Seven Mile Creek Watershed

Nine Key Element Watershed Plan

For Fecal Coliform, Nitrate, and Turbidity

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Prepared for

Minnesota Pollution Control Agency

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Background

The U.S. EPA has identified nine key elements that should be contained within a watershed plan (US EPA 2008). The Seven Mile Creek Watershed is well studied and collectively these reports can serve as the basis for a nine element plan. This document compiles these existing documents to address the nine key elements into the Seven Mile Creek Nine Element Watershed Plan to address phosphorus and sediment. Information and conclusions are summarized from the existing reports, to support consistency with each of the nine elements. References to the original reports are included; please refer to the original reports for the specific details of the analyses.

Introduction

Seven Mile Creek is located within Nicollet County between the communities of Nicollet and St. Peter in South Central Minnesota and is located within the greater Minnesota River-Mankato Watershed. The watershed is 23,551 acres with 79% of acres being intensively managed for corn and soybean production and 14% being in forests, wetlands, and grasslands. The remaining land is developed, pasture, or other crops (NRCS-USDA 2019). The creek garners more attention than most waterways in the area due to Seven Mile Creek Park located at the mouth of the watershed. The county park is 640 acres and contains open, mowed areas and 10 miles of trails throughout the ravine system. The creek has been designated as a class 1-D marginal trout stream by the Minnesota Department of Natural Resources since 1985 (Kuehner 2009), and it is listed as a warmwater general use Class 2B stream and coldwater Class 2A stream in two sections by the Minnesota Pollution Control Agency (MPCA) (Bateman et al. 2019).

Many years of monitoring, assessment, implementation, and coalition building form the basis for the Seven Mile Creek Watershed Project, a collaborative effort to restore and protect the water quality of Seven Mile Creek. This Nine Element Watershed Plan summarizes the information gained through the work of dedicated staff and volunteers in several projects and identifies and prioritizes areas within the watershed where conservation efforts are needed.

Seven Mile Creek is impaired for lack of macroinvertebrate assemblage, lack of fish assemblage, fecal coliform, turbidity, and nitrate. It is stocked annually with Brown Trout in order to maintain a population in the creek. In the lower reach of the creek, total phosphorus has a high average concentration in Seven Mile Creek of 0.22 mg/L (the MCPA WRAPS report calculated a FWMC of 0.35 mg/L from 2007-2015), but the lack of secondary data prevented any conclusions about total phosphorus's impact on aquatic life in the stream. Nitrate concentrations ranged from 0.2 – 42.8 mg/L with an average of 16.4 mg/L (the MPCA WRAPS report calculated a FWMC of 21.5 mg/L from 2007-2015), and 68% of the samples exceeded the 10 mg/L standard. Stream bank and ravine erosion are a major source of suspended solids in the creek with total suspended solids (TSS) averaging 140 mg/L (the MPCA WRAPS report calculated a FWMC of 341.5 mg/L from 2007-2015), a high of 5,970 mg/L, and 60% of the samples exceeding the 10 mg/L standard for cold-water streams. However, the greatest mass of sediment flows through Seven Mile Creek during large rain events when massive ravine erosion takes place. In the upper, warm-water reach of the creek, nitrate ranged from 0.2 – 49.5 mg/L with an average of 17.8 mg/L (Bateman et al. 2019).

Temperature, nitrate, suspended solids, habitat, connectivity, and altered hydrology were all confirmed stressors for aquatic life in Seven Mile Creek (Bateman et al. 2019). However, nutrients and sediment discharge from the creek into the Minnesota River and contribute to water quality issues downriver. The loads of nutrients and sediment from this stream are significant and practices to address them should be prioritized in the greater watershed.

This watershed plan is a compilation of reports, strategies, and data from within the Seven Mile Creek watershed. The intent of this document is to provide a comprehensive and detailed plan that integrates the various components of the project, identifies additional information and actions needed, and meets the guidelines for watershed plans developed by the US EPA (2008). The plan describes the watershed, identifies water quality goals and objectives, quantifies the pollutants degrading stream water quality, and identifies the work needed to improve the water quality. The plan will be updated as the work is implemented, goals for water quality improvement are met, or greater priorities arise. The goal for this document is to reduce nutrient, suspended sediment, and fecal coliform loads within the Seven Mile Creek watershed.

The plan incorporates the nine elements presented in the Clean Water Act Section 319 guidelines for watershed plans to fully address impaired or threatened waterbodies. The nine elements include:

A. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan.
B. An estimate of the load reductions expected from management measures.
C. A description of the nonpoint source management measures that will need to be implemented to achieve load reductions in paragraph 2, and a description of the critical areas in which those measures will be needed to implement this plan.
D. 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 this plan.
E. An information and education component used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.
F. Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.
G. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.
H. 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.
I. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item h immediately above.

The EPA watershed planning guidelines provide direction in developing a sufficiently detailed plan at an appropriate scale so that problems and solutions are targeted effectively.

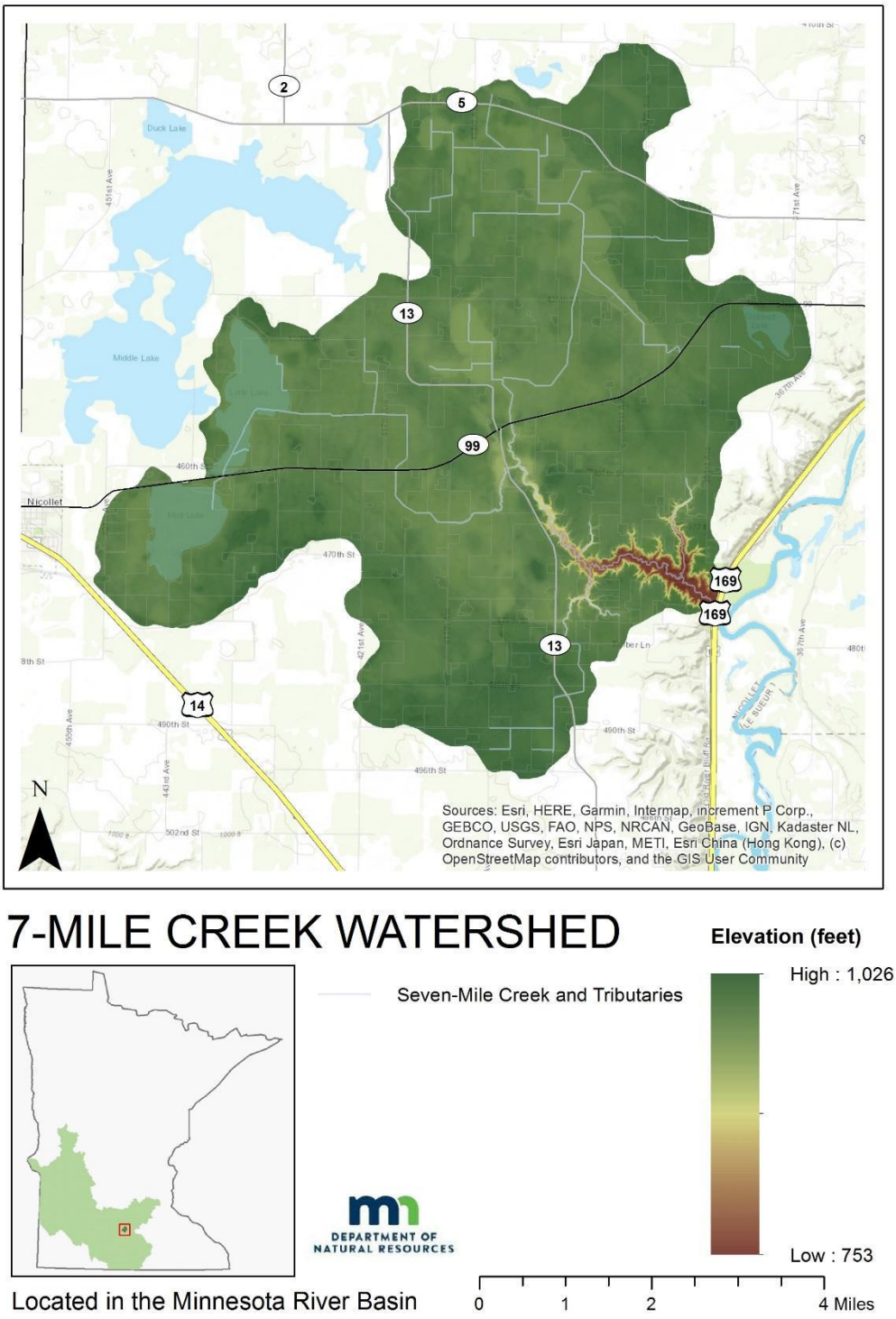

Figure 1. Seven Mile Creek Watershed located within the greater Minnesota River Basin. The majority of the tributaries to the creek are drainage ditches, and the elevation changes dramatically before the stream discharges into the Minnesota River.

Watershed Description

Physical and Natural Features

The Seven Mile Creek Watershed is a 37-square mile (23,551 acres) watershed located between the cities of Nicollet and St. Peter in Nicollet County, Minnesota. The watershed is located in the Minnesota River Basin, within the Minnesota River - Mankato major watershed (HUC8) in South-Central Minnesota (Figure 1). The stream flows directly to the Minnesota River. Flat agricultural fields (0-2% slope) dominate the upper watershed while steep, highly dissected, and forested terrain comprises the lower portion of the watershed. Cropland covers 81% of the watershed, dominated by corn and soybean production (NRCS-USDA 2019).

Seven Mile Creek transitions from being a drainage ditch to a stream where it flows under MN-99. The creek is 6.1 miles long from MN-99 to the Minnesota River. It originates as a series of public drainage ditches in the upper watershed. Most of the stream is a designated trout stream and flows through a 640-acre county park. Much of the upland watershed was originally comprised of wetlands but surface and tile drainage have been installed to enable crop production. By 1985, the agricultural drainage consisted of approximately 25 miles of surface ditches and 600 miles of sub-surface tile (Kuehner 2009). Significantly more tile has been installed since that time. By the 2000s, less than 15% of the original wetlands remained.

Climate

The climate of Seven Mile Creek Watershed is continental with cold, dry winters and warm wet summers. The average annual temperature from 1919-2018 in the Minnesota River – Mankato Watershed is 44.6 °F. The average annual precipitation over that same period is 28.5 inches and has increased to an average of 29.4 inches over the past twenty years (University of Minnesota 2019). Figure 2 illustrates the average monthly precipitation for the area. The water year average runoff coefficient from 1926-2005 as measured in Mankato was 0.12 (SD = 0.08), or approximately 3.4 inches (Vandegrift and Stefan 2010).

