 80 watersheds in Minnesota on a 10-year cycle (i.e., every major watershed is sampled for 2 years, once every 10 years). The selection of IWM sites will be a collaborative effort between the MPCA and local partners. During the site selection process, the MPCA will use information gathered from the first cycle to establish long-term 'Core' (water chemistry) and 'Anchor' (biological) stations and provide local partners an opportunity to request monitoring to support projects or investigate problems. The final selection of the Core, Anchor, and locally requested sites will not occur until approximately nine months before the start of IMW.

Adaptive Management

Adaptive management is an approach to water quality protection efforts where BMP implementation efforts are combined with an on-going evaluation of water quality issues. Effects of implemented BMPs are reflected by adjustments to the resource goals, implementation NKE plan and/or implementation efforts when needed. Adjustments are made to incorporate the knowledge gained through the combined efforts. Adaptive management—sometimes referred to as adaptive implementation—is critical when various uncertainties are significant in a watershed (Shabman et al., 2007). This approach is essentially a "learning while doing" approach. It means that uncertainty is not forgotten once implementation begins. Rather, a focus is placed on reducing the uncertainty present through implementation, monitoring and evaluation, research, and experimentation. The knowledge gained through these efforts is then focused on reducing the uncertainties the implementation approaches and/or water uses and criteria. The approach goes beyond just asking "when" in implementation to include "where, what, how and why" (Shabman et al., 2007).

Through an adaptive management approach, this initial implementation NKE plan has been developed to begin implementation activities, continue survey and inventory efforts, and evaluate the progress toward meeting the aquatic recreation goals for Blackduck River Subwatershed. As this work is completed the implementation goals, priorities, and BMPs will be examined and revised, as needed.

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