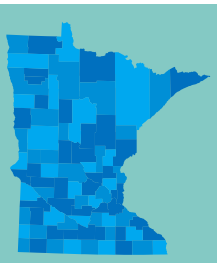
Grant

April 2025

Pelican Lake Nine Key Element Plan

Federal Clean Water Act Section 319 Small Watersheds Focus Grant

MINNESOTA POLLUTION CONTROL AGENCY



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Executive summary

Pelican Lake is an important local and regional lake in northern Minnesota. It is one of the most developed lakes in the Vermilion River hydrological unit code (HUC) 8 watershed. The Bois Forte Band of Ojibwe has tribal land parcels in the watershed. The lake is a popular recreation destination and is known to regularly experience nuisance algal blooms. There is an active lake association and citizen involvement. Given these things, there is a strong desire to protect the lake from degradation and foster enhanced water quality. The Vermilion River Watershed WRAPS Report identified the Section 319 Small Watersheds Program as a good fit for supporting the efforts of local units of government and citizens to address nonpoint sources of pollution within the Pelican Lake Watershed.

The Pelican Lake Watershed is comprised of a single HUC 12 located in the Vermilion River Watershed (HUC8 09030002). Pelican Lake and Moose Lake are the primary waterbodies in the HUC12 watershed. Pelican Lake is classified as a deep lake and meets the lake eutrophication standards for Northern Lakes in Minnesota. Moose Lake is a shallow lake that meets the lake eutrophication standards for Northern Lakes in Minnesota. The focus of this nine key element (NKE) plan is to protect the water quality of the lakes. The North Saint Louis SWCD is leading/coordinating the protection efforts for the lakes.

The goal for Pelican Lake is to reduce phosphorus loading by 5% to protect the water quality.

This plan was developed by the North St. Louis Soil and Water Conservation District (SWCD) and the Minnesota Pollution Control Agency (MPCA) to meet the nine key elements (NKE) of watershed-based planning for the U.S. Environmental Protection Agency's (EPA) Federal Clean Water Act Section 319 grant program.

Funding of projects proposed in this plan may be restricted to funding source. Only projects and practices that are allowable by EPA's 2014 program guidelines and Minnesota's Nonpoint Source Management Program Plan (except where noted in the MPCA's NPSMPP) will be funded by the Federal Clean Water Act Section 319 funds. Match funds and activities must also be eligible under the guidelines and plan.

Water quality conditions

Pelican Lake (waterbody identification (WID) 69-0842-00) was identified as nearly impaired by eutrophication indicators in 2017. Total phosphorus (TP), chlorophyll *a* (Chl-*a*), and Secchi depth transparency data were near the numeric eutrophication criteria established for lakes in the Northern Lakes and Forests ecoregion indicating a risk for becoming impaired (Table 1). The presence of nuisance algal blooms and somewhat elevated Chl-*a* concentrations highlight the importance for protecting the water quality of the lake. Moose Lake (WID 69-0806-00), a shallow lake in the Pelican Lake Watershed, only has water quality data for 2018. The lake has not been assessed by the MPCA given that it does not have the necessary amount of data for assessment, but the average TP and Chl-*a* concentrations for 2018 are less than the water quality standards (Table 2). Protection of Moose Lake will contribute to the protection of Pelican Lake.

Table 1. Average summer water quality data for Pelican Lake compared to the Northern Lakes and Forests (NLF) Ecoregion water quality standards for lakes

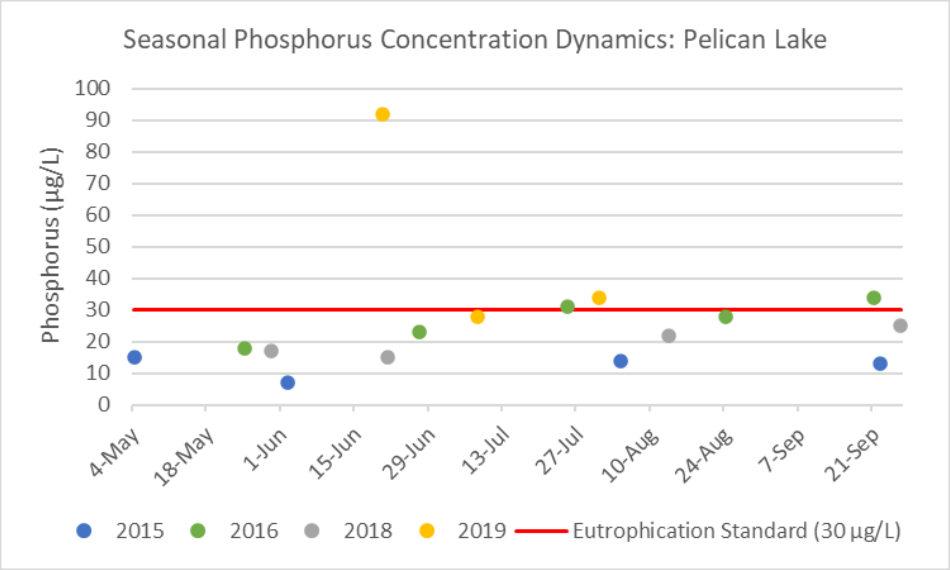
Year	TP (µg/L)	Chl. a (µg/L)	Secchi (m)
2015	14	11.5	2.7
2016	27	13.1	2.5
2017			2.9
2018	22	8.6	3.0
2019	31		3.8
2020			2.6
2021			2.6
Average	23	11	2.9
Standard criterion	< 30	< 9	> 2.0

Table 2. Average summer water quality data for Moose Lake

Year	TP (µg/L)	Chl. a (µg/L)	Secchi (m)
2018	27	4.4	1.5

The TP concentrations for Pelican Lake average below the Northern Lakes and Forests (NLF) Ecoregion water quality standard of 30 µg/l, with the average being 23 µg/l. The TP concentrations remain mostly stable through May to September (Figure 1).

Figure 1. Seasonal phosphorus concentration dynamics: Pelican Lake (site 202, EQuIS).



Pelican Lake is considered a deep lake (max depth of 38 ft); however, it behaves as though it is a shallow lake that make the water more vulnerable to eutrophication and changes in the climate. The dissolved oxygen (DO) profiles and hypolimnion phosphorus samples were collected in 2015-2016. The data show that the hypolimnion did not become anoxic (i.e., DO concentrations lower than 5 mg/L) (Figure 2).

Figure 2. Dissolved oxygen profiles for Pelican Lake in 2016 (site 202, EQuIS).

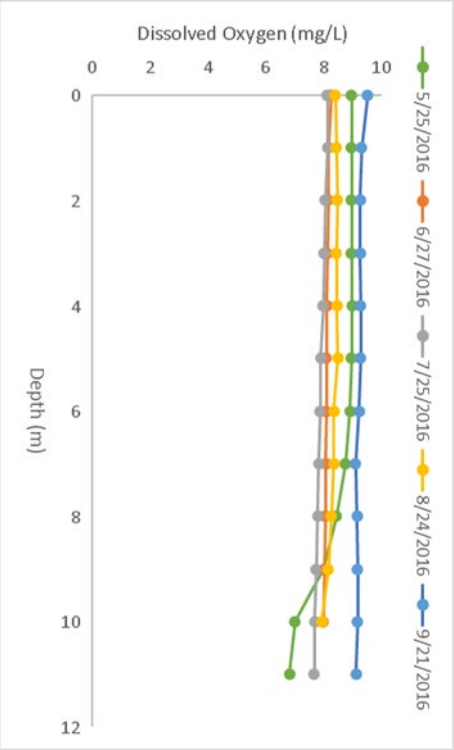
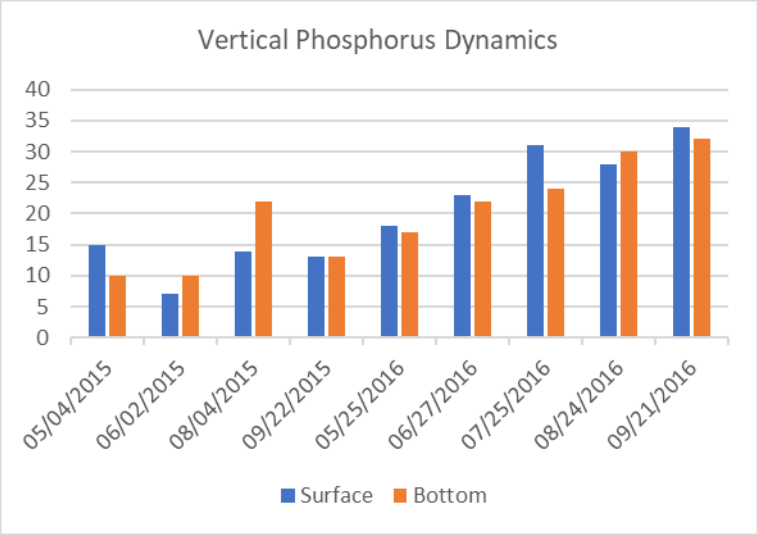


Figure 3 shows that hypolimnion (bottom) TP concentrations are lower than the epilimnion (surface) TP concentrations. This provides an indication that internal loading of phosphorus is not an issue and that implementation strategies should focus on upland watershed source loading.