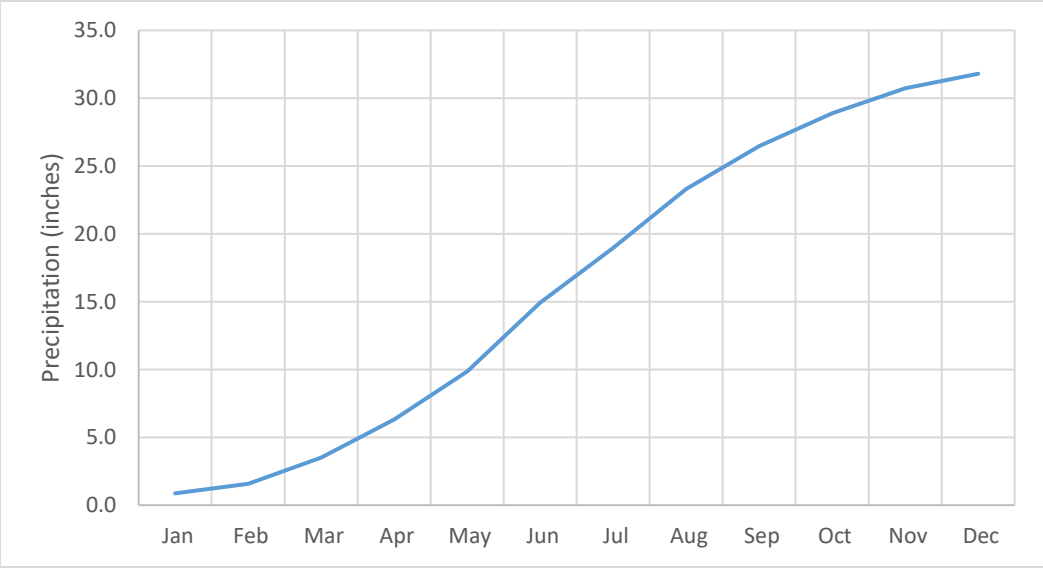

Figure 2. Cumulative monthly precipitation from 1981-2010 averages in Nicollet County, MN (University of Minnesota 2019).

Hydrology

Seven Mile Creek is a perennial stream originating near the intersection of County Road 13 and MN-99. The tributaries upstream of MN-99 are drainage ditches, and the stream enters a ravine system after it passes under the highway. It maintains a base flow of 1 to 3 ft^3/sec from groundwater presumably upwelling from the Jordan Sandstone Aquifer. Three public ditches (CD 46, CD 13, and CD 24) and two public tile systems (CD 29 and CD 58) form the headwaters of the watershed. The ditches contribute water to the stream during spring and storm event runoff and typically become intermittent after July. A shallow subsurface flow component is present from the public tile systems, private tile systems connected to the ditches and public tile systems, and near-bank storage of surface water infiltrating to alluvial material along the stream. Multiple seepage wetlands can be found within the ravine system where infiltrated surface water from the upland areas discharges near or in the stream. The groundwater and surface water interaction should be further investigated due to the effect each may have on the other in terms of water quality and quantity. Additional studies need to be completed to further the understanding of groundwater and surface water interactions within Seven Mile Creek.

According to 1854 Public Land Survey Maps, tributaries to Seven Mile Creek totaled about 7.3 miles at that time. Most of these tributaries meandered and extended from large upland prairie pothole wetland complexes. Many of the prairie potholes that were once scattered throughout the watershed were closed-flow intermittent wetland systems, which filled with rain and melting snow and then slowly evaporated or drained through the ground-water system during the late summer months. Under most conditions, water was trapped in these potholes and only a small portion entered the creek as runoff.

Artificial drainage systems were first established in the 1880s to manage the high water table present in much of the upper watershed and thus enhance crop production. The systems incorporated open ditches and tile drains. Today, approximately 25 miles of open ditches and approximately 15 miles of public drain tile exist in Seven Mile Creek Watershed. The estimate for private tiles lines was approximately 600 miles in 1985, but the current length of tile is unknown (Kuehner 2009) (Figure 3).

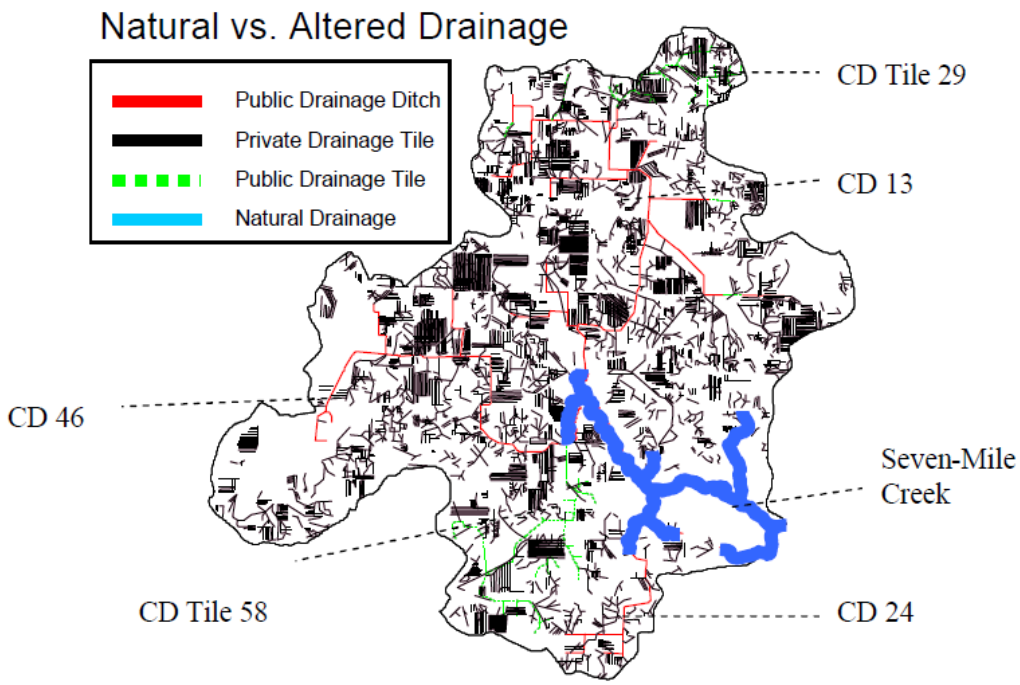

Figure 3. Natural and altered drainage in the Seven Mile Creek watershed from Kuehner 2004.

Topography and Elevation

Much of the watershed is nearly level or gently sloping until the slopes increase in the lower portion of the watershed (Figure 1). The watershed begins at an elevation of 1,020 feet and ends at an elevation of 746 feet. It drops 210 feet in its 6.1-mile length resulting in an average gradient of 34.4 feet/mile. The watershed above the ravine system is relatively flat, and the elevation drops only 25 feet from the northern-most extent of the ditch system to the start of the stream (where it intersects Hwy-99). A longitudinal profile of the northern ditch and the creek is shown in Figure 4 demonstrating the drastic elevation change of the stream compared to the ditches above the stream.

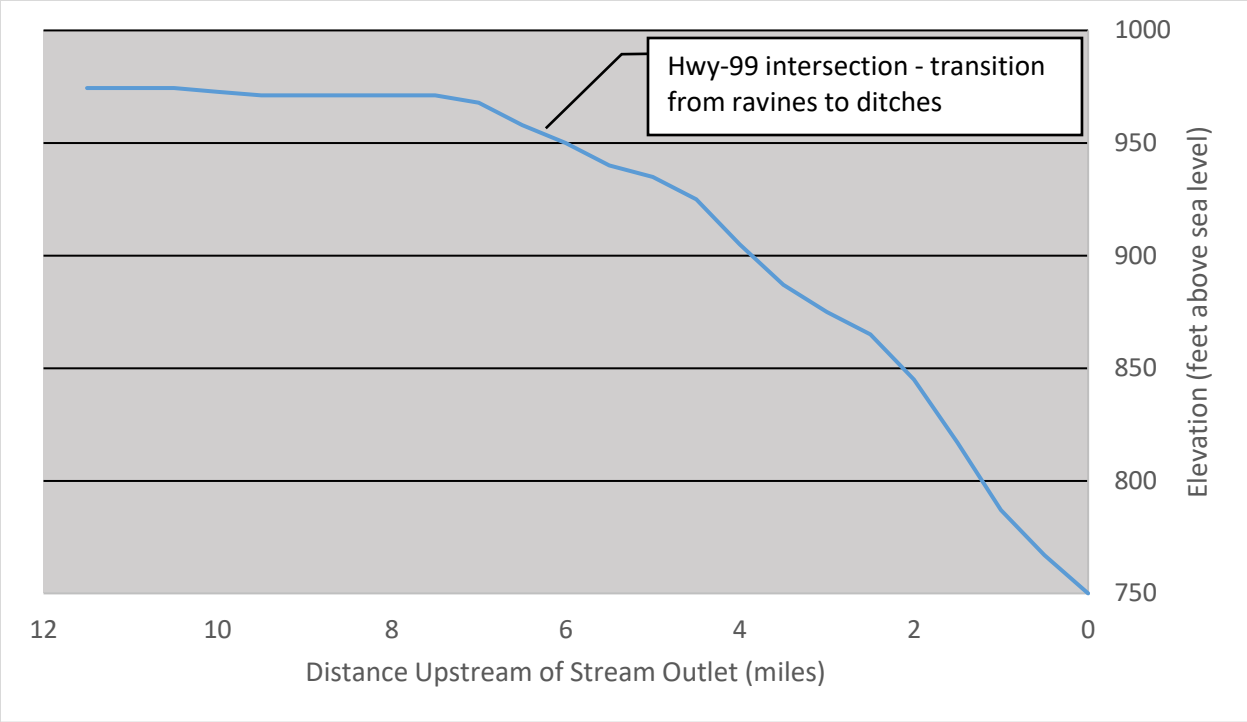

Figure 4. Water surface elevation of Seven Mile Creek by stream mile including elevations in the northern ditch tributary above the intersection with Highway 99.

Geology and Soils

The upper portion of the watershed lies in the Olivia Till Plain section of the Minnesota Lowlands province. It is covered by a thick mantle of glacial drift varying in thickness from 50 to 200 feet (Jackson 1994). The nearly level terrain of the upper watershed contains historical, small depressions, marshes, and swales characteristic of the immature drainage network of a young till plain.

Geomorphological composition of the Seven Mile Creek Watershed is predominantly till plains. Most of the soils in the watershed were developed in glacial till under tall grass prairie conditions. Soils consist mostly of poorly drained clay loams and silty loams on level land. Soils along the creek are mainly well-drained loams to poorly drained clay loams. As the creek descends into the Minnesota River valley, outcrops of Jordan Sandstone are evident. Soils near the mouth of the creek transition to alluvial deposits and coarser textured materials (Jackson 1994; Jirsa et al. 2011; USDA 2015).

The three dominant soil series within the watershed are the Canisteo Glencoe complex, Cordova clay loam, and Canisteo clay loams. Together these soils comprise nearly 40% of the watershed area (Figure 5). The Canisteo Glencoe Complex and Canisteo Clay Loam Series are very deep, very poorly drained, formed out of glacial till, slightly alkaline, and slopes approximately 0-2%. Cordova Clay Loam soils are characterized as very deep and poorly drained. They have moderately slow permeability in the upper part and moderate permeability in the lower part, were formed from ground moraines in glacial till, and have slopes in the 0-2% range (Jackson 1994).

Over 85% of the watershed is classified as prime farmland. Many areas that have not been considered prime farmland have been extensively tiled to improve drainage and make the land farmable. Poor drainage and steep slopes near the lower portion of the watershed are the primary limitations for crop production (Jackson 1994).

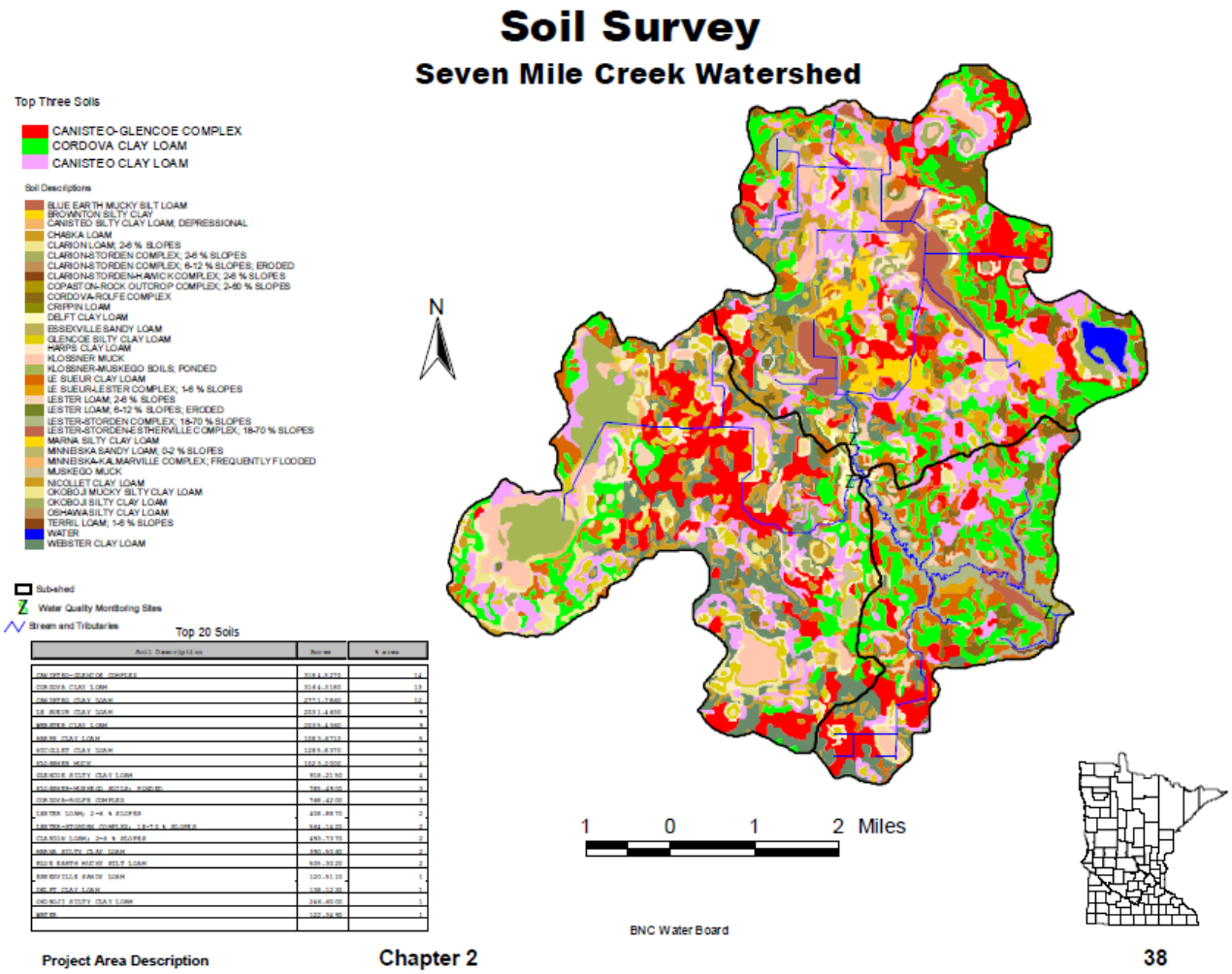

Figure 5. Soil types in the Seven Mile Creek watershed (USDA 2015).

Vegetation

Presettlement vegetation in the watershed was predominantly tall prairie grasses and wetlands with small areas of mixed deciduous hardwood forests scattered in the eastern portion of the watershed (Figure 6). Analysis of pre-settlement maps and survey notes by Kuehner (2004) indicate that about 50% of the watershed was once covered by wetlands (Figure 7). Current vegetation is dominated by corn and soybean production following extensive surface and tile drainage with a small area of remaining

deciduous forest, wetlands, and grassland. Residential development is growing in the watershed, resulting in small areas of lawn, trees, and impervious surfaces.

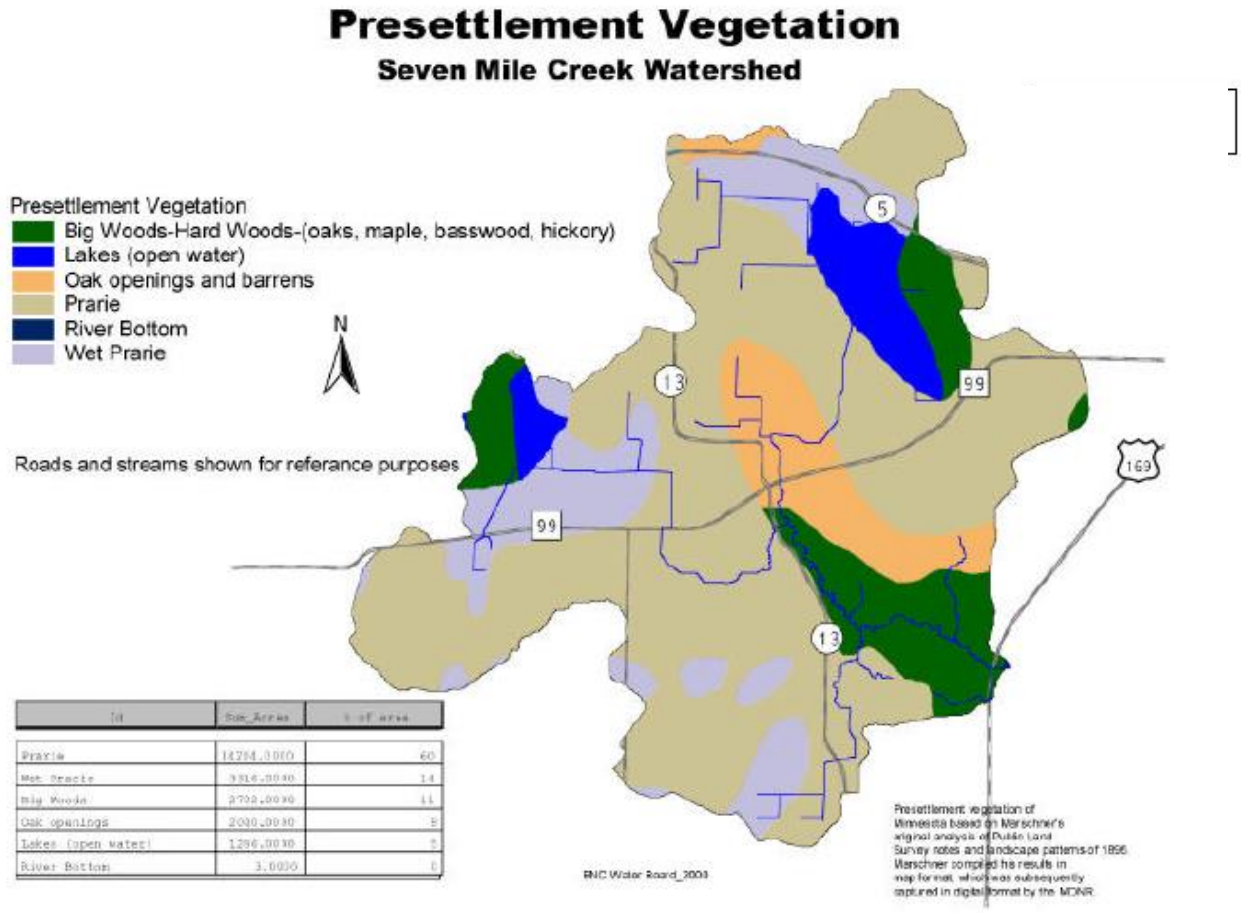

Figure 6. Pre-settlement vegetation in the Seven Mile Creek watershed.

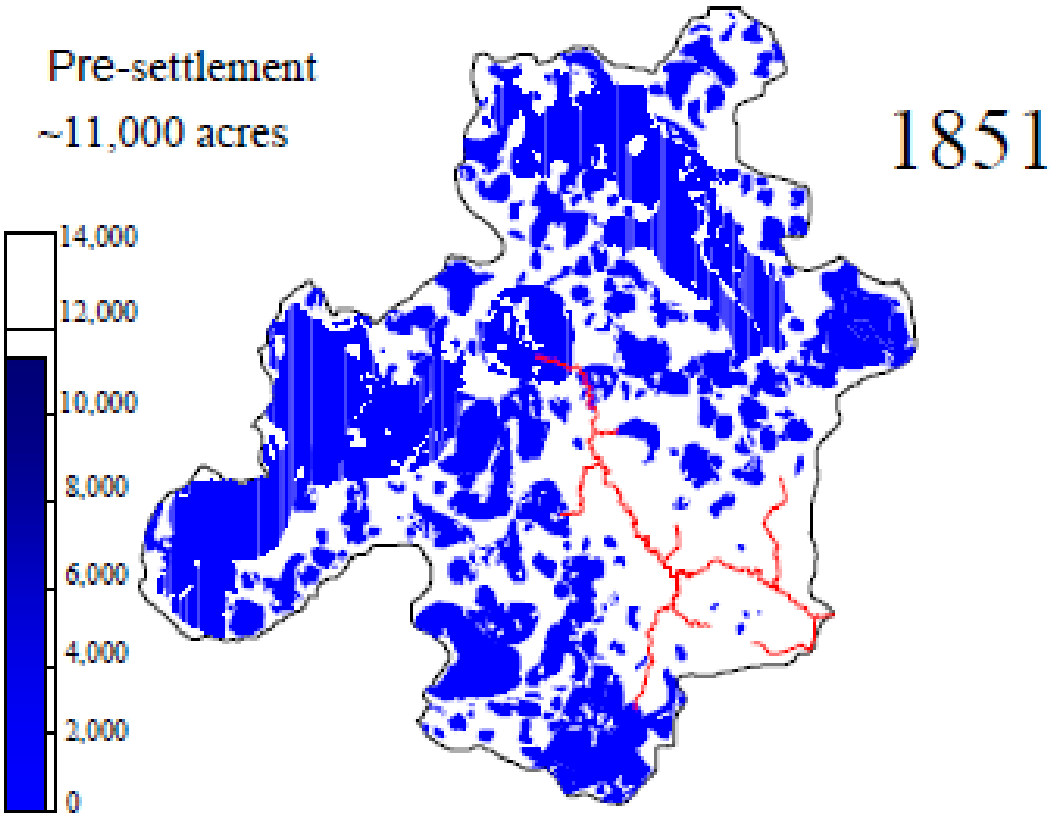

Figure 7. Estimated pre-settlement wetlands in the Seven Mile Creek watershed (Kuehner 2004).

Fish, Wildlife, and Plant Species Status

The county park provides a refuge for a diverse set of birds and animals. Songbirds, hawks, owls, wild turkeys, and other common southern Minnesota bird species are present in the park. No exotic or invasive aquatic animal species have been identified in the watershed. Common buckthorn (*Rhamnus cathartica*) is present in the wooded areas above and in the county park.

Cerulean warbler (*Setophaga cerulean*), Louisiana waterthrush (*Parkesia motacilla*), and Acadian flycatcher (*Empidonax virescens*) have been identified as species of special concern by the Minnesota Department of Natural Resources. Plant species of special concern include American ginseng (*Panax quinquefolius* L.) and snow trillium (*Trillium nivale* Riddell). The yellow sandshell mussel (*Lampsilis teres*) is a state endangered species that has been found at the confluence of Seven Mile Creek and the Minnesota River.

Seven Mile Creek is classified as a Class 1-D marginal trout stream and is stocked with brown trout (*Salmo trutta*) by MN DNR (Kuehner 2009). This type of fishery is very rare for south central Minnesota due to the need for cold water temperatures and adequate habitat. The steep gradients and gravelly substrate of the creek, along with the heavily forested areas along its lower reaches, provide a unique habitat for brown trout. Fingerling brown trout were first introduced into Seven Mile Creek in 1986. Prior to this introduction, the stream supported a fish community dominated by cyprinid species.