Figure 3. Surface and hypolimnion (bottom) phosphorus concentrations in Pelican Lake in 2015 and 2016 (site 202, EQuIS).



The Chl-*a* concentration in Pelican Lake averages 10 µg/L and exceeded the eutrophication standard for the NLF Ecoregion (9 µg/L) at the end of the summer in 2015, 2016 and 2018. The MPCA data comparing user perceptions with Chl-*a* concentrations has concluded that lake users perceive a major algae bloom when the Chl-*a* concentration reaches 20 µg/L (Heiskary & Wilson, 2008). In Pelican Lake, an algae bloom was observed in 2015, 2016, and 2018, as shown in Figure 4.

The transparency, expressed via Secchi depth, in Pelican Lake averages 12.5 feet. Data show the transparency is highest in June, when it can be as high as 20-25 feet. In August, the transparency decreases to 5-10 feet as the lake experiences algae blooms as shown in Figure 5.

Figure 4. Seasonal Chl-*a* concentration dynamics 2015-2019: Pelican Lake (site 202, EQuIS).

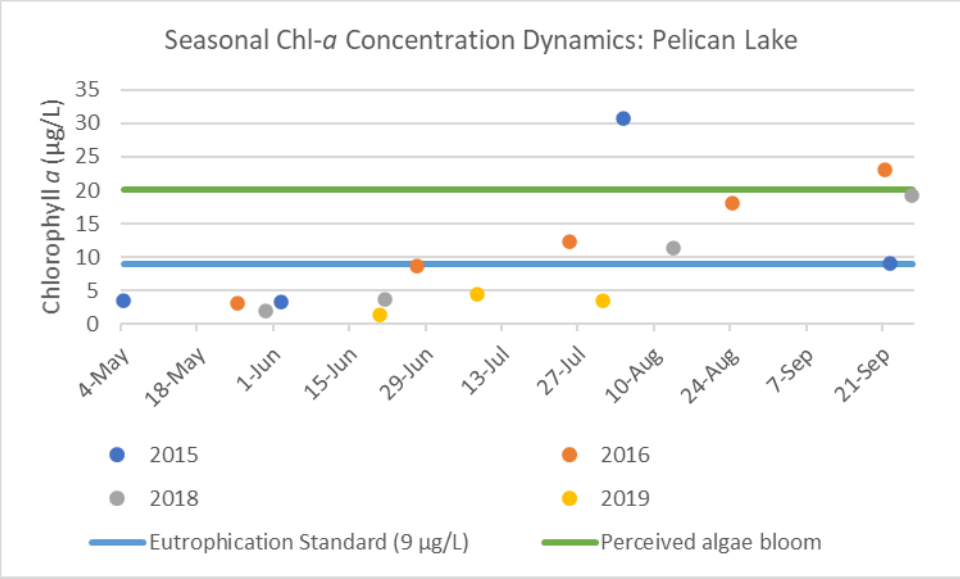
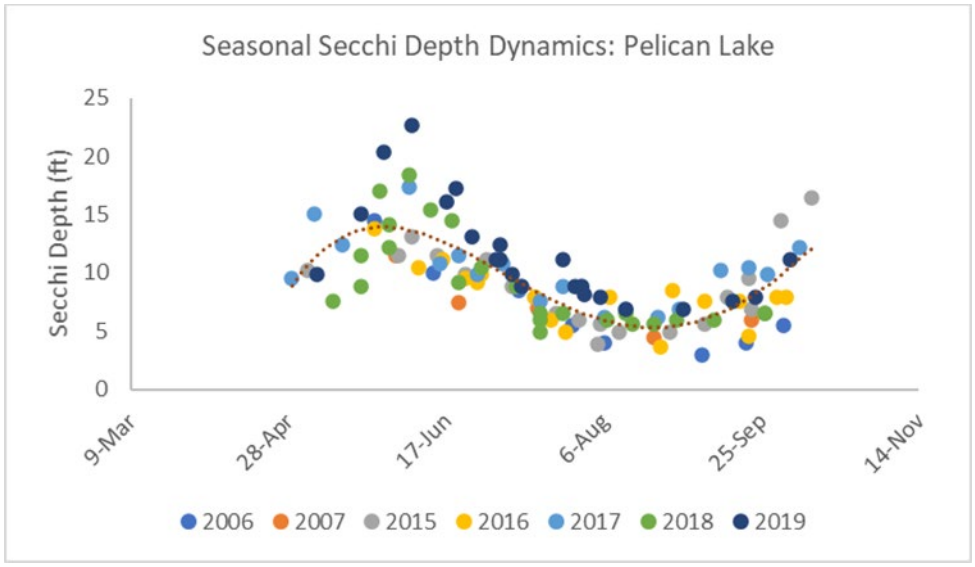
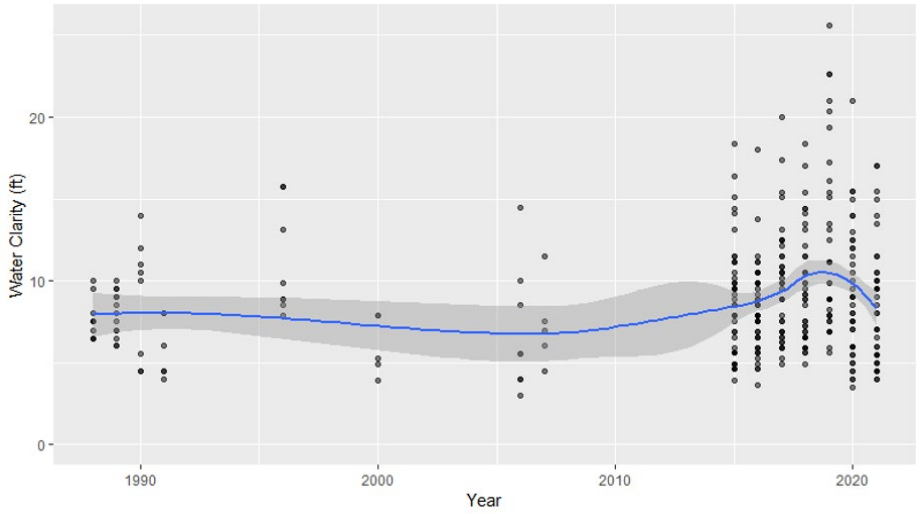


Figure 5. Seasonal transparency dynamics: Pelican Lake 2006-2019 (site 202, EQuIS).



The range in measurements each year and across years is shown in Figure 6. Sporadic data was collected back to 1988 with annual measurements beginning in 2015. Data through 2019 suggested an increasing trend, but data from 2020 and 2021 showed a decrease in clarity and results in a trend analysis result indicating no significant change in water clarity. The recent increase and subsequent decrease in clarity is not understood. Continued monitoring is recommended.

Figure 6. Long-term transparency trend (Secchi depth) 1990-2021: Pelican Lake (MPCA Citizen Data website).



The only water quality impairments identified in the Pelican Lake watershed are for aquatic consumption due to mercury in fish tissue (Table 3). Mercury is difficult to address at the local level and will be addressed through the Implementation Plan *for Minnesota's Statewide Mercury Total Maximum Daily Load (TMDL) Implementation Plan*.

Table 3. Impairments in the Pelican Lake Watershed (HUC 09030002)

Water body name	Water body type	Year added to list	AUID	Use class	Affected designated use	Pollutant or stressor
Bell	Lake	2012	69-0805-00	2B, 3C	Aquatic Consumption	Mercury in fish tissue
Moose	Lake	1998	69-0806-00	2B, 3C	Aquatic Consumption	Mercury in fish tissue
Pelican	Lake	1998	69-0841-00	1C, 2Bd, 3C	Aquatic Consumption	Mercury in fish tissue

Given that the water quality of Pelican Lake is better than the eutrophication standards applicable to it, the goal for the lake is to maintain the mean summer TP concentration of 26 µg/L. Using the DNR lake sensitivity modeling analysis (MPCA and DNR, 2019), a load reduction goal of 5% of the estimated current annual load of TP is assumed to maintain the in-lake mean summer TP concentration below 30 µg/L. Table 4 summaries the current estimated annual TP load to the lake is estimated to be 3,369 lbs/yr the EPA's Pollution Load Estimation Tool (PLET). The target TP load reduction is 168 lbs/yr or 5% of the current load.