Stocking information from the CWP Diagnostic Study Report indicated that fingerling brown trout were stocked in the late 1980s and early 1990s. DNR fish surveys note the survival of annually stocked trout, but also noted that low flows and the lack of deep pools with overhead cover were significant factors limiting the survival of the trout. Online DNR stocking records show that the stocking of 7,500 fingerling brown trout continued every year between 1998 and 2015, except for 2000, 2003, 2007, and 2009. In addition to the fingerlings, 333 yearling brown trout were stocked in 2001. A total of 10,500 fingerlings were stocked in 2004.

Open Space, Forested Areas, Sensitive Areas, and Cultural Resources

The 625-acre county park at the mouth of the watershed is a local and regional source of recreation. The park contains about 320 acres of mixed deciduous hardwood forest. The rest is open grass, developed, or wetland. Besides Minnemishinona Falls – a small, scenic overlook – the Seven Mile Creek County Park is Nicollet County's only park. The park has more than seven miles of hiking, biking, and horse trails. It has abundant bird and wildlife populations and provides a home for the bird and plant species of special concern in the watershed. It is often used for educational programs by local schools and universities, it has playgrounds and ball fields, provides fishing access, and opportunities for numerous other outdoor activities.

Land Use and Land Cover

Approximately 81% of the watershed is now agricultural land composed of corn and soybeans in rotation with some peas, sweet corn, alfalfa, and pasture (NRCS-USDA 2019). Some land is enrolled in state or federal conservation programs or too steep to farm, but most of the land is in row crops (Figure 8). The watershed contains 38 state- and county-permitted feedlots. Over 6,600 acres of cropland are permitted to receive spread manure by the county (MPCA 2020; Nicollet County 2020), and more acres likely have state permits for spread manure (current state data unavailable). The ravine system is largely wooded with some open areas, but it is mostly unmanaged due to its steep slopes. No municipalities exist within the watershed. State, county, and township roads are present along most of the section lines in the watershed.

The predominance of row crop agriculture in the watershed is due to the extensive water drainage that has occurred. As noted above, wetlands accounted for nearly 50% of the watershed's land cover prior to European settlement. However, wetlands now account for about 7% of the watershed (Figure 9). With the advent of federal Farm Bill policies and state wetland programs in support of wetland protection and restoration, over 940 acres of wetlands and grassland have been restored since 1985 (NRCS-USDA 2019).

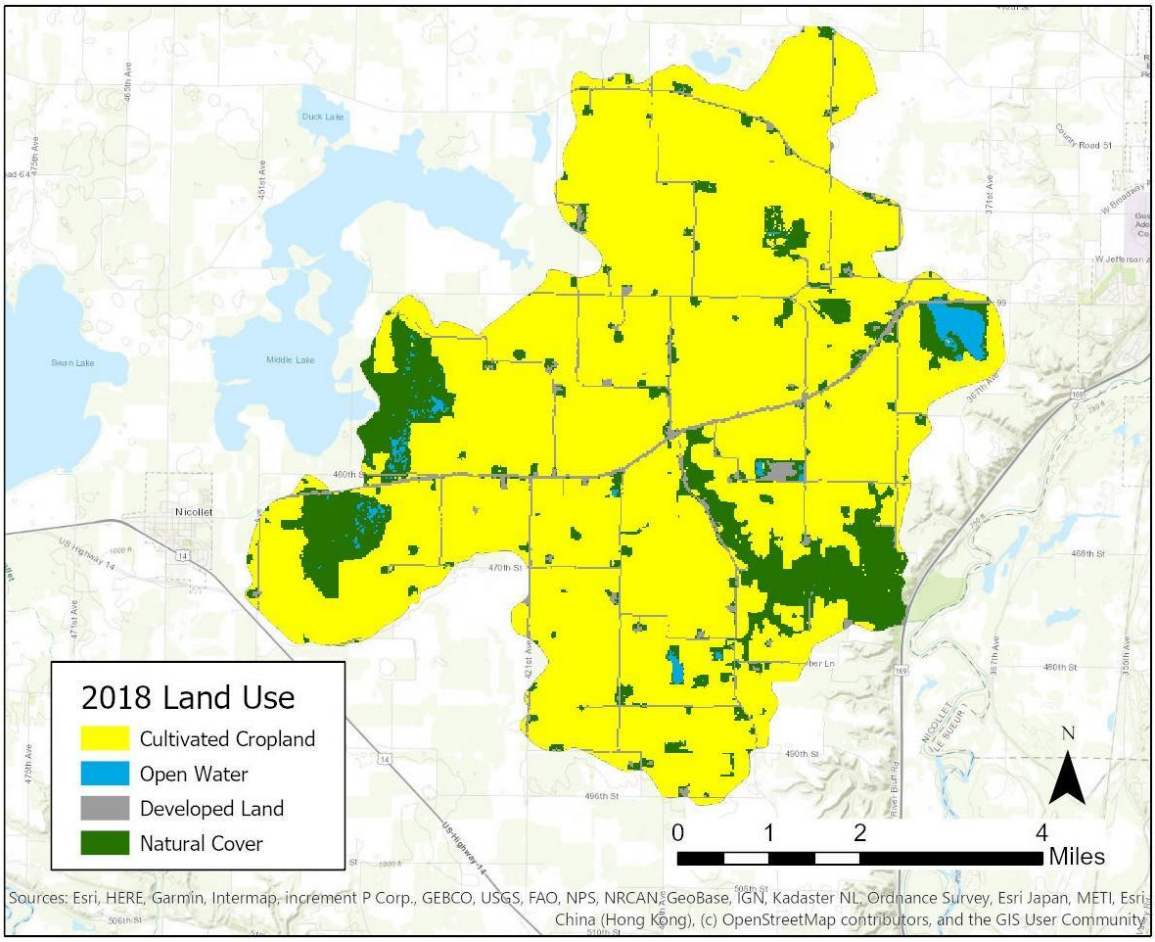

Figure 8. Seven Mile Creek watershed land use and cover in 2018.

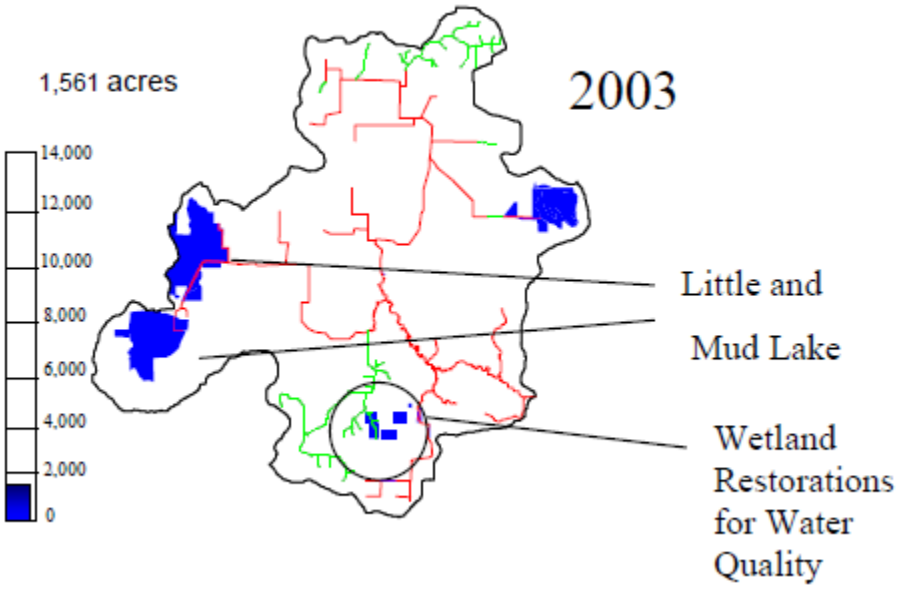

Figure 9. Remaining and restored wetlands in the Seven Mile Creek watershed in 2003 (Kuehner 2004).

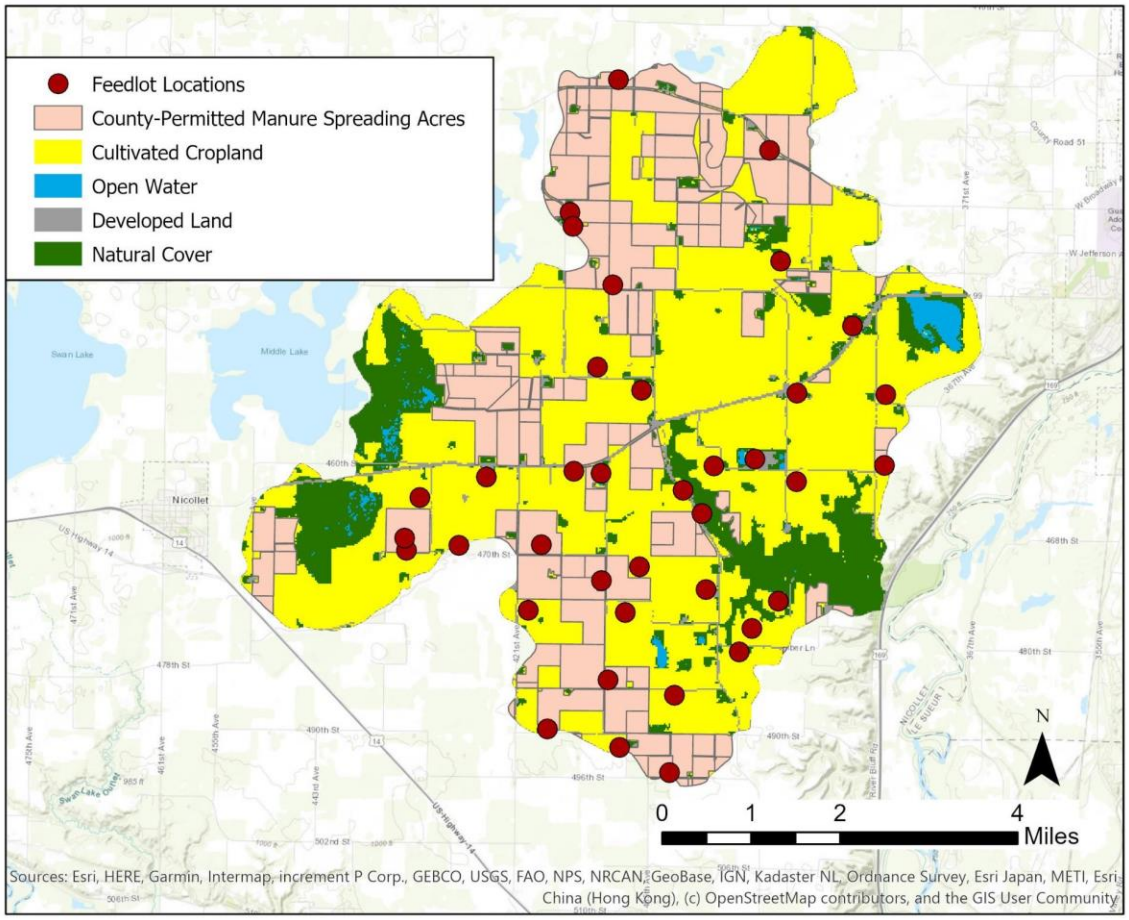

Figure 10. Feedlots and permitted acres for spreading manure within the watershed. Spreading acres in this map are only those permitted for manure application by the county (MPCA 2020; Nicollet County 2020). Larger feedlots with state spreading permits are not included in this map due to the GIS data being unavailable at this time.

Developed Areas, Future Land Use Expectations, Political Boundaries, and Relevant Authorities

The Clean Water Partnership (CWP) Diagnostic Study indicated that there were an estimated 157 homes in the watershed in 2001 (Figure 10). The watershed population was estimated at just over 500, assuming an average household of 3.3 people. Most of the houses in the watershed are located on farmsteads however some individual rural residential development has occurred. Nicollet County does not allow urban land uses in the county's agricultural districts. According to the Nicollet County Zoning Ordinance, the county will only consider rezoning for commercial, industrial, or platted residential use on land immediately adjacent to municipal boundaries where municipal services can be provided. One new dwelling per quarter section is allowed in all the districts outside of the cities, provided that the building lot has access to a public road.

The watershed is located entirely in Nicollet County. The majority of the watershed is located in Oshawa Township and smaller portions are located in Traverse, Belgrade, and Nicollet Townships. A portion of the watershed lies within the City of St. Peter wellhead (source water) protection area (Figure 11). The St. Peter drinking water wells are in areas of high vulnerability to nitrate contamination and costly treatment (Boettcher and Spindler 2019).

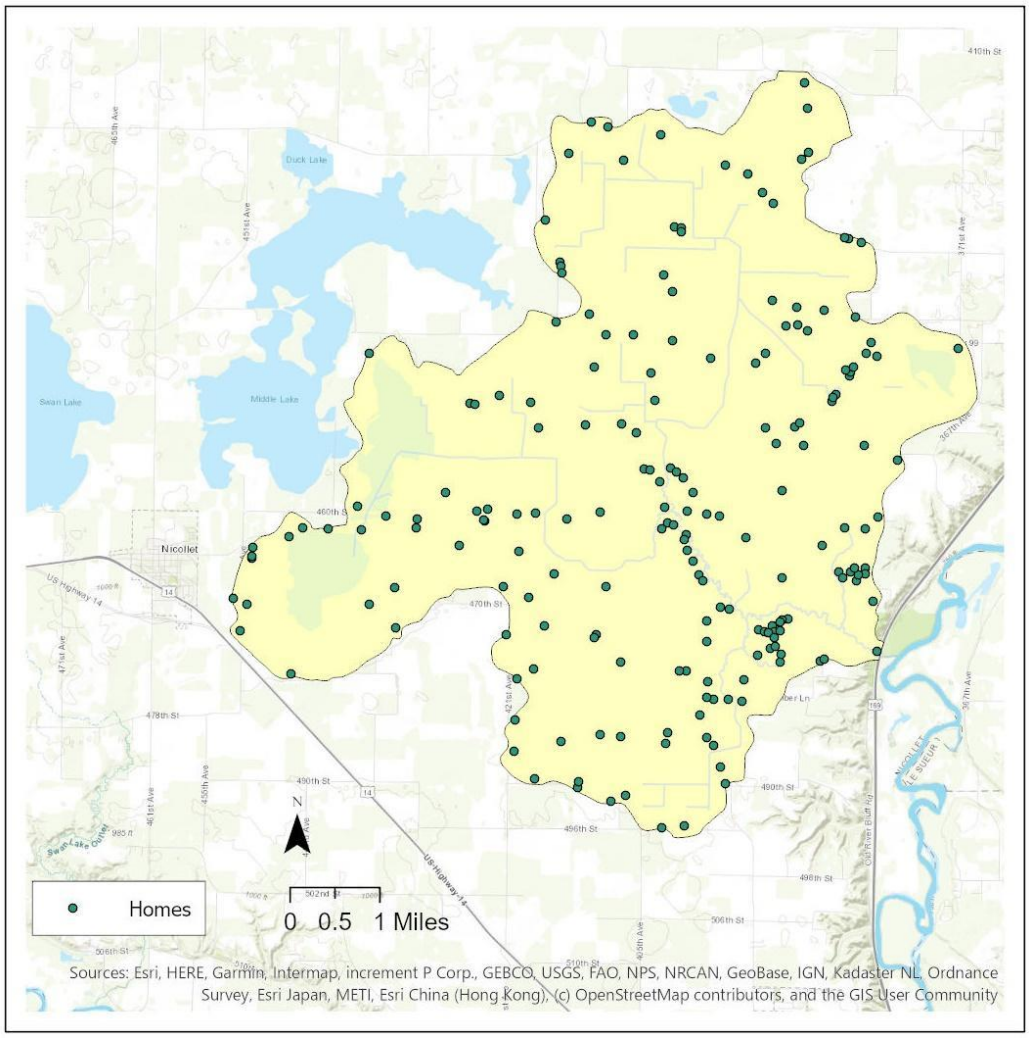

Figure 10. Home locations in the Seven Mile Creek watershed (Nicollet County 2020).

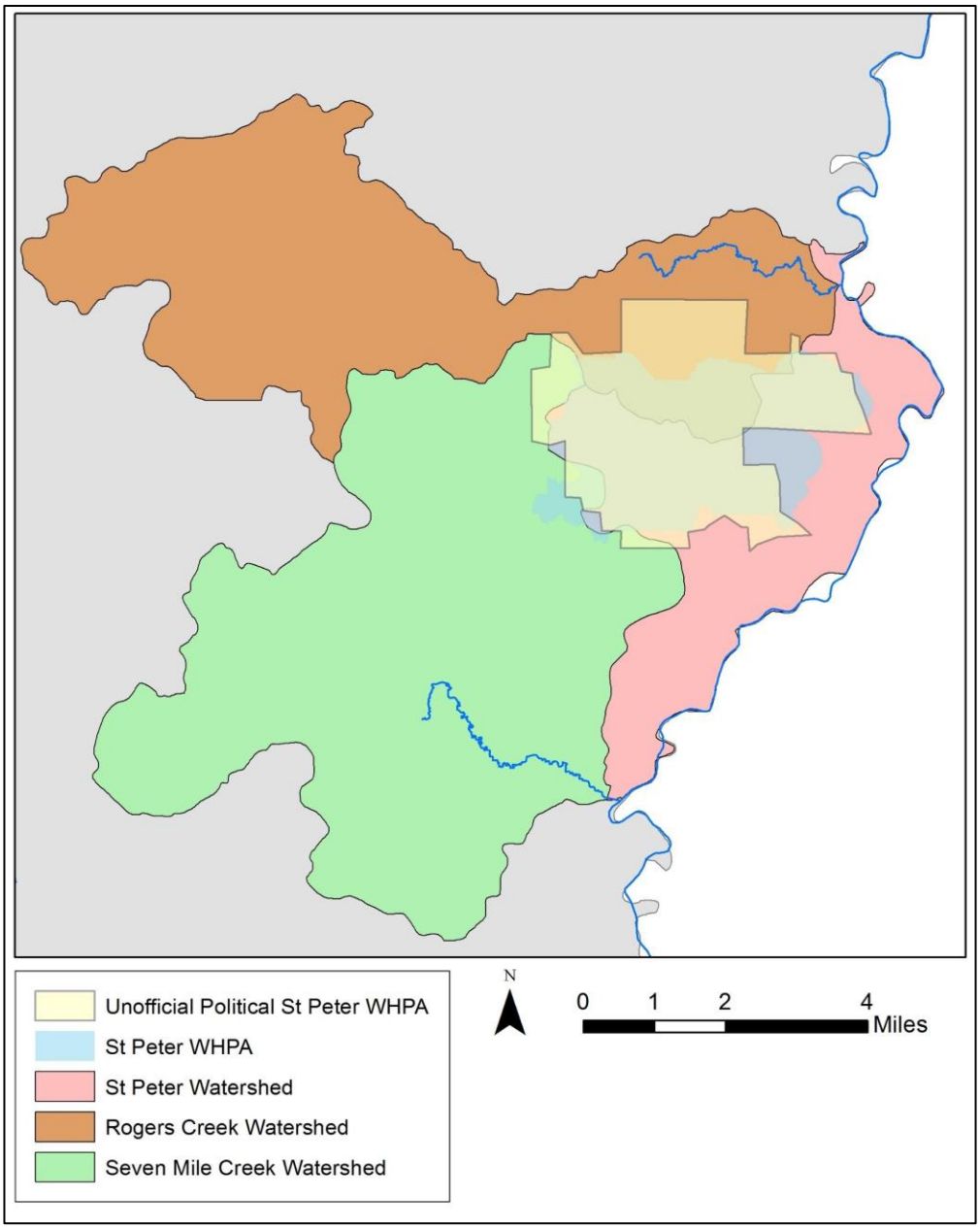

Figure 11. Watershed boundaries and the St. Peter Wellhead Protection Area (WHPA).

Septic Systems

Septic systems are required in all homes located in the watershed. Based on estimates by the Nicollet County Environmental Services Department, there are 199 septic systems in the Seven Mile Creek Watershed. Of those systems, 154 were built since and in compliance with the 1996 Minnesota Rule 7080, 10 have not been updated since the rule, and 35 have no record (Figure 12, MPCA 2014d). Septic systems constructed before Rule 7080 are likely less effective than those built since the rule was established. Based on the current data, 77% of the septic systems in the watershed are compliant with

the current rules and standards. This is a significant improvement from 2001 data displaying only 38% compliance within the watershed (Kuehner 2001) and local county data listing compliance possibly as low as 20% (Nicollet County 2020).

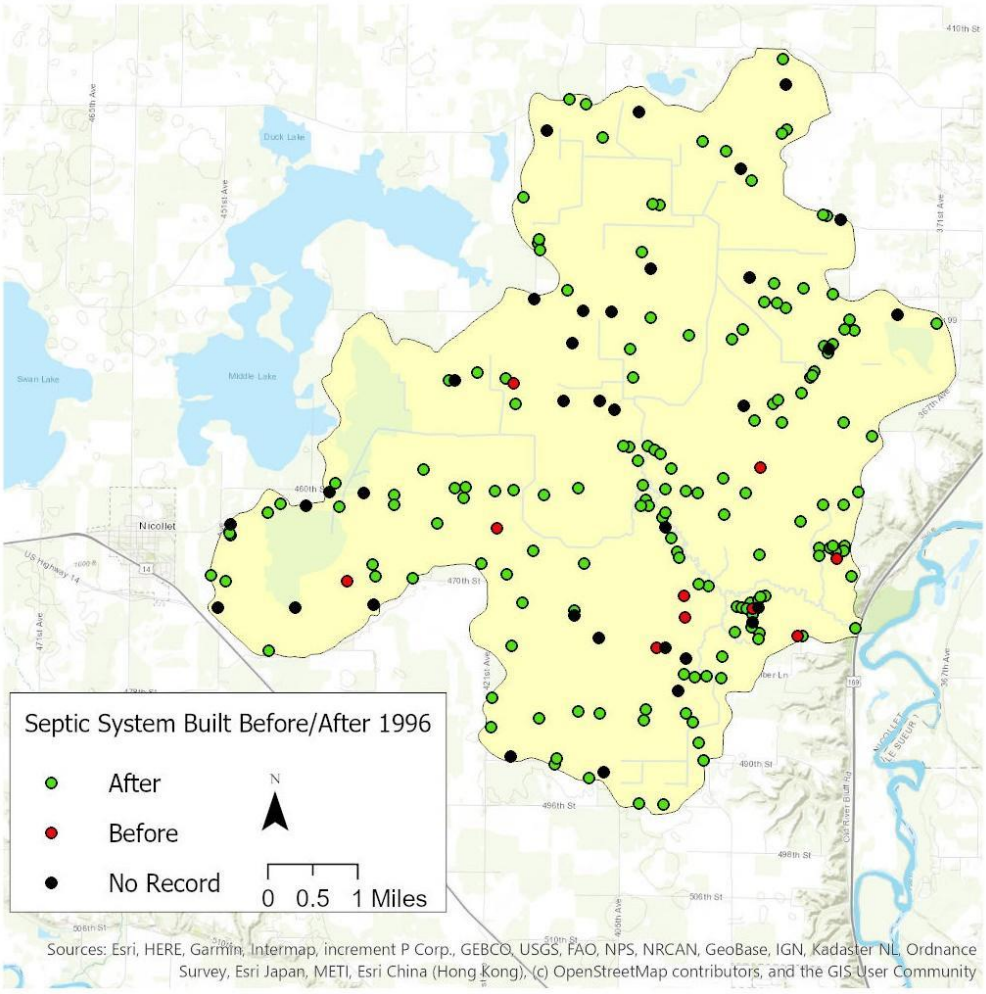

Figure 12. Locations of septic systems in the Seven Mile Creek watershed. Systems constructed before the new rules in 1996 are likely less effective than those constructed after 1996 (MPCA 2014d). Many older systems have been updated and are now categorized as being constructed after 1996 (Nicollet County 2020).