Table 4. Pollution loads to the Pelican Lake Watershed (09030002) estimated by PLET, 2023

Watershed	N load (lbs/yr)	P load (lbs/yr)	Sediment load (t/yr)
090300020303 - Pelican Lake	12078	3369	159

Implementation strategies

The activities planned for this watershed are summarized in Table 5 This table includes the schedule, milestones, assessment criteria, and estimated costs to implement this plan. These strategies and activities will achieve the estimated reductions to protect water quality standards and achieve goals for the Pelican Lake Watershed in 10 years.

The reductions estimated by practice type were calculated using the EPA's PLET model in Table 5. Final reductions for the plan are calculated using the PLET's combined efficiencies calculator and are presented in Element b.

The implementation practices listed are not necessarily eligible for Section 319 funding; however, to show the entire level of effort required to restore the watershed, all practices are identified. Practices identified as eligible are subject to change, depending on the current program guidance. Eligibility for Section 319 funds and match will be determined using the EPA's 2013 *Nonpoint Source Program and Grants Guidelines for States and Territories* and Minnesota's *2021 Nonpoint Source Pollution Management Program Plan*. Subsequent guidance issued will supersede the identified documents.

Table 5. Type, funding eligibility, activities, milestones, schedule, assessment criteria, costs, estimated reductions by practice (PLET, 2023) in the Pelican Lake Watershed

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
Administration	Y	Coordination and implementation of 319 activities by working with Landowners, stakeholders, agencies, or participating parties for North Saint Louis SWCD	Coordinate and/or implement NKE Plan activities.	Coordinate and/or implement NKE Plan activities.	Coordinate and/or implement NKE Plan activities.	Coordinate and/or implement NKE Plan activities.	Coordinate and/or implement NKE Plan activities.	Invoices and Semiannual reports are received	$350,000			
Developed	N	Build upon current culvert surveys			Complete watershed-wide culvert assessment.			# crossings	$2,000			
	Y	Modify/replace 2 culverts & fish passage barriers				Replace 1 priority stream crossings	Replace 1 priority stream crossings	# crossing improvements	$200,000	31.49	13.82	0.6
	Y	Implement stormwater BMPs in city of Orr to reduce runoff from built structures using Constructed Wetland 656; Heavy Use Area Protection 561; Roof Runoff Structure 558; Raingarden	Complete Stormwater Management Plan for City of Orr	Implement 2 stormwater BMPs	Implement 2 stormwater BMPs	Implement 2 stormwater BMPs	Implement 2 stormwater BMPs	# projects; # plan	$150,000			

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
		creation; Sediment Basin 350; Stormwater Runoff Control 570; Water and Sediment Control Basin 638; Wetland Creation 658; Wetland Enhancement 659; Wetland Restoration 657										
	Y	Road and trail ditch stabilization and restoration workshops describing the impact and generating interest		1 Workshop		1 Workshop		# workshops # contacts # people indicating interest and/or requesting assistance	$2,000			
	Y	Implement road ditch and culvert treatment to address erosion on 45 ditch/culverts		Implement 11 treatments	Implement 11 treatments	Implement 11 treatments	Implement 12 treatments	# of ditch/culvert treatments	$75,000	211.7	43.05	8.36
	Y	Stormwater retention ponds in developed areas 39 ponds in developed areas		9 ponds installed	10 ponds installed	10 ponds installed	10 ponds installed	# projects	$800,000	239.34	48.31	9.21
	Y	Fixing road ditch gullies and runoff		17 repairs made	17 repairs made	17 repairs made	17 repairs made	# repairs	$150,000	349.2	75.53	16.91

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
		(not culverts) 68 repairs										
	Y	Improve porosity and improve infiltration in developed areas on 85 acres		21 acres improved	21 acres improved	21 acres improved	22 acres improved	# of improvements	$30,000	400.89	46.79	9.04
	Y	Install 10 raingardens on residential and commercial properties		2 raingardens installed	2 raingardens installed	3 rain gardens installed		# projects	$85,000	322.18	41.35	7.92
	N *	Septic system maintenance and improvement [126M] Update/replace 94 failing or noncompliant SSTS to meet county ordinances	Coordinate with county and landowners to develop plan for OSWW inspections	Cost share inspection 30 systems	Host 1 workshop to provide information on OSWW programs; provide cost share for 5 OSWW system designs		Host 1 workshop to provide information on OSWW programs; provide cost share for 5 OSWW system designs	# inspections # workshops # system designs	$30,000			
Forestry	Y	Develop 15 forest management plans (e.g., SFIA) to prevent new losses and maintain at least 75% forested watersheds surrounding lakes and streams.	Outreach to 100% of private landowners with >20 acres that are not currently enrolled in SFIA/2C or another easement program	5 Forest Stewardship/Mgmt. Plans written and enrolled in SFIA/2C or another easement program	Follow up outreach to 100% of private landowners with >20 acres that are not currently enrolled in SFIA/2C or another easement program	5 Forest Stewardship/Mgmt. Plans written and enrolled in SFIA/2C or another easement program	5 Forest Stewardship/Mgmt. Plans written and enrolled in SFIA/2C or another easement program	# plans #acres enrolled % protected	$30,000			

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
	Y	Implementation of Forestry Management Plan strategies on 1477 privately-owned acres to create healthy forest conditions		200 acres of forest management practices		200 acres of forest management practices	200 acres of forest management practices	# plans #acres enrolled % protected	$30,000	3.1	1.36	0.06
	Y	Protection of 6,400 acres current forest lands	1280 acres protected private forest land	1280 acres protected private forest land	1280 acres protected private forest land	1280 acres protected private forest land	1280 acres protected private forest land	#acres	$100,000			
	Y	Implement Cost Share program for Stewardship Plan Writing		5 Plans Cost Shared		5 Plans Cost Shared	5 Plans Cost Shared	#plans	$5,500			
	Y	Cost share for the implementation of forestry BMPs	Outreach to 100% of private landowners with >5 acres but <20 acres of forested land.		Cost share implementation of 2 projects.	Cost share implementation of 2 projects.	Cost share implementation of 2 projects.	# projects program developed # contacts	$30,000			
	Y	Terrestrial invasive species prevention and mitigation	1 Workshop	1 Workshop	1 Workshop	1 Workshop	1 Workshop	# workshops # contacts # people indicating interest and/or requesting assistance	$5,000			

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
	Y	Implement climate resilience plantings on three projects for 120 acres managing understory and replacement species; coordinate with municipality, township, county, state, tribal, and federal entities on opportunities to implement climate/invasive spp. resilient plantings.	Coordinate with agencies through meetings.	Project planning/development	40-acre understory management	40-acre understory management	40-acre understory management	# plantings # acres	$15,000	31.49	13.82	0.6
	Y	Planting trees on 645 acres of harvested forest land	Plant 129 acres of trees on harvested forest lands	Plant 129 acres of trees on harvested forest lands	Plant 129 acres of trees on harvested forest lands	Plant 129 acres of trees on harvested forest lands	Plant 129 acres of trees on harvested forest lands	# acres planted	$600,000	33.99	14.93	0.6
	Y	Improve road and trails during timber harvests (MFRC forest harvest guidelines on 462 acres	Improve 92.4 acres of road and trails during timber harvests	Improve 92.4 acres of road and trails during timber harvests	Improve 92.4 acres of road and trails during timber harvests	Improve 92.4 acres of road and trails during timber harvests	Improve 92.4 acres of road and trails during timber harvests	# acres road protected	$50,000	24.72	10.86	0.44
	Y	Forest buffers improving and left intact per	Improve 92.4 acres of forest buffers	Improve 92.4 acres of forest buffers	Improve 92.4 acres of forest buffers	Improve 92.4 acres of forest buffers	Improve 92.4 acres of forest buffers	# acres forest buffer	$350,000	24.72	10.86	0.44