Element A. Identification of causes of impairments and pollutant sources

The MPCA has divided Seven Mile Creek into two sections with impairments. The first section (703) extends from MN-99 to CD 46A. It is a warmwater general use Class 2B impaired for lack of macroinvertebrate assemblage, fecal coliform, and turbidity. The second section (562) extends from CD 46A to the Minnesota River. It is a coldwater Class 2A impaired for lack of macroinvertebrate assemblage, lack of fish assemblage, fecal coliform, nitrates, and turbidity (Bateman et al. 2019).

The greatest suspected sources for stressors in the two sections of Seven Mile Creek include tile drainage/land use for nitrate; flow alteration/velocity, streambank erosion, and tile/channelization for suspended solids; and channel morphology and bedded sediment for habitat; altered hydrology for temperature; flow alteration and road crossings/perched culverts for connectivity; and altered waters/channelization, reduced baseflow, and tile drainage/land use for altered hydrology (Bateman et al. 2019). Sources for fecal coliform were not discussed in the MPCA stressor report, but the most likely sources listed in the Minnesota River – Mankato draft WRAPS report that would likely be sources in Seven Mile Creek include surface runoff from crops with surface-applied manure, surface runoff from crops with subsurface-applied manure, environmental propagation, failing or absent septic systems, pets and wildlife, pastures, and feedlot runoff (Boettcher and Spindler 2019). In a study using HFERP DNA fingerprint analysis in Seven Mile Creek, *E. coli* populations consisted of both transient and persistent strains, some of which appeared to be naturalized to the environment (particularly sediment) but were mixed with newly contributed strains of *E. coli* (Sadowsky et al. 2010).

Total phosphorus concentrations in Seven Mile Creek oftentimes exceed the 0.150 mg/L standard, and this exceedance is usually during higher flows in the creek (Fettig et al. 2016). However, due to a lack of secondary data (Chl-a, BOD, Do flux), results were inconclusives as to whether phosphorus was a stressor for impairments in Seven Mile Creek (Bateman et al. 2019). Regardless of whether phosphorus is a stressor in Seven Mile Creek, it should be reduced due to the load contributing to phosphorus induced impairments downriver.

Element B. Expected load reductions for solutions identified

Solutions for stressor remediation/mitigation include agricultural BMPs such as bioreactors, WASCOBs, cover crops, perennial crops, fertilizer management, filter strips, grass buffers, and others. Investments in agricultural BMPs that simultaneously remove nitrate from drainage, store water, and reduce runoff would be ideal. Reducing flow into the creek during rain events could reduce numerous causes of impairments from ravine and streambank erosion to phosphorus. Upgrading and repairing septic systems and feedlots throughout the watershed could reduce bacterial inputs and nutrients to the creek. Removing barriers along the stream could improve fish habitat and connectivity where removal of these structures is possible. Remeandering ditches and restoring floodplains could reduce flow, sediment, and nutrients flowing downstream. Improving the growth of deep, densely rooted vegetation around the ravine system could reduce streambank erosion, channelization, and slope erosion (Lenhart et al. n.d.). Installing engineered erosion control and water retention structures and improving hiking trail design could be helpful in highly erodible areas or where safety for park users is a concern.

Reductions of pollutants will depend on the practices implemented. In the Seven Mile Creek Watershed, one bioreactor installed in 2015 and two drainage water management systems installed in 2017 and 2018 reduced estimated loads of 1,700 lbs of nitrogen each year. A combination of 46 other BMPs installed throughout the watershed between 2013 and 2018 reduced as much as 3,700 lbs of phosphorus and 1,900 tons of sediment each year. The TSS load from Seven Mile Creek into the Minnesota River ranged from approximately 205 to 17,300 Mg/yr from 2007 to 2013 (Baskfield 2016; Lenhart et al. n.d.), and the ravines in this system are eroding rapidly each year. Addressing the erosion in the ravines could reduce the loss of thousands of tons of sediment each year (Lenhart et al. n.d.).

Element C. Nonpoint source management measures

The biophysical goals for the Targeted Watershed Demonstration Program (TWDP) project were to reduce the erosion rates of ravines in Seven Mile Creek County Park, reduce peak stream flows, and retain nitrogen and phosphorus in the crop-soil system. A socio-economic goal was to establish a small-scale, intensively community-focused approach of the Seven Mile Creek project to achieve and demonstrate a "social-economic-environmental triple win" in improving water quality along with providing a sustainable agricultural system in the watershed.

Recognizing the need for this broader socio-economic goal, the Seven Mile Creek Partnership developed a community-led approach that emphasized personal engagement in creating locally-led solutions. This collaboration began with the Nicollet Soil and Water Conservation District (SWCD), Great River Greening (GRG), and the Minnesota Agricultural Water Resource Center (MAWRC) reaching out to agricultural producers to gain their trust and understand their goals and priorities. This focus was formalized through a multi-year community engagement effort to build local ownership of the water quality challenges in the watershed by enlisting local champions to lead the charge for action (Fellows, Green, and Davenport 2017). The effort involved the following:

- MAWRC working with the Nicollet County Farm Bureau and Minnesota Pork Producers to identify influential local leaders willing to bring their neighbors together to discuss and work on water quality concerns;
- GRG coordinating the overall effort and facilitating water quality conversation among non-farm rural landowners and recreational users of Seven Mile Creek Park in the context of non-farm land uses; and
- University of Minnesota providing a baseline assessment of the watershed community's capacity for collective action on water quality at the outset of the project, an evaluation at its close, and facilitation support during the project.

The conservation practices targeted for implementation included:

- Sediment control projects
    - Ravine stabilization
    - Buffer establishment
    - Water and sediment control basins
    - Grade stabilization
    - Tile side inlet replacement
- Targeted drainage improvements
- Cover crops and conservation tillage
- Tile outlet interventions
    - Saturated buffers
    - Tile treatment wetlands and
    - Bioreactors
- Nutrient management
- Feedlot assistance

Element D. Technical and financial assistance

Direct project funding has been received from various sources leading up to and in addition to the Clean Water Partnership program funding. The sources include Nicollet County, Great River Greening, Minnesota Board of Water and Soil Resources, McKnight Foundation, Bush Foundation, US Department of Agriculture – Natural Resources Conservation Service (USDA – NRCS), US Army Corps of Engineers (USACE), and Fishers and Farmers Partnership. In addition to direct funding, watershed work has been completed within other local, state, and federal agencies and organization programs. Some of the work has been described above. Other agency or program work in the watershed includes work performed by the University of Minnesota Extension, Minnesota Department of Agriculture, Minnesota Department of Health, Minnesota Department of Natural Resources, Gustavus Adolphus College, Minnesota State University at Mankato, US Forest Service, and University of Minnesota – Twin Cities. The Seven Mile Creek TWDP Project, funded by state Clean Water Funds and matching local, state, and federal funds, provided the foundation for the current project work.

Costs for practice implementation have been funded by the TWDP grant, National Water Quality Initiative (NWQI) Environmental Quality Incentives Program (EQIP) funds, and nonprofit organization grants, combined with mandatory landowner cost-share contributions. Some expenses have been provided by in-kind staff support and volunteer labor. Technical assistance is provided through the TWDP grant and by the NRCS for NWQI activities. However, much of the success of this plan relies upon voluntary implementation of agricultural BMPs. Estimated costs for each practice can be found in the Agricultural BMP Handbook for Minnesota (Lenhart et al. 2017).

Element E. Information and education

Developing one-on-one personal relationships and the trust that slowly develops among watershed residents and government staff, combined with the exchange of information and ideas are more likely to affect an individual's decision to make changes over time than one-way information sharing. A new approach to watershed planning and management was needed – one that spoke to both the civic imagination and the self-interest of watershed residents. When given a meaningful role to play in creating and advancing a watershed plan and the ability to influence local decision making, many citizens find participation in these community activities rewarding and meaningful. Small groups of committed citizens dedicated to collaboration, civic involvement, and cooperation have proven their ability to make a significant difference in advancing new practices and creating mutually beneficial agreements that can improve water quality. However, in order for this to happen, government organizations must create the right kind of public "stage." Creating accountability mechanisms around watershed plans is also critical to ensuring that any cooperative plan is implemented and adapted over time.

In Seven-Mile Creek watershed, some of these new ideas had taken root and begun to bear some fruit in 2017 when the 319 project was first proposed. Local efforts began with direct outreach to landowners – meeting one-on-one and taking the time to listen, working to understand landowner goals and priorities, and developing a trust with them in recent years. The approach was developed further through a collaborative visioning, goal-setting, and conservation planning process by the Seven Mile Creek Watershed Partnership. The process depended entirely upon the collaboration of the people that live and engage in activities within this watershed. Ongoing outreach activities include events, gatherings, forums, and field days as well as encouraging community members to communicate with each other.

Great River Greening, the Nicollet County Soil and Water Conservation District, and Gustavus Adolphus College are coordinating the current overall effort and facilitating water quality conversations among farmers, non-farm rural landowners, and recreational users of Seven Mile Creek Park in the context of farm and non-farm land uses. County staff are coordinating outreach efforts for work performed within the park and ravine system. Other groups and agencies who have been involved or will continue to be involved in these outreach efforts and community conversations include the MPCA, NRCS, Minnesota Farm Bureau, Fishers and Farmers Partnership, MDA, USACE, BWSR, MNDNR, Minnesota Corn Growers Association, Minnesota Agricultural Water Resource Center, University of Minnesota Extension, The Prairie Enthusiasts, Trout Unlimited, Pheasants Forever, Minnesota State University – Mankato, and multiple outdoor recreation clubs.

Element F. Implementation schedule

Implementation of the watershed plan for Seven Mile Creek should initially focus on issues identified as high priorities in this plan. Implementation progress will depend on available funding and the implementation schedule must take into account this dependency. Significant delays in securing sufficient funding will necessitate an extension of the implementation schedule.