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
		RMZ guidelines treating 462 acres										
	Y	Preparing sites with vegetation for tree replanting (e.g., hydromulch, site prep, seed) on 462 acres	Site prep on 92.4 acres of harvested forest land for replanting	Site prep on 92.4 acres of harvested forest land for replanting	Site prep on 92.4 acres of harvested forest land for replanting	Site prep on 92.4 acres of harvested forest land for replanting	Site prep on 92.4 acres of harvested forest land for replanting	# acres prepared for planting	$95,000	24.72	10.86	0.44
	Y	Improving and maintaining appropriate road/trail ditch vegetation (e.g., grass and legume seeding) 462 acres	Improving vegetation on 92.4 acres of road/trail ditches	Improving vegetation on 92.4 acres of road/trail ditches	Improving vegetation on 92.4 acres of road/trail ditches	Improving vegetation on 92.4 acres of road/trail ditches	Improving vegetation on 92.4 acres of road/trail ditches	# acres ditch planted	$35,000	24.72	10.86	0.44
	Y	Reforestation (tree planting) on 396 acres of open lands	Planting trees on 79.2 acres of open land	Planting trees on 79.2 acres of open land	Planting trees on 79.2 acres of open land	Planting trees on 79.2 acres of open land	Planting trees on 79.2 acres of open land	# acres reforested	$300,000	423.31	41.33	4.38
Monitoring	Y **	Surface water sampling and field parameter measurements (2-meter integrated sampler of TP, and Chl-*a*, and a Secchi reading) 2x month Apr-Sept in Moose and Pelican Lakes -	24 sampling events/year	24 sampling events/year	24 sampling events/year	24 sampling events/year	24 sampling events/year	# samples Annual data summary and evaluation	$40,000			

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
		based on spring ice out dates										
	Y **	Secchi depth monitoring conducted by Citizen Monitoring in Moose and Pelican Lakes	24 Secchi measurements	24 Secchi measurements	24 Secchi measurements	24 Secchi measurements	24 Secchi measurements	# samples	$1,000			
Outreach	Y	Support Pelican Lake Association by attending annual member meeting	2 meetings	2 meetings	2 meetings	2 meetings	2 meetings	# meetings	$2,000			
	Y	Work with Pelican Lake Association and MN Lakes and Rivers Advocates to develop a shoreline stewardship recognition program	1 program developed					Program in place	$3,000			
	Y	Enroll shoreline owners in shoreline	2 shoreline owners enrolled	4 shoreline owners enrolled	4 shoreline owners enrolled	4 shoreline owners enrolled	4 shoreline owners enrolled	# shoreline owners enrolled	$5,000			

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
		stewardship program										
	Y	Conduct an annual workshop in the Orr area on shoreline/smart salting/septic/well and/or stormwater best management practices including incentives such as well testing, rain barrels, or native plant giveaways	2 workshops held 5 participants, minimum	2 workshops held 5 participants, minimum	2 workshops held 5 participants, minimum	2 workshops held 5 participants, minimum	2 workshops held 5 participants, minimum	# workshops # participants # new participants # people requesting assistance	$10,000			
	Y	Cost share with City of Orr interpretive materials that promote water quality such as signage or interactive displays at the Orr Bog Walk or city park	Plan developed	1 installation	1 installation	1 installation	1 installation	# installations	$50,000			
	Y	Leverage local interest in minimizing the spread of aquatic invasive species by making the	Educational handouts produced for Pelican Lake watercraft inspectors,	2 handouts created and distributed	Educational handouts revised for Pelican Lake watercraft inspectors, resorts, and local businesses	1 new handout created and disturbed	Educational handouts revised for Pelican Lake watercraft inspectors, resorts, and local businesses	# handouts created	$5,000			

Type	319 funding eligibility	Activities	Milestones					Assessment	Cost	Reductions		
			2-year (2023)	4-year (2025)	6-year (2027)	8-year (2029)	10-year (2031)			N	P	TSS
		connection with water quality	resorts, and local businesses									
	Y	Coordinate with municipality, township, county, state, tribal, and federal entities on opportunities to implement stormwater and other water quality projects	2 meetings	1 workshop	2 meetings	1 workshop	2 meetings	# meeting participants # workshops	$15,000			
Shoreline	Y	Shoreline restoration of 3200 feet around Pelican Lake	Outreach to 100% of landowners adjacent to Pelican Lake and its tributaries.	400 feet of shoreline restoration	400 feet of shoreline restoration	400 feet of shoreline restoration	400 feet of shoreline restoration	# projects # contacts	$90,000	60.1	16.43	2.15
Study	N	Further evaluate the impacts of internal loading in Pelican lake.		Develop plan to investigate internal loading.	Collect Data	Analyze Data		# samples # data/report	$10,000			

* SSTS upgrades/replacements cannot be funded using Section 319 grant funding; however, it is an eligible match activity

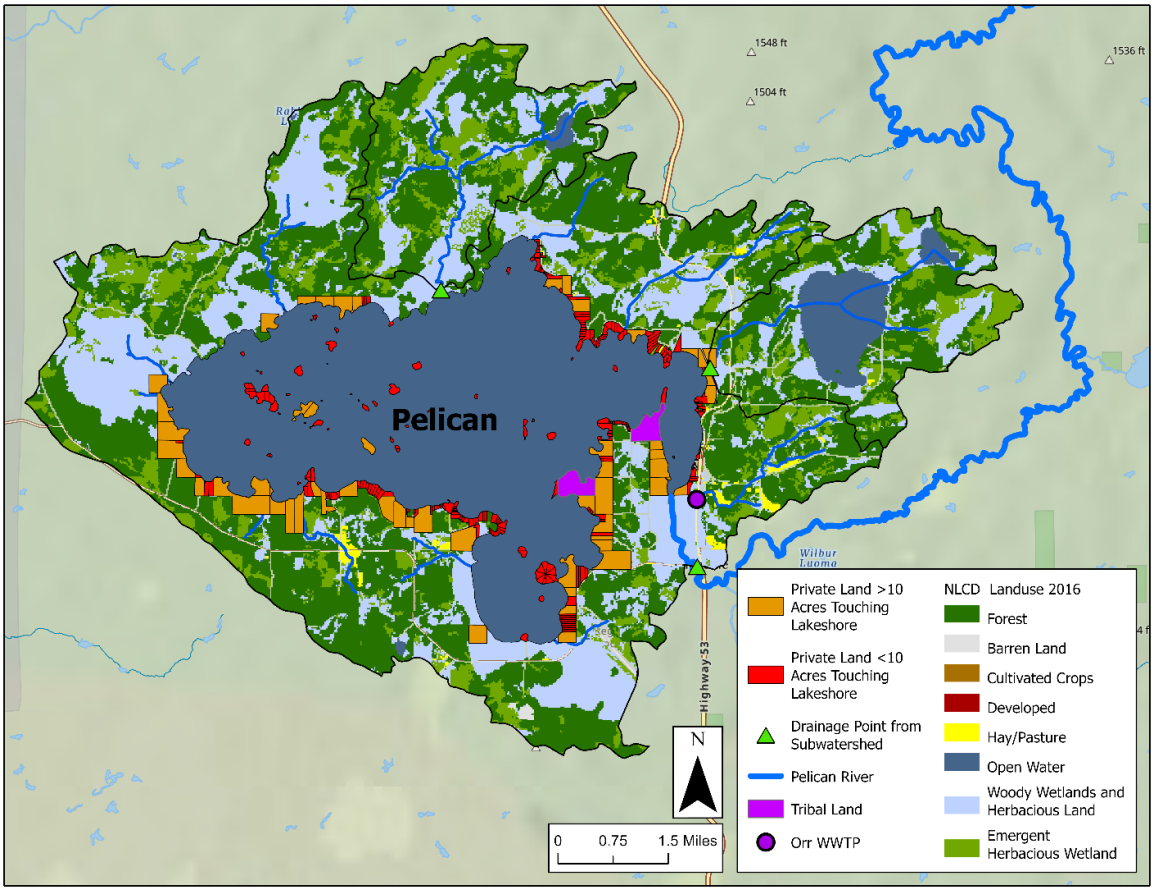
** Effectiveness monitoring is eligible for Section 319 monitoring

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 plan (and to achieve any other watershed goals identified in the watershed-based 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 land use of the watershed contributing to the lake is primarily forests and wetlands with some development along the lakeshore. The City of Orr sits on the eastern side of the lake. There are some small streams draining into the lake, but the drainage area to the lake is relatively small. The Pelican River outlets the lake near Orr and drains to the east and then north, eventually joining the Vermilion River as shown in Figure 7.

Figure 7. Land use, tributaries, and private land identification in the Pelican Lake Watershed.



The EPA's PLET model was used to identify loading by land uses. The loading for the entire watershed, by pollutant, is summarized in Table 4. A 5% reduction in phosphorus loading (168 lb) is the protection goal but reductions in nitrogen and TSS are also helpful for the protection of the lake.

The annual pollutant loading to Pelican Lake is broken down by land use in Table 6, which can help guide implementation activities for reducing phosphorus loading to the lake. Figure 8 illustrates the loading by land use.