Given these considerations, the following timeframes have been established for implementation of management measures, to the greatest extent practical, within the identified watersheds:

- High priority sources – 10 years from plan date
- Medium priority sources – 15 years from plan date
- Low priority sources 25 – years from plan date

Element G. Milestones

Implementation progress can be measured by the miles or acres of management measures installed within the watershed. For each of the high, medium and low priority sources, implementation should be assessed at the 5, 13 and 20 year marks from plan date, respectively, with the goal of having 60% of the needed practices on the ground at the respective assessment points. Measurements of implementation may include:

- Miles of stream banks stabilized
- Miles of buffer strips
- Acres of cover crops
- Acres of conservation tillage
- Acres of alternative crops seeded
- Miles of grassed waterways
- Number of stabilization structures installed
- Acres of land managed for vegetation/erosion
- Feet of hiking trails restored

Element H. Assessment criteria

This watershed plan focuses on identifying and reducing loads of fecal coliform, nitrate, and suspended sediment. Although total phosphorus (TP) is not a current impairment for Seven Mile Creek, it needs to be assessed due to the limited samples indicating that the creek exceeds standards. The Minnesota River – Mankato WRAPS draft has a 50% reduction goal in lake and stream loads entering the Minnesota River over the next 50 years and a 10% reduction goal over the next 10 years. The annual load of TP to the Minnesota River should be assessed. The criteria to assess fecal coliform are based on the Minnesota River – Mankato WRAPS draft to reduce the load of bacteria in the Minnesota River by 60% over 40 years with a 13% reduction goal over the next 10 years. The criteria to assess nitrate are based on the WRAPS draft goal to reduce nitrogen loads in the Minnesota River by 60% over 55 years and 10% over the next 10 years. Concentrations of nitrate in the creek have consistently exceeded standards. Load reductions will be monitored where the creek discharges into the Minnesota River. The criteria to assess sediment loads are based on the WRAPS draft goal to reduce sediment by 50% over 40 years and by 12% over 10 years. The majority of loads of each parameter from Seven Mile Creek to the Minnesota River have typically come from only a few large rain events each year. Therefore, the most important assessment criteria of each will annual loads.

It is expected that implementation of a combination of management practices identified in Element C will result in the achievement of the assessment criteria for each of the above loads.

Element I. Monitoring

Monitoring Approach

A multi-scale and interdisciplinary monitoring approach will be used to capture watershed and water quality changes to document the effectiveness of watershed management activities in improving water quality. It will also provide data in which to test current assumptions and knowledge regarding pollutant and other stressor sources, processes and pathways, and watershed responses (human health, aquatic life, agricultural production, and downstream loads).

Combining the current and future intensive implementation efforts with the intensive monitoring approach is important given the complexity of and difficulty in linking BMP implementation with measurable water quality outcomes at the watershed-scale. Several opportunities exist in the watershed to connect to and build on previous monitoring and research efforts to support the examination of linkages and processes from the field-scale to small watershed scale for improved watershed management.

Monitoring Goals and Objectives

Water quality monitoring within the watershed plan serves multiple goals. The end result is to demonstrate water quality impacts of land management practices for watershed residents and users. The approaches for watershed monitoring in this plan are to:

- Evaluate the effect of BMP implementation on the water quality of Seven Mile Creek and its impacts to the connecting overall watershed
- Identify and document the sources and pathways of pollutants and other variables that affect the ecological health of Seven Mile Creek

Each goal has one or more objectives that provide descriptions of specific monitoring types and designs needed to achieve the watershed monitoring goals. Some overlap will occur as the monitoring unfolds, but it is hoped that the individual objectives will provide a framework in which to integrate data collection when possible and differentiate monitoring efforts when needed. The monitoring objectives for each monitoring goal are listed below by goal:

1) Evaluate the effect of BMP implementation on the water quality of Seven Mile Creek and the subwatershed in the Seven Mile Creek watershed.
   a) Utilize before/after implementation upstream/downstream watershed monitoring design to evaluate if water quality changes to the stream can be attributed to ravine restoration practices. Secondarily, evaluate if restoration and management practices result in water quality changes in the watershed. This will monitored by streamflow, chemistry, biology, and geomorphology.
   b) Continue the Watershed Pollutant Load Monitoring Network (WPLMN) site near the mouth of Seven Mile Creek for use in trend analysis.

2) Identify and document the sources and pathways of pollutants and other variables that affect the ecological health of Seven Mile Creek.
    a) Design and conduct *E. coli* monitoring to isolate the source of elevated bacteria levels in the stream and document whether concentrations have decreased with the upgrade of watershed septic systems.
    b) Design and conduct water quantity monitoring and use the monitoring data to develop a detailed water budget to evaluate changes in hydrology attributable to implementation practices.

Monitoring Timeline

Evaluating changes in water quality attributable to land use and/or management activities, restoration projects, and pollutant treatment systems takes a long time as described previously in this plan. The watershed plan is written as a ten-year plan, but the work in the plan will likely extend well beyond ten years. Monitoring data is needed prior to any implementation activity in addition to after the activity is completed. Adding to that, seasonal and annual variability in weather, vegetation, management practices, and other landscape factors will likely mask any changes in water quality. The monitoring approach in this plan, therefore, is viewed as a ten-year effort that will require considerable support from individuals, agencies, universities, and funding programs.

Monitoring Designs

A major purpose of the monitoring is to provide the necessary data to evaluate if water quality changes can be attributed to watershed project implementation activities. As such, it is important to provide a "before implementation" baseline of data and an "after implementation" data record. It is also important to have data from an area that did not receive implementation (ie., baseline data) along with data from the area receiving implementation to allow a comparison between the two conditions.

The geographic layout of the Seven Mile Creek watershed combined with the presence of previous monitoring data allows the setup of, at least, before-after designs. An upstream/downstream control/treatment design will be developed using the current load monitoring site near the mouth of the stream and two load monitoring sites that will be re-established on the primary upstream tributaries. The two upstream load sites and their watersheds will be evaluated for use as a paired-watershed monitoring design featuring adjacent watersheds with and without implementation activities combined with before and after implementation monitoring. The use of smaller, field-scale paired watersheds will also be explored.

A water quality assessment package will be developed and deployed utilizing simple to advanced monitoring setups to provide landowners with immediate feedback about the quality of water leaving their land before and after individual BMP projects are implemented. Nicollet County and Great River Greening have identified this field-scale feedback as a critical need in their effort to mobilize additional landowners in the watershed.

Monitoring Types

Several different types of monitoring will be incorporated into the monitoring approach for the watershed.

- Water quality and streamflow monitoring will be completed to track pollutant concentrations and loads moving in the watershed system. Water quality sampling will involve both grab sampling, automatic samplers, and field meters and sensors. Water quality variables include various forms of phosphorus and nitrogen, total suspended solids, turbidity, bacteria, pesticides, and other variables.
- Biological monitoring will involve fish, macroinvertebrate, and stream habitat sampling.
- Fluvial geomorphology monitoring will include physical measurements of the stream and valley including cross-section dimensions, slope, sediment particle sizes, stream bed and banks materials in the determination of stream stability and sediment loss and deposition estimates.
- Watershed characteristics monitoring will be completed. While often not thought of as monitoring, the collection of a wide range of watershed characteristics is important in documenting factors that affect the movement of water and pollutants in the system along with overall ecosystem functioning. Variables that will be tracked range from geology, soil types, and topography to soil conditions, cropping patterns and management, ravines, and vegetation (plant/tree species richness, percent cover, frequency and age).

Monitoring Sites

Monitoring will be conducted at several sites in the watershed, as described in Tables 3 and 4 below. Some sites will be monitored regularly over the long-term, while other sites will be monitored for relatively short periods of time. Types of results are briefly described here:

- Long-term pollutant load monitoring will occur at three sites in the watershed: SMC1, SMC2, and SMC3. The monitoring will involve continuous water level measurements, streamflow measurements, and water quality sampling.
- In addition, the MDA samples pesticides, nitrate, and a few other variables at the site as part of their pesticide monitoring program. The two tributary sites are being re-established following a few years of not being monitored.

Other sites will be monitored for biological and geomorphological characteristics by MPCA and DNR.

Additional monitoring sites will be established to evaluate project- and field-scale implementation activities. Given the large contribution of ravine erosion to the sediment loading in the stream, a ravine will be selected for monitoring before and after restoration activities are completed to obtain a better estimate of ravine contributions to the stream and subsequently the effect of restoration activities.

Streamflow monitoring

Streamflow monitoring at the outlet site will be completed by the MN DNR following their standard operating procedures. From 2016-2021 the tributary gage sites will also be monitored following MN

DNR procedures by Gustavus College faculty and students. Continuous water level data is collected, processed, and stored in the MPCA/DNR times series database (currently Hydstra). Streamflow measurements and rating curve development were done by the MN DNR at the outlet site.

A constraint in the collection of water quality data in small watersheds is the difficulty in operating gage sites in the winter. Water level recording equipment is typically operated during the open water season (usually March to November).

Water quality sampling

In recent years, stream water quality samples will be collected by a combination of grab sampling, automatic sampler sample collection, and field meter measurements. Water samples are collected at the outlet site by MPCA staff following MPCA standard operating procedures. MDA staff also collect grab samples at the outlet site for pesticide and nutrient analysis. Grab sampling at the two tributary sites is being conducted during 2016-2021 by Gustavus College faculty and students along with project staff following MPCA standard operating procedures.

Sample collection using automatic samplers is completed by MDA staff at the outlet site following MDA standard operating procedures. Automatic samplers at the tributary sites are being operated by Gustavus College faculty and students following MDA standard operating procedures from 2017-2021.

From 2018-2021, water samples will be analyzed in a certified laboratory and the Gustavus laboratory for these parameters:

- Nitrogen forms
    - Nitrate+nitrite as nitrogen
    - Total Kjedahl nitrogen
    - Ammonia as nitrogen
- Phosphorus forms
    - Total phosphorus
    - Dissolved ortho-phosphorus
- Total suspended solids
- *E. coli* bacteria

Laboratory analysis of samples by a MDH-certified laboratory is required for samples collected with MPCA grant funding. MVTL is the certified lab that will likely be used for general sample analysis. To expand the dataset, samples will also be collected for analysis at the Gustavus laboratory.

Biological monitoring

Biological monitoring will include fish and macroinvertebrate sampling following DNR and/or MPCA standard operating procedures ((MN DNR 2007; MPCA 2014c, 2014e). The fish and macroinvertebrate monitoring and assessment descriptions below are excerpted from a monitoring plan developed for the Fishers and Farmers Initiative (FFP) in 2011 (Anon 2011). Four sites in the watershed will be sampled including one site in each tributary and two sites in the main stem of the creek. All habitat types will be sampled (e.g., riffle, pool, run) within each station. Backpack electrofishing will be used to sample stream fishes.

Macroinvertebrate sampling will be completed using kick nets (D-frame dip nets). Some of the macroinvertebrate data collected from samples will include taxa (species or genera), number of species

and genera, number of individuals, and habitat characteristics. The data will be used to calculate various invertebrate metrics and an Index of Biotic Integrity (IBI) following MPCA procedures (MPCA 2014b). The invertebrate IBIs comprise metrics representing individual types and trait categories.

Geomorphic monitoring

DNR staff have conducted periodic surveys of geomorphology in the watershed following Rosgen 1996. Those surveys provide a long-term view of geomorphic change, which is strongly related to sediment mobilization and transport out of the system. DNR staff will continue those at infrequent intervals, unrelated to the current 319 grant.

Watershed characteristics (Land and land management) monitoring

Agricultural land information will be collected through a landowner interview process. For a comprehensive perspective on chemical cycling and pollutant loading from the watershed, these kinds of information would be helpful. In the current 319 project, we plan to contract with MDA to conduct a FANMAP nutrient survey which can be compared to previous surveys.

Vegetation surveys, including plant/tree species richness, percent cover, frequency and age, will be completed in the non-agricultural areas with special attention being given to riparian areas susceptible to erosion and ravine areas. Erosion estimates will be made using one or more simple to complex tools including BEHI, BSTEM, and CONCEPTS.

Watershed characteristics will also be used to complete the PTMApp and ACPF targeting tools. PTMApp is the Prioritized Target and Measure Application and ACPF is the Agricultural Conservation Prioritization Framework. The tools are designed to aid in targeting and prioritizing land for BMP implementation and will be used that way; however, the output of the tools will also be used in evaluating changes in land cover and management as they relate to changes in water quality.