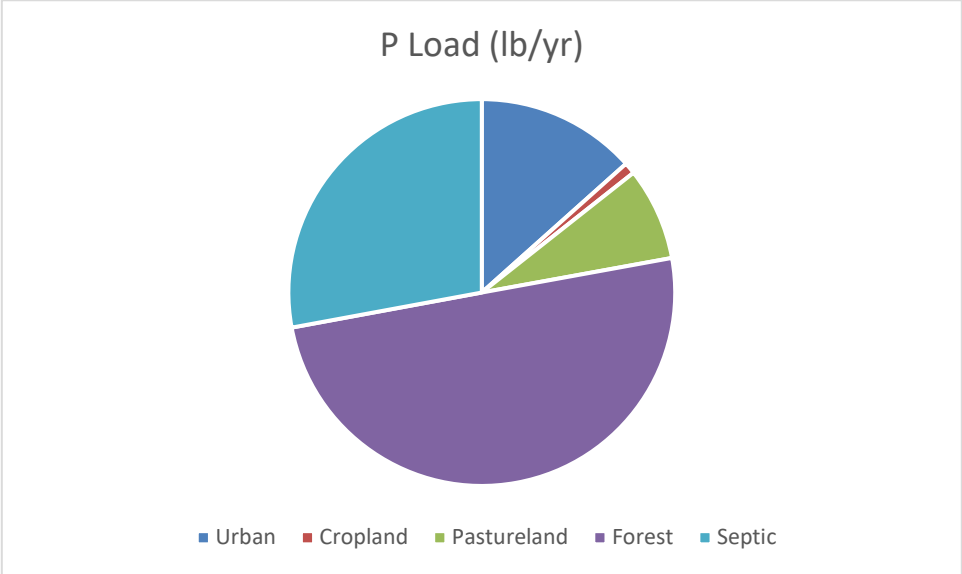
Forests initially appear to be a high driver of loading; however, it is due to the amount of acreage in forest cover and the low development density in the watershed. Forest land contributes approximately 0.1 lb/ac, demonstrating the need for the preservation of healthy forestry in the Pelican Lake Watershed. The restoration of previously forested lands to restore the protective land cover is important to the protection of these waterbodies.

The highest three contributors per acre are developed, cropland, and pastures. Cropland and pasture comprise a very small percentage of land use in the Pelican Lake Watershed; therefore, developed areas are the highest contributors. The rate of loading from these other land uses demonstrates the importance of healthy forest cover in this watershed. The BMPs and activities to address loading from these sources will be addressed by this plan.

Table 6. Annual pollutant loading by land use (PLET)

Sources	N load (lb/yr)	N load by acre lb/ac	P load (lb/yr)	P load by acre lb/ac	TSS load (t/yr)	TSS load by acre t/ac/yr
Urban	2967	3.26	458	0.50	68	0.07
Cropland	182	3.47	32	0.62	9	0.18
Pastureland	3134	2.97	261	0.25	26	0.02
Forest	3400	0.12	1679	0.06	55	0.00
Septic	2395		938			
Total	**12078**		**3369**		**159**	

Figure 8. Sources of P loading in the Pelican Lake Watershed



The primary focus of this plan is to reduce the phosphorus loading to Pelican Lake. The BMPs and activities will also help to reduce nitrogen (Figure 9) and TSS (Figure 10) loads to the lake. Although these are not immediate concerns or pressures on the lake's health, the reduction of these will benefit lake health.

Figure 9. Annual nitrogen loading by land use (PLET)

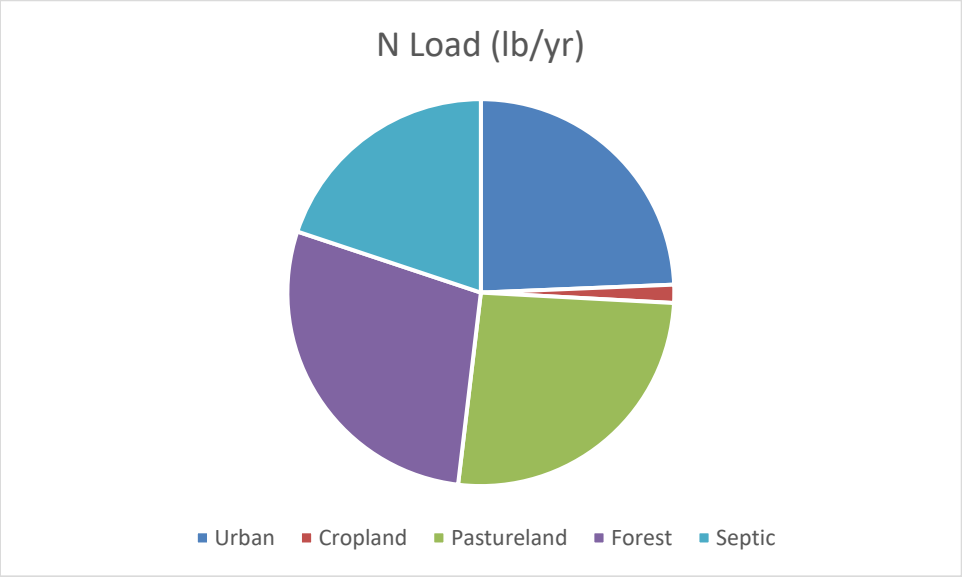
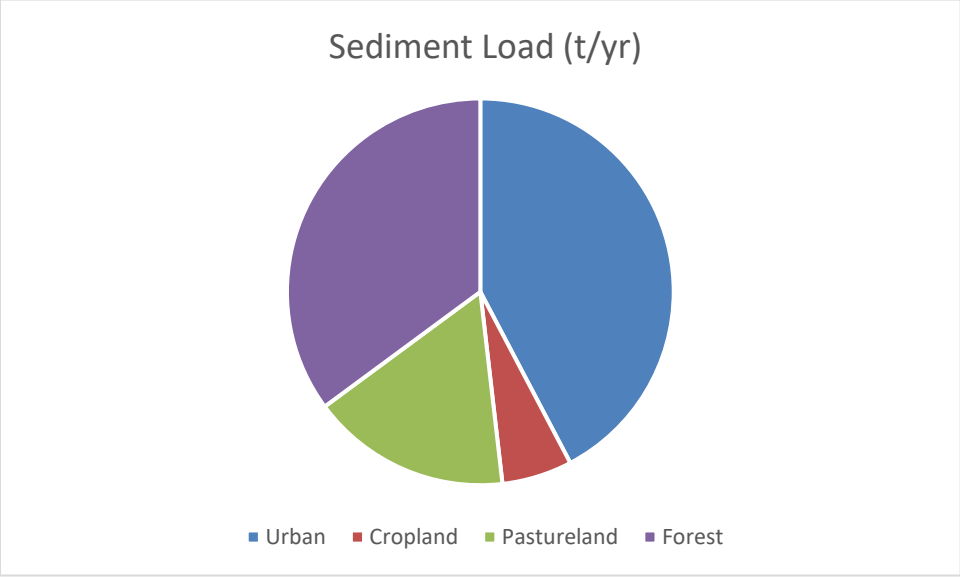


Figure 10. Annual TSS loading by land use (PLET)



Point sources

There are no significant sources of point source pollutant loading in the Pelican Lake Subwatershed.

Wastewater treatment

There is only one wastewater treatment plant (WWTP) in the Pelican Lake Watershed (Table 7). This WWTP is located at the outlet of Pelican Lake and discharges downstream to the Pelican River; therefore, it is not considered a loading point for the watershed. It is expected that a permitted facility meets all loading requirements.

Table 7. WWTP permit

Facility	Permit number
City of Orr WWTP	MN0024422

Confined animal feeding operations (CAFO)

There are no feedlots with an NPDES/SDS permits within the watershed. There are feedlots that require SDS permits or gap feedlots. Permitted animal operations are not a source of nutrient, TSS, or bacteria loading.

MS4

There are no MS4 permits in the Pelican Lake Watershed.

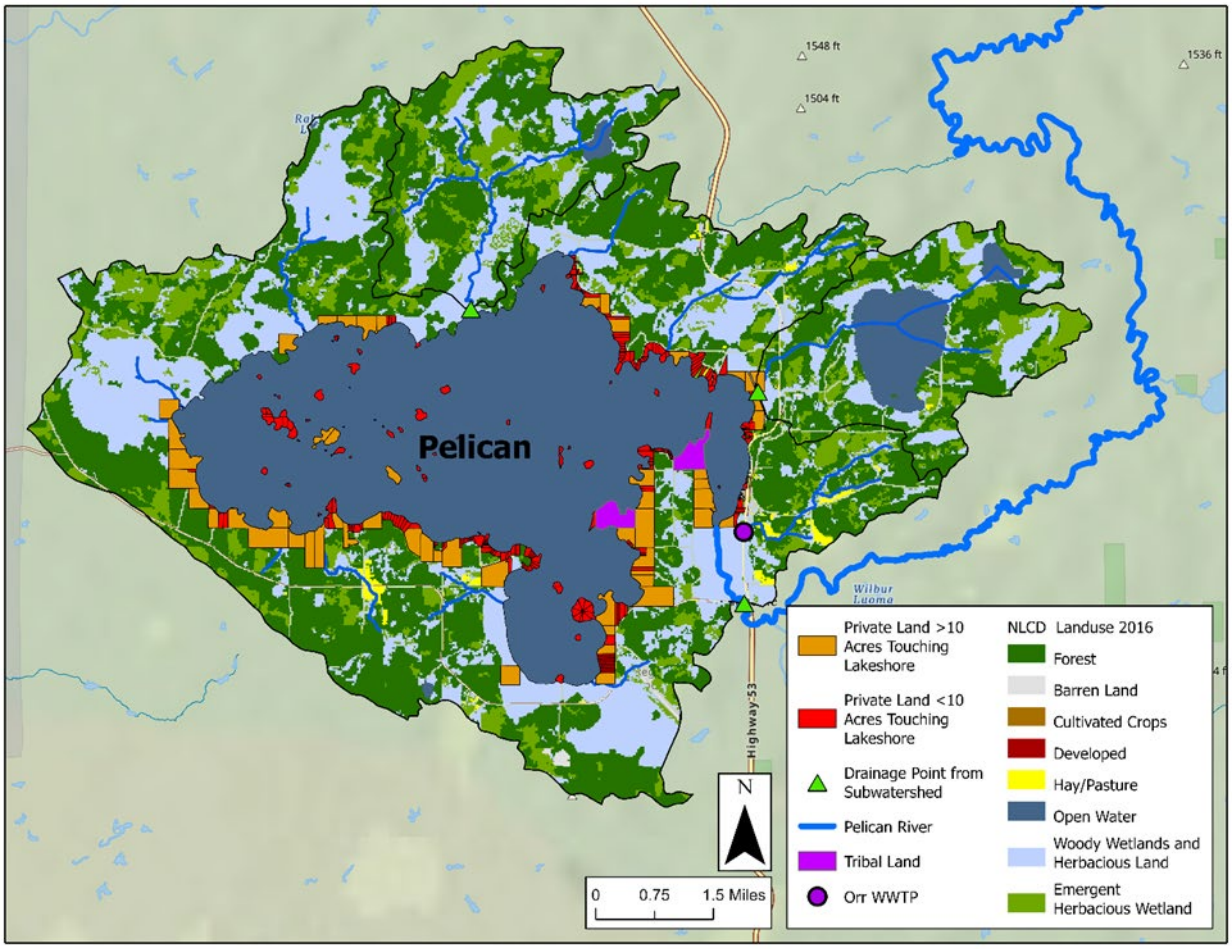
Nonpoint source

The primary source of pollutant loading in the Pelican Lake Subwatershed is NPS.

Development

Pelican Lake has been identified as a lake with significant development pressure. Increased impervious cover, proximity of US Highway 53, and a lack of buffers create areas of high nutrient and sediment loading and are identified as red in Figure 11. Best management practices for landscaping and stormwater mitigation will be used to address these areas.

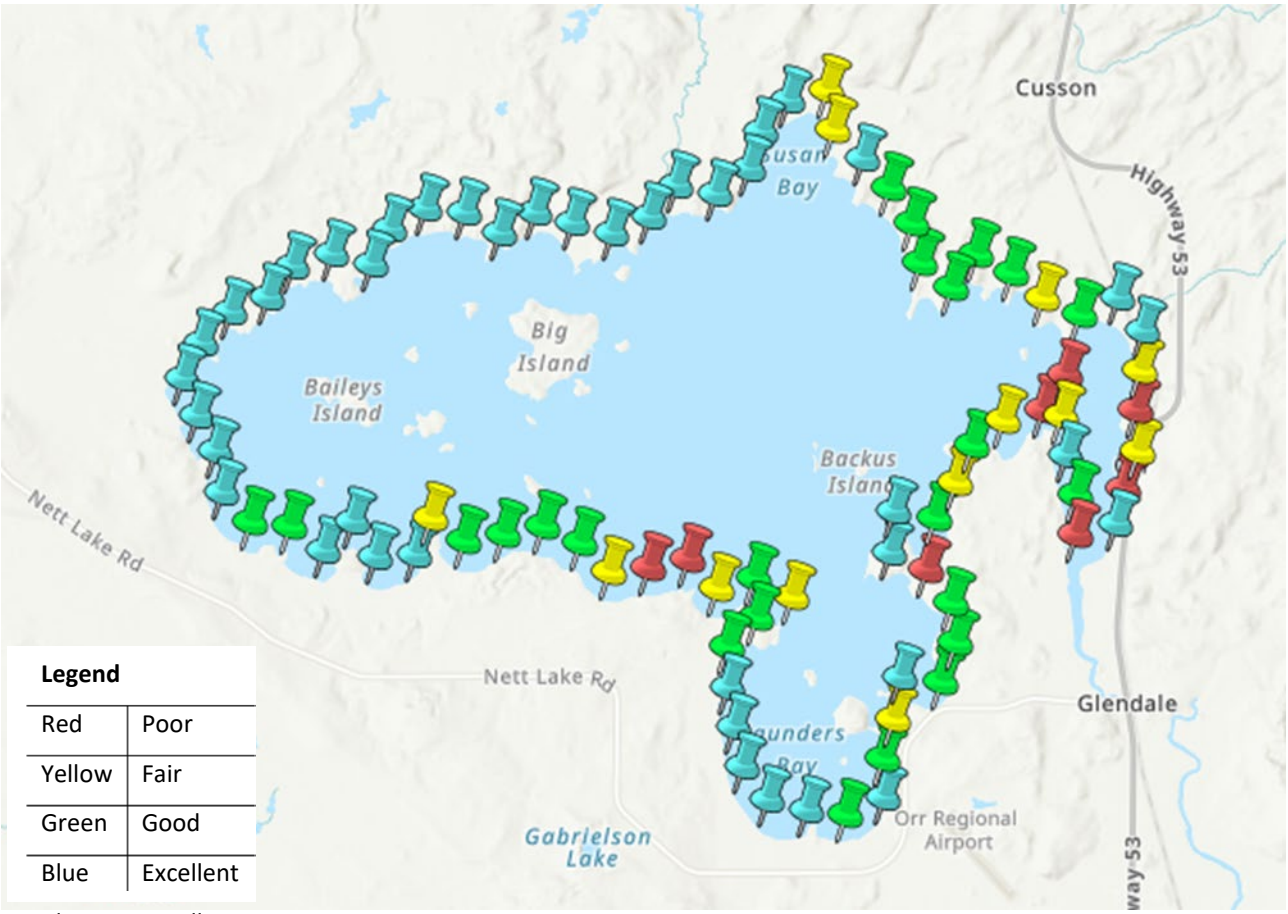
Figure 11. Land use, tributaries, and developed land identification on Pelican Lake shoreland



Private lakeshore properties are also primary locations for addressing lakeshore restoration and improvements. Lakeshore development is susceptible to increased runoff with lawns mowed to the lake shore, the natural vegetation removed, and unstable shorelines.

In 2019, SWCD staff used St. Louis County aerial photos to score shoreline development around Pelican Lake at 500 m straight line intervals. Sections were scored from poor-excellent based on percent vegetation cover. This methodology was developed by the DNR efforts for Lake Vermilion. It was determined that 48% of the shoreline is determined to be excellent, 28% good, 15% fair, and 9% poor (Figure 12). The less quality shoreline areas are on the east side of the lake.

Figure 12. Condition of lakeshore vegetation coverage around Pelican Lake (2019)



Moose Lake is a tributary to Pelican Lake. Although Moose Lake currently meets water quality standards, its protection is integral to successful protection of Pelican Lake. There are many wetlands surrounding the lake with low development.

The City of Orr is located on the eastern side of the lake. The impervious surfaces that are part of this development contribute to the phosphorus loading. US Highway 53 runs the length of the eastern bay and follows the lakeshore. Stormwater and other runoff from these impervious surfaces increase nutrient loading. Figure 12 shows the quality of shoreline vegetation around Pelican Lake.

City of Orr stormwater

The City of Orr is not an MS4-permitted entity. The impervious surfaces do not allow for stormwater to infiltrate the soil and increase the rate of runoff. Without the filtration of soil or buffers stormwater will enter the lake carrying higher concentrations of nutrients and sediment. The Orr Regional Airport is likely to carry contaminants, such as PFAS, which are considered a contaminant of emerging concern. These constituents will need to be monitored for future understanding of the effects. Areas of high population density, in general, can cause water quality stressors. However, due to the limited population within the watershed, it is expected that these urban stressors are localized and are only impacting Orr or lakeshore developments (MPCA, 2022).