Evaluation Framework

The success of the watershed project will be evaluated in various ways at different times. The foundation of the evaluation framework will be the physical, biological, and chemical monitoring of the stream; however, the evaluation will be much bigger than the end numbers. The presence and functioning of a landowner and citizen governance structure will signal true progress toward addressing water quality problems in the watershed. Monitoring land cover, management practices, soil conditions, along with climate variables will provide data in which to characterize changes in water quality. The ultimate measure of success will be the presence of the desired human and ecological uses (swimmable and fishable of the Clean Water Act) for Seven Mile Creek by watershed residents and stream and park users.

Rapid dissemination and communication of the watershed management work occurring in the watershed is important to keep the watershed landowners and others informed about progress in the project. It is especially important in quickly communicating and sharing the monitoring results with watershed farmers and residents, scientists, policy-makers, and the public. Data compilation and synthesis will be completed by Gustavus faculty, staff, and students; agency staff; and others. A Seven Mile Creek watershed website will be created to provide easy access to technical reports, non-technical

summaries and articles along with the data collected in the watershed. efforts will be made to collaborate with research teams that worked in the watershed previously to centralize data and results from the various studies.

In addition to the website, outcomes from the project will be shared locally and regionally through at least 3 high profile news stories and 3 workshops or talks for conservation practitioners. The water quality monitoring findings will be presented to the watershed farmers annually. An annual meeting will be help to discuss monitoring progress, results, and needs. The lessons-learned, strategies, and tools used in this intensive and long-term effort in the small Seven Mile Creek watershed will be compiled and shared with others interested in replicating or building on the work.

Annual and semi-annual reports summarizing work in the watershed will also be completed as required by the various funding sources.

Monitoring Collaboration

Gustavus Adolphus College is taking the lead in working with the Seven Mile Creek watershed project to conduct the interdisciplinary monitoring described above. Faculty members from several departments in the college will participate in the monitoring program and use it in their research and teaching programs to advance the understanding of watershed systems and develop students into watershed professionals . The collaborative dynamics and the liberal arts tradition of Gustavus encourage multi-disciplinary problem-solving, which is the hallmark of integrated environmental assessments and management plans.

Nicollet County, Nicollet SWCD, and Great River Greening staff will complete much of the watershed characteristic monitoring. They will also be integral in the evaluation of the data.

The MPCA, DNR, and MDA are actively participating in the watershed through their monitoring at the outlet site of Seven Mile Creek. MPCA also conducts biological monitoring as part of the ten-year watershed approach monitoring cycle. The MPCA is currently completing the monitoring and assessment report for the first cycle of biological monitoring, conducting a stressor identification process, and will develop a WRAPS report for the Minnesota River – Mankato major watershed in conjunction with local staff and stakeholders. In addition to collecting streamflow data, DNR has staff in other programs that are providing biological and geomorphic monitoring support. The MDA conducts pesticide and nutrient monitoring at the outlet site. It also has supported various agricultural research projects and modeling efforts in the watershed.

The University of Minnesota and Mankato State University – Mankato will also likely provide monitoring support in the development of the Seven Mile Creek watershed as a Sentinel Watershed for long-term monitoring and evaluation at multiple watershed scales to improve the understanding of watershed processes and the implementation needs to significantly change the water quality and ecological health of the stream and watershed.

Review of Historic Monitoring Efforts

Water quality monitoring in the Seven Mile Creek watershed began in 1996. Tables 3, 4, and 5 provide summaries of the monitoring sites and available data. The Brown Nicollet Cottonwood Water Board, Nicollet SWCD, Fishers and Farmers Partnership, Gustavus Adolphus College, Minnesota Department of Agriculture, and MPCA have engaged in monitoring since 1996. Citizen monitoring was performed through the Minnesota Citizen Stream Monitoring Program administered by MPCA. Much of the data collected by the BNC and Nicollet SWCD in the 2000s was performed through Clean Water Partnership projects. Monitoring by Gustavus Adolphus College has included chemistry, biology, and geomorphology in coordination with the watershed project and student research. MDA monitoring was completed as part of the MDA's pesticide monitoring program and support of the Red Top Farm research project. Fishers and Farmers Partnership monitoring was done through independent funding. MPCA monitoring was completed as part of the MPCA's ambient monitoring program, CWP program, Intensive Watershed Monitoring, and, currently, Watershed Pollutant Load Monitoring program. DNR monitoring was conducted as part of the fish survey program and the state's watershed approach.

Table 3. Monitoring sites in the Seven Mile Creek watershed with data contained in the Environmental Quality Information System (EQuIS) database managed by MPCA.

Water Body	Sampling Site ID	Sampling Site Location Description	Date Range	# Samples
Seven Mile Creek – Upstream	S002-934	SEVENMILE CK DWST OF MN-99, 6 MI SW OF ST. PETER	1996 – 2016	235
Seven Mile Creek – Outlet	S003-706	SEVEN MILE CK IN SEVENMILE CK CTY PARK, 6 MI SW OF ST PETER	2003	1
	S002-937	SEVENMILE CK IN SEVENMILE CK CTY PK, 5.5 MI SW OF ST. PETER	1996 - 2018	~500 (CSMP)
	S002-466	7 MI CK AT 7 MI CK PARK, 5.3 MI SW OF SAINT PETER, MN	2003 - 2015	296 (CSMP)
County Ditch 24	S002-464	CO DT 24 AT TIMBER4 LANE, 5.5 MI NW OF MANKATO, MN	2003 - 2009	61
County Ditch 46A	S003-515	CO DT 46A AT 411TH AVENUE, 5 MI E OF NICOLLET, MN	2004 - 2015	60 (CSMP)
	S002-936	CTY DTCH 46A DWST OF CSAH-13, 6 MI SW OF ST. PETER	2000 - 2012	219

Table 4. Summary of monitoring locations, years sampled, variables, and organization and/or program doing the monitoring.

Location	Location Notes	Years	Variables*	Organization/Program**
Seven Mile Creek County Park	Outlet station	1996-2014 (on-going, long-term)	Chemistry[1]	MPCA BNC Water Board
	Outlet station	2013-2014	Chemistry[1]	SWCD
	Outlet station	2012-2014 (on-going)	Chemistry[2]	FFP
	Outlet station	2010-2014 (on-going)	Nutrients, Pesticides	MDA
	371 ft. upstream from outlet station	2012-2014 (on-going)	Biology	FFP/DNR
	1,621 ft. upstream from outlet station	2012-2014 (on-going)	Biology	FFP/DNR
	20 channel widths over 2,500 ft. reach upstream from last footbridge	2012-2014 (on-going)	Geomorphology	FFP/DNR
	Outlet station	2009-2011	Biology	MPCA
	Outlet station	2003-2012	Transparency	CSMP
	Downstream of confluence with CD24	2003	Nitrates, Total P, Fecal coliform, E. coli	
Sub-watershed 1, CD13	Downstream of Hwy. 99	1996-2011	Chemistry[1]	BNC Water Board
	Upstream of Hwy. 99	2012-2014	Biology	DNR
	Downstream of Hwy. 99	2012-2014	Chemistry[2]	FFP/DNR
	Uptream of Hwy. 99	2016-2021	Chemistry	Gustavus
Sub-watershed 2, CD46A	At 411th Ave.	2001 & 2010	Biology	
	Downstream of CR 13	2004-2006	Temperature, Transparency	CSMP
	Upstream of CR 13	2012-2014 (on-going)	Biology	FFP/DNR
	Downstream of CR 13	2000-2011	Chemistry[1]	BNC Water Board
	Downstream of CR 13	2012-2014 (on-going)	Chemistry[2]	FFP/DNR
	Downstream of CR 13	2016-2021	Chemistry	Gustavus
Sub-watershed 3, CD 24	Downstream of Hwy. 13	2003-2009	Chemistry[1]	BNC Water Board

* Variables:

Chemistry[1]: Flow, Temperature, Transparency, Dissolved Oxygen, Nitrates, Total Phosphorus, Total Suspended Solids, E. coli

Chemistry[2]: All Chemistry[1] parameters plus pH, dissolved Phosphorus, Specific Conductance, and Fecal Coliform;
Biology: fish species (count, minimum length, maximum length), fish IBI, invertebrate IBI, temperature, conductivity, field turbidity, dissolved oxygen, pH, nitrogen, total phosphorus, total suspended solids, ammonia
Geomorphology: Minnesota stream habitat assessment score

** Organization/Program – See list of acronyms

Table 5. Timeline of water quality monitoring (chemistry and CSMP) in Seven Mile Creek watershed.

Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Site 1 – Seven Mile Hdwtrs. & CD 13 (S002-934)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Site 2 – CD 46A (S002-936)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X
Site 3 - Outlet (S002-937)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Seven Mile Outlet (MDA SM3) (same as S002-937)							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CD 24 (S002-464)								X	X	X	X	X	X	X											
Seven Mile upstream of outlet (S003-706)								X																	
CD 46A CSMP (S003-515)									X	X	X	X	X	X	X	X	X	X	X	X					
Seven Mile Outlet CSMP (S002-466)								X	X	X	X	X	X	X	X	X	X	X	X	X					

Water quality and streamflow monitoring to compute pollutant loads was initiated in 2000 at three sites in the watershed. The monitoring was part of the Seven Mile Creek Watershed Clean Water Partnership Diagnostic Study. The three sites were selected based on spatial proximity to areas of environmental concern, feasibility of determining stream discharge relationships, and previous monitoring history. The three sites were characterized as the Hwy 99, County Road 13, and mouth sites and referred to as sites 1, 2, 3, respectively, in the diagnostic study and ensuing implementation project. The EQuIS identification numbers for the three are S002-934, S002-936, and S002-937, respectively.

Additional monitoring sites were added in 2003 to help build a better understanding of the pollutant sources and to measure the effect of best management practices at a smaller scale (< 1,000 acres). A fourth load monitoring site was added in 2006. It was located on County Ditch 24. CD 24 represents much of the remaining upper watershed not previously monitored. Monitoring at the four load sites continued through 2008 as part of the CWP implementation project.

Monitoring at upper watershed sites was discontinued in recent years while monitoring at outlet site has continued through to the present. Water sampling was and continues to be weighted towards snow

melt and storm event runoff events with fewer lower flow samples to provide better load computations. The outlet site is now part of the MPCA Watershed Pollutant Load Monitoring Network with monitoring planned to be long-term.

The MDA began monitoring the outlet of Seven Mile Creek in 2002 and continues sampling the site as part of their Agricultural Chemical Monitoring Program. The monitoring began as a general survey for agricultural pesticides and has increased in intensity through the years. The site is one of seven sites in the state that is intensively monitored. Sampling now incorporates automatic sampler composite samples of storm event runoff with grab samples between storm events. A suite of pesticides, nitrate-nitrogen, and total phosphorus are analyzed for each sample. Annual reports summarizing the data are published on the MDA website at http://www.mda.state.mn.us/chemicals/pesticides/maace.aspx.

Additional chemistry sampling has been completed by the BNC, Nicollet SWCD, FFP, and DNR to supplement the data collected for the WPLMN. The MPCA, FFP, and DNR has completed biological monitoring in recent years. The MPCA biological monitoring consisted of fish and macroinvertebrate sampling at several sites and was done as part of its Intensive Watershed Monitoring program being completed in each major watershed of the state.

Two Citizen Stream Monitoring Program (CSMP) volunteers have monitored two sites in the watershed. A site near the stream outlet has been monitored since 2003 and a site on County Ditch 46A has been monitored since 2004. CSMP monitoring includes Secchi transparency and stream condition observations.

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Appendices

Appendix I: Monitoring Program Site Details

Appendix I