Lakeshore properties

Residential and other developed properties that feature shorelines by removing natural buffers, including vegetation and other filtering features. Maintenance and upkeep of residential yards can be a source of loading through fertilizers and erosion, as well as a loss of habitat through manicured lawns and hard armoring of lakeshore property. Education and outreach to lake shore owners and cost share and technical assistance can help to support landowners in creating more lake-friendly decisions.

Erosion in ditches and from roadways are areas of high nutrient and sediment runoff. Many of the small roads and driveways have points of erosion stemming from inadequate vegetation and incorrectly sized/placed culverts. As many crossings in the region are known to be poorly placed, with scour, causing loading and connectivity issues, it is likely that there are crossings that need addressing within the watershed. A complete inventory of road crossings will identify where these critical areas are located

Subsurface sewage treatment systems (SSTS)

Less dense development poses potential water quality risks due to the lack of localized or regional sanitation infrastructure. SSTS that are not properly maintained contribute to pollution loading (MPCA, 2019). The estimated percentages for septic compliance are summarized in Table 8. Compliant systems are functioning as designed and up to standards and are not considered a significant source of loading. Nonconforming systems are systems that function as designed, but do not meet the current standards. This could be a failure to meet setbacks, undersized, or other issues. Noncompliant do not meet the required operational treatment and safety goals the state has put into place for SSTS.

The percentage of both nonconforming and unknown statuses of the SSTS is assumed to be a contributor to nutrients for the purposes of the plan. Further investigation may show that they are functioning well, but the plan is for the worst-case scenario.

Table 8. Summary of compliance in St. Louis County

Data provided by St. Louis County Onsite Wastewater Department

%	Status
40	Compliant
23	Nonconforming
4	Noncompliant
34	Unknown

Forestry

A significant portion of the watershed area is forested. Protection strategies specific to forestland management are important to maintaining and protecting water bodies in the watershed. Forest loss can impact the local environment by reducing stream shading and increasing erosion. In the late 1800s and early 1900s, there was large-scale timber harvesting of mature forest within the watershed. Since then, the region's forests have reestablished, and many continue to be managed for forest harvest at varying levels of intensity. In addition to harvest, forest loss can occur from insect damage, disease, large scale blowdowns, and wildfires. Current forestland management activities in the VRW, especially on public lands, have successfully protected waterbodies and should be maintained (MPCA WRAPS).

Forest lands comprise a significant amount of the P loading in the Pelican Lake Watershed due to the number of acres in the watershed; however, forest land cover is a natural source of loading with a low per-acre load (Table 6). Therefore, the preservation of natural forested lands is imperative to the health of water quality.

The differences in these values illustrate the impact development and the degradation of mature forest acres can have on runoff, sediment, and nutrient loading as described in the WRAPS (2021). The most optimum land cover with a positive impact on water quality is mature forest.

Internal loading

Many Minnesota lakes include some level of internal loading from legacy phosphorus. The source of these legacy nutrients in Pelican Lake likely occurred from loading from the former clear-cut approach to forestry. As the watershed loading sources are addressed and additional loading pressures are reduced, this internal loading with naturally resolve. The size of Pelican Lake makes most internal loading practices unreasonable. The problem must be addressed through limiting and reducing loading from the watershed.

Atmospheric deposition

The PLET model does not calculate an estimated loading from atmospheric deposition. The large surface area of Pelican Lake is a condition that allows for a relatively high level of loading. Atmospheric deposition is outside the control of the watershed partners. It cannot be addressed in this plan but should be acknowledged as a source of phosphorus loading.

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 total estimated reductions realized when this plan is fully implemented are summarized in Table 9. These exceed the determined 168 lbs/yr P reduction needed to protect the water quality of Pelican Lake.

Table 9. Total estimated annual load reductions for Pelican Lake Watershed (PLET)

Watershed	N reduction (lbs/yr)	P reduction (lbs/yr)	TSS reduction (t/yr)
090300020303 - Pelican Lake	2381	465	55

SSTS reductions

The repair and/or replacement of SSTS that are failing will reduce loading in the watershed (Table 10).

Table 10. Annual reductions from repair or replacement of failing SSTS

Sources	N load reductions (lb/yr)	P load reductions (lb/yr)
Septic	2155	844

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 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 plan.*
>
> EPA *Handbook for Restoring and Protecting Our Waters*

Load reductions will be achieved through a combination of outreach and education activities to landowners to promote best management practices (BMPs). The BMPs will apply to forestry, shoreline, developed areas, and septic system improvements. Efforts to prevent increased loads will include outreach and education activities to landowners, use of BMPs to prevent increased loads, and use of easement and land acquisition programs to keep land cover protected.

The activities to be used in this NKE plan are listed in the implementation activities table (Table 5) along with milestones and measures.

BMP program descriptions

Best Management Practices (BMPs) that will provide the greatest protection and enhancement to the Pelican Lake Watershed can be lumped into roughly four groups: Shoreline; Forestry; Stormwater, and Onsite Wastewater.

Shoreline

Restoring shoreline that has been altered by human development will help protect Pelican Lake by filtering pollutants out of runoff draining from upland areas and minimizing erosion from wave action and storm events. The shoreline transitional area also provides essential habitat to aquatic life and other wildlife that provide recreational opportunities for the lake users. The primary practice utilized in protection and restoring shorelines is by planting native vegetation.

Forestry

Forested land is an abundant cover type in the Pelican Lake watershed and surrounding areas. Healthy forests are known for their capability of protecting water quality and reducing peak flows in a watershed. Providing guidance to private landowners on how to manage their forested lands to meet mutual benefits of protecting water quality while meeting their needs is the ultimate goal of forthcoming forestry outreach. Statewide tax incentive programs such as the Sustainable Forest Incentive Act (SFIA) or Class 2c Managed Forest Land are tools resource managers can promote to private landowners to reduce land use conversion out of a forested cover type. Keeping vigilant on invasive species risks and the effects of climate change on the forests in the watershed will also help keep the water quality protected by preventing the loss of healthy forestland.

Data from the DNR consistently shows that the percent of forest cover for a watershed is correlated to the water quality conditions of the water bodies in a watershed.

Currently, the threshold for protection would be considered met in the watershed for Pelican Lake. However, being close to impairment, factors including future forest change, development, climate change, and invasive species pose risks to push Pelican Lake into an impaired status. Therefore, creating incentives and opportunities for current forest to stay in good health are imperative to this plan in addition to reductions to current pollution inputs.

Stormwater

Though this watershed has a relatively small portion of developed and/or impervious surface, some development is adjacent to or in very close proximity to Pelican Lake. Conversion and expansion of vacation properties to year-round homes and/or the development of undisturbed land could potentially cause an increase in developed and impervious surfaces in the watershed. Implementing practices that allow stormwater runoff to infiltrate into the soil and be taken up by terrestrial life will help reduce the quantity of pollution reaching the lake. Practices such as rain gardens, stormwater ponds, pervious pavement, urban forest management, and others can all be utilized in a developed setting to reduce stormwater peak flows.

Onsite Wastewater

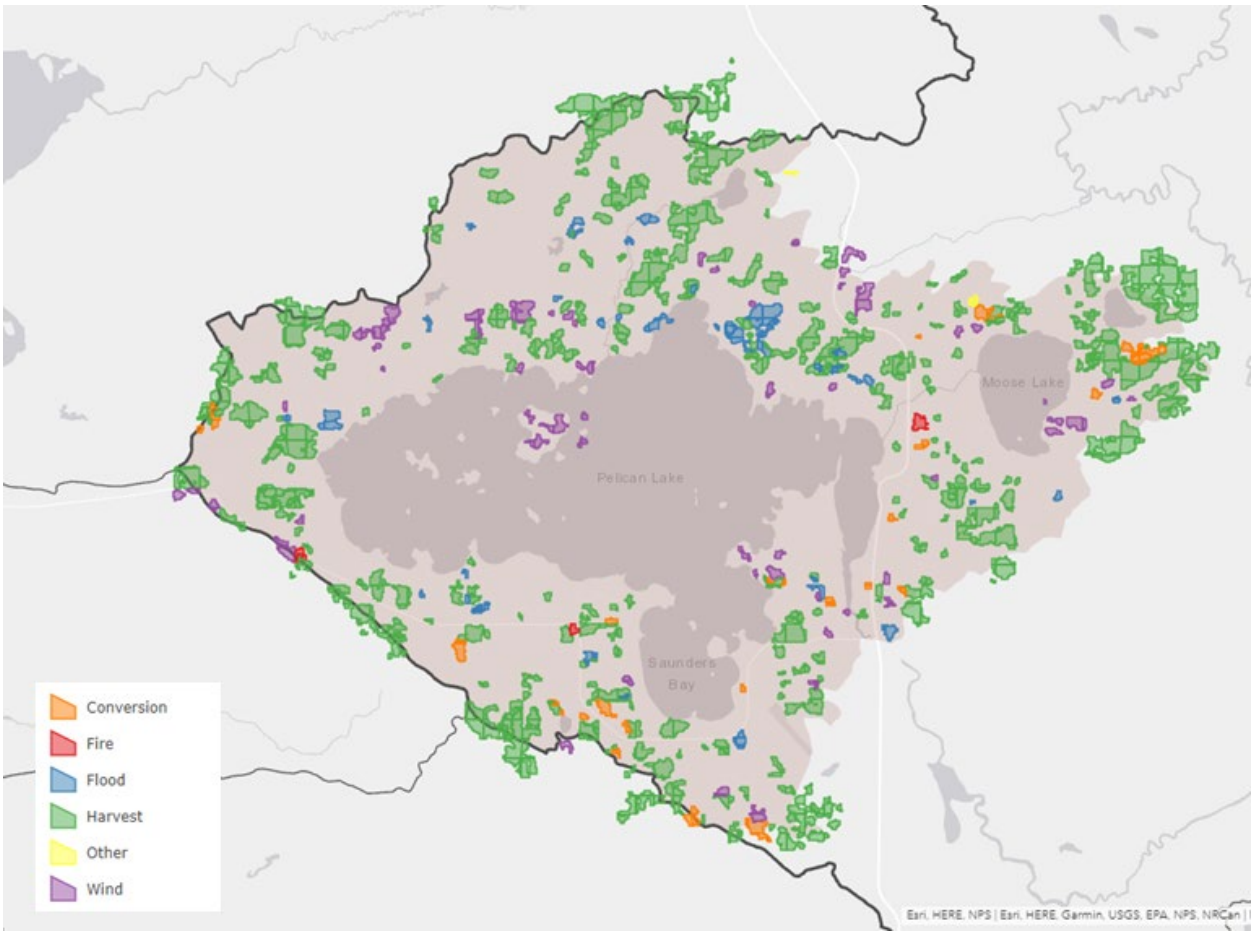
Wastewater management in rural areas can be a bit of a complex subject. Local and state regulations require a point-of-sale inspection to determine if onsite wastewater management systems, usually a subsurface sewage treatment system (SSTS), are functioning properly to protect water quality. This complicates determining up-to-date compliance in onsite wastewater systems. Working with private landowners to provide resources on how to maintain their septic systems and/or the importance of having routine inspections completed is one way of encouraging landowners to help keep ground and surface waters clean. Additional opportunities for low interest loans and/or low-income system replacement programs could be bolstered to provide additional assistance.

Critical areas defined and targeted

Critical areas for BMP implementation to reduce phosphorus loads in the watershed are the lakeshore properties (red and orange in Figure 7) and possible failing septic systems (Table 8). The lakeshore areas are most likely to have open and impervious areas susceptible to storm runoff. The private lakeshore areas greater than 10 acres in size are priority areas for protection given their size for consideration in conservation acquisition and easement programs to maintain the natural vegetation of the land and protect from increased amounts of development. Nonconforming and unknown statuses of STSS are also assumed to be contributing nutrients, and identifying failing septic systems for replacement is also a priority.

Looking to the future, the highest likelihood of loading comes from forested areas as the largest land cover type. Even though the largest load occurs from forested lands given the high percentage of acreage in forest the per acre load is very small. Hence, the greater number of acres of healthy forest provides protection from nutrient loading. The critical areas for forest management are harvested or damaged forest areas that are susceptible to increased nutrient runoff. These areas are identified in Figure 13. Harvested and fire damaged areas in the last 10 years are the most critical areas for reforestation (e.g., tree planting).

Figure 13. Pelican Lake Watershed Fast Fire Forested Disturbance Areas



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 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 plan.

The cost to implement this plan fully is estimated at approximately $3,400,500. Costs by practices and activities are itemized in Table 5. This estimate includes implementation of BMPs, staff time, education and outreach, studies, inventories, and monitoring. The implementation of this plan will be funded by local funding, state and federal grants, and support from private organizations. Section 319 grant funding will serve as the foundation for implementing this plan. Additional funding includes local SWCD operational funding, State Clean Water Funds (CWF) through the Minnesota Board of Water and Soil Resources (BWSR), and US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP) funding. Landowners will contribute funds for grant match requirements. Private organization and foundation funding opportunities will also be pursued.

Partnerships in the watershed include the City of Orr, the Pelican Lake Association, and lake resorts. There are also long-established partnerships with St. Louis County, the Minnesota Department of Natural Resources, and other state agencies. Recognizing the land surrounding Pelican Lake is culturally significant to the indigenous community of northern Minnesota, continuing efforts will be made to expand partnerships with the Bois Fort Band of Chippewa.

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.

There are several strategies to provide education and outreach for this project as highlighted in the Table 5. This is a critical tool for successful implementation for BMPs. Providing landowners with the information they need to make wise management decisions for their property and STSS maintenance is key to restoring the quality of these waters.

Building and sustain relationships with the City of Orr and the Pelican Lake Association will be key to reaching stakeholder of Pelican Lake. Partnering with them on reaching landowners and lake users will help us spread the education and outreach messages for this project. They will also be key partners for workshops that will introduce best management practices and allow people to learn from each other. We will also utilize printed outreach and education including direct mailings to reach landowners and other stakeholders of Pelican Lake.

Element f. Reasonably expeditious schedule

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

The schedule for this watershed plan is designated in 2-year increments described in Table 5. When implemented as planned, the activities and BMPs described will reach the estimated reductions needed to meet water quality standards in 10 years.

Element g. Milestones

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

The planned milestones for this watershed are designated in 2-year increments and will take place over the next 10 years (2023-2033). Specific milestones for each activity are captured in Table 5. The accomplishment of these milestones will be used to evaluate the implementation of this plan.

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 assessment criteria for this watershed are designated in 2-year increments and the unit of measure is described in Table 5. The assessment criteria and achievement of milestone goals will be used to measure the accomplishment of this NKE plan. Load reductions achieved through implementation of the NKE Plan will be evaluated using the PLET model estimates of the total load reductions estimated for the activities in the plan and the number of activities completed with associated estimated load reductions.

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 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 plan has been developed to begin implementation activities, continue survey and inventory efforts, and evaluate the progress toward meeting the aquatic recreation goals for Pelican Lake. As this work is completed, the implementation goals, priorities, and BMPs will be examined and revised, as needed.

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.

The monitoring and evaluation for this watershed will include on-going lake water quality monitoring and tracking of BMPs and protection measures along with land use changes. Surface water sampling and field parameter measurements will be made two times per month from April through September in Pelican Lake and Moose Lake. Field measurements will include depth profiles of temperature and dissolved oxygen to track potential internal loading from the lake bottom through lake mixing. Bottom water samples will be collected when hypolimnetic DO is less than 5 mg/L. Secchi depth monitoring will continue with the participation of citizen (volunteer) monitors.

Surface water quality data will be evaluated for changing conditions over multiple years to account for natural variability in conditions. The depth profiles and bottom water quality data will provide an improved understanding of the dissolved oxygen dynamics in the lake and possible internal loading issues in the lake. The data collected will also be used in the BATHTUB model to better characterize the lake's condition and response to load reductions implemented in the project.

Specific monitoring tasks, costs, milestones, and schedule are described in Table 5.

Volunteer water monitoring

The MPCA coordinates the Volunteer Water Monitoring (VMP). Having citizen volunteers monitor a given lake or stream station monthly and from year to year can provide long-term data needed to help evaluate status and trends. Citizen monitoring is especially effective at helping to track water quality changes that occur in the years between intensive monitoring years.

References

Minnesota Department of Natural Resources (DNR) and Minnesota Pollution Control Agency (MPCA). (2021). *Lakes of Phosphorus Sensitivity Significance (LPSS).*

MPCA. (2022). *Vermillion River Watershed Restoration and Protection Strategy (WRAPS) Report.* Retrieved from https://www.pca.state.mn.us/sites/default/files/wq-ws4-86a.pdf

Vaughn, A. A. (2020). *Rainy HW, Vermilion, and Rainy Lake Watershed HSPF model updates: Conversion to gridded weather data extension through 2019.* Retrieved from https://www.pca.state.mn.us/sites/default/files/wq-ws1-35.pdf

Shabman et al., 2